FOR THE RADIO ENTHUSIAST...

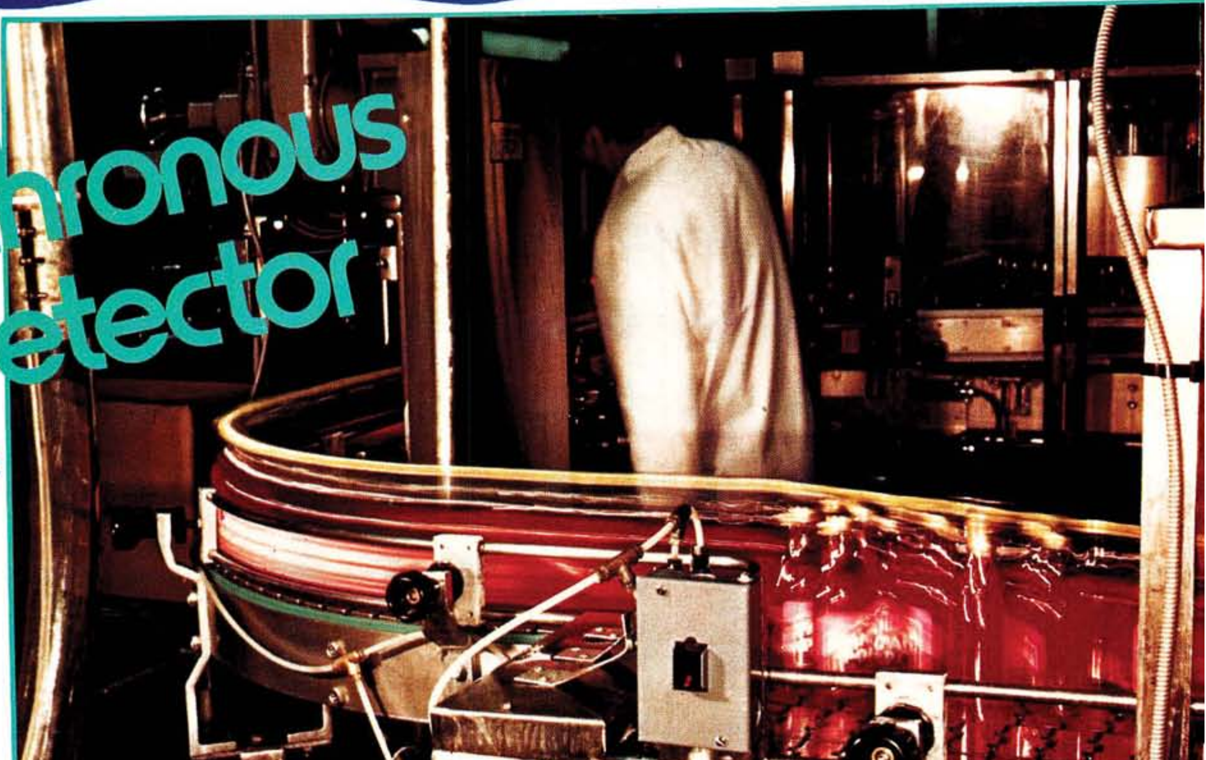
Practical Wireless

DECEMBER 1981

Australia $1.28
New Zealand $1.30
Malaysia $4.50
IR £1.07 (inc. VAT)

75p

SPECIAL TOOL OFFER



Synchronous Detector

Part One

and EXTRA Concluding section of A GLOSSARY OF RADIO TERMS

plus AMATEUR RADIO & THE DISABLED

DO YOUR CHRISTMAS SHOPPING
THE EASY WAY – THE BREDHURST WAY
TO ORDER ANY OF THE ITEMS LISTED BELOW SIMPLY WRITE ENCLOSING A CHEQUE OR PHONE AND QUOTE YOUR CREDIT CARD NO.
– WE DO THE REST!

Bredhurst electronics

TS 7730

£247 inc. VAT

TRIO		£	Carr.
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	17.90	(0.75)
LF30A	HF Low Pass Filter 1kW	19.30	(0.75)
TR9000	2M Synthesised Multimode	389.00	(—)
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)
TR2400	2M FM Synthesised Handheld	198.00	(—)
SMC24	External Speaker/Microphone for 2400	13.80	(1.00)
ST1	Base Stand and Quick Charger	45.00	(1.50)
BC5	12V Quick Charger	18.40	(1.00)
SC3	Soft Carrying Case Plus Belt Hook	11.50	(0.50)
PB24	Spare Battery Pack and Charger Lead	15.87	(0.75)
TR8400	70cm FM Synthesised Mobile Transceiver	334.00	(—)
PS10	Base Station Power Supply for 8400	64.00	(2.00)
TR9500	70cm Synthesised Multimode	449.00	(—)
R1000	Synthesised 200KHz-30MHz Receiver	297.00	(—)
SP100	External Speaker Unit	26.90	(1.50)
HC10	Digital Station World Time Clock	58.80	(1.50)
HS5	Deluxe Headphones	21.85	(0.75)
HS4	Economy Headphones	10.35	(0.75)
SP40	Mobile External Speaker	12.40	(1.50)

ICOM			
IC730	HF Mobile Transceiver 8 Band	586.00	(—)
IC720A	HF Transceiver & Gen. Cov. Receiver	883.00	(—)
PS15	Power Supply for 720A	99.00	(3.00)
IC251E	2M Multimode Base Station	499.00	(—)
IC25E	2M Synthesised Compact 25W Mobile	259.00	(—)
IC290E	2M Multimode Mobile	366.00	(—)
IC2E	2M FM Synthesised Handheld	169.00	(—)
IC L1/2/3	Soft Cases	3.50	(0.50)
IC HM9	Speaker/Microphone	12.00	(0.75)
IC BC30	230V AC Base Charger and Hod	39.00	(1.50)
IC BC25	230V AC Trickle Charger	4.25	(0.75)
IC CP1	Car Charging Lead	3.20	(0.50)
IC BP2	6V Nicad Pack for IC2E	22.00	(1.00)
IC BP3	9V Nicad Pack for IC2E	17.70	(1.00)
IC BP4	Empty Case for 6×AA Nicads	5.80	(0.75)
IC BP5	11.5V Nicad Pack for IC2E	30.50	(1.00)
IC DC1	12V Adaptor Pack for IC2E	8.40	(0.75)
IC ML1	10W Booster	49.00	(1.00)

TV INTERFERENCE AIDS

Ferrite Rings 1½" dia. per pair	0.80	(0.20)
Toroid Filter TV Down Lead	2.00	(0.50)
Low Pass Filter LP30 100W	3.95	(0.50)
Trio Low Pass Filter LF30A 1kW	19.30	(0.75)
Yaesu Low Pass Filter FF501DX 1kW	22.25	(0.75)
HP4A High Pass Filter TV Down Lead	5.95	(—)

ANTENNA BITS

H1-Q Balun 1:1 5kW pep (PL259 Fitting)	9.95	(0.75)
T Piece Polyprop Dipole Centre	1.00	(0.20)
Ceramic Strain Insulators	0.40	(0.10)
Small Egg Insulators	0.40	(0.10)
Large Egg Insulators	0.50	(0.10)
75 ohm Twin Feeder – Light Duty-Per Meter	0.16	(0.02)
300 ohm Twin Feeder – Per Meter	0.14	(0.02)
URM67 Low Loss 50 ohm Coax-Per Meter	0.60	(0.20)
UR76 50 ohm Coax-Per Meter	0.25	(0.05)

Please send total postage indicated Any excess will be refunded.

MICROWAVE MODULES			
MMT144/28	2M Transverter for HF Rig	99.00	(—)
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	(—)
MML432/50	70cm 50W Linear Amp (10W I/P)	119.00	(—)
MML432/100	70cm 100W Linear Amp (10W I/P)	228.64	(—)
MM2000	RTTY to TV Converter	169.00	(—)
MM4000	RTTY Transceiver	269.00	(—)
MMC50/28	6M Converter to HF Rig	27.90	(—)
MMC70/28	4M Converter to HF Rig	27.90	(—)
MMC144/28	2M Converter to HF Rig	27.90	(—)
MMC432/28S	70cm Converter to HF Rig	34.90	(—)
MMC432/144S	70cm Converter to 2M Rig	34.90	(—)
MMC435/600	70cm ATV Converter	27.90	(—)
MMK1296/144	23cm Converter to 2M Rig	59.80	(—)
MMD050/500	500MHz Digital Frequency Meter	69.00	(—)
MMD600P	600MHz Prescaler	23.00	(—)
MMDP1	Frequency Counter Probe	11.50	(—)
MMA28	10M Preamp	14.95	(—)
MMA144V	2M RF Switched Preamp	34.90	(—)
MMF144	2M Band Pass Filter	9.90	(—)
MMF432	70cm Band Pass Filter	9.90	(—)
MMS1	The Morse Talker	99.00	(—)

DATONG PRODUCTS			
PC1	General Coverage Converter HF on 2M Rig	120.75	(—)
VLF	Very Low Frequency Converter	25.30	(—)
FL1	Frequency Agile Audio Filter	67.85	(—)
FL2	Multi-mode Audio Filter	89.70	(—)
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	24.00	(—)

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 (HF) Complete with Lower Clamps	99.95	(2.50)
KR600RC	Kenpro (Med HF) Complete with 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	(—)
ADONIS AM601 Compression Mic+Meter 1 O/P	49.00	(—)
ADONIS AM 802 Compression Mic+Meter 3 O/P	59.00	(—)

MOBILE SAFETY MICROPHONES

ADONIS AM 202S Clip-on	20.95	(—)
ADONIS AM 202F Swan Neck +Up/Down Buttons	30.00	(—)
ADONIS AM 202H Head Band+Up/Down Buttons	30.95	(—)
DAIWA RM940 Infra Red Link	45.00	(0.75)

HAND MICROPHONES

T.A. 600 Fist Mic.	4.95	(0.50)
Power Mic. Wide Impeadance	9.95	(0.75)
TRIO MC30/35 600/50K IMP	13.80	(0.75)
YAESU YE7A/YD846 600/50K IMP	5.75	(0.75)
SHURE 201 High IMP. Quality Mic.	14.50	(0.75)

TEST EQUIPMENT

Drae VHF Wavemeter 130-450MHz	24.95	(—)
FXI Wavemeter 250MHz MAX	28.00	(0.75)
DM81 Trio Dip Meter	51.75	(0.75)
MMD50/500 Microwave Modules Frequency Counter	69.00	(0.75)

YAESU			
FT902DM	160-10m 9 Band Transceiver	799.00	(—)
FC902	All Band A.T.U.	126.00	(1.50)
SP901	External Speaker	28.75	(1.50)
FT101Z	160-10m 9 Band Transceiver (FM)	529.00	(—)
FT101ZD	160-10m 9 Band Transceiver (FM) Digital R.O.	599.00	(—)
DCT101Z	DC/DC Power Pack	34.50	(1.50)
FAN101Z	Cooling Fan for 101Z/ZD	13.80	(0.75)
FT707	8 Band Transceiver 200W Pep	529.00	(—)
FT707S	8 Band Transceiver 20W pep	454.00	(—)
FP707	Matching Power Supply	109.00	(5.00)
FTV707R(2)	Transverter – 2M	183.00	(—)
FV707DM	Digital V.F.O.	186.00	(—)
FC707	Matching A.T.U./Power Meter	80.50	(1.00)
MR7	Metal Rack for FT707	14.95	(1.00)
MMB2	Mobile Mounting Bracket for FT707	16.10	(1.00)
FRG7	General Coverage Receiver	189.00	(—)
FRG7700	200KHz-30MHz Gen. Coverage Receiver	309.00	(—)
FRG7700M	As above but with Memories	389.00	(—)
FRT7700	Antenna Tuning Unit	34.75	(1.00)
FT208R	2M FM Synthesised Handheld	190.00	(—)
FT708R	70cm FM Synthesised Handheld	199.00	(—)
NC7	Base Trickle Charger	24.55	(1.30)
NC8	Base Fast/Trickle Charger	41.40	(1.50)
NC9C	Compact Trickle Charger	7.65	(0.75)
FBA2	Battery Sleeve for use with NC7/8	2.70	(0.50)
FNB2	Spare Battery Pack	16.10	(0.75)
PA3	12V DC Adaptor	12.25	(0.75)
FT480R	2M Synthesised Multimode	359.00	(—)
FT780R	70cm Synthesised Multimode (1.6MHz Shift)	429.00	(—)
FP80	Matching 230V AC Power Supply	59.00	(1.50)

★ AS REVIEWED ★

FT290R	2M Portable Synthesised Multimode	229.00	(—)
MMB11	Mobile Mounting Bracket	20.70	(1.00)
CSC1	Soft Carrying Case	3.45	(0.75)
NC11C	240V AC Trickle Charger	7.65	(0.75)
FL2010	Matching 10W Linear	59.75	(1.20)
Nicads	2.2 AMP HR Nicads Each	2.50	(—)
FL2100Z	160-10m 1200 Watt Linear	385.00	(5.00)
FF501DX	H.F. Low Pass Filter 1kW	22.25	(0.75)
FSP1	Mobile External Speaker 8 ohm 6W	9.60	(0.75)
YH55	Headphones 8 ohm	9.95	(0.75)
YH77	Lightweight Headphones 8 ohm	10.75	(0.75)
QTR24D	World Clock (Quartz)	25.70	(0.75)
YM24A	Speaker/Mic 207/208/708	16.85	(0.75)
YD148	Stand Microphone Dual IMP 4 Pin Plug	19.15	(1.50)
YM34	As 148 but 8 Pin Plug	18.80	(1.50)
YM38	As 34 but up/down Scan Buttons	22.60	(1.50)

FDK VHF/UHF EQUIPMENT			
Multi 700EX	2M FM Synthesised 25W Mobile	189.00	(—)
Multi 750E	2M Multimode Mobile	289.00	(—)
Expander	70cm Transverter for M750E	169.00	(—)

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)
C12/230	Charger	7.59	(0.75)

DRAE POWER SUPPLIES

All with Over-Volts – Current Limit and Thermal Protection

4 AMP	27.95	(1.50)	12 AMP	69.00	(2.00)
6 AMP	44.95	(2.00)	24 AMP	99.00	(3.00)

SWR – POWER METER

Model 110	H.F./2M Calibrated Power Reading	11.50	(0.50)
SWR25	H.F./2M Twin Meter	11.50	(0.50)
UH74	2M/70	13.95	(0.50)
WELZ SP15M	H.F./2M 200W	29.00	(0.75)
WELZ SP200	H.F./2M	59.00	(0.75)
WELZ SP300	H.F./2M/70	79.00	(0.75)
WELZ SP400	2M/70	59.00	(0.75)
DAIWA SW110A	H.F./2M	35.00	(—)
DAIWA CN620A	H.F./2M Cross Pointers	52.80	(—)
DAIWA CN630	2M/70 Cross Pointers	71.00	(—)

DUMMY LOADS

DL30	PL259	30W MAX	5.00	(0.50)
DL60	PL259	60W MAX	8.80	(0.70)
DL60	N TYPE	60W MAX	16.50	(0.70)
DL150	PL259	150W MAX	14.95	(0.75)
DL600	SO239	600W MAX	29.95	(1.50)
DL1000	SO239	1000W MAX	39.95	(1.50)

Buy it with Access

MAIL ORDER
Mon-Sat. 9-12.30/1.30-5.30

All prices correct at time of going to press.

BREDHURST ELECTRONICS

RETAIL
Mon-Sat. 9-12.30/1.30-5.30

BARCLAYCARD VISA

HIGH STREET, HANDCROSS, WEST SUSSEX. TEL. 0444 400786

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

Geoff Arnold T.Eng(CEI) G3GSR
Editor

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

Peter Metalli
Art Editor

John Fell G8MCP
Technical Editor

Alan Martin G8ZPW
News & Production Editor

Elaine Howard G4LFM
Technical Sub-Editor

Rob Mackie
Technical Artist

Keith Woodruff
Assistant Art Editor

Sylvia Barrett
Secretarial

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

Dennis Brough
Advertisement Manager
✆ 01-261 6636
✆ 01-261 6872

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

Claire Gerrish
Secretary
✆ 01-261 6636

Barbara Blake
Classified Supervisor
✆ 01-261 5897

Dave Kerindi
Make-up & Copy
✆ 01-261 6570

Practical Wireless

DECEMBER 1981 VOL. 57 NO. 12 ISSUE 897

contents

Our thanks to Panda Soft Drinks Ltd., Blandford, for allowing us to photograph their bottling plant for our cover this month

TRIO *pacesetter in amateur radio*

The TS-830S has every conceivable operating feature built in for full and lasting enjoyment of the HF bands. It combines VBT (variable band width tuning), IF shift and an IF notch filter as well as very sharp filters in the 455KHz second IF.

TS-830S

£694.83 inc VAT Securicor carr. £4.50

The TS-530S is an HF transceiver based on the reputation of the TS-520 series. Included are, of course, the new bands and the rig has both digital and analogue frequency readout.

TS-530S

£534.98 inc VAT Securicor carr. £4.50

The TS-130S is **the** mobile 200 watts Pep HF transceiver from Trio, again featuring the three new bands. Just the rig for mobile high power operation. Also available the TS-130V – a 20 watt Pep version.

TS-130S

£525.09 inc VAT TS-130V £445.05 inc VAT

MAKE MOBILE OPERATION A PLEASURE

A digital frequency remote controller complete with up/down microphone and having four memories. Ideal for simpler mobile operation. Compatible with the TS-830S, TS-530S, TS-130S and V and the TS-120 series.

DFC-230

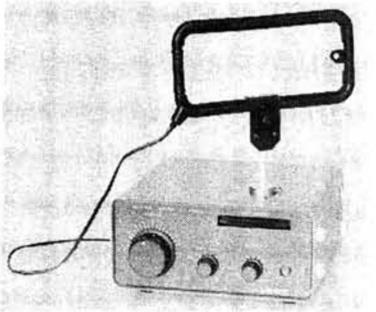
£179.86 inc VAT Securicor carr. £4.50

LOWE IN LONDON

NOW OPEN, OUR SHOP IN THE CITY
278 PENTONVILLE ROAD, LONDON N1 9NP.

RECEIVERS & ACCESSORIES

		Inc VAT	Carr
R1000	Synthesised 200KHz-30MHz receiver. Price includes dc kit fitted	297.85	4.50
HC10	Digital station world time clock	58.88	1.50
HS5	Deluxe headphones for all TRIO equipment	21.85	.75
HS4	Economy headphones	10.35	.75
CS201/TW2	Two way 50 ohm coax switch. 0-500MHz	11.98	.75
FBB9A	1:1 50 ohm balun. 1KW pep rating. For use as dipole centre	11.50	.75
DPX	Allows single feed line to VHF/UHF aerials. Reduces cable cost	10.50	1.00
SRX30D	Digital readout HF receiver. 500KHz-30MHz. AM/SSB/CW	215.00	4.50



UL-1000

£39.50 inc VAT

The UL-1000 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 UL-1000 is a self-contained variable gain, tuned preamplifier suitable for use with various aerial systems. A particular feature of the UL-1000 is the use of a high Q loop aerial for the 500KHz-1.6MHz band.

The TR9500, a 70 cm 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 70 cm band this is the rig all discerning VHF and UHF amateurs have been waiting for.

TR-9500 *70cm multimode*

£449.88 inc VAT carriage £4.50

CN520	1.8-60MHz mini cross needle power/SWR meter	28.26	32.50	1.50
CN540	50-150MHz mini cross needle power/SWR meter	30.44	35.00	1.50
CN620A	1.8-150MHz cross pointer power and SWR meter. Up to 1KW	45.92	52.81	1.50
CN630	140-450MHz cross pointer power and SWR meter. Up to 200W	65.22	75.00	1.50
CN650	1.2-2.5GHz cross pointer power and SWR meter. Up to 20W	82.61	95.00	1.50
CNW518	3-30MHz 8 band hi power tuner and cross needle power meter	152.17	175.00	2.00
CNA1001A	Fully automatic all band ATU. Includes cross pointer power meter	135.65	156.00	2.00
CNA2002	As for CNA1001A but 2KW rating for tuner and power meter	198.26	228.00	2.00
SW110A	SWR/power meter 1.8-150MHz. 0-20 and 0-200W. Not cross pointer	26.00	29.90	1.25

THE DAIWA FAMILY

AR740	70cm FM synthesised handheld transceiver	195.00	2.00
AR240A	2m FM 1W synthesised handheld complete with NiCad pack etc.	158.00	2.00
AR245	2m FM 5W synthesised handheld complete with NiCad etc.	178.00	2.00
ARMS	External mic/speaker	10.50	1.00
ARCC	Carrying case	4.10	.75
ARHA	Optional helical antenna	4.10	.75
ARBC	12V battery charger. (Mains charger included with transceiver)	4.10	.75
AR30	25W 2 metre linear. RF switched. 12V powered	38.50	1.75

THE AOR FAMILY

PRICES & SPECIFICATION SUBJECT TO CHANGE WITHOUT NOTICE

TRIO

pacesetter in amateur radio

Trio 8400 the new way to 70cm FM mobile, a fully synthesized 430 440MHz 10 watt output, mobile transceiver with memories, 2 separate VFO's all in a truly amazing compact package. Complete with up/down frequency shift microphone and car mounting bracket the TR8400 is the way to go . . . 70cm is on the move.

TR-8400 *70cm FM mobile*

£334.88 inc VAT. Securicor carriage £4.50

TR-9000 The exciting TR-9000 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 TR-9000 is ideal for mobile installation, add on its fixed station accessories and it becomes the obvious choice for your shack.

TR-9000 *2 Metre Multimode*

£394.00 inc VAT. Carriage by Securicor £4.50

TR-7800 Trio's remarkable TR-7800 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 TR-7800 by Trio, the only FM mobile.

TR-7800 *The Ultimate 2 Metre Mobile FM rig*

£284.97 inc VAT. Carriage by Securicor £4.50

HEAD OFFICE AND SERVICE CENTRE

Chesterfield Road, Matlock, Derbys. Tel. 0629 2817 or 2430.

Open Tuesday-Friday 9-5.30, Saturday 9-5.00. Closed for lunch 12.30-1.30.

For all that's best in ham radio, contact us at Matlock.

For full catalogues send 70p in stamps with your address. Mark enquiry PW.

All these advantages...

- Instant all-weather starting
- Smoother running
- Continual peak performance
- Longer battery & plug life
- Improved fuel consumption
- Improved acceleration/top speed
- Extended energy storage

..in kit form

SPARKRITE X5 is a high performance, top quality inductive discharge electronic ignition system designed for the electronics D I Y world. It has been tried, tested and proven to be utterly reliable. Assembly only takes 1-2 hours and installation even less due to the patented 'clip on' easy fitting.

The superb technical design of the Sparkrite circuit eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R P M. Contact breaker burn is eliminated by reducing the current by 95% of the norm.

There is also a unique extended dwell circuit which allows the coil a longer period of time to store its energy before discharging to the plugs. The unit includes built in static timing light, systems function light, and security changeover switch. Will work all rev counters.

Fits all 12 v negative-earth vehicles with coil/distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED
Die pressed case. Ready drilled, aluminium extruded base and heat sink, coil mounting clips and accessories. All kit components are guaranteed for a period of 2 years from date of purchase. Fully illustrated assembly and installation instructions are included.

Roger Clark the world famous rally driver says "Sparkrite electronic ignition systems are the best you can buy."

Sparkrite

HIGH PERFORMANCE
ELECTRONIC IGNITION

Electronics Design Associates, 82 Bath Street, Walsall, WS1 3DE.

Electronics Design Associates, Dept. PW/12/81
82 Bath Street, Walsall, WS1 3DE. Phone: (0922) 614791

Name ____________________
Address ____________________

Phone your order with Access or Barclaycard

Inc. V.A.T. and P.P.	QUANTITY REQ'D.
X5 KIT £16·95	
ACCESS OR BARCLAY CARD No.	

I enclose cheque/PO's for £ ________
Cheque No.
Send SAE if brochure only required.

RST

VALVE MAIL ORDER CO.
Climax House
159 Fallsbrook Road, London SW16 6ED
SPECIAL EXPRESS MAIL ORDER SERVICE

	£p
AZ31	1·10
CL33	2·00
DY86/7	0·84
DY802	0·84
E88CC	3·36
E180F	8·40
E810F	14·47
EABC80	1·20
EB91	0·82
EBF80	0·50
EBF89	0·85
EC91	7·56
ECC33	3·50
ECC35	3·50
ECC81	0·88
ECC82	0·72
ECC83	0·88
ECC85	1·20
ECC88	1·90
ECC91	8·93
ECF80	1·08
ECH35	2·00
ECH42	1·15
ECH81	1·20
ECL80	1·00
ECL82	1·00
ECL83	1·50
ECL86	1·20
EF37A	3·50
EF39	2·75
EF41	2·00
EF42	2·00
EF50	1·50
EF54	5·00
EF55	2·50
EF80	0·80
EF86	1·52
EF91	1·80
EF92	5·81
EF183	0·80
EF184	0·84
EH90	1·40
EL32	1·50
EL33	3·50
EL34	2·20
EL36	1·60
EL81	3.50
EL84	1·00
EL86	2·50
EL91	7·14
EL95	1·32
EL360	8·50
EM81	1·00

EM87	1·50
EN91	3·50
EY51	1·75
EY86	0·84
EY88	1·75
EY500A	1·94
EZ80	0·84
EZ81	0·84
GY501	2·75
GZ32	1·25
GZ33	4·00
GZ34	2·50
GZ37	4·00
KT61	3·50
KT66	10·00
KT77	8·00
KT88	12·00
N78	9·00
OA2	2·00
OB2	2·55
OC3	1·92
OD3	1·92
PC86	1·40
PC88	1·40
PC92	1·28
PC97	1·20
PC900	1·20
PCF80	1·00
PCF82	1·00
PCF86	1·60
PCF801	1·60
PCF802	1·90
PCF805	1·60
PCF808	1·60
PCH200	1·60
PCL82	1·00
PCL83	2·00
PCL84	1·00
PCL85	1·08
PCL86	1·08
PCL805	1·08
PD500	3·60
PFL200	1·80
PL36	1·20
PL81	1·20
PL82	1·20
PL83	2·22
PL84	1·08
PL504	1·40
PL508	1·80
PL509	3·20
PL519	3·20
PL802	2·96
PY33	1·10

PY81	0·84
PY82	0·80
PY83	0·70
PY88	0·88
PY500A	1·80
PY800	0·84
PY801	0·84
QQV02-6	14·06
QQV03-10	5·80
QQV03-20A	17·50
QQV06-40A	£55.10
QV03-12	4·46
R18	4·25
R19	1·20
SP41	6·00
SP61	2·00
U19	13·75
U25	1·16
U26	1·44
U37	9·00
UABC80	1·25
UBF89	1·20
UCH42	1·20
UCH81	2·32
UCL82	1·04
UCL83	1·44
UF89	1·44
UL41	2·50
UL84	1·20
UY41	1·25
UY85	1·04
VR105/30	1·92
VR150/30	1·92
Z759	16·80
Z803U	7·90
2D21	3·50
3B28	14·35
4CX250B	45·00
5R4GY	3.50
5U4G	1·52
5V4G	1·52
5Y3GT	0·85
5Z3	1·50
5Z4GT	1·50
6/3DL2	1·56
6AB7	1·50
6AH6	4·71
6AK5	3·60
6AL5	0·82
6AM6	1·80

6AN5	4·74
6AN8A	3·45
6AQ5	0·96
6AR5	1·98
6AS6	4·98
6AS7GA	6·75
6AT6	0·85
6AU5GT	4·32
6AU6	1·08
6AW8A	3·39
6B7	1·50
6B8	1·75
6BA6	1·00
6BA7	5·12
6BE6	1·08
6BH6	1·52
6BJ6	1·08
6BN6	1·65
6BQ7A	3·72
6BR7	4·00
6BR8	1·75
6BS7	4·00
6BW6	4·00
6BW7	1·52
6BZ6	2·37
6C4	0·88
6C6	1·75
6CB6A	2·49
6CD6GA	5·07
6CL6	£3.72
6CH6	10·40
6CW4	7·68
6D6	1·75
6DQ5	5·94
6EA8	2·94
6EH5	1·85
6F6	1·75
6Gk6	2·67
6H6	1·50
6HS6	3·77
6J5	2·50
6J6	3·50
6J7	2·50
6JB6A	4·56
6JS6C	5·58
6K4N	1·25
6K6GT	1·30
6K7	1·50
6K8	1·75
6KD6	6·36
6L6G	2·50
6L6GC	2·50
6L7	2·00
6LQ6	6·72

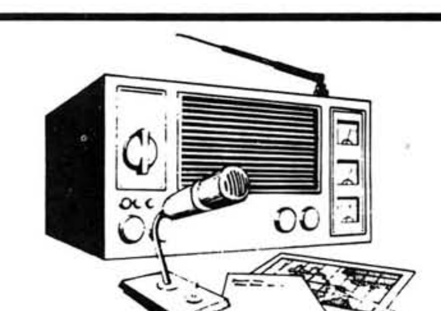
6Q7	2·20
6SA7	1·45
6SC7	1·50
6SJ7	1·60
6SK7	1·30
6SL7GT	2·68
6SN7GT	1·60
6SS7	1·80
6SG7M	2·50
6U8	0·80
6V6GT	1·60
6X4	1·20
6X5GT	0·85
7C5	2·95
7C6	2·25
7S7	2·25
12AT6	1·20
12AT7	0·88
12AU7	0·72
12AX7	0·88
12BA6	2·19
12BE6	2·43
12BY7	2·70
12BY7A	2·70
12HG7	4·17
30FL1/2	1·12
30P4	1·20
30P19	1·20
30PL13	1·80
30PL14	1·68
75C1	2·35
85A2	2·39
90C1	2·44
150B2	3·02
150C2	1·92
150C4	2·39
572B	27·50
805	20·00
807	3·75
811A	18·33
812A	18·33
813	79·26
866A	15·27
872A	21·47
931A	15·78
2050	6·96
5763	3·75
5814A	3·72
5842	12·09
6080	6·85
6146A	10·64
6146B	8·12
6883B	12·73
6973	3·87
7360	9·96
7586	10·14
7587	17·49

Open daily to callers: Mon-Fri 9 a.m.–5 p.m.
Valves, Tubes and Transistors · Closed Saturday
Terms C.W.O. only · Tel. 01-677 2424-7.
Quotations for any types not listed S.A.E.
Post and packing 35p per order

Prices excluding VAT add 15%

Telex 946708

Prices correct when going to press



BECOME A RADIO AMATEUR

Learn how to become a radio amateur in contact with the whole world. We give skilled preparation for the G.P.O. licence.
No previous knowledge required.

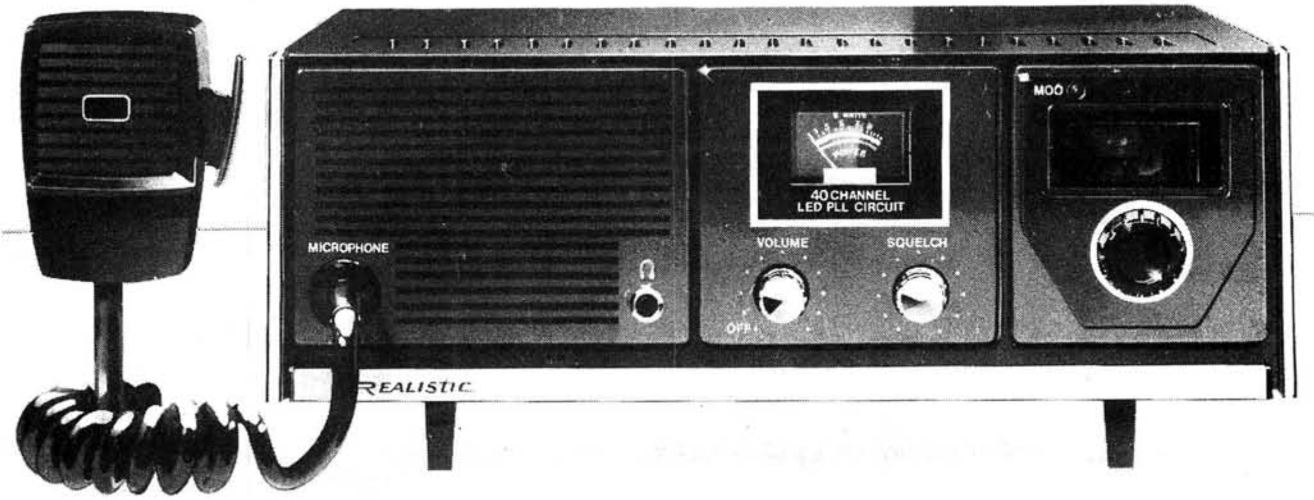
Free!

Brochure without obligation to :–
British National Radio & Electronic School
READING, BERKS. RG1 1BR

Name . . . .
Address . . . .
. . . .
. . . .

PW/12/815 BLOCK CAPS PLEASE

CHATTER-BOXES SERVED HERE.



Realistic is the biggest name in Citizens Band Radio and accessories – and you will be able to buy the full range at Tandy – the world's largest retailer of CB equipment!

REALISTIC®

CB from Tandy

WATCH PRESS FOR FORTHCOMING ANNOUNCEMENTS

ICOM

from Thanet Electronics Ltd
143 Reculver Road, Herne Bay, Kent
Tel: 02273 63859

IC290E. TWO METRE 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 100Hz tuning steps. Instant rev-repeat.

IC25E. 25W 2M FM MOBILE. Amazingly small. 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.

IC24G. 10W 2M FM MOBILE. This is the low-cost, easy to use economy model. Full band – 80 channels at 25KHz spacing by easy to use press button switches. 12½KHz spacing if reqd. 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.

THE POPULAR IC2E HANDY TALKY – EVERYBODY HAS ONE!

CHECK THE FEATURES:

FULLY SYNTHESIZED – Covering 144-145 99s in 400 5kHz steps.
POWER OUTPUT – 1.5W with fine 9V rechargeable battery pack as supplied – but lower or higher output available with the optional 6V or 12V packs.
BNC ANTENNA OUTPUT SOCKET – 50 ohms for connecting to another antenna or use the Rubber Duck supplied.
SEND/BATTERY INDICATOR – Lights during transmit, but when battery power falls below 6V it doesn't light indicating the need for a recharge.
FREQUENCY SELECTION – by thumbwheel switches, indicating the frequency.
+5kHz SWITCH – adds 5kHz to the indicated frequency.
DUPLEX SIMPLEX SWITCH – gives simplex or plus 600kHz or minus 600kHz Transmit.
HI-LOW SWITCH – reduces power output from 1.5W to 150mW reducing battery drain.
EXTERNAL MICROPHONE JACK – If you do not wish to use the built-in electret condenser mic an optional microphone/speaker with PTT control can be used. Useful for pocket operation.
EXTERNAL SPEAKER JACK – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

A full range of accessories in stock

IC ML1	
10 Watt Mobile Booster for IC2E	**£49.00**
BPS 11 Volt Battery Pack	**£30.50**
BP4 Empty Battery Case For, 6 × AA Cells	**£5.80**
BP3 Standard Battery Pack	**£17.70**
BP2 6 Volt Pack	**£22.00**
BC30 Base Charger For Above	**£39.00**
BC25 Mains Charger As Supplied	**£4.25**
DC1 12 Volt Adapter Pack	**£8.40**
HM9 Speaker/Microphone	**£12.00**
CP1 Mobile Charging Lead	**£3.20**
IC1/2/3 Cases	**£3.60 each**

All Prices include V.A.T.

ASK ABOUT THE 70cm VERSION THE IC4E – NOW AVAILABLE

BUY DIRECT FROM US OR OUR AGENTS AND GET
TWO FULL YEARS WARRANTY ON ALL EQUIPMENT

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 13V DC or use PS15 mains PSU.
And to match the IC720A:– **IC2KL** 500W output all mode linear amplifier. Similar size and completely automatic – no tuning. **ICAT500** completely automatic antenna tuner.

IC251E & 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, 10W output on FM, SSB and CW, built-in 12 and 240V supplies. None other like them.

ALL TONO PRODUCTS NOW IN STOCK

PLEASE RING US FOR THE LATEST PRICES, YOU MAY CALL AFTER HOURS USING OUR ANSAFONE ON 02273 63850

WE STOCK CUSHCRAFT ANTENNAS

H.F.			**INC. VAT**
A3	20/15/10	3ele Beam 8dB gain	**£147.00**
ATV5	80-10	Trapped Vertical	**£74.40**
ATV3	20/15/10	Trapped Vertical	**£34.00**

VHF (144MHz)

A3219	19ele Long 'Boomer' Yagi 16.2dB gain	**£62.00**
214B	14ele Jnr 'Boomer' Yagi 15.2dB gain	**£49.50**
ARX2	Ringo Ranger 6dB gain vertical	**£24.75**
A144-4	4ele Yagi 9.0dB gain	**£16.25**

A144-7	7ele Yagi 10.0dB gain	**£20.31**
A144-11	11ele Yagi 11.3dB gain	**£25.72**
DX120	20ele Array 13.2dB gain	**£47.20**
ARX2B	Ringo Ranger II	**£28.75**
ARB2K	Conversion Kit for Ringo to Mk II version	**£12.75**

WE ALSO STOCK:–

J-BEAM ● MICROWAVE MODULES ● YAESU ● WESTERN RSGB BOOKS ● BEARCAT ● JIL ● TAL ANTENNAS ● VIDEO GENIE

AGENTS (PHONE FIRST – evenings and weekends only)

Scotland	Jack GM8GEC (031-665-2420)	Wales	Tony GW3FKO (0874 2772 or 3992)
North West	Gordon G3LEQ (0565 4040) Ansafone Service available	Midlands	Tony G8AVH (021-329-2305)

MAIL ORDER

Photo Acoustics Ltd

MICRO COMMUNICATIONS DIVISION

BUDGET ACCOUNT

WE ARE AUTHORISED DEALERS FOR:-

APPROVED TRIO DEALER — YAESU — AUTHORISED ICOM DEALER — FDK

TR-7730

H.F. Transceivers

Trio TS830S .... **£694.83 (4.50)**
Trio TS530S .... **£534.98 (4.50)**
Trio TS130S .... **£525.09 (4.50)**
Trio TS130V .... **£445.05 (4.50)**
Yaesu FT902DM .... **£799.00 (4.50)**
Yaesu FT101ZD .... **£599.00 (4.50)**
Yaesu FT707 .... **£529.00 (4.50)**

2 Metre & 70 cms

Trio TS770E .... **£784.99 (4.50)**
Trio TR9000 .... **£394.91 (4.50)**
Trio TR7730 .... **£247.94 (4.50)**
Trio TR2300 .... **£166.75 (4.50)**
Trio TR8400 .... **£334.88 (4.50)**
Trio TR9500 .... **£449.88 (4.50)**

FT-707

2 Metre & 70 cms

Icom IC251E .... **£499.00 (4.50)**
Icom IC290E .... **£366.00 (4.50)**
Icom IC25E .... **£259.00 (4.50)**
Icom IC2E .... **£169.00 (4.50)**
Yaesu FT290R .... **£229.00 (4.50)**
Yaesu FT708R .... **£199.00 (2.50)**
Yaesu FT480R .... **£359.00 (4.50)**
Yaesu FT780R .... **£409.00 (4.50)**
FDK M700EX .... **£189.00 (4.50)**
FDK M750E .... **£289.00 (4.50)**
AZDEN PCS3000 .... **£219.00 (4.50)**
STANDARD C58 .... **£239.00 (4.50)**
STANDARD C78 .... **£219.00 (4.50)**

IC-251

RECEIVERS

Trio R1000 .... **£305.90 (4.50)**
Lowe SRX 30D .... **£195.00 (4.50)**
Yaesu FRG7700 .... **£309.00 (4.50)**
Yaesu FRG7700M .... **£389.00 (4.50)**
SX200N .... **£264.50 (4.50)**
R517 Airband Receiver .... **£49.45 (1.00)**
Academy CB-Airband .... **£14.95 (1.00)**

AERIALS
J. BEAM
CUSHCRAFT
AVANTI
HOXIN
HOKUSHIN
G-WHIP

MULTI-750E

ACCESSORIES

5 amp PSU Bermec .... **£14.75 (1.25)**
10 amp PSU PP1310 .... ***£49.50 (4.50)***
20 amp PSU Yaesu .... **£110.00 (4.50)**
FX1 Wavemeters .... **£28.00 (1.25)**
DM801 G.D.O. .... **£51.78 (1.25)**
SP15M SWR & Power Meter .... **£29.99 (2.50)**
SP300 1.8-500 Mhz .... **£79.99 (2.50)**
SP400 130-500 Mhz .... **£59.99 (2.50)**
CNA 1001 Auto ATU .... **£129.95 (2.50)**
SW110A SWR/Power .... **£31.33 (1.25)**
CN620A Twin Pointer SWR .... **£52.81 (2.50)**
LAR VHF Omni Match .... **£34.90 (2.50)**
LAR HF Omni Match .... **£69.25 (2.50)**
FULL RANGE OF MICROWAVE MODULES

Buy it with Access

—24 HOUR ANSWERPHONE CREDITCHARGE PART EXCHANGE—

58 HIGH STREET, NEWPORT PAGNELL, BUCKS.

TEL: 0908 610625

BARCLAYCARD VISA

AJH ELECTRONICS

20 BARBY LANE, HILLMORTON,
RUGBY, WARWICKSHIRE CV22 5QJ.
TEL: 76473 EVE 71066.

Mail Order Only or callers by appointment.
All prices include VAT but add 50p post & packing.

VHF RF POWER TRANSISTORS:–

Type	Gain (db)	Output	Volts	Freq. (MHz)	Price
2N6083	5.7	30w	12	175	**£6.50**
PT4555	8	25w	12	150	**£4.00**
SD1212-6	8.2	3w min.	12	175	**£2.50**
PT4556	7	40w	12	80	**£4.50**
PT4236A	10	1w min.	12	175	**£0.75**
PT4236B	10	11w	12	88	**£3.00**
PT4236C	6	35w	12	88	**£4.50**
2N5070	13	25w pep	24	30	**£5.00**
BFW16A	10	1w	12	175	**£0.75**
2N3866	10	1w	28	175	**£0.75**

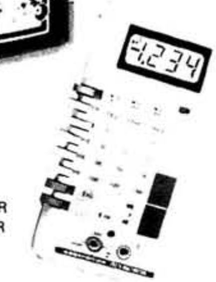
CB 27MHz RF POWER TRANSISTORS:–
2SC2028 **£1.90,** 2SC2078 **£2.90,** 2SC1306 **£2.75,** 2SC1307 **£3.25.** 2SC1909 **£2.75.**
TA7205P 6 watt audio IC 12v. ex-new equipment & tested **£1.50.**
TDA1010 9 watt audio IC @ 14v. single in line type **£1.50 ea.**
MDA800 8 amp 50 volt bridge rectifier OK for 12 volt PSU **70p ea.**
LOW PROFILE RELAY 12 volt 2 pole change over OK for 50 watts RF @145MHz. New **only £2.25.**
FETS/MOSFETS:–
3SK51 (40673) **70p,** 3SK60 (sim. 3N204) **80p,** 3SK88 26db gain 1.1db NF @ 150MHz **£1.40,** BFR84 18db 3db nf @ 200MHz **75p,** E5565 (2N3919) **30p,** TIS88A **40p,** BF256 **38p,** 2N4381 "P" chan. **40p.**
BIPOLAR VHF/UHF RF AMPS:–
BF166 **25p,** BF180 **30p,** BFY90 **95p,** BF152 **15p,** BF576 (pnp 1200MHz ft) **20p,** 2N4957 (pnp UHF RF amp. 3½db nf @ 1GHz) **30p,** ST2110 (2N918 BSX20) **15p.**
VHF/UHF SWITCHING DIODES BA243 (VHF) **20p.** BA244 (UHF) **25p.**
VHF/UHF VARICAP DIODES ITT210 **20p,** BB105 **set of 4 60p,** BB141 **25p.**
TIL209B LEDS ⅛" dia. "red" **only 10p, 10 for 75p.**
PL259 PLUGS 50p, reducers for UR43/UR76 **15p.** PL259 right angle plug for RG58U **65p**
SO239 SOCKETS 50p. PL258 couplers **60p.**
BNC 50 Ohm flange sockets **70p.**
CO-AXIAL disc ceramics 100pf 100 volt OK UHF/SHF decoupling-pkt **20 for 25p.**
10.7MHz CRYSTAL FILTER ±3.5KHz @ 3db, 910 ohm. ITT024DE/923L **£7.00.**
10.7MHz CRYSTAL FILTER ±7½KHz @ 3db, 910 ohm. LQU/445/901B ex-equipment **£6.00.**
10.7MHz CRYSTAL FILTER SSB type BP4133 (LSB only available), 200 ohm imp. small size 38×18×15mm. New **£4.00 each.**
21.4MHz CRYSTAL FILTER ±7½KHz @ 3db. imp. approx. 2k ohm. New **£5.00.**
2 KILO BOX BROKEN CAR RADIO BOARDS OK for spares **£3.00** plus £1.50 pp.
OXLEY PTFE FEEDTHROUGH INSULATORS 4mm hole size **6p each. 25 for £1.00.**
GLASS FEEDTHROUGH INSULATORS solder in type silver plated requires 4mm hole **60p per 100.**
1000pf 500v. FEEDTHROUGH CAPACITORS solder in type requires 3½mm hole **30p per 10.**
MIXED DISC CERAMIC CAPS. 1 to 220pf bag of 100, ideal for the VHF constructor. All Erie miniature types **£1.40 per 100.**
MIXED BAG RESISTORS all ¼ watt vertical pre-formed type with long leads. Bag of 250 plus **£1.60.**
BALUN CORE 2 hole type 13×8×8mm **15p each, 10 for 80p.**
1000pf 250v LEEDLESS DISC CERAMICS 5mm dia. **10 for 25p.**

"YEASU MUSEN" EQUIPMENT LET US QUOTE YOU COMPETITIVE PRICES

---

sabtronics

An entire range of low-cost high-performance instruments



•8610A 600 MHz FREQUENCY METER

- 2010A 3½ DIGIT L.E.D. DMM
- 2015A 3½ DIGIT L.C.D. DMM
- 2035A 3½ DIGIT L.C.D. HANDHELD DMM.
- 8110A 100 MHz 8 DIGIT FREQUENCY METER
- 8610B 600 MHz 9 DIGIT FREQUENCY METER
  8000B 1 GHz 9 DIGIT FREQUENCY METER
  5020A 200 KHz FUNCTION GENERATOR
  LP-1 10 MHz LOGIC PROBE
- ALSO AVAILABLE IN KIT FORM

• 2037A L.C.D. HAND HELD DMM WITH TEMPERATURE

Test our low priced test equipment. It measures up to the best. Compare our specs and our prices — no-one can beat our price/performance ratio.

sabtronics

"Making Performance Affordable"

Full colour illustrated brochure and price list from:
BLACK STAR LTD, 9a Crown Street, St. Ives, Cambs. PE17 4EB
Tel: (0480) 62440. Telex: 32339

Black Star

SMC SERVICE

Free Finance on many items. Two-year guarantee on Yaesu. Free Securicor on major Yaesu items. Access and Barclaycard over the telephone. Biggest Branch, Agent and Dealer network. Ably staffed, courteous, Service Department. "B Services" Securicor contract at £3.50!! Biggest stocks of amateur equipment in UK. Twenty-two years of professional experience.

FREE FINANCE

On regular priced items from: Yaesu, Ascot SMCHS, CDE, HyGain, Channel Master, Hansen, SMC, MFJ, KLM, Mirage and Hy Mound, on invoices over £100 SMC offers Free Finance! How is it done? Simple, pay 20%, split the balance equally over 6 months or pay 50% down and split the balance over a year. You pay no more than the cash price!!

YAESU MUSEN

SMC are proud to be UK agents for Yaesu Musen the brand leader in Amateur Radio. Their exclusive concentration on communications equipment – The most diverse product line and a reputation for continuous innovation are your assurances that SMC and Yaesu can provide equipment to exactly fit your needs and you will be at, and remain at, the forefront of today's high technology.

GUARANTEE

Yaesu's *own* warranty does not extend outside Japan. Repairs are the responsibility of the UK dealer selling the set. SMC's two-year guarantee is backed, as UK distributors, by daily contact with the factory and many tens of thousands of pounds of spares and test equipment. Avoid hawkers offering sets without serial numbers, spares, service or advice back-up.

FT ONE £1295

COVERAGE

RX; 150 KHz-30 MHz. Continuous general coverage. TX; 160-10m (9 bands). 1.5-30 MHz commercial version.

MODES

All modes; AM, CW, FM, FSK, LSB, USB.
Tx and Rx on opposite sidebands possible.

FREQUENCY SELECTION

No bandswitch. Multiple methods of frequency setting. Main dial; "velvet smooth" 10 Hz resolution, 3 speeds; Set MHz, KHz/R – Normal, KHz/R – Fine, Controls RIT or offset (synthesised clarifier).
Inbuilt Keypad; direct digital entry to 100 Hz, Fast/slow, up/down tuning, Scanning manual or auto mode.

RECEIVER

Receiver dynamic range up to 100 dB. Pair of low noise power transistors in RF. Ring mixer with LO injection at 10 dBm. Advanced variable threshold noise blanker. AGC: slow-fast-off. Squelch control. Variable RF attenuator and RF gain circuits. SSB; Variable bandwidth and IF shift. 3 CW and 2 FSK bandwidth positions. 300 Hz, 600 Hz, 2,400 → 300 Hz, 6 KHz, 12 KHz.

TRANSMITTER

100w RF, (50% duty FSK) all solid state. No preselector, no "plate" tune, no loading controls. Mains and 12V DC. Switch-mode PSU built in. CW change over delay adjustable through to *full break in.* Electronic keyer built in. Drive level control. Front panel adjustable VOX. Signal monitor feature. RF processor, compression control concentric with mic gain. Auto mic gain, reduces extraneous off mic noises.

MEMORY

Two memory banks (A + B) each with 10 slots. Simplex or Semi duplex A, B, RxA/TxB, TxA/RxB. ANY frequency storable. ANY TX-RX split within coverage. RIT offset stored together with memory channel.

METERING

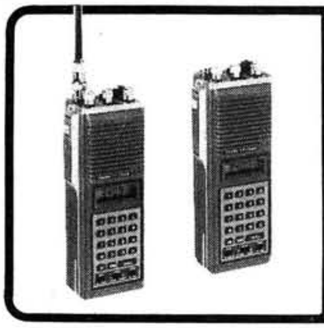
Two large moving coil meters (+3 digitals and 12 leds). R.H. (Rx – TX); 'S' (1-9, + 20, + 40, + 60 dB) and ALC level. L.H. switched; Ic (20A), Va, Discriminator (FMzero), Compression (0-25 dB), Forward, Reflected. Digital readout to 100 Hz. Analogue markings for "feel". Dedicated digital readout of RIT offset to ±9.9 KHz. Digital readout of memory channel number recalled. LED's; Processor, Noise blanker, Auto mic gain, Monitor, Peak – Notch filter, *Scan*, Transceive, TX – RX Clarify, Dial Lock, Tx Disabled.

FT207R

£169.00 buys you a Yaesu FT207R an IC2F or an AR240 (with £10.00 change) synthesised handheld transceiver. The FT207R steps in 12½ KHz (Not 10 KHz with added "5 up" switch) it scans for occupied or empty channels (no scanning) it has 4 channels of memory (none) and "auto revert" priority mode (none), programmable and ± 600 KHz splits (±600 KHz only), one could go on – but we would probably not have any left by the time you read this!!

FT720

A unique modular VHF/UHF FM transceiver system at a remarkable price. Take a tiny FT720R control head for £115.00 plug in a 720R' 2M ('V 10w £130.00, 'VH 25w £140.00) or 70cm ('U 10w £150.00) RF deck or operate it remotely with a 200cm or 400cm (E72S £15.00 or E72L £20.00) extension cable. Better still, buy a switching box (S72 £55.00) to enable control of a 2m and a 70cms deck from one control head, for the neatest installation around.



FT208R £209.00
2.5w, 2m
12.5/25 KHz
Synthesised

FT708R £219.00
1w, 70cms
25 KHz
Synthesised

FRG7700 £329

0.15-30 MHz General Coverage Receiver AM/SSB/CW/FM (Memory Version £409).

★FT902D £800
★FT902DE £790

FT902DM £885

10-160m. SSB, CW, AM, FM, Deluxe digital, Keyer, fan, variable bandwidth etc.

902

FTV901R	Transverter Frame, 3 band	£195
FV901DM	Digital VFO. 40 mem. Scan	£260
YO901P	Monitor scope/Panadaptor	£330
FC902	Antenna tuner unit	£135
SP901	Speaker (Patch version £55)	£31

FT707 £569

10-80m. 100w PEP. SSB, AM, CW. Variable IF bandwidth, Digital (10w model £485).

707

FP707	Mains P.S.U. (20A)	£125
FC707	Antenna tuner	£85
FV707DM	Digital VFO 6 Mem	£203
FTV707R	Transvertor Frame, 1 Band	£90

50TV **£70,** 70TV **£80,** 144TV **£100,** 430TV **£185.**

FT209R £249

2m, synthesised. 25 + 12½ KHz steps FM, 1 KHz + 100 Hz steps SSB. 2½W PEP.

FT480R £379

2m Synthesised, 25 12½, 1 KHz steps FM. 1 KHz, 100, 10 Hz steps SSB. 10W PEP.

FT107M £725

10-160m. 100w PEP, SSB, AM, CW. Variable IF. Deluxe all solid state. (DMS version £799).

107

FP107E	Mains PSU External	£113
FP107	Mains PSU Internal	£102
FTV107	Transvertor frame 2 band	£119
FV107	External VFO	£98
FC107	Antenna Tuner	£112

PRICES INCLUDE VAT @ 15% **FREE SECURICOR DELIVERY** **2 YEAR IMPORTER WARRANTY**

SOUTH MIDLANDS COMMUNICATIONS LIMITED

S. M. HOUSE, OSBORNE ROAD, TOTTON, SOUTHAMPTON, SO4 4DN, ENGLAND
Tel: Totton (0703) 867333, Telex: 477351 SMCOMM G, Telegram: "Aerial" Southampton

AGENTS

G3ZUL	Brian	Stourbridge	(03843) 5917
GI3KDR	John	Bangor	(0247) 55162
GM8GEC	Jack	Edinburgh	(031665) 2420
GI3WWY	Mervyn	Tandragee	(0762) 840656
GW3TMP	Howarth	Pontybodkin	(035287) 846/324
GW8EBB	Peter	Swansea	(0792) 872525
GJ4ICD	Geoff	Jersey	(0534) 26788
G4EQS	Simon	Redcar	(0642) 480808

LEEDS
S.M.C. (Leeds)
257 Otley Road,
Leeds 16, Yorkshire.
Leeds (0532) 782326
9-5.30 Monday-Saturday

CHESTERFIELD
S.M.C. (Jack Tweedy) Ltd
102 High Street,
New Whittington, Chesterfield.
Chesterfield (0246) 453340
9-5 Tuesday-Saturday

WOODHALL SPA
S.M.C. (Jack Tweedy) LTD
150 Horncastle Road,
Woodhall Spa, Lincolnshire.
Woodhall Spa (0526) 52793
9-5 Tuesday-Saturday

PM COMPONENTS LTD. VALVE & COMPONENTS SPECIALISTS

BARCLAYCARD VISA

DEPT. P, CONINGSBY HOUSE, WROTHAM RD, MEOPHAM, KENT DA13 0HN

PHONE 0474 813225. TELEX 965966 WEST ST G

Buy it with Access

NEW BRANDED VALVES

A2087	11.50
A2134	9.00
A2293	7.20
A2900	10.90
DAF91	0.45
DAF96	0.65
DF91	0.45
DF92	0.60
DF96	0.65
DK91	0.90
DK92	1.20
DK96	1.00
DL92	0.60
DL94	1.20
DL96	1.00
DLS10	9.00
DLS16	10.00
DY86/87	0.55
DY802	0.60
E55L	14.00
E80CC	4.75
E80F	6.25
E81CC	3.90
E82CC	1.50
E83CC	1.50
E83F	2.50
E86C	6.00
E88C	4.00
E88CC	2.60
E130L	13.00
E180F	5.25
E182CC	4.50
E810F	8.25
EABC80	0.56
EAF42	1.40
EB91	0.52
EBC81	0.85
EBC89	0.85
EC90	0.45
ECC81	0.55
ECC82	0.55
ECC83	0.60
ECC85	0.60
ECC88	0.65
ECC91	0.65
ECC804	0.40
ECC807	1.30
ECC808	2.00
ECF80	0.65
ECF82	0.60
ECF86	1.50
ECF812	1.20
ECH3	2.50
ECH35	1.50
ECH42	1.00
ECH81	0.58
ECH84	0.93
ECL80	0.66
ECL82	0.58
ECL84	0.74
ECL86	0.74
EF37A	3.60
EF39	2.00
EF42	1.95
EF55	2.25
EF80	0.48
EF83	3.50
EF85	0.48
EF86	0.70
EF89	0.75
EF91	1.22
EF92	2.50
EF93	0.65
EF94	0.55
EF183	0.56
EF184	0.56
EH90	0.65
EK90	0.65
EL33	2.50
EL34	1.54
EL34 Mullard	2.45
EL36	1.60
EL37	9.00
EL38	4.50
EL41	1.50
EL81	2.05
EL82	0.58
EL84	0.60
EL85	3.85
EL86	0.80
EL90	0.82
EL360	9.00
EM80	0.70
EM81	0.70
EM84	0.70
EM85	0.85
EM87	1.10
EMM803	2.50
EN91	0.95
EN92	4.00
EY84	8.00
EY86/87	2.00
EY88	0.60
EZ80	0.56
EZ81	0.56
EZ90	0.96
G1/371K	30.00
G55/1K	8.00
G120/1B	8.00
GS10C	12.00
GXU50	12.50
GY501	1.20
GZ30	0.85
GZ32	0.85
GZ33	3.25
GZ34	2.00
GZ37	4.00
KT61	3.50
KT66 USA	4.95
KT66 UK	9.00
KT77	5.00
KT88 USA	6.00
KT88 UK	11.50
KTW61	1.50
M8079	6.00
M8083	3.25
M8100	2.85
M8137	2.85
M8162	3.85
M8225	1.20
ME1400	4.00
N78	8.90
OA2	0.60
OB2	0.65
PC86	0.80
PC88	0.80
PC92	0.85
PC97	0.95
PC900	0.85
PCF80	0.70
PCF82	0.60
PCF86	1.20
PCF200	1.35
PCF201	1.35
PCF801	0.92
PCF802	0.72
PCF805	1.80
PCF808	1.48
PCH200	1.10
PCL82	0.74
PCL83	2.00
PCL84	0.76
PCL85	0.80
PCL86	0.76
PCL200	1.60
PCL805	0.80
PD500	2.95
PFL200	1.13
PL36	1.05
PL81A	0.74
PL84	0.65
PL500	1.12
PL504	1.20
PL508	1.48
PL509	2.30
PL519	2.60
PL802	2.50
PY88	0.74
PY500A	1.35
PY800	0.65
PY801	0.65
QQV02-6	10.50
QQV03-10	2.50
QQV03-20A	12.25
QQV06-40A	13.95
QS150/45	7.00
QS1200	3.15
QS1209	1.50
QS1212	3.20
QV03-12	3.50
TY2-125A	45.00
U19	11.95
UCH81	0.65
UCL82	0.76
UF80	0.80
UL84	0.78
YL1020	29.00
Z759	9.00
Z803U	12.50
ZM1001	5.00
1X2B	1.15
2C51	0.80
2D21	0.95
2K25	10.00
4CX250B	26.60
4CX350A	39.90
5U4G	0.85
5U4GB	1.50
5V4G	0.85
5Z4G	0.85
6AB7	0.60
6AB8	0.66
6AC7	1.00
6AF4A	1.20
6AG7	1.20
6AH6	1.00
6AJ7	1.00
6AK6	2.00
6AL5	0.52
6AM4	2.50
6AM5	6.00
6AM6	1.30
6AN5	2.00
6AN8A	2.50
6AQ5	0.82
6AS5	1.50
6AS6	3.50
6AS7G	4.50
6AT6	0.80
6AU6	0.55
6AV6	0.72
6AW8A	2.50
6BA6	0.50
6BA7	3.75
6BA8A	3.50
6BE6	0.50
6BD6	1.00
6BH6	1.60
6BJ6	1.05
6BN7	3.50
6BN8	0.85
6BR7	3.75
6BR8A	1.20
6BS7	3.30
6BW6	4.50
6BZ6	2.00
6C4	0.45
6CL6	1.50
6EA8	0.80
6F6G	2.00
6F28	1.25
6GH8A	0.80
6GK6	1.00
6H6	1.00
6HF5	4.50
6J5GT	0.75
6J6	0.55
6J7GT	1.00
6JS6C	2.55
6K7	0.70
6KD6	3.95
6L6GC	1.75
6L6GT	1.10
6L7	0.55
6U8	0.60
6V6GT	0.90
7B7	1.40
7S7	2.00
11E2	15.50
12AC6	0.80
12AD6	0.80
12AE6	0.85
12AE6	0.85
12AG8	1.50
12AH8	5.50
12AT6	0.59
12AT7	0.55
12AT7WA	1.50
12AU6	0.60
12AU7	0.55
12AV6	0.80
12AX7	0.55
12AX7WA	1.50
12AY7	4.00
12AZ7A	1.50
12B4A	1.60
12BA6	0.75
12BE6	1.05
12BH7	0.95
12BL6	0.70
12C8GT	0.70
12E1	16.50
12GN7	3.25
12HG7A	3.25
12SL7	1.50
12SN7GT	1.85
13D8	3.20
30FL2	0.95
40KD6	2.80
85A1	5.40
85A2	1.20
90CG	10.85
92AG	9.00
92AV	9.00
807	1.50
811A	9.00
813	11.30
833A	47.85
5636	3.00
5651	1.75
5670	3.50
5687	8.15
5696	2.55
5749	2.00
5751	1.50
5814A	2.75
6080	4.20
6146B	4.45
7360	7.50
5965	2.25
6060	1.60

INTEGRATED CIRCUITS

AN214Q	2.50
AN240	2.80
LA4031P	2.70
LA4400	4.15
LC7120	3.50
LC7130	3.50
MB3712	2.50
MC1307P	1.00
MC1330P	0.76
MC1349	1.20
MC1495	3.00
ML231B	1.75
SL901B	4.35
SN76003N	1.65
SN76013N	1.65
SN76023N	1.45
SN76033N	1.65
SN76131N	1.30
SN76660N	0.60
SN76666N	0.70
TAA550	0.25
TAA661B	1.20
TA7120	1.85
TA7130	1.50
TA7204	2.15
TA7205AP	1.95
TA7222	1.80
TA7310	1.80
TBA120S	0.70
TBA520Q	1.10
TBA530	1.10
TBA540	1.25
TBA550Q	1.45
TBA800	0.89
TBA810S	1.35
TBA920Q	1.65
TDA1004A	2.20
TDA1170	1.95
TDA1190	2.15
TDA1327	1.70
TDA1412	0.85
TDA2020	2.45
TDA2030	2.80
TDA2532	2.40
TDA2540	2.15
TDA2590	2.95
TDA2600	2.95
TDA2611A	1.95
UPC566H	2.95
UPC575C2	2.95
UPC1001H	3.95
UPC1025	2.50
UPC1156H	2.15
UPC1365C	3.95

SEMICONDUCTORS

AC127	0.22
AC128	0.28
AC141K	0.34
AC176	0.22
AC176K	0.31
AC187	0.26
AC187K	0.28
AC188	0.22
AD149	0.70
AD161	0.39
AD161/2	1.04
AD162	0.39
AF124	0.34
AF125	0.32
AF126	0.32
AF127	0.32
AF139	0.42
AF239	0.42
AU106	2.06
AU107	1.75
AU110	2.00
AU113	1.48
BC107	0.10
BC107B	0.10
BC108	0.10
BC109B	0.10
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
BC157	0.10
BC158	0.09
BC159	0.09
BC160	0.28
BC170B	0.10
BC171	0.08
BC172	0.09
BC173B	0.10
BC182	0.09
BC183	0.09
BC184LA	0.09
BC212	0.09
BC212L	0.09
BC213	0.09
BC213L	0.09
BC214	0.09
BC214L	0.09
BC237	0.09
BC238	0.08
BC307	0.09
BC327	0.10
BC337	0.10
BC461	0.30
BC478	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC557	0.07
BC558	0.07
BD131	0.32
BD132	0.35
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.28
BD138	0.30
BD139	0.32
BD140	0.30
BF179	0.34
BF180	0.29
BF183	0.29
BF194	0.11
BF195	0.11
BF196	0.11
BF197	0.11
BF198	0.10
BF199	0.14
BF200	0.30
BF258	0.25
BF259	0.26
BF336	0.34
BFX29	0.30
BFX84	0.26
BFX85	0.28
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.73
BT106	1.00
BT108	1.22
BT116	1.20
BU105	1.22
BU108	1.69
BU124	1.00
RU126	1.22
BU205	1.30
BU208	1.39
BU208A	1.52
BU326A	1.42
MJE340	0.40
MRF450A	11.50
MRF475	2.50
MRF477	9.50
OC71	0.22
R20088	1.70
R2010B	1.70
R2540	2.48
TIP29	0.40
TIP29C	0.42
TIP30C	0.43
TIP31C	0.42
TIP32C	0.42
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP2955	0.84
TIP3055	0.60
TIS91	0.20
2N3054	0.59
2N3055	0.59
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N5294	0.38
2N5296	0.48
2N5298	0.38
2N5496	0.66
2SA715	0.95
2SC495	0.80
2SC496	0.80
2SC1173	1.15
2SC1306	1.25
2SC1307	1.85
2SC1449	0.80
2SC1678	1.25
2SC1945	2.10
2SC1953	0.95
2SC1957	0.80
2SC2028	1.15
2SC2029	1.60
2SC2078	1.45

Many other items available
Please phone send list for quote

CALLERS WELCOME

★ Entrance on **Wrotham Rd. (A227)** **Near Meopham Stn.**

★ Hours Mon.-Fri. 9.30-5.30 Saturday 9.30-12.00

P. & P. 50p. Please add V.A.T. at 15%

★ 24-HOUR ANSAPHONE SERVICE ★

TAKE IT UP A CHANNEL

With J.W.R's Big Range for Breakers. Over 450 listed items

Send £1 for Accessory Catalogue

JWR

John Woolfe Racing Ltd., Woolfe House, Norse Road, Bedford, MK41 0LF England. Telephone: 0234 41441. Telex: 825483.

RADIATION DETECTORS

- THIS DOSIMETER WILL AUTOMATICALLY DETECT GAMMA AND X-RAYS
- UNIT IS SIZE OF FOUNTAIN PEN & CLIPS ONTO TOP POCKET
- PRECISION INSTRUMENT METAL CASED WEIGHT 2OZ
- MANUFACTURERS CURRENT PRICE OF A SIMILAR MODEL OVER £25 EACH

British design & manufacture
Tested & fully guaranteed
Ex-stock delivery

£6·95 inc VAT Post & Pack 60p

Ideal for the experimenter
COMPLETE WITH DATA

HENRY'S 404 EDGWARE ROAD LONDON W2 1ED

RADIO/TAPES BARGAINS

LW/MW/Mains/Battery Radios **£9.00 each** (P&P £1.00)
LW/MW Car Radios with speaker **£9.00 each** (P&P £1.00)
Small VHF/MW Battery Radios **£7.00 each** (P&P 50p)
8-C60 High gain Cassettes **£2.00** (P&P 50p)
5-C90 High gain Cassettes **£2.00** (P&P 50p)
Stereo Headphones with lead and Jack Plug **£4.50** (P&P 50p)
Maximum Postage Charge £1.00.
Money refunded if not satisfied.

AERIAL AMPLIFIERS

Aerial amplifiers can produce remarkable improvement on the picture and sound in fringe or difficult areas.

B45 – For Mono or Colour this is tunable over complete UHF television band.

B11 – For stereo or standard VHF/FM radio.

B12 – for VHF television band 1 & 3.

All amplifiers are complete and ready to use Battery type PP3 or 8V to 18V DC next to the set type fitting.

PRICES £6·70 each.

Signal Injectors with (pre-set) variable AF, which emits RF harmonics into the UHF band. Protected up to 300 volts DC. Complete with leads **£5.70 each.**

All Prices Include VAT at 15%. P & P per Order 30p. S.A.E. for Leaflets. Access Cards.

ELECTRONIC MAILORDER LTD,
62 Bridge St, Ramsbottom, via Bury, Lancs. BL0 9AGW.
Tel Rams (070 682) 3036.

NEW THIS MONTH

BIGEAR 500A

Another Super 2 Metre Rig from UNIDEN

Ideal for mobile or base use. Covers 144-148 MHz with 800 synthesised 5 KHz channels, 1 dial programmable memory channel and 4 diode matrix programmable scan channels. 25 and 1 watt power switch, LED readout of transmit, receive and offset frequencies. Programmable offset + / − 0.6, 0.7, 1.0, 1.2 and 1.6 MHz. Automatic 1750 Hz tone burst. 1.2 watt Audio output.

PRICE: £199.00 inc VAT

328 FM SCANNING MONITOR

without a clock but with performance

A tailor made, no compromise unit designed for the UK market. Covers 55-88, 144-174 and 400-470 MHz in 12.5 KHz steps. Features include:- Frequency synthesis with continuous display of active channel. 2 speed scan with priority and channel lockout. 20 memory channels. Auxilliary equipment control. Block frequency search option between programmable limits. Mains or battery operation. Vehicle mount provided.

Acclaimed by the "Snoopers" of Britain as the BEST

PRICE: £198.00 inc VAT (Carr and packing £3.00)

PLUGS AND SOCKETS

Description	Code	£
4 Pin Mic Plug	(514)	0.69
4 Pin Mic Socket	(515)	0.69
PL259 Plug	(551/S)	0.55
SO239 Square Chassis Mount Skt	(552)	0.55
2 x SO239 In line Coupler	(553)	0.87
SO239 Single Hole Mount Skt	(554)	0.52
Reducer for PL259	(555)	0.18
SO239 to Phono Plug Adapter	(557)	0.39
SO239 to PL259 Elbow Coupler	(558)	1.00
3 x SO239 'T' Connector	(559)	1.27
2 x SO239 to 1 PL259 'T' Conn	(560)	1.48
2 x PL259 Inline Coupler	(563)	0.75
PL259 to SO239 Lightening Arrester	(566)	1.38
SO239 to SO239 Lightening Arrester	(567)	1.10
Solderless Splicer for UR67 Cable	(569)	0.92
Lighted Dummy Load	(570)	1.15
PL259 with built in reducer (UR43)	(572)	0.64

Description	Code	£
PL259 Screw-on for UR67/RG8-U	(573)	0.58
SO239 to Quickfit PL259 Adaptor	(575)	0.75
PL259SE Side Entry Plug for UR43	(577)	0.68
SO239SE Side Entry Skt for UR43	(578)	0.70
Dummy Load — 30 watt — 50 ohm	(589)	5.75
2 x Female BNC Incline Couplers	(1505)	1.55
2 x Male BNC Incline Couplers	(1506)	2.24
1 x Male, 2 x Female BNC 'T' Conn	(1507)	2.30
3 x Female BNC 'T' Connectors	(1508)	2.25
SO239 to BNC Plug Adaptor	(1520)	1.84
PL259 to BNC Socket Adaptor	(1521)	1.84

ALL ABOVE PRICES INCLUDE VAT

Add £0.25 for postage and packing for up to 4 items and for each additional 4 items or part thereof. Contact for rates for large quantities. Order using code numbers listed above.

Zycomm Electronics Ltd.

Full range of amateur and commercial antennas and Home Office approved two way radio equipment available. SAE for details.

47/51 Pentrich Rd., Ripley, Derby DE5 3DS Tel (0773) 44281 Telex 377466

SUGIYAMA F850

An all band (160 to 2m including 4m) all mode transceiver, with a specification to suit the most discerning operator.

VOX and speech processor as standard. 10 watts output SSB/CW/FM — 5 watts AM Mains or Battery, large LED frequency display.

LIST PRICE:
Fitted 2.4 KHz filter £799.00 inc VAT
Fitted ALL filters £899.00 inc VAT
432 MHz Transverter (ordered with F850) £100.00 inc VAT

Zycomm Z5800 Hand Portable

A no nonsense sythesised rig, free of gimmicks yet offering high power and good sensitivity. Covers 144-148 HMz with channels in 5 KHz spacing selected by decade switches. Slide switches control simplex or repeater and high or low power operation. Low power level is adjustable by internal preset. Maximum power (5 watts nominal) may exceed 7.5 watts from internal NiCd battery pack. Antenna has BNC connector.

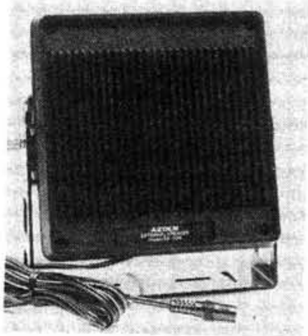
PRICE: Z5800, Desk Charger and Remote Mic/ Speaker £199.00 inc VAT

STABILISED POWER SUPPLIES

Rugged professional quality units at realistic prices

5 Amp — £18.40 inc VAT
7 Amp — £32.00 inc VAT

AZDEN AS006 COMMUNICATIONS SPEAKER



Adds punch to any rig — rated up to 6 watts. Supplied with moulded jack plug and mounting bracket.

Price £11.50 inc VAT

NOVEMBER NOVEMBER NOVEMBER NOVEMBER NOVEMBER NOVEMBER NOVEMBER NOVEMBER NOVEMBER

EUROCOMM Deluxe 40 CB

A 40 channel 27 MHz FM transceiver approved to Home Office Specification MPT 1320 will be available in November at £65.00 inc VAT.

Send SSAE to receive full details of the Eurocomm Deluxe 40.

TRADE ENQUIRIES INVITED

Ci-110 Mk2 POWER AMP

A Solid State, all modes unit covering 1.7 to 38 MHz. Typical power output 130 watts for 215 watts DC input and 4-7 watts drive (15 watts SSB). RF sensing VOX circuit. Switchable receive pre-amp. Supply requirements: 13.8V at 20A, Negative Earth.

Size 5"w x 7"l x 3"h. Weight: 2.5lbs.

Price — £99.00 inc VAT

Similar model available for 49 MHz available shortly.

YOUR LAST CHANCE TO BUY THIS POPULAR LINEAR AT THIS PRICE

Please address all Amateur Equipment correspondence for the attention of Lou Glover (G4GKJ)

Zycomm Electronics Ltd.

G3ZYC G8CNB G3NJX G3ZYD G4GKJ G8ZYC

47/51 Pentrich Rd., Ripley, Derby DE5 3DS
Tel Ripley (0773) 44281 Telex 377466

Agents: Clem Tabor (G3UGR), Banksia, Queen Camel, Yeovil, Somerset 0935-850463 (Evenings & Weekends only)
Alan Kenyon (GW4DOO), 24 Connaught Street, Port Talbot, Glamorgan 0639-887963
Peter Clark (G4IUV), 91 Farmer Road, Leyton, London E10 5DJ 01-539 3385
Bob Finch (G4DDM), REF Electronics, Church Road, Pen, High Wycombe 049 481-4483
Ted Bowen (G4JKQ), Coalville Communications, 6 Ashby Road, Coalville, Leicestershire 0530-38779 (Day) 0530-60396 (Evenings)

comment...

FREEDOM ?

REGULAR readers will know that I am very much against the improper use of any radio transmitting equipment, be it illegal CB, a jammer, or just a badly adjusted transmitter. All of these can and do interfere with other people's legitimate use or enjoyment of facilities in which they have made a considerable investment in equipment and also perhaps licence fees.

The close control maintained over the use of radio transmitters in the UK in bygone years meant that the public could generally enjoy radio, TV or hi-fi free of interference. Alas, this is no longer so; poorly drafted legislation and government dilly-dallying have allowed these islands to be flooded with illegal CB transceivers, often used to drive "linear amplifiers" which are anything but linear.

The performance specifications and licence for the UK's new legal CB systems, which should be in operation by the time this appears in print, leave far too many things to chance, and unless firm steps are taken to control both the illegal and legal services, many people may as well sell off their TV or hi-fi and take up gardening, d.i.y., hiking or whatever. They should do it carefully though, because their local ambulance radio channels could be jammed too!

The UK Wireless Telegraphy Acts control not only transmission but reception too. Any person who, without authority, uses radio apparatus with intent to obtain information as to the contents, sender or addressee of any message is guilty of an offence. The problems of establishing intent have meant that there are very few prosecutions, and these are usually confined to blatant breaches of the law, like the chap who was showing yards of radio-teleprinter copy from a subscription news service to all and sundry in his local pub.

There can be few owners of v.h.f. f.m. receivers in the UK who have not found the police transmissions on Band II, or owners of general coverage communications receivers who have not eavesdropped on shipping or other commercial links in the h.f. bands. Monitor and scanning receivers covering air, marine, private mobile and public service channels are freely sold today in high street stores. Users of radio services know they are not confidential, and may take steps to protect their conversations with scramblers or codes, or use more secure routes such as land-line or satellite for the most sensitive messages.

So, remembering also that receivers cause little or no interference to other radio users, there seems to me a very good case for doing away with the present law on the grounds that it is virtually unenforceable. Instead, make it an offence to make use of any information gained by eavesdropping, which would appear — at first sight at least — to be far easier to prove. Perhaps such a change could be included in the revisions in UK radio regulations which are currently under way.

Geoff Arnold

services

QUERIES

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

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

PROJECT COST

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

CONSTRUCTION RATING

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

Beginner

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

Intermediate

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

Advanced

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

SUBSCRIPTIONS

Subscriptions are available to both home and overseas addresses at £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.

CRYSTAL CALIBRATOR

R. A. PENFOLD

This crystal calibrator is primarily intended for use with a communications receiver to check the dial calibration, and to enable accurate readjustment to be carried out when necessary. It can also be used to tune a receiver to a desired frequency with an accuracy of about 1kHz or so, which is good enough for all normal requirements. This is especially useful when searching for a particular broadcast station which has a known operating frequency and time. The calibrator can, of course, also be used for checking frequency meters, v.f.o.s, and other similar test gear.

The unit provides switch selected outputs of 10kHz, 100kHz, 1MHz and 4MHz. Powered from two small 9 volt batteries, it is housed in a case measuring about 153 × 84 × 59mm. Harmonics from the unit can be detected at frequencies beyond the upper limit of the s.w. spectrum (30MHz) on any reasonably sensitive s.w. receiver. The two higher frequency outputs provide harmonics that are quite strong even at about 150MHz.

The Circuit

The circuit, shown in Fig. 1, consists of three basic sections: a 4MHz crystal oscillator, a divider chain, and an output waveform shaper. The purpose of the divider chain is to produce the additional 1MHz, 100kHz, and 10 kHz output signals from the basic 4MHz one. The output shaper merely ensures that the output signal has a very fast risetime so that harmonics of the output frequency are available at good strength up to frequencies of many megahertz.

Harmonics are signals at multiples of the fundamental frequency. For example, the 4MHz signal produces harmonics at 8MHz, 12MHz, 16MHz, 20MHz, etc. The 1MHz signal produces harmonics at 2MHz, 3MHz, 4MHz, 5MHz, and so on. Thus the unit does not just provide four output frequencies, but a multitude of calibration points. In theory the 10kHz output signal will provide all the required calibration signals, rendering the other three fundamental frequencies unnecessary. In practice though, this is not the case, since the calibration points would be so closely spaced that identifying each one would be virtually impossible. The harmonics of the higher frequency outputs are well spaced out and easily identified, and can be used to help with the identification of the 10kHz harmonics, as we shall see later.

The 4MHz crystal oscillator uses Tr1 in a Pierce oscillator circuit. Trimmer capacitor C2 enables the output frequency to be accurately tuned to the appropriate frequency, and the stability of a crystal controlled oscillator is such that once adjusted, the circuit should not require readjustment for a considerable length of time. Tr2 is a simple common emitter amplifier which ensures that the output voltage swing of the oscillator circuit is sufficient to reliably drive the subsequent divider stage.

Three divider stages are used, each employing a c.m.o.s. device. IC1 is the first stage, and this is a 4018 divide by N counter. It can be used to divide by any even whole number from 2 to 10 inclusive. In this application the data input at pin 1 is connected to the $\overline{Q}2$ output at pin 4 so that the required division rate of 4 is obtained, and a 1MHz output signal is produced.

The other two divider stages are identical, and each use a 4017 decade counter to give a division ratio of 10. Thus the 100kHz signal appears at the output (pin 12) of IC2, and the 10kHz signal appears at the output of IC3.

Rotary switch S1 is used to select the output carrying the desired fundamental frequency, and to pass this signal to the waveform shaping stage. There are two factors which determine the strengths of the various harmonics of the output signal. These are the amplitude of the signal, and its shape. The mark-space ratio has some effect on the strengths of the harmonic signals, and in theory certain mark-space ratios result in some of the harmonics being totally absent. A 1 to 1 mark-space ratio, for example,

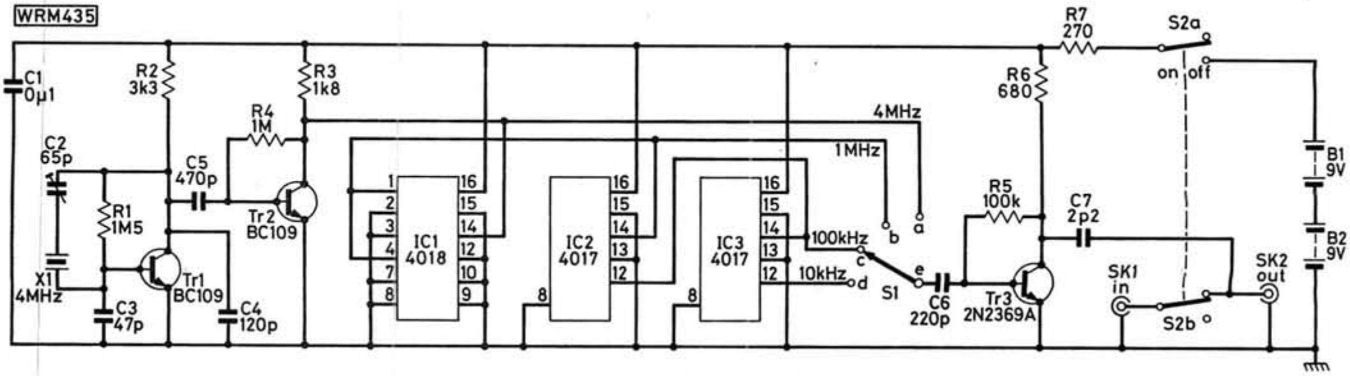
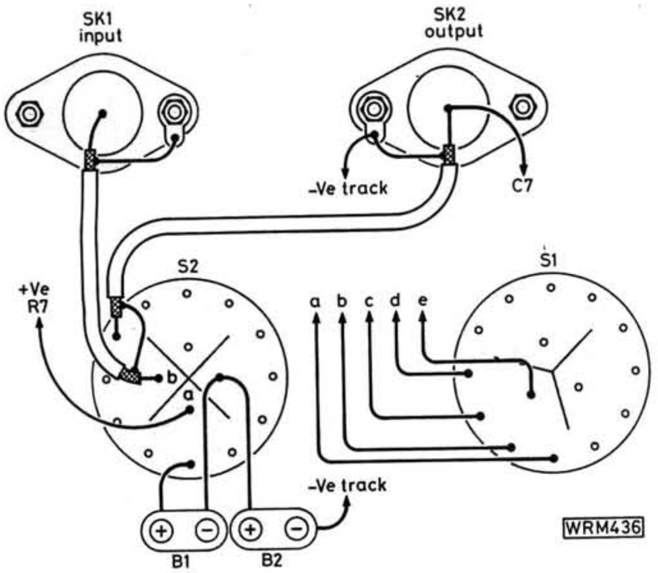


Fig. 1: The circuit of the Crystal Calibrator

theoretically only has the odd order harmonics (i.e. three times the fundamental frequency, 5 times the fundamental frequency, 7 times, and so on). In practice there will be some variation in the strengths of the harmonics on the output, but none of them will actually be missing. Even if the mark-space ratio of the output was to be such that certain harmonics should be absent, imperfections in the signal would actually prevent this from happening, and these harmonics would simply be lower in amplitude than those around them.

There is a general fall away in the strengths of the higher order harmonics. In order to minimise this effect it is essential for the output waveform to have a rise time which is as fast as possible. This is the purpose of the out-



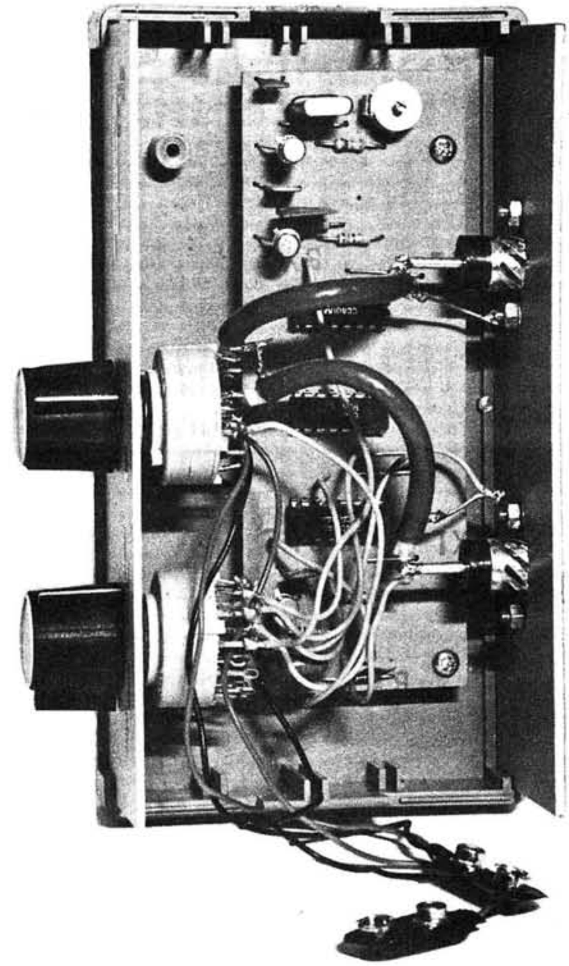


Fig. 2: (Top left) the inter-wiring between the switches, sockets and p.c.b. of the calibrator

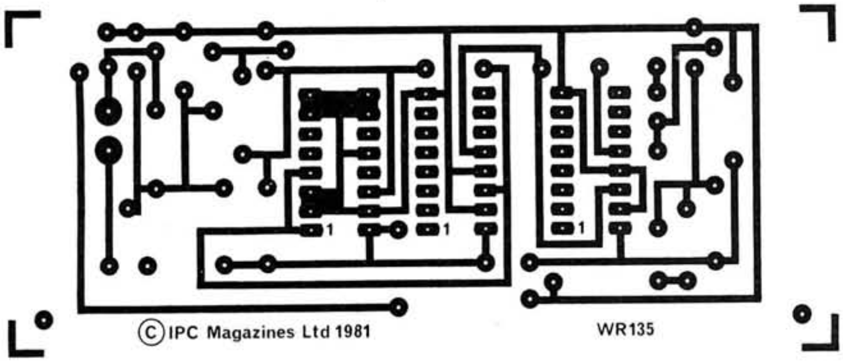


Fig. 3: (Left) the full size copper track pattern for the printed circuit board

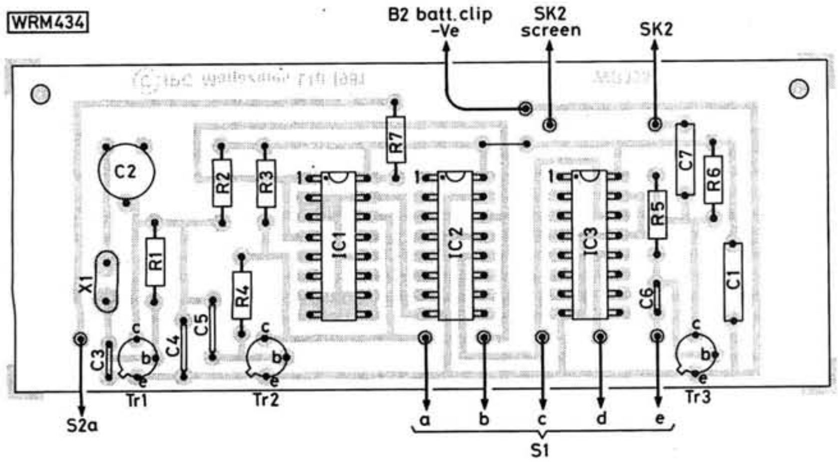


Fig. 4: (Left) the component placement drawing of the p.c.b. The picture at the top of the page shows the internal layout of the calibrator

CONSTRUCTION RATING **Beginner**

BUYING GUIDE

Constructors should have no difficulty in obtaining the components for this project. The crystal can be obtained from several sources including QuartSLab and P. R. Golledge Electronics, both of whom advertise in this magazine. Electrovalue can also supply all of the components.

APPROXIMATE COST **£10**

★ components

Resistors		
¼W 5% Carbon film		
270Ω	1	R7
680Ω	1	R6
1·8kΩ	1	R3
3·3kΩ	1	R2
100kΩ	1	R5
1MΩ	1	R4
1·5MΩ	1	R1
Capacitors		
Ceramic Plate		
2·2pF	1	C7
47pF	1	C3
120pF	1	C4
220pF	1	C6
470pF	1	C5
Polyester (C280)		
0·1μF	1	C1
Film Dielectric Trimmer		
65pF	1	C2
Semiconductors		
Transistors		
BC109	2	Tr1,2
2N2369A	1	Tr3
Integrated Circuits		
4017	2	IC2,3
4018	1	IC1

Miscellaneous
4MHz crystal, 30pF, HC–18/U; Rotary switch 3p.4w. (S1); Rotary switch 4p.2w. (S2) (see text); Coaxial sockets (2); Plastics case (see text); PP3 batteries and connectors (2); Printed circuit board.

put waveform shaper, which uses a high speed switching transistor in the common emitter mode to give a suitably fast switching time.

The unit is connected in line with the receiver's aerial lead, the input from the aerial being taken to SK1 and the output to the receiver coming from SK2. The output from the calibrator is coupled to the output socket via low value capacitor C7. S2b disconnects the aerial from SK2 when the calibrator is switched on, and this is necessary for two reasons. It prevents the output signal of the calibrator from being connected to the aerial and causing illegal radiation, and it blocks the aerial signal from the receiver so that the signal from the calibrator is not lost amongst a multitude of strong aerial signals.

The unit requires a supply voltage of about 12 to 15 volts, and this is obtained from two 9 volt batteries connected in series, the excess voltage being lost through dropper resistor R7.

Construction

The circuit is constructed on a printed circuit board using the foil pattern and component layout illustrated in Figs. 3 and 4. The specified crystal has an HC–18/U case, which is a wire ended type, and it is therefore soldered direct to the p.c.b. in the same way as the other components. However, the two soldered joints must be completed fairly rapidly so that the crystal does not overheat and become damaged. All three i.c.s are c.m.o.s. types and the usual handling precautions should be taken when dealing with these. Sockets are recommended for these devices.

Fig. 2 shows the point to point wiring of the calibrator, and this is all quite straight forward. An otherwise unused tag of S2 is used to provide a suitable connection point for the junction of the two batteries. S2 is a 4p.3w. rotary switch with the end stop set for 2 way operation.

A Verobox type 75–1238D makes a suitable housing for the calibrator, and the printed circuit board can be fitted onto the rear set of mounting pillars moulded into the base section of the case using the self tapping screws supplied with the case. The general layout of the unit can be seen from the photographs, but is not critical and any sensible layout can be employed.

Adjustment

Probably the easiest way to adjust the unit for a high degree of accuracy is to use the BBC 200kHz l.w. transmission as a frequency standard. Adjust an ordinary transistor radio for reception of the BBC Radio 4 l.w. transmission, and place around the set a length of insulated wire fed from SK2 of the calibrator. With the calibrator switched on and S1 set to the "100kHz" position, a beat note between the 200kHz carrier wave and the

continued on page 37 ▶▶▶

Lee Electronics Ltd

LEE

ONE OF LONDONS OLDEST COMMUNICATIONS ESTABLISHMENTS

!! IS NOW STOCKING C.B. !!

WHY BUY FROM US ? ? ?

WE ARE IN THE HEART OF LONDON'S ELECTRONIC CENTRE

WE HAVE BEEN SUPPLYING COMMUNICATIONS FOR OVER 10 YEARS

YOU CAN COME IN AND GET EXPERT ADVICE FROM THE PEOPLE WHO **KNOW** ABOUT COMMUNICATIONS

WE HAVE ONE OF THE BEST SERVICE CENTRES WITH OVER £100,000 OF TEST EQUIPMENT TO KEEP YOUR EQUIPMENT ON THE AIR

WHEN ALL IS SAID AND DONE YOU WOULDN'T BUY A CAR FROM AN ELECTRONICS SHOP SO WHY BUY YOUR C.B. FROM ANYWHERE BUT A COMMUNICATION SPECIALIST?

HUGE RANGE OF CB SETS/ ANTENNAS/ACCESSORIES COME IN AND TRY THEM

COME AND SEE THE **AMAZING NEW TELECOMM TC 9000** AND LOTS LOTS MORE

YOU WON'T BEAT OUR SERVICES OR OUR PRICES!

YOUR ONE STOP SHOP FOR ALL YOUR NEEDS!

400 EDGWARE ROAD, LONDON W2 01-723 5521 Tlx 298765		**NEAREST TUBE: EDGWARE ROAD PADDINGTON** — **BUSES: 6, 8, 16, 16A, 176, 616.**

RADIO SPECIAL PRODUCT REPORT

FT-290R

YAESU

MULTI-MODE PORTABLE TRANSCEIVER

I can remember a time, not so many years ago, when a 2m crystal controlled f.m. only hand-held, offering the staggering total of 12 channels, 1W of r.f. and all contained within a "minute" 2kg package, was regarded as the ultimate. (Those *were* the good old days!)

Rapid developments in l.s.i. technology soon after made available, at a price, facilities allowing the operator a degree of flexibility previously only dreamed of, or found within 19 inch rack mounts. Eighteen months ago heralded the arrival of multi-mode mobile transceivers employing fully synthesised coverage of 2m. Very nice.

Well, having almost got over that episode along comes the Yaesu FT-290R, a true portable rig, embodying all the previous "state of the art" sub-systems of the mobile/base stations but enclosed in a package slightly smaller than the original f.m. only, sparsely channelled rig!

Features and Controls

The first question when contemplating the purchase of any new rig must be can it be operated easily, safely and in a straightforward manner in the normal operating environment. In this case the answer is definitely affirmative.

Front panel, or top face when vertically mounted, controls are well identified and provided with easily accessible knobs or key pad type switches.

A large 26mm diameter knurled plastic knob is located centrally on the front panel, providing the control adjustment for the dual, independent, v.f.o.s. This control features the familar "click stop" ratchet mechanism, being both light in operating pressure and positive in its action.

Selection of the required v.f.o. is made by depression of the latching v.f.o. A/B pushbutton. An additional STEP button allows 12·5 or 25kHz increments of either v.f.o. when in the f.m. mode and 1kHz or 100Hz steps in s.s.b. and c.w. Receiver incremental tuning is available at a fixed 100Hz step rate in all modes, selected by depressing the CLAR button.

For f.m. repeater operation a ±600kHz transmit offset option is available whilst using either v.f.o. In addition up to ten frequencies may be entered into the memory system and are selected by an additional control knob and memory key switch. Any required in-band transmit receive split may be obtained by using a pre-programmed memory channel and v.f.o. setting combination in conjunction with the MPU alternative function F and DIAL/S buttons.

Other front panel features include a conventional dual concentric volume and squelch control, the latter being precise in its operation and only operative in the f.m. position of the adjacent six position mode selector switch.

A small moving coil meter is provided to indicate received signal strength, battery charge state and relative power output. Mounted directly over the v.f.o. control knob is an easily read 35 × 10mm liquid crystal display, indicating operating frequency and mode; frequency resolution is to 100Hz, the reading giving the last 5 digits of the frequency in use. For operation in poor lighting conditions a rear apron switch can be latched to illuminate the "S" meter and l.c.d., both devices are easily read.

Also found on the front panel is a telescopic $\frac{\lambda}{4}$ antenna, which may be retracted into the body of the rig, and a pair of coloured l.e.d.s that illuminate to indicate the squelch opening, BUSY, and transmit, ON AIR, states. A seven pin socket for the dynamic hand mic., with its in-built up/down scan buttons, completes the front panel.

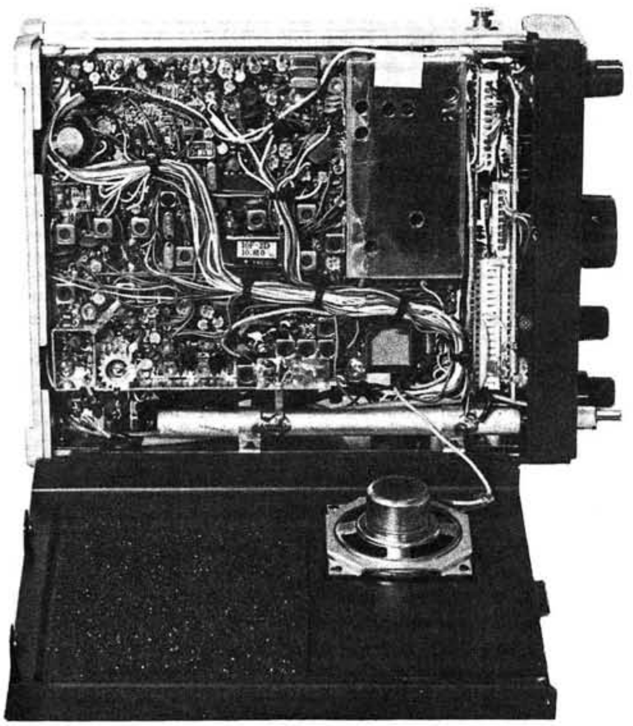
The rig is equipped with a 45mm internal speaker, adequate for quiet locations and also a 3·5mm socket for connection of an external 8Ω loudspeaker or earpiece. Other sockets provide inputs for p.t.t. line STANDBY operation, external 13·8V d.c. supply, battery charger, Morse key and 50Ω antenna.

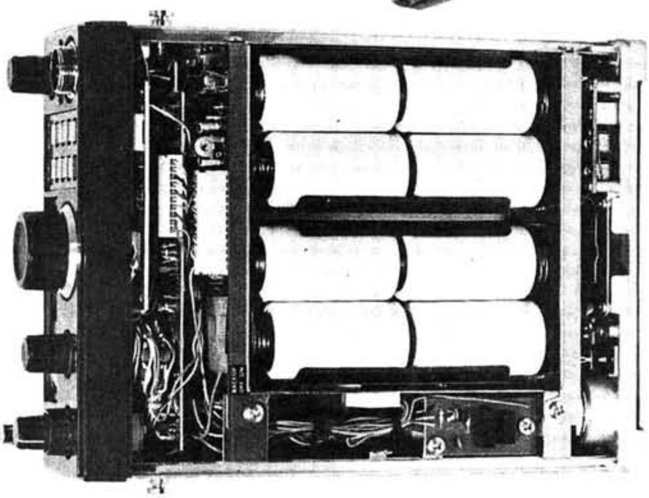
Power output level selection, HI-LOW, is provided by a rear apron mounted slide switch, as is the control switch for the very effective noise blanker which is operable in *all modes*.

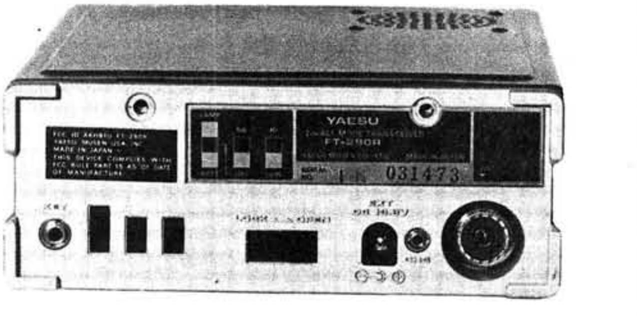
The latching bottom panel is easily removed to access a miniature slide switch controlling the scan operating pattern, allowing options of halt on BUSY, CLEAR or MANUAL alternatives.

Memory back-up supply is provided by an on-board lithium cell, continuously float charged from the main 12V supply, this facility also being provided with slide selector switching.

FT-290R







Circuit Description

On receive, signals from the antenna are routed via a low-pass filter to *pin* diode antenna switching and a 3SK59Y, low noise dual gate MOSFET, first r.f. amplifier stage. The amplified r.f. is then passed through a 3 section auto tuned filter network to remove unwanted r.f. present and likely to cause intermod problems at the following first mixer stage, a 3SK51-03 dual gate MOSFET.

At the mixer a signal, derived from the buffered output of the phase locked loop v.c.o. is introduced, producing a first i.f. output at 10·8MHz which is subsequently passed, via a pair of monolithic crystal filters, having a ±15kHz bandwidth, to the combined first i.f. stage amplifier/noise blanking switch.

From this point f.m. i.f. signal processing is handled by an MC3357P i.c., undergoing conversion to a second i.f. frequency of 455kHz before passing through limiting and discriminator stages to the audio amplifier, via an active lowpass filter.

SSB and c.w. i.f. signals are passed through a side-band

★specification

GENERAL

Frequency range:	144-146MHz
Modes:	s.s.b. (A3J-J3E) c.w. (A1–A1A) f.m. (F3–F3E)
Synthesiser steps:	s.s.b./c.w. 100Hz or 1kHz f.m. 12·5kHz or 25kHz
Supply requirements:	Internal 8C size dry or NiCad cells External 8·5-15·2V d.c. negative earth Memory back-up built in lithium cell
Current consumption:	receive 60mA, squelch closed transmit 800mA, 2·5W r.f. output
Antenna impedance:	50Ω
Dimensions:	58 × 150 × 195mm
Weight:	1·3kg without internal cells

RECEIVER

Sensitivity:	s.s.b./c.w. 0·5μV for 20dB S/N *(0·2μVp.d., 12dB SINAD 0·1μVp.d.)* f.m. 0·25μV for 12dB *(0·15μVp.d.)* *(Squelch sensitivity 0·12μVp.d.)*
Selectivity:	s.s.b./c.w. 2·4kHz at −6dB *(better than −60dB at 5kHz spacing)* f.m. 14kHz at −6dB 25kHz at −60 dB *(−63dB adjacent channel)*
Image rejection:	better than 60dB *(intermodulation response rejection 66dB)*
Audio output:	1W at 10% t.h.d. into 8Ω *(1·4W at onset of clipping, 2W at 10% t.h.d.)*
S-meter calibration:	*S1 = −107dBm* *S5 = −105dBm* *S9 = −103dBm*

TRANSMITTER

RF output power:	0·5W LOW *(250mW f.m. 700mW p.e.p. s.s.b.)* 2·5W HI *(3·2W f.m. 8·5W p.e.p. s.s.b.)*
Carrier suppression:	better than 40dB
Spurious output:	better than 60dB *(all better than −60dB)*
Unwanted side-band suppression:	better than 40dB
FM deviation:	±5kHz
Frequency response:	300-2700Hz (−6dB)
Microphone:	Dynamic 600Ω with p.t.t. and UP/DOWN switches
Tone-burst frequency:	1750Hz

Test equipment

Marconi TF2011 signal generator; TF2370 spectrum analyser: TF2373 frequency extender: TF893A audio power meter; Racal 9081 synthesised signal generator: Sinadder SINAD meter; Bird 43 Thru-line wattmeter.

Test results are shown in italics.

crystal filter, with very high slope factor, before being amplified and fed to an MC1496P balanced demodulator i.c. A signal supplied from the selectable 10·8093 or 10·8115MHz carrier oscillator results in an a.f. output which is then fed to the i.c. audio amplifier stage via a 3kHz cut off active low-pass filter.

Rectified i.f. is used to control the gain of two separate MOSFET's within the preceding i.f. amplifier stages, with a portion of this buffered a.g.c. signal being used to feed the "S" meter amplifier.

During s.s.b. transmissions amplified audio from the microphone is processed by active low-pass filtering, to remove energy above 3kHz, and is then fed to an MC1496P balanced modulator. The applied audio modulates the carrier oscillator input resulting in a 10·81MHz double-sideband signal. An amplifying buffer stage passes the d.s.b. signal to the crystal filter which removes the unwanted side-band and after further amplification this is mixed with the output of the p.l.l. local oscillator, producing a 144-146MHz s.s.b. output. To minimise the level of spurious radiation the signal then passes through an auto-tuned filter stage, held at resonance on the operating frequency by MPU derived control bias applied to varactor diodes forming part of the tuned network. A further four stages of linear amplification follow resulting in 2·5W of r.f. at the antenna switching diodes.

During f.m. transmission audio from the microphone is first amplified and passed through a limiting stage and low-pass filtering, to remove harmonics. The resulting signal is used to frequency modulate the 10·81MHz l.o., which is then amplified before being mixed with the p.l.l. local oscillator output. All subsequent stages are common to the s.s.b. processing path. A 10·8093MHz carrier is generated for c.w. transmissions with keying applied to buffer stages; side tone is provided at 800Hz.

The p.l.l. control unit uses a low current drain 4-bit MPU which processes data for controlling the operating frequency, UP/DOWN scanning, priority channel and memory selection. The CPU program is held in ROM.

Operating Impressions

Whilst the FT-290R does possess a large range of sophisticated features, *portable base station* would be a better description, mastering the techniques of operation proved very straightforward and more or less self explanatory. This was fortunate because the comprehensive 64 page instruction manual arrived about three weeks after the rig!

Being occasionally of the f.m. persuasion, the lack of a reverse repeater button initially seemed to be a drawback, but this was resolved satisfactorily by use of memory or alternative v.f.o. selection. Listening "on air" revealed another solution, which involves setting the non-operational v.f.o. to a frequency that would be out of band when down shifted 600kHz on transmit. If input receive monitoring is desired, pressing the p.t.t. switch immediately before switching to the out of band v.f.o. inhibits transmission and leaves the rig listening to the repeater input. All other ideas please to Roger Hall, G8TNT.

I have never really encountered a situation where auto scanning did what I wanted, all of the time, but in this respect the FT-290R has been designed to allow for a very flexible combination of scan patterns. By setting of the internal scan switch, programming for stop on BUSY, VACANT or MANUAL selection is achieved. Apart from v.f.o. and memory scan the ability to scan the r.i.t., in 100Hz steps over ±10kHz of centre frequency, is very useful for monitoring around the nominal s.s.b. calling frequency.

Signal reports received during s.s.b. and f.m. contacts indicated good quality, well deviated, transmitted audio.

▶▶▶ *continued on page 31*

MAIL ORDER

FROM

AMCOMM

by two way FREEPOST

MORSE KEYS

HK 707	Straight Up/Down keyer	£11.44
BK 100	Semi-automatic mechanical bug	£17.88
MK 702	Up/Down keyer on marble base	£22.43
MK 702	Manipulator	£22.43
MK 704	Squeeze paddle	£14.38
MK 705	Squeeze paddle on marble base	£22.43
EKM 1A	Morse code practice oscillator	£8.63
MK 1024	Automatic memory keyer	£135.13
EK 150	Semi/Automatic keyer	£74.75

SHURE MICS

201	Hand ceramic omnidirectional high impedance	£14.49
202	Hand ceramic noise reducing high impedance	£15.18
401A	Hand controlled magnetic high impedance	£16.56
401B	Hand controlled mag. low impedance (200 ohms)	£16.56
444	Desk adjustable height controlled magnetic	£32.43
526T	Desk controlled response transistor preamp	£39.33

LINEAR AMPLIFIERS

2M10-80P	144MHz 10W input/80W output with 9dB preamp	£138.00
2M25-150P	144MHz 25W input/150W output with 9dB preamp	£184.00
2M10-150P	144MHz 10W input/150W output with 9dB preamp	£209.88
2M3-150P	144MHz 3W input/150W output with 9dB preamp	£209.88

DUMMY LOADS

DL20	30W 3.5-150MHz with PL259 connector	£6.33
T-80	80W 3.5-500MHz with SO239 connector	£22.94
T-150	150W 3.5-500MHz with SO239 connector	£32.78

G. WHIP Mobile Antennas

Tribander 10-20 Slide	£25.88
L.F. Coil 40/80/160 MTS	£6.56
L.F. Whip Telescopic	£4.26
Multimobile 10-20 Auto	£30.48
M/Mobile Coil 40/80/160	£6.56
M/Mobile Whip Telescopic	£4.26
Flexiwhip 10M Mast	£18.11
F/Whip Coils 40/80/160	£6.56
Base Standard	£6.00
Base Heavy Duty	£6.50
Extenarod	£12.00

STILL HELPING WHERE IT HURTS

Here's a list below to make buying easier for you – Work it out yourself – You'll see – It really is easy!

Product	*List Price*	*Deposit*	*12 Payments*
Yaesu FT 902DM	£885	399	£40.55
Yaesu FRG 7700/S	£329	£139	£15.89
Yaesu FRG 7700/M	£409	£180	£19.01
Yaesu FT 101ZD/FM	£665	£300	£30.41
Yaesu FT 101ZD/AM	£650	£275	£31.29
Yaesu FT 101Z/FM	£590	£250	£28.27
Yaesu FT 101Z/AM	£575	£225	£29.15
Yaesu FL 2100Z	£425	£185	£20.08
Yaesu FT1	£1295	£600	£57.91
Yaesu FT 480R	£379	£185	£16.18
Yaesu FT 707	£569	£230	£28.27
Yaesu FT 290	£249	£120	£10.82
Standard C78	£219	£99	£10.04
Standard C58	£247	£107	£11.69
ICOM 730	£574	£250	£27.00
ICOM 720A	£883	£400	£40.26
ICOM 290	£366	£166	£16.67

Many Other Items Available on Similar Terms
Call for Details

MICROWAVE MODULES

MMT 432/28S	£149.00
MMR 432/144R	£184.00
MMT 28/144	£199.00
MMT 144/28	£99.00
MMC 28/136	£27.90
MMC 28/156	£27.90
MMC 28/144	£27.90
MMC 144/any IF	£27.90
MMC 144/28LO	£29.90
MMC 70/any IF	£27.90
MMC 432/28S	£34.90
MMC 432/144S	£34.90
MMC 1296/any IF	£32.20
MMC 050/500	£69.00
MMA 28 preamp	£14.95
MMA 144V preamp	£34.90
MMV 1296/28	£32.20
MML 144/100 linamp	£142.60
MML 432/100 linamp	£228.85
MML 144/25 linamp	£59.00
MML 432/50 linamp	£119.00
MM2000	£169.00

UNADILLA/REYCO

Antenna Traps–
Precision moulded coil forms stainless – hardware – Aluminium tube irridit finish – Coated aluminium wire. Fully waterproofed.
Available 7/14/21 MHz **£12.99**

W2AU BALUN

3.5/30 MHz 2.5 Kw with Lighting Arrestor – Suitable Vees, Yagis, Doublets, Quads etc. **£12.99**

STANDARD

C8800 2m, Tcvr	£252.00
C7800 70cms Tcvr	£275.00

DENTRON

GLA 1000 Linear Amp 10/80 1Kw	£295.00
MLA 2500 Linear Amp 10/160 2Kw	£699.00
MT 3000 3Kw Tuner/SWR/Dummy Load	£275.00

FDK Multi 700EX
£199.00
FDK Multi 750E
£299.00

Send 30p for our bumper bundle literature

No Quibble Guarantee
Same Day Despatch
All Items Advertised

Choose your AMTECH here

Amtech 100 Mobile Match		£16.95
Amtech 200 Random Wire ATU 10-160m 200w pep		£29.95
Amtech 300 Random and Coax Fed ATU 300w pep		£43.95
Amtech CW 250 – The most outstanding CW filter available		£24.90
Amtech Channelguard – A plug in device to eliminate those unwanted stations	Decoder	£15.25
	Sender	£7.25
Amtech FM7: FM Demodulator for FRG 7		£11.90

SWAN CUBIC

ASTRO 103	POA
PSU	POA
1500Z linear	POA
ST1A ATU	POA
ST2A ATU	POA
ST3 ATU	POA

ICOM

ICOM 730
10-80 mtrs – 100 watts SSB AM and CW – Dual VFO's and memory.
See list for HP details

ANTENNAS

Wide range in stock including JAYBEAM – HYGAIN – CUSHCART – ASP TELECON – HOKUSHIN etc.

Bantex 5/8 whip complete antenna	£8.99
Bantex ¼w whip complete antenna	£3.50

ROTATORS

Skyking SU 4000	£92.00
Skyking 250	£39.50
Emoto 502CXX	£139.75
KR 400RC	£92.85
AR 40	£59.00
KR 950 2A	£50.00
Rotor Bearing	£12.00

***All items VAT and carriage paid.**

SWR/RF POWER METERS

SWR 25 3.5/170 MHz	£12.94
LEADER LPM 885-HF 1Kw	£58.00
HANSON 3.5/150MHz 200w	£28.75
REECE UHF 74 144/432	£16.28
HANSON FS 500H 1.8/60MHz 2Kw	£67.85
OSKAR SWR 200 3.30 MHz 2Kw	£40.00

NO POSTAGE REQUIRED

AMCOMM SERVICES (PW1),
FREEPOST,
HARROW HA2 0BR.

Please send me ....

at .... enclosed cheque/P.O. for

.... or charge my VISA/ACCESS

Nr ....

Name ....

Address ....

.... Post Code ....

AMCOMM SERVICES

194 NORTHOLT ROAD, SOUTH HARROW, MIDDX.
Telephone: 01-864 1166, 01-422 9585

Opposite South Harrow Tube Station on Piccadilly Line

Showroom Opening Hours
Tuesday to Saturday 9-5.30
Sunday by Appointment

All items over £100 available on easy terms at List Price

the key to MORSE PART 3

Elaine HOWARD G4LFM

In Part 1 of this series in our October issue, talking about the first steps in learning the Morse code, the editing process produced two statements which do not accurately reflect the author's views. On page 55, the second paragraph in the right-hand column should begin:

"Learn to read Morse at 12 words per minute . . ."

On page 56, under the side-head "Learning to Use the Key", the opening line should read:

"Once you feel not too unhappy at receiving 12 w.p.m. . . .". Our apologies to Tony Smith for these discrepancies.

In this final part of the series we follow up Tony Smith's articles by looking at some of the various aids for learning and using Morse code.

Records and Tapes

The first teaching methods that we will look at are the popular record or cassette tape lessons. There are several of these courses available and we have selected a few of these at random. Some of these require a 78 r.p.m. record player, others a cassette player.

The first course looked at is "The Rhythm Method of Morse Tuition". This was invented by G3HSC.

The course consists of a basic course l.p. The beginners' record takes the student up to 20 w.p.m. assuming you have a 33/45 and 78 r.p.m. player. At 45 r.p.m. the Morse speed is just about 12 w.p.m., the speed of the Post Office Morse Test.

Stan Bennett G3HSC uses the method of learning a small group of letters at a time, for example A–G, H–M and so on. The only problem that I encountered was the 78 r.p.m. record player. For more details write to Stan Bennett G3HSC, 45 Green Lane, Purley, Surrey CR2 3PQ enclosing a stamped self-addressed envelope, or telephone 01-660 2896.

The second course studied was the Ameco code course. It is actually a preparation course for the Amateur FCC Code exam in America, but it is still a good course for the Post Office Morse Test.

The course consists of two cassette tapes containing 22 lessons and an explanation booklet. This course is slightly different from some others as it deals with plain language words as well as mixed groups. One thing which could be regarded as a drawback is the immediate use of some punctuation marks, although it is useful to learn all the necessary characters first time—thereby saving you the time of learning new characters after your Morse test.

The lessons go from 4 w.p.m. to 18 w.p.m. in various increments. These cassettes are only available from Radio Shack Limited priced £6·90 including VAT and postage.

Along the same line as the record and cassette courses is a book from Tandy called *From 5 Watts to 1,000 Watts*.

The first chapter of the book deals with *Learning the International Morse Code* whilst the following chapters deal with other aspects of becoming a radio amateur (US style).

The method of learning the book recommends is basically an oral method. By repeating the sounds of each letter, then building words up, the alphabet is learnt and recalled. The next step is recognition of letters and they have exercises written in the book to aid this process.

Finally it deals with using a Morse key and a practice oscillator, and thereby building your speed up for the Morse test. This book is available from Tandy priced £1·99.

Morse Tutors

Now we move on to the latest type of Morse tutor—the random Morse generator. We looked at two of the tutors on the market at the present time, the Microwave Modules Morse Talker and the Datong Morse Tutor.

The Morse Talker

This is a very unusual piece of equipment, it actually tells you the Morse character it has sent. You can have either letters or figures in single characters or groups of 5 or 50 characters in length. The speed that the Morse Talker will send at is between 2 and 20 w.p.m. at 2 w.p.m. steps.

The speech from the Morse Talker is synthesised and also has an American drawl! Therefore some people may take a few minutes to get used to the sound of the voice, and "Zee" instead of "Zed".

You can also choose the range of letters you require: A–F, A–M, A–U, A–Z or numbers only or mixed letters and numbers. One good point when studying for the Post Office Morse Test is that for speeds below 12 w.p.m. the characters are sent at 12 w.p.m. with the spacing adjusted for the selected speed. There is an internal speaker fitted as well as facilities for an external speaker or headphones. If you want to tape the characters to be replayed in your car for example there is also a socket for a tape output provided.

Once you have reached a satisfactory speed then there is a socket so you can connect a Morse key and use the Morse Talker as a practice oscillator. The Morse Talker is available from Microwave Modules price £99 including VAT.

Morse Tutor

The Datong Morse Tutor is useful because it is portable and is powered by internal batteries. It will generate random Morse in five character groups, either letters, figures or mixed groups. The speed control for the characters starts at 6·5 w.p.m. and finishes at 37 w.p.m.

It has a delay control which allows you to listen to the character sent at the set speed but with a delay between the characters. You can start with a long delay and gradually as you become more proficient you can decrease the delay time. This also has provision for an earpiece and provides a practice oscillator for your key.

Morse Keys

Before we go on and look at Morse key boards we will look at four different types of Morse key.

The first is the telegraph key and is the type of key you practise on. In the Post Office Morse Test you cannot use any type of automatic or "bug" key and therefore there is little point in learning on one in the first place.

Fig. 1: A telegraph key suitable for the Post Office Morse Test

The Morse key in the photograph is a typical telegraph key, with adjustable contact spacing and spring tension. This type of key is available in many radio shops.

The next kind of key is the mechanical "bug" key. The paddle is moved from side to side as opposed to up and down. Pressing the paddle to the right produces a string of dots, but dashes have to be made individually with movements to the left.

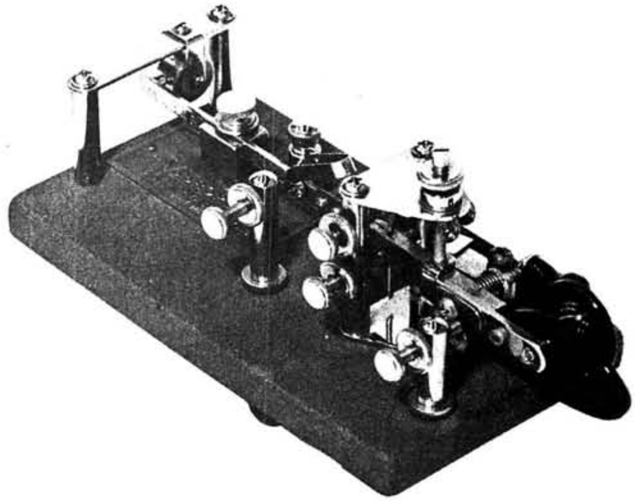


Fig. 2: A mechanical "bug" key

An electronic key is very similar to the mechanical "bug" key except it produces a string of dashes when moved toward the left. It will generally insert the correct spaces between successive dots and dashes.

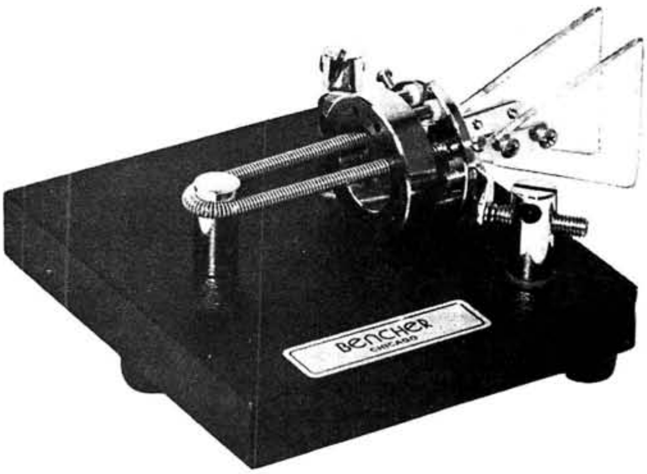
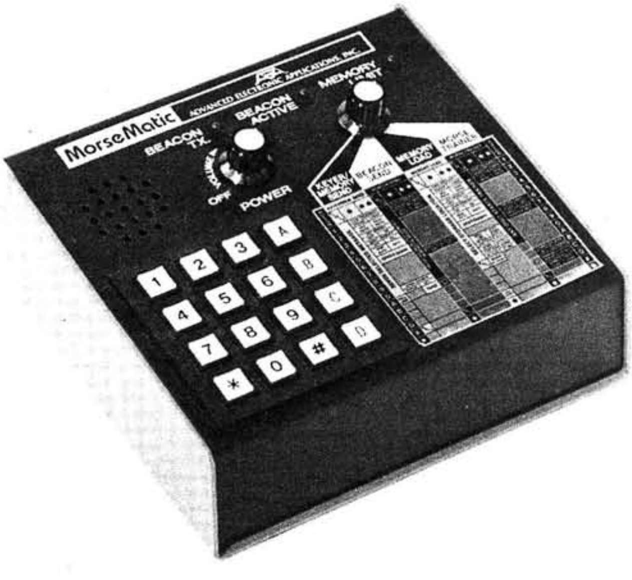


Fig. 3: An iambic paddle

The final type of key we looked at was an iambic paddle. In conjunction with the necessary electronics this paddle forms an iambic keyer. This is a development of the electronic key already described and has the special feature that, if both paddles are held or squeezed the unit will send alternate dots and dashes, or dashes and dots depending on which paddle was pressed first.



Electronic Keyer

The AEA Morsematic acts as the necessary electronics to operate the iambic paddle, as well as providing many other useful functions.

It incorporates a beacon mode which allows precise timing of a transmitted message and the pause period before the message is re-transmitted. This mode is ideal for scatter, moonbounce or tropospheric scheduling.

It can also be used as a Morse trainer which can be programmed by the operator according to his own speed requirements. It can provide random Morse or any of ten set sequences, for which answers are provided. The speed can vary between 2 and 98 w.p.m.

The Morsematic has a 500 character memory which can either be allotted to one message or divided up into as many as 10 separate messages. You can also edit any one of these messages by using the edit mode. This module is available from Radio Shack Limited price £124·20.

Fig. 4: The Datong Morse keyboard

Morse Keyboard Sender

This device is available from Datong Electronics Ltd. and is the latest in sending devices. It features four independent 64 character memories and a separate buffer memory to compensate for bad or slow typing. It is also self contained and will run from either its internal batteries or an external supply of 4–15V. It is very simple to operate, even slow typing can produce medium speed Morse. It does not matter how erratic the input is as long as you are ahead of the output, the keyboard sends at the set speed. The 16 character buffer memory accepts the characters typed in and then sends them spaced correctly. Whenever the buffer is full the pip tone and BUFFER FULL lamp stay on continuously to tell you to slow down the typing speed.

It has two sending speed ranges: 5–33 w.p.m. and 20–132 w.p.m. These higher speeds, using the auto repeat function with the memory, are ideal for meteor scatter operation. There is a side tone built-in with a front panel volume control.

As a training aid a variable extra delay between letters can be introduced. By playing back from the memories with extra delays between the letters copying practice can be achieved.

This module is available priced £161 from Datong Electronics Ltd.

There you are then, that's several ways of learning Morse. No one method is better than any other and what will suit you is very much a matter of individual preference. I hope the comments given will help you make up your mind which way to go, but in the end, nothing can really beat individual tuition from another operator with a good style. ●

RADIO SPECIAL PRODUCT REPORT

▶▶▶*continued from page 26*

When using an extension speaker it is advisable to use a "communications", rather than "hi-fi", quality device to avoid bass heavy response.

Removing the side panels reveals the source, if fitted, of approximately 50 per cent of the all-up weight, eight C size NiCad cells. For any serious, sustained, portable operation this battery capacity of over 2Ah is a good compromise between convenience and deadweight. Coupled to an HB9CV mini-beam the FT-290R plus a good hilltop site should kindle the enthusiasm for QRP DX on 2 metres.

For base station or mobile use, the addition of a complementary 30W linear amplifier will produce a very potent combination, with receive capability in reserve. A d.c. voltage is available at the antenna socket on transmit, providing a useful control for outboard p.a. switching.

To conclude this brief report, the arrival of the FT-290R must mark a significant watershed in cost effective equipment for the radio amateur and should help to increase the utilisation of the lower MHz.

John M. Fell

Prices

The basic transceiver is available at £249·00, with the following optional accessories: 2·2Ah NiCad batteries (8)—£21·60, charger £8·05, soft case £3·45, mobile mount £22·25 and FL2010 matching 10W linear amplifier £64·40; all inclusive of VAT and delivery.

Thanks for the loan of the review sample go to **South Midlands Communications Ltd., S M House, Osborne Road, Totton, Southampton, SO4 4DN or Tel: 0703 867 333.**

INTRODUCING SSTV PART 5

M.J. AXSON BA G8WHG

Obviously a combined fast to slow and slow to fast-scan converter as described previously in this series is a fairly complex piece of equipment, and whilst there are a number of published designs available for home construction many amateurs with limited time to spare will prefer to buy a "black box" and get on the air with SSTV as quickly as possible. The Robot 400 is the answer for them.

The Robot 400

Housed in a fairly compact case, 320mm wide × 152mm high × 300mm deep, this is a very sophisticated device which provides an excellent range of facilities. Considerable thought on the part of the designers makes for ease of use. All the circuitry apart from the power supply is carried on a single plug-in double-sided glass-fibre printed circuit board. There are 19 transistors, 77 i.c.s and 16 4K RAMs. All the i.c.s are in plug-in sockets so they can quickly and easily be replaced should any troubles occur.

All connections are made to the rear panel of the unit. There are two BNC sockets, one of which is to connect to a fast-scan camera and the other to a video monitor. These should be of the closed-circuit surveillance type, many of which are now appearing at very reasonable prices on the secondhand market. Alternatively, the video monitor may be a conventional fast-scan TV set in which case a u.h.f. modulator is interposed between the Robot and the antenna input socket of the TV set. There are also a number of RCA type phono sockets which provide for connections from the station receiver audio output for reception of SSTV off the air, input and output to an audio tape recorder and input from other ancillary equipment; e.g. a keyboard to generate alphanumeric information such as callsign, CQ's, etc. Finally there are two jack sockets into one of which the station microphone is plugged whilst the other is connected to the transmitter microphone input. This sounds rather complicated, but in practice it does allow a very neat and compact SSTV station to be set up. The only control on the rear panel is the SSTV level out, but, since once this has been set it will only require occasional adjustment, this is not inconvenient.

All the other controls are on the front panel for ease of operation. One difficulty in setting up an SSTV system is the number of variables that affect the quality of the pictures. There are controls on the camera, receiver, converter and monitor and they may interact with each other. The Robot engineers have therefore provided a built-in grey-scale generator and this is of great assistance in making the necessary adjustments.

Reception

Reception of pictures is relatively simple. Having found an SSTV signal on the bands (14·230MHz is a good place to start looking, although of course a Class B Licence holder cannot transmit on this band) and adjusted the receiver in the normal way, the memory input selector is set to RECEIVER and the memory input switch to CONTINUE. The receiver brightness and contrast controls are adjusted for the best picture. If the controls are left like this and a series of pictures are being transmitted they will be displayed in turn on the monitor, each newly arriving picture replacing the previous one from the top down. If it is wished to retain any picture for longer study the memory input switch is set to HOLD and updating of the memory will cease, and the picture can be displayed for as long as required. The video information in its audio form can also be recorded on tape for later display.

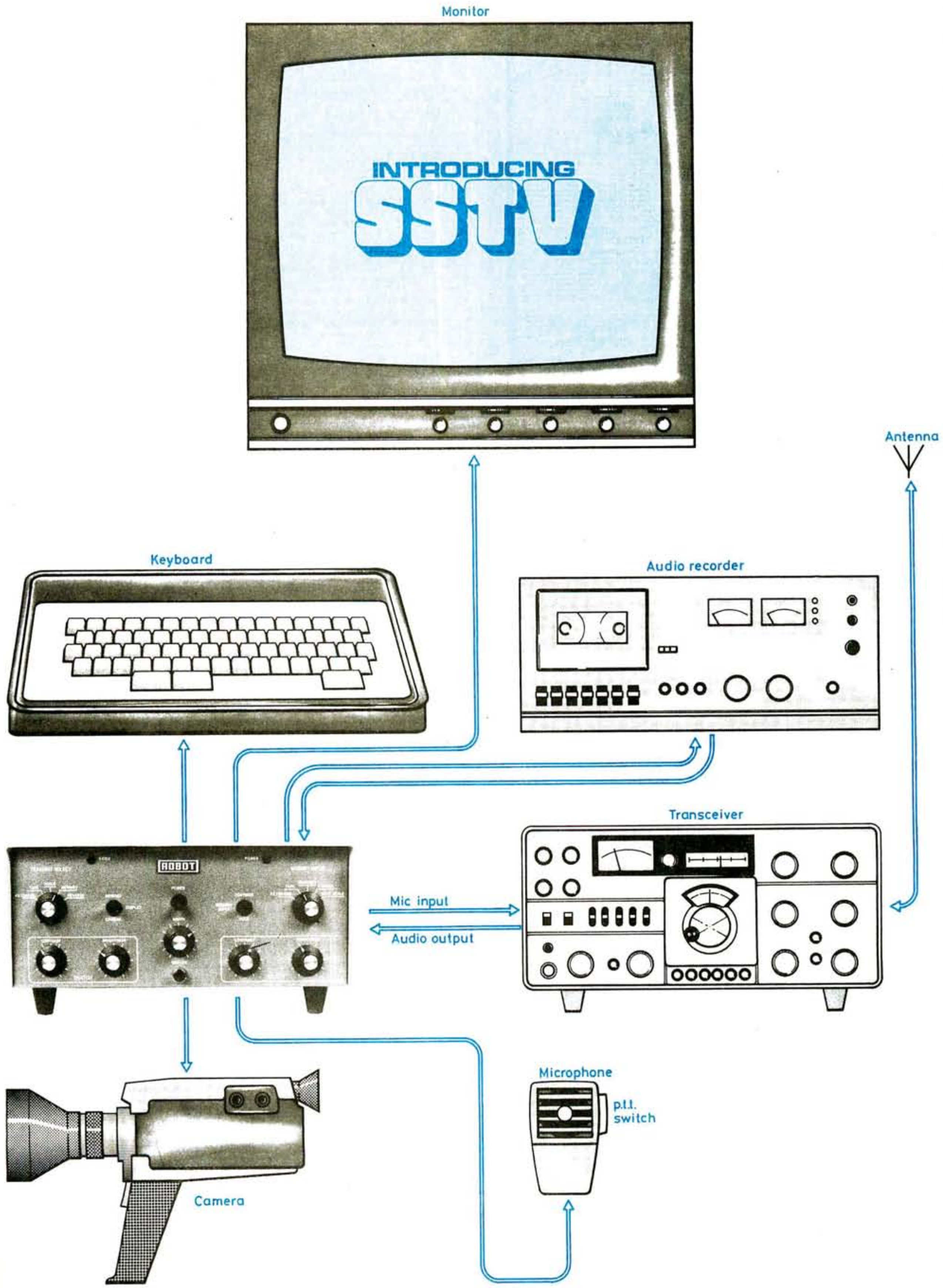
Transmission

Transmission is also simple. The display switch is set to CAMERA and the monitor will display the camera video output converted to SSTV standards. The camera can now be focused and framed on the subject and the snatch brightness and contrast controls adjusted for the best picture. When satisfactory, pressing the SNATCH button will store the picture in the memory. If the display switch is now set to MEMORY the monitor will display the picture ready for transmission. Setting the transmit select to VOICE allows telephony contact to be made with the receiving station. It is then set to MEMORY and the SSTV output will be applied to the transmitter, which is controlled by the p.t.t. switch in the normal manner. The video indicator l.e.d. indicates when video is applied to the transmitter. A 128-line picture is transmitted, the last 8 lines carrying a grey scale which helps the receiving station to align his equipment. It is advisable to continue transmission for three or four frames; i.e. approx 22-30 secs. If the receiving station also has a scan converter he will store a good picture in memory and if not the picture will remain available on the long-persistence phosphor tube for sufficient time for it to be assimilated and if desired recorded on tape.

It is also possible to pre-record pictures or graphics on an audio tape recorder and then send them by using the transmit select TAPE position. Finally the REVERSE position on this switch inverts the transmitted picture video modulation so that for example a black on white callsign caption can be also sent as white on black.

The fast-scan output from the Robot 400 incorporates a line doubler as described previously; i.e. each line is output twice so increasing the number of lines displayed on the monitor to 256. This would seem to be a very crude way of improving definition, as the Robot engineers obviously thought, because before finalising the design they tried much more sophisticated methods. It has been said before

WRM449



continued on page 34▶▶▶

Follow-up to The BASICS of TV DXing

Roger BUNNEY

In the January/February 1981 issues of *Practical Wireless* there appeared some basic and essential information for TV-DXing. Several enquiries have arisen on two specific points which are herewith expanded upon.

It seems the use of wide-band i.f. TV receivers is rather more widespread than anticipated. This aspect of TV-DXing operation was covered in the January issue and specifically the problem of interference from a strong "local" signal—such as the sound channel of a BBC Band I transmitter producing a "splattering" visual effect over quite a considerable part of the tuning spectrum. The solution to this nuisance is the insertion into the antenna input circuit of a notch filter, a very sharp filter possessing a notch depth of perhaps 35dB at resonance but with a very low insertion loss elsewhere in the band. A circuit is shown of a basic and reliable filter of this type that has been in use by TV-DXers for many years.

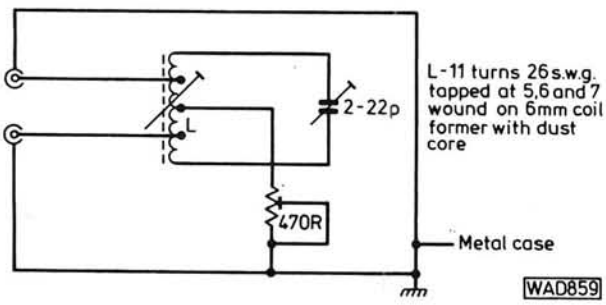


Fig. 1: Band I notch filter

Tuning of the filter is critical. Set the preset 470Ω potentiometer to mid-travel and then slowly tune the trimmer until the interfering source abruptly drops in level. Confirm exact setting point for this trimmer and then slowly reduce the value of the 470Ω preset. The interfering source will drop still further until it suddenly increases in strength. The correct setting of this preset is just before the interference level rises.

In Part 2 of the series the use of the SGS SH221 hybrid amplifier was suggested as an ideal means of producing a high performance antenna amplifier. We have been advised by SGS that the company are reducing their commitment into low level r.f. transistor devices and that when present stocks are exhausted no further supplies will be available. An alternative is the Mullard hybrid thin film amplifier package type OM335 (also stocked by RS Components). This wide-band unit with a 27dB typical gain covers the 40MHz-900MHz spectrum with a noise figure of typically 5·5dB. Experience has shown however that simple filtering is necessary at the input to reduce or prevent breakthrough of high powered m.w./s.w. transmissions, which could mix to produce a spurious signal within the v.h.f. band. A simple v.h.f. choke is often sufficient to stop such undesirable effects. A 24V source at 35mA is needed.

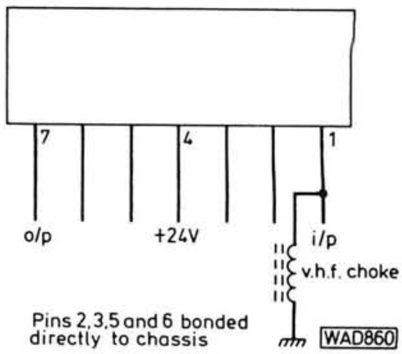


Fig. 2: OM335 Hybrid Amplifier 40–900MHz

In the "Suppliers of Equipment" section, Hugh Cocks was inadvertently printed as "High Cocks", sorry! South West Aerial Systems catalogue as of 1 March 1981 costs 45p (the article was written during the life of the 1979 catalogue which did cost 25p); they can also supply RS OM335 (£13.15 incl.) and Babani's BP52 book on TV-DXing (£2.15 incl.). ●

INTRODUCING SSTV

▶▶▶continued from page 32

that theoretically optimum definition occurs when the vertical and horizontal resolving powers are equal, so if the picture is to be made up of 256 lines, each line should have 256 pixels. Since the video information is stored digitally any line of 128 pixels can be converted to one of 256 pixels by averaging the value of adjacent pixels and inserting this value between them; e.g. two adjoining pixels have values of 0010 (2) and 0100 (4) so a pixel 0011 (3) is inserted between them. Similarly the new lines could be inserted by averaging the pixels in successive lines of the 128-line picture. However, in subjective testing it was found that there was no discernible advantage in this complication and the simple system of line-doubling was adopted!

This certainly works well in practice for very acceptable pictures are reproduced by the Robot providing that one constraint is noted and that is the viewing distance from the monitor, which should be at least 1·8 to 2·1m for a 9 inch and correspondingly greater for larger screen sizes. Conversely, a Sinclair 1A monitor with a screen approx. 25 × 38mm, or the same size as a 35mm film frame, gave good results when perched on top of the rig at normal working distance (approx. 760mm with my bifocals).

In conclusion, the Robot 400 is a very well designed and executed piece of equipment and can be strongly commended to those wishing to adopt the "black-box" approach to the fascinating subject of SSTV.

Our thanks go to the sole importers of Robot equipment in the U.K., **Aero & General Supplies, Building 33, East Midlands Airport, Castle Donington, Derbyshire,** for the extended loan of the review sample. ●

▶▶▶ continued from page 22

second harmonic from the carrier should be evident. This will almost certainly be at too low a frequency to produce an audible tone, but a phasing effect will cause the strength of the Radio 4 transmission to vary in strength at a rate equal to the difference in the frequencies of the two signals. C2 is simply adjusted by empirical means to obtain the lowest possible beat note. By careful adjustment it should be possible to obtain a beat frequency of well under 1Hz, and this gives more than adequate accuracy for normal requirements.

Using The Calibrator

If the unit is used to help with the calibration of a newly constructed receiver, use the 4MHz signal to give some initial calibration points. These should be so well spread out that even on the higher ranges of a general coverage set only about four harmonics will be picked up, and there should be no doubt about the frequency to which each of these marker signals corresponds. The calibrator can then be used in turn in the 1MHz, 100kHz, and 10kHz modes to enable intermediate calibration points to be added at progressively small intervals.

A similar procedure can be adopted when checking the calibration of a receiver, but do not attempt to recalibrate a set unless suitably equipped and experienced to do so.

If the calibrator is to be used to tune a receiver to some desired frequency, the following procedure can be used. If the set is to be tuned to a frequency of say 16·345MHz, first use the 4MHz or 1MHz output to locate 16MHz on the receiver. Then switch the calibrator to the 100kHz mode and tune the set higher in frequency through the 16·1 and 16·2MHz markers, and onto the 16·3MHz one. With the calibrator then switched to the 10kHz mode, the receiver is tuned higher in frequency through the 16·31, 16·32, 16·33, and 16·34MHz markers, and then to what is judged to be half way between the 16·34 and 16·35MHz markers. The receiver should then be tuned with sufficient accuracy to receive the desired transmission if it should appear.

It is not really practical to include a lower fundamental frequency to permit the set to be tuned with greater accuracy, since the marker signals would be useless as with most receivers the bandwidth is such that several would be received at once! The above method permits perfectly adequate results to be obtained anyway.

Spurious Responses

It is advisable to keep the r.f. gain control on the receiver advanced no further than is necessary to give marker signals of reasonable strength. This is because most receivers have spurious responses, and these could lead to confusion if excess receiver gain is used. Also, there is inevitably a small amount of break-through of harmonics from the lower frequency outputs when the unit is switched to one of the higher output frequencies. A high level of gain could boost these very weak signals to a point where they cause confusion.

If there is any doubt as to whether a signal is emanating from the calibrator or is an external signal, switching the calibrator on and off will clarify the situation. ●

PRODUCTION LINES

ALAN MARTIN G8ZPW

Telephone Link

Hadley Sales Services has recently introduced the FM-121D, a two handset "wireless" telephone link which utilizes the a.c. mains wiring for interconnection with a claimed range of up to a quarter of a mile.

Each unit is installed simply by plugging it into the a.c. mains socket and is ideal for desk top, wall mounting or even portable use. There are no controls to operate and lifting the handset transmits a call-tone to the other receiver. As with ordinary telephones both parties can speak simultaneously.

The FM-121D two unit system costs £120·00 plus VAT for the two stations and is available from: *Hadley Sales Services, 112 Gilbert Road, Smethwick, Warley, West Midlands B66 4PZ. Tel: 021-558 3585.*

Digital Watch from Casio

Tempus has recently introduced a new Casio multi-function digital quartz watch called the AX-210.

The main feature of the AX-210 is the dual analogue/digital l.c.d. display, which includes a day of the week indicator. Listing the other mode features, they include: day, date, month and year; current month's numerical calendar and the following month's calendar, both have the Sunday columns indicated; daily alarm which can be selected to operate a 20 second buzzer or any of three melodies, Dixieland, Greensleeves or My Darling Clementine, also on the hour a selectable "Bip" signal sounds with a "Big Ben" type chime at noon; countdown alarm (timer) which ranges from 1 minute to 1 hour; stopwatch with a measuring capacity of 1 hour in units of 1/100 of a second, and finally the dual time function which should be particularly useful to the amateur radio enthusiast, the analogue portion displays local time whilst the digital section may be set to display any other time zone.

The watch is presented in a stylish stainless steel case with an adjustable link strap and the recommended retail price is £34.95; however, it can be obtained at a discounted price of £29.95 from: *Tempus, Beaumont Centre, 164–167 East Road, Cambridge CB1 1DB. Tel: (0223) 312866.*

The Ultimate h.f. Base Station?

I have just received detailed information on the very latest h.f. base station rig from Yaesu. Designated the FT-ONE this new fully synthesised transceiver employs the very latest solid state technology and includes general coverage on receive from 150kHz to 30MHz and 160m to 10m over nine bands on transmit with r.f. power out at 100W.

Being an all-mode transceiver, reception and emission features are: a.m., c.w., f.m., l.s.b., u.s.b. and f.s.k. (frequency shift keying) for RTTY. Split frequency operation and even TX and RX on opposite sidebands is possible.

The i.f. bandwidth is continuously variable on s.s.b. from 2·4kHz and there are three switched positions on c.w. and two on f.s.k. For added selectivity the audio peak/notch filter can be used on c.w.

Frequency selection is achieved either via a direct entry keyboard at 100Hz increments or from the three-speed tuning dial which is accurate down to 10Hz resolution.

All the bands may be scanned either manually or automatically and the memory bank feature is able to recall 10 memories of any frequency within the coverage, together with an r.i.t. offset.

Other features include electronic keyer, signal monitor and operation from either a.c. mains or 12V d.c. supply.

By the time this issue of *Practical Wireless* is published, a few sets will be on display in the UK and quantity stocks should be available before Christmas.

The FT-ONE will cost £1295, which includes VAT, and further details are available from: *South Midlands Communications Ltd., S. M. House, Osborne Road, Totton, Southampton SO4 4DN. Tel: (0703 86) 7333.*

Practical Wireless will be reviewing the FT-ONE as soon as is possible.

PRODUCTION LINES

ALAN MARTIN G8ZPW

934MHz CB Transceiver

R.F. Technology Ltd. have designed, developed and are at this moment manufacturing a u.h.f. (934MHz) CB mobile transceiver, called the Reftec 934.

The transceiver's specification conforms to the requirements of MPT.1321, which are briefly: 20 channels at 50kHz spacing, modulation mode f.m. and 8 watts (±2dB) power out. The overall size of the unit is similar to conventional mobile rigs and unlike foreign designed and built equipment, has the microphone on the right-hand side for right-hand drive cars.

Priced in the region of £200, which is considerably higher than 27MHz sets, the Reftec 934 possesses the added advantages of reduced interference, potentially superior performance in built-up areas and very compact antennas.

For details of availability and distribution outlets, contact: *R.F. Technology Ltd., Leyton Avenue, Industrial Estate, Mildenhall, Suffolk. Tel.: (0638) 715053.*

If you please

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

Sabtronics Instruments

A wide range of very useful test gear from the Sabtronics range of instruments, which should be of particular interest to the radio amateur and electronics enthusiast, has recently been introduced by Black Star Ltd.

This range of products, already well established in the USA, includes digital l.e.d. and l.c.d. multimeters, 8 and 9-digit 100, 600 and 1000MHz frequency counters and a 1Hz to 200kHz function generator. In addition to ready-built and aligned units, very comprehensive kits are available allowing construction by anyone with reasonable soldering ability and limited test facilities.

Practical Wireless has already constructed a kit for the 8610B 600MHz frequency counter, which has proved to be as stable and accurate as its ready-built counterpart. An "Air Test" review will be published later.

Specimen prices from the range are: the 2035A $3\frac{1}{2}$-digit l.c.d. hand-held d.m.m. £83.00 assembled and £64.00 in kitform, the 8610B 9-digit 600MHz frequency counter £109.00 assembled and £89.00 in kitform. Prices quoted do not include VAT.

These products are available from a number of well known distributors or direct from: *Black Star Ltd., 9A Crown Street, St Ives, Huntingdon, Cambs. PE17 4EB. Tel: (0480) 62440.*

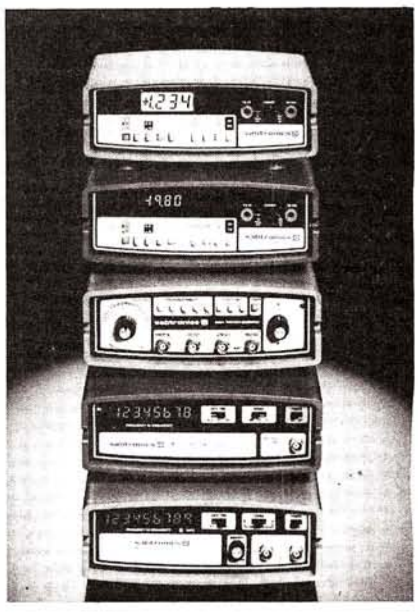
New Range of VHF/UHF Antennas

A new range of antennas for the 144, 432 and 1296MHz bands is now available in the UK from muTek Ltd. These antennas manufactured by Hamburger - Antennen - Grosshandel have been developed using the computer-aided "Double Optimisation" technique described by Günter Hoch DL6WU, in *VHF Communications*. This technique ensures optimum gain for a given boom length, and hence a very clean pattern. A by-product of this design procedure is a reduction in the number of elements for a given gain, and therefore a significant reduction in weight and wind-loading.

The antennas have outstanding mechanical stability and corrosion resistance due to the use of stainless-steel and marine-grade aluminium. The elements are sprung stainless-steel and assembly is made simple by virtue of an ingenious clipping arrangement to the square boom.

Good broadband matching is achieved through the use of a precision p.t.f.e. balun, handling 1000W c.w./s.s.b., and 500W at 100% duty cycle.

For further details of the range and prices contact: *muTek Ltd., Bradworthy, Holsworthy, Devon EX22 7TU. Tel.: (040 924) 543/8.*



air test

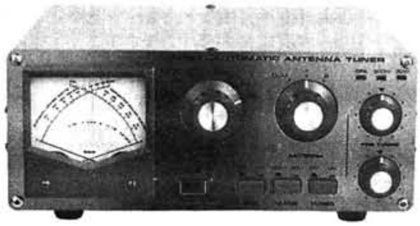
USER REPORTS ON SETS AND SUNDRIES

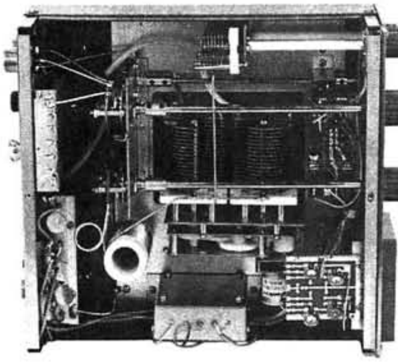
DAIWA CNA-1001 Automatic Antenna Tuner

The Daiwa CNA-1001 combines a forward/reverse power meter, antenna switch, 50Ω dummy load and automatic antenna tuning unit for the eight amateur bands from 3·5MHz to 28MHz, all in one box measuring approximately 90 × 225 × 240mm and weighing around 3·6kg.

The forward/reverse power indication is by means of the Daiwa "crossed pointer" system described in *Air Test* in our July 1981 issue. Ranges are 20/200W forward and 4/40W reverse, with a minimum of 5W required for s.w.r. indication. Accuracy is ±10% of f.s.d. The antenna switch allows selection of two antennas or the internal dummy load which is rated at 10W continuous or 50W for 1 minute.

The tuning unit is based on a standard "pi" network with an additional series capacitor on the antenna side, which will match antennas of 10–250Ω impedance (15–250Ω on the 3·5MHz band) to transmitters with 50Ω output, giving a maximum s.w.r. of 1·5:1 on automatic. The appropriate input capacitor and coil tap are selected by means of the manual bandswitch. The output capacitor and the series capacitor are variable types, driven by the tuning servo, but have panel-mounted trimmers connected across them to allow manual adjustment for lowest possible s.w.r. after the





automatic tuning has reached its optimum setting. The basic antenna s.w.r. must be better than 5:1.

The input for the automatic tuning servo amplifier is taken from an additional reverse power detector, via a switched attenuator which permits selection of 1, 5 or 10W drive level. The tuning process takes a maximum of 45 seconds, and a power supply of 13·8V d.c. at 200 mA.

Results

Our fairly brief tests of the CNA-1001 showed it to perform very well, producing s.w.r. readings of well under 1·5:1 on automatic when connected to an antenna system with s.w.r. of 4:1 at its worst point. The 4-page instruction manual gives specification, block and circuit diagrams and operating instructions, but does not make *it clear that* the OPERATE button should be pressed only momentarily to start the auto-tuning process. If you hold the button in, as I did at first, the motor just carries on whirring round and round!

The unit operates with unbalanced antenna feeders only, so that a balun is required if balanced feeders are fitted to your antenna. You must be able to reduce transmitter power to 10W or less for initial tuning-up, to avoid possible flashover or damage to the a.t.u. circuitry, but this is a fairly normal requirement anyway.

I understand that the CNA-1001 has proved itself very popular indeed with physically handicapped radio amateurs. Obviously, being able to tune and match an h.f. antenna using just one rotary switch and a push-button, instead of two or more interdependent rotary controls, is a great boon for anyone with limited control of hands or limbs.

The Daiwa CNA-1001 is available price £129·50 including VAT from **Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire DE4 5LE, telephone Matlock (0629) 2430/2817,** to whom we offer our thanks for the loan of the review unit.

Geoff Arnold

THE PW 'WINTON' Stereo Tuner

Part 3

E. A. RULE

Last month we dealt with the digital board, circuit changes, the component list and the descriptions of the p.c.b.s. This month we continue with the a.m. and f.m. boards and circuit functions.

Logging Oscillator

Transistor Tr12 is used in a Clapp oscillator circuit and works at a frequency of from 655kHz to 955kHz. The varicap tuning diode D24 is controlled from the main varicap tuning circuits, and therefore the frequency of the logging oscillator is adjusted at the same time as the rest of the circuits. The output from this oscillator is fed into the a.m. section of the digital counter via Tr14, and the diode function matrix is switched so that the counter is set up for a.m. The display obtained is offset by the a.m. i.f. frequency and can then be used as a simple logging scale of 200–500 when using the TV band. Once found on the main tuning, stations can be quickly set up on the pre-set push buttons.

The Varicap Diode Circuit

A stabilised supply is provided by a special Zener diode, D19; this is in fact a small integrated circuit which not only provides the very stable supply voltage required for varicap tuning but is also fully temperature compensated. When it is considered that on the TV band (for example) a change in the d.c. voltage applied to the varicap diodes of only one millivolt will shift the frequency by 5kHz, and when a shift of only a few kilohertz from the correct tuning point on f.m. will introduce distortion, it can be realised just how important it is to have a fully stabilised supply. Further to this, it must not introduce a noise into the system. If we take our 100 per cent modulation as equal to a f.m. deviation of 75kHz which would in turn be equal to a noise generator, the very special properties of D19 can be appreciated. So don't be tempted to use something else instead.

The stabilised voltage is applied to the manual and pre-set tuning potentiometers via S13 to either R65 or R66. Switch S13 selects the correct amount of a.f.c. for the TV or f.m. band. The junction of R65/66 and the tuning pots also goes to the collector of Tr6, which is the a.f.c. voltage amplifier. As the current through this transistor varies it changes the voltage drop across either R65 or R66. The system works like this:

As the current through Tr6 varies due to the a.f.c. voltage from the i.f. section, it will cause the voltage at the end of R65/66 to vary and correct any drift or errors in tuning, by changing the actual voltage supply to the varicap diodes. This change in voltage is of course arranged to have the correct phase. If the tuning voltage goes higher the varicaps will adjust to a lower capacity and therefore the frequency of the tuned circuits will go higher. This change will also cause the i.f. frequency to go higher which will mean that the detector will be off tune. A voltage will occur at its output which will increase the current through Tr5 and Tr6 and in turn cause the voltage drop across R65/66 to increase, thus lowering the varicap supply voltage and off-setting the original increase. Similarly with the reverse process.

The outputs of the various potentiometers are selected by switches S4 to S8 for feeding on to the varicaps.

The f.m. and TV varicaps are connected to S4 and can be switched either to the manual tuning potentiometer R56 or to one of the pre-sets R57 to R64. The a.m. varicaps are connected directly to the manual tuning pot and no pre-sets are provided. However, by swopping the feed points to S4 around, the pre-sets could be re-arranged in some other combination, manual and pre-sets on a.m. and f.m. and only manual tuning on TV, for example. In practice, however, it is felt that the combination shown is the best. The selected output from the switches for TV is also fed to the varicap tuning diode of the logging oscillator Tr12. Because it is not practical to display the actual frequency when on the TV band (the counter would have to read up to 1000MHz and therefore would be expensive) it was decided to provide a logging scale only and the function of this is described in the digital section.

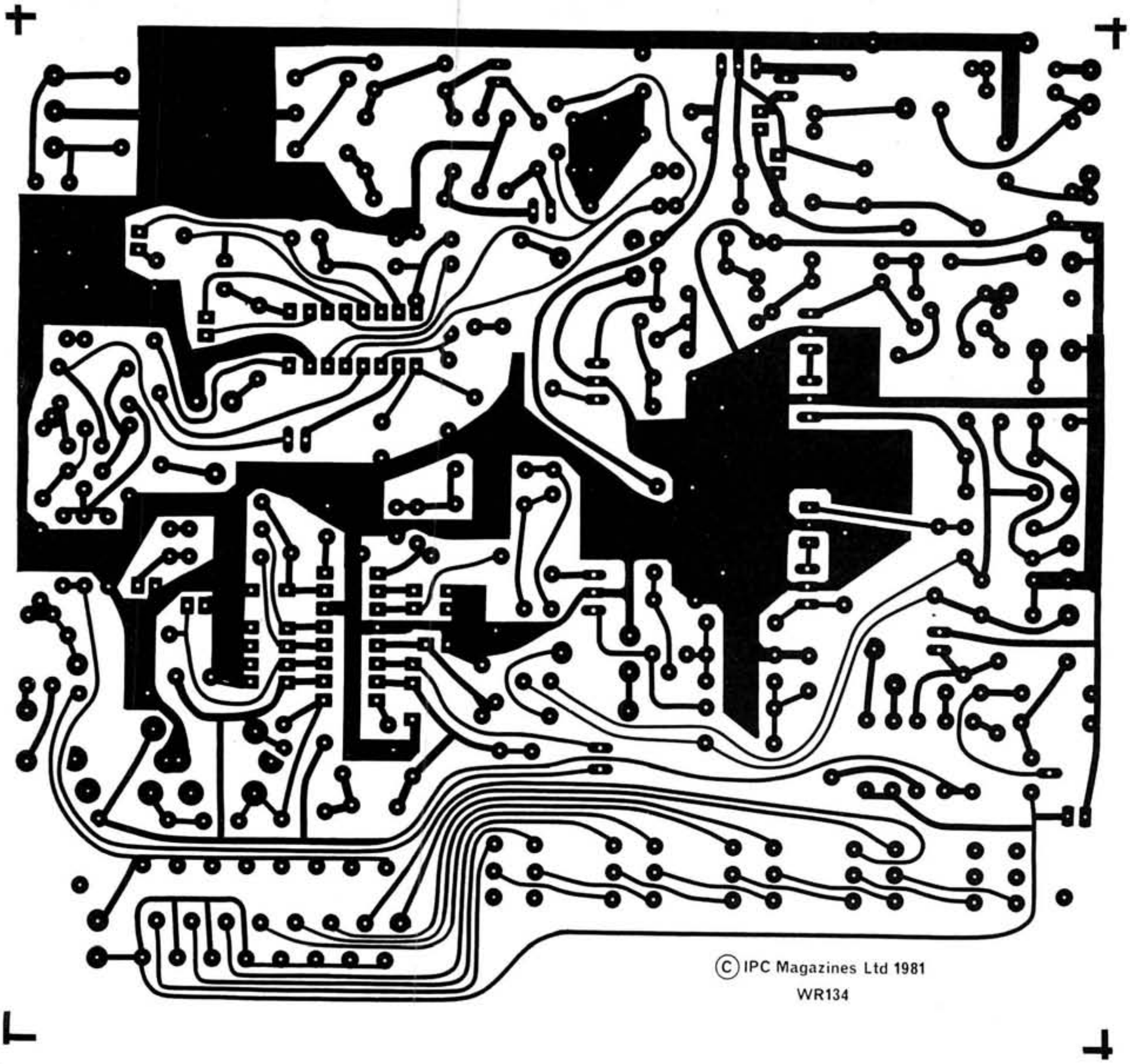
Digital

The digital frequency counter used in the Winton Tuner is based on the popular OKI MSM5524RS l.s.i. device. The design of a frequency counter has been dramatically simplified since the introduction of l.s.i. (large scale integration), and a complete counter system can now be produced using only one additional i.c., a few transistors and other components. As well as the normal frequency readout, it has a 12-hour clock with a 24-hour-cycle timer and alarm functions and an elapsed time stopwatch function up to 12 hours 59 minutes 59 seconds. Any of these can be used on the Winton Tuner, although some may require a small amount of additional wiring to an extra output socket. The main functions of frequency readout and a 12-hour clock or stopwatch are already wired for use.

The 6-LT-09 Futaba fluorescent display is used with the MSM5524RS and provides a display bright enough for most lighting conditions. The resolution obtained on each band is:

f.m.	0·1MHz
l.w.	1kHz
m.w.	1kHz
s.w.	10kHz

On the TV band the digital display is used to provide a "logging" scale of from 200 to 500.



▲ Fig. 8: Track pattern of the f.m. board, shown full size
▼ Fig. 9: Component layout for the f.m. board

Circuit Function

The outputs from the r.f. oscillator are fed via Tr13, Tr14 or Tr15, depending on the band in use, to the MSL2318 pre-scaler input. The required function is selected via a diode matrix by either S14 (function selector), or S11 and S12. Additional diode switch D13 is used on the TV band.

The MSM5524RS is capable of being set up to cater for a number of different i.f. frequencies via the i.f. diode matrix; however, in the Winton Tuner the matrix is already set up and no further adjustment is required. For a more detailed account of the functions of the MSM5524RS the manufacturer's data sheet should be consulted, as a full description here would take up several pages of magazine space.

Power for the various digital circuits is obtained from the main power supply, but with the addition of IC7 on the digital p.c.b. to provide a stabilised five volts.

Control Functions

Each control will now be fully described regarding its function and this section should be referred to as required during the setting up and operating procedures.

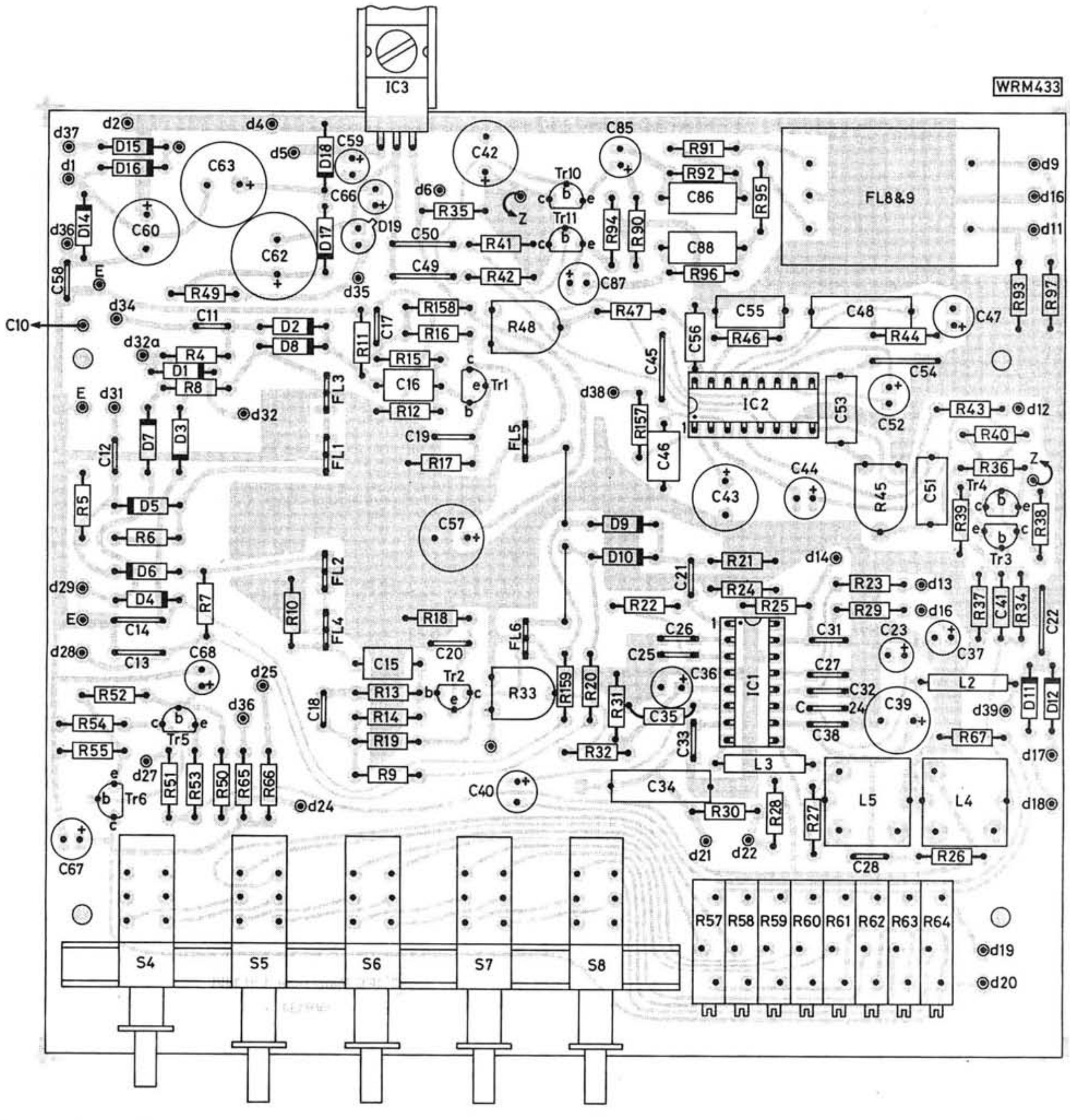
Standby switch. Switch S16, when in the off position this switch breaks the h.t. supply to IC3 and therefore removes the h.t. voltages from the tuner sections. The h.t. is left connected to the digital section. This switch also disconnects the tuner section of the diode matrix and puts the digital display into the "clock" mode.

Tuning control. This is a ten turn potentiometer, R56, and it adjusts the voltage applied to the varicap diodes when in the "manual tune" position.

Pushbuttons. The LW, MW, SW, FM and TV buttons select the band required. The first four are interlocking but in order to select TV it is necessary to first select FM and then TV as the TV button is not interlocking. The TV button must be released when selecting any of the other bands otherwise the frequencies on each band will be displaced. This is because the TV switching also adjusts the amount of a.f.c. control voltage effective on TV or FM and this causes a change in the overall varicap supply voltage. The reason the TV button is not interlocking is simply due to using a commercial design r.f. section which already had switching built in. Making use of what was already *present* in the way of switching is a small penalty for using ready built units originally designed for some other purpose.

Mute. This switches a pre-set voltage to the muting circuits of IC1 and prevents reception of all signals below approximately 25 microvolts. It also removes the interstation hiss normally heard when tuning. This control is also effective on TV.

AFC. This brings in automatic frequency correction on FM



and TV. Tuning should first be carried out with the AFC off and once a station is located either on manual tune or pre-set the AFC can be switched on. When using the pre-set station buttons (having already set them up) the AFC may be left on, particularly on TV where it may be found impossible to maintain the correct setting without AFC.

Selectivity. This offers a choice of band width on f.m. When switched to narrow band the tuner is also switched to MONO mode. In the wide band position the tuner will automatically select STEREO if a stereo signal is present.

Manual. This selects the manual tuning control on all bands. Pre-sets 1–4. These enable up to four pre-set stations to be obtained on each of any two bands. The tuner is normally wired to provide pre-sets on FM and TV with only manual tuning on AM.

Digital Section—Controls and Functions

Warning. The l.s.i. is very easy to damage by either static or excess voltage on any of its pins. In particular, great care should be taken when connecting up external circuits. Devices damaged by static or excess voltage will not be accepted as faulty under the guarantee by the manufacturer or supplier.

The main display function control has five positions:

Frequency **(F)**

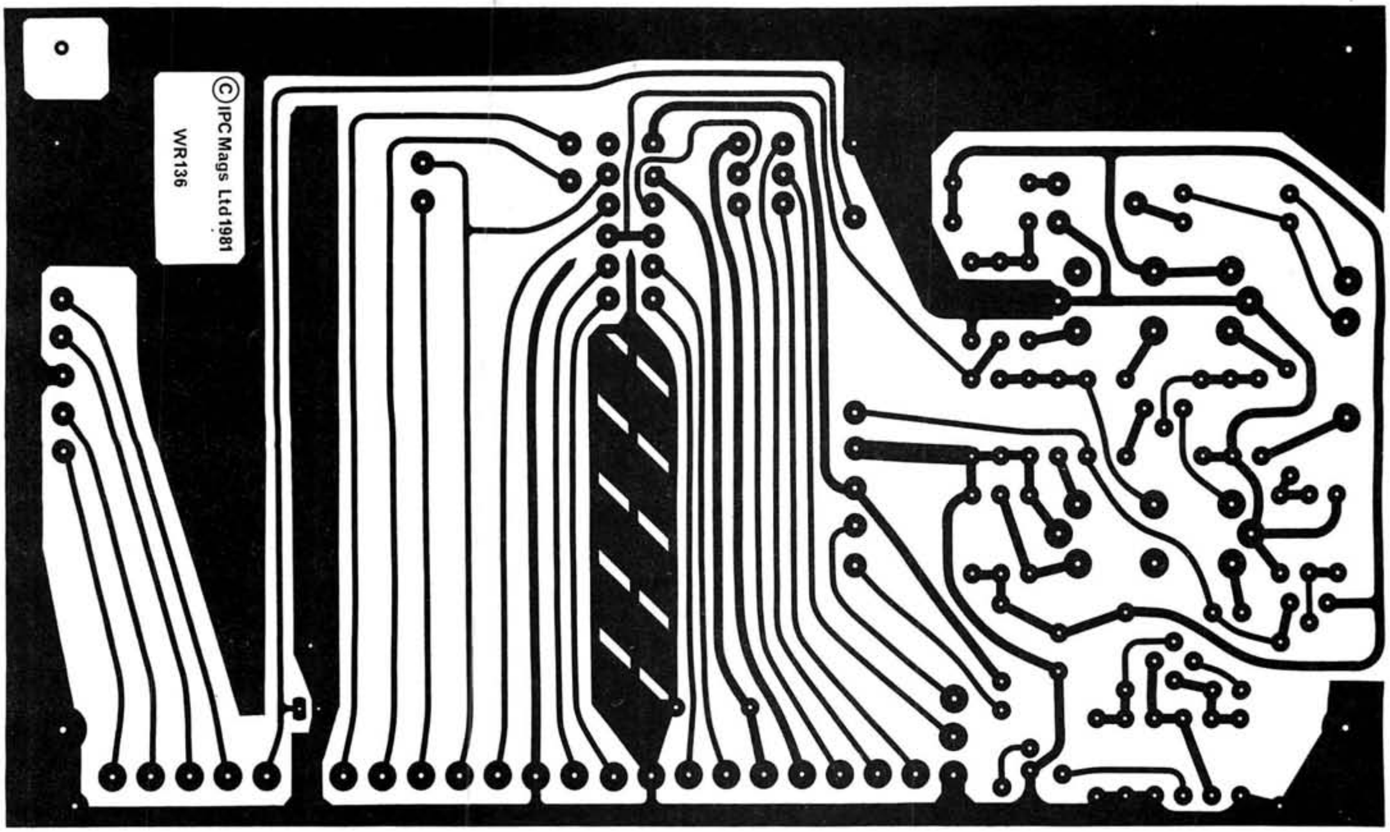
Clock, normal clock function **(C)**

Timer On **(T on)**—Enables a pre-set time to be programmed into the clock

Timer Off **(T off)**—Enables a pre-set time to be programmed into the clock

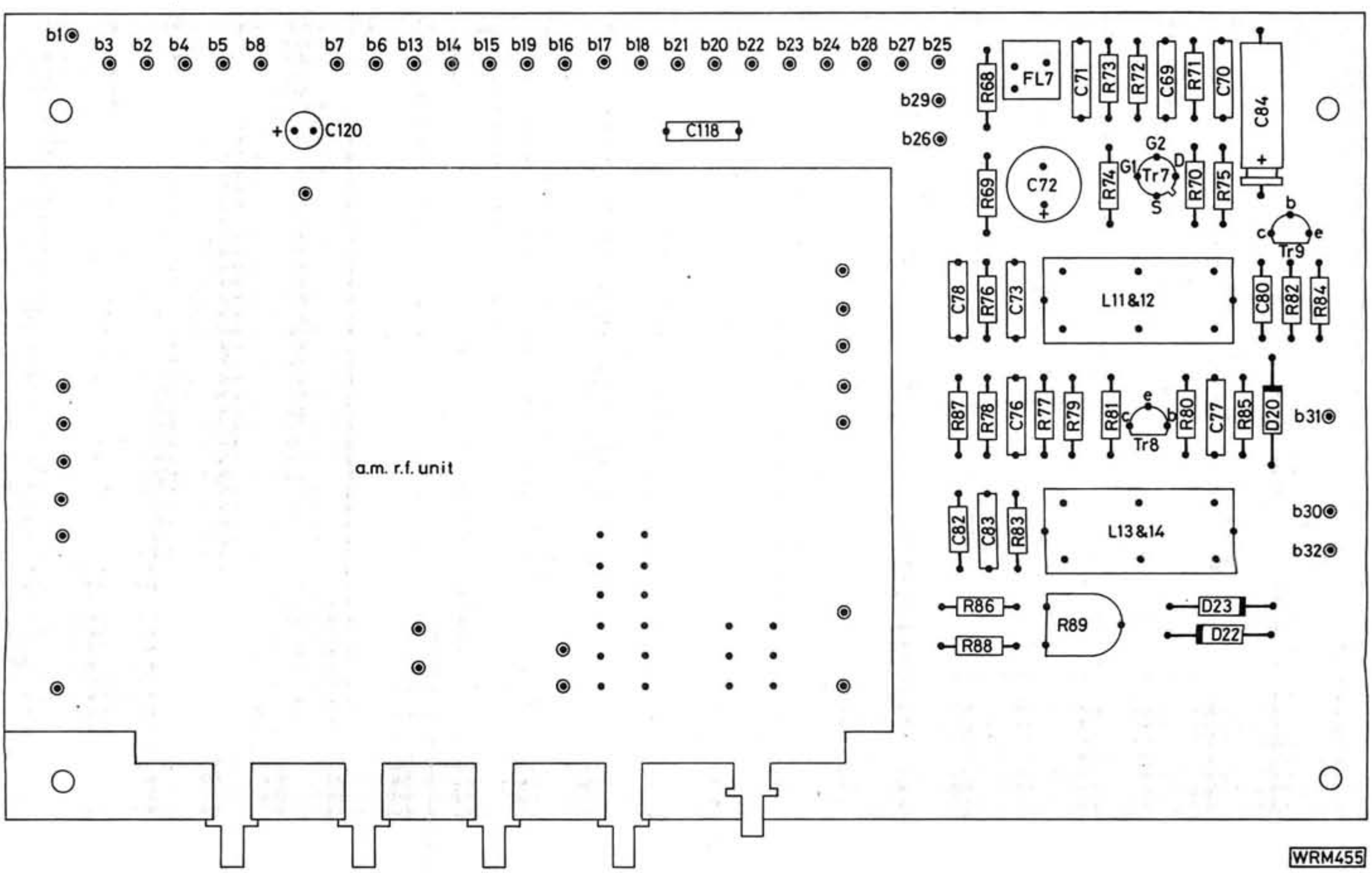
The last two positions are used to set the time, the l.s.i. output on pin c26 is either at "high" (5 volts) or "low" (zero volts). As the clock reaches the pre-set "on" time this pin will go "high" and return to "low" when the "off" time is reached. This voltage can be used to control an external circuit. The maximum current is 1mA and a transistor amplifier must be added if higher currents are required to control external circuits.

The fifth function is a sleep timer **(S).** This sets the timer to count down in minutes from 59. Pin c30 goes high when the counter reaches "00" and is "low" while counting



▲ **Fig. 10: Track pattern for the a.m. board, shown full size**

▼ **Fig. 11: Component layout for the a.m. board**



down. Any starting time between 59 and zero minutes may be selected by the use of the "B" button. This feature and the timer functions are useful for timing tapes or cassettes.

Digital Pushbuttons

For "A", "B" and hours set (H–S) refer to table. Sleep Timer Off (T–O) resets the timer out to "high" and returns the countdown to "00".

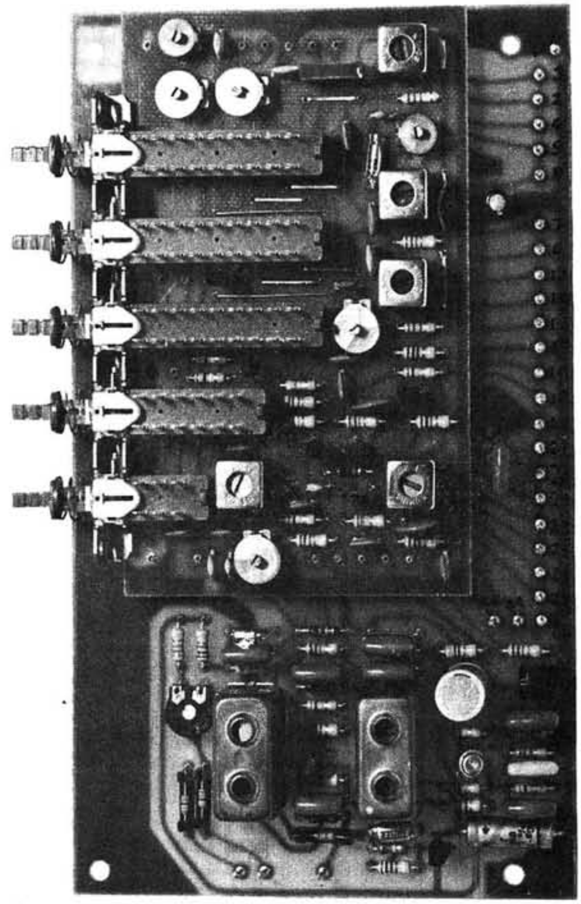
Examples of Displays Obtained

Display selected	Display
Frequency LW MW SW TV FM	130–280kHz 500–1625kHz 3·25–6·34MHz 200–500* 78–109MHz
Clock	1.00–12.59 with "point" pulsed at 1Hz
Timer On	1.00–12.59 with "point" constant
Timer Off	1.00–12.59 with "point" constant
Sleep Timer Stopwatch Mode Timer On Timer Off	00 counting down from 59 "colon" lit in stopwatch mode 1.00–12.59 (hours and minutes) 0.00–59.59 (minutes and hours) "point" pulsed when stopwatch is timing

Note * On TV the kHz sign is displayed and should be ignored. The 200–500 display is for logging only.

Function	A	B	Operation
Clock	P	P	Reset clock counter 1.00.00
	*	P	Setting minutes (hours held)
	P	*	Setting hours (minutes held)
	*	*	Normal clock operation
Timer On	P	P	Reset on-timer 0.00
	*	P	Set minutes (hours held)
	P	*	Set hours (minutes held)
	*	*	Retain setting time
Timer Off	P	P	Reset off timer 0.00
	*	P	Set minutes (hours held)
	P	*	Set hours (minutes held)
	*	*	Retain setting time
Sleep Timer	P	P	Reset sleep timer counter 00 minutes
	*	P	Countdown 59 to 00
	P	*	Hold setting time
	*	*	Normal operation with display counting down

Note. These time adjustments and setting functions are operated by pushbuttons A and B. In the table the letter P means pressed and * means unpressed. If A or B are held for between 0.1 and 1.6 seconds a single digit will be counted, if they are held for longer, the count rate increases to 10 digits per second.



The completed a.m. board, with the Hart FX811 tuner head mounted on it

A	B	Hour Set	Display Selected	Result
*	*	P	Timer On	Stopwatch display 0.00 to 12.59 in hours and minutes
*	*	P	Timer Off	Stopwatch display 0.00 to 59.59 in minutes and seconds
*	*	P	Stopwatch mode	Return to timer operation
P	*	*	Stopwatch mode	Start count
P	*	*	Stopwatch mode	Stop count
*	P	*	Stopwatch mode	Reset to 00.00

Note. Pressing the "hours set" when in the clock mode will set minutes to 00. When switched to stopwatch mode any pre-set times in the timer On or Off positions will be erased.

TO BE CONTINUED

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.

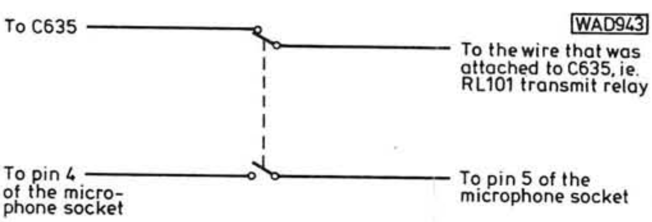
Roger Hall G8TNT(Sam)

No. 11

Let me start this month's column by apologising to those of you who read in last month's *PW* that I would be discussing the Trio TR-9000 in this issue. Unfortunately the contributor who was going to supply me with the various mods didn't realise that the articles that appear in most magazines are usually written some two months before they're published. When I told him that I hoped to include them in this, the December, issue he thought that he had plenty of time. Now that he has been enlightened, he hopes to have everything ready for next month and I'll do my best to make sure that it is all written up in time.

When I discovered that I couldn't cover the TR-9000 this month, I was left with the problem of finding something else very quickly and just as I was about to sort through my files, I received a letter from Hal GW8TMZ. He has a Yaesu CPU-2500RK and in his letter he asked me to publish a request for mods for it. He said that although he would be pleased to hear of any mods, the two that he would especially like are for altering the channel spacing from 5 and 10kHz to 25kHz, and for providing either semi or full reverse repeater. Before I publish any request for mods, I always check to see if I have it on file and, fortunately for Hal, I already have one of the mods that he requested. It was sent in by Ian G6BAI, and it is for semi-reverse repeater i.e. listen on the input. The only extra parts that are needed are a non-latching pushbutton switch that has one pair of contacts that are normally closed and another pair that are normally open and approximately 30cm of four core cable.

The first step is to mount the push-button switch somewhere on the set. It can be mounted anywhere you like but somewhere on the front panel will obviously be the most convenient. Then disconnect the wire that is attached to the lead of the feedthrough capacitor C635 on the phase lock loop control unit. When viewed from the front, it's the fifth tag from the right at the back. Now connect one of the inner wires from the four core cable to the free end of the capacitor and another one to the free end of the wire that you have just removed from C635. The other ends of these two inner wires should now be soldered to the tags of the normally closed part of the pushbutton switch.



The next step is to connect one of the remaining inner pieces of wire to Pin 4 of the microphone socket and the other one to Pin 5. The other ends of these two pieces should then be soldered to the tags for the normally open part of the switch as shown in Fig. 1.

Now, whenever the set is in the repeater mode, pressing the pushbutton will switch the set to the input of the repeater but the transmit side will be disabled.

Ian's letter then went on to say that it is very easy to extend the frequency range of the CPU-2500 up to 4MHz for transceiver operation. All you need to do is take the top off the set and find the p.c.b. that has the p.l.l. on it. There you will find that between J604 and J603 there are six solder pads. For 2MHz coverage, the pads marked "A" are shorted together with a link and if you remove this link the set will then cover 144–148MHz.

There are however two shortcomings: the # key on the microphone will no longer bring up 145·500MHz, in fact it now does nothing at all, and when the set is first switched on it will now display 147·000MHz. Both of these seem minor inconveniences and I'm sure that you could live with them if you wanted the full 4MHz coverage. The added bonus is that the * key will now give +5kHz whenever pressed.

Thanks for writing Ian and if anyone else has any more mods for this set for Hal, I will be happy to pass them on.

Wanted

The first request this month is a little unusual because it's from a reader who would prefer to remain anonymous. He has written in asking me if I know of a way to extend the frequency range of the Trio TR-7800. Unfortunately I don't have this mod on file and so I have had to publish this request. He has also asked for a personal reply, as have many other readers, some of whom have been kind enough to enclose a stamped self-addressed envelope, but I would like to mention that this is not usually possible and I would prefer to reply through this column whenever I can.

The second request this month comes from Morris GW8OPK. He would like some mods for the DX300 receiver, especially one to prevent overloading on medium wave. He has also asked if I can advise him on the best a.t.u. for his receiver and he mentions some of the well known names and he then asks if it is possible to make one. Well Morris, as I haven't tested all of the a.t.u.s on the market, I'm not in a position to say that brand A is better than brand B. What I will say is that it is very important that you do use an a.t.u. as it will improve the performance of your receiver considerably and any of the well known makes should perform well. As we are a constructional magazine, I would be failing in my duty if I didn't suggest that you go ahead and make one for yourself. We have published several designs in the past and one of the most recent was in our antenna special called *"Out of Thin Air"* which is still available from some amateur radio shops.

Mr G. A. Newman has written in from Norfolk because he would like to improve the s.s.b. selectivity of the FRG-7 using a LFc-2A 2·4kHz filter, as recommended by Yaesu. Does anyone know anything about it?

The last request this month is from Mr A. A. Banks. He has a Standard C-8000 scanner/transmitter and he would like to increase the output power from 50mW to 100mW. If you know how to do this or if you would like to know how to do a mod for your rig of if you have a mod that you would like to pass on, please write to: R. S. Hall, Room 301, Hatfield House, Stamford Street, London SE1 9LS.

73's
Sam G8TNT

NEWS NEWS NEWS

PW Exe

Electroforms & Components, specialists in microwave engineering, have recently notified me of the availability of ready built units or component parts for the G4ALN/PW Exe parabolic dish feed. In addition to the feed assembly, Electroforms list includes many hard-to-come-by microwave components including plain and choke flanges, seals and waveguide 16 manufactured in both brass and copper and cut to length.

To obtain a copy of the full list including prices, send an s.a.e. to: *Electroforms and Components Ltd., 90 High Street, Whetstone, Leicester LE8 3LQ. Tel: (0533) 864832.*

70MHz (4 metres)

Following many months of rumour about the future use of this band in the UK, the Home Office Press Office have issued a verbal statement to clarify the position.

From 1 January 1982 the frequency allocation on the 4m amateur band will be reduced from the existing 70·025–70·700MHz limits, to 70·025–70·500MHz, a reduction of 200kHz. This reduction has been made in recognition of decisions taken at WARC '79.

The statement concludes with a confirmation that holders of the Amateur Class B Licence will not be allowed the use of the 4m band.

Unconfirmed rumours still circulate suggesting the future total withdrawal of the 4m band in the UK, but this cannot, at this time, be verified. The Home Office spokesman did however state that no plans to introduce an amateur allocation at 6m (50MHz) were envisaged for the "forseeable future".

Trio Test Gear

Since April this year, House of Instruments are now the exclusive distributor in the UK for the Trio range of test and measuring instrumentation.

The full range of instruments are readily available direct from House of Instruments, their area distributors and retail shop outlets throughout the UK. For further details contact: *House of Instruments, Clifton Chambers, 62 High Street, Saffron Walden, Essex CB10 1EE. Tel: (0799) 24922.*

Update to Life Saving Story

Following the mention in this column in August of the international emergency operation, involving Chris Baker G4LDS and Yugoslavian amateur Dusko Petrovic YU1PDP, further details have emerged.

After compiling considerable documentation of this incident, we can now reveal that a parallel operation was carried out by Fergus Veitch G4LEV, who also responded to the CQ emergency appeal and organised a direct dispatch to Yugoslavia.

Both Chris and Fergus went to considerable trouble and personal expense to ensure the prompt delivery to Belgrade of the wanted drugs.

The reason for the duplication appears to be the combined results of high levels of QRM on the 15 and 20 metre bands and the language difficulty, neither Chris nor Fergus was aware of the action being taken by the other.

Practical Wireless would therefore like to extend congratulations to Fergus for his exemplary action.

Perhaps a lesson to learn for the future is that when responding to an emergency broadcast, it is vital to pass all received information to the local authorities to avoid unnecessary duplication.

U.H.F. Repeater Close Down

After a period of protracted negotiations between the RSGB and the group responsible for the operation of u.h.f. Repeater GB3WS, RB6, Sudbury, Suffolk, the Home Office have been advised of its close down. The reason for this action was due to an unofficial relocation and the failure of the group to comply with repeated requests for a valid site clearance form for its new site. However the RSGB still hold a current licence for this repeater and are anxious to establish the installation at an approved location. Any interested parties are asked to contact Mike Dennison G3XDV via RSGB HQ.

PW helps group win HF NFD81

In response to an appeal for help from Mike Allisette GU4EON via 2m repeater GB3SC, *PW* Technical Editor, John Fell G8MCP, was able to rapidly locate and dispatch, via airfreight, essential materials to repair the Guernsey Amateur Radio Society's h.f. antenna system.

The repairs must have been good as the society went on to amass a total of 3423 points during the 1981 HF National Field Day Contest, sufficient to win the NFD Trophy.

New Catalogues

Bi-Pak Semiconductors, the electronic component suppliers, inform me that their latest 64-page catalogue is now available.

The catalogue lists hundreds of very useful items including antennas and accessories, technical books, cases and enclosures, tools, kits, instruments and meters, p.c.b. supplies and a host of semiconductors and components.

Priced at £1.00, which includes 25p p&p, the catalogue along with price list and order forms is obtainable from: *Bi-Pak Semiconductors, The Maltings, 63a High Street, Ware, Herts. SG12 9AD. Tel: (0920) 3442/3182.*

OK Machine & Tool (UK) Ltd. have launched a new division, Electroware, to provide the electronics user with what is thought to be the widest range of electronic hardware currently available in the UK.

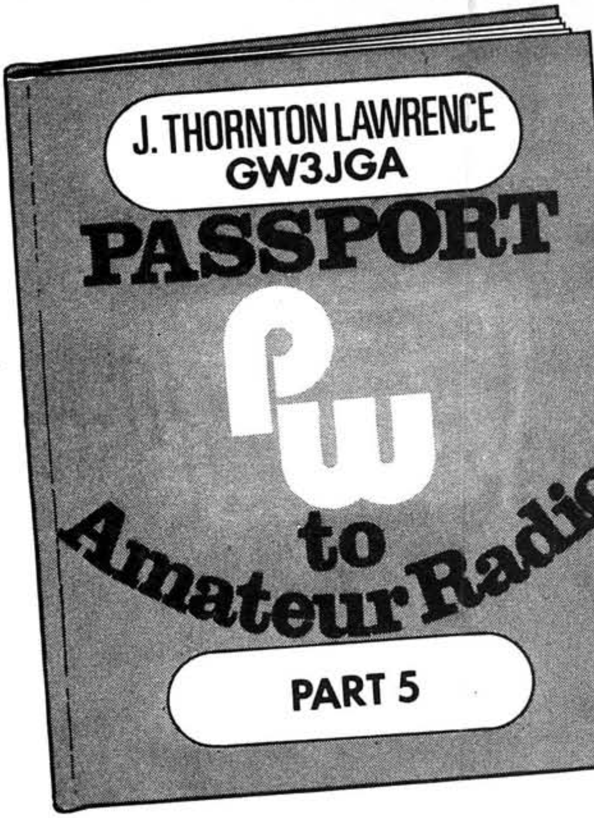
The new 40-page catalogue contains details of various products selected from OK's bench tool range, plus many new items.

To obtain your copy of this new catalogue, send 30p (for p&p) to: *OK Machine & Tool (UK) Ltd., Dutton Lane, Eastleigh, Hants. SO5 4AA. Tel: (0703) 610944.*

Electronic Brokers, Europe's premier test equipment company, have just released their latest catalogue of used equipment calibrated to original specifications.

Listed is a very wide range of test equipment from most of the major manufacturers, such as Tektronix, Marconi, Hewlett Packard, Philips, Fluke and Hameg of West Germany.

The catalogue is available free from: *Electronic Brokers Ltd., 61/65 Kings Cross Road, London WC1X 9LN. Tel: 01-278 3461.*



Last month we looked at magnetism, inductors and capacitors, and so now we move on to alternating current, reactance, resonance and transformers.

Alternating Current

In the previous sections we have dealt with direct current (d.c.) and we know that d.c. maintains a steady value, either positive or negative in polarity as shown graphically in Fig. 19.

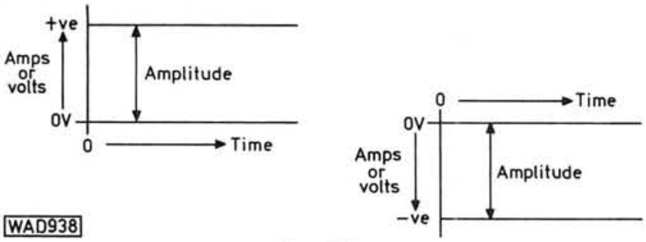


Fig. 19

Alternating current (a.c.) on the other hand varies in a special way and to understand this, we return to the magnetics section. You will remember that when a conductor is moving in a magnetic field the direction of the induced e.m.f. depends on the direction of movement and the direction of the magnetic field.

Let us imagine two bar magnets, a loop of wire and a meter arranged as shown in Fig. 20. The loop is rotated and we look in detail at the induced e.m.f. in the loop as shown in Fig. 21.

In (a), no e.m.f. is induced because the direction of movement of the conductors forming the loop is parallel to the direction of the magnetic field. In (b) an increasing e.m.f. is induced as the conductor cuts across the field. In (c) maximum e.m.f. is induced as the moving conductor cuts the field at right angles. In (d) the e.m.f. is decreasing and at (e) again no e.m.f. is induced. Here the position is

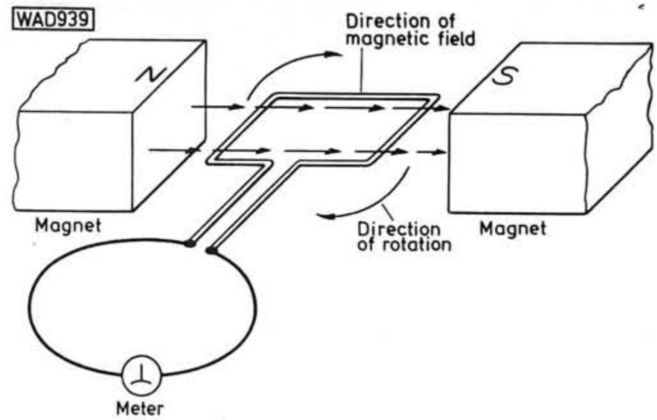


Fig. 20

similar to (a) except that the conductors A and B are transposed. This means that when moving through (f) and beyond, conductors A and B are then cutting the field in the opposite direction. This results in the induced e.m.f.

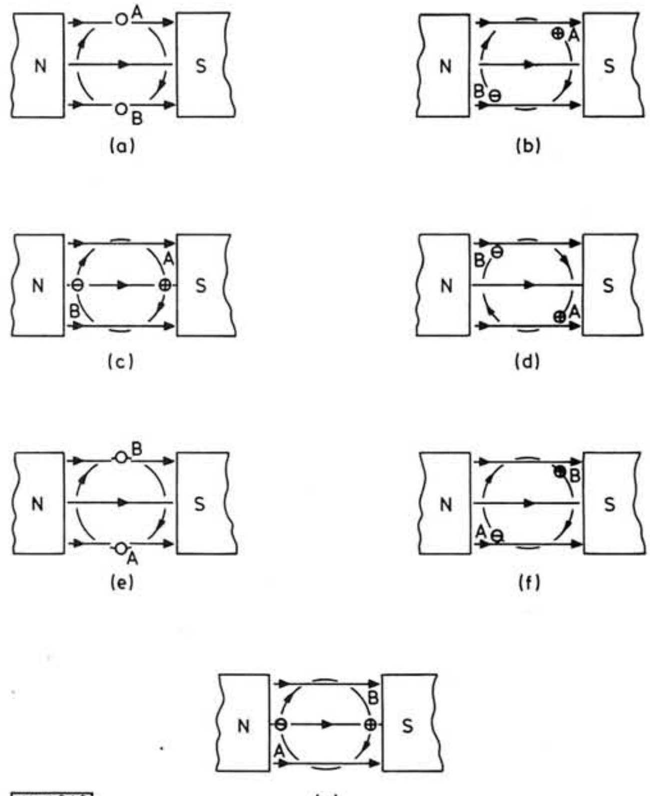


Fig. 21: The induced e.m.f. as the loop is rotated

being reversed every half revolution. This is shown graphically in Fig. 22 and it can be seen that in one revolution, the e.m.f. starts at zero, rises to a positive maximum and falls to zero again, then rises to a negative maximum and again falls to zero. Thereafter the pattern is repeated for every revolution of the loop. If the rotation is continuous and at a constant speed then the peak amplitude of the voltage waveform and the period or frequency are also constant.

The Sinewave

The shape of the alternating waveform we have observed is called sinusoidal or a sinewave because the amplitude of the voltage or current at any point during the

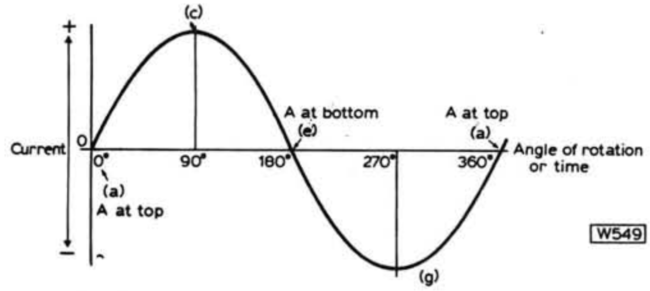


Fig. 22: The induced e.m.f. is reversed every half revolution

cycle is related to the trigonometrical function called sin of the angle of rotation. The amplitude at the peak of the sinewave is known as peak value. Because the instantaneous value is constantly varying between the peak value and zero, the value which is equivalent in heating effect to d.c. lies between these two values. It is known as the root mean square, or r.m.s., value and it is the r.m.s. value which we use when stating the mains supply voltage, or the rating of a transformer or a lamp.

The r.m.s. value of a sinewave is 0·707 of the peak value and conversely, the peak value is 1·414 the r.m.s. value. For example, the peak value of the 240 volt mains supply is 240 × 1·414 = 340 volts approximately. The peak value is of particular interest when specifying the maximum voltage rating of components in an a.c. circuit and in rectifier circuits. The peak-to-peak value is twice the peak value.

In Fig. 23 a 2Hz sinewave is shown. As there are two complete sinewaves within a time of one second, then each cycle of the sinewave occupies a time period of 0·5 second.

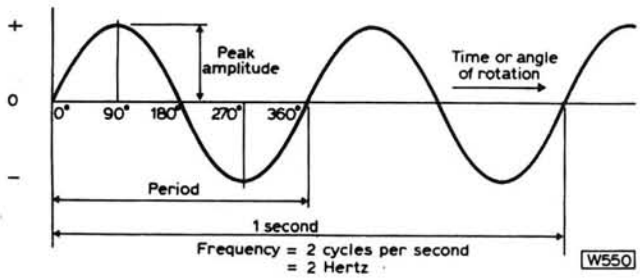


Fig. 23: A 2Hz sinewave

As a further example, suppose the time period of one sinewave was 1ms (1×10^{-3}) then there would be 1000 cycles or periods in 1 second and the frequency would be written as 1000Hz or 1kHz.

Frequency

Frequency, symbol f, is measured in hertz, symbol Hz.

$f\,(\text{frequency}) = \frac{1}{t}$ where t is the time of one cycle or period

and $t = \frac{1}{f}$

The alternating current supply to your home is generated at the power station by an alternator and the frequency is 50Hz. The alternating current passing from an amateur v.h.f. transmitter to the antenna is generated by a valve or transistor oscillator and amplifier. The frequency may be 145MHz (145 000 000 cycles per second) but the alternating voltage or current is still a sinewave and it has the same properties as its lower frequency compatriot.

Phase Differences

With alternating voltage, and current, it is quite possible to have two or more voltages of identical frequency but having a time or **phase** difference between them. For example, this effect would be produced by adding an extra coil to the generator in Fig. 20.

If the coil was placed at 90° to the existing coil, then the voltage induced in this coil (b) would be delayed or would lag by 90°, one quarter of a revolution or one quarter of a cycle, with respect to the original coil. This effect is shown graphically in Fig. 24.

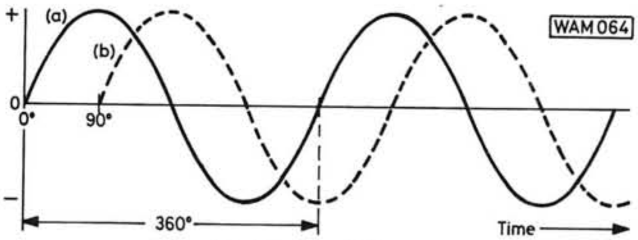


Fig. 24: Phase difference

Suppose that we reversed the connections to this new coil, then the polarity of the voltage would be reversed and the wave would be inverted. This wave would then appear to be in advance or "lead" the original wave by 90°. In other words, reversing the connections would change the relative phase by 180°.

Resistors in an AC Circuit

In this case both voltage and current are "in phase" with one another, i.e. they both reach maximum or minimum values at the same time. When calculating current and voltage, the r.m.s. (root mean square) values are used:

$$I_{rms} = \frac{V_{rms}}{R}$$

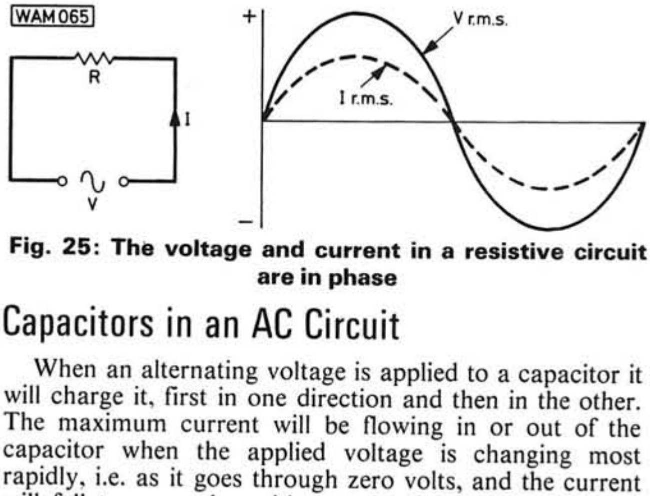


Fig. 25: The voltage and current in a resistive circuit are in phase

Capacitors in an AC Circuit

When an alternating voltage is applied to a capacitor it will charge it, first in one direction and then in the other. The maximum current will be flowing in or out of the capacitor when the applied voltage is changing most rapidly, i.e. as it goes through zero volts, and the current will fall to zero when either peak of the cycle has been reached and the voltage is virtually steady for an instant.

Since the current is at a peak one quarter of a cycle before the voltage it is said to "lead" the applied voltage by 90° (one full cycle being 360°). The energy which is stored in the capacitor during the quarter of a cycle charging period is returned to the circuit in the following quarter cycle. The current flowing is known as "Wattless Current" as no power is dissipated in the conventional I^2R sense.

If the relationship between voltage and current is investigated, the frequency of the alternating current must be taken into account, together with the value of the

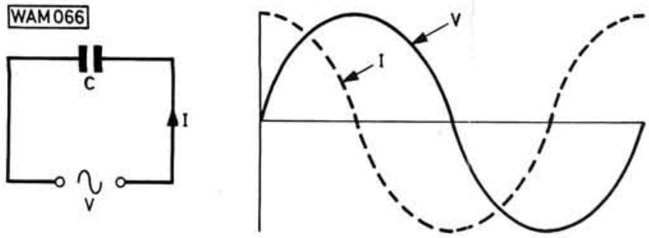


Fig. 26: In a capacitive circuit the current which flows leads the applied voltage

capacitance in the circuit. In fact, the current flowing is proportional to capacitance, frequency and voltage. By arranging these factors we can extract a quantity which is akin to resistance in a d.c. circuit. This quantity is known as **capacitive reactance** and its unit is the ohm.

Capacitive Reactance $(X_C) = \frac{1}{2\pi fC}$

where f = frequency of alternating current
C = capacitance
$\pi = 3{\cdot}142$

Using Ohm's Law and reactance we can calculate the voltage or current in an a.c. circuit containing a capacitor.

$I = \frac{V}{X_C} \quad X_C = \frac{V}{I} \quad V = I \times X_C$

Note that V and I are r.m.s. values.

Inductors in an AC Circuit

When an alternating voltage is applied to an inductor the resultant current causes a counter e.m.f. to be induced which is proportional to the rate of change of the current. In the inductor, as in the capacitor, the maximum current occurs when the voltage is changing most rapidly (as it goes through zero), except that in the case of the inductor the current "lags" the voltage by one quarter of a cycle or 90°.

It will be realised that if the frequency of the a.c. increases, so will the rate of change of current. Thus the value of the e.m.f. generated in the inductance will be proportional to the frequency, and the current flowing will be inversely proportional to the frequency. From this we can extract a quantity known as the **inductive reactance** whose unit is again the ohm.

Inductive Reactance $(X_L) = 2\pi fL$

where f = frequency
L = inductance
$\pi = 3{\cdot}142$

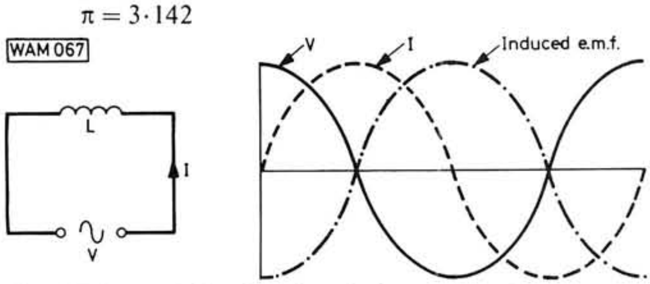


Fig. 27: In an inductive circuit the current lags the applied voltage by 90°. The induced e.m.f. is in antiphase to the applied voltage

Again we can use Ohm's Law and calculate current and voltage in the inductive circuit using reactance in the place of resistance:

$I = \frac{V}{X_L} \quad X_L = \frac{V}{I} \quad V = I \times X_L$

Note that V and I are r.m.s. values.

Reactance in Series and Parallel

Reactances of the same kind, inductive or capacitive, can be treated similarly to resistors:

Series $X = X_L - X_C$

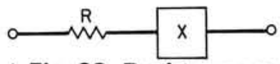
Parallel $X = \frac{-X_L \times X_C}{X_L - X_C}$

This follows because when reactances of opposite kinds are combined in the circuit, the currents lag and lead the voltages, in the inductive and capacitive sections respectively, by 90° and consequently they must first be subtracted from one another to find the total reactance. For this purpose, inductive reactance is normally considered "positive" and capacitive reactance as "negative".

Impedance

In any circuit containing reactances there will be some resistive element in the wires, for example, in the inductor windings, thus when we consider the resistance to current flow presented by reactances we must add that presented by the ohmic resistance of the circuit. When we consider all these elements together it is known as **impedance**. The resistive element of the impedance may be either in series or in parallel with the reactance.

WAM 068



▲ Fig. 28: Resistance and reactance in series

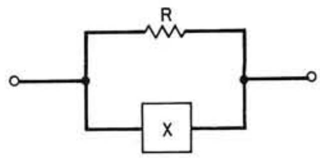


Fig. 29: Resistance and reactance in parallel ▲

Series: The impedance Z in this case is $Z = \sqrt{R^2 + X^2}$

where Z = impedance (ohms)
R = resistance
X = reactance (inductive or capacitive)

Parallel: The impedance Z in this case is $Z = \frac{R \times X}{\sqrt{R^2 + X^2}}$

In circuits which contain impedances, Ohm's Law can be applied as follows:

$I = \frac{V}{Z} \quad Z = \frac{V}{I} \quad V = I \times Z$

Note, use r.m.s. values of V and I.

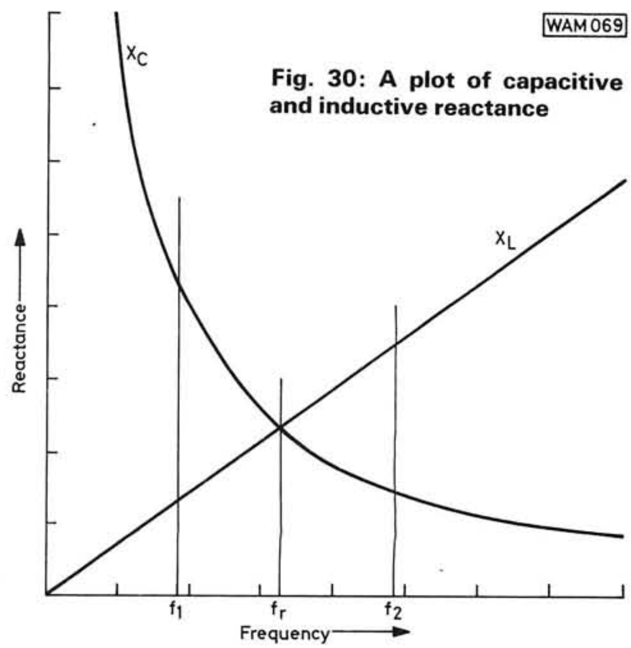


Fig. 30: A plot of capacitive and inductive reactance

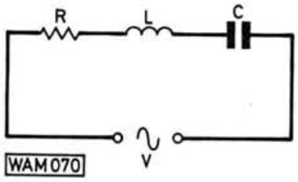
Resonance

The next characteristic of the a.c. circuit that we are going to examine is **resonance**. This is a most important effect which is employed many times over in every radio transmitter and receiver. As the a.c. frequency, applied to a circuit containing inductance and capacitance, is increased, the value of the inductive reactance increases, whilst that of the capacitive reactance decreases, as shown in the graph, Fig. 30.

From this it is apparent that at a certain frequency (f_r), the capacitive reactance equals the inductive reactance.

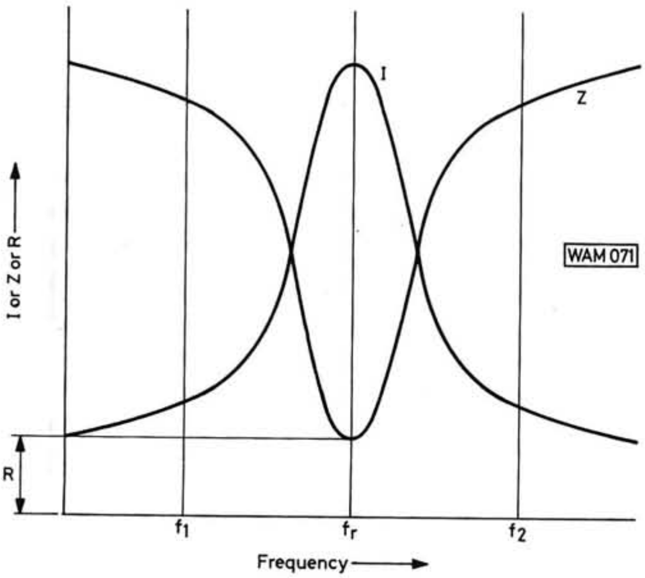
Series Resonant Circuit

This is sometimes called an acceptor circuit. Referring to Figs. 31 and 32, if the frequency of V changes between



◀ **Fig. 31: A series resonant circuit**

Fig. 32: A series RLC circuit at resonance ▼



f_1 and f_2 then at a frequency f_r the current flowing in the circuit will rise to a maximum. The impedance, on the other hand, falls to a value equal to R. To summarise this in an expression:

$$X_L = 2\pi fL \text{ and } X_C = \frac{1}{2\pi fC}$$

$$\text{at } f_r\ 2\pi fL = \frac{1}{2\pi fC}$$

$$\text{therefore } f_r = \frac{1}{2\pi\sqrt{LC}}$$

where f = frequency in hertz
L = inductance in henries
C = capacitance in farads
$\pi = 3{\cdot}142$

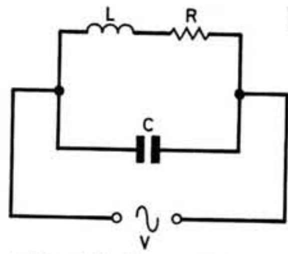
The value of the current flowing in the circuit is found as follows:

$$I = \frac{V}{Z} = \frac{V}{\sqrt{R^2 + (X_L - X_C)^2}}$$

Thus at resonance, the impedance of a series resonant circuit is equal to the resistive component R alone, X_L and X_C having cancelled each other out.

Parallel Resonant Circuit

This circuit is sometimes called a rejector circuit. This arrangement, referring to Figs. 33, 34 and 35, is awkward



▲ **Fig. 33: A parallel resonant circuit**

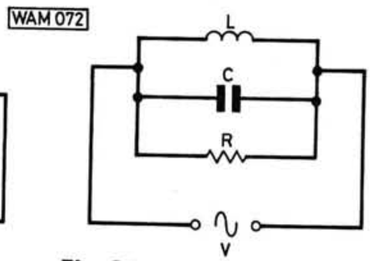


Fig. 34: The equivalent circuit of Fig. 33 ▲

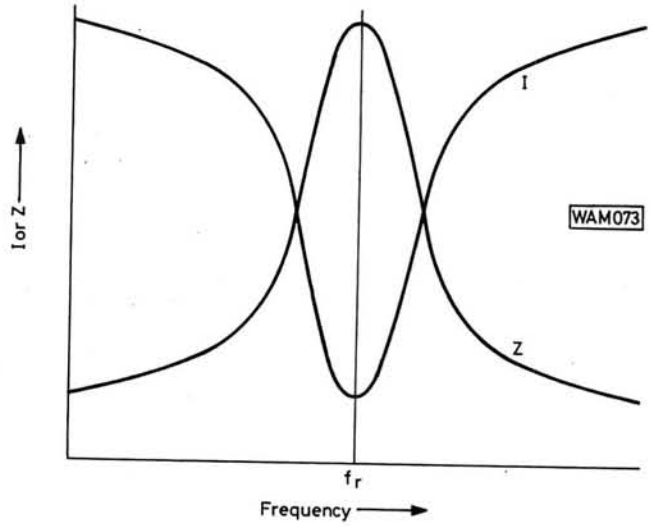


Fig. 35: A parallel RLC circuit at resonance

for the purpose of investigating the variation of current and impedance with frequency, so an equivalent parallel circuit is used. In this circuit a perfect inductor and a perfect capacitor are in parallel with an assumed resistance, known as the dynamic resistance R_D, this being equal to L/C_r at resonance.

The expression for the resonant frequency of the parallel tuned circuit is, in practical terms, the same as for the series tuned circuit.

$$F = \frac{1}{2\pi\sqrt{LC}}$$

Magnification Factor "Q"

In the circuit shown in Fig. 31 at resonance, the voltage across the inductor (or the capacitor) can be considerably greater than the applied voltage V. As we have seen, the current at resonance is defined by the value of the resistor R, but the voltage across the inductor (or the capacitor) is given by the product of the current and the reactance in question, which is usually very much greater than R. The ratio of the voltage across the reactance to that across the resistor is called the magnification factor "Q" of the circuit.

The "Q" of a practical tuned circuit depends mainly on the "quality" or "goodness" of the coil as the capacitor normally has very low losses associated with it. A high "Q" tuned circuit has the ability to respond to one frequency whilst rejecting others. In a receiver, this would imply "selectivity", the ability of the receiver to select a wanted signal and reject unwanted signals.

An example of the practical use of a simple resonant circuit is in an absorption wavemeter. In this device the resonant frequency of a tuned circuit is used to check the output frequency of a transmitter.

Resonance Curve

The response or resonance curve of a parallel tuned circuit is shown in Fig. 36.

The width of the curve at 0·707 of the maximum response is known as the bandwidth of the tuned circuit. The relationship between "Q" and bandwidth is:

$$\text{"Q"} = \frac{\text{Resonant frequency } f_r}{f_{high} - f_{low}}$$

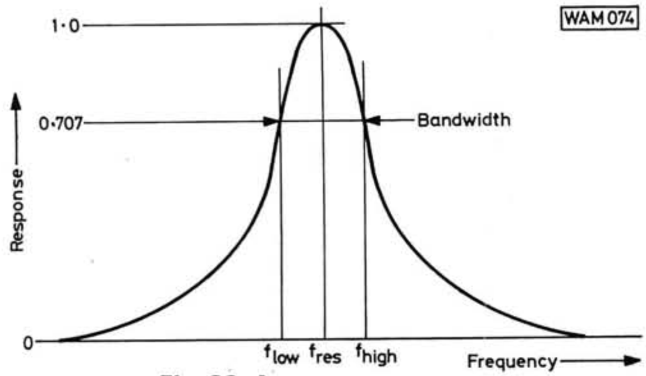


Fig. 36: A resonance curve

A resonant circuit with a high "Q" will have a smaller difference between f_{high} and f_{low} and the resonance curve will be narrower and sharper, indicating a narrower bandwidth and greater selectivity.

LC Ratio

The resonant frequency of a tuned circuit is determined by the product of inductance (L) and capacitance (C), but there will be an infinitely wide range of L and C values which together will tune to the same frequency.

However, the choice of practical values for L and C will be determined by the impedance of the associated circuits and the desired working value of "Q".

The "Q" of a tuned circuit, on its own, may be in the region of 100-400, depending mainly on the quality or goodness of the coil. As soon as the tuned circuit becomes part of, say an amplifier, the components in the associated circuit "load" it and the practical working "Q" becomes considerably less than the unloaded "Q".

For example, a receiver r.f. amplifier stage employing a field effect transistor would require a tuned circuit with a working "Q" of about 100 to give good selectivity and a high dynamic resistance to give good gain, so a high *LC* ratio would be required. One physical limitation to the value of C could well be the residual stray capacitance in the wiring etc.

Alternatively, an important factor affecting the choice of the tuned circuit in the output stage of a 2m transistorised transmitter would be good power transfer from the output stage to the antenna. Here a working "Q" of 15 would be typical and the low impedance of the transistor output stage would make a relatively low *LC* ratio necessary.

In almost all cases the choice of *LC* ratio is a compromise between conflicting requirements.

Transformers

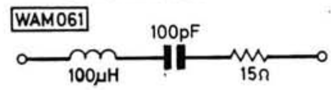
As mentioned in the section on inductance two coils having mutual inductance constitute a transformer. The coil connected to the source of energy is called the primary coil, and the other the secondary.

A transformer can only be used with a.c. since no voltage will be induced in the secondary winding if the magnetic field is not constantly changing.

Transformers come in many shapes and sizes. The construction may vary from two "hairpins" of thick wire with an air core, forming a transformer which will couple power out of a v.h.f. or u.h.f. transmitter, to the heavy laminated iron cored version found in the "mains" transformer.

The primary and secondary windings may be side by side or wound one on top of the other. The windings may also share a common core material such as in the mains transformer. This serves to increase the inductance and concentrate the linking magnetic field, thus improving the efficiency of the magnetic circuit. The windings may also form part of a tuned circuit, as in the i.f. (intermediate frequency) transformer, which will be described later.

RAE Practice Questions



1. What is the impedance at resonance of the series circuit shown above?

a. 30Ω

b. 215Ω

c. $\sqrt{15\Omega}$

d. 15Ω

2. The reactance X_L of an inductor L at a frequency f is given by which formula?

a. $X_L = \frac{1}{2\pi fL}$

b. $X_L = \frac{1}{2\pi\sqrt{fL}}$

c. $X_L = 2\pi fL$

d. $X_L = \frac{1}{\pi fL}$

3. An alternating voltage of sinusoidal waveform has a peak-to-peak value of 200V. The r.m.s. value would be:

a. 70·7V

b. 35·35V

c. 50·0V

d. 141·4V

4. One cycle of a sinusoidal wave has a duration of two milliseconds. The frequency is:

a. 1MHz

b. 500Hz

c. 1kHz

d. 50Hz

Answers:
1. d., 2. c., 3. a., 4. b.

CONTINUED NEXT MONTH

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

Letters

Blush!

Sir: It really is about time that someone handed the people who produce *Practical Wireless* a huge bouquet. If it has not yet happened then please allow me to do it (in writing at least).

A couple of years ago I used to look at the index before buying, perhaps three issues in a year. Now I just buy it! This letter would be far too long if I mentioned all the ways in which the improvements have combined to make *PW* the best radio magazine on the market by far. By comparison now, the specialist amateur radio magazines look totally inadequate.

Your major projects are interesting, well presented and very tempting even to someone like myself who has been "stung" by many non-working projects from all magazines over the years. (I really fancy having a go at the Helford but, as the 80 metre net is too weak and noisy for me, I am following the 6 month rule.) Your equipment reports are the best I have seen, especially where a series of proper tests are reported. So often nowadays reviewers tell the reader little more than the colour of the knobs.

I consider that the balance of the magazine, with something for all levels of the hobby, without any section having too great a share, would be difficult to improve upon. In particular, I find your *On the Air* columns neither too short nor too long. (The other mags. are now printing little else.)

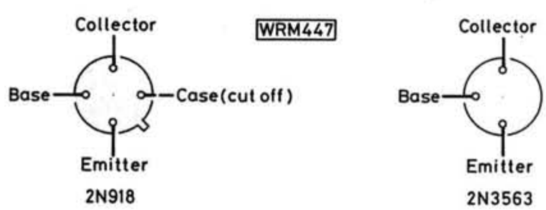
This letter is becoming too long really, but finally, may I say that I hope that you do not plan to devote too much space in future issues to a "CB section". That fraternity of non-technical escapees from Hazard County already have their trivial comics.

A. Jacques G3PTD,
Manchester.

kindly note!

VHF Pre-amplifier, June 1981

The transistor specified for this project is no longer available. A 2N918 should be used as a replacement; the fourth lead, connected to the case, should be cut off. The case should not touch the ground-plane.



Amateur Radio and the Disabled

Radio is very undiscriminating, it takes no notice of creed, colour or disability. Amateur radio is no exception, anyone with a suitable receiver can listen to international broadcasts or licensed amateurs. It makes no difference whether the person listening is blind, disabled, bedfast, housebound or fully healthy. Perhaps that is part of the attraction to amateur radio for blind and disabled people.

Everyone who wishes to transmit on the amateur bands must obtain a licence after passing the City and Guilds Examination and, for a Class A licence, a Morse test. The disabled are not exempt; however, special provisions are made to take the exam at home and orally if necessary. Similar arrangements can be made for the 12 w.p.m. Morse test.

There are organisations, backed by many willing helpers, to guide these people through the necessary exams and to overcome their disabilities in operating the equipment. One such organisation is the Radio Amateur Invalid and Blind Club.

The RAIBC disabled enthusiasts have had their own Club since 1954. The aim of the RAIBC is to enable blind and disabled short wave listeners and licensed amateurs to pool their knowledge and experience and, with the assistance of representatives and supporters, enjoy their hobby.

The 700 members are kept informed of events by their bi-monthly newsletter *Radial*. The Club assists in getting practical aid for members and, in some cases, provides suitable equipment on loan. This equipment is often donated or purchased from the generous donations of the amateur radio fraternity. The RAE courses produced by the Club, on cassette, are in great demand by the many blind members. There are also weekly "nets" on 80 metres to keep the members in touch.

The aid and assistance is organised on a local level by representatives; these are either individuals or local radio clubs. The assistance can vary from explaining how to tune a receiver to installing a complete station and antenna system.

Even with the wide range of disabilities encountered it is usually possible for equipment to be modified for satisfactory operation. The modifications range from the simple fitting of larger control knobs and levers for someone who has lost manual dexterity, or with Braille markings for a blind operator, to complicated control systems responding to a slight finger-tip movement.

Radio can break down the barriers of being confined to the home and literally open up the world for the disabled. Any enquiries should be sent to Mrs Frances Woolley G3LWY, whose address is in the reference box. Of course the RAIBC is always pleased to hear from anyone interested in joining the Club, but they are also pleased to hear from people who can help out. Either ask in your local radio club if they are involved in any way, or write to Frances Woolley who will put you in touch with your local representative.

St Dunstan's

Another group you may not have heard of is the St Dunstan's Amateur Radio Society. St Dunstan's is an organisation for Forces men and women blinded in either war service or active service.

Captain Ian Fraser was blinded in the Battle of the Somme in 1916, yet on his return home still kept his interest in radio that stemmed from his school days. He enlisted the help of the, then, Wireless Society of London to help other blind people to build radio equipment.

It was in 1967 that a suggestion was put forward that all St Dunstaners who were licensed amateurs should meet at Brighton. The Home they met at is now called the Ian Fraser House, and they discussed problems which had been encountered and overcome by blind operators.

Not until 1976 did the St Dunstaners consider forming their own society. Until that time they had been associated with the RAIBC. The newly formed society adopted the object, "To create and encourage interest in, and further the knowledge of, amateur radio amongst St Dunstaners, their contacts and friends."

Today, the society is affiliated to the Radio Society of Great Britain, the three Armed Forces Societies—Royal Naval, Royal Signals and Royal Air Force, and the RAIBC. There is a tape library at HQ, which holds such items as the *Radio Amateurs' Examination Manual,* and subsequent revision notes. The newest addition to the Library is *A Guide to Amateur Radio* (18th edition).

The Society now has two callsigns for its base stations, G3STD and G8STD, and these are run from the Ian Fraser House at Brighton. For more details about St Dunstan's you should contact Ted John G3SEJ, whose address is in the reference box.

Highfields Day Centre

Highfields caters for eighty "clients", as they call their disabled, and these range from the blind through to those who are unsuitable for any type of employment.

Back in the autumn of last year Mr Cyril Parsons GW8NP was approached with the idea of setting up an amateur radio club there. He believed that amateur radio is an ideal hobby for a large percentage of disabled people, and in addition would provide world-wide advertisement for the unit.

The suitably adapted radio station was duly opened and received radio and television coverage. It was issued with the callsign GW4LFO and ten clients will be taking the RAE this month after being tutored by Dan Adams GW3VBP.

Local Involvement

In our part of Southern England the Bournemouth RAIBC group is very active and is one of the best organised in the country.

Here in Bournemouth the local RAIBC group consists of a representative, helpers and members with various disabilities. They have a scheme by which one licensed operator "looks after" two or three disabled members, a sort of "minder" if you like. This way there are many real friendships set up and the "minders" can understand the disabilities their friends are learning to cope with. These helpers look after the equipment, install antennas, help with RAE and Morse tuition and show the operators how to "drive" their own equipment.

Most of the members need to have their equipment modified to suit their various needs. This is also done by the helpers, some even design useful aids like boom microphones to aid operating. A 2m "net" is held on a Friday night, when members are invited to call in, so checking that the operators and their stations are all right. Should members' equipment go wrong, they have several ways of getting it repaired.

Two members of the Bournemouth RAIBC have written to tell of the difference that amateur radio has made to them. The first of these is Bob G6BEP, who is war-disabled.

"My disabilities had reached a point whereby I was practically house-bound and in a wheel-chair. I have always been interested in radio from a s.w.l. point of view and I began to think in terms of becoming a Radio Amateur. Once a month my wife purchased *PW* (just for me to look at as she so tactfully put it!). This was when I first came to hear about the RAIBC. I had heard that there was a radio amateur living nearby and so I wrote a short note asking for any help. That same day Alan G4GQH called in to see me saying that despite any disability if I was willing to work hard at studies for the RAE he was only too willing to help me.

"Within a week I was 'on the air' as a s.w.l. and Alan and Danny put up a dipole for me. From that point my whole outlook on life changed, I realised at last I had something to fight back with.

"Being unable to get to technical college my studies had to be done at home with the help of books purchased from the RSGB. Alan then arranged the loan of the complete set of tapes dealing with the RAE examination.

"I decided to buy my own equipment and this was fitted for me, then when I was ready I sat the RAE at home. This was arranged for me through the RAIBC with a doctor's certificate. The examiner who came quickly put me at ease, the tension that had built up seemed to disappear, first part one and then part two were completed. Then for the wait which everyone has to go through, all that time I had a go at c.w.

"I was very pleased to receive news of my passing the RAE, now for the Morse. I was getting my station up together, with planning permission for a 13 metre tower being obtained.

"All different problems arise from being disabled, mine being learning to use a rig with one hand, due to spinal damage. Alan has set out my station so that I can operate and fire up my rig with only one hand, and I have an automatic a.t.u. which works very well. I have a typed copy of the correct procedure to follow and once a week I am taken step by step through this method.

"I have now taken the Morse exam, once again everything was organised through the doctor and RAIBC allowing me to take the exam at home. I have just heard from the appropriate department that I have passed the Morse, and believe me the vital piece of paper plus the licence fee was soon sent off and I now await my new call.

"To the RAIBC, Alan, David, Nick, Tom and many amateur radio hams I would like to thank them for all their help and encouragement to get me through to a marvellous hobby."

For Further Information

Mrs F. Woolley G3LWY, 9 Rannoch Court, Adelaide Road, Surbiton, Surrey KT6 4TE.

Mr T. John G3SEJ, 52 Broadway Avenue, Wallasey, Merseyside L45 6TD.

Mr C. Parsons GW8NP, 90 Maesycoed Road, Heath, Cardiff CF4 4HH.

Our thanks to those people mentioned above and also Alan Lees G4GQH, Bob Hibberd G6BGP and Brad Scott G4KRK for their help in the writing of this article.

The second letter we had was from Brad G4KRK who suffers from muscular dystrophy and lives at Shaftesbury House.

"My first interest in amateur radio happened quite a few years ago. A friend had an old ex-service receiver, but when he left he took it with him and it was forgotten until early 1979. Geoffrey Cole, a licensed amateur, brought in a short wave receiver and rigged up an antenna between two balconies. He left the receiver with us to do some listening. Two of us then decided we would like to try and obtain our own licences.

"The invigilator arrived at 9.30am and so began the ordeal! Then for the rest of June that year I just spent my time listening and longing.

"At the beginning of July I began learning some Morse code, it's like relearning the alphabet armed with letters and numbers committed to memory. Alan G4GQH started off with Morse lessons, I must admit I found it harder than I had expected it to be, Alan spurred me on, and I achieved twelve words a minute. In late August I sat my c.w. exam, by which time my RAE results had arrived, a credit in part one and two. A few days later my Morse pass slip came, that same day my application was in the Royal Mail.

"After some more waiting the 'great day' arrived, 22 October, with my callsign in my hand and a trembling thumb on the p.t.t. (G4KRK listening S20). Paul G3ZWD came back then I was away once I got my confidence.

"Nearly a year later I enjoy the hobby more now than I did in the beginning. I have made so many friends, but it is all due to the RAIBC Bournemouth and District Club which has really made it possible. Recently Frank G6DXJ has received his licence, and I hope he gets as much fun out of amateur radio as I have. I would like to say a big thank you from us both to Paul G3ZWD, Alan G4GQH, Harry G8XBL and all the other helpers for their support. Good luck to all those taking the RAE, I look forward to meeting you on the air waves."

Whilst 1981 has been the official International Year of Disabled People, your generous support is always needed and welcome. Why not see what you can do to help? ●

Synchronous Detector

R. MYERS G8LUL*

PART 1

What is Synchronous Detection? Perhaps surprisingly it exists in many forms surrounding us in everyday life and need not be an electronic device.

A few examples are called for: The whirling flywheel of a car engine can be seen only as a blur of visual information until a bright light is made to flash synchronously at it. This light is normally called a timing light and because it is made to flash always at a certain point in the rotation of the flywheel, that particular spot may be inspected easily—it has been synchronously detected by using what is commonly known as the stroboscopic effect.

Bottles and Cans

Imagine evenly spaced bottles moving quickly along a conveyor belt. Standing at the side of the conveyor, only a blur of bottles would pass our eyes. If however we were to blink at just the right frequency and phase, a steady image of a bottle would be seen. A random selection of tin cans placed with the bottles will remain a faint blur because our eyes are taking synchronous pictures of the signal they are expecting. The tin cans are not synchronous with the bottles and are therefore only poorly detected.

It can be clearly seen that in both cases samples of the signal are taken at the correct frequency and with due regard for phase. Taking samples in this way is bound to produce a better result than continuous looking.

With particular reference to the demodulation of a.m. signals, a standard diode detector is much akin to the continuous looking process, it is unable to discriminate between the bottles and tin cans. The synchronous detector, having been told to look for bottles, will tend to average out its occasional glimpses of the odd tin can. This is not to say that all diode detectors are inferior to the synchronous type.

Consideration must first be given to what will appear at the detector input—it is pointless having a special detector which only sees bottles if all the tin cans have already been removed.

* *Myers Electronic Research*

Receiver Considerations

In the older traditional type of communications receiver the i.f. strip consists of a number of stages of gain each having its own tuned circuit. The general layout is shown in Fig. 1.

As all the tuned circuits are set to a common frequency, the selectivity steadily improves until, on reaching the diode detector, the bandwidth may be only a few kilohertz. In this case, replacing the diode detector with a synchronous type is unlikely to produce worthwhile improvement as the signal is well filtered; the broadband noise contributed by each gain stage being attenuated by the tuned circuits—all the tin cans have been removed leaving only bottles to be detected.

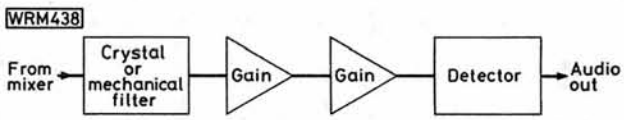


Fig. 2: The modern receiver

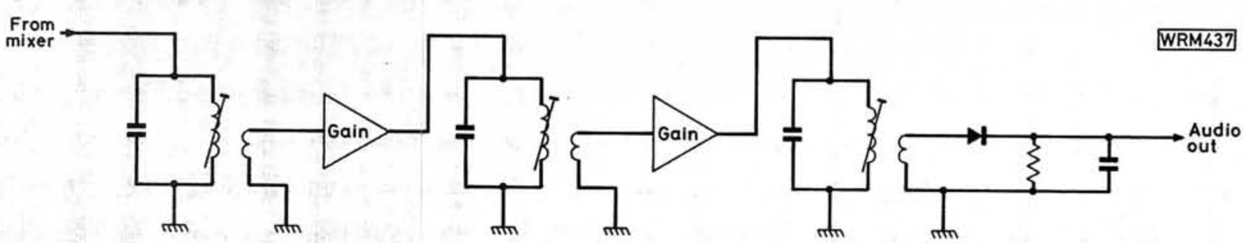
This type of i.f. strip has the marked disadvantage that the early stages have relatively poor selectivity giving rise to the possibility of several strong signals entering a gain stage and being mixed due to the non-linearity of the amplifier. Once such mixing has taken place, no subsequent filtering can correct the situation. A further consideration is the changing load on the tuned circuits as the gain of the stages is altered by the a.g.c. system. This results in shift of centre frequency and passband shape which, although minimised by good design, is not helpful.

A modern receiver has a quite different arrangement; a schematic diagram is shown in Fig. 2.

The filter is a high quality device producing all the required selectivity in a single block. The output of the filter is therefore a single signal, removing all danger of accidental mixing of signals in the following gain stages.

The snag with this technique is that the broadband noise produced by the gain stages appears at the detector

Fig. 1: The traditional receiver



input. In this situation there are hundreds of unwanted tin cans mixed with the bottles. With this type of receiver, when detecting an s.s.b. or c.w. signal, a b.f.o. is operating which causes the signal to be sampled at the b.f.o. frequency. As a form of sampling is again in use, the broadband noise produced by the i.f. gain stages tends to be averaged out. Even the simple diode detector exhibits this sampling effect as the b.f.o. injection voltage tends to switch the diode "on" and "off" at b.f.o. rate.

When dealing with a.m. signals, the b.f.o. can be used to provide an approximation to synchronous detection but it is not feasible to tune the signal to exact zero beat and zero phase error. The resultant output is readable and often hides behind the "communication quality" badge being the only way to resolve a.m. on some receivers. Using only a diode detector without the b.f.o. will result in a poor signal to noise ratio for all but massive a.m. signals, as the excess broadband noise contributed by the i.f. gain stages is no longer being sampled.

It may be suggested that one way of curing the excess noise is to add a second filter just prior to the diode detector. This works in much the same way as rubber gloves cure a leaky fountain pen. The true answer is to upgrade the a.m. detector to function on the same sampling principle as used for s.s.b. and c.w.

Detector Design

It will be seen that to detect a.m. truly synchronously we must use both a product detector and a b.f.o., the b.f.o. running at the same frequency and phase as the carrier of the incoming signal. Rather than go to the trouble of phase-locking a b.f.o., it is more logical to use the carrier of the input signal to perform the switching action necessary for the sampling.

If the signal to be detected is first passed through a limiting amplifier, all the modulation envelope is stripped from the carrier. Fig. 3. This limited carrier is injected into

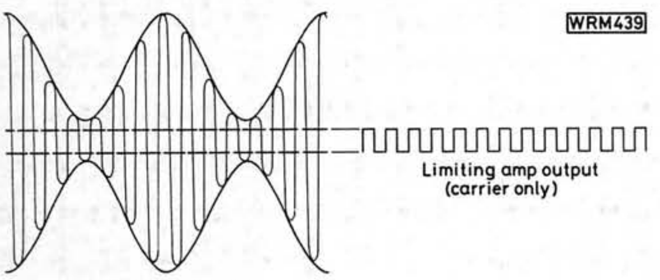


Fig. 3: Extracting the carrier

the product detector as a substitute for the conventional b.f.o., the original modulated signal being fed as usual to the signal port of the detector. Fig. 4.

If the input to the synchronous detector is an amplitude modulated carrier, both upper and lower sidebands mix with the stripped carrier to produce an audible output

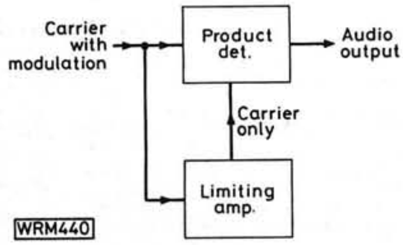


Fig. 4: The a.m. Synchronous Detector

from the product detector. If the carrier is unmodulated, a d.c. output is produced in proportion to its level—just like a diode detector.

A simple way of looking at this detection system is to think of the product detector as a single pole switch being opened and closed at carrier rate by the output of the limiting amplifier. Fig. 5.

If the switch closes every positive-going half cycle of the signal then the resultant output is positive-going, the amplitude being directly proportional to the input signal. Having grasped this, it is a small step to understand the true operation which is that the product detector is acting as a double pole, double throw, switch so wired as to invert the negative-going half cycles of the signal, the resulting output waveform appearing full wave rectified. The synchronous detector may therefore be considered to be an "intelligent" full wave rectifier.

Synchronous Advantages

It is interesting at this stage to consider the advantages of such a detector by comparing it with a much better known radio system which employs the limiting principle.

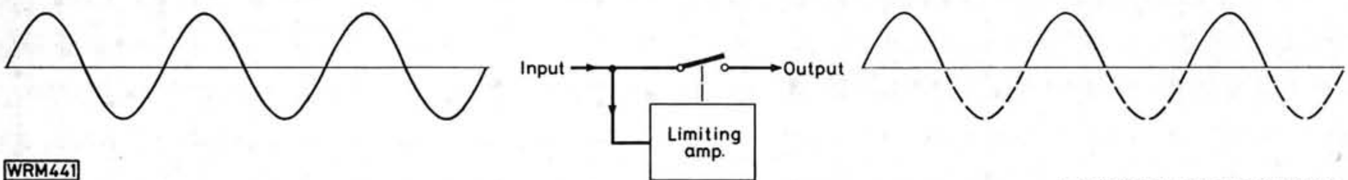
One feature of a well designed f.m. receiver is that if there are two signals operating on nominally the same frequency, one need be only slightly stronger than the other to take total control of the receiver. This phenomenon, the capture effect, is best noticed if an f.m. mobile calls in on top of a fixed station. As the mobile signal flutters, first one signal then the other is heard clearly; there are no half measures, the transition from one signal to the other is very clean.

The action of the a.m. synchronous detector is very similar. If two signals are applied to the input, one needs to be only a little stronger than the other to cause the limiting amplifier to switch at that frequency. The weaker signal although close in frequency is neither synchronous nor in phase with the established switching action of the detector and is therefore largely rejected.

Synchronous Applications

If a synchronous detector stage is fully supported by broadband gain with a.g.c. and comprehensive squelch facilities, an a.m. radio receiver module having rather unusual properties is the result.

Fig. 5: The basic idea



continued on page 62 ▶▶▶

LC Calculations Simplified

$$L=\frac{a^2n^2}{229a+254b} \qquad C=\frac{KA}{d}$$

G. P. STANCEY G3MCK

It is a fact of life that one cannot move very far if at all in the field of r.f. design and construction without encountering coils and their associated capacitors. It also seems that this is an area in which some people are unhappy. The aim of this article is to show some simple approaches to these problems.

In many cases, at least in the h.f. range, they will enable you to make resonant circuits without the assistance of a grid dip oscillator (g.d.o.), or reduce the effort needed in "cut and try" work with a g.d.o.

Resonance

The resonant frequency, inductance, and capacity of a tuned circuit are related by the following equations—

$$4\pi^2 f^2 = \frac{1}{LC}$$

Hence knowing any two variables the third can easily be calculated. However, the units are hertz, henries and farads, which are not very practical for amateur radio use, and a more useful form is

$$f^2LC=25\,329$$

f is in MHz, L is in μH and C is in pF

Using this practical approach we can arrive at a numerical product of L and C for a given resonant frequency.

For the h.f. amateur bands specific cases of this are given in Table 1.

Table 1

Band (MHz)	LC
1·8	7812
3·5	2068
7·0	517
14·0	129
21·0	57·4
28·0	32·3

For example, a circuit will resonate at 7MHz when the product of the inductance in microhenries and capacity in picofarads is 517, e.g. 10μH and 51·7pF, or 1μH and 517pF.

Two things should be noted about the resonance formulae:

a) A wide range of inductances, with the appropriate capacitors, will resonate at the same frequency. (See Table 2.)

b) To double the resonant frequency, yet still maintain the same *LC* product, both capacity and inductance must be halved. (Table 3.)

Obviously the converse is true, and to halve the frequency you must double the capacity and inductance. This only applies if it is desired to keep the *LC* product constant as 5μH with 104pF will resonate at 7MHz or with 26pF it will resonate at 14MHz.

For those who do not like doing calculations of any sort the standard handbooks include graphical solutions to this problem under the titles of nomographs, ABACs, or alignment charts. With these, all it is necessary to do is to lay a ruler across the chart through the two known points and read off the unknown point on the appropriate scale. Any two of the factors can be the known ones but, of course, you do need two!!

Fig. 1 shows a simplified chart which enables quick sizings to be made. It gives resonance values for 1, 10 and 100pF capacitors and inductance, against frequency and is plotted on log-log graph paper.

Say you want to know what inductance is needed to resonate a 100pF capacitor at 3·5MHz. Select 3·5 on the frequency scale, and use the 100pF line to find 21μH on the lower axis. Should you actually want to use 300pF, then just divide the answer by three to give 7μH. Remember L × C is constant for a given frequency.

It is true that this method does require some calculation, but for sizing purposes most of it is easy mental arithmetic, e.g. if 110pF was used in the above sample (100pF plus 10 per cent), then the inductance needed would be 21μH less 10 percent say 19μH.

The observant reader will also have realised that the chart can be used the other way round, i.e. transpose capacity to the axis and inductance to the lines. In this case to resonate 10μH at 5MHz requires 105pF. Again, mental arithmetic scaling can be used to solve the problem you really have.

Graphs can be constructed for any capacity. However, if you put too many lines on the same graph it does get rather cluttered, and I have found the clean graph well worth the slight penalty of doing mental arithmetic.

Table 2

Inductance (μH)	Capacitance (pF)
10	52
5	104
7	74
13	40

Table 3

f (MHz)	L (μH)	C (pF)	L/C
7	10	52	0·197
14	5	26	0·197

In practice, when designing amateur gear, you frequently have suitable capacitors and need to wind the coil to give the appropriate resonant frequency. The preceding section should have got you to the stage where you are trying to make a coil of a known inductance. A first source of help is again the handbooks which often list the inductances of various coils or give charts from which they can be calculated.

Two problems here, firstly you do not have the coil formers that they specify, secondly, the charts and tables are more suited to finding the inductance of a known coil, i.e. just the opposite of what you want to do. But take heart for in the real world all is not lost!

The usual formula for the inductance (in microhenries) of a single layer air-cored coil is

$$L = \frac{a^2 n^2}{229a + 254b}$$

where a is the radius of coil in mm, b is the length of coil in mm and n is the number of turns

Please note, however, that the assumption is that you are happy with a single layer coil. If not, either a) cut and try, b) cut and try and use a g.d.o., c) give up and read a good novel.

At first sight, this formula appears to be less than 100 per cent helpful as it too gives the inductance of a known coil. But remember, in the real world of shacks and solder, you will know the sort of former you wish to use and also the type of wire. In this case, the coil radius, a, is fixed and, if it is a ribbed former, so is the number of turns per mm. Alternatively, if the former is smooth, the wire gauge will determine the maximum number of turns per mm.

Consider a close wound coil on a known former with known wire. Let the wire gauge give "k" turns per mm, hence for "n" turns the coil is n/k mm long and the formula now becomes

$$L = \frac{a^2 n^2}{229a + 254\,\frac{n}{k}}$$

Substitution for "a" and "k" enables the above quadratic equation to be solved. For those who do not wish to get close to quadratic equations and their solutions, evasion is possible by the technique of inspired guess-work as the following example shows.

I wish to wind a coil of 8μH on a former 37mm diameter using 18s.w.g. enamelled wire close wound.

18s.w.g. close wound gives 0·78t.p.mm

$$a = 37 \div 2 = 18{\cdot}5$$

$$\therefore 229a = 4236{\cdot}5$$

$$a^2 = (18{\cdot}5)^2 = 342{\cdot}25$$

$$254b = \frac{254n}{0{\cdot}78} = 325{\cdot}6n$$

$$L = \frac{342{\cdot}25n^2}{4236{\cdot}5 + 325{\cdot}6n}$$

Guessing that the correct answer is n=10, and solving gives L=4·7, i.e. too small, so try n=15, when L is found to be 8·75, i.e. too large, so try n=14 when L=8·0. Eureka!!

Note that if the former is ribbed, it is the ribbing which determines "k", not the wire gauge. If you want to wind a space wound coil on a smooth former one dodge is to space the wire with string or another dummy wire; again it is the actual pitch of the coil and not the wire gauge which determines "k".

An alternative method of designing a coil of given inductance to go on a known former is to fix the length of the coil at some multiple of the diameter; this ratio is known as the form factor. For example, a coil that is 1·5 times longer than its diameter has a form factor of 1·5. In this case, we can substitute 3a for b in the inductance formula which now appears as

$$L = \frac{a^2 n^2}{229a + (254 \times 3a)} = \frac{a\,n^2}{991}$$

To show how this formula can be used, let us assume we want a coil of 60μH on a former 25mm diameter and 37·5mm long. (NB the length is coil length, not former length.)

Then $a = 12{\cdot}5$ $\quad 60 = \frac{12{\cdot}5n^2}{991}$

n=69 turns

If the coil is to be close-wound, then wire that will give 69/37·5 or 1·8 t.p.mm is needed.

So far, the examples have been with air-cored coils. If a cored coil is used, then a correction has to be made for the core material. Typically, with dust iron slugs, the core will increase the inductance by about 50 per cent. The easiest way to handle this is to design an air-cored coil for 80 per cent of the required inductance using the above methods. When the slug is half way in, the coil will be the correct inductance.

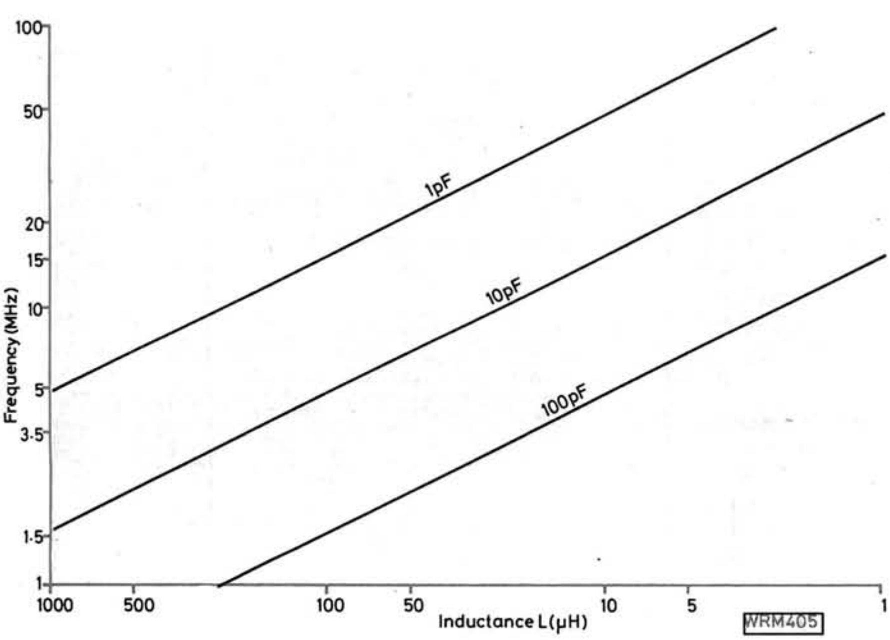


Fig. 1: Simple chart to enable the quick determination of resonance for given values of L and C

Variable Capacitors

Whilst it is possible to build a resonant circuit to a given frequency from a fixed capacitor and coil, it is usual to make one or both of them variable.

In the case where the capacitor is fixed the inductance is usually varied by means of a slug, taps, or a roller coaster. Let us consider one or two points about the case where the capacitor is the variable element. No problems should exist if you know the value of the capacitor, but even if you do not, all is not lost. The best way of finding the capacity is to use a bridge or g.d.o. system, but it is possible to get reasonable results by physically measuring the plates and their spacing.

The formula for an air-spaced parallel plate capacitor consisting of two plates is given by

$$C_{pF} = \frac{KA}{d}$$

$K = 0{\cdot}0089$ when $A = mm^2$, $d = mm$

A is the area of overlap, i.e. the area of the smallest plate, and d is the distance between plates. So to find the capacity of an air-spaced variable, simply measure it, apply the above formula and multiply the answer by the number of unique pairs of plates, i.e. for a condenser consisting of 2 fixed and 1 variable plate, the factor is 2, for 2 fixed and 2 variable plates, the factor is 3, and so on.

One small point about the measuring technique, feeler gauges are suitable for measuring "d". However, to avoid straining the capacitor, do not try to push a gauge that is too thick into the gap. Following this advice will tend to give a smaller figure for "d" than is correct. This in turn will make the calculated capacity too large. To try and correct for this to some degree, be mean when assessing the area, as too low a value for the area will give a lower calculated value for the capacity. If the plates are "shaped", the area may be estimated by sketching the profile on graph paper and counting the squares.

Coils and Capacitors Together

In many cases, it will be obvious which is the fixed element. The capacitor usually varies in p.a. tank circuits but in low power circuits such as i.f. amplifiers the inductance is usually varied.

However, in some circuits you have the choice and can make it fit your junk box or construction techniques. Given a free choice there is a lot to be said for using variable capacity, as a capacitor will exhibit a range of about 9:1 compared with 1·5:1 for a cored coil. In other words, your chances of hitting resonance will be six times higher. Of course, if you use both, your chances will be even better.

Finally, no matter which method you use remember to allow for stray capacity when assessing the size of the resonating capacitor. Also, when the circuit is tuned, if you feel that the resonating capacitor should be meshed more deeply, remember you can always remove a turn or so from the coil.

Final Comments

The above methods do not compare with professional methods but do provide a reasonable route for the true amateur to construct tuned circuits that work, especially in those areas where *LC* is not critical. To give an idea of what can be done, I have successfully constructed a.t.u.s, simple transmitters, tuned anode crystal oscillators, v.f.o.s, receiver pre-selectors, etc., using these techniques. ●

Synchronous Detector

▶▶▶ *continued from page 59*

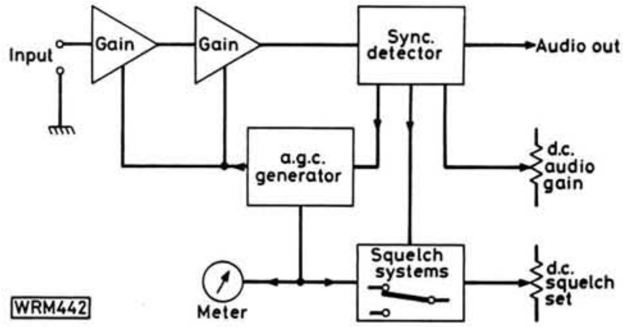


Fig. 6: Block diagram of the AMS Module

The AMS Module from Myers Electronic Research is such a device and will be used as an example of the possibilities. A block diagram of the module is shown in Fig. 6.

The input sensitivity is such that signals from microvolts to hundreds of millivolts may be handled while the signal frequency may lie between the limits 200 kHz to 20 MHz. If this Synchronous Detector Module is connected after the filter in a superhet receiver, it may be considered to be an i.f. amplifier—no adjustments need be made to the module provided the i.f. lies within the limits stated. The module may be equally correctly considered to be a radio receiver in its own right as the addition of the simplest tuned circuit, such as a standard ferrite rod assembly with tuning capacitor, will result in a high performance medium wave receiver. This surprising fact results from the ability of the detector to "latch" onto signals, even the poor selectivity of a single tuned circuit providing an overall good result.

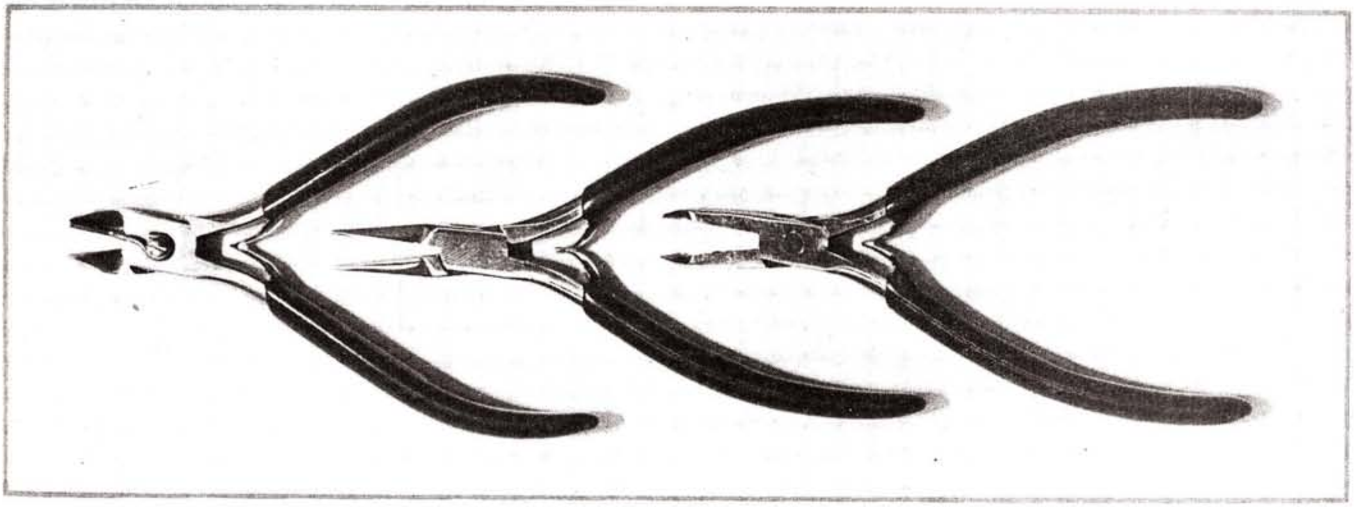
The AMS Module makes extensive use of Plessey radio i.c.s supported by new and unusual circuitry which will be covered in detail in Part Two.

"CQ, CQ, CQ, this is G8 . . . I have a Police Constable here with me, who urgently requires re-assuring that this is an Amateur Frequency, can anyone help please." *Reply:* "Yes that's for sure, for sure good Buddy, put the Bear on the Air!!!"

. . . Brighton & District RS Newsletter

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

*special PLIERS offer



Last year's special tool offer proved very popular with our readers, so we have decided to put together another set of high quality electronics tools, selected by the Practical Wireless team, to complement those offered previously.

The flat-nosed pliers have smooth, flat jaws 3mm wide at the tips, while the top cutters are ideal for snipping out small components on closely packed p.c.b.s. The other small side-cutters have a special clip to prevent the wire ends flying around the shack.

All three pliers have moulded-on pvc grips, are box-jointed and lightly sprung to the open position.

Made from the finest materials, and guaranteed by the well-known CK Tools, these tools are something you will be able to use for a long time. Remember, it pays to buy the best.

Don't delay, fill in the coupon now and send it with your remittance to "Practical Wireless", Dept. PWL 10, Rochester X, Kent ME99 1AA.

HOW TO ORDER

Please complete both parts of the coupon in BLOCK CAPITALS.

Remittance may be by Postal Order or Cheque (name and address on back of cheques, please), crossed, and made payable to IPC Magazines Ltd. This offer is open to readers in England, Scotland, Wales, Northern Ireland and Channel Islands only. It is not available in Eire or overseas.

Orders are normally despatched within 28 days but please allow time for carriage. You will be notified if a longer delay may be expected.

THE CLOSING DATE OF THIS OFFER IS 26 FEBRUARY 1982, subject to availability.

To: PRACTICAL WIRELESS
Dept PWL10, Rochester X, Kent ME99 1AA.
Please send me the Pliers Set(s) as indicated @ £21·95 each, including P&P.

I enclose P.O./Cheque No .... **Value** ....

Number of Pliers Sets required

Name..

Address..

....

....

Tel. No. (Home or Work) ....

Number of Pliers Sets required

Name..

Address..

....

From PRACTICAL WIRELESS
Dept PWL10, Rochester X, Kent ME99 1AA

CUT ROUND DOTTED LINE

on the air

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.

This month I'd like to deal with one or two problems that seem to arise regularly in readers' correspondence. The first is the use of headphones on receivers and the complaint of excessive "hum" even when the volume control is turned to zero. This is particularly so with the older valved receivers, where the supply voltages are of the order of 250V compared to the very low voltages employed on solid-state receivers.

In both cases the d.c. supply voltages are derived from rectifier circuits when running from the mains supply and being, invariably, full-wave rectification, the resultant ripple is 100Hz. Since almost all headphones around these days are the domestic stereo type these are pressed into service on communications receivers. Naturally enough their low frequency response is excellent and the 100Hz ripple signal comes through loud and clear! This result compares very unfavourably with the older style diaphragm headphones whose response at the lower frequencies was nil, more or less!

One answer today is to improve the smoothing of the supply circuits but in practice the improvements resulting do not justify the extra cost of smoothing components. The easiest way is to spoil the response of the headphones by inserting a capacitor in series with one lead of the headset. In fact, of course, there are two live leads, for the right and left hand channels, plus earth. These two live leads should be shorted together anyway for mono reception when DXing, but be careful! If the stereo headset is used by other members of the family for listening to the hi-fi outfit in the drawing room then don't forget to take the short off before handing them back!

Disconnect the two live wires from the plug, short them together and connect a capacitor between the leads and the pins on the plug. This can best be done with very thin insulated wires approximately 70mm long so that the plug cover can be screwed back again, leaving the capacitor outside. The value of the capacitor may have to be found by trial and error but about 10µF will be satisfactory with most low-impedance headphones, with a voltage rating of, say, 10V minimum. Polarity is not of importance since there is unlikely to be any d.c. at the headphone socket, but check with a meter, just in case.

If one is prepared to get inside the set then the elegant way to achieve the change is to swop the headphone socket for a stereo one and wire the capacitor in permanently. It should be mentioned that any serious chaser of DX would always use headphones in preference to a speaker, improving concentration and enabling the weaker signals to be copied.

On a slightly different tack, a fairly steady comment from readers concerns the poor response to the number of QSL reports sent out to amateur stations. Considering the cost of QSL cards today and the postage charges the cost-effectiveness is pretty low! QSL bureaux help a bit but so does the response time increase! Well, the situation has changed very dramatically in the last decade or so, with the large majority of amateur stations using commercial equipment and effective beam antenna systems. In consequence they would be surprised if they did NOT work almost anywhere in the world so the value of the average s.w.l. report to them is zero unless the circumstances were exceptional.

You may have just got your first communications receiver and heard your first VK station and consequently are very excited, but the VK has possibly been working into G-land every day for years past and doesn't need confirmation from a listener! It is very sad but that is the position today. An interesting letter from 9M2DW in Western Malaysia, via Ed Baker of the ISWL, puts the DX station's attitude when he says he gets three s.w.l. reports from Europe for every QSO he makes in that direction! In consequence he now bashes a rubber stamp on the s.w.l.'s card and returns it as confirmation. He suggests that a report should be of at least three QSOs heard and preferably when he is working outside Europe so that some idea of his antenna's performance might emerge from an otherwise useless report.

9M2DW confirms another unpleasant fact that is not unknown to us that have been in the game for a while. Namely that logs are compiled by listening to the European end of a DX QSO and not to the DX station itself. He carried out actual tests to check on this theory and found it to be true. Remember, nothing is gained by such tactics. As I have said before, it is better to get on with studying for the radio amateur's examination and to pass the exam and then work the DX yourself than to waste time sending expensive QSLs around the world to amateurs who don't want them.

In General

A very long letter from **Stuart Mather** of Edinburgh bemoans the fact that he can't find an amateur radio retailer in his area. Plenty for CB gear of course which is why he is using a 27MHz whip with his FRG-7. He finds the various chat nets on 80m very fascinating but not much DX has been logged yet. Next target is the December RAE and the code test, so we wish you well, OM.

Good news from **Terry Underhill** (Coventry) who having got his RAE managed to pass his code test "by the skin of my teeth" and very wisely says he intends to keep up his Morse on the air very soon with an FT-101ZDFM and a G5RV antenna. From **Jon Kempster,** news of passing six of his eight "O" level exams so let's hope he has the technique now to make a success of the RAE. Jon is also BRS45205 in Berkhamsted, Herts and runs an FRG-7 with 20 metres of wire at 9 metres a.g.l. plus an a.t.u. **W. Kelly** of Bodmin, Cornwall, has just become BRS47313 and sports yet another FRG-7, a.t.u. and 30m of antenna and writes in for the first time so we look forward to some regular loggings before long, OM.

Several readers seem to have logged me on the 80m band including **Graham Powell** BRS46228, a 16-year-old in Pontypridd, Mid-Glamorgan, also contacting the column for the first time. He has a Heathkit GR64 receiver and 9 metre-long antenna indoors at the moment. On the matter of QSL cards it is worth mentioning that cards can be sent **out** via the RSGB's QSL bureau service whether one is a member of the RSGB or not, but incoming cards are only forwarded to members.

A good point to mention the Amateur Radio Mobile Society whose excellent journal *Mobile News* is the work of editor **Norman Fitch** G3FPK who will be glad to hear from any reader who is interested in this highly specialised aspect of amateur radio. His QTH is 40 Eskdale Gardens, Purley, Surrey CR2 1EZ. An interesting statistic from *Mobile News* is that G3VLW/M has worked 203 countries in that mode! A highly important observation from G4EWG, in these days when so many licensed amateurs are being stopped and held by the police when suspected of running illegal CB gear in their cars, is that the Home Office will supply an official back-dated receipt in respect of the amateur licence on request, also containing other relevant information on the individual's licence. Thanks, *Mobile News*. It does seem incredible that one's official licence is not accepted at its face value by the police on many occasions.

Round the Bands

In Bridgend, Mid-Glamorgan, **Rhys Thomas** takes time off from his studies for the next RAE to log such as PY1RR and CN8AT on 80m s.s.b., HR1JSH, A7XD, HP1RA on the 20m band and TU2JL, 5N0AK and 6Y5DA on 15m. The 5N0 mentioned a Nigerian amateur net on 7·04MHz Sunday mornings at 0800GMT. Only thing of interest on 10m was OH1TD/4U on the Golan Heights, all on a Trio R-1000, a.t.u. and long wire. Rhys also intends to get his code OK by next spring. The FRG-7 and Datong active antenna accounted for C5ACZ, 4Z4ZQ, and 5H3KS/MM in the Red Sea, for **Len Stockwell** of Grays, Essex, the 4Z4 being mentioned because he was heard via an f.m. repeater on the 10m band. Best on 20m were 4N2CBM and VK6RY.

In Weymouth, Dorset, **David Warr** awaits the replacement of his roof by the local council before he puts up his W3DZZ trapped dipole. However a makeshift 10m dipole in the shack caught 9Q5FL. Another project is a 7MHz beam in the attic, but DX on that band doesn't seem too bad already with a half-sized G5RV, like CM8AF, J87BK, LU3JCY, OA4OS, TG9AL, ZP5PX, ZL3GN, 7X5AB and 8P6OR. Phew! not bad eh? All on a 9R59DS receiver. From Crowthorne, Berks, an elegant QSL from stalwart columnist **Allan Stevens** BRS45712 on my 80m s.s.b. Hardly DX but Allan only has a whip antenna on his 9R59DS set plus PR40 pre-selector. He comments on the numerous CB pirates on 28MHz s.s.b., playing at being amateurs and generally getting it wrong, and most originating in the UK. DX from Allan includes VP2MCK on 40m, A71AD in Qatar (note new prefix), CE5VSS, HS1BV (QSL received) and 9X5MX in Ruanda. Only DX of note on 10m was VK6CF. A later note reports VK0AM on 10m from Mawson Base in Antarctica at

67°S and 62°E operating well without the "assistance" of a net control, plus 7Q7LW in Malawi on 15m.

Basil Woodcock BRS44266 (Leeds) another regular writer seeks a manual for his cherished JR310 receiver on the basis of a quick copy and return. He is at 36 Carr Manor Grove, Leeds LS17 5AJ if anyone can help. Best in the log were 5H3TM and VP2VJ on 28MHz, OA4M and 7Q7LW on 21MHz, A35JL, 3A2HN, JT0WA (QSL OK1DWA), KH6LW, KS6DV (QSL WB6FBN), VP8AEN, 5W1DG and ZK1CV all on 14MHz. The 7MHz band produced VP2MCK, VP8QI (QSL G4CHD).

Old timer, column-wise, **Bill Rendell** (Truro, Cornwall), got a lot of fun listening to the VKs discussing the Test match series, wondering how they managed to lose! Bill finds 10m opening again as late as 2000GMT to S. America and the Caribbean with 15m bringing in the VKs around 0630. From his log come M1C, VK2AGT on Lord Howe Is., VP8QI, VR6TC, 5T5ZZ, 6W8FZ on 20m, DU6LL, S79RD (QSL Box 391, Victoria, Seychelles), VK8JC in Alice Springs for an unusual VK, VS5DD, YB2BJM who wants cards to Box 136, Solo, Indonesia, 7Q7LW, and 9X5PP who resides at Box 863, Kigali, Ruanda, well, not actually in the box! All these on 15m while 10m brought forth PJ8QQ, VP8QG a YL it seems, 5N6RED, and 8R1J who'd like cards to Box 10767, Guyana.

Another item from **Ed Baker** of the ISWL concerns the Radio Vaticana award for contacting HV stations starting in October this year on any amateur band and any mode. As there are only three active HVs this ought not to be too difficult. Details from HV1CN, Radio Vaticana, Città Del Vaticano. How many HVs have you heard or worked?

Graeme Caselton, BRS44984 as was, is now G6CSY in Orpington, Kent, used the AR88D and 11 metre-tall vertical belonging to a fellow RAE classmate to copy EL2AU and HH2BM on 28MHz, CP6HQ, F0HI/P/FC, K7ZZ/P/HB0, HI8KW, HV2VO, TR8DX and U2Q on 14MHz. Said classmate has done the code task and awaits his G4 + 3. **Philip Morris** of Swansea plus CR-100 and G5RV caught A4XIY on 80m, VK9NS on 40m not to mention VK9ZG on Willis Is. (QSL VK3OT), ZK1CV (QSL Box 143, Raratonga), 9N1BMK, YJ8RG, FR7CE on 20m. Philip also copied the 7Q7LW on 15m plus 3D6AB, KX6BU (QSL N6BSD), and CE0AE with cards to WA3HUP.

From Chalfont St Giles, Bucks, **L. Ayres** writes to the column for the first time and would like to hear from other users of the Eddystone 840C receiver of which he is very proud. Rest of the QTH is "Hillview", London Road. Although only 15 he is having a go at the RAE in December. His 61 metre-long wire and a.t.u. found OJ0MA, 5N0FCA, ZB2EO and SV5AQ on 20m s.s.b. 10m has been the happy hunting ground for **Rob Gibson** of Wadhurst, E. Sussex, with his FRG-7 and fan dipole, with 8Q7AZ, 9Q5FL, CP8AL, CX3UH, H44PT, S79WHW, TU2JQ, VU2DK, ZS3FDC and VK5NXQ who was only using 9W p.e.p.! On 20m CO6RL and JT0WA were worth noting, plus 9Q5L and 9X5PP from Africa, H44DX, HL9FR and YC3FM, on 15m.

A Yaesu FRG-7700 helped the first report from **John Hayes** of Edmonton, London, who aspires to the RAE before long. On 28MHz it was A2PH, FR0FLO, FR0FLO/P/J on Juan de Nova Is., KA2MZS/SV9, 3B8AE/P/3BY on Rodriguez Is., while 21MHz sported C5AR, DU6LL, H44CF, KC4AAC, KL7Y, VK1FT and 8P6OL. 20m came up with C5ACG, FC9UC, JX5VAA on Jan Mayen Is., VP1JG, VP8AGX on Rothera Base, Adelaide Is., YB3AB and 8P6PO. On to 40m where the FR0FLO/P/J turned up again, VP5WJR and PT7AEE, with 80m showing CT2ARA, HI8MFP and 8P6GO among others. How we are going to manage for space when we get three new bands I just don't know!

In Edinburgh **Anne Edmondson** BRS47285 keeps up the good work studying for the RAE when not busy with the Edinburgh & District ARC (GM4HAM) but her DX200 and indoor wire copped A9XDO (QSL KA4S), K5VRX/SV5 (QSL W3YY) and TI2ACA on 20m, plus LA1EKO in the Ekofisk field in the North Sea on 80m. Apart from building himself a direct conversion receiver for 15 and 20m and a collection of audio filters plus a 2m converter **Jim Dunnet** of Prestatyn, Clwyd, hasn't been very active! But he did collect some stuff on c.w. for a change, like K6TMB/OH0 on 80m, OJ0AM on 40, HK7AMZ, HS5AID, TN8VT and 9X5SP on 20m, CE0AE, HC1FM, KH6WU, TN8VT, TR8DX, VP9KO, 6W8EX and 8R1J on 15m, ending up with C31NM (QSL PA0GIN), XT2AW and ZD8TC on 10m plus "many CBers". Oh, yes, Jim copied, or saw, EI3CN and GM3ZXL on 80m RTTY, EA6HH and OH2TI on 20m and AK3V on 15m, but doesn't mention the gear in use.

A delta loop two-element beam on 10m helped **Dave Coggins** of Knutsford, Cheshire pull in G3MUV/CE0, XZ9A in Burma for a good one and 8Q7AZ on the Maldives. His FRG-7700 plus 7700 a.t.u. also found HS0HS, ST0AS (southern Sudan), and S79RD on 15m, with 20m catches in the form of A35RX (Box 46, Nukualofa, Tonga), CE0AE, KS6CQ, VK9NS on Norfolk Is, VR6TC, VS5DD, YJ8RG, ZK1CG, 3X1Z in Guinea, 5T5AY and 5V7HL. Turned up on 40m were CE8ABF, JX7FD, and VP8QI with 80m providing FR0FLO and a PY4XUP. CW catch on 160m was UL7ACD.

Club Time

Radio Society of Harrow. Fridays, 8pm, the Roxeth Room, Harrow Arts Centre, Harrow Weald, Middx, with November dates being an informal and practical evening on the 6th, Basics-Part 3 on the 13th, another informal on the 20th and a demo of v.c.r. equipment on the 27th. Contact Peter Marcham G3YXZ, 29 Standfield, Abbots Langley, Watford, Herts or Chris Friel G4AUF, QTHR or on 01-868 5002.

Fareham & District ARC. Wednesdays in Room 12 of the Portchester Community Centre at 7.30. An 80m receiver project occupies November 4 with a discourse on repeater GB3PH on the 18th, while G6NZ chats on the history of radio on the 25th. There is a full programme already organised for the rest of the year. More from Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants PO16 7QL or ring 234904.

West Yorkshire Metropolitan Police. Better mention this club, thought to be the first in the UK, restricted to serving or retired police officers and civilian employees, already with a membership of over 30 and meeting second Tuesdays at the Police Academy, Westfield Road, Wakefield. Club calls are, fortuitously, G8WYP and G3WYP! Hon Sec is W. Starkey G4IEJ who can be reached at the above QTH.

North Bristol ARC. High activity continues throughout the year, especially on Fridays at 7.30 at the Self-Help Enterprise, Braemar Crescent, Northville, Bristol 7, which sec W. Bidmead G4EUV explains is a centre otherwise for the elderly and handicapped who can still help themselves over their problems by getting together. He lives at 4 Pine Grove, Northville, Bristol 7 if you'd like to know more about the club.

Chichester & District ARC. Club net on S11 every Wed at 7pm but you can also get along to the Spitfire Social Club, Tangmere on the first and third Mondays at 7.30. Advance note of a special evening on Monday Dec 7 when potential members, in particular, can see some slides of the club's activities over the past year. More from S. Talbot G8FCX, 31 Pier Road, Littlehampton, W. Sussex or contact L'hampton 5082.

Verulam ARC. Fourth Tuesdays Charles Morris Memorial Hall, Tyttenhanger Green, Tyttenhanger near St Albans at 7.30 with second Tuesdays devoted to informal matters at the RAFA HQ, Victoria Street, St Albans. Highlights for the near future include G3UFB on d.i.y. in amateur radio on Nov 24 and the a.g.m. and social on Dec 22. Hilary Claytonsmith G4JKS at 115 Marshalswick Lane, St Albans AL1 4UU awaits to tell you all.

Stevenage & District RS. Going from strength to strength the club recently recruited no less than a massive 34 new members, taking the total to over 100, at an open evening/beginners night attended also by the local press. Two RAE classes are under way, one for December RAE and the other for next May, the efficacy of these projects showing up with 17 candidates passing out of the 20 who entered this year's RAEs. Trevor Tugwell G8KMV, 11 The Dell, Stevenage, Herts SG1 1PH can give you the details of the club which meets on first and third Thursdays in the staff canteen, British Aerospace Dynamics, Site B, Gunnels Wood Road. On Nov 5 Dave Musson talks about ICL with the 19th devoted to a film evening.

West Kent RS. Formal meetings Fridays, Adult Education Centre, Monson Road, Tunbridge Wells at 7.30 while informal get-togethers happen on Tuesdays at 8pm at the Old Drill Hall, Victoria Road, TW. On Nov 13 Pat Tierney continues his chat on colour TV, with Dick Mills expounding on the BBC's Radiophonic Workshop on the 27th. Excellent magazine *QLF* for September reproduced article from *CQ-DL* journal on a combined 14/21/28MHz vertical dipole which should be of interest to listener and transmitter alike. It is Brian Castle G4DYF, 6 Pinewood Avenue, Sevenoaks, Kent or 0732 56709 while 01-432 2256 is during office hours.

Cray Valley RS. Details received of the club's Activity Weekend on Nov 14/15 with three separate contests on 1·8/14/144MHz for licensed ops and listeners whether members or not. Full details from Owen Cross G4DFI, 28 Garden Avenue, Bexleyheath, Kent DA7 4LF honorary chairman and contests manager.

Southgate RC. A reminder that the club now meets at a new venue, St Thomas Church Hall, Prince George Avenue, Oakwood, London N14 on second Thursday of the month at 7.30, the November gathering concentrating on the G6QM construction trophy. Newcomers to the club can contact V. Austin G4MCD on 01-360 5832 beforehand, which is a good idea generally when intending to visit a club for the first time. Otherwise try Stuart Lindell G4IEH, 73 Old Park Ridings, N21 2ER who is PRO.

Sutton Coldfield RS. Monday Nov 9 is natter-nite at the SC public library, Sainsbury Centre, with the 23rd concentrating on the a.g.m. and the construction contest judging. Can tell you also of talk on microprocessors and the like on Dec 14. Waiting for your call is Derek Turner G8TUR, 10 Jervis Crescent, Sutton Coldfield, W. Mids B74 4PW.

Radio Amateur Invalid & Blind Club. Magazine *Radial* reports receiving £250 from a lodge of the Buffaloes in Oman as one of its contributions to the IYDP. Nice surprise! Also reported that well-known member G2DX has just passed his 88th birthday, so it's a matter of 73's on your 88th! Club net

G4IBC 3·75MHz Tuesdays 1000 and Weds 1400, always of interest if you can be around at those times. HQ QTH is Frances Woolley G3LWY and she lives at 9 Rannoch Court, Adelaide Road, Surbiton, Surrey KT6 4TE.

Braintree & District ARS. First and third Mondays at the B'tree Community Centre, Victoria Street, B'tree and 7.45 will do. A net operates on the remaining Mondays on S15 at 8.30, with the B'tree Raynet group occupying the frequency just beforehand. For those with more time on their hands the club magazine *BARSCOM* gives details of other local club meetings. Janet Storey, 33 Redwood Close, Witham, Essex has all the details.

Edgware & District RS. Second and fourth Thursdays 8pm at Watling Community Centre, 145 Orange Hill, Burnt Oak, Edgware, Middx plus club net Mondays 10pm 1·875MHz, while G3ASR pumps out slow Morse on Top Band and 2m for the benefit of all and sundry. Now, Nov 12 video tape show, wait for it, on The Secret Listeners and Satellite Communications, with the SW Herts u.h.f. repeater group visiting on Nov 26 to talk on repeaters and microwave beacons. Make a note of a junk sale on Dec 10. Club project group under G4BZY seems to have settled on a direct conversion receiver for 160/80m for its next venture. More on the club from Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx which also hides 01-952 6462.

Maidstone YMCA ARS. Looking forward to a visit by Ron Broadbent G3AAJ of AMSAT fame who will be talking on you know what on Nov 13, followed by a senior county emergency planning officer discussing the role of the amateur on such occasions, on the 27th. The beginners' class has been a sell-out so supplementary classes take place in the shack on Tuesdays at 8pm where Morse tuition can also be found. Normal shack hours are Friday evenings at the YMCA. But Graham Edy G4AXD, 29 Beech Road, East Malling, Maidstone, Kent will fill in the gaps if you write, or call him on W. Malling 841021.

Roy Stevens MBE G2BVN

It was with great sorrow that we learned of the death on 30 September of Roy Stevens MBE G2BVN. Roy's contribution to amateur radio in the UK and internationally was immense, and his dedication to the hobby outstanding in every way.

I was privileged to meet Roy face-to-face for the first time at the recent Brighton conference of IARU Region 1, of which he was secretary. The many tributes and honours bestowed upon him by the delegates there were ample evidence of the great esteem in which he was held by amateurs everywhere.

Our sympathy and gratitude are offered to Audrey, who helped Roy for many years, especially during the time of his increasing ill-health.

G3GSR

White Rose ARS. Located at the Moortown Rugby Union ground at Moss Valley, King Lane, Leeds, gatherings are around 8pm on a Wednesday. Delving into the profits from the club's famous annual rally the members now proudly possess a TH6 tri-bander! Details of the winter programme from Dave Coomber G8UYZ QTHR.

Crawley ARC. Unusual feature of the club's activities is an informal gathering at the QTH of one of the members. At G4GHO recently a wine tasting competition brought forth guesses such as pond oil, sump oil and deadly nightshade which did not please the hostess very much! Meetings at the Trinity United Reformed Church, Ifield, Sussex around 7.30 but hon editors of club mag will be glad to supply details, so it's G3MSK Vernon and G3MER Dot Davis, 16 Newmarket Road, Furnace Green, Crawley, Sussex.

Worcester & District ARC. Last two meetings of the year at the Old Pheasant, New Street, Worcester, around 8pm on Nov 2 when Dr Alfrey from B'ham University will address the assembled multitude on the subject of radio stars, while on Dec 7 G3RGD holds forth on c.w. operating. It is the end of the secretarial trail for Mike Tittensor G4EKG, 16 Durcott Road, Evesham, Worcs but he'll be glad to answer any queries until the new lad gets settled in. QTH is also Evesham 41105. Thanks OM for all your many letters on behalf of the club.

Right, letters and logs and club news direct to me by the 15th of the month remembering that around six weeks' notice is required of events if they are to appear in the column in time.

By the time this appears in print our own UOSAT satellite should be blazing a polar orbit with beacons just inside the lower edge of several of our h.f. bands. Much media publicity can be expected especially on the TV pictures of the earth, all of which should be of immense benefit to the amateur radio movement.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

One easily forgets in these days of television that there are still a large number of listeners to "steam radio", many of whom would like to listen to more distant broadcasts than those from their local station. The problems involved in doing this are greater than they were in pre-television days, the result of increased electrical interference, the larger number of broadcasters, and receivers in general use which are not really intended for long range reception. The problems encountered, which are similar to those facing the medium wave DXers, are highlighted in a letter from reader **Michael Slevin,** who lives in Omagh in Northern Ireland. Michael says that he would like to improve medium wave and long wave reception but there is a lot of noise when the volume control is turned up. Weaker broadcasts are swamped by noise and whistles and suffer from fading. He goes on to suggest that a broadband amplifier such as a car antenna amplifier, would bring stronger and clearer signals if connected to his domestic radio.

Directional Antennas

The modern domestic radio is a marvellous product of technology. It will pull in many stations at good entertainment value without an antenna, or more correctly, with its own internal antenna. This antenna is wound round a ferrite rod or slab and it is easy to overlook the fact that it is directional. I did so recently with a bedside radio alarm which gave poor reception of BBC Radio Merseyside until the set was repositioned slightly. The ferrite rod was pointing at the transmitter and as this is the position for minimum pick-up, poor reception was the result. Try turning your radio when listening to your local station. You will find there is a position where the signal drops to a low value with a noisy background. It may even disappear entirely.

When I tune to 1457kHz (207m) during the day I pick up a jumble of two stations which are Radio Manchester and Radio Carlisle. If I turn the radio (rotate it about its vertical axis) I can find one position where R.Manchester is on its own and another where R.Carlisle is reasonably clear of interference (QRM). The internal ferrite rod antenna is acting like a small m.w. loop, to null out co-channel QRM. It can also be used to reduce electrical noise, static, whistles, TV buzz in the same way, so try moving the set to different positions in the room and try rotating it. You will often bring a considerable improvement to reception if you do.

Signal-to-Noise Ratio

You will not obtain a stronger, clearer signal by using an antenna amplifier. All you do is to amplify signal and noise together. The ratio between them is unchanged. The weak signal in a noisy background will become a stronger signal in a noisier background. What we want to do is to increase the strength of the signal relative to the noise, or, in more technical language, we want to improve the signal-to-noise ratio.

The method of measuring the S to N ratio puzzles some people. For convenience, we measure the signal plus noise and divide it by the noise. S to N ratio $= \frac{S+N.}{N}$

If we could measure S on its own then we would not be troubled with the S to N ratio!

A good outdoor antenna should deliver a stronger and clearer signal than an indoor one. A lot of electrical noise exists in and close to a modern dwelling. An outdoor antenna mounted as high above the ground and buildings as possible will pick up less noise and more signal than an indoor one. The principles involved are really as simple as that. Keep the antenna away from the house and the S to N ratio will improve.

What if you can't put up an outdoor antenna? A whip or car antenna on the window sill with a screened lead to the receiver should bring an improvement. So will a whip mounted on the chimney stack and you can even use your outdoor TV antenna as a substitute. Receiver overloading and fading will be covered next time.

TV Buzz

My enquiry in the September issue for information about the suppression of TV line timebase interference brought a couple of interesting replies. **A. J. Cawthorne** (G3TDJ) has sent details of his own work towards a solution. "The secret lies in balance of the antenna and feeder system. In my case a large untuned two turn loop is used (the coupling winding of a tuned device can be used in the same fashion) and the balance preserved all the way to the receiver with two-core screened r.f. cable e.g. BICC DRM 68. At the receiver end a balun must be used unless the receiver input is balanced. I used a conventional 1:1 balun, 16 turns wound on a 40mm ferrite ring." Fig. 1 shows the arrangement.

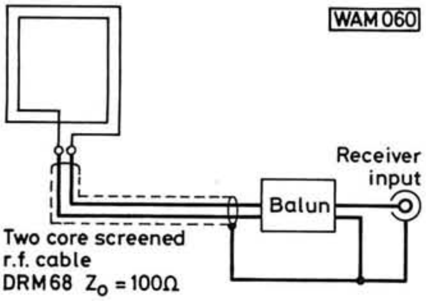


Fig. 1

J. W. Barker (G3WAL) suggests that "for the antenna side a centre fed configuration is used with the downlead being two lengths of co-ax—the centres go to the two parts of the antenna and the braids strapped at the bottom and well earthed. Tune via a Z match type of a.t.u. with Faraday Shield between the windings."

Many thanks to G3TDJ and G3WAL for replying. I'm sure their suggestions will provide ideas for the experimenter. Using two lengths of co-ax instead of two-core screened r.f. cable is a good dodge as the latter is not too easy to come by.

Readers' Letters

The appearance of Devonair at two different points on the dial puzzles reader **J. F. Coulter** (Winchester) who wonders if one of them is spurious. The two are genuine signals. Devonair (Exeter) is on 666kHz (450m) and Devonair (Torbay) is on 954kHz (314m). I'm told that the two run separate programmes which will add to the confusion.

More local radio DX from **Simon Hamer** (New Radnor) who used a Grundig Satellit 1400 to pull in Two Counties Radio in Bournemouth on 828kHz (362m), Devonair 954kHz, BBC Leicester 837kHz (355m) and Manx Radio Isle of Man on 1368kHz (219m). Simon uses a 9m antenna along with an "earth" connection to the radiator in his bedroom (central heating) which makes a big difference for m.w./l.w. DX. The antenna and earth are connected to a Melody Boy 500E which is placed close to the S1400, coupling between the two being by induction. "I cannot understand why some makers of expensive receivers should do away with sockets for antenna/earth" writes Simon. Probably to stop users connecting up a long wire and thus overloading the receiver! Few portables work well with a long wire connected directly. Loose coupling is required and if an antenna socket is not provided then wrap the antenna lead once round the receiver.

Fifteen year old **Howard Davis** (Braintree) uses a domestic receiver of about 1947 vintage and he thinks it is handy to have antenna and earth connections at the rear. He too uses the radiator for an earth. He reports hearing Devonair on 954kHz and BBC Radio 1 and 2 on the long waves. The latter are images of m.w. stations and there must be a fault or misalignment at the "front end" when the receiver is switched to long waves.

Swansea Sound is on 1170kHz with 500 watts

Rhys Thomas (Bridgend) reports that he has now picked up 23 different local radio stations among which are Radio Clyde (Glasgow) on 1152kHz (260m), Radio Tees 1170kHz (256m) and Radio City in Liverpool on 1548kHz (194m). **Richard Fernie** (Woking) uses his Fidelity 21 portable for local radio DXing and he wonders if UK local stations issue QSL cards. Many of them do. Among Richard's best catches are Manx Radio on 1368kHz and Radio Victory on 1170kHz (256m). Finally **Ted Jones** (Woking) who has poor reception of BBC2 R2 on the medium waves reports hearing the *Hundred Best Tunes* on v.h.f. which came from BBC Radio London, who relay R2 when not carrying their own programmes. Isn't this a general practice with BBC local radio stations?

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

Back to antennas again, this time to deal with points raised by readers. There is a shortage of information about antennas for broadcast band DXing and as a result, those designed for use on the amateur bands are being employed even though in some cases they are not really suitable.

Windom Antenna

Reader **E. Addison** is not sure about the length of the top of the Windom. It is half a wavelength less 5% i.e. 0·475λ. You can use the formula

$$L = \frac{142 \cdot 5}{MHz}$$

where L is in metres. A Windom or dipole cut for 6MHz would have a length

$$\frac{142 \cdot 5}{6} = 23 \cdot 75m.$$

The downlead for the Windom is a single wire, sorry this was not made clear.

Alan Williams (G3KSU) says that provided the single wire feeder is reasonably matched, the Windom will have the same pattern as a dipole with directivity and gain expected for lengths λ and 2λ. The engineering section of Radio Netherlands (Holland) in their 8 page booklet *Give your antenna some Air* claim that optimum results will be obtained on wavebands which are approximately half or one quarter of that for which the antenna is designed. Radio Canada International's *Antenna Handbook* states that the Windom should be cut to the lowest frequency band to be used where it will be directional and the antenna can then be used as a general purpose short wave antenna on the rest of the frequency spectrum. RCI's approach is the one relevant to broadcast band DXing since these bands are not harmonically related. In this context the performance of either the Windom or the half wave dipole as harmonic antennas, is irrelevant.

One point I overlooked in the September issue is the need for a good earth at the receiver when using the Windom. The single wire lead-in is part of a transmission line whose other "leg" must be earth.

Harmonic Antennas

Alan (G3KSU) disagrees with my comments in the September issue about dipoles and he says "half wave dipoles when used on *higher* bands *are* directional and *do* give gain—via an a.t.u. of course." He then goes on to suggest, rather unkindly, that I should read any antenna handbook—"*Out of Thin Air* would be a good start." But I am one of the contributing authors to *Out of Thin Air*!

What is not immediately apparent is that the international short wave bands are, unfortunately, not harmonically related in the way the amateur bands are. Consequently it *is* true to say that a half wave dipole cut for one (broadcast) band will have no gain on other (broadcast) bands.

For the Experimenter

It is possible, by careful choice of frequency, to construct a Windom or dipole that may give passable results on two broadcast bands. This is the path I was trying to indicate in the September issue. For example, if you choose the l.f. end of the 49 metre band, which is 5·95MHz, then the third harmonic, which is 17·85MHz, is only 50kHz from the h.f. end of the 16 metre band. There is a small correction to apply, the electrical length of a harmonic antenna is slightly less than geometry would suggest so the antenna will resonate at a frequency slightly higher than 17·85MHz.

We now have an antenna that will give a boost to signals at the l.f. end of 49 metres and at the h.f. end of 16 metres. Antenna bandwidth is the factor that will decide how well it performs on those two bands and this is a good field for the experimenter to explore.

Of the two, I think the Windom has more to offer to the broadcast band DXer than the dipole. The Windom is not a dipole as the top is a single piece of wire, nor is it an end-fed antenna as the lead-in is tapped down to 600 ohms at resonance. The Windom is easy to make as you only need ordinary antenna wire and it does give a boost to the frequency for which it is cut. It will, as RCI suggests, make a useful general purpose short wave antenna as well and it may, with a bit of juggling, boost signals on more than one broadcast band.

Fit an Extension Loudspeaker

One does not normally expect good audio quality from short wave broadcasts. The crowded state of the bands is partly responsible as channel spacing is only 5kHz against 9kHz on the medium waves. The narrower bandwidth does not lead to high quality audio, while 5kHz whistles are commonplace, being the heterodynes from the carriers of adjacent broadcasters.

In spite of these drawbacks the quality of audio obtained from short wave receivers could be a lot better than it is. It is not the fault of the receiver as audio stages are usually well designed and capable of delivering an adequate signal into a reasonably sized speaker. I came in contact with the problem a few years ago when a colleague gave me a present of an 8 inch loudspeaker fitted in a home-made wooden cabinet. At that time I was using a Siemens s.w. communications receiver which had a miniature 3 inch internal loudspeaker. When the larger external speaker was substituted the improvement in audio quality was unbelievable. So if you want to enjoy a bit of music on the short waves and your receiver only has a tiny loudspeaker then try a larger external loudspeaker in its place.

It is not difficult to connect up. If the receiver has an external L/S socket then all you have to do is to join up a speaker of the appropriate impedance. This value can be found from the receiver handbook. If there isn't a loudspeaker socket then disconnect the leads to the internal loudspeaker and extend them to an external one of the same impedance, which is usually 8 ohms with modern equipment.

Readers' Letters

"I have just bought an FRG-7 after several years of experimenting with t.r.f. sets and a clapped out CR70A" writes **David Ellis** of Rhyl, who goes on to say that he has been using his new receiver with an indoor antenna and a mains earth. Not surprisingly he has been having trouble with timebase harmonics from TV sets. With such a combination it is inevitable as a mains earth is a very good source of mains-borne interference and is usually a poor earth for DXing as well. David likes the tone control on his new receiver and so far he has not experienced intermodulation problems and has not needed to use the attenuator.

Reader **K. Miosga** of Durban in RSA wonders if he can make a short wave anti-distorter. I have a great deal of sympathy with this request but I'm afraid there is no easy way of improving the quality of short wave broadcasts. The modern tendency is for stations to use relay transmitters near the target area so that single hop i.e. a single reflection from the ionosphere, reception is all that is required.

International Co-operation. A QSL card issued by the Swiss Short wave Merry-go-round and Radio Canada's DX Digest for a shared broadcast earlier this year

In reply to **Stephen Hall** of Rotherham. Radio Tirana broadcasts on 7·065MHz and I suspect this is the "radio amateur" you heard. **Keith Dwyer** of Pietermaritzburg RSA has a concerto valve radio and 30 metre long wire but he has never heard any stations from South America. A friend of his with a communications receiver has had a similar experience. I believe this path is only open at certain times of the day/year especially on the tropical bands. Can anyone help? To Keith Nockels of Ipswich. Sorry I cannot deal with non-broadcasting stations as it is illegal to listen to them. For the same reason pirates and other unauthorised transmissions are out—Ted Jones please note.

To end with, there is a request from 17 year old **Daniel Ozoko** who is a student at the University of Nigeria at Nsukka and who would like to correspond with other readers of *Practical Wireless*. He is interested in radio and electronics and his address is St Paul's Parsonage, PO Box 16, Nsukka, Nigeria.

VHF Bands

by Ron Ham BRS15744

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

During the winter months the 10m band should be full of interest with JAs, VKs and ZLs early in the mornings and VEs and Ws at midday. It is also worth keeping an ear on those International Beacon Project stations between 28·175 and 28·315MHz, to get some idea of which signal paths are open and don't forget, winter in the UK is noted for short periods of high atmospheric pressure and sudden temperature changes, so watch out for openings on the 2m and 70cm bands.

Solar

On August 21, **Ted Waring,** Bristol counted 76 sunspots during his routine observations and **Cmdr Henry Hatfield,** Sevenoaks, using his spectrohelioscope, noted the remains of 3 flares within one of the sunspot groups. These were no doubt responsible for the 20 minute burst of noise he recorded at 0832 and the radio noise I heard in the 10m band. Later in the day, both Henry and I recorded a modest noise storm at 136 and 143MHz respectively. Mild solar noise storms were again recorded on September 12 and 13. Ted counted 85 sunspots on August 24, 40 on September 2, 84 on the 8th and 54 on the 13th. Both Henry and I received a variety of individual solar bursts on August 28, 29, 30 and September 1, 5, 6, 8, 9, 14 and 15 and early on the 15th I again heard large bursts of noise around 28MHz. On September 9, Henry saw 7 sunspot groups and inside one group, containing 3 large spots and about 20 small ones, he observed a flare and an eruptive prominence which covered 4 angstroms of the optical spectrum.

VLF and the Sun

Henry is the Director of Observational Techniques with the British Astronomical Association and true to form is always experimenting both in the optical and radio fields. His latest study is v.l.f. with a Cambridge Kits receiver and two home brewed amplifiers, one to feed a loudspeaker and the other to drive a pen-recorder. This equipment enables Henry to monitor the MSF time signal on 60kHz, important to most astronomical work, and to see what happens at these low frequencies when the sun is active. On August 21, he noted a sudden increase in the strength of MSF some 4 minutes after he recorded a solar burst at 136MHz, yet, after a large solar flare on September 9 there was no effect on the MSF signal. Henry is now monitoring a reasonably clear spot around 49kHz to see if there is a relationship between the active sun and the level of atmospherics around this frequency.

The 10m Band

Both **Ken Jeal** G8SVY, Horsham, who uses a Drake R4C, and I noted that the 10m band opened up for DX on August 30. Ken heard several Ws and a VE at 1430 and I heard a couple of VKs around 1000 and a VE and SM at 1920. It's good to hear the DX again and during the first 12 days of September, **Ron Chambers** BRS46622, Worcester Park, Surrey, heard signals from Australia, Europe, Middle East, USA and the USSR. Ron, a member of the Surrey Radio Contact Club, visited the Chalk Pits Museum on September 6 and told me that his interest in radio dates back to 1947 and that he uses a Trio R-1000 receiver fed by a long wire antenna via a Yaesu FRG-7700 a.t.u. Ron is studying for the RAE and Morse and is currently building the active antenna recently published in *PW*. **Harold Brodribb,** St Leonards-on-Sea is another reader pleased with the renewed activity on 10m, especially when he heard the north-American stations on August 30 and the return of the familiar pattern of strong signals from the USSR in the mornings and from Canada and the USA in the afternoons. Since about September 10 the band has really picked up with strong signals from Japanese stations in the early mornings and on some days I heard weak signals from the beacons in Adelaide VK5WI 28·260MHz and Sydney VK2WI 28·262MHz up to about 1400. As these two beacon signals are so close together very careful tuning is required. At 0815 on September 12 there were very pronounced echoes on the signals from four European stations as they successively worked a UD6 in the contest. "I have been beaming longpath to VK and ZL after 2030 during the evenings of September 9 and 10" writes **Sam Faulkner,** Burton-on-Trent, who received s.s.b. signals at incredible strength from VK2 and VK3 until about 2230. The band was much less DXy on the 19th, so I was not surprised when the BBC World Service reported an ionospheric disturbance during the early hours of the 20th.

10m Beacons

During the 32 day period between August 21 and September 21 I received signals, at varying strengths, from the International Beacon Project stations in Australia VK5WI and VK2WI on 9 days, Bahrain A9XC on 5 days, Bermuda VP9BA on 5 days, Cyprus 5B4CY on 20 days, Germany DL0IGI on 17 days, Hungary HG2BHA on 4 days, Norway LA5TEN on 7 days and New Zealand ZL2MHF on 4 days. Henry Hatfield has been checking the signals of LA5TEN, VP9BA and 5B4CY as a propagation guide and Ted Waring's beacon log shows consistent signals from 5B4CY and the two South African beacons ZS6DN and ZS6PW. Between September 6 and 12 Ted was receiving signals from the Canadian beacon VE2TEN.

Sporadic-E

The last 4 events of the 1981 sporadic-E season to influence signals between 50 and 80MHz occurred during the evenings of August 26 and 30 and September 2 and around 0900 on the 5th. Although these events were more intense around 50MHz, strong signals were received from 9, 5, 8 and 3 respectively, east-European f.m. broadcast stations between 66 and 73MHz. Throughout the sporadic-E season, users of the 4m amateur band have frequently been troubled by these broadcast signals which, periodically, have blotted out the entire band.

RTTY

Alf Lee G4DQS, uses an FT-101E giving 50 watts to a Delta Loop antenna, a Microwave Modules MM4000, RCA solid state keyboard and a 9 inch Motorola video monitor for RTTY. Alf is often operating on 15 and 20m from his home in Brighton and has made RTTY contacts with stations in the Middle East and Scandinavia. At 0920 on September 16 I copied IZ5ARI, the special station at the second exhibition of textile machinery in Nrat (Sept 15-20), working XE1CCK on 20m with my Microwave Modules MM2000 fed from a FR-101 communications receiver and at 1355 I copied another special station, HB0LP, operated by HB9LP, calling CQ from the Principality of Liechtenstein. Between August 21 and September 21 I copied 77 stations in 16 countries, DF, EA, F, HB9, I, IT9, K, OE, OH, OK, ON, OZ, SM, VK, Y3 and YU. Among the two-way RTTY signals I received were QSOs between I0GDN and DL5GAS at 0857 on September 12, HB9GS and OZ8JYL at 1046 on the 13th, I4JXE and Y6IZ in Berlin at 1355 on the 17th and 3A2EE and SM5JQJ at 0930 on the 21st. My best DX was Australia copied around 0755 on the 19th from VK3OK near Melbourne as he worked a RTTY station in Italy and later called CQ.

Tropospheric

The atmospheric pressure was high and steady at 30·4 inches (1029mb) from August 23 until midday on the 27th when it began to fall reaching 30·1 (1019mb) at noon on the 29th. The pressure began a slow rise from 30·1 at midnight on the 31st to 30·4 again at noon on September 4 when it began a gradual fall to 30·1 at midday on the 7th. During this period disturbances were reported in Band II and the range of the signals from the 2m repeaters was greatly increased. **Jon Kempster** RS45205, Berkhamsted, Fig. 1, has built horizontal and vertical dipoles for 2m mounted some 10m above ground and rotated by hand. The first results from his new antennas showed that he can receive signals from the repeaters GB3CF, EL, NL, PI, SL, WL and WH and his best s.s.b. DX so far is GM2OUR/P on August 18.

Band II

On August 28, Harold Brodribb counted 17 French stations and several editions of BBC Radios 2, 3 and 4 between 88 and 100MHz and **Nick Brown,** Rugby, received signals from Belgium, BBC Radios Derby and Sheffield, and France between 96 and 100MHz on the 27th. While on holiday in Tynemouth, Northumbria, **Ken Smith** BRS20001, using a portable with its own rod antenna, heard stations in Norway on the 30th. **Keith Nockels,** Ipswich, uses a Sony TFM-C660W with a horizontal wire antenna around his wardrobe and since September 5 he has monitored the test transmissions from Essex Radio, who by now should be fully operational on 95·3MHz. During the early mornings and late evenings Keith can usually hear Capital Radio and while the conditions were good in early September he heard stations in Belgium, France and Italy.

Sixteen year old **Ian Kelly** is a newcomer to v.h.f. DXing and at his home in Reading he uses a Realistic Modulette 929 music centre. While he was on holiday in Great Yarmouth between September 5 and 12 he heard many stations from Belgium and Holland with his Pye 9015 radio recorder and telescopic antenna and around 1000 on the 9th and 10th he received strong signals from the British Forces Broadcasting Service in Germany.

"From August 27 to 29, the high pressure moved across the North Sea toward S. Norway giving interesting results on the v.h.f. and u.h.f. bands" writes **Peter Ebsworth,** Steinsland, Norway, who received


OP: JON KEMPSTER
QTH: 18 LYME AVE, NORTHCHURCH, BERKHAMSTED, HERTS HP4 3EG
ENGLAND' U.K. TELEPHONE: 4175
BRITISH RECEIVING STATION
R.S.G.B. RS45205 QRA : ZL59H
To Radio , Rpnt Ur CQ/QSO
With , At GMT/BST. on 19
Freq. Mhz. Ur Signals Were RS/T
QRM , QRN , QSB
Condx , Wx
RX
Ant
Remarks
Pse QSL Direct or via bureau: TNX. 73/88 Op

Fig. 1: Jon Kempster's QSL card

programmes from Finland and BBC Radios 2 and 4 between 2100 and 2118 on the 29th and the BBC stations again between 0730 and 0840 on the 30th. Peter uses a home-brew Band II tuner and a 3 element beam in the loft and directed toward the UK.

News Items

Congratulations to Eric Clarke, Chichester on passing the RAE with credits and now sporting the call-sign G6CSX. Eric is a member of the Chichester Amateur Radio Club and for many years has been a Civilian Radio Instructor with the ATC. He has several radio interests and is now equipped with a FDK Multi 750 for 2m and 70cm.

Congratulations also to Jeff Goodley, London, who passed the RAE and now, with the call-sign G6EXF, will be active on 2m.

Among the visitors to the Chalk Pits museum on August 30 was Beverley Dennis G3UIE, Titchfield, carrying a Trio 2400. At home, his main v.h.f. gear is a TR-9000 multimode into a 8 element beam for 2m s.s.b. and a FT-101 into a trap dipole for 10m, his favourite h.f. band.

Paul Clements, Seaford, Sussex, has just purchased a Yamaha CR820 stereo and with an indoor dipole has heard the DX in Band II. Paul intends to take the RAE in December and the Morse test as soon as possible.

Early in September, Colin Watson BRS46598, Cumbernauld, Dunbartonshire, was listening to the trade test transmissions from the new ILR service from S.W. Ayr, on 96·2 MHz in full stereo.

Among the members of the Chichester Model Boat Club who demonstrated their radio controlled boats at the Chalk Pits museum on September 13 was RSGB member Cyril Spurrier, who is an ex-RAF wireless operator and plans to take the RAE in December. Cyril is keen on c.w. and at present has a Yaesu FR-7700 receiver, a home-brew a.t.u. and a long wire antenna.

Alan Baker G4GNX, 38 Elphick Road, Newhaven, Sussex BN9 9SY, would like to hear from anyone who uses a Tangerine Microtan 65 computer system in conjunction with their amateur radio transmissions.

TV

by Ron Ham BRS15744

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

Outside of the sporadic-E season and possibly for 8 months of the year DXTV, apart from a few good tropo openings, can be a bit sparse. However, there is always something to write about because this column covers both slow and fast scan television as well as broadcast TV and, like my readers, I am always interested to hear about other people's antennas and equipment.

Sporadic-E

At 0910 on August 23, **Harold Brodribb,** St Leonards-on-Sea, received very strong sound from Italian TV on 59·25MHz. On August 26, **Nick Brown,** Rugby, received test cards from JRT RTV-LJNA Ch. E3 55·25MHz and JRT ZGRB1 Ch. E4 62·25MHz, both Yugoslavia, and a German language programme on Ch. E2 48·25MHz. The following day he received an Italian test card RAI-1 on Ch. 1A 53·75MHz and around 0825 on September 3 he saw the Nederlands test pattern PTT-NED 1 on Ch. E4 62·25MHz. "The last sporadic-E signals I received here were on September 5, on Chs. R1 49·75MHz and R2 59·25MHz and came from MTV Hungary" writes Nick, who like several of us watched an episode of *The Streets of San Francisco.* Between 2000 and 2100 on September 3, **Simon Hamer,** Presteigne, watched a group of singers on RAI and says that he has thoroughly enjoyed the latter part of the sporadic-E season, especially when the pictures from Poland were so unbelievably strong. Simon has received his first

G4JDT
HARVEY

EAST LONDON HAM STORE

G8NKV
DAVE

H. LEXTON LIMITED

191 FRANCIS ROAD LEYTON E.10
TEL 01-558 0854 TELEX 8953609 LEXTON G

RADIO & ELECTRONIC ENGINEERS — ENGINEERS ALWAYS AVAILABLE ON THE PREMISES

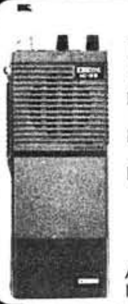
MAIN (UK) SERVICE CONTRACTOR TO HITACHI SALES (UK) LTD

EXCLUSIVE TO US IN THE UK. 1kW input 600W ssb 350FM 2MTR LINEAR!!

BUILT-IN POWER SUPPLY, ELECTRONIC WARM UP, VARIABLE INPUT ATTENUATOR. ADAPTS EXCITERS FROM 2W-25W. RADIAL BLOWER. LED's FOR READY, TX, OVERLOAD, PTT & RF VOX with VARIABLE DELAY CHOICE OF EIMAC TUBES. 4×150A OR 4C×250B OR 4C×250R. ELECTRONIC PLATE CURRENT FUSE – NO THERMAL DAMAGE OF P.A. TUBE POSSIBLE. SIZE: H.88mm, W.318mm, D.375mm. FROM £300.00

D 70C	70cms.	10W in – 200W out	£489
D 200S	2mtr.	1kW p.e.p. ssb. (650 FM)	£599
D 200	2mtr.	500W p.e.p. ssb. (400 FM)	£475
D 200C	2mtr.	350W p.e.p. ssb. (150 FM)	£300

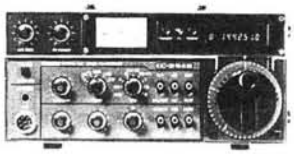
All these linears have adjustable inputs and outputs and they are all fully protected.
ALSO AVAILABLE:- 18db Gasfet masthead preamplifier which suits the output of these linears and which is also powered by them via the antenna co-ax.



ICOM PORTABLES

IC2E FM 2m £169.00
IC202 SSB £169.00
IC402 70cm £242.00
All accessories available – see below
AVAILABLE SOON IC 4E 70CM

ICOM MULTIMODES



IC251 2m	£499.00
IC451 70cm	£630.00
IC260 2m few left	£299.00
IC290 2m	£366.00

ICOM FM MOBILES

IC24G	£165.00
IC255	£255.00
IC25E	£259.00

ICOM HF TRANSCEIVERS

IC730 200W	£586.00
IC2KL 500W linear	£839.00
IC2KLPS Power supply	£221.00

ICOM 720A G/C

GENERAL COVERAGE TX ALL BANDS

IC720A 200W	£883.00
PS15 Power Supply	£99.00
PS20 P/S with speaker	£130.00
IC730 200W HF	£586.00

MANY ACCESSORIES FOR ABOVE AVAILABLE

JAYBEAM ANTENNAS

8Y/2M 8 ELE YAGI	£15.50
10Y/2M 10 ELE YAGI	£33.00
PBM 10/2M 10 ELEMENT PARABEAM	£39.00
8XY/2M 8 ELE X YAGI	£31.00
X6/2M/X12/70CM DUAL BAND CROSSED	£41.40

MANY OTHERS IN STOCK

ICOM ACCESSORIES

BP5 IIV Pack	£30.50
BP4 Empty case for 6XAA	£5.80
BP3 STA Noard Pk	£15.50
BP2 6V Pack	£22.00
BC30 Base charger	£39.00
DC1 12V adaptor	£8.40
WM9 Mic speaker	£12.00
CP1 Mobile Charging load	£3.20
LC1/2/3 cases	£3.50
ICMLI 10W Mobile booster for 2E	£49.00

TRIO/KENWOOD

TS830S HF Transceiver	£700.00
TS130S HF Transceiver	£530.00
TR8400 UHF Mobile	£320.00
TR9500 UHF Multimode	£470.00
TR7800 VHF mobile	£270.00
TR7840 HP FM 2m	POA
TR7730 2m FM	TBA
TR9000	£370.00
TR2400 Portable	£195.00
PS30 20 1 amp PSU	£85.00

Many Trio/Kenwood accessories available

YAESU/SOMMERKAMP

FT902DM WARC	POA
FT101ZD FM/AM	POA
FT707	See below
FP707 Power Supply	£109.00
FC707 ATU	£88.00
FV707 DM VFO	£189.00
FT480R 2m Multimode	£359.00
FT290 2m Portable multimode	£229.00
FT207R 2m Special	£170.00
FT767DX Sommerkamp	£559.00
FT101ZD Sommerkamp all options FM	£710.00
FT277 Sommerkamp AM	£647.00
FT208	£190.00
FT708	£195.00
All accessories available, including FV902, FC902, YP901P, YK901	POA

FT707+FP707 PSU £610.00

MICROWAVE MODULES

MMA 144V 2m Preamp	£34.90
MML 144/25 RF AMP	£59.00
MML 144/40	£77.00
MML 144/100S New with Preamp	£129.95
MMT 432/144 2-70 Transverter	£184.00
MMT 28/144 10m Transverter	£99.00
MM2000 RTTY Receiver	£169.00
MMI Morse Talker	£99.00

MM 4000 RTTY
SEE IT WORKING AT OUR SHOP
£269.00. Full range stocked.

STANDARD

C7800 70CM special offer	£250.00
C78 70cm Portable	£219.00
C58 2 mtr Multi Portable	£245.00
CPB58 25W Linear	£79.50
CPB78 10W 70CM Linear	£72.00
CM8 Mobile mount	£19.95
CL8 Carry case	£6.95
Set Nicads	£11.00
C230 Charger	£7.95

ROTATORS ETC

DIAWA

DR7600X	£135.00
DR7600R	£144.00
DR7500R	£105.00
CN620 1·8 150MHz Pwr/swr	£52.00
CN2002 2·5 kW PEP auto ATU	£190.00

KENPRO

KR250	£44.85
KR400RC	£90.88

CDE

HAM IV	£189.00

CHANNEL MASTER

9502B	£50.00

CARRIAGE FREE MAINLAND

SWAN/CUBIC

102BX 235W + PS5	£799.00
103BX WARC 235W	£1000.00
PS6 Power Supply	£145.00
150MX Digital SP	£500.00
15002 Linear	£406.00
ST2A ATU	TBA
ST3A ATU	TBA
HF Mobile ant	£80.00

CUSHCRAFT AMATEUR ANTENNA

HF, A3 20/15/10 3 ele beam 8bD	£165.00
ATV3 20, 15, 10 Trapped vertical	£38.30
ATV5 10.15.20.40.80 Trapped vertical	£83.69
214B 14 ele boomer 15·2db	£55.77
ARX 2 Ringo Ranger 6dB vertical	£28.00
CS100 Speaker	£13.00
A144·4 ele Yagi	£18.25
A144·7 ele Yagi	£22.82
A144·1 11 ele Yagi	£28.94
ARX2B Ringo Mk11	£33.00
ARB2K Conversion kit RINGO	

KB105 10-80mtr 5 band trapped vertical 20′ high complete with guy ropes. Excellent value for money *** £77.75 ***
MkI to Ringo MkII £14.18
FULL RANGE IN STOCK
SAE CATALOGUE
144+10T+Yagi } OSCAR
144+20T+Yagi }
For vertical and horizontal Oscar specials

RECEIVERS ALL ON SPECIAL OFFER – P.O.A.

R1000	Kenwood
FRG7700	Yaesu
FRG7700	Memory
FRT7700ATV	£34.00
IC2001L	Sony
SEARCH II	2 metre

ALL POA ARE ON SPECIAL OFFER. PHONE HOT LINE ★ 01-556 1415 ★

Let others make an exhibition of themselves, we'll be open through October – including the Saturday and Sunday of the Leicester Exhibition and we will beat anything Leicester has to offer. If they have got it; we've got it.

ALL ACCESSORIES AVAILABLE – PLUGS SKTS CO-AX 2MTR COLINEAR £31.50, 70CM COLINEAR £31.50

Access

PRICES INCLUDE VAT AT THE PRESENT RATE OF 15%
OPEN MON–FRIDAY 9:00–5.30. SATURDAY 10:00–3:00. INSTANT HP FACILITY AVAILABLE
EASY ACCESS M2–M11–M1 NORTH CIRCULAR ROAD–EASY PARKING

BARCLAYCARD VISA

COMMUNICATION CENTRE OF THE NORTH

The largest range of communications equipment available in the North. Full range of receivers, transceivers, antennas, power supplies, meters etc.

We are the only official TRIO stockists in the North West. Full range of equipment on display. Guaranteed after sales service.

We can offer a full range of receiver from the SR9 2m **£46.00** to the Drake R7 at **£989.**

We shall be stocking a range of top quality CB equipment when available.

MK II MULTITUNER. In 1977 we introduced our latest design in antenna tuners. This has now been exported to over 75 countries and recommended on Overseas World Broadcasts including HCJB. Will match practically any antenna to most receivers.

£35.00 inc. VAT & POST

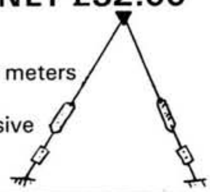
Part Exchanges welcome. Second hand lists daily.
Send S.A.E. for details of any equipment.
HP terms. Access/Barclaycard facilities.
Open 6 days a week. 24 Hour Mail Order Service.

Phone 0942-676790.

STEPHENS JAMES LTD.
47 WARRINGTON ROAD,
LEIGH, LANCS. WN7 3EA.

M&B RADIO

INVERTED VEE DIPOLES — ONLY £32.00



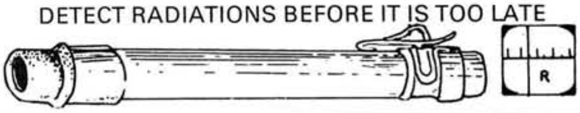
MULTIBAND 10-11-15-20-40-80 meters
- 2kW Handling Power
- Heavy Duty Stranded Non-corrosive & Plastic Coated
- Total Length 26 meters

RADIATION DETECTOR — ONLY £2.70

COMPLETE WITH INFORMATION

- Metal Cased
- Quartz Fibre Type
- Contains 3 Lenses
- Only the Size of a Pen

DETECT RADIATIONS BEFORE IT IS TOO LATE



RACAL RA17L Communication Receiver 500kc/s-30MHz		**£125**
RACAL RA17 Communication Receiver 500kc/s-30MHz		**£100**
GEC BRT402K Communication Receiver 150kc/s-30MHz		**£75**
EDDYSTONE 880 Receivers 100kc/s-31MHz	from	**£155**

BOSCH 2·5kV 40uF Capacitors **£8.00** VAT p&p extra.

VAT & P&P EXTRA UNLESS STATED

M&B RADIO 86 BISHOPSGATE STREET
TEL (0532) 35649 LEEDS LS1 4BB

MORSE TUTOR

The uniquely effective method of improving and maintaining Morse Code proficiency. Effectiveness proven by thousands of users world-wide.

- ★ Practise anywhere, anytime at **your** convenience.
- ★ Generates a random stream of perfect Morse in five character groups.
- ★ D70's unique "DELAY" control allows you to learn each character with its correct high speed sound. Start with a long delay between each character and as you improve reduce the delay. The speed **within** each character always remains as set on the independent "SPEED" control.
- ★ Features: long life battery operation, compact size, built-in loudspeaker plus personal earpiece.

Price **£49.45**

ACTIVE RECEIVING ANTENNAS

Datong active antennas are ideal for modern broadband communications receivers – especially where space is limited.

- ★ highly sensitive (comparable to full-size dipoles).
- ★ Broadband coverage (below 200 kHz to over 30 MHz).
- ★ needs no tuning, matching or other adjustments.
- ★ two versions AD270 for indoor mounting or AD370 (illustrated) for outdoor use.
- ★ very compact, only 3 metres overall length.
- ★ professional performance standards.

Prices: Model AD270 (indoor use only) **£42.55**
Model AD370 (for outdoor use) **£56.35**
Both prices include mains power unit.

VERY LOW FREQUENCY CONVERTER

If your communications receiver gives poor results below 500 kHz Model VLF is the answer.

- ★ Connects between antenna and receiver input.
- ★ Converts signals between DC and 500 kHz to the range 28 to 28.5 MHz with low noise and high sensitivity.
- ★ Crystal controlled for high stability.
- ★ Quality construction in diecast aluminium box (size 112 x 62 x 31mm), SO239 connectors, LED indicator, in/out switch.
- ★ Operates from internal 9 volt battery or external supply (5-15 volts DC).

Price: only **£25.30**

Our full catalogue plus further details of any product are available free on request.
All prices include VAT and postage and packing.

DATONG ELECTRONICS LIMITED
Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE England.
Tel: (0532) 552461

South West Aerial Systems

10 OLD BOUNDARY ROAD, SHAFTESBURY, DORSET, SP7 8ND

tel. 0747 4370

The PLUSTRON 5" TVR5D 'Euro TV' features VHF/UHF TV coverage with system B/G/I (5.5/6MHz) sound switching and MW/LW/VHF-FM radio facilities. Operating from internal/external batteries or AC mains, it features good sensitivity and selectivity via its integral whip or external (coaxial socket) aerial input. The receiver is ideal for basic TV and FM DXing. Other Plustron models are available, send SAE for leaflet.

Our comprehensive range of aerials, amplifiers, filters and accessories for TV/FM DXing, domestic/fringe installations, deflector and 2nd channel reception is detailed in our catalogue. We make our own range of wide-band Band 1, Band 2, air/marine PSB aerials, a CB ½ wave dipole, and a customer consultancy service is available to resolve reception problems.

Plustron TVR5D 5" mono TV (Securicor delivery)	£96.50
SWAS – WB3 Wideband Band 1 (47-68MHz) 3 element yagi	£26.75
Jaybeam ABM8 Wideband Band 3 (175-230MHz) 8 element high gain yagi	£18.20
Wolsey 'Colour King' wideband UHF (470-860MHz) 4 bay bowtie aerial	£21.75
Babani BP52 (2nd edition) Roger Bunney's book on DXTV technique/practice	£2.35
BATC 'Amateur Television Handbook' (3rd edition), ATV technique/practice	£2.35

All prices include VAT, carriage and packing. Include SAE with ALL enquiries. Our comprehensive catalogue costs 45p.

Fig. 1 *(H. Nykvist)*

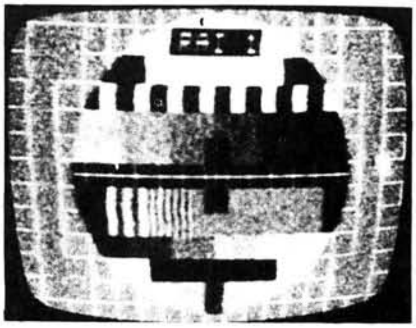


Fig. 2 *(H. Nykvist)*

Fig. 3 *(H. Nykvist)*

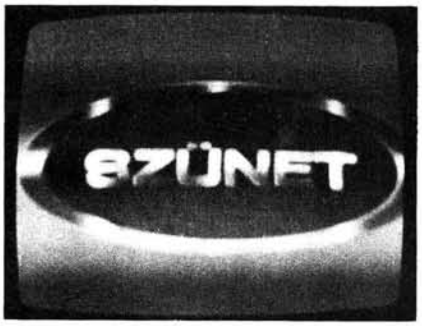


Fig. 4 *(B. Renforth)*

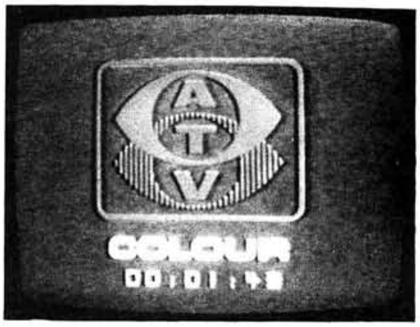


Fig. 5 *(G. Garden)*

Fig. 6 *(G. Garden)*

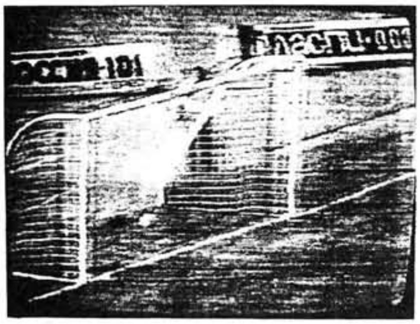


Fig. 7 *(R. Ham)*

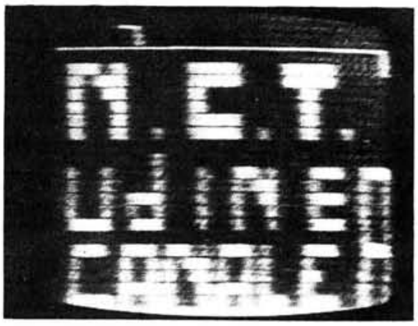


Fig. 8 *(S. Faulkner)*

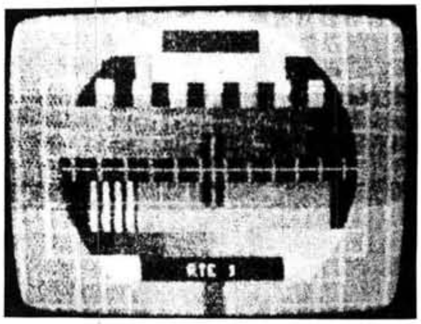


Fig. 9 *(D. Appleyard)*

DXTV QSL card in answer to a report he sent to Radio Denmark about their signals he received on Chs. E3 and 4.

During the sporadic-E events between 0915 and 1215 on August 21, 23, 25 and 27, **T. Ampi,** London, received pictures on Chs. R1 from Budapest, R2 Bucharest, E2 Spain, E3 Norge Gamlem and E4 Yugoslavia. On the same days, **Brian Renforth,** Chippenham, had similar results with the addition of Austria, Czechoslovakia, Sweden and the USSR. Like most of us, Brian was surprised to see the sporadic-E season run into September and on the 2nd and 5th he received pictures from Italy, Poland and Spain. Brian also monitored another event between 1440 and 1700 on the 20th when he received perfect pictures and sound from RTVE Spain, including a cartoon programme, adverts for Ajax, Fanta, Paper-Mate and Zanussi followed by the American programme, *BJ and the Bear* dubbed into Spanish. Fellow TV columnist, **Henrik Nykvist,** Kungsbacka, Sweden, arrived home from holiday on August 15, switched on and found extra strong pictures from RTVE and watched a series of cartoons, adverts and a disco show called *International Competition.* At 1650, the signal was so strong that Henrik could read the maker's name on the microphone that the man on the screen was using. During the sporadic-E season, Henrik received pictures from Germany, Italy and the USSR, Figs. 1, 2 and 3.

Fig. 10: DXTV QSL from Radio Denmark received by Simon Hamer

While I was receiving a strong colour test card from Norge Melhus around 0900 on August 16, **David Appleyard,** Uppsala, Sweden, received a test card, Fig. 9, from Radio Telefis Eireann RTE 1 on Ch. B 53·75MHz from 1010 to 1050 using his 8in National portable receiver with its own rod antenna mounted on the windowsill of his fourth floor flat.

Tropospheric

Conditions were generally good for Bands III and V between August 24 and September 7 when I received pictures from the IBA transmitter at Lichfield on Ch. 8, a test card from BRT UTU-1 Belgium on Ch. E10 and a strong colour test card from Radio Telefis Eireann on Ch. H at 0910 on the 26th. RTE was first received in monochrome on the back of my beam and then came up in brilliant colour when I turned my antenna toward it.

From Warwickshire, Nick Brown, received Yorkshire Television on Chs. 25 and 47, Tyne Tees on Ch. 29, HTV Wales on Ch. 49 on the 28th and the test card PTT-NED 2 on Ch. 27 on September 3rd. During the period, T.Ampi received u.h.f. pictures from Belgium, Holland and Germany and saw such station identifications as BRT-UTU 1, PTT-NED 2, Dortmund ZDF, Wesel ZDF and DBP-WDR-3.

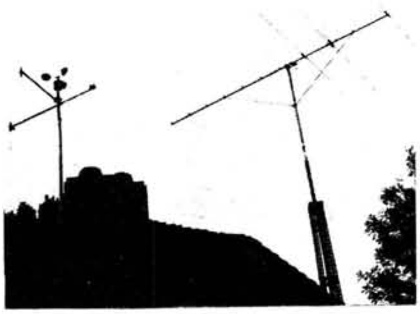


Fig. 11: The author's new antenna installation for DXTV

Amateur Television

Tropospheric conditions were very good for Amateur TV signals on September 6 when the 70cm band was open for most of the day. Around 1100, **Andrew Emmerson,** author of *TV On The Air* in the British Amateur Television Club's journal *CQ-TV,* G4IMO and G8UWS all exchanged strong pictures with stations in Belgium. It is obvious from Andrew's column that the number of ATV enthusiasts is growing rapidly so if any of my readers are interested in this fascinating subject they should write to Andrew at 4 Mount Pleasant, Blean Common, Canterbury, Kent, CT2 9EU.

SSTV

"Band conditions were quite noticeably changing around mid-August" writes **Sam Faulkner,** Burton-on-Trent, who received SSTV pictures from LU5AN on 28·680MHz at 1800 on August 15, 16 and 30. Between 1315 and 1530 on the 30th, Sam logged pictures from ZS6BNT, ZS6BQT, ZS6BTD and ZS6PP and his first Stateside signal of the new active season on 10m, came at 1645 from WB1SAI followed by KA4H and KC4TV. At 1630 on September 6, Sam received excellent video from EA8RX who was using a "light pen" while in QSO with I7PQD and at 2100 on the 7th he received pictures from W4CFM.

Fig. 12: Sanyo 9300PN used by the author *(picture supplied by Sanyo)*

Other Stations

Ed Baker, Cramlington, uses a Baird receiver fed by a rotatable dipole at 9m a.g.l. and despite his camping activities and working overtime, he managed to log television pictures from Czechoslovakia, Hungary and the USSR on Ch. R1, Austria on Ch. E2 and Norway, Spain and Sweden on Ch. E3 during August.

Wenlock Burton, Melbourne, Australia, says that their amateur TV transmitters are generally between 10 and 15 watts and are designed and supplied by a local amateur.

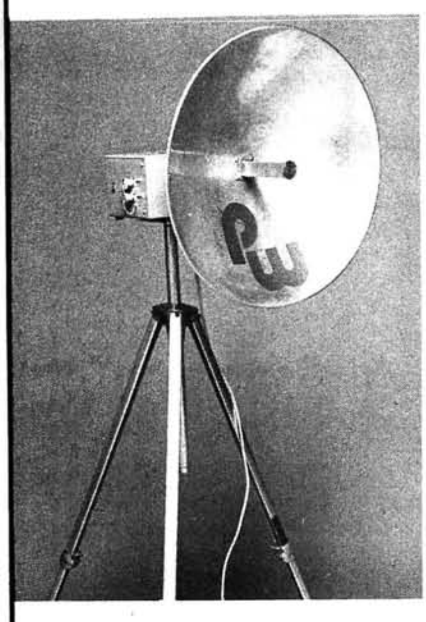
Fig. 13: George Garden's u.h.f. antenna

"We were able to watch the Royal Wedding on 4 out of 5 of our local channels" writes Wenlock and adds that their new Ethnic Service operates in Band I on Ch. 0 46·25MHz and on Ch. 28 u.h.f. and is available on the same channels in Sydney.

George Garden, a keen u.h.f. DXer, directs his 46 element Jaybeam antenna toward the east coast through a window of his 5th floor flat, Fig. 13, in Bracknell and feeds the signal to a Labgear pre-amplifier and then to a 20in ITT colour receiver. When conditions are good, George can receive signals from ATV's Waltham transmitter on Ch. 61, a distance of about 145km, Fig. 5, which is not possible under normal conditions. George, who normally watches the IBA from London and Southern Television, enjoys many of ATV's programmes and during a lift will often use his National Panasonic video recorder and replay the pictures later, Fig. 6, or photograph them with his Kodak Retinette 1B camera. Last November, George received pictures from Belgium, Holland and Germany and when he wants to see pictures from his native Scotland, he takes his big antenna and a Sanyo 10in colour portable to a spot near his home, some 427m a.s.l. and tunes to STV. During one of these expeditions he received pictures from HTV and Mendip.

My two station changes proved very worthwhile during the 1981 sporadic-E season. First came a new set of antennas, Fig. 11, forced on me by a March gale and then the addition of a Sanyo 9300PN video recorder, Fig. 12, to the DXTV equipment. Although the Antiference MH311 antenna usually points toward the east, the rotator is used especially when signals are coming from Iceland, Ireland or Scandinavia. The single coaxial feeder from the antenna is connected to an Antiference XS3 wideband distributor which in turn feeds a R216 v.h.f. communications receiver, a JVC 3060 multiband TV receiver and the video recorder. The general layout of the Sanyo recorder met my requirements because all its main controls are on the front panel which allows the machine to stand on a high shelf. It has two outputs, one via Ch. 35 on a standard u.h.f. receiver and the other for a video monitor which means the recorder, especially with each of its 8 station selectors tuning through Bands I, III and V, can be used as a super front end for TVDX. Normally I keep the buttons tuned to Chs. E2, R1, R2, E5, E10 and our local BBC 1, 2 and Southern Television. The machine really proved its worth on the occasions when the DX was coming thick and fast because it could be left recording on one channel, say R1, while the DX on other channels could be seen on another receiver. The video tape can be played back later and photographs taken as required, Fig. 7.

PW EXE PARABOLIC DISH OFFER



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

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

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

All enquiries and orders to the Editorial offices at Poole.

INDEX

Volume 57
JANUARY TO DECEMBER 1981

COMMENT

CONSTRUCTIONAL—General

CONSTRUCTIONAL—Receiving

CONSTRUCTIONAL—Transmitting

CONSTRUCTIONAL—Test Equipment

IC of the MONTH by B. Dance

ON THE AIR

GENERAL INTEREST

KINDLY NOTE

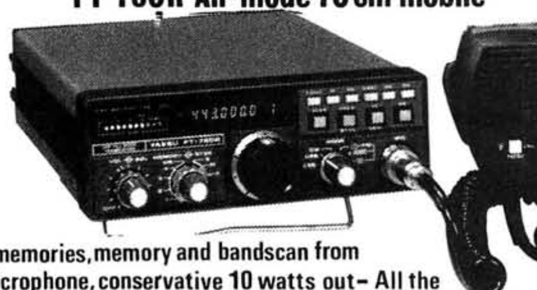
Points arising from articles in previous volumes

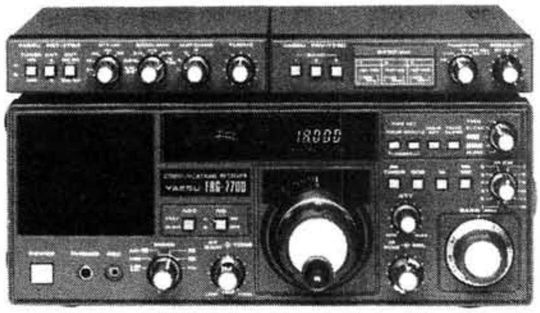
PRODUCTION LINES by Alan Martin

MISCELLANEOUS

SHOW REPORTS

SUPPLEMENT etc





Sinclair ZX81 Personal Comp
the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.

New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification
- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

JMI

FOR A LIMITED PERIOD ONLY

cut the cost of high precision multimeters

SAVE £5

MAIH Analogue Multimeter
Normal Price: £33.35

Special Discount Price:
£27.60 (inc leads, Vat and postage/packing)

Analogue multimeter pivoted movement and easily read mirror scale.
Input impedance 20K 0/V D.C.
DCV 9 ranges up to 1000V
ACV 6 ranges up to 500V
DCA 6 ranges up to 5A
ACA 5 ranges up to 5A
Resistance 4 ranges up to 1 MΩ
Capacitance can also be measured from 2-200,000uF.
Carrying Case: £5.18 inc Vat

SAVE £8

MAID
Digital Multimeter
Normal Price: £63.25

Special Discount Price:
£54.05 (inc. leads, carrying case, Vat, Postage/Packing)

Digital multimeter Large LCD display.
Input impedance 10MΩ.
AC and DCV 5 ranges up to 650V
AC and DCA 4 ranges up to 2A
Resistance 5 ranges up to 20MΩ

OR ORDER BOTH & SAVE £15
ONLY £79.35 (inc Vat)

Full service back-up and money-back guarantee.

From one of Europe's leading electrical groups, now available in the U.K. from JMI.

John Minister Instruments Ltd., 137/139 Sandgate Road, Folkestone, Kent CT20 2DE.

JMI JOHN MINISTER INSTRUMENTS LTD
137/139 SANDGATE ROAD, FOLKESTONE, KENT CT20 2DE
Telephones (STD) 0303 41598/54002 Telex 965418

Name ______________________
Address ______________________
____
____

Please supply:
☐ MAIH Analogue Multimeter ☐ with carrying case.
☐ MAID Digital Multimeter inc carrying case.

Cheque/Postal Order for £ ______________

U.H.F. RECEIVER TYPE R278 designed by Collins Radio used as ground station Rx provides up to 1750 channels spaced in 100Kc steps in freq. range 225 to 400 Mc/s any 10 of these can be selected from front panel plus one service channel, unit is triple conversion with some 38 crystals, no ext crystals are required, all controls etc are on front panel for use on 230v 50c, AF O/P 600 ohm 2 watts. Also provision for remote chan selection, 19" rack mounting unit about 50Kg supplied with circ & manual. **£87.**

MARCONI AIRCRAFT H.F. Rx high grade 6 band Rx covers 150/510Kc in two bands & 2 to 18.5 Mc/s in 4 bands uses 11 min valves with 2x RF, BFO, Xtal Cal, AF O/P for low imp phones, reqs 28v DC supply, as high resolution film scale for the 4 HF bands, compact unit weight 10 Kg supplied with circ. **£75.**

COMMUNICATIONS Rx made by Murphy Radio for RN covers 60/560Kx in two bands & 1.5 to 30Mc/s in 3 bands uses 13 miniature valves with 2x RF, 3x IFs at 800Kc, BFO, Xtal Cal etc Swt Selectivity of 8, 3, 1 Kc & 200c/s, AF O/P for 100 ohm phones or 2 watts into 600 ohm, in case size 13×14×14" supplied tested with handbook, note these require ext supplies of 250v HT 100 Ma 150v Stab & 6.3v AC at 4 amps. **£115.**

PAN & TILT HEADS HD type for outdoor use for 240v mains give 360' pan & ±45' tilt fixing by 6" dia ring possible use as Aerial or Dish mounts **£35.**

RADIOSONDE UNIT TYPE 11 older type unit as 3 valves, AF Osc, Mod & RF Osc at 27Mc/s (reqs 90v ht & 2v lt) as 3 var freq osc in range 600/1000c/s for Temp. Press & RH these are selected in turn by swt unit and are used to mod the RF from Tx. Supplied in new cond with chart & circ. **£6.50** also have a few M.60 R/S at **£12.50.**

RECEIVER UNIT part of Army 128 Set tunes 2 to 8 Mc/s in two bands 4x min valves plus BFO in case size 8×5×4" req 135v & 1.5v O/P for HR phones with circ. **£15.** Batteries **£4.50,** 2 for **£8.**

Above prices include Carr/Postage & VAT.
Goods ex equipment unless stated new, SAE with enquiry or 2 × 14p stamps for list 27.

A. H. SUPPLIES

122, Handsworth Rd., SHEFFIELD S9 4AE.
Phone 444278 (0742).

VALVES

V.A.T. INCLUDED

ECH42	1.20
ECH81	0.70
ECH84	0.80
ECL80	0.70
ECL82	0.75
ECL83	1.40
ECL85	0.80
ECL86	0.90
EF37A	2.15
EF39	1.80
EF80	0.85
EF83	1.75
EF85	0.60
EF80	0.75
EF89	1.05
EF91	1.50
EF92	2.90
EF95	0.65
EF96	0.60
EF183	0.80
EF184	0.80
EF804	4.95
EF812	0.75
EFL200	1.85
EH90	0.85
EL32	1.10
EL34	1.80
	2.90*
EL37	4.40
EL81	2.45
EL82	0.70
EL84	0.80
EL86	0.95
EL90	1.00
EL91	4.20
EL95	0.80
EL504	1.70
EL803	5.90
EL509	2.70
EL802	1.70
EL821	8.20
EL822	9.95
EM31	1.60
EM80	0.85
EM81	0.85
EM84	0.85
EM87	1.30
EY51	0.95
EY81	0.65
EY86/87	0.60
EY88	0.65
EZ80	0.70
EZ81	0.70
GM4	5.90
GY501	1.30
GZ32	1.05
GZ33	4.20
GZ34	2.75

GZ37	3.95
KT66	6.30
	9.20*
KT88	8.95
	13.80*
MH4	2.50
ML6	2.50
MX10/01	21.50
N78	9.90
OA2	0.70
OB2	0.80
PABC80	0.60
PC85	0.75
PC86	0.95
PC88	0.95
PC97	1.50
PC900	1.15
PCC84	0.50
PCC89	0.85
PCC189	1.05
PCF80	0.80
PCF82	0.70
PCF84	0.75
PCF86	1.50
PCF87	0.50
PCF200	1.60
PCF201	1.65
PCF800	0.50
PCF801	1.75
PCF802	0.85
PCF805	2.45
PCF806	1.20
PCF808	2.75
PCH200	1.35
PCL81	0.75
PCL82	0.95
PCL84	0.90
PCL86	1.05
PCL805/85	1.25
PD500/510	4.30
PFL200	1.10
	2.80*
PL36	1.25
PL81	0.85
PL82	0.70
PL83	0.60
PL84	0.95
PL504	1.45
PL508	1.95
PL509	2.90
PL519	3.20
PL802	3.20
PY33	0.70
PY80	0.70
PY81/800	0.85
PY82	0.65
PY83	0.80
PY88	0.85

PY500	1.70
PY809	6.45
PY801	0.80
QQV03/10	2.85
QQV03–20A	14.40
QQV03-25A	21.20
QQV06/40A	16.10
QV03-12	4.20
SC1/400	4.50
SC1/600	4.50
SP61	1.80
TT21	16.50
U25	1.15
U26	1.15
U27	1.15
U191	0.85
U281	0.70
U301	0.65
U600	11.50
U801	0.90
UBC41	1.20
UABC80	0.75
UAF42	1.20
UBF80	0.70
UBF89	0.70
UBL21	1.75
UCC84	0.85
UCC85	0.70
UCF80	1.30
UCH42	1.65
UCH81	0.75
UCL82	0.95
UF41	1.35
UF80	0.95
UF85	0.95
UL41	2.30
UL84	0.95
UM80	0.90
UM84	0.70
UY82	0.70
UY85	0.85
VR105/30	1.25
VR150/30	1.35
X66	0.95
X61M	1.70
XR1–6400A	82.90
Z759	19.00
Z749	0.75
Z800U	3.45
Z801U	3.75
Z803U	16.00
Z900T	2.45
1A3	0.85
1L4	0.50
1R5	0.60
1S4	0.45
1S5	0.45
1T4	0.45
1U4	0.80
1X28	1.40

2D21	1.10
	1.85*
2K25	11.90
2X2	1.15
3A4	0.70
3AT2	2.40
3D6	0.50
3D22	23.00
3E29	19.00
3S4	0.60
4B32	18.25
5B/254M	16.90
5B/255M	14.50
5B/258M	12.50
5C22	29.90
5R4GY	1.80
5U4G	0.75
5V4G	0.75
5Y3GT	0.80
5Z3	1.50
5Z4G	0.75
5Z4GT	1.05
6/30L2	0.90
6AB7	0.70
6AC7	1.15
6AG5	0.60
6AH6	1.15
6AL5	0.60
6AL5W	0.85
6AK5	0.65
6AK8	0.60
6AL5	4.20
6AM6	1.50
6AN8A	2.50
6AQ4	3.40
6AQ5	1.00
6AQ5W	1.80
6AS6	1.15
6AT6	0.90
6AU6	0.60
6AV6	0.85
6AX4GT	1.30
6AX5GT	1.30
6BA6	0.55
6BE6	0.60
6BG6G	1.60
6BJ6	1.30
6BQ7A	0.85
6BR7	4.80
6BW6	6.20
6BW7	0.90
6C4	0.50
6C6	0.55
6CH6	8.20
6CL6	1.70
6CX8	3.80
6CY5	1.15
6D6	0.70
6EA8	3.20
6F6	1.60
6F6G8	1.10
6F7	2.80
6F8G	0.85
6F12	1.50

6F14	1.15
6F15	1.30
6F17	1.15
6F23	0.75
6F24	1.75
6F33	10.50
6FH8	4.20
6GA8	0.90
6GH8A	0.95
6H6	1.60
6J4	1.35
6J4WA	2.00
6J5	2.30
6J5GT	0.90
6J6	0.65
6J6W	0.90
6JE6C	2.95
6JS6C	2.95
6K7	0.80
6L6M	2.80
6L6G	2.50
6L6GC	2.10
6L6GT	1.25
6L7G	0.65
6L18	0.70
6LQ6	2.95
6LD20	0.70
6KG6A	2.70
6Q7G	1.30
6SA7	1.00
6SG7	1.15
6SJ7	1.05
6SK7	0.95
6SL7GT	0.85
6SN7GT	0.80
6SR7	1.10
6SQ7	0.95
6V6G	1.50
6V6GT	0.95
6X4	0.75
6X4WA	2.10
6X5GT	0.65
6Y6G	0.90
6Z4	0.70
7B7	1.75
7Y4	1.25
9D2	0.70
9D6	2.90
10C2	0.85
10F18	0.70
10P13	1.50
11E2	19.50
12A6	0.70
12AT6	0.70
12AT7	0.65
12AU7	0.80
12AV6	0.95
12AX7	0.65
12BA6	0.90
12BE6	1.25
12BH7	1.10
12C8	0.65
12E1	18.95
12J5GT	0.55

12K7GT	0.70
12K8GT	0.80
12Q7GT	0.60
12SC7	0.65
12SH7	0.65
12SJ7	0.70
12SQ7	1.45
12SQ7GT	0.85
12Y4	0.70
13D3	0.70
13D5	0.90
13D6	0.80
14S7	1.15
19AQ5	0.85
19G3	11.50
19G6	8.50
19H5	39.55
20D1	0.80
20F2	0.85
20E1	1.30
20P1	0.65
20P3	0.75
20P4	1.25
20P5	1.35
25L6GT	0.95
25Z4G	0.75
30C15	0.50
30C17	0.50
30C18	2.45
30F5	1.15
30FL2	1.40
30FL12	1.25
30FL14	2.15
30L15	1.10
30L17	1.10
30P12	1.15
30PL13	1.25
30PL14	2.45
35L6GT	1.40
35W4	0.80
35Z4GT	0.80
40KD6	3.15
50C5	1.15
50CD6G	1.35
75B1	1.25
75C1	1.70
76	0.95
78	0.95
80	1.70
85A2	1.40
	2.55*
723A/B	11.90
807	1.25
813	14.80
829B	14.00
832A	8.90
866A	3.80
866E	6.25
931A	13.80
954	0.60
955	0.70
956	0.60
957	1.05
1625	1.80

1629	1.85
2051	2.90
5763	4.20
5842	7.50
5881	3.40
5933	6.90
6057	2.20
6060	1.95
6064	2.30
6065	3.20
6067	2.30
6080	5.30
6146	4.95
6146B	5.20
6360	2.85
6550	6.60
6870	14.00
8552	8.20
6973	3.30
7199	2.85
3BP1	11.00
5FP7	18.00
4EP1	32.00
88J	14.00
88L	14.00
CV1526	16.00
DG7-32	34.80
DG7-36	36.00
DPM9-11	38.40
D13-33GM	41.80
IC	
SN5402N	0.28
SN5410F	0.32
SN5470F	0.48
SN54196J	1.20
SN7407N	0.29
SN7408N	0.18
SN7445P	0.85
SN74453P	1.10
SN7453N	0.18
SN74L73N	0.38
SN7474N	0.30
SN7485N	0.95
SN74L85N	1.10
SN7491AN	0.32
SN74123N	0.42
DM74123N	0.38
SN15836N	0.26
SN76013N	1.80
SN76003N	1.60
SN76033N	1.95
MC6800P	8.20
MC68B00P	9.80
MC14511BA1	2.95
B1702AL	4.30
MM6300-1J	3.80
MCM6810AP	3.40
6340-1J	3.60
MIC945-50	0.28
MIC936-50	0.22

*SPECIAL QUALITY

VALVES and transistors

Telephone enquiries for valves, transistors, etc: retail 749 3934, trade and export 743 0899.

POSTAGE: £1-£3 45p; £3-£5 55p; £5-£10 60p; £10-£15 75p; £15-£20 90p; over £20 free.

PRICES MAY VARY

COLOMOR 907/3530 London
(ELECTRONICS) LTD.
170 Goldhawk Rd., London W.12

Tel. 01-743 3934
Open Monday to Friday 9-1 pm, 2.00-5.30 pm.

When replying to Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.
(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
(D) That your letter is correctly addressed to the advertiser.

This will assist advertisers in processing and despatching orders with the minimum of delay.

Receivers and Components

BRAND NEW COMPONENTS BY RETURN

HIGH STABILITY RESISTORS.
¼W Carbon Film E12 Series 1R-10M. (E24 2R-6M2)—**1p**
½W, ⅓W & 1W Metal Film E12 Series 10R-2M2—**2p**
METAL FILM ¼w 1% E12 series 10R to 1M0—**3p**
CAPACITORS.
MULLARD Min. Ceramic E12 100V 2% 1.8pf. to 47pf.—**3p**
2% 56pf. to 330pf.—**4p.** 10% 390pf. to 4700pf.—**4p**
Plate Ceramic 50V Wkg. Vertical Mounting.
E12 22pf. to 1000pf. & E6 1K5pf. to 47Kpf.—**2p**
Miniature Polyester 250V Wkg. Vertical Mounting.
.01, .015, .022, .033, .047 & 068 mfds.—**4p**
0.1—**5p.** 0.15 & 0.22—**6p.** 0.33 & 0.47—**8p**
0.68—**11p.** 1.0—**15p.** 1.5—**20p.** 2.2—**22p**
ELECTROLYTIC. Wire Ended (Mfds/Volts).

0.47/50	5p	22/25	6p	100/25	7p	470/25	11p
1.0/50	5p	22/50	6p	100/50	8p	470/40	16p
2.2/50	5p	47/16	6p	220/16	8p	1000/15	15p
4.7/50	5p	47/25	6p	220/25	8p	1000/25	18p
10/50	5p	47/50	6p	220/50	10p	1000/40	35p
22/16	6p	100/16	7p	470/16	11p	2200/16	20p

TANTALUM BEAD SUBMINIATURE ELECTROLYTICS.
0.1, 0.22, 0.47, 1.0, 2.2 @ 35V & 4.7 @ 6.3V—**14p**
4.7/16V & 25V—**15p.** 10/16 & 22/6—**20p.** 10/25—**29p**
10/35V, 22/16V, 47/6.3V, 68/3V & 100/3V—**30p**
15/25, 22/25, 47/10—**35p.** 47/16—**80p.** 220/16—**£1.20**
Polystyrene 63V Wkg. E12 Series Long Axial Wires.
10 pf. to 820 pf.—**3p.** 1000 pf. to 10,000pf.—**4p**
TRANSISTORS.

BC107/8/9	10p	BC182L	8p	BF197	10p
BC147/8/9	10p	BC184L	8p	BFY50/51/52	18p
BC157/8/9	10p	BC212L	8p	BFX88	25p
BC547C/8C/9C	7p	BCY70	15p	2N2926	7p
BC557C/8C/9C	7p	BF195	10p	2N3055	50p

8 Pin D.I.L. i.c's 741 Op/amp.—**18p.** 555 Timer—**24p**
Holders 8 Pin—**9p.** 14 Pin—**12p.** 16 Pin—**14p.** 18 Pin—**16p.** 28 Pin—**25p.** 40 Pin—**30p.**
DIODES (p.i.v./amps).

75/25mA	1N4148	2p	1250/1A	BY127	10p
100/1A	1N4002	4p	400/3A	1N5404	14p
800/1A	1N4006	6p	60/1.5A	S1M1	5p
1000/1A	1N4007	7p	30/150mA	AAY32	12p

ZENER DIODES.
E24 Series 3V3 to 33V 400mW—**8p.** 1W—**14p**
L.E.D.'s 3 mm. & 5 mm. Red—**10p.** Green, Yellow—**14p**
Grommets for 3 mm.—**1½p.** Holders for 5 mm.—**2p**
FUSES. 20 mm. Glass. 100mA to 5A. Q.B.—**3p.** A/S.—**5p**
VOLTAGE REGULATORS+. 5V, 8V, 12V, 15V 100mA.—**35p**
5V, 8V, 12V, 15V, 18V & 24V 0.5A—**60p.** 1A—**65p**
PRESET POTENTIOMETERS
50mW & ¼W 100R to 1M0—**7p.**
PAIRS BATTERY SNAPS PP3—**5p.** PP9—**10p**

THE C. R. SUPPLY CO.
127, Chesterfield Road, Sheffield S8 0RN.
V.A.T. Inclusive Prices, Postage 15p
(FREE over £5.00)

AUTOMATIC MORSE DECODER – Low cost, easy build 9v circuit. Accepts audio input or practice key. Gives continuous readout on 12 character alphanumeric display. Send £3.95 plus large S.A.E. for fully detailed 17 page construction data. Parts and p.c.b. available. MacRitchie (Micros), 100 Drakies Avenue, Inverness IV2 3SD.

SMALL ADS

The prepaid rate for classified advertisements is 32 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £10.70 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance should be sent to the Classified Advertisement Manager, Practical Wireless, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

Whilst prices of goods shown in advertisements are correct at the time of closing for press, readers are advised to check with the advertiser both prices and availability of goods before ordering from non-current issues of the magazine.

BOURNEMOUTH/BOSCOMBE. Electronic components specialists for 33 years. Forresters (National Radio Supplies) late Holdenhurst Rd. now at 36, Ashley Rd., Boscombe. Tel. 302204. Closed Weds.

BALLARD'S OF TUNBRIDGE WELLS have moved to 54 Grosvenor Road, no lists. S.A.E. all enquiries phone Tunbridge Wells 31803.

VALVES

Radio – T.V. – Industrial – Transmitting
Projector Lamps and Semiconductors

We Dispatch Valves to all parts of the world by return of post, Air or Sea mail, 6000 Types in stock, 1930 to 1976. Obsolete types a speciality. List 60p. Quotations S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves, Projector Lamps and Semiconductors.

COX RADIO (SUSSEX) LTD.
Dept. P.W. The Parade, East Wittering,
Sussex PO20 8BN
West Wittering 2023 (STD Code 024366)

VHF CONVERTOR. 45-220MHz. 28-30MHz tuneable IF OP. Highly sensitive unit. £8 inc. p.p. 50-300MHz type £9.50. Sae data, TVDX lists: H. Cocks, Cripps Corner, Robertsbridge, Sussex. Tel. 058083-317.

Southern Valve Co.,
2nd Floor, 6 Potters Road, New Barnet, Herts.

Tel: 01-440 8641 for current prices & availability, all popular valves stocked. SAE Lists. Cash with order. Same Day Postal Despatch. Telephone afternoons preferred. Not Thursday.

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter or MAIL ORDER. NO COD. Speedy Despatch assured. No order under £1.
Philip Bearman, 6 Potters Road, New Barnet, Herts.
Tel: 01-449 1934/5 (1934 Recording Machine).
Closed Thursday. Telephone for Shop Hours.

MEMORIES 2716 (TMS 2516) Special Offer £3.50. Red LED's 10p + 50p P&P. S.A.E. for lists. T.H.D. Electronics, 90 Longford, Yate, Bristol.

CRYSTALS Brand new high-precision. You benefit from very large stocks held for industrial supplies. All normal freq standards, baud rates, MPU, and all magazine projects inc: HC33/U: 1·0, **£3·75**, 2·5625 MHz, **£3·50**. HC18/U: 4·0, 5·0, 6·0, 7·0, 8·0, 9·0, 10·0, 10·7, 12·0, 15·0, 16·0, 18·0, 20·0, 38·6667 MHz, **£3·35**. Selected freqs stocked in Glider, Marine and 27 MHz bands. Any freq made to order in 8 weeks from **£4·10**. 2-3 week service available.
FILTERS Your best source for 6 and 8 pole and monolithics for AM, CW, SSB, FM, on 455 kHz, 1·6, 9·0, 10·7, 21·4 MHz, etc.
Prices inc. VAT and UK post. SAE lists.

P. R. GOLLEDGE ELECTRONICS
G3EDW, Merriott, Somerset, TA16 5NS.
Tel: 0460 73718

CRYSTALS MADE TO ORDER within 6 weeks. 4-105MHz, wires or pins. £3.90 each inclusive. Hartley Crystals, Green Lane, Milford, Godalming, Surrey GU8 5BG.

WE REPAIR/RESTORE valve type communication receivers with a one year guarantee. For a free quote telephone Corby 61697. Vintage British Radio Components Co., 22 Thurso Walk, Corby, Northants.

Record Accessories

STYLI for Music Centres etc. Free list for S.A.E., includes other accessories. FELSTEAD ELECTRONICS, Longley Lane, Gatley, Cheadle, Cheshire SK8 4EE.

Books and Publications

OUT OF PRINT BOOK SERVICE. 17 Fairwater Grove (E), Cardiff. Send S.a.e. for details.

WORLD RADIO TV HANDBOOK. The world-famous guide to broadcasting schedules, indispensable for serious listeners – £10.49 or state Access/Visa number. Pointsea Research, 25 Westgate, North Berwick, East Lothian.

Aerials

COPPER AERIAL WIRE 14swg hard drawn 70' £5.34. 140' £8.84 inc. VAT. Postage £1.75 T.M.P. Electronics, Supplies, Britannia Stores, Leeswood, Nr. Mold. N. Wales.

G2DYM ANTI-INTERFERENCE
ANTI-TVI TRAP DIPOLES
TRANSMITTING & S.W.L. MODELS
Data Sheets Large SAE. Aerial Guide 50p.
Indoor and Invisible Aerials **£3.50.**
Callers welcome Tel: 03986-215
G2DYM, Uplowman, Tiverton, Devon.

Services

OSCILLOSCOPE repair and calibration. Quick service, competitive rates. W.I.R. Electronics 01-367-6816.

Christmas Gifts

IDEAL XMAS GIFT. FM Radio – Air, TV, CB Receiver. Only £15. FOREMAN'S, 31, Watling Street, Bexleyheath, Kent. Despatched by Return Post.

Courses

COURSES – RADIO AMATEURS EXAMINATION. City and Guilds. Pass this important examination and obtain your licence, with any RRC Home Study Course. For details of this and other courses (GCE, professional examinations, etc.) write or phone – **THE RAPID RESULTS COLLEGE,** DEPT JX1, Tuition House, London SW19 4DS. Tel: 01-947 7272 (9am–5pm) or use our 24 hr Recordacall Service: 01-946 1102 quoting Dept. JX1.

DATONG MORSE TUTOR £5.75 for first month. Keep it longer if you like. Send £20 deposit (or Access/Visa number) to Pointsea Research, 25 Westgate, North Berwick, East Lothian.

PLEASE MENTION PRACTICAL WIRELESS WHEN REPLYING TO ADVERTISEMENTS

Educational

CAREERS in Marine Electronics, Courses commencing September and January. Further details, The Nautical College, Fleetwood FY7 8JS. Tel. 03917 79123.

TELEVISION COMPUTER RADIOCOMMUNICATIONS & RADAR SERVICING

TWO YEAR full-time Modular Diploma course to include a high percentage of practical work.

- ELECTRONIC PRINCIPLES
- MONO TV & CCTV
- COLOUR TV & VCR
- MICROELECTRONICS & DIGITAL TECHNIQUES
- MICROPROCESSORS & COMPUTERS
- RADIOCOMMUNICATIONS & RADAR

Each of the above Modules are 13 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.

Tuition fees (UK & Overseas) £1575 per year (i.e. £525 per Module).

Next session starts January 4th.

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept: PP, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.

Wanted

ELECTRONIC COMPONENTS PURCHASED. All types considered – Must be new. Send detailed list – Offer by return – WALTONS, 55A Worcester Street, Wolverhampton.

RADIO AND TELEVISION ENGINEER requires work anywhere. Also experienced in audio work, holds City and Guilds. Box No. 155.

WANTED. Early model transistorised Sony Model TV990VB in any condition. Telephone 01-242-3732.

Service Sheets

G.T. TECHNICAL INFORMATION SERVICE
76 CHURCH ST., LARKHALL, LANARKS.

Any full size service sheet – still only £1 + s.a.e.

Thousands of different sheets & manuals in stock (many of these only obtainable from us)

Repair data your named T.V. £6 (with circuits £8)

Domestic Equipment, exploded diags, circs, etc. in 2 huge binders £26.50

S.A.E. for free newsletter, price lists, any quotation, bargain offers, unique T.V. publications. 2 big catalogues list thousands service sheets/manuals plus £4 vouchers for **£2** + large s.a.e. Complete British Colour TV circuits, etc. in 3 huge binders only **£39.50.**

Phone: 0698 883334 anytime. Callers 4–6 pm weekdays, Sat. after 10.

30,000 SERVICE SHEETS IN STOCK
COLOUR MANUALS ALSO AVAILABLE

TV Monos, Radios **£1.25** – Tuners **£1.25** – Tape Recorders, Record Players, Transistors **from £1.25** – Car Radio **£2.00** + S.A.E. – Stereograms, Radiograms **from £1.25** – Also Colour available. – State, if circuit will do, if sheets are not in stock. All TV sheets are full length 24 × 12", not in Bits & Pieces. All other Data full lengths. Free Fault Finding Chart or TV Catalogue with order. Crossed P.O.s returned, if sheets not in stock. S.A.E. please.

£2 OLD Valve Radio

C. CARANNA
71, Beaufort Park, London NW11 6BX
01-458 4882 (Mail Order)

SERVICE SHEETS, Radio, TV etc., 10,000 models. Catalogue 25p, plus S.A.E. with orders, enquiries, TELRAY, 5 Henderson Street, Preston PR1 7XP.

BELL'S TELEVISION SERVICES for Service Sheets on Radio, TV etc. £1.00 plus S.A.E. Colour TV Service Manuals on request. S.A.E. with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel. (0423) 55885.

SERVICE SHEETS, Radio, Television, Stereo, etc., from 50p. Catalogue 25p. S.A.E. with orders, enquiries. Hamiltons, 47 Bohemia Road, St. Leonards, Sussex.

For Sale

NEW BACK ISSUES OF "PRACTICAL WIRELESS" available 90p each, post free. Cheque or uncrossed P/O returned if not in stock – BELL'S TELEVISION SERVICE, 190 Kings Road, Harrogate, N. Yorks. Tel. (0423) 55885.

The proprietors of British Trade Marks Nos. 858291 for

JOYMATCH

in respect of radio apparatus and parts thereof and 839458 for

JOYSTICK

in respect of wireless aerials, invite offers for their purchase. JOYMATCH and JOYSTICK are also registered in Australia, Canada, West Germany, New Zealand, South Africa, Sweden and U.S.A. These registrations are similarly available for purchase.

Please reply to Box No. 156.

ICOM 255E, excellent condition, complete & boxed £170.00. Ring Baggett, Bournemouth 420666.

SIGNAL GENERATOR. Grundig transistorized 10Hz to 100KHz £25.00 + £2.50 p+p. Ring Ardglass (0396) 841631.

R1155 WWII RAF RECEIVER V&C internal PSU sound output. Offers. 82 Motherwell Road, Hatlepool, Cleveland.

F.D.K. MULTI-700E 2m FM TRANSCEIVER in brand new condition £150.00 o.n.o. Phone Weybridge (0932) 40966.

Miscellaneous

SUPERB INSTRUMENT CASES by Bazelli, manufactured from P.V.C. Faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range. Competitive prices start at a low £1.05. Chassis punching facilities at very competitive prices. 400 models to choose from. Suppliers only to Industry and the Trade. BAZELLI, (Dept No. 25), St. Wilfrid's, Foundry Lane, Halton, Lancaster LA1 6LT.

MORSE CODE TUITION AIDS

Cassette A: 1-12 w.p.m. for amateur radio examination.
Cassette B: 12-25 w.p.m. for professional examination preparation. Each cassette is type C90.
Morse Key and Buzzer unit for sending practice.
Price each Cassette (including booklets) **£4·75.** Morse Key and Buzzer **£4·75.**
Prices include postage etc. Overseas Airmail £1·50 extra.
MHEL ELECTRONICS (Dept 2), 12 Longshore Way, Milton, Portsmouth PO4 8LS.

QSL CARDS £5.00 P/P S.A.E. 6 × 4" for samples. McLelland, 42, Lancaster Road, Marsh Green, Wigan, Lancs. Tel. 217087.

ADVERTISERS PLEASE NOTE

Our Box Number Service is **NOT** available for Mail-Order Advertising

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Practical Electronics for..............................

insertions. I enclose Cheque/P.O. for £..............................

(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Electronics).

NAME..............................

ADDRESS..............................

....

Send to: Classified Advertisement Manager
PRACTICAL WIRELESS
Classified Advertisements Dept., Room 2337
King's Reach Tower, Stamford Street,
London SE1 9LS. **Telephone 01-261 5846**
Rate:
32p per word, minimum 12 words. Box No. **60p** extra.

Company registered in England. Registered No. 53626. Registered Office: King's Reach Tower, Stamford Street, London SE1 9LS.

Miscellaneous Continued

CENTURION BURGLAR ALARM EQUIPMENT. Send SAE for list or a cheque/PO for £11.50 for our Special Offer of a full sized signwritten Bell Cover, to Centurion, Dept. PW, 265 Wakefield Road, Huddersfield, W. Yorkshire. Access & Barclaycard, Telephone orders on 0484-35527.

ALUMINIUM TUBES FOR AERIALS. Various sizes available. Nerva Metals. 01-904 4647.

THE SCIENTIFIC WIRE COMPANY

PO Box 30, London E.4
Telephone 01 531 1568

ENAMELLED COPPER WIRE

SWG	1 lb	8 oz	4 oz	2 oz
8 to 29	2.76	1.50	0.80	0.60
30 to 34	3.20	1.80	0.90	0.70
35 to 39	3.40	2.00	1.10	0.80
40 to 43	4.75	2.60	2.00	1.42
44 to 47	5.90	3.40	2.39	2.00
48 to 49	15.96	9.58	6.38	3.69
SILVER PLATED COPPER WIRE				
14 to 30	6.50	3.75	2.20	1.40
TINNED COPPER WIRE				
14 to 30	3.85	2.36	1.34	0.90

Prices incl. P&P and VAT. Orders under £2 add 20p.
SAE for list of Copper/Resistance Wire.
Dealer enquiries welcome.
Reg. Office 22, Coningsby Gardens.

C.W.A.S. ALARM. Send now for the latest discount catalogue of Professional Burglar Alarm Equipment. C.W.A.S. Alarm, 11 Denbrook Walk, Bradford BD4 0QS, W. Yorks. Phone 0274 682674.

TELEPHONE ANSWERING MACHINE. Build your own for under £10 plus any cassette recorder. Send £3 for circuit and plans. S. D. Cross, 24 Thorney Road, Streetly, Sutton Coldfield, West Midlands.

ICOM TRIO/KENWOOD OWNERS. Very informative separate newsletters. Details S.A.S.E. G3RKC QTHR.

PARAPHYSICS JOURNAL (Russian Translations): Psychotronic Generators, Kirlianography, Gravity Lazers, Telekinesis. Details: SAE 4+9" Paralab, Downton, Wilts.

UK AIRCRAFT FREQUENCIES LIST including spot frequencies of airports, air traffic control services, weather reports, navigation beacons, etc. £1. UK MARINE FREQUENCIES LIST including spot frequencies of coast stations, (plus broadcast times) port operations, navigation beacons, etc. £1. INTERNATIONAL DISTRESS FREQUENCIES CHART 75p. prices include postage, same day despatch. PLH ELECTRONICS, 20, Vallis Road, Frome, Somerset. BA11 3EH.

TIME WRONG?

MSF CLOCK is ALWAYS CORRECT – never gains or loses, SELF SETTING at switch-on, 8 digits show Date, Hours, Minutes and Seconds, auto GMT/BST and leap year, also parallel BCD output, receives Rugby 60KHz atomic time signals, built-in antenna, 1000Km range, GET the TIME RIGHT, only **£62.80.**
LOSING DX UNDER QRM? DIG it OUT with a Tunable Audio Notch Filter, between your receiver and speaker, BOOST your DX/QRM ratio. 40dB notch, near WEAK DX, **£13.80.**
V.L.F.? EXPLORE 10-150KHz, Receiver **£16.50.**
SIG. GEN., 10Hz-200KHz, logic and 0-1V sine and square wave outputs, rf harmonics, **£16.80.**
LINEAR OKAY? Two Tone Oscillator **£12.90.**
LONG WAVE DX? 100-600KHz Converter to 4.1-4.6MHz, built-in ATU, **£15.90.**
60KHZ RUGBY RECEIVER, as in MSF Clock, serial data and audio outputs, **£17.90.**
Each fun-to-build kit includes all parts, printed circuit, case, instructions, postage etc, money back assurance so GET yours NOW.

CAMBRIDGE KITS
45 (PZ) Old School Lane, Milton, Cambridge.

ELECTRONIC KITS. Largest range of kits in the U.K. Everything from stroboscopic lights to transmitters, at unbeatable prices. Send S.A.E. for free catalogue to: Eastling Electronics (Kits), 64B Hawthorne Road, Winton, Bournemouth.

PRE-PACKED. Screws, nuts, washer, solder tags studding. Send for price list. A1 Sales (PW), P.O. Box 402, London SW6 6LU.

WAVEGUIDE, FLANGES & DISHES. All standard sizes & alloys stock. Special sizes to order. Call Earth Stations, 01-228 7876. 22, Howie Street, London SW11 4AR.

ZX81 MORSE CODE PROGRAM. Send Morse from your ZX81 keyboard. Cassette £2.95. Sullivan, 80 Rectory Road, Redditch B97 4LL.

HART KITS

WINTON TUNER
Complete designer approved kits (including pre-aligned AM front end) will be available from us for this excellent design. Phone or write for your free copy of lists.

WINTON AMPLIFIER
We have taken over the supply of kits for this high performance 'PW' design. Size and appearance match above tuner. Reprints of all articles describing design **85p** VAT and post free.

VFL 910 VERTICAL FRONT LOADING CASSETTE DECK
Very high quality cassette mechanism as used in our Linsley Hood cassette recorder kit. Wow and flutter .09%. Memory counter. Sendust alloy head. 12V DC. Frequency generating feedback servo motor. Oil damped eject. **£31.99** + VAT.

SF925 FRONT LOADING SOLENOID CONTROL CASSETTE DECK
Having full solenoid control of all functions this deck has numerous uses, most obvious is microcomputer drive, particularly since there is a facility to read the tape in the fast modes. Deck is full hi fi quality and is fitted with memory counter, Hall IC for auto stop and stereo R/P head. Price only **£38.90** + VAT.

HART TRIPLE E PURPOSE TEST CASSETTE TC 1
Sets up tape speed, head azimuth and VU level all without test instruments. Fantastic value at only **£2.70** + VAT.

CASSETTE HEADS
We hold large stocks of cassette heads ranging from mono to 4 track for domestic and industrial use including the fabulous HS16 sendust alloy super head at **£8.20** + VAT. Remember your tape machine is only as good as its head. A worn head will lose the high frequency information on the tape and a very worn head will chew up the tape as well. Full technical spec of all heads is in our lists.

Write or phone for your copy of our free lists.

HART ELECTRONIC KITS LTD
Penylan Mill,
Oswestry, Shropshire SY10 9AF.
Tel: 0691 2894
Telex: 35661 HARTEL G.

PCBs FOR PRACTICAL WIRELESS PROJECTS

Jan. 79	Sandbank Metal Detector	R035	£3.81
Mar. 79	Soundlite Converter	WK001	£6.63
Jan. 80	A F Speech Processor	WR068	£2.68
Jan. 80	Wide Band RF Pre Amp	WR067	£1.00
June 80	Nimbus Base Station Adpt	WR083	£2.90
Aug. 80	Model Railway Converter	WR085	£2.47
Sept. 80	Transceiver Power Unit	WR095	£1.00
Sept. 80	Beginners 2 Meter Converter	WAD634	£1.38
Feb. 81	PW Morse Tutor	WR081	£3.70
Feb. 81	Tape Slide Controller	Set of 3	£7.50
Mar. 81	Active Antenna	WAD784	£1.20
April 81	PW Helford 6V Stabiliser	WAD804	£1.00
April 81	Boat Engine Hours Counter	WAD788	£2.70
May 81	PW Stour	WAD834	£2.90
June 81	Car Audio Amp	WAD847	£1.35
July 81	Auto Cut-Out Power Supply	WAD853	£1.90
July 81	Stour	WR123	£4.40
July 81	Stour	WR124	£4.40
July 81	Stour	WAD830	£2.75
July 81	Stour	WR125	£5.50
Aug. 81	Exe. Micro Wave Transceiver	WR126	£3.90

Full range of RS components available.
Please phone for quote.
Please note our new address:
C. BOWES ELECTRONICS LTD.,
28 Stockport Road, Cheadle, Cheshire
Tel: 061-491 1644 ext. 5.
PLEASE SEND CASH WITH ORDER.

"Rubber Duck to Logi Baird, say good buddy, where do I get transistors and I.C's for C.B. and R.F. applications?"

"ANGLIA of course!! they are the UK's leading supplier of Motorola & Japanese types"

ANGLIA COMPONENTS
BURDETT ROAD WISBECH CAMBS PE13 2PS
Telephone 0945 63281 Telex 32630

DEACs

VARTA BUTTONS
(1·24V PER CELL)

VAT included
P+P 70p per order
RECHARGEABLE BATTERIES.

Size/Cell	225mA DKZ 25mm dia×9mm	600mA DKZ 34½mm dia×10mm
4·8V Pack	£3·20	£5·55
6·0V Pack	—	£6·94
9·6V Pack	—	£11·10

CYLINDRICAL NICADS HP7 Size (500mAh) £1·00; HP11 (1800mAh) £2·35; HP2 (4000mAh) £3·20; PP3 £4·00; PP3 Charger £5·00; 1 to 4 HP7 nicads charger £7·45.

CONSTANT CURRENT CHARGER – Switched 9mA/25mA/50mA/120mA/200mA/400mA output – charges 1 to 12 nicads – £14·95.

V & F SMALLCRAFT (POPLAR) LTD
38, STONELEIGH ROAD, CLAYHALL, ILFORD, ESSEX IG5 0JD
Tel: 01-550-6642
LIMITED TRADE DISCOUNTS POSSIBLE ON DEACs.

INDEX TO ADVERTISERS

ILP TOROIDALS UNBEATABLE VALUE FOR MONEY!

New production capacity at Canterbury has increased our range, decreased our prices, improved our special customer design service. Choose from toroidal transformers in a range of 98 types.

Order using the FREEPOST coupon below.

Trade enquiries are welcome.

Supplied with rigid mounting kit with centre bolt, steel and neoprene washers. GUARANTEED 5 YEARS

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE inc VAT	PRICE ex VAT
30 VA 70 × 30mm 0 45 Kg Regulation 18%	1X010	6 + 6	2 50	£5 28 + 0 87p P/P	£4 48 + 0 87p P/P
	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 × 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		
	2X028	110	0 45		
	2X029	220	0 22		
	2X030	240	0 20		
80 VA 90 × 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 × 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 × 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 × 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 × 45mm 2 2 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 × 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 × 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		
	9X025	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 × 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		

IMPORTANT: Regulation — All voltages quoted are FULL LOAD. Please add regulation figure to secondary voltage to obtain off load voltage.

The benefits of ILP toroidal transformers

ILP toroidal transformers are only half the weight and height of their laminated equivalents, and are available with 110V, 220V or 240V primaries coded as follows:

For 110V primary insert "0" in place of "X" in type number.

For 220V primary (Europe) insert "1" in place of "X" in type number.

For 240V primary (UK) insert "2" in place of "X" in type number.

How to order Freepost:

Use this coupon, or a separate sheet of paper, to order these products, or any products from other ILP Electronics advertisements. No stamp is needed if you address to Freepost. Cheques and postal orders must be crossed and payable to ILP Electronics Ltd: cash **must** be registered. C.O.D. — add £1 to total order value. Access and Barclaycard welcome. All UK orders sent post free within 7 days of receipt of order for single and small quantity orders.

Also available at Electrovalve, Maplin, Marshalls, Technomatic and Watford Electronics

ILP Electronics Ltd., Graham Bell House, Roper Close, Canterbury, Kent. CT2 7EP.

Please send me the following ILP modules ______

Total purchase price ______

I enclose Cheque ☐ Postal Orders ☐ Int. Money Order ☐

Please debit my Access / Barclaycard No ______

Name ______

Address ______

Signature ______

Post to ILP Electronics Ltd, Freepost 2, Graham Bell House, Roper Close, Canterbury CT2 7EP, Kent, England

Telephone (0227) 54778 Technical (0227) 64723 Telex 965780

ILP TRANSFORMERS (a division of ILP Electronics Ltd)

STAY AHEAD. STAY WITH US

MARCO TRADING

WATCH OUT – Limited stocks only: LED push button watches. Supplied in robust box. This five function watch is supplied complete with batteries. Two type of strap either metal or soft leather style leather style. THESE WATCHES ARE BRAND NEW AND IN NO WAY SUBSTANDARD.

Supplied with metal strap: **£3.50** Including VAT and carriage.
£3.00 Including VAT and carriage.

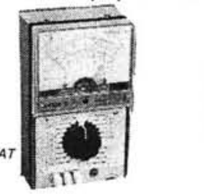
DEVELOPMENT PACKS: These famous resistor packs are now available in two sizes: Carbon film 5% resistors, every value individually packed in a clearly labelled bag. 10 of every value in the E24 range between the values stated:

¼ Watt Pack: 10 ohm to 1 Meg (610 resistors) **£5.00 per pack + VAT**

½ Watt Pack: 10 ohm to 2M2 (650 resistors) **£6.00 per pack + VAT**

MULTIMETER SPECIAL Russian type U4324 (Advertised elsewhere in this magazine for over £15.00 each recently).

d.c. Voltage: 0.6, 1.2, 3, 12, 30, 60, 120, 600, 1200.
a.c. Voltage: 3,6, 15, 60, 150, 300, 600, 900.
d.c. intensity m/a: 0.06, 0.6, 6, 60, 600, 3000.
a.c. intensity m/a: 0.3, 3, 30, 300, 3000.
d.c. resistance: 0.2, 5, 50, 500, 5000. kOhm.
g.e. level dB: −10 to + 12.



FANTASTIC SPECIAL PRICE: **£12.00** *including P/P and VAT*

TRANSFORMERS

British made transformers at very attractive prices.

Primary	Secondary	Current	1+	10+	100+
240v:	4.5-0-4.5v	400m/a	**50p**	**45p**	**35p**
240v:	6-0-6v	100m/a	**58p**	**52p**	**43p**
240v:	6-0-6v	500m/a	**65p**	**60p**	**48p**
240v:	9-0-9v	200m/a	**75p**	**70p**	**58p**

Manufacturers note: We can supply FROM STOCK, 1000+ quantities of the above transformers and adaptors below.

EUROPEAN ADAPTORS

These very high quality British made two pin European adaptors are ideal for driving Radios, cassette recorders, TV games, calculators etc. The adaptors fit the UK shaver socket.

REF.	D.C. Voltage	Current	1+	10+	100+
EO8	4.5V	200m/a	50p	45p	32p
EM3	6V	200m/a	£1.00	80p	55p
EO9	6V	400m/a	£1.50	£1.25	85p
ET4	9V	150m/a	£1.50	£1.25	85p

Please note that there is no extra P/P charge on the above transformers & adaptors.
Export please add Sea/Air mail at cost.
Callers welcome Mon-Fri 9-5.

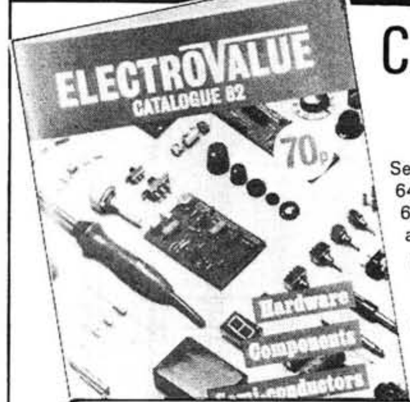
This advert is only a fraction of our range, send 25p for our latest catalogue. Please add 35p P/P to all orders. (Free over £5.00). Add 15% VAT to total. Send orders to:

Dept. PW10, MARCO TRADING,
The Old School, Edstaston, WEM, Shropshire SY4 5RJ.

Special Offer Test Equipment Catalogue available upon request. Send S.A.E. or Telephone.

All orders despatched by return of mail. **Tel: (094872) 464/465.**

ELECTROVALUE



CATALOGUE 82

Send 70p for your copy now – 64 pages (A4). More than 6000 stock items from nuts and bolts to complete computer systems. With it we include a Reclaim Voucher value 70p for spending towards orders value £10 or more.

FROM CATALOGUE 82, PAGE 19

SABTRONICS

DIGITAL TEST EQUIPMENT

2015A	$3\frac{1}{2}$ digit LCD (Bench) DMM	**£108.75 (N)**
2035A	$3\frac{1}{2}$ digit LCD (Hand) DMM	**£95.45 (N)**
8110A	8 digit 100MHz DFM	**£95.45 (N)**
8610A	8 digit 600MHz DFM	**£114.85 (N)**
5020A	1-200KHz Function Generator	**£98.90 (N)**

RANGE OF ACCESSORIES ALSO AVAILABLE

ELECTROVALUE LTD. Dept. PE12, 28 St Judes Rd., Englefield Green, Egham, Surrey TW20 0HB.
Phone: Egham 33603 (STD 0784; London 87) Telex 264475.
Northern Branch: 680 Burnage Lane, Burnage, Manchester M19 1NA. Telephone 061-432 4945.

Published on approximately the 7th of each month by IPC Magazines Limited, Westover House, West Quay Road, POOLE, Dorset BH15 1JG. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand – Gordon and Gotch (Asia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions INLAND and OVERSEAS £13·00 payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any ... literary or pictorial matter whatsoever.

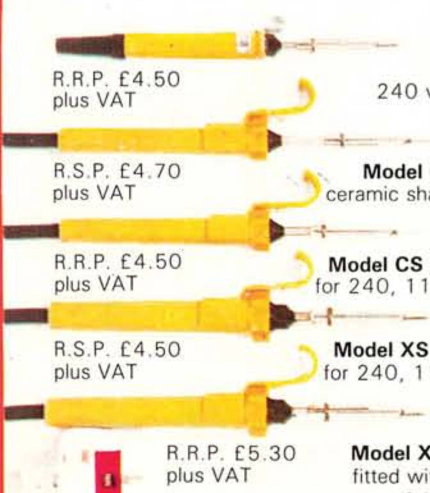
We've actually done it!

Improved on Antex Soldering Irons

Made them tougher, lighter, better for getting into tight corners.

Re-designed the hook to double up as a finger protector and made it detachable.

Of course we kept the Antex efficiency, low leakage and energy saving features. Bits that slide on and off and cover the elements and that superb insulation with a ceramic shaft inside the stainless steel one.



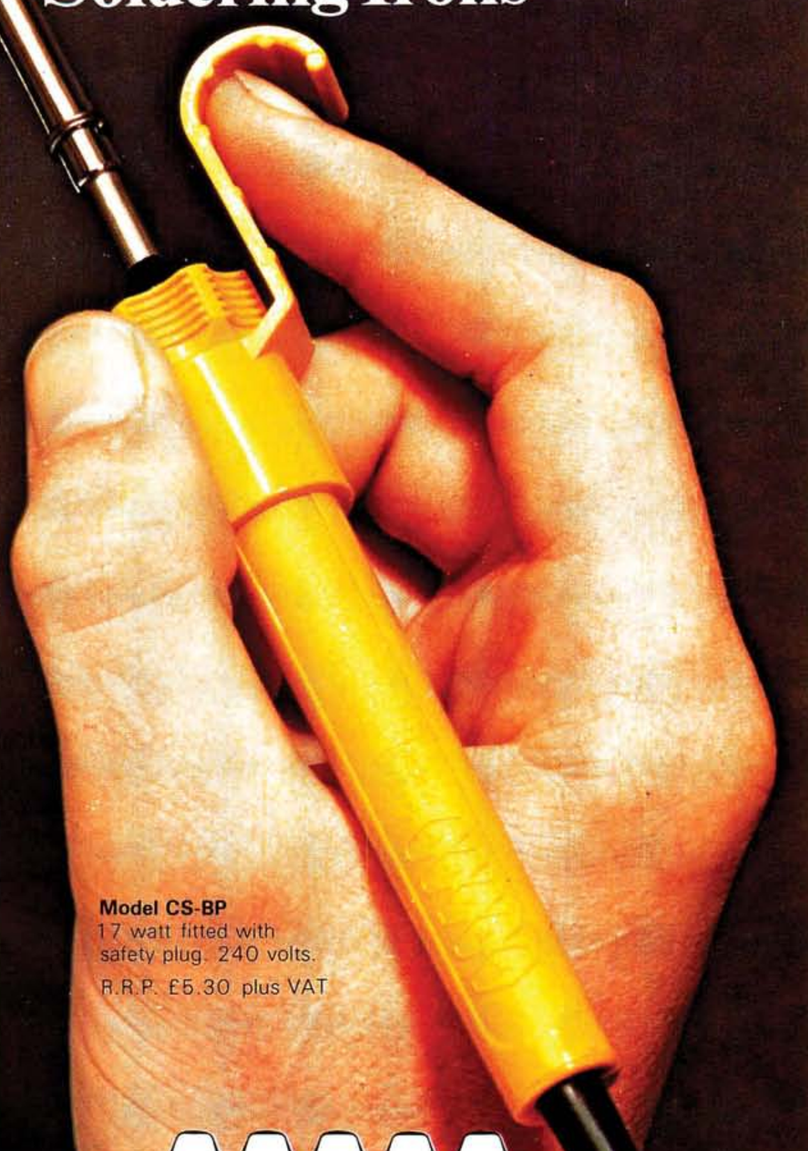
R.R.P. £4.50 plus VAT — **Model C** 15 watt stainless steel shaft only. 240 volts and 110 volts

R.S.P. £4.70 plus VAT — **Model CCN** 15 watt ceramic shaft only. 240 volts.

R.R.P. £4.50 plus VAT — **Model CS** 17 watt available for 240, 110, 24 or 12 volts.

R.S.P. £4.50 plus VAT — **Model XS** 25 watt available for 240, 110, 24 or 12 volts

R.R.P. £5.30 plus VAT — **Model XS-BP** 25 watt fitted with safety plug. 240 volts.



Model CS-BP
17 watt fitted with safety plug. 240 volts.
R.R.P. £5.30 plus VAT

Model TCSU1 Soldering Station
to control the temperature of 24 volt Antex 40 watt XTC or 30 watt CTC miniature irons.

Tip temperature can be set anywhere between 65° and 420°C — 2% accuracy R.R.P. £38.00 plus VAT (complete with either XTC or CTC iron)

The **ANTEX XTC** and **CTC** 24 volt irons fitted with temperature sensors, transparent handles and LED indicators.
R.R.P. £9.75 plus VAT

ANTEX

MADE IN ENGLAND

ANTEX (Electronics) Ltd.,
Mayflower House, Plymouth, Devon.
Tel: (0752) 667377 Telex: 45296

Our products are widely distributed by wholesalers and retailers throughout the UK. Please try your local dealer.

Please send literature and price list to:

Name ....

Address ....

.... Telephone ....

PW 12

MAPLIN make it easy...

in SOUTHEND
284 London Road
Westcliff-on-Sea
Essex
Tel: (0702) 554000
(Closed Mondays)

in HAMMERSMITH
159-161 King Street
Hammersmith
London W6
Tel: 01-748 0926
(Closed Mondays)

For personal service visit one of our stores.
Our new store at Hammersmith is conveniently situated near the end of the M4 and the North and South Circular Roads.
There is excellent street parking on meters a few steps away and Hammersmith Underground Station is nearby. Call in and see us soon.

in our CATALOGUE
320 big pages packed with data and pictures of over 5,500 items

Over 100,000 copies sold already!
Don't miss out on your copy.
On sale now in all branches
WH Smith price £1.
In case of difficulty check the coupon below.

by MAIL ORDER
A fast service
You can rely on

- ✲ Same day service on in-stock lines
- ✲ Very large percentage of our stock lines in stock
- ✲ All prices include VAT
- ✲ Large range of all the most useful components
- ✲ First class reply paid envelope with every order
- ✲ Quality components—no rejects—no re-marks
- ✲ Competitive prices
- ✲ Your money is safe with a reputable company

On price, service, stock, quality and security it makes sense now more than ever to make MAPLIN your first choice for components every time!

make it easy... with MAPLIN

The Maplin Matinée
Amazing value for only £299.95 plus £99.50 for cabinet if required
(Carriage Extra)

Easy to build ....
selling for up to £1,000.
Send for our new book giving full construction details. Order as XH55K.
Price £2.50 inclusive.

Post this coupon now.
Please send me a copy of your 320 page catalogue. I enclose £1.25 (incl. 25p p&p). If I am not completely satisfied I may return the catalogue to you and have my money refunded. If you live outside the U.K. send £1.68 or 12 International Reply Coupons.

Name ____________________

Address ____________________

PW/12/81

MAPLIN ELECTRONIC SUPPLIES LTD.

All mail to: **P.O. Box 3, Rayleigh, Essex SS6 8LR. Tel: Southend (0702) 554155 Sales: (0702) 552911**