MARCH 1984 90p

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Practical Wireless

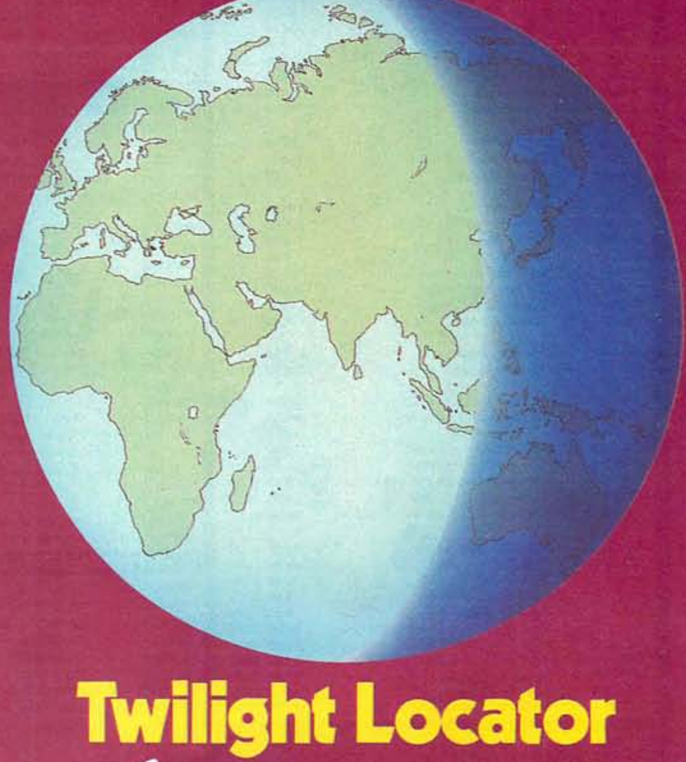
THE RADIO MAGAZINE

INSIDE

SPECIAL PULL-OUT FEATURE

PW RADIO DATA

part 1-"abbreviations"



Twilight Locator

PLUS Top-Band Direction Finding

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FT708	70cm H/Held	209.00	(—)
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FRG7700M	As above with memory	385.00	(—)
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FRA7700	Active Aerial for above	38.[illegible]	(1.00)
FRV7700A	Converter 118-150MHz	78.95	(2.00)
FRV7700B	Converter 50-60MHz & 118-150MHz	[illegible].70	(2.00)
FRV7700C	Converter 140-170MHz	74.75	(2.00)
FRV7700D	Converter 70-80MHz & 118-150MHz	80.90	(2.00)
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SB2	PTT Switch Box 290/790	12.65	(0.75)
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DATONG PRODUCTS

		£	c&p
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VLF	Very low frequency conv.	29.90	(1.00)
FL2	Multi-mode audio filter	89.70	(1.00)
FL3	Audio filter for receivers	129.00	(1.00)
ASP/B	r.f. speech clipper for Trio	82.80	(1.00)
ASP/A	r.f. speech clipper for Yaesu	82.80	(1.00)
ASP	As above with 8 pin conn	89.70	(1.00)
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D70	Morse Tutor	56.35	(1.00)
MK	Keyboard morse sender	137.40	(1.00)
RFA	RF switched pre-amp	33.90	(1.00)
AD270-MPU	Active dipole with mains p.s.u.	51.75	(2.00)
AD370-MPU	Active dipole with mains p.s.u.	69.00	(2.00)
MPU	Mains power unit	6.90	(1.00)
DC144/28	2m converter	39.67	(1.00)
PTS1	Tone squelch unit	46.00	(1.00)
ANF	Automatic notch filter	67.85	(1.00)
SRB2	Auto Woodpecker blanker	86.25	(1.00)

ICOM

		£	c&p
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IC751	HF Transceiver	969.00	(—)
IC745	HF Transceiver	759.00	(—)
IC730	Mobile HF Transceiver	P.O.A.	(—)
PS15	P.S. Unit	119.00	(4.00)
PS30	System Power Supply	228.85	(—)
SM6	Base microphone for 751/745	29.00	(1.00)
IC290H	2m 25w M/Mode	433.00	(—)
IC271E	2m 25w M/Mode Base Stn.	569.00	(—)
IC25H	2m 45w FM	329.00	(—)
IC45E	70c 10w FM	289.00	(—)
ICBU1	B/U Supply for 25/45/290	20.00	(1.00)
ICR70	General Coverage Receiver	499.00	(—)
IC02E	New 2m H/Held	229.00	(—)
IC2E	2m H/Held	P.O.A.	(—)
ML1	2m 10w Linear	64.00	(2.00)
IC4E	70cm H/Held	199.00	(—)
BC30	Base Charger	49.00	(—)
HM9	Speaker mic	15.00	(0.75)
IC3	Carry Base	4.25	(0.75)
ICBP3	Std Battery Pack	23.00	(0.75)
BP5	High Power Battery Pack	44.00	(0.75)
CP1	Car Charging Lead	4.49	(0.75)
DC1	12v Adaptor	11.99	(0.75)

LINEAR AMPS

TOKYO HY POWER

		£	c&p
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HL 82V	2m inc preamp (2-12W in 35-85 + out)	144.50	(2.00)
HL 160V	2m inc preamp (1-10W in 160W + out)	242.40	(2.00)
HL 45U	70cm inc preamp (2-15W in 10-45W out)	119.75	(2.00)

MICROWAVE MODULES

		£	c&p
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MML144/50-S	inc preamp, switchable	92.00	(2.00)
ML144/100-S	inc preamp (10w i/p)	149.95	(2.50)
MML144/100-HS	inc preamp (25w i/p)	149.95	(2.50)
MML144/100-LS	inc preamp (1/3w i/p)	169.95	(2.50)
MML432/30L	inc preamp (1/3w i/p)	129.95	(2.00)
MML432/50	inc preamp (10w i/p)	129.95	(2.00)
MML432/100	linear (10w i/p)	245.00	(2.50)

B.N.O.S.

		£	c&p
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LPM 144/10-100	(10 watt input) inc preamp	149.50	(2.00)
LPM 144/25-160	(25 watt input) inc preamp	189.50	(2.00)
LPM 144/10-180	(10 watt input) inc preamp	212.50	(2.50)

TONO

		£	c&p
MR 100	2m (10w in 90w out) inc preamp	129.00	(2.00)
MR 150	2m (10w in 120w out) inc preamp	169.00	(2.00)

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HANSEN

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FS210	1.8-150MHz 20/200 Auto SWR	55.20	(1.00)
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FS500H	1.8-80MHz 20/200/2000W Pep	69.75	(1.00)
FS7	145 & 432MHz 5/20/200	41.00	(1.00)
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SP300	1.8-500MHz PWR/SWR	106.00	(1.00)
SP350	1.8-500MHz PWR/SWR	65.00	(1.00)
SP400	130-500MHz PWR/SWR	75.00	(1.00)
SP600	1.8-500MHz PWR/SWR	106.00	(1.00)

TOYO

		£	c&p
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T435	144/432 200 W	39.10	(1.00)

YAESU

		£	c&p
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YS2000	1.8 60MHz	69.79	(1.00)

STATION ACCESSORIES

MUTEK PRODUCTS

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SLNA 144s	144MHz Low noise switched preamp	37.10	(1.20)
SLAN 145sb	Preamp intended for 290	27.40	(1.20)
TLNA 432s	70cm Switched preamp	74.90	(1.20)
RPCB 144ub	Front end FT221/225	71.00	(1.20)
RPCB 251ub	Front end IC251/211	76.90	(1.20)
BBA 500u	20-500MHz Preamp	29.00	(1.20)
GFBA 144e	2m Mast head preamp	129.90	(2.50)
SBLA 144e	2m Mast head preamp	79.90	(2.50)
RPCB 271ub	Front end for IC271	79.90	(1.20)

POWER SUPPLIES

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4 amp	30.75	(2.00)	6 amp	48.30	(2.50)
6 amp	49.00	(2.50)	12 amp	86.40	(3.00)
12 amp	74.00	(3.00)	24 amp	125.00	(4.00)
24 amp	105.00	(4.00)	40 amp	225.00	(4.00)

CW/RTTY EQUIPMENT

		£	c&p
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Telereader CWR610E		189.00	(2.00)
MM2001	RTTY to TV converter	189.00	(1.25)
MM4000	RTTY terminal	269.00	(1.25)
MM4001KB	RTTY term with keyboard	299.00	(2.00)

HI-MOUND MORSE KEYS

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HK704	Up down keyer	16.68	(1.00)
HK705	Up down keyer	12.50	(1.00)
HK706	Up down keyer	13.75	(1.00)
HK708	Up down keyer	11.96	(1.00)
MK704	Twin paddle keyer	10.95	(1.00)
MK705	Twin paddle keyer marble base	22.00	(1.00)

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Sigma	2 way 'n' Skts	12.95	(.075)
Welz	2 way SO239	19.50	(0.75)
Welz	2 way 'n' Skts	34.50	(0.75)
Drae	3 way SO239	15.40	(0.75)

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KR400	Med/H Duty	90.85	(2.50)
KR500	6 core Elevation	112.12	(2.50)
KR400RC	6 core Medium Duty	114.94	(2.50)
CD45	8 core Heavy Duty	136.85	(2.50)
KR600RC	8 core Heavy Duty	163.30	(3.00)
HAM1V	8 core Heavier Duty	258.75	(4.00)
T2X	8 core Very Heavy Duty	327.75	(4.00)

MISC.

		£	c&p
DRAE	Wavemeter	27.50	(1.00)
T30	30W Dummy load	6.61	(0.50)
T100	100W Dummy load	20.12	(1.00)
T200	200W Dummy load	31.36	(1.50)
CT300	300W Dummy load	49.50	(2.00)
GT4	Digital World Time Clock	49.95	(2.00)

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Practical Wireless

FOR THE Radio ENTHUSIAST ...

MARCH 1984 VOL. 60 NO. 3 ISSUE 924

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in glasgow,

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in darlington,

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Lowe Electronics in the North East of England, set in the delightful market town of Darlington, the shop displays the full range of amateur products sold by the company. Our address in the town is 56 North Road, that is the A167 Durham road out of Darlington. Open Tuesday to Friday from 9am till 5.30pm, Saturday from 9am till 5pm (closed for lunch 12.30 to 1.30). A huge free car park across the road, a large supermarket, bistro restaurant and banking facilities combine to make a visit to this delightful market town a pleasure for the whole family.

in london,

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Lowe Electronics in London, our shop in the Capital City, easily found on the lower sales floor of the Hepworths' shop on Pentonville Road, within 3 minutes walk of Kings Cross railway station. Open all day Monday to Saturday, six days a week, from 9.30am to 5.30pm during the week and from 9.30am to 5pm on Saturday, a warm and courteous welcome, together with sound advice awaits those who enter. The entire range of amateur products is on display, backed by a considerable amount of stock. When in the City, visit Lowe Electronics.

We cannot seem to keep the TR9130 in an "in stock" situation. No sooner has a shipment arrived than we are "out of stock". I must say that even I am surprised by its popularity. Based on the renowned TR9000, the TR9130 has additional features that make it the most popular multimode on today's market. We are still getting requests for second-hand TR9000's and even they are a rarity on our second-hand shelf. Having a clear green readout, reverse repeater, the ability to tune whilst transmitting, 25 watts output, 6 memories and of course memory scan: TRIO's two metre multimode, the TR9130.

TR9130

TR9130 **£442.52 inc. VAT.** carriage £6.00

There are two schools of thought regarding two metre mobile FM equipment. One group are of the opinion that the simpler the rig the better and refer to the TRIO TR7500 as the ultimate mobile transceiver ever made. There are others who require their mobile rig to have memory channels and all associated facilities in order to gain operational flexibility. TRIO cater for both.

The TM201A and the TM401A are simple rigs, designed to fit into the smallest of today's cars and provide the simple functions that make mobile operation a pleasure. Repeater shift and lockable reverse repeater are included as well as superb receive performance. 25 watts from the 2 metre TM201A and 12.5 watts from its 70 centimetre cousin, the TM401A, ensures a strong transmitted signal. A separate 77 mm (3 inch) speakers in a solid enclosure gives high quality receive audio even whilst mobile.

TM201

TM201A .... **£269.00 inc VAT.** carriage £6.00
TM401A .... **£299.00 inc VAT.** carriage £6.00

A remote controller with a green backlit LCD frequency readout is also available as an optional accessory. The FC10 simply plugs into the side of the transceiver and comes complete with mounting bracket and velcro pads to ease fixing without drilling holes in the car's dashboard.

TW4000A

FC10 .... **£41.20 inc VAT.** carriage £6.00

For a mobile transceiver having more operating features the TR7930 is the model to choose. The TR7930 is TRIO's logical progression from the very popular and reliable TR7800. The design of the TR7930 takes into account the minor and justifiable criticisms levelled against the TR7800. You will now find the frequency readout is a green backlit liquid crystal display that can be read in the brightest of sunlight. The memory allocation has been increased to a total of 21 channels and the rig can be instructed to hold on the received signal for either a timed period or until the signal disappears. Programmable band scan is also available between user defined limits. To make mobile operation safer the transceiver is preprogrammed so that if you select for example, 145.450 then the rig will adopt the simplex mode, if you select 145.650 then, automatically, *you will* get repeater mode. Of course TRIO have made it easy to over-ride this feature as you would naturally expect. I can say no more about the TR7930, a comprehensive rig for the mobile enthusiast.

TR7930 .... **£312.00 inc VAT.** carriage £6.00

To improve mobile operation there is the TRIO MC55 boom microphone. Not jut an electret condenser microphone but having a transmission timer, up/down frequency shift switch, adjustable microphone gain and fitted with either a 6 or 8 pin microphone plug. To monitor the swr/output power of your mobile installation TRIO have produced the SWR100A/B. (model A: 1.8 to 150 MHz and model B: 140 to 450 MHz) Compact and easily fixed to your dashboard, be the first to know something is wrong with your mobile station.

MC55 .... **£38.64 inc VAT.** carriage £2.00
SW100A/B .... **£37.26 inc VAT.** carriage £2.50

LOWE IN LONDON, Open monday to saturday, six days a week
lower sales floor, Hepworths, Pentonville Rd, London. telephone 01.837.6702
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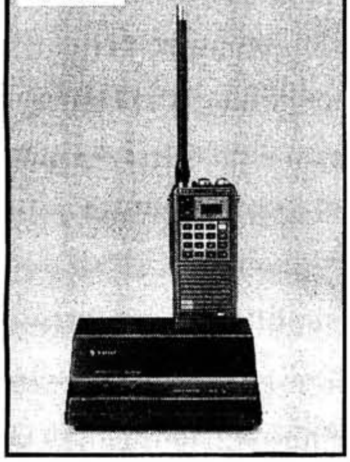
For the real VHF/UHF enthusiast there is only one FM mobile rig that in one compact unit has both 2 metres and 70 centimetres. The TRIO TW4000A. Not a cheap piece of equipment, the TW4000A has to be seen to be appreciated. Having many features to assist mobile operation the TW4000A also speaks. Unless you have actually operated the rig with the optional VS1 voice synthesizer fitted, then you cannot really make a considered judgement. It is easy to say that such a feature is a gimmick but I, on my journeys up and down the country, have found that having the frequency, memory number etc announced in clear distinct voice is much better than stealing a glance at the display. A recent review in AMATEUR RADIO magazine (December 1983) tells more.

TW4000A .... **£469.00 inc VAT.** carriage £6.00
VS1 .... **£24.50 inc VAT.** carriage £0.75

(in fact the VS1 is not a voice synthesizer, it is the digitally recorded voice of a Japanese girl programmed into a dedicated chip, her Japanese diction can be had as an alternative by moving an internal switch on the VS1 board from position EN to JA.)

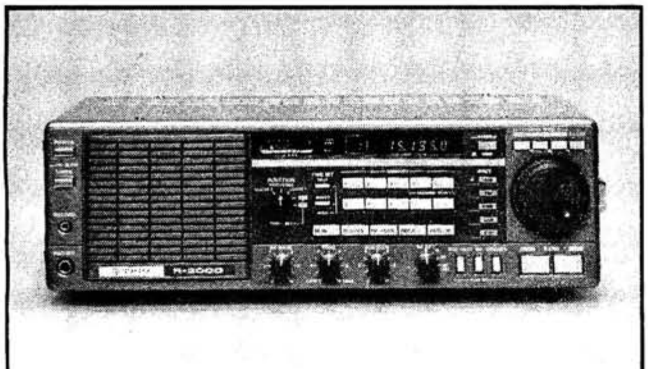
Don't let us forget the two handhelds from TRIO, the 2 metre TR2500 and the 70 centimetre TR3500. Both very popular pieces of equipment. Reliable and functional. Each having ten memories, memory scan, programmable scan, repeater and reverse repeater shift and a comprehensive range of accessories compatible to both models.

TR2500



TR2500 .... **£237.82 inc VAT.** carriage £6.00
TR3500 .... **£256.45 inc VAT.** carriage £6.00

Two general coverage receivers are available from TRIO, the R600 and the R2000. The R600 is the basic model and covers continuously frequencies from 150 KHz to 30 MHz having AM, CW and SSB modes. The R2000 is more sophisticated having the same coverage but FM in addition to the usual modes found on a high quality general coverage receiver. Ten memories, memory scan, programmable band scan between user defined limits all add to the enjoyment to be had from a TRIO R2000. To create the perfect receiver an optional VHF converter covering again continuously 118 to 174 MHz and fitting inside the receiver is available. The nice thing about the VHF converter is that the frequency readout of the R2000 is also corrected so that if you are tuned to 145.600 then that is what the readout displays.



R2000

R600 .... **£263.00 inc VAT.** carriage £6.00
R2000 .... **£421.20 inc VAT.** carriage £6.00
VC10 .... **£113.00 inc VAT.** carriage £6.00

HF equipment from TRIO provides you with a choice, solid state or valve. The NEW TS530SP from TRIO is the choice for those who require a rig that will give them world wide communication without frills. The TS830S has a receiver with variable band width and a transmitter having an RF speech processor. Both the TS530SP and the TS830S use a pair of the well known 6146B valves. There are also the four solid state rigs. The TS130 V and S amateur bands only, 25 watts and 200 watts PEP respectively, the TS430S covering the amateur bands and also being a general coverage receiver and the "FLAGSHIP" of the range, the incomparable TS930S, a piece of equipment whose specification and performance are well known.

TS430S

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TS530SP

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The items are too numerous to list, full details and prices can be obtained from any LOWE ELECTRONICS shop.

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★ The **LOWE TX40 CB transceiver** is now well known on the band. Many have bought other rigs, only to be dissatisfied. They have then heard about the **TX40** from their friends, bought one and been delighted. The rig performs as a well designed rig should. And for those who think otherwise, the CB frequencies are now populated by operators having pleasant contacts. The band has come of age. The **LOWE TX40** has been available for some time now for the sum of £29.50 inc VAT, carriage £3.00.

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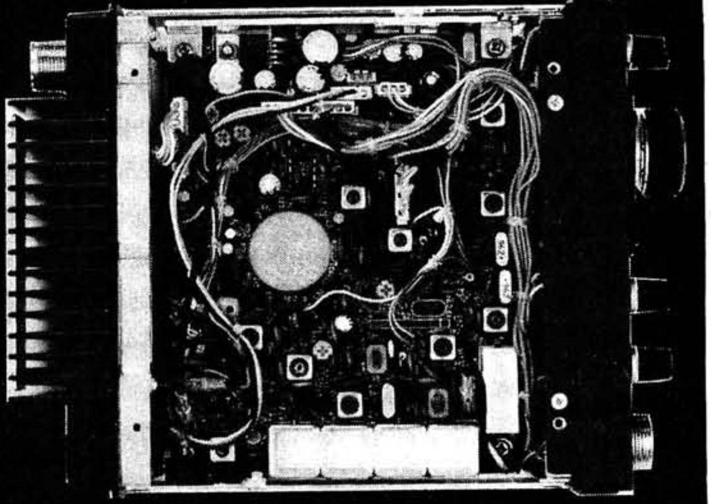

IC-271E/471E, £569/£659. VHF Multimode Base Stations

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IC-290D/490E, £433/£459. VHF Multimode Mobiles

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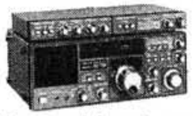

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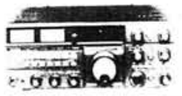

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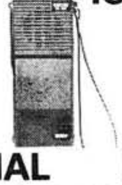

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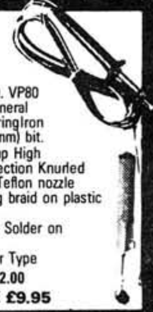

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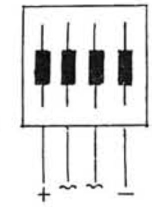

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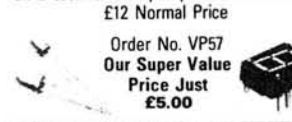

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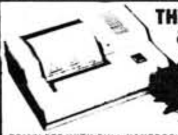

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BT approved ready assembled unit with data and accessories. **£39.95** inc. VAT

CHERRY ADD-ON KEYPAD

16 button pad non-encoded **£5.95**

SANYO DM2112 HIGH RESOLUTION MONITOR

SAVE £20 TO £30

12" green display: Composite video: 1280 characters: Over 15 MHZ B/W: 240V AC 34 w: 16" x 11¼" x 12⁷⁄₁₆": Alphanumeric and Graphic display: Usually **£89.95 - £99.95**

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I.T.T. 2020 CABINET

Professional Computer Case
18" x 15½" x 4½" (front slopes). As previously advertised.

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HIGH VOLTAGE METER

Direct reading 0/40 KV. 20K/Volt. **£23.00** (UK C/P 65p)

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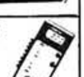

0.1 pf to 2000 mfd LCD 8 ranges
DM6013 **£52.75**

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KD30C ■ 26 range 1A AC/DC 20 meg ohm	£29.50
KD55C ■ 28 range 10A AC/DC 20 meg ohm	£33.50
Metex 3000 ■ 30 range 10A AC/DC. 20 meg ohm	£33.24
6010 + 28 range 10A AC/DC 20 meg ohm	£34.40
7030 4+ AS6010 high acc. 0.1% basic	£41.30
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SIFAM 2200B 21 range 2A AC/DC 20 meg	£29.95
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FUNCTION: All sine/square/triangle/TTL etc.	
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Single Antenna	**£15.95**
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Pye Pocketfone Nightcall for PF1/TX/RX. New boxed **£17.00**.

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Aluminium masts 4ft × 2in dia poles. Height 50ft, push in, complete in bags. Ex-Gov. stakes, ropes, base. Good condition **£45.00**. Callers **£35.00**.

Crystals HC6U Ex. Equip. 5.000 mc/s, 7.000 mc/s, 8.000 I.M.C mc/s, 9.000 mc/s. Also Glass Crystal 100 Kc/s, to fit B7G base. All at **£2** p&p paid.

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Small 230V fans, 4 in. × 2½ in. 2,500 r.p.m. **£4.50** *p&p paid.*

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We have also for sale the following items which are too numerous to advertise. Callers only, valves, transformers, tuning units, receivers, bases, wave-guide, scopes, plugs, sockets, power units, capacitors, aerials, headsets, cable, signal generators, BC221.

Ni-Cad batteries for Pye PF1 RX. 5 for **£2** p&p paid. Min. order 5.

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All these batteries are ex-eq. but good condition.

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HIGH STREET, CHESLYN HAY
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BEARCAT 200FB — LIMITED NUMBER AVAILABLE AT THE OLD PRICE

£184.95

SPECIFICATIONS

Frequency range:

66-88 MHz	Low Band
138-144 MHz	Extended VHF Range
144-148 MHz	2-Meter Amateur
148-174 MHz	High Band
406-420 MHz	Extended UHF Range
420-450 MHz	70-cm Amateur
450-470 MHz	UHF Band
470-512 MHz	UHF "T" Band
Size:	9"W×3"H×9½"D
Weight:	3 lbs.
Power Requirements:	240 Vac, 50 Hz (using external wall outlet power supply, included)
Audio Output:	800 milliwatts RMS
Antenna:	Telescoping (suppled)
Sensitivity:	1.0μV for 12 dB SINAD
Scan Rate:	Selectable, 5 or 15 channels per second
Connectors:	Externalspeaker card edge connector (optional accessoryModel No. WH-1)

Wall outlet power supply. Plug-in power supply converts standard household current to safe voltages used by radio.

16 channels. Program 16 frequencies for automatic scanning in any combination of bands and frequencies.

Patented Track Tuning. Electra-patented feature allows scanner to peak on each transmission automatically for optimum reception.

2 banks. Activate or lockout groups of channels quickly. Scan channels 1-10, 11-16, or both.

Priority. Lets you sample a designated frequency, on Channel 1, every two seconds to prevent missing important calls.

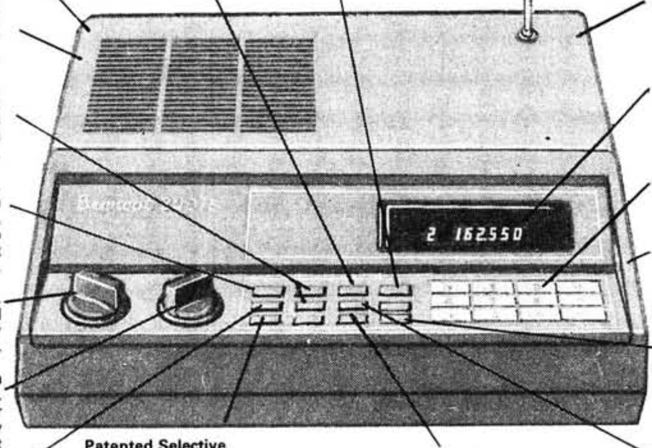
On/Off Volume. Power switch and continuously variable volume.

Automatic squelch control. Factory set for easier operation or manually adjust to block out unwanted noise.

Dual scan speed. Scan at either 5 or 15 channels each second.

▼/Limit key. Sets lower and upper frequency limits for Automatic Search. Also used to "step down" through frequencies in Manual Search.

Automatic lockout. By-pass any channel not of current interest for faster scanning cycle.



Patented Selective Scan Delay. Adds a two-second delay on desired channels to prevent missing transmissions when "calls" and "answers" are on the same frequency.

▲/Hold key. Stops searching action to hold on frequency of interest. Also used to "step up" through frequencies in Manual Search.

Single Antenna. Single telescopic antenna provides optimized reception without the need for long low band antenna.

Crystal-free. Program thousands of frequencies with pushbutton ease... and without a single crystal needed.

Decimal display. Bright vacuum fluorescent display shows frequency being received.

One piece keyboard. Sealed keyboard with "key locator" ridges for positive, easy operation.

8 band coverage. Includes Low, High, UHF and UHF-"T" bands, 2-meter and 70-centimeter Amateur ("ham") bands, extended Land-Mobile bands.

Direct channel access. Go directly to any channel, without stepping through other channels.

Automatic search. Seek and find new active frequencies automatically between frequency limits you select.

Performance and Value. Bearcat® 200FB

Direct-Access Keyboard Tuning of 22,884 Frequencies

£229.95

Available 15th January, 1984

Covers 68-88 MHz VHF-Lo, 144-148 MHz Ham, 108-136 MHz AM Aircraft, 138-144 MHz, 148-174 MHz VHF Hi, 380-450 MHz Ham, 450-470 MHz UHF-Lo, 470-512 MHz UHF-Hi

Realistic PRO-30. A full-feature, microprocessor-controlled scanner with extended frequency coverage – in a compact size you can carry wherever you go! Scan up to 16 of your favourite channels continuously, or search a selected frequency range for new or unpublished channels. Scan and Search in two speeds. Two-second Scan Delay, selectable for each channel prevents missed replies. Lockout feature temporarily bypasses unwanted channels. Big LCD display shows channels and frequencies being monitored or progammed as well as the status of the channels. Priority function monitors your favourite frequency while you listen to others. Frequency-tracking front end assures top sensitivity on all bands. Squelch control eliminates noise between messages. Has jacks for external antenna and earphones. With flexible antenna. 7½×2$\frac{15}{16}$×1$\frac{13}{16}$". Requires six "AA" batteries or mains or DC adapter. Memory backup requires four silver-oxide batteries. **£229.95**

Mains Adapter **£6.99**
DC Adapter **£4.49**

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Our complete system consists of the following items:–

1. **ANTENNA**; 1.1 metre diameter parabolic dish with feed, supplied in kit form to reduce costs and make transportation easier.
2. **ANTENNA PREAMPLIFIER**: Gasfet low-noise preamplifier to be bolted on to the antenna, to overcome feeder losses and provide maximum sensitivity.
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5. **DIGITAL FRAME STORE**: The audio signal from the receiver is stored in a large Dynamic RAM memory, which then drives the monitor to provide a continuous display.
6. **VIDEO MONITOR**: A high quality black-and-white monitor, with 25 MHz bandwidth, ideal for displaying this type of image with excellent definition.

The above items are all that are necessary to obtain first-class pictures from Meteosat. **ALL FOR £1,375 + VAT.**

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DO YOU HAVE A REQUIREMENT FOR VHF/UHF RECEIVERS OR TRANSMITTERS?

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UNIT TYPE	AR21	AR71
Description	VHF FM Receiver	UHF FM Receiver
Frequency Range	130-180 MHz	400-500 MHz
Number of Channels Available	2 (6ch also available)	2 (6ch also available)
Sensitivity	0.25µV P.D. for 20dB Sinad	
Selectivity	>80dB at ±25kHz	
Input Impedence	50 ohm	50 ohm
Audio Output Power	3 watts into 4 ohms	
Squelch Range	0.2-1.0µV	0.2-1.0µV
Supply Voltage	12.5 volts (11v min, 15.6v max)	
Current Consumption	50-600mA dependent on audio level	
Dimensions	135 × 123 × 26mm	

UNIT TYPE	AT25	AT75
Description	VHF FM Transmitter	UHF FM Transmitter
Frequency Range	130-180MHz	400-500MHz
Power Output	4 watts (normal) 0.5 watts (reduced)	2 watts (normal) 0.5 watts (reduced)
Output Impedence	50 ohm	50 ohm
Supply Voltage	12.5 volts (11v min, 15.6v max.)	
Current Consumption	0.8 amps for 4w output 0.5 amps for 1w output	0.6 amps for 2w output 0.4 amps for 0.5w output
Dimensions	135 × 102 × 26mm	

UNIT TYPE	PRICE (exc. VAT)
AR21 VHF FM Receiver	£149
AR71 UHF FM Receiver	£177
AT25 VHF FM Transmitter	£84
AT75 UHF FM Transmitter	£110

The above items carry a 12 month guarantee, and we normally carry good stocks to ensure the minimum of delivery delays. If you have a requirement, or would be interested in quantity discounts, please contact our sales department.

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BRAID BREAKER/HI PASS FILTER. Stop TVI at TV. **£6.50 Ex stock.**

NEW. RF NOISE BRIDGE. Adjustable 0-1,000 ohms, 3" × 1½" × 2" only. S0239s, 1-170MHz. Neat, accurate & economical. **£29.50 Ex Stock.**

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The most VERSATILE Ant. Matching system. Will match from 15-5000 Ohms BALANCED or UNBALANCED at up to 1kW.. Link coupled balun means no connection to the equipment which can cure TVI both ways. SO239 and 4mm connectors for co-ax or wire feed. 160-10 metres TRANZMATCH **£75.50.** 80-10 metres **£67.50.** EZITUNE built in for **£24 extra.** (See below for details of EZITUNE). **All ex-stock.** Note. We sell many more with EZITUNE fitted.

3 WAY ANTENNA SWITCH 1Kw SO239s. Good to 2 metres. **£15.00 Ex stock. Or 4th position to earth** output **£17.50 Ex stock.**

S.E.M. 2 METRE TRANZMATCH. 5½" × 2", 3" deep. SO239s. **£24.90 Ex stock.**

S.E.M. EZITUNE. New circuit.
Gives MORE noise & bomb proof operation.

Because no similar unit is made, it's usefulness is not appreciated until you have used one. Eliminates need for S.W.R. bridge.

Clean up the bands by tuning up without transmitting.

Connects in aerial lead, produces S9 + (1 – 170MHz) noise in receiver. Adjust A.T.U. or aerial for minimum noise. You have now put an exact 50 Ohms into your transceiver. Fully protected, you can transmit through it, save your P.A. and stop QRM. SO239s. 3" × 1½" × 2". **£29.50 Ex stock.** P.c.b. to fit any A.T.U. **£24 Ex stock.**

SENTINEL 2M LINEAR POWER/PRE-AMPLIFIERS
Feature either POWER AMP alone or PRE-AMP alone or both POWER AND PRE-AMP or STRAIGHT THROU when OFF. Plus a gain control on the PRE-AMP from 0 to 20dB. N.F. around 1dB with a neutralised strip line DUAL GATE MOSFET (BF981).

Ultra LINEAR for all modes and R.F. or P.T.T. switched. 13.8V nominal supply. SO239 sockets.

Three Models:
1. **SENTINEL 35** Twelve times power gain. 3W IN 36W OUT. 4 amps. Max. drive 5W. 6" × 2¼" front panel, 4¼" deep. **£65 Ex stock.**
2. **SENTINEL 50** Five times power gain. 10 W IN 50W OUT. Max drive 16W 6 amps. Same size as the Sentinel 35. **£79.50 Ex stock.**
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POWER SUPPLIES for our linears 6 amp **£34.** 12 amp **£49.**

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PA5 Same specification as the Auto including 240V P.S.U. **£33.00 •**
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To improve ANY receiver on ANY mode. The most versatile filter available. Gives "passband" tuning, "variable selectivity" and one or two notches. Switched Hi-pass, Lo-pass, peak or notch. Selectivity from 2.5KHz to **20Hz.** Tunable from 2.5KHz to 250Hz. PLUS another notch available in any of the four switch positions which covers 10KHz to 100Hz. 12V supply. Sizes: 6" × 2¼" front panel, 3¼" deep, all for only **£57.00 Ex stock.**

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Already a great success. If you want an 80 metre (3.5-3.8MHz) Rx. Only 2¼" × 6" × 3". 12 volt operation. I.W. o/p. This is for you. **£45.**

12 MONTHS *COMPLETE GUARANTEE* INCLUDING ALL TRANSISTORS.

Prices include VAT and delivery. C.W.O. or phone your credit card number for same day service. •Means Belling Lee sockets, add £1.90 for S0239s or BNC sockets. Ring or write for more information. Place orders or request information on our Ansaphone at cheap rate times.

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DF91	0.70
DF92	0.60
DF96	0.65
DK91	0.90
DK92	1.20
DK96	2.50
DL92	0.60
DL96	2.50
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DY802	0.72
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E80CF	10.00
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E810F	18.50
EA76	1.95
EABC80	0.70
EAF42	1.20
EB91	0.60
EBC81	0.85
EBC91	0.75
EBF80	0.50
EC90	1.10
ECC81	1.15
ECC82	0.55
ECC82 Philips/ Mullard	1.35
ECC83	0.65

ECC83 Brimar Made in UK	1.35
ECC85	0.60
ECC88	0.85
ECC91	2.00
ECC804	0.60
ECC807	2.50
ECF80	0.85
ECF82	0.85
ECF86	1.70
ECH3	2.50
ECH35	1.60
ECH42	1.00
ECH81	0.58
ECH84	0.69
ECL80	0.60
ECL82	0.65
ECL84	0.74
ECL86	0.80
EF37A	2.00
EF39	1.00
EF42	3.50
EF55	3.50
EF80	0.55
EF83	3.50
EF85	0.50
EF86	1.25
EF89	0.85
EF91	1.50
EF92	2.50
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N78	14.95
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OB2	0.85
PC97	1.10
PC900	1.25
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PCF82	0.60
PCF86	1.20
PCF200	1.80
PCF201	1.80
PCF801	1.35
PCF802	0.60
PCF805	1.25
PCF808	1.25
PCH200	1.50
PCL82	0.80
PCL83	2.50
PCL84	0.85
PCL86	0.85
PCL805	0.90

PFL200	1.25
PL36	0.95
PL81A	0.72
PL84	0.65
PL500	0.95
PL504	0.95
PL508	1.95
PL509	4.85
PL519	4.95
PL802	5.95
PY88	0.65
PY500A	1.95
PY800	0.79
PY801	0.79
QQV02-6	12.75
QQV03-10	5.50
QQV03-20A	18.50
QQV06-40A	18.00
QS150/45	7.00
QV03-12	4.95
S11E-12	38.00
TD03-10E	28.00
TD03-10F	28.00
U19 M.O.V.	12.00
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6BD6	1.00
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6BW6	5.35
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6CH6	8.50
6CL6	3.50
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6DQ5	3.35
6DQ6B	2.50
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6F28	1.25
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6J5	1.95
6J5GT	1.50
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6KD6	5.50
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6L6GT	1.15
6LF6	4.50
6LQ6	4.50
6U8	0.85
6V6GT	0.85
6X5GT	0.55
7S7	3.00
866A	3.50
11E2	16.50

12AT6	0.65
12AT7	1.15
12AT7WA	2.50
12AU6	1.50
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12AV6	0.80
12AX7	0.65
12AX7WA	2.50
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12BH7	1.80
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92AV	12.50
150B2	5.50
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833A	115.00
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7027A	4.65
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TA7061AP	3.95
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TA7130	1.50
TA7193	5.50
TA7204	2.15
TA7205AP	1.50
TA7222	1.80
TA7310	1.80
TA7314	2.50
TBA120S	0.70
TBA520Q	1.10
TBA530	1.10
TBA540	1.25
TBA550Q	1.45
TBA641.BX1	3.00
TBA800	0.89
TBA810S	1.65
TBA920Q	1.65
TDA1004A	2.20
TDA1170	1.95
TDA1190	2.15
TDA1327	1.70
TDA2020	2.45
TDA2030	2.80
TDA2532	1.95
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TDA2590/3	2.95
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UPC566H	2.95
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UPC1025	2.50
UPC1156H	2.75
UPC1182H	2.95
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AC128	0.28
AC141K	0.34
AC176	0.22
AC176K	0.31
AC187	0.25
AC187K	0.28
AC188	0.25
AD142	0.79
AD149	0.70
AD161	0.39
AD161/2	0.90
AD162	0.39
AF124	0.34
AF125	0.35
AF126	0.32
AF127	0.32
AF139	0.40
AF239	0.42
AU106	2.00
AU107	1.75
AU110	2.00
AU113	2.95
BC107	0.10
BC108	0.10
BC109B	0.12
BC139	0.20
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
BC157	0.12
BC158	0.09
BC159	0.09
BC160	0.28

BC170B	0.15
BC171	0.09
BC172	0.10
BC173B	0.10
BC182	0.10
BC183	0.10
BC184LA	0.09
BC212	0.09
BC212L	0.09
BC213	0.09
BC213L	0.09
BC237	0.10
BC238	0.09
BC307	0.09
BC327	0.10
BC461	0.35
BC478	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC557	0.08
BC558	0.10
BD131	0.32
BD132	0.35
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.32
BD138	0.30
BD139	0.32
BD140	0.30
BF179	0.34
BF180	0.29
BF183	0.29
BF194	0.11
BF196	0.11
BF197	0.11
BF198	0.16

BF199	0.14
BF200	0.40
BF258	0.28
BF259	0.28
BF336	0.34
BFX29	0.30
BFX84	0.26
BFX85	0.32
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
BT106	1.49
BT108	1.89
BT116	1.20
BU105	1.22
BU108	1.69
BU124	1.00
BU126	1.60
BU205	1.30
BU208	1.39
BU208A	1.52
BU326A	1.42
MRF450	12.50
MRF450A	12.50
MRF453	17.50
MRF454	23.50
MRF475	2.50
MRF477	10.00
OC71	0.40
R2008B	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
TIP146	2.75
TIP2955	0.80
TIP3055	0.55
TIS91	0.20
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3704	0.12
2N3705	0.12
2N3708	0.12
2N3773	1.95
2N5294	0.42
2N5296	0.48
2N5496	0.65
2SA715	0.95
2SC495	0.80
2SC496	0.80
2SC1096	0.80
2SC1173	1.15
2SC1306	1.00
2SC1307	1.50
2SC1449	0.80
2SC1678	1.25
2SC1945	2.10
2SC1953	0.95
2SC1957	0.80
2SC1969	1.95
2SC2028	1.15
2SC2029	1.95
2SC2078	1.45
2SC2091	0.85
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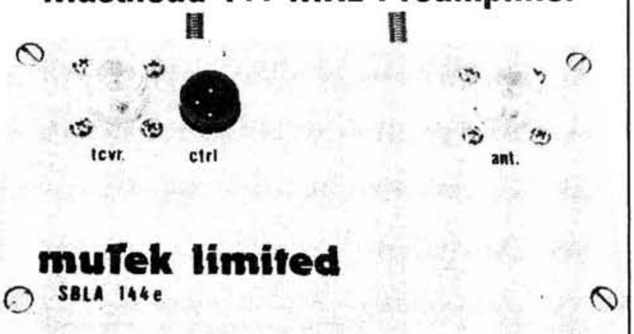

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☆ variable gain
☆ unique balanced pair of BF981's for excellent dynamic performance
☆ superb filtering (of course!)
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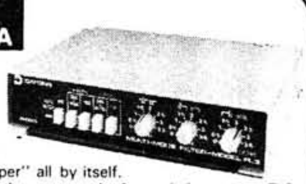
AUDIO FILTERS
MODELS FL2, FL3, FL2/A



Model FL3 represents the ultimate in audio filters for SSB and CW. Connected in series with the loudspeaker, it gives variable extra selectivity better than a whole bank of expensive crystal filters. In addition it contains an automatic notch filter which can remove a "tuner-upper" all by itself. Model FL2 is exactly the same but without the auto-notch. Any existing or new FL2 can be up-graded to an FL3 by adding Model FL2/A conversion kit, which is a stand-alone auto-notch unit. Datong filters frequently allow continued copy when otherwise a QSO would have to be abandoned.

Prices: **FL2 £89.70, FL3 £129.37, FL2/A £39.67**

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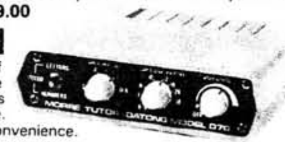
Datong active antennas are ideal for modern broadband communications receivers —especially where space is limited.

- 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) **£51.75** Both prices include mains power unit.
Model AD370 (for outdoor use) **£69.00**

MORSE TUTOR



The uniquely effective method of improving and maintaining Morse Code proficiency. Effectiveness proven by thousands of users world-wide.

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- 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.
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Static Mobile?

Probably the single most argued-about feature of the UK Amateur Licence regulations is what you should or should not do and say when operating from a vehicle. I'm afraid that I'm not going to give you a definitive answer, because there are several points I've never been able to get an entirely satisfactory answer to.

First, a red herring—can one be "/static mobile"? The logical answer is no, but actually it depends on your definition of mobile. The international Radio Regulations (always a good starting point, though not infallible because national administrations sometimes adopt different definitions) say a mobile station is one "intended to be used while in motion or during halts at unspecified points". But why do I call it a red herring? Because the licence says "in or on a vehicle or vessel the suffix '/M' shall be added to the callsign". So though you might argue that you're using "mobile" as a phonetic interpretation of "M", you'll have a hard job to justify "/static mobile".

Now the log-keeping bit. The licence says (for a Mobile Station or as a Pedestrian) that you can keep an abbreviated record of date, geographical area of operation, frequency band(s) used and times of commencement and end of journey, filling in the information as soon as practicable after the end of a journey. And you can keep a separate log book for the purpose. Notice that the word "mobile" has crept in here, the only place it appears in the Amateur Licence. The Licence doesn't define mobile, so we are presumably safe in taking that Radio Regulations definition, which seems to tie-in broadly with "operating from a vehicle". Except, that is, for when you are parked in your drive at home. You are then presumably at "the main address" for which the licence was issued, so you seem to come into two categories at once. If you argue that "the main address" is the house only, where does that leave the amateur with a garden shed for his "shack"?

The Amateur Licence doesn't give any guidance on when a journey is considered to have "ended", but in the RSGB *Amateur Radio Operating Manual,* the chapter on mobile operation quotes a point where the vehicle remains stationary for 15 minutes or more.

Now I **think** that all this can be summarised as follows: When operating amateur radio equipment in a vehicle, you should always use your callsign with "/M" added, regardless of whether you're moving or stopped. If stopping anywhere for 15 minutes or more you must bring your log book up to date for the most recent journey, but if you operate whilst stopped (having a cup of tea and a sandwich or whatever) you can still use the abbreviated "mobile" log book format. I think the same applies if you operate whilst parked in the drive of your home, because the fact that the station is established in a vehicle seems to override the fact that you are operating at "the main address" for which your licence is granted.

If you stop in the country and shin up a tree with an antenna that you connect to the rig installed in your car, I think you are still "/M", not "/P", because the "station" is still established in the vehicle.

I'd be delighted to hear from anyone who has got firm evidence to confirm or to contradict these points.

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.

INSURANCE
Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.

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 at £13 per annum to UK addresses and £14 overseas, from **"Practical Wireless" Subscription Department, Room 2816, 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 £1 each, including post and packing to addresses at home and overseas.

Binders are available (Price £5.50 to UK addresses, £5.75 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.

PW RADIO USERS INSURANCE SCHEME

Practical Wireless Radio Users Insurance Scheme was devised by Registered Insurance Brokers B. A. LAYMOND & PARTNERS LIMITED following consultation with PRACTICAL WIRELESS to formulate an exclusive scheme designed to meet the needs and requirements of: Amateur Radio Enthusiasts ● CB Radio Users ● Taxi Companies and Fleet Users with Radio Telephones. A copy of the Policy can be inspected at the offices of B. A. Laymond & Partners Ltd., or of Practical Wireless in Poole.

SPECIAL FEATURES

● All Risks Cover ● "New Lamps for Old" Cover (as defined in policy) ● Index Linked Cover to combat inflation ● Includes Personal Liability cover against damages payments of up to £500000 to members of the public ● Licence protection—covers legal costs arising from any breach of your licence conditions ● Equipment covered anywhere in the UK, Channel Islands and Isle of Man, but not Northern Ireland and Eire ● Fixed Antennas (Aerials) covered ● Frequency, Power and SWR Meters and similar radio-related test equipment covered ● 30 days cover on Western Europe included Free of Charge ● Absolute Security as this scheme is underwritten by a leading member of the British Insurance Association on the London Insurance Market ● Practical Wireless radio receiver and transmitter projects covered (when stated in feature) ● Available to Clubs and Organisations† ● Available to Companies†

†Write directly to B. A. LAYMOND & PARTNERS LTD, for a special application form and full details enclosing the coupon below.

B. A. Laymond & Partners Ltd., Practical Wireless and the Underwriters wish to make it clear that it is an offence to instal or use a radio transmitter in the UK except under the authority of a licence granted by the Secretary of State and it is not their intention to provide cover for or to encourage or condone the illegal use of CB and/or other communications equipment.

Cover for property contained in vehicles is subject to a Limit of Liability of £250, increased to £750 where the vehicle is protected by a reputable audible alarm, correctly set and operational.

When the vehicle is unattended, mobile equipment secured so that tools or a key are required to remove it must be disguised or concealed from view. Portable and mobile equipment not so secured must be removed and placed in a locked boot or otherwise concealed from view, or removed from the vehicle entirely. Equipment not in a secure building or vehicle must not be left unattended.

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Sum to Insure	£1000	£3000	£5000
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All others:	Sums insured up to £3000	£25
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Complete the application form below to obtain immediate insurance cover. Photocopies will not be accepted

APPLICATION FOR PRACTICAL WIRELESS RADIO USERS INSURANCE SCHEME PW3/84

Name in full (State Mr, Mrs, Miss or Title)

Address

Post Code

Occupation Age Phone No. (Home) (Work)

I/We hereby apply to insure the equipment detailed below

BLOCK LETTERS

	Manufacturer's Name	Model	Serial No.	Description of equipment to be insured e.g. Base station; Mobile; CB; etc.	VALUE £
1					
2					
3	Antennas (Aerials), s.w.r. meters, etc.				

Please continue list of equipment on a separate sheet if necessary **TOTAL SUM TO INSURE £**

DECLARATION: I/We hereby declare that: 1. The sums insured represent the full replacement value of the equipment. 2. I/We have not* had insurance cancelled, declined, restricted, or other terms imposed in any way other than the normal Policy terms. 3. This proposal shall be the basis of the contract and that the contract will be on the Underwriters normal terms and conditions for All Risks and Legal Costs/Expenses cover unless otherwise agreed. 4. I/We have not* sustained any loss or damage to any radio communications equipment or been involved in litigation relating to use of radio equipment during the past three years, whether insured or not. 5. All the above statements made in connection with this proposal are true and no material information has been withheld. 6. I/We understand no liability shall attach until this proposal shall have been accepted by *Laymond's and the premium paid in full* and a Certificate issued.

* If you have, please give details on a separate sheet.

Date Signed

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Products

RTTY T.U. for the BBC Computer

We have received details of a dedicated RTTY Terminal Unit for the BBC model B home computer.

When used in conjunction with the programs developed by G3WHO or G4BLT, full transceive RRTY may be realised.

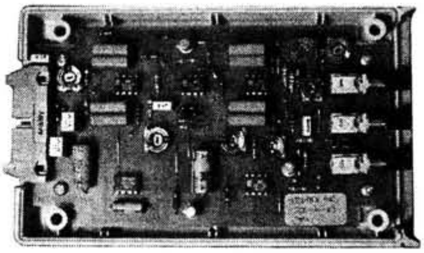
Developed by G3LIV, the terminal is designed around the latest bi-f.e.t. operational amplifiers known for their low noise and high gain, and are well at home in the role of active filters, four of which are used in this unit.

The circuit provides two pre-limiting filters, one on each of the mark and space frequencies; these are followed by a limiting amplifier, the output of which drives a pair of active filters on each of the tone frequencies. All active filters have switched bandwidths controlled from the front panel. This allows the reception of both amateur and commercial signals. After the second pair of filters is a standard chopper circuit with normal/reverse switching, via the front panel, to allow signals to be copied that are transmitted in the wrong sense (upside down). This drives a BC107 to the t.t.l. levels required by the BBC B.

As the BBC has only 5V available at the I/O port an i.c. supply inverter is used on-board to supply the negative volts rail, so that the bi-f.e.t. op.amps. may be used to their best advantage, from balanced voltage rails. Two transistors are used as l.e.d. drivers to give front panel indication of signal tuning.

Also incorporated on the same p.c.b. is a transmit filter to smooth and reduce the square waves generated by the software. These smoothed tones can then be passed on to the mic. socket of the transceiver. An output control is fitted to the tone filter, so that the p.a. is not over driven.

Connections are terminated with a standard 20-pin i.d.c. connector and require a 20-way double-ended ribbon cable (not supplied as standard) to interface direct into the BBC I/O port. A 3·5mm stereo jack socket is provided for audio connections to the transceiver.



The G3LIV RTTY Terminal Unit costs £75.00 plus £2.00 p&p and the G3WHO software costs £7.50 inclusive. Both are available from: *J. Melvin G3LIV, 2 Salters Court, Gosforth, Newcastle, Tyne & Wear. Tel: (0632) 843028.*

Also available is a range of RTTY system components enabling receive only or transceiving arrangements to be built up for many other home computers.

If you please

Please mention this column when applying to manufacturers or suppliers featured on these pages.

144MHz Masthead Pre-amplifier

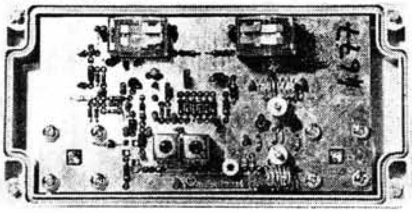
New from muTek Ltd., the highly respected r.f. technology specialists, is a 144MHz masthead preamplifier, entitled the SBLA144e.

The unit comprises a high sensitivity dual-balanced m.o.s.f.e.t. r.f. pre-amp, and relay switching facility, capable of handling 250W p.e.p. through-power, contained in a durable weatherproof enclosure.

Unlike previous designs, this preamplifier employs a balanced pair of low-noise BF981 dual-gate m.o.s.f.e.t. semiconductors. Design emphasis is placed on strong signal handling performance together with exceedingly well-defined bandwidth, and minimal passband ripple. The all-important input circuitry combines impedance matching and bandpass characteristics in a low noise arrangement, presenting the active devices with correct source impedance.

Amplifier output is terminated by a variable resistive network, allowing overall gain to be adjusted on installation to provide a system noise figure set by external noise sources. For terrestrial v.h.f. operation, at least, this arrangement represents current (and ultimate) state of the art—GaAs-f.e.t. devices will allow lower noise figures but at 144MHz their true potential will be masked by man-made and ground noise effects unless you are using a massive cold sky facing antenna array.

Other practical features include r.f. vox and hardline switching control options, input static discharge protection and N-type connectors. A novel feature



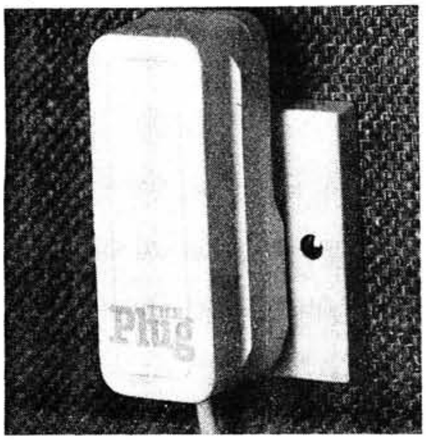
concerns the output matching, which is basically a π-section utilising the inductive reactance of the relay contacts as the inductive element of the network.

Priced at £79.90 plus £2.50 p&p (includes VAT), the SBLA144e is available from: *muTek Ltd., Bradworthy, Holsworthy, Devon EX22 7TU. Tel: (040 924) 543.*

Pure Power

Home computer users will not need reminding that the domestic a.c. mains supply is inherently noisy with interference generated by industrial machinery, domestic appliances switching transients—even CB radio.

Insignificant as this noise may be in general domestic power situations, it can be a critical factor in circuits where digital data is required to be processed in an error free manner—home computers!



Noise on the a.c. mains supply, particularly high voltage spikes, introduces spurious pulses into the computer system which may then be processed as significant data, creating havoc for the user and resulting in—at worst, a complete crash, and at best, a corruption of vital data.

A recently introduced product, designed specifically to counter the problem, and prevent downtime and reprogramming, plus enhancing the computer's reliability, is "The Plug" from Power International Ltd.

"The Plug" is neatly packaged in a modified 13 amp plug and contains an r.f.i. filter and transient suppressor, that effectively smooths the supply and absorbs high voltage spikes.

Priced at £15.50, which includes p&p and VAT, "The Plug" is obtainable from dealers or direct from the manufacturers: *Power International Ltd., 2A Isambard Brunel Road, Portsmouth, Hampshire PO1 2DU. Tel: (0705) 756715.*

Coaxial Switch

Lowe Electronics have recently started to stock a new coaxial 4-way switch made by Daiwa.

Specifications supplied with the switch, model CS-4, indicate a through-power rating of 500W p.e.p. (250W c.w.) and v.s.w.r. of under 1·2:1 between d.c. and 1500MHz. Impedance is 50Ω with an insertion loss of less than 0·2dB, and isolation quoted at better than 60dB.

The switch is operated by a single 30mm knob which has a continuous 360° sweep with precise "click-stop" positions every 90°. The common pole and four switch positions are terminated at the rear of the unit with 50Ω BNC sockets.

Currently, the CS-4 is available ex-stock at all Lowe Electronics branches for £18.86 (or plus £2.50 p&p) VAT included.

Lowe Electronics, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817, 2430, 4057 and 4995.

48K ZX Spectrum RTTY Program—Please Note!

Will readers please note that a pricing confusion arose last month in the *Products* mention of the above program.

It concerned the service that Scarab Systems are offering to customers who originally purchased the 16K program tape and interface p.c.b. Scarab will supply the 48K cassette tape program only, in return for the 16K cassette, at a special price of £7.50. The interface p.c.b. for both versions being identical.

For new purchasers the 16K program and p.c.b. costs £15.00, with the 48K split-screen version costing £17.50.

We apologise to both Scarab Systems and any of their customers who may have been inconvenienced.

Uncle Ed

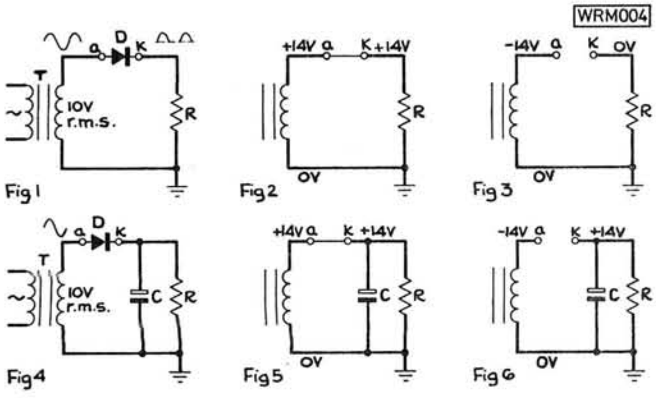
RECTIFIERS

The report on the May 1983 Radio Amateur's Examination, just published by City and Guilds, mentions several topics which weren't very well understood by candidates. I plan to look at some of these, starting with the peak inverse voltage (p.i.v.) applied to the diode (or diodes) in a rectifier circuit.

In Fig. 1, I've shown the simplest case, a half-wave rectifier feeding a resistive load R. The transformer T is fed with a.c. mains and gives an output of 10V r.m.s. The bottom end of the secondary winding is earthed to provide a zero volts (0V) reference point, and the top end is connected to the anode of diode D. I've drawn little circles either side of the diode to indicate the anode (a) and cathode (k) connection points, for reasons which should become obvious shortly.

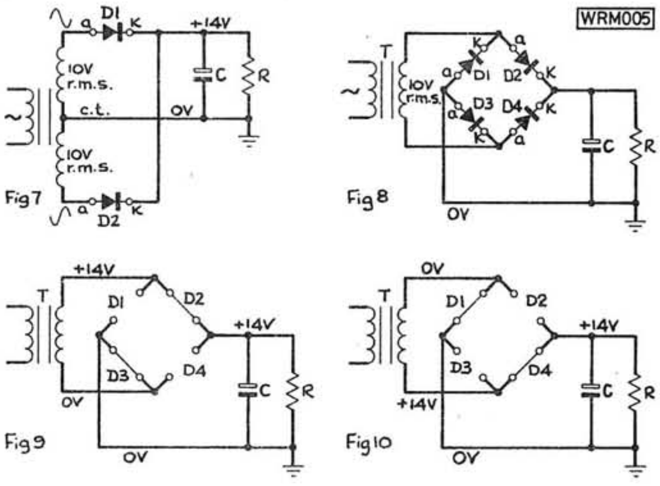
When the top end of the transformer secondary goes positive, diode D will conduct (looking more or less like a short circuit—hence the a/k link) and the positive half-cycle of the output will be passed to the load (Fig. 2). Negative half-cycles will be blocked by D, which will then look like an open-circuit (Fig. 3), and at the negative peak there will be an inverse or reverse voltage of 14V across it (anode negative with respect to cathode). Strictly speaking, the reverse voltage is $10 \times \sqrt{2} = 14{\cdot}14$V, but it's easier to work in round numbers so I've called it 14V for now.

There aren't too many applications where we want unsmoothed unidirectional pulses (to give them their technical name) out of a power supply. More often we want a nice smooth d.c. voltage. If we stick a large capacitor across the output, as shown in Fig. 4, we can come close to achieving that. On the positive half-cycle (Fig. 5) C will charge up to the peak value 14V as before, but it will stay at or near that as the transformer output falls and then reverses to −14V



(Fig. 6). Some of the charge will leak away from C through R, but if the value of R is high the voltage across C won't fall too much between the positive peaks. In Fig. 6 you'll see that the diode cathode is at +14V and its anode is at −14V, which is an inverse voltage of 14+14=28V across D, that's twice as much as in Fig. 3, and the difference is entirely due to capacitor C and its ability to hold a charge.

In the type of full-wave rectifier circuit shown in Fig. 7 (often called a bi-phase half-wave rectifier), an extra transformer secondary winding is connected up to give another output in anti-phase to the first one. The secondary centre-tap (c.t.) is earthed, and the two halves and their diodes work alternately, each in exactly the same way as Fig. 4, with their outputs combined to charge C twice as often as the simple half-wave circuit. The peak inverse voltage across each diode is the same too, equal to $2 \times \sqrt{2}$ times the r.m.s. secondary voltage.



Nowadays, two extra diodes are a lot cheaper than the extra copper wire needed to double up on the transformer secondary winding, and the bridge full-wave rectifier circuit of Fig. 8 has almost entirely replaced the Fig. 7 circuit, which was very convenient in the days of valve rectifiers, when a double-diode with two anodes and a single cathode/heater would have been used.

Notice in Fig. 8 that no point on the secondary winding is directly earthed, so we can't label either side of it as 0V. When the top end of the secondary goes positive (Fig. 9), D2 will conduct, linking it to the top ends of C and R, and D3 will conduct, linking the bottom end of the secondary to the 0V rail.

On the other half-cycle, when the bottom end of the secondary goes positive, D4 conducts, linking it to the top of C and R, while D1 will link the top end of the secondary to 0V (Fig. 10). No part of the secondary ever goes negative (below 0V, in other words), because the diode bridge behaves as a sort of automatic switch, always connecting the more negative end of the winding to 0V.

None of the non-conducting diodes (D1 and D4 in Fig. 9, D2 and D3 in Fig. 10) ever has an inverse voltage of more than 14V across it, as you can see from the drawings, so the p.i.v. is $\sqrt{2}$ times the r.m.s. secondary voltage.

continued on page 37 ▶▶▶

Twilight

For h.f. DX use the front of the globe.
For m.f. DX use the back of the globe

Whilst reading a recent issue of *PW*, I noted that a correspondent had enquired about so-called "difficult" paths. The writer of this letter was obviously interested in h.f. bands DX and the difficult paths referred to are those which cross a twilight zone. Whereas the h.f. DXer relies on daylight conditions, the person interested in m.f. DX prefers darkness and therefore the twilight boundary is very significant in a number of ways.

The locator to be described in this article gives a very clear trace of all great circle paths with particular emphasis on those going along and passing through a twilight zone. Before deciding upon the final design alternative approaches were tried. Some time ago I obtained a small great circle map, traced the outlines, printed many copies, and then drew many charts of twilight zones for different times of day and seasons of the year. On completion I had dozens of maps covered in grid lines of various shapes; with commendable effort I had produced many most impressive pictures—far too many!! It had all been a waste of time. An alternative approach, and the one finally chosen, is to pretend to be sitting on the sun, which always sees half of the earth's surface as a disk and showers it with daylight and ultra-violet radiation. The strongest incidence of radiation is at the centre of the disk because this is where the sun would be directly overhead on earth; edges of the illuminated disk are the twilight zones where received radiation falls to zero. The basic orbital geometry of the earth's passage around the sun is shown in Fig. 1.

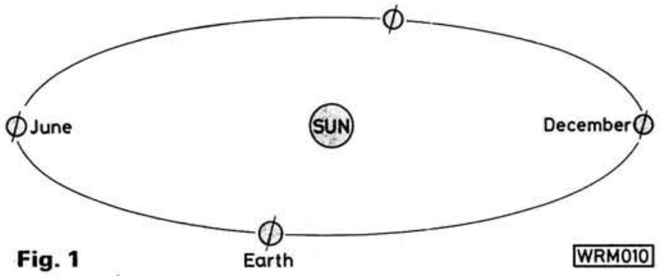


Fig. 1

The Locator

The main features of the twilight locator are a home-made screen and modified model globe. A circular cut-out in the screen reveals half of the globe whilst concealing the other. The half at the front is the one in sunshine.

Normally, even model globes are mounted on stands which give roughly 23° inclination to the globe's axis. If the stand is positioned in the screen with the North Pole made to tilt directly toward the front, the revealed half of the globe shows what the sun would see in midsummer. Turning the stand the other way creates the midwinter scene. Part of the subsequent construction work involves fitting twelve sticky labels, one for each month of the year, around the base of the globe so that it can be positioned for any month and season of the year.

As mentioned earlier, the sun always sees half of the earth's surface but the encompassed area gradually changes throughout the year. Positioning the base stand will accommodate seasonal (monthly) changes. Hourly changes are catered for by rotating the globe on its pivots. The main reason why I had an unmanageable set of maps was because I could not make the grid lines tilt and rotate.

All that is needed on the locator to represent all separate times of day is a g.m.t. time-scale of sticky markers around the equator of the globe. Twenty-four tiny stickers numbered 0 to 23 are placed at 15° intervals along the equator. Midday, 12.00 hrs., is represented by placing sticker 12 at 0° longitude, i.e. on the Greenwich meridian. Sticker 0 goes on the International Date Line.

Having dealt with the season of the year and the time of day, using a screen that registers with the twilight zone on the surface of the earth, all that remains is the track of any great circle path. By combination of this data the locator will illustrate how "difficult" or "favourable" a path is likely to be at any time.

Globe Modifications

Traditionally globes are made with a semi-circular bracket for the pivots at the North and South Poles.

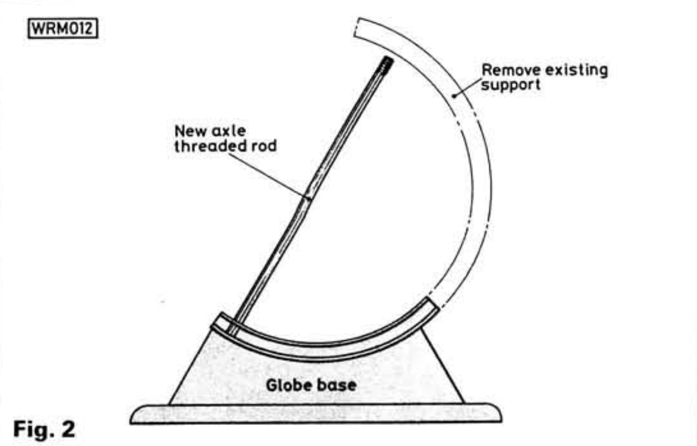
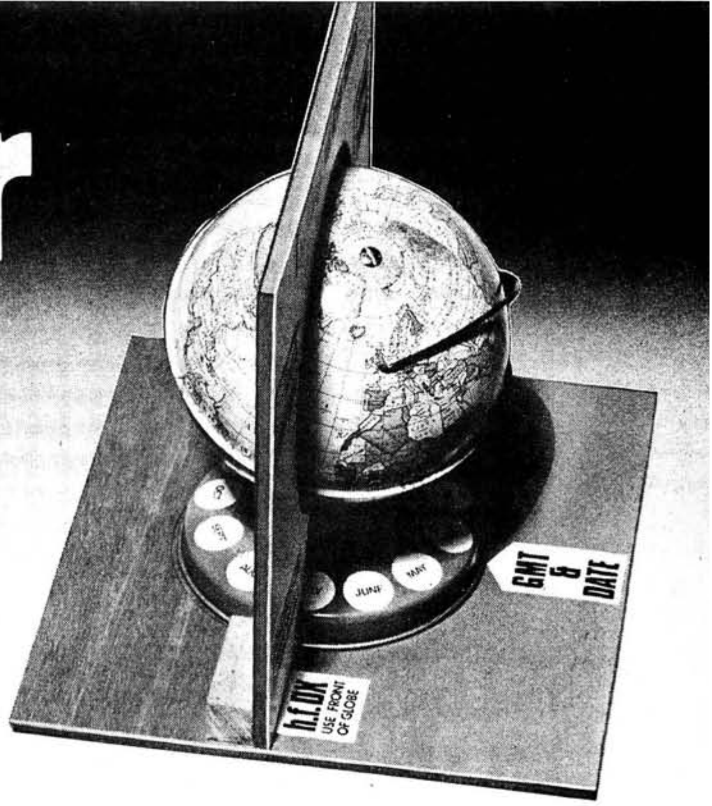


Fig. 2

Locator

by John R. Greenwood



The globe for the locator has to be modified as shown in Fig. 2 by removing the bracket and fastening a sloping axle onto the stand. The axle goes through the South Pole and through the middle of the globe to just beneath the North Pole. The pivot at the North Pole is a screw fitted to the end of the axle and must not project above the surface of the globe. This method of mounting provides an unobstructed surface for shifting the marker track representing great circle routes.

Actually the "great circle" marker is merely a semicircle of thin wire with ends bent over sharply so that they will tuck into small holes on opposite sides of the globe. Where you mount the wire on the globe depends on where you live. For the UK, one end would be in the UK and the other at 53° to 57° South on the International Date Line, i.e. somewhere near New Zealand. If you lived in the USA the semi-circular wire would have its ends re-located accordingly. Incidentally, for anyone living at the North and South Poles there are no places to fix the wire but the globemakers have fortuitously drawn great circles for them as lines of longitude—all Eskimos ought to be highly delighted!

Construction Work

Returning to more serious matters, I regard the construction work as extremely simple. For the original prototype I used a strong cardboard box to build the centre screen. The four flaps in the bottom of the box were opened out, cut away and re-folded. I have since made the more elegant screen, as shown, using plywood laminated with smooth card and transparent film.

Regions of good propagation merge only gradually into place where transmissions are poor and the boundaries are not precisely defined. Consequently I consider that a cheap "toy" globe is quite sufficient for the locator assembly. Taking a hacksaw to the stand and puncturing the globe in two places does not seem quite so bad when making a useful locator out of an inexpensive toy.

Details of mechanical modifications to the globe supports are shown in Fig. 2. Fitting the new axle could cause a headache but using threaded rod is an easy solution.

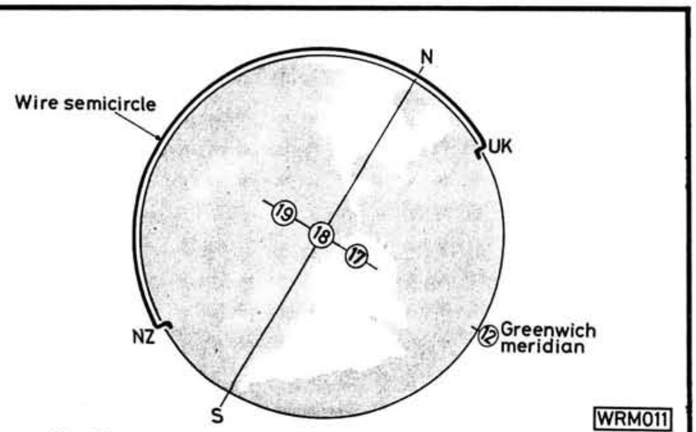


Fig. 3

Most stationers and photographers stock small round sticky labels in many contrasting colours. Twelve medium-sized labels are stuck onto the stand, together with 24 tiny labels around the equator.

The tracer for the great circles can be made from ordinary solid-core insulated connecting wire. The trick is to straighten it by pulling it across a rounded edge whilst under considerable tension. This makes the copper stiffen so that it is hard and springy. Having taken out all kinks, the wire can be shaped to fit as shown in Fig. 3.

Using the Locator

A good starting point for obtaining improved DX is knowing the best frequencies to tune at times which are most favourable—the twilight locator can be your guide. A better receiver helps but only when the reception conditions are right; the impossible will never be achieved even with a near perfect receiver. A little knowledge of diurnal variations and quite elementary use of the locator will identify the impossible and save many fruitless hours of listening.

Manipulating the locator is so simple it barely needs any explanation. The way I use mine is as follows:

1) Find the DX location on the globe and set the wire trace for the great circle leading to the UK.

2) Correctly position the globe stand for the season of the year.

3) Rotate the globe to cover the listening times.

4) Assess the "difficulty" or "favourability" of the path.

5) Confirm by tuning and log the result.

Some obvious paths to look for are night-time great circles to North America giving m.f. openings in the Autumn and the 08.00 path to the Far East occurring just after sunrise in the middle of October, and so on.

With experience and careful log-keeping it will not be long before you learn which frequency bands present the best DX at various times of any day throughout the year. Most usefully you will begin to appreciate why a lot of DX is available at only certain times and is impossible for the greater part of the year. ●

What is SINAD?

by Brian Dance

One of the most vital characteristics of a receiver or of any communications system is its ability to produce an output signal with a minimum of noise and distortion. Although one can easily amplify the output signal, this will also amplify the noise and distortion by the same factor; it therefore follows that it is convenient to express the performance of a system in terms of its signal-to-noise ratio. Obviously this will depend not just on the receiver alone, but also on the type of antenna and its siting, the frequency, the signal strength, etc.

SINAD

Nowadays it is becoming increasingly common to use the term SINAD for the expression:

$$\text{SINAD} = \frac{\text{(Signal + Noise + Distortion) voltage}}{\text{(Noise + Distortion) voltage}}$$

SINAD is an acronym for Signal + Noise + Distortion. It is normally pronounced with a long I (as in the word "mine") rather than with a short I (as in the word "bin"), but this is not important. It is almost always used in specifying ultimate f.m. receiver performance, including f.m. receiver chip performance, but is gradually coming into more widespread use for a.m. receiver specifications.

The SINAD specification is usually expressed as a decibel figure. In this case one can write:

$$\text{SINAD (in dB)} = 20 \log_{10} \frac{\text{(Signal + Noise + Distortion) voltage}}{\text{(Noise + Distortion) voltage}}$$

Although signal-to-noise ratio has been very widely used, it is not nearly so easy to measure the signal voltage at the output. Thus SINAD is a more convenient expression than signal-to-noise ratio in a practical situation. In general, the (signal + noise + distortion) voltage will be very similar in value to the signal voltage alone, although there are exceptional cases where the signal is so small compared with the unwanted voltages that the signal may have to be recovered by special techniques (such as in the case of deep space communications). Thus, in most cases where one has a reasonable value of the signal-to-noise ratio and hence a usable signal, there is little difference between the signal-to-noise ratio and the SINAD value (no matter whether they are both expressed as a ratio or both as their dB values).

Table 1 shows the dB values for the SINAD figure against the voltage and power ratios. Thus a SINAD value of 6dB implies that the (signal + noise + distortion) voltage is twice the (noise + distortion), but in terms of power the factor is four times.

A SINAD value of 40dB represents a voltage ratio of one hundred and in such a case the signal voltage is so much greater than the two unwanted components that one can say the signal-to-noise voltage ratio is one hundred; that is, the unwanted components at the output constitute one per cent of the output signal. Similarly for a SINAD value of 60dB, the unwanted components are 0·1 per cent of the output signal, whereas a SINAD value of 20dB represents some ten per cent of the output signal as being noise and distortion expressed as voltages.

SINAD Value (dB)	Voltage Ratio	Power Ratio
6	2	4
10	3·16	10
12	4	16
20	10	100
30	31·6	1000
40	100	10 000
50	316	100 000
60	1000	1 000 000
70	3160	10 000 000
80	10 000	100 000 000
90	31 600	1 000 000 000
100	100 000	10 000 000 000

Table 1. Voltage and power ratios of (signal + noise + distortion)/(signal + noise) against the SINAD value in dB

Measurement

The SINAD values are measured by injecting a signal into the input of a receiver or other system and measuring the output. A single frequency tone signal suitably modulated onto a carrier may be injected into the antenna socket of a receiver and a distortion meter connected across the output.

The distortion meter is used to measure the output signal and is then switched so that a "notch" filter in the distortion meter prevents the signal tone from reaching the meter itself, thus leaving only the noise plus distortion. The SINAD value can then be found.

In actual practice receiver measurement tests are more complex. It is the intention of this short note only to provide readers with the essential basic ideas to understand about SINAD. ●

PW RADIO PROGRAMS CASSETTE OFFER

Cassette	Programs	For	Price incl. p+p & VAT	Order as	Available from
1	Morse tutor: QTH Locator/Contest Score; Distance & Bearing Calculator; Spurious Product Calculator	ZX81 (1K)	£3.50	ZX81 Radio Programs-1	PW Editorial Offices Westover House West Quay Road POOLE Dorset BH15 1JG
	Morse Tutor; Callsearch File; Radio Logbook; Oscar-RS Orbits Calculator	ZX81 (16K)			
2	Structured Morse Learning Course	ZX81 (16K)	£5.75	ZX81 Radio Programs-2	Practical Wireless Cassette Tape Offer Department PWC1 ROCHESTER X Kent ME99 1AA
3	As for Programs-1; *excluding* Morse Tutors 1K and 16K, but *plus* TV Colour Test-Pattern Generator	Spectrum (16/48K)	£3.75	PW Radio Programs-3	
4	Antenna & Feeder Calculations; Radio Range Calculator; Single Layer Coils & Resonant Frequency Calculations; QSL Card Printer; Meter Shunt & Multiplier Calculator; Reactance/Impedance Calculator	ZX81 (16K)	£3.75	PW Radio Programs-4	
5	As for Programs-4	Spectrum (16/48K)	£3.75	PW Radio Programs-5	

PW Bridport

Part 2 by E. A. Rule

DUAL POWER SUPPLY

Construction is very straightforward and no problems should be encountered. The printed circuit board layout is shown in Fig. 2.1. Assemble the smaller components first and be careful to observe the polarity of diodes and electrolytic capacitors. Use the components specified unless you are certain of the alternatives. Terminal pins may be used for connecting the p.c.b. or the wires may be soldered directly into the board. Both boards are identical.

The chassis layout is shown in Fig. 2.2 and is a view from the inside before the chassis, made from 16 s.w.g. aluminium sheet, is bent up. The p.c.b. mounting holes are not shown, and it is suggested that the p.c.b.s are laid onto the chassis in the correct position and the holes marked out. Likewise, only the main meter holes are shown, meters tend to vary regarding the position of their fixing screws and the correct position is best found by "offering" the meter up to the panel once the main hole has been cut. In fact it is suggested that **all** components are checked for size before cutting holes as component sizes do vary from time to time, even from the same manufacturer.

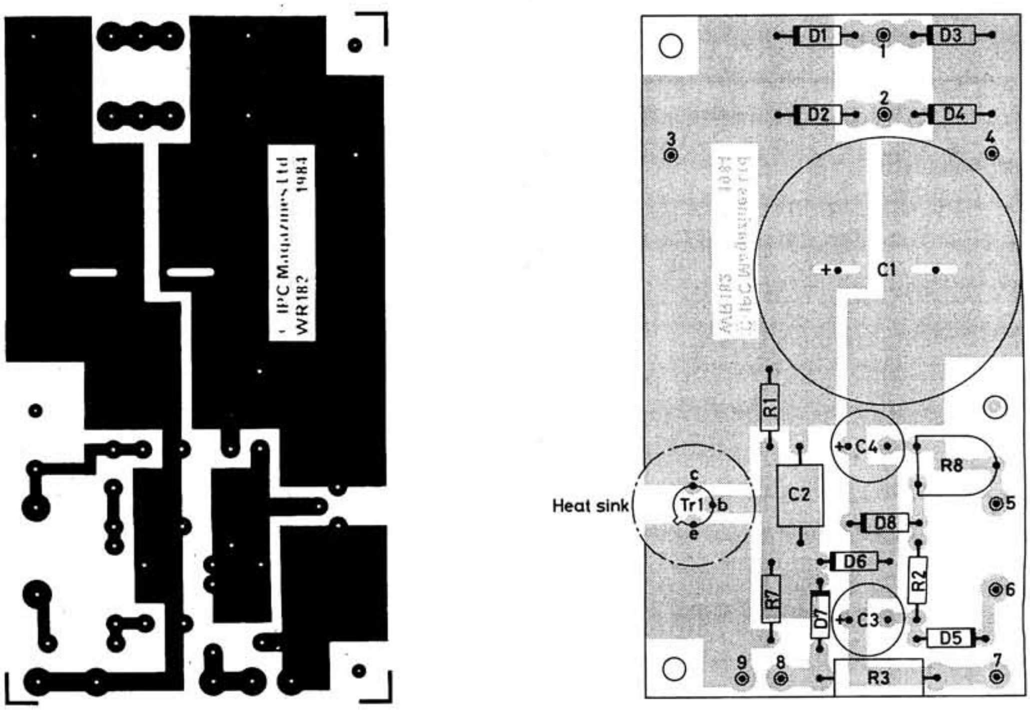
Once the chassis has been formed it should be carefully checked for size and the cover dimensions adjusted if necessary. Do this before making the cover as the final size may vary from that expected depending on the accuracy of your marking and bending. Once the cover and chassis have been constructed they can be fitted together and the cover fixing screw positions marked onto the chassis. The cover will "overhang" the chassis front and back and may be adjusted for best effect. Note the rear corners of the cover are cut away so that airflow to the heat sinks is not obstructed. The heat sinks are held in place with captive nuts which are supplied with the sinks, 4BA screws are used.

Four self-adhesive feet are fitted to the underside of the case once assembly is completed. The heat sinks should be adjusted in height so that there is a small gap between the bottom of the sink and the bottom edge of the chassis to ensure a free air flow.

The layout is not critical in any way and once wiring is completed it can be tidied up by using small plastic cable ties. 16/0·2mm wire should be used for all the main power circuits but 7/0·2mm is suitable for the other circuits. Cer-

WKM239

Fig. 2.1: Full-size p.c.b. details. Note that two of these boards are needed for the PW Bridport



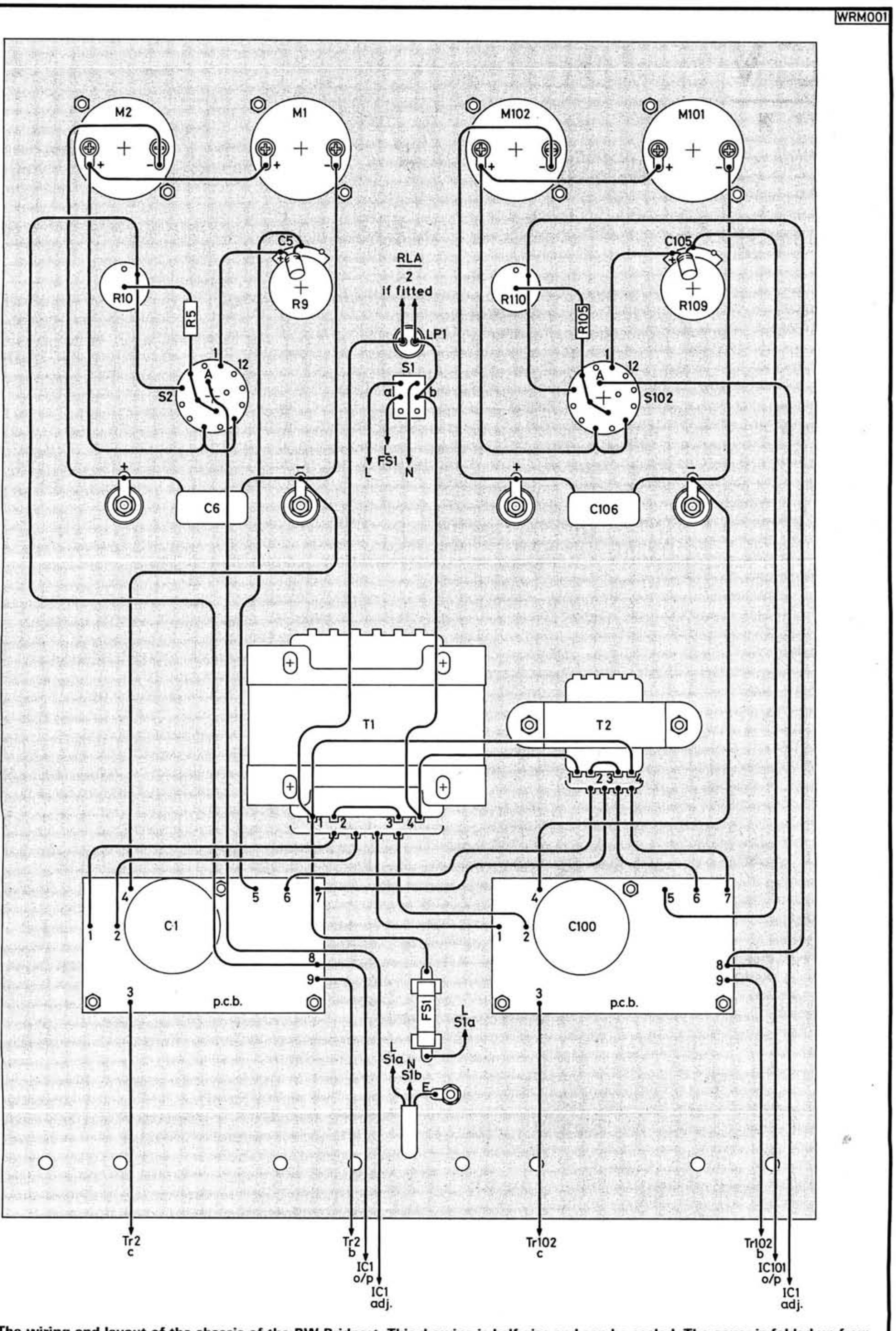


Fig. 2.2: The wiring and layout of the chassis of the PW Bridport. This drawing is half-size and can be scaled. The cover is folded up from aluminium sheet and wraps around the chassis. The chassis slides into the cover and is fastened with four self-tapping screws

tain components are fitted directly onto the regulator and power transistor and also onto the voltage control potentiometer. Do not be tempted to fit these onto the p.c.b. as the specification of the power supply may be impaired. The mains lead should be held in place with a suitable cable clamp fixed to the chassis between the two heat sinks.

A metal plate must be screwed into place between the two heat sinks to prevent an inquisitive finger touching any live parts inside.

General Notes

A heat sink must be fitted to Tr1 and should be rated at around 50°C/W. A solder tag is fitted behind the mains fuse and bolted to the chassis and is used for the mains earth lead. This is the **only** connection to the chassis, all other circuits are isolated. After assembling the regulator i.c. and power transistor onto the heat sink, check, using an ohmmeter, that they are isolated from the heat sink. This is important as a short to chassis will result in the destruction of one or both devices. Fig. 2.3 shows the correct method of assembly for both the i.c. and power transistor.

The pins coming through the heat sink should be sleeved to prevent possible shorts at this point (the insulation stripped from the 16/0·2mm wire makes suitable sleeving). Sleeving should also be fitted over the fixing screws as with the thick heat sinks used it is possible for the screw to touch the sink and cause a short because the insulating washers do not penetrate to the full thickness of the sinks.

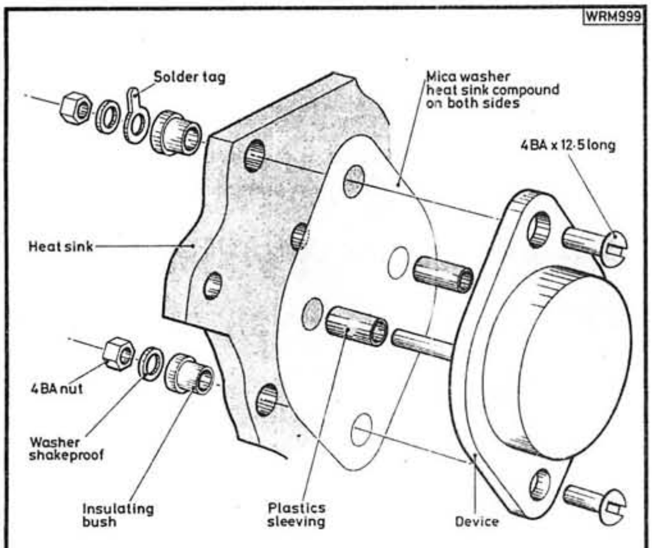


Fig. 2.3: Details of assembling the TO3 power devices onto the heat sinks

Testing and Setting Up

Two 33 ohm wire-wound resistors will be found helpful during initial tests. Disconnect one lead from each secondary of T1 and insert one of the 33 ohm resistors in series with the lead. This resistor is used to limit the current when first switching on and will help prevent damage should a short circuit be present in the power supply. Turn all front panel controls fully anti-clockwise. Switch the unit on and measure the voltage present across C1 on each board; this should be around 70–75 volts. If this is satisfactory, connect an external voltmeter to the output terminals of each section in turn and turn the voltage control potentiometer clockwise, the output should show an increase in voltage from around zero (a small voltage may be present at this stage), up to around 50–55 volts.

If all is correct, switch the unit off and remove the two 33 ohm resistors. Reconnect the transformer secondary windings. Turn the voltage control fully anti-clockwise again and switch on. If a voltage is present at the output, adjust R8 (pre-set on each p.c.b.) for zero volts. The voltage control should now permit a range of from zero to 50 volts plus to be obtained at the output terminals. Adjust the voltage and fit a suitable load resistor to load the circuit to 1A (i.e. at 50 volts use a 50 ohm 50 watt resistor, or say 8 volts and 8 ohms 8 watts). The current meter should show the current flowing and with this around 1 amp the voltage drop should not be more than about 0·2 volts when loaded as shown on the voltmeter fitted to the power supply or an external meter. Using a suitable low value resistance, say around 8 ohms, turn the voltage control to maximum, ignore the current meter which will be "hard over". Note the voltage reading obtained. Calculate from V/R the current flowing. This is the short circuit current and will be around 2·25 amps if the unit is working correctly.

Switch off and remove the load resistor, be careful, it may be very hot! (with 8 ohms and 2·25 amps the resistor will be dissipating over 40 watts).

An alternative method of checking the short-circuit current is to simply connect an external ammeter across the terminals and measure the current flowing; a 5A f.s.d. meter would be suitable.

In the standby position, there should not be any voltage present at the output terminals.

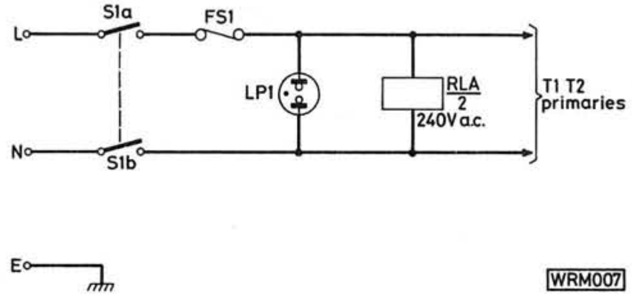
Turn the current limit control to its fully anti-clockwise (minimum current) position. Switch the selector to the constant current position and switch the power supply on. The voltmeter should go "hard over" and if an external meter is connected across the output terminals it will read about 56 volts (no load). Connect a resistor of, say, 100 ohms across the terminals and note the voltage shown on the voltmeter. Calculate the current from V/R and check that the current meter gives a true reading. For example if the voltage reads 20 volts, then $20/100 = 0{\cdot}2$ amps. Change the resistor to one of higher value, say 220 ohms, if the current is constant at 0·2 amps the voltage will increase to 44 volts ($I \times R$).

The voltage available to drive a current through a load is 50 volts and this sets the limit of the value of load for any given current setting. For example, with the current control set for 1 amp the maximum load would be 50 ohms. If the current is limited to say 100 milliamps then this current would be maintained with load resistor values up to 500 ohms.

To set up any particular current limit, simply short-circuit the output terminals and adjust the current control potentiometer R10 for the current required. The current set will not be exceeded whatever load is presented. The voltmeter will indicate the actual voltage present across the load at all times, likewise the current meter will always indicate the current flowing. This applies to both the constant voltage and constant current modes.

Using the *PW* Bridport

As with any piece of test equipment certain precautions are required if the best results are to be obtained. Power supplies are no exception to this although more often than not they are just taken for granted.



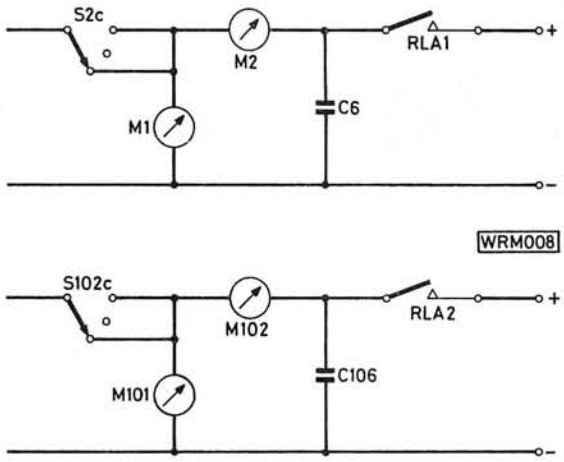


Fig. 2.4: Optional modification to prevent damage due to output voltage surge occurring on mains failure (see Part 1). Relay RLA/2 should have a 240V a.c. coil and twin "make" contacts rated to carry at least 1A. Connect contacts into lines between ammeters and positive output terminals as shown

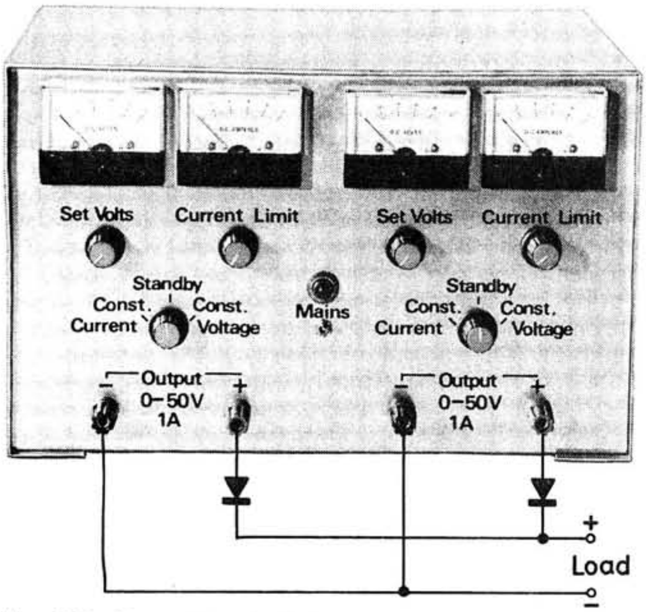


Fig. 2.5: Two silicon diodes must be connected as shown if the two outputs are connected in parallel. Note that the front panel markings for Const. Current and Const. Voltage must be interchanged to correspond with Fig. 2.2

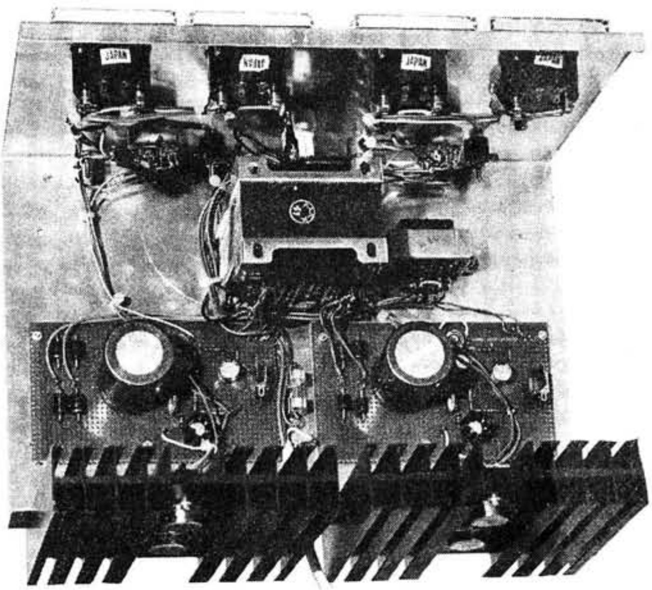
Use as a voltage source: The power supply may be used to provide either two separate 0 to 50 volts supplies at load currents up to 1 amp or may be series connected to provide either a 0 to 100 volt supply at 1 amp or a centre-tapped (common) +50 and −50 volt supply. A centre-tapped supply is often required for modern semiconductor circuits and normally both sections would be set to the same voltage to give a "balanced" supply.

It can also be used as a 0 to 50 volt supply with load currents up to 2 amps if certain precautions are taken. First a 1N5004 silicon diode must be connected in each of the positive outputs. The load is connected to the common connection *of these* diodes as shown in Fig. 2.4. Both supplies should be set up for the same voltage output but this is best checked by slightly adjusting the voltage control of one supply until the same current is being drawn from each.

With these diodes wired as shown the supplies are protected from reverse voltage being fed one to the other. However, the regulation is impaired and this becomes very poor at outputs much below 5 volts. If only low current is being taken a resistor across the output to maintain at least 100 milliamps will be required. The supplies must not be connected in parallel without these diodes.

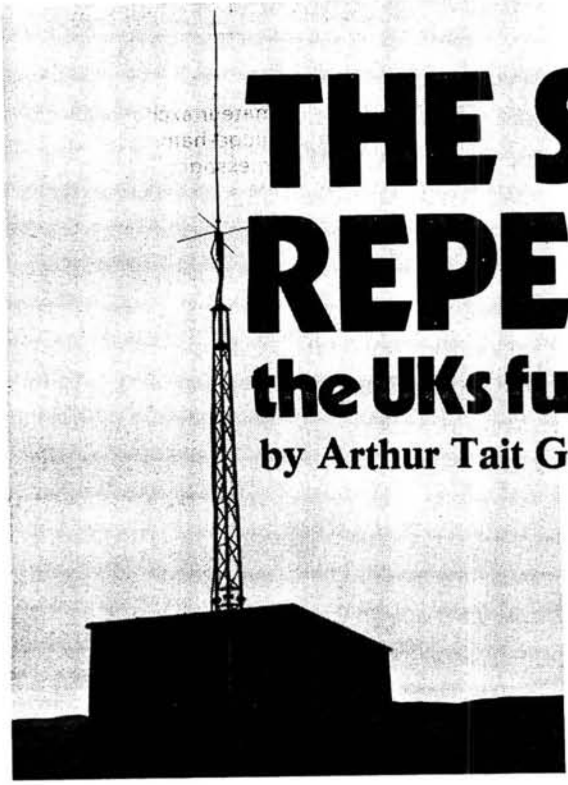
When external loads, amplifiers which have large electrolytics across the supply for example, are used these diodes should also be used in each positive line. The reason for this is that if you had set the output of the power supply to, say, 45 volts and then reduced it to, say, 10 volts, the electrolytic in the external load would discharge through the regulator i.c. and damage it. The use of a series diode prevents this and should always be used in such cases unless you are extremely careful not to reset to a lower voltage with the power supply switched on. Switch to standby, wait for the voltage to decay and then turn the voltage control down before switching on again.

Use as a current source: The power supply can be used to provide a constant current between the limits of 100 milliamps and 1 amp. This can be used for charging NiCads, for example, subject to the current rating of the cells. As 50 volts is available, up to around 30 cells in series, of the same type, may be charged at the same time.



Up to 2 amps may be obtained by using the diodes as shown in Fig. 2.5 and the supplies connected in parallel. **They must not be connected in parallel without the diodes in circuit. When in the constant current mode the supplies must not be connected in series.**

Much of this is plain common sense but by observing these precautions the power supply unit should give years of trouble-free service. ●



THE SHETLAND REPEATER GB3LU

the UKs furthest north

by Arthur Tait GM4LBE

From time to time over the years, amateurs in Shetland have discussed the possibility of having a 144MHz band repeater somewhere in the islands. However, the great leap forward took place on 17 December 1981, at a special meeting of the Lerwick Radio Club (GM3ZET), it was decided "to proceed with a 144MHz repeater project, with the repeater being sited on the Ward of Bressay".

The Lerwick Radio Club had two great strokes of luck, or good fortune, in executing the plan to construct a repeater. Firstly, the Club had, in the person of Jim Butler GM3ZMA, a person of great technical expertise, and virtually single handed Jim has constructed the complete RX/TX/Logic unit which forms the heart of the repeater—indeed Jim has even constructed a complete spare repeater unit! Secondly, the Club received generous financial aid from the Leisure and Recreation Department of Shetland Islands Council, and it is doubtful if the project would or could have got off the ground, let alone into the air, without Jim's technical ability and the financial help of the Local Authority.

Jim GM3ZMA in the Lerwick Radio Club with the Wacom duplexer and the TX/RX/Logic unit—in fact the complete repeater except the antenna!

Photo by GM4LBE

The RX/TX units are Pye R460/T460 units modified for 144MHz use, while the logic is based on the GB3US MkI design with some modifications by GM3ZMA. The duplexer was purchased from Wacom Products Inc., of Waco, Texas, USA, and its performance is first class from a very well made unit. The repeater channel, by the way, is R3.

In the summer of 1982 it was decided to locate the repeater not on the Island of Bressay, but on the summit of Shurton Hill (ZU64d) which lies some 3km west of Lerwick. This site is much more accessible than the previous one and there is easy vehicular access right to the equipment hut. The repeater is housed in the Local Authority (Department of Construction) radio hut. A 6·5m lattice mast was erected to carry the antenna, which is a Hustler G6–144B colinear, with about 12m of Heliax feeder to the TX/RX unit. The base of the mast is a couple of metres below the actual highest point of the hill (175·55m a.o.d.) at about 173·55m a.o.d. with the base of the actual antenna at approximately 180m a.o.d. At this location winds of 125m.p.h. are not uncommon.

While Jim deserves the lion's share of the credit for the project, a number of others were involved in the spade work such as concreting the antenna base, excavation, mast erection etc., and those were: Frank GM4SWU, Tommy GM3LER, Hans GM4SSA, Billy GM8RUI and Arthur GM4LBE. Arthur was also responsible for all the paperwork relating to the project.

The photographs show Jim in the Lerwick Radio Club with most of the repeater—only the antenna is missing, and also the equipment hut with mast and antenna.

The repeater has been completed now for a number of months and as soon as the licence is granted should be "on air" without further delay. ●

Why not help your local repeater group by *joining* them and making some sort of contribution. Remember that all repeaters are built, maintained and financed by amateurs for the benefit of all amateurs

Letters

Packet Radio

Sir: I have now dutifully ploughed through Parts 1 and 2 of your Packet Radio article at least four times but I doubt if I am now any more able to understand the concept or the working of the system from Tucson.

We amateurs are in the communication business, but of late the means to achieve this has become so much more important than the content of the messages transmitted and (hopefuly) received. The late Marshall McLuhan commented that in his view "The medium is the message" when he referred to the content of many TV programmes, and it seems that this concept may now be applied to much of what is now developing in amateur radio.

The complexity of a Packet Radio system is staggering. I have been a licensed non-professional radio amateur for more than 37 years and have always tried to keep abreast of modern trends and developments. I have done my share of experimentation and construction work, but now it seems I must admit defeat for I find it impossible to come to terms with your Packet Radio article or visualise the operation of the system. I must confess to not being a "Computer Man", but even so I must regard the offending article as so much wasted space in a magazine which is normally so very readable and informative. Perhaps I am alone in holding this viewpoint, but I am confident that there must be a wide section of your readership who are just as unable to cope with the article under discussion. I am thinking particularly of the army of recently or soon to be licensed amateurs, many of whom it seems find the RAE so exacting!

Using Packet Radio for normal amateur exchanges would surely be akin to the classic sledge-hammer and nut situation? If it is meant for lengthy messages of importance and urgency it is surely redundant? We have the telephone, Telex and of course the mailbox all of which are cheaper and easier to set up and use.

If there were to be an annual award for the article in any radio magazine which contained the greatest proportion of "gobbledegook" to standard English (A Nullitzer Prize?), the piece on Packet Radio would be the certain 1983 winner. Here is hoping for a rapid return to sanity on your Editorial Board!

John D Heys G3BDQ, Hastings.

I hope not too many readers found "Packet Radio" so indigestible. Obviously it would not appeal to all, and especially not to the beginner unless he happened to be a "computer freak". Our feeling was that the articles gave a good insight into the basic principles and the sort of hardware necessary to use this newly developing communications mode. Readers may be interested to know that the first transpacific QSO using packet radio on h.f. has recently been reported in the American press.

A sledge-hammer to crack a nut? Well maybe, if the message really is the most important thing, but surely in amateur radio the medium — the means of communication — is first and foremost what the hobby is all about. If this aspect were to disappear totally in favour of chatting and making friendships over the air, pleasant though that may be, we would soon start losing our frequency allocations to other users.— Editor.

Lengthy Licence

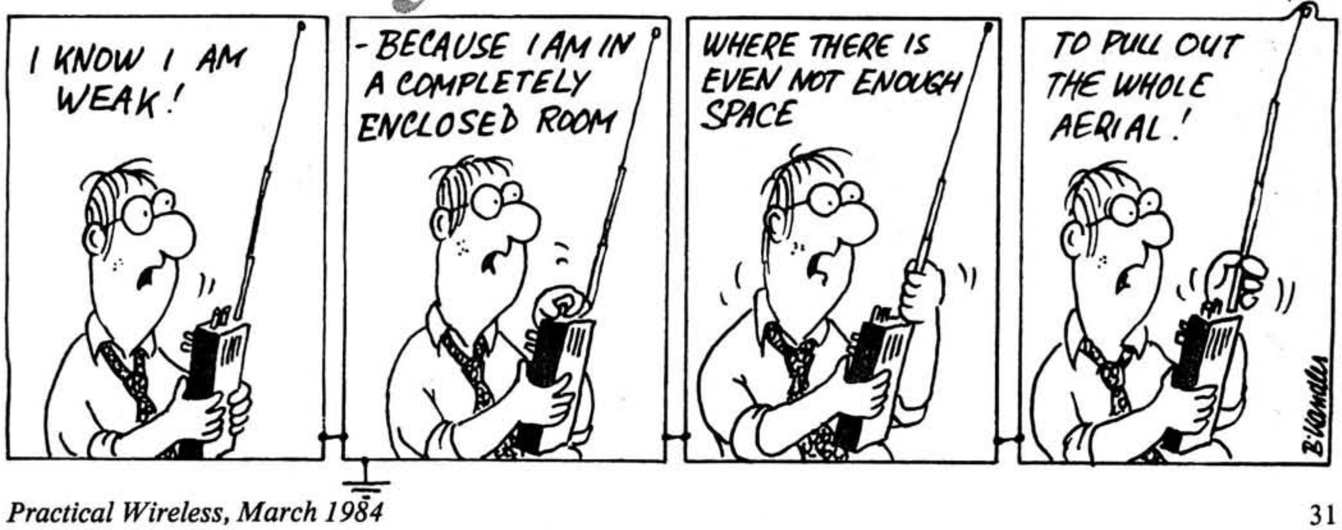
Sir: As one of the longest licensed amateurs in the country I read with much interest the item under the heading "Vintage QSL Cards" in the November issue, and was perhaps a little amused to see that a card from 1948 was thought of as vintage.

Whilst I remember many of the broadcasting stations mentioned in the report, I did not myself collect broadcast cards—probably I was foolish! But I have an exceptional collection of amateur QSL cards, one of which refers to QSOs with G5HS in the year 1923. Amongst my cards are a number of Americans without international prefixes, as those were not thought necessary in 1924 or '25; together with a card from New York State printed with a now Russian "U" prefix.

I find it a little difficult to think of 1948 as early. To "antiquated Ern G6GR" is seems just the other day! I also echo the sentiments of your previous writer that my cards will find a safe and appreciative home when I am no longer in a position to admire them in person. They certainly illustrate much of the history of amateur wireless which *Practical Wireless* today covers so effectively.

E. L. Gardiner G6GR
Torquay

Benny



Swap Spot

Have RTTY equipment consisting of Z80-based micro, ST5 TV and RS232 monior. Would exchange for Canon AE1 accessories and lenses or other camera equipment or w.h.y, Tel: Bracknell 52518 (evenings). *U277*

Have Canon 514 XL-S sound cine camera macro lens, mint condition, plus tripod, editor, slicer and light. Would exchange for Yaesu FT-290R all-mode 144MHz transceiver or similar. Anthony Pease, 18 Ruskin Drive, Airedale, Castleford, W. Yorks. *U286*

Have 1500 watt 240 volt generator with handbook hardly used. Would exchange for good communications transceiver/receiver. Tel: 0778 343785 (Peterborough). *U287*

Have Bremi BRL200, 200W p.e.p. 100W r.f. linear amplifier. Ideal for 28MHz f.m., cost £93. Would exchange for good condition boxed FC-707 a.t.u. Tel: 0625 527250 after 4pm on weekdays (Wilmslow). *U288*

Have Microwave Modules 144–432R transverter. Would exchange for ATV transmitter, modern dual-trace oscilloscope, 144MHz 100W linear, Com-in 64 or CBM printer. G6DQK, 25 Hamilton Street, Stalybridge, Cheshire SK15 1LL. *U289*

Have gents 12-gear racing cycle in new condition. Would exchange for 430MHz handheld. G4TBM. Lewes (Sussex) 6099. *U311*

Have TR-2300, VB-2300 amp, mobile mount, Azden speaker, boom mic, PS1200 charger, soft carry case and helical portable antenna. Would exchange for SX200N scanner plus antenna. G8NKU. 3 Castleacre Close, South Wootton, King's Lynn, Norfolk. Tel: 674015. *U340*

Have Realistic TRC-101 handheld f.m. 4W CB plus all accessories (inclusive both K40). Also have Daiwa SR9 144MHz receiver with gutter-mount 1/4 wave. Would exchange for 144MHz handheld plus NiCads. Robert. Tel: 0633 277013 Tues, Sat and evenings. (Newport, Gwent). *U348*

Have Yashica FR1 f1.4 s.l.r. plus one-touch zoom 80/200 m.l. lenses alone valued over £200. Would exchange for h.f. rig, Atlas 215 or Trio 120, etc. D. V. Walters G3MXO. 92 Falkland Way, Birmingham B36 0LX. Tel: 021-788 0518. *U349*

Have Bell & Howell 634 sound projector 16mm. Would exchange for 430MHz transceiver, 16mm cine camera or reflector telescope. G8BSK. 290 Priory Road, Southampton SO2 1LS. *U370*

Have 4½in refracting telescope 65in f.l., polished steel, equatorial head, motor driven, mounted on cast iron pillar, plus accessories, value over £400. Would exchange for general coverage receiver of same value. Tel: 0438 724630. (Stevenage). *U372*

Have Gibson Les Paul Cherry Sunburst, Laney Pro session 50, analog echo, phaser, mic and stands, all brand spanking new. Used at home a couple of times. Would exchange for h.f., v.h.f., u.h.f. gear, test gear or w.h.y. Pete. Tel: Telford 616611. *U378*

Have excellent KW202 amateur bands receiver, 1·8–30MHz, mint condition with handbook, no mods, a.m./c.w./u.s.b./l.s.b., preselector, Q-multiplier, 3·1kHz mechanical filter, notch, calibrate, etc. Would exchange for mint 35mm s.l.r. camera equipment of equal appraisement. Fairclough G3OEI. 28 Rimmer Green, Southport, Merseyside. *U386*

Have a 1956 ex-Admiralty type B-40 radio receiver, frequency range 640kHz–30MHz with a.m./u.s.b./l.s.b./c.w. Would exchange for ZX Spectrum computer 16 or 48K. Mike Douglass. Tel: 061-434 6263 (Manchester). *U391*

Have Chinon Super 8 sound cine camera, rechargeable batteries and charger, many extras. Cost £200 eighteen months ago. Would exchange for v.h.f./u.h.f. scanner similar to Bearcat or Garex 200, or Commodore 64. Must be in working condition. Tel: Twyford (Berks) 340052 anytime. *U395*

Have Vega 402D v.h.f./u.h.f. tunable TV 3 months old and Aerialite 14-element u.h.f. antenna (unused). Would exchange for Datong FL2 or SEM audio filters. K. Chorley, 7 Foxfield, Everton, Lymington, Hants. Tel: Milford-on-Sea 5231. *U416*

Have Teac A3300S2T reel-to-reel tape recorder (cost £375). Would exchange for 144MHz rig. A. Weddell, 10 High Street, Eyemouth, Berwickshire TD14 5EU. *U444*

Have FRG-7 h.f. general coverage receiver with a.t.u., Beta 1000 CB with antenna, Acorn Atom computer and IC24G 144MHz f.m. transceiver. Would exchange for 430MHz handheld and 144MHz multimode (FT-290R, C58, etc.) or w.h.y. Richard G4TGJ. Tel: 0707 51449 (Hatfield, Herts). *U446*

Have Search 9 144MHz receiver plus ZX81 + 16K, also 12 SW Mags (June 1969–May 1970). Would exchange for IC202S. Mr Keen, 30 Bath Road, Chiswick, London. Tel: 01-995 7339. *U451*

Have Yaesu FR-101 receiver deluxe in mint condition (cost £250) analogue readout only and 4½in Tasco reflecting astronomical telescope (cost £290) only used once. Would exchange for FT-290R or similar. Tel: 01-743 8352 anytime. *U473*

Have a Kodak 4000 disc camera, used twice. Would exchange for a v.s.w.r. meter, must be good for frequencies 144–146MHz. K. J. Pallant. Tel: Braintree 24692 between 6pm and 9pm. *U493*

Have 12 foot unsinkable sailing boat with road trailer and winch. Would exchange for any h.f. or test gear. D. Peach G3VXS. Tel: 0782 625661 (Newcastle-under-Lyme). *U494*

Have Sony ICF6800W communications receiver, 31 waveband, unused—immaculate. Would exchange for electric piano. Tel: High Wycombe 30065. *U495*

Have Trio 9R59DS communications receiver 0·5–30MHz, a.m./s.s.b., r.f. gain, antenna tune, etc. In excellent condition. Would exchange for good oscilloscope or anything interesting and useful. Tel: Landrake 540 (Cornwall). *U507*

Have Cambridge tuneable audio notch filter. Would exchange for an s.w.l. a.t.u. S. Rake, 80 Cripps Avenue, Tredegar, Gwent. *U513*

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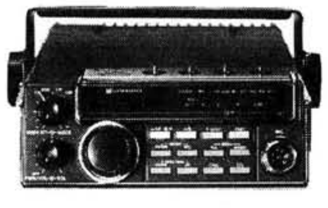

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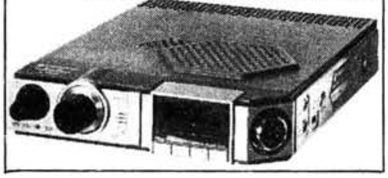

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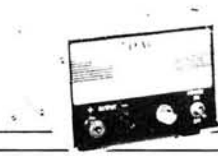

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The Origin Of Radar

by F. C. Judd **Part 2**

The evolution from wireless to radar and the general development work leading up to the design of the first CH (Chain Home) radiolocation (radar) transmitters put into operation just prior to World War II was dealt with in Part 1 of this article.

Whilst it is not possible to entirely cover the technicalities concerned with function and circuitry used in these high-power pulse transmitters, including the higher frequency CHL (Chain Home Low) system, some of the main technical aspects may be of interest.

The first specifications for CH equipment were issued from the Bawdsey Research Station of the Air Ministry in 1937/8. The general plan for location of these stations around the coastline of England, including parts of Wales and Scotland, was shown in Fig. 1.1 in Part 1. The specifications were brief and for the transmitter they required the production of pulsed radio frequency transmission with a peak power equal to or even exceeding 200kW, the frequency stability required being within 0·05 per cent of that stipulated. The pulse repetition rate was either 25 or 50 per second and locked to a 50Hz source (nominal 230V—50Hz mains supplies). Rise time of the transmitted pulse was 1µs to 0·9 of maximum amplitude and the pulse duration was adjustable between 5 and 35µs. The power radiated during quiescent periods had to be maintained at less than a few microwatts so as not to cause unnecessary interference to the CH receiver during the periods between the transmission of pulses when echoes were being received.

It is interesting to note some of the power ratings of valves used in the CH transmitter drive and output stages:

- Type SW5. Double tetrode with 1400 watt tungsten cathode and capable of 10kW c.w.
- Type 43. Tetrode with tungsten filament requiring 18 volts at 140 amps and capable of 40kW output c.w.
- Type 45. Similar to above but capable of 85kW at wavelengths longer than 6·25 metres.

The Basic CH Transmitter Circuit

In the original circuit, Fig. 2.1, the master oscillator was a single Ediswan valve type ES751 employing four pre-set tuned circuits and switching mechanism for changing to a required frequency. These circuits could be adjusted from controls on the main transmitter unit but were all mounted in a thermostatically controlled screened enclosure. This stage was operated at half the normal transmitter frequency in order to minimise r.f. leakage during quiescent periods, i.e. between pulses. Then followed a doubler stage using a pair of Ediswan valves type M75 which were 75 watt tetrodes driven in anti-phase and connected to one of four sets of circuits tuned to the final operating frequencies. Note that the master oscillator and frequency doubler were not pulse modulated. The output from the M75 doubler provided the drive to the grids of the SW5 double tetrode to which the pulse modulation signals were applied. These were timed either from a locally derived lock pulse or from a signal fed to the lock amplifier from the CH receiver. The SW5 double tetrode supplied power to the control grid of the drive amplifier, a type 43 valve. The output stage, a pair of type 43s in push-pull, could be switched to any of four tuned output circuits from which the feed lines to the antenna system were taken.

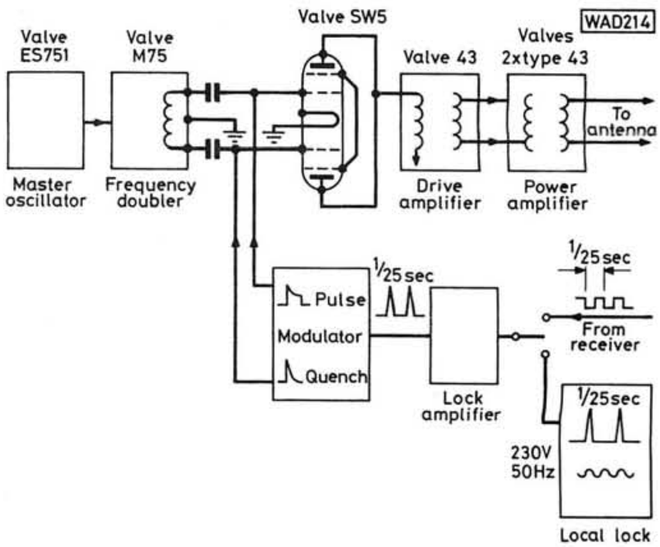


Fig. 2.1: Original basic circuit of a CH radar transmitter. Modified at a later date as explained in text

By courtesy of the Institution of Electrical Engineers

The Modified CH Transmitter

It was found to be more or less impossible with the basic system as described to limit stray radiation between pulses and this affected the function of the CH receiver. It was realised, however, that the master oscillator could be pulsed directly and the output stages driven from this via an intermediate doubler stage. This arrangement still allowed a satisfactory pulse to be produced but, more important, virtually eliminated residual r.f. during the quiescent period to an acceptable 1µW. This reduced the risk of interference to the CH receiver during the reception of echoes. The master oscillator/frequency doubler arrangement as in Fig. 2.1 was therefore abandoned and an SW5 valve was used as a directly pulsed master oscillator with an output stage consisting of a pair of type 43 valves operated in push-pull. These valves were demountable types with vacuum maintained by pumps and anode cooling by water circulation. About 90 per cent plumbing and 10 per cent real r.f. circuitry!

Performance

In final form, operational CH transmitters were capable of pulse power of at least 600kW with 35kV h.t., the average figure being 750kW. Special tests revealed that with the h.t. voltage increased to 40kV a pulse output in excess of 1 megawatt was obtainable but this put undue stress on various components within the transmitter and on the antenna systems in use. The reliability of these stations reached a very high level and rarely was a station off the air for more than an hour or so per year because of some fault or other. Even after damage caused by enemy action, full operation was frequently restored within a few hours. Each station had duplicated equipment as well as auxiliary power generators in case of mains failure. The photograph in Fig. 2.2 shows a CH transmitter room with its duplicated transmitters and control consoles. (Typical circa. 1939-1940). Each control console carried a c.r.t. which displayed the transmitted pulse, and all functions such as obtaining vacuum in the valves and applying the various voltage supplies to the transmitter circuitry, etc., were activated from the console.

The CH Receiver

Receivers for CH radiolocation stations, also known as RDF (Radio Direction Finding) receivers, were produced not only for use in conjunction with fixed stations, as previously described, but also for mobile CH stations. Original development work began in 1937 in conjunction with the Bawdsey Research Station and even by 1938 a number of receivers and transmitters were put into operation experimentally on sites near the south-east coast. They were to provide range information (up to 200km) as well as direction and approximate height of incoming aircraft. The operating frequencies were between 20 and 46MHz.

The construction of CH receivers was based on rack type units and the early RF series for fixed station function occupied four bays each 2·1m high. Various modifications and additions were made but otherwise the general arrangement remained similar to that shown in Fig. 2.3 (left side of photo).

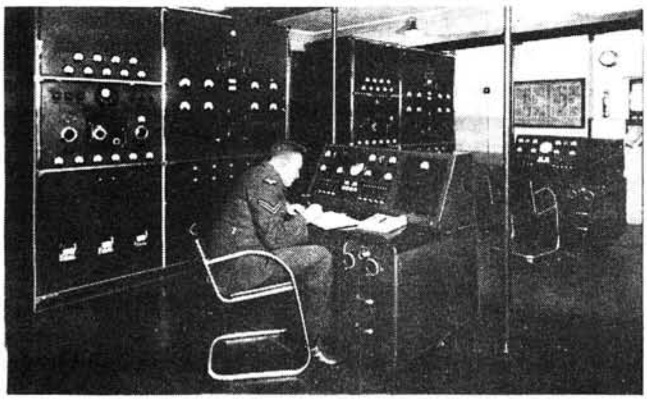


Fig. 2.2: CH radar transmitter and control desk. Note: equipment is duplicated

Photo by courtesy of RAF Museum

Basic Circuitry

The frequency range, later changed to 20 to 60MHz, was covered in four bands and the receiver employed special low-noise r.f. pentodes in the first signal amplifier stages followed by standard pentodes in following stages. Three stages of r.f. amplification preceded the triode-hexode mixer/frequency changer and the intermediate frequency was 2MHz. Later models employed five i.f. stages with control over bandwidth to 50, 200, and 500kHz. Then followed a detector and d.c. amplifier feeding signals to the c.r.t. Y plates to produce the echo "blips". The c.r.t.s were long persistence types with electrostatic focusing and deflection.

Various methods were used for synchronising the transmitted pulse and receiver display timebase and on later receivers (the RF8) a system was used in which a pulse generated in the receiver initiated the transmitter with a fraction of the pulse being fed back to the receiver to start the timebase for the c.r.t. display.

Fig. 2.3: Section of a CH radar receiver room. The CH rack built receiver can be seen on the left. Wireless operator and plotting personnel in the foreground

Photo by courtesy of Imperial War Museum

Pulse Generation

The pulse generating circuits for CH radar were relatively complex involving the use of a large number of valves. These circuits had to provide the c.r.t. timebase, lock pulses for the transmitter, c.r.t. brightening pulse and timebase calibration as well as a capability for IFF signals (Identification Friend or Foe) and the rejection of c.w. interference or deliberate jamming. A facility was provided to reduce "clutter" due to echo returns from fixed obstacles in the vicinity of the station itself.

Credit for much of the original design work on CH receivers must go to members of the Bawdsey Research Station, Telecommunications Research Establishment (TRE) and Royal Aircraft Establishment (RAE). Further design work and development to production stage was undertaken by engineers at the works of A. C. Cossor Ltd. under the supervision of Mr. O. S. Puckle, so well known for the timebase circuit which bears his name.

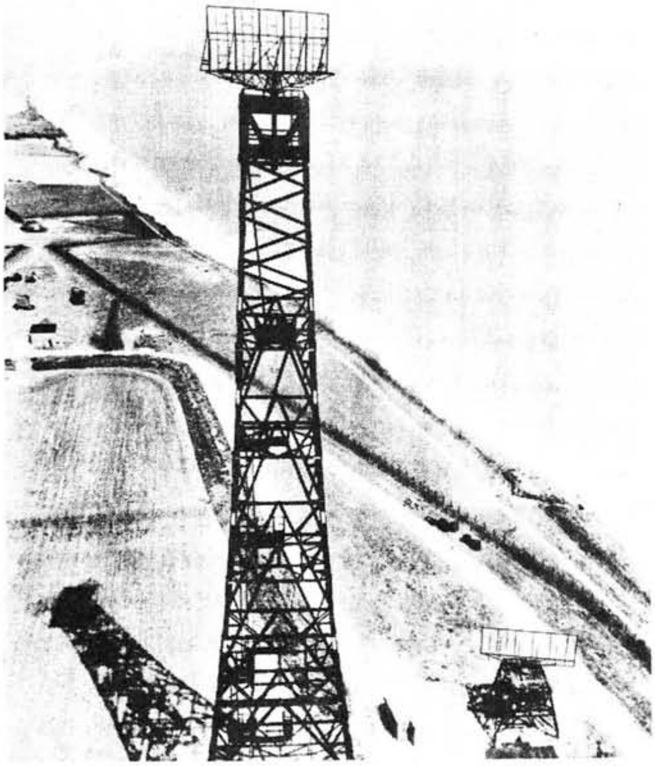


Fig. 2.4: To detect low flying German aircraft, the CHL stations were used. These operated on 200MHz and the rotating antenna array was mounted at the top of a 56m tower to achieve the desired low angle radiation

The CHL-GCI System

The original CH radar system required large antenna arrays for transmitting mainly because of the relatively low frequencies employed. The use of much higher frequencies enabled more compact equipment to be produced and used together with highly directional and physically much smaller antennas. The Army needed portable equipment and the Royal Navy required radar systems that would occupy the least possible space on warships of one kind or another. The Army GL1 and GL2 and Navy type 281 equipment was perhaps the best known and is no doubt still remembered by many who were in either of those services during the war. The type 281 operated on frequencies between 86 and 94MHz but real v.h.f. and centimetre wavelength equipment was also being developed, some even for use in aircraft.

The CHL (Chain Home Low) and GCI (Ground Control Interception) radar used by the RAF played a very important role, in that CHL was capable of plotting very low flying aircraft that might not be seen by the CH system, whilst GCI was used for ground controlled interception of enemy bombers at night by our own night fighter planes equipped with a special on-board radar known as AI (Aerial Interception). The essence of the GCI system for night-time interception of enemy bombers was to provide the night fighter crew with continuous course and height information (from the GCI radar) so as to place the fighter aircraft in a position favourable enough to use the on-board, short-range AI radar to get a really accurate fix on the enemy plane. Achievement of this by the night fighter crew resulted in a triumphant "Tally-Ho" over the v.h.f. communication link between the night fighter and the GCI operators and controller. Little guesswork is required to realise what followed!

The photograph (Fig. 2.4) shows a CHL station antenna mounted at the top of a 56m tower to achieve low angle radiation necessary for the detection of low flying enemy aircraft. The author was attached to one of these stations on the East Coast at Happisburgh in Norfolk, which also had a GCI station on the same site. The buildings used are still virtually intact today but used by local farmers for storing cattle feed, etc. The mast has long since gone.

During the course of the war many and varied radar systems were designed and put into operation, including 10 centimetre equipment employing the Magnetron valve developed by Drs. Boot and Randall. Some of this equipment, such as ASV, Oboe, Gee Navigation, H2S etc. was developed at Leeson House near Swanage in Dorset and which became known as "centimetre alley". A fascinating account of all the wartime radar systems and their development and use is given in a book called *One Story of Radar* by A. P. Rowe (Cambridge University Press) and also in Ref. 3.

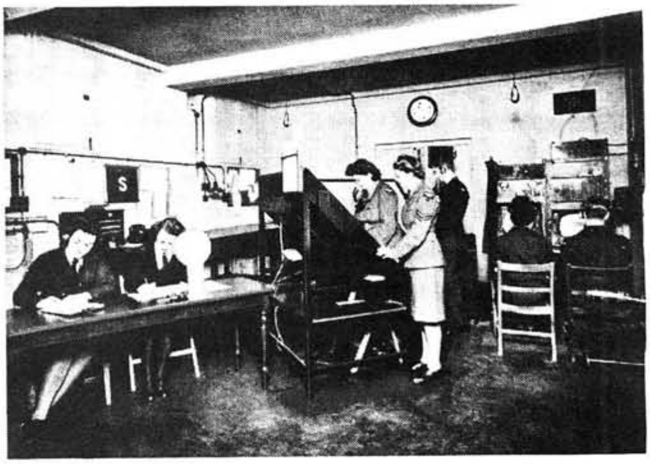


Fig. 2.5: A typical CHL receiver room. Receiver with displays in right hand corner. Plotting table centre and plotting and recording personnel on the left. CRT displays were p.p.i. (plan position indicator) and "A" trace type

Photo by courtesy of RSRE Great Malvern

Finally, it must be said that many pre-war licensed radio amateurs who joined the RAF soon found themselves attached to a "60 Group" radar station and those who were will probably never forget the radar courses at Yatesbury! The author spent most of the war period 1939-1945 on CHL and GCI on the east Norfolk coast. The CO of the Wing covering that area at the time was none other than John Scott-Taggart. His name will no doubt be remembered by "old timers" for the receiver circuits he devised and published in many pre-war wireless magazines. ●

References

1. *The CH Radiolocation Transmitters*. J. M. Dodds and J. H. Ludow. J.I.E.E. Vol. 93 Part 3A. Radiolocation No. 6. 1946.
2. *The Development of CH Type Receivers, For Fixed and Mobile Working*. J. W. Jenkins. J.I.E.E. Part 3A Vol. 93. No. 5—10. Page 1123. 1946.
3. *Radar Transmitters. A Survey of Developments*. O. L. Ratsey. J.I.E.E. Part 3A. Vol. 93. No. 1. 1946.

Additional Reading

The Principles and Practice of Radar. H. E. Penrose and R. H. Boulding. 7th edition. 1963.
Radiolocation. Basic Principles. R. L. Smith-Rose. *Wireless World*. Feb. 54 (and following articles).

Acknowledgements

Thanks are due to—Royal Signals and Radar Establishment, Malvern; The Imperial War Museum, London; The RAF Museum, Hendon, London; The Marconi Co., Chelmsford; *Wireless World*, Business Press International Ltd.; The Institution of Electrical Engineers, London; for kind assistance with photographs and other relevant information.

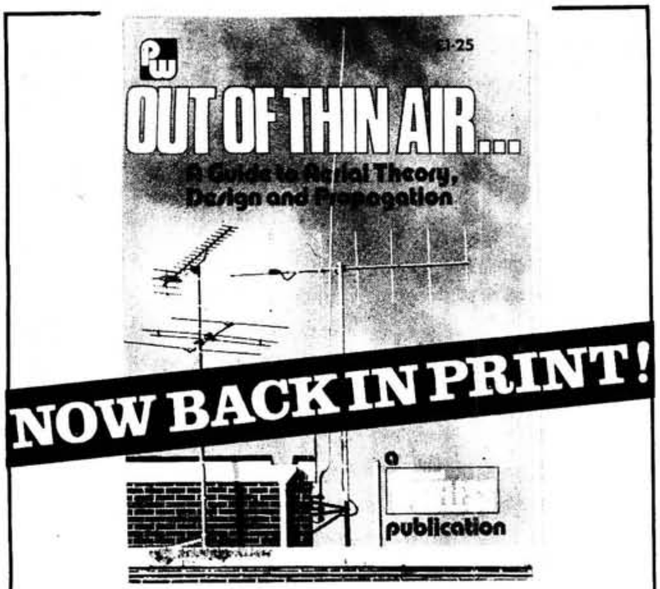
Uncle Ed

▶▶▶*continued from page 21*

To try to make things easier to understand, I've ignored several factors in my explanations: **1.** A conducting diode doesn't look quite like a short circuit, because it has a forward voltage drop of around 0·7V (700mV) if it's a silicon diode, or around 0·2V (200mV) for a germanium. This will reduce the peak voltage on the capacitor. **2.** The r.m.s. voltage from the transformer will be 10V at full rated load. Lightly loaded, the natural self-regulation of the transformer could cause that to rise by anything between 10 and 25 per cent depending on its design and rating, increasing both the peak voltage on the capacitor and the reverse a.c. voltage on the anode of the non-conducting diode. **3.** The mains supply voltage can vary above and below its nominal value (240V in the UK). The official tolerance allowed is 6 per cent, but depending on your distance from the electricity substation that can be exceeded, and it's wise to allow 10 per cent.

At the worst combination of factors 2 and 3 (from a diode's p.i.v. point of view) you could add 27·5 per cent to the transformer secondary voltage. So, our 14·14V from the 10V winding could rise to around 18V. Deducting the 0·6V forward drop on the diode gives a peak capacitor voltage of 17·4V. The diode in Fig. 4 could see a peak inverse voltage of 18+17·4=35·4V, and that from a nominal 10V transformer!

It's worth mentioning too that a 15V or 16V working electrolytic used for C could be somewhat overstressed. Better to play safe and go for at least a 25V rating capacitor. ●



Aerials and aerial accessories are very definitely among the most popular topics covered in *Practical Wireless*. In response to requests from readers, we've reprinted a selection of articles from the past three years, plus two new features—one by Ron Ham on v.h.f. propagation, the other describing the "Ultra-Slim Jim", a new version of that most popular 2-metre aerial design by Fred Judd.

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SPECIAL PULL-OUT FEATURE

PW RADIO DATA

part 1-"abbreviations"

"Please tell me where I can find a list that will help me understand all the abbreviations used in radio magazines and books." Many newcomers to the hobby write to us with this sort of request, and we usually recommend several reference books. Unfortunately, though, unless you can afford one of the bigger radio/electronics dictionaries, abbreviation lists aren't very comprehensive.

So, we thought we'd try to put together a list to cover the whole hobby of radio, plus related aspects of electronics and computing. We've included many terms you'll come across in books from bygone days, and some from the professional field, too.

The problem with abbreviations is that the same group of letters can mean several different things, even within just one technology, take for example n.c. To decide which meaning is the right one each time, you have to look at the context in which it's used. We've added some notes to help you where we can (the notes are in italic type).

This is just the first part of a new series of features in *Practical Wireless*. Pull them out and file them away to form a useful collection of radio data for future reference. The plastics slip-on spines you can buy in stationers are ideal for the job. A sheet of stiff card front and back will help to keep the data clean and tidy as it builds up.

A

a	atto (10^{-18})
A (amp)	ampere
A battery	valve filament/heater supply
Å	Angström
a.a.	artificial aerial (antenna)
a.b.c.	automatic brightness control
a.c.	alternating current
a.c.i.	adjacent channel interference
a.c.w.	anticlockwise
a–d	analogue to digital
a.d.c.	analogue to digital converter
a.d.f.	airborne direction finder
a.d.f.	automatic direction finder
a.d.p.	automatic data processing
Ae	aerial (antenna)
AES	Audio Engineers Society
a.f.	across flats
a.f.	audio frequency
a.f.c.	automatic frequency control
a.f.s.k.	audio frequency shift keying
a.g.c.	automatic gain control
a.g.l.	above ground level
AGREE	Advisory Group on Reliability of Electronic Equipment *(Industrial Reliability & Test Standard)*
Ah	ampere-hour
Al	aluminium *(chemical symbol)*
a.l.c.	automatic level control
a.l.c.	automatic load control
ALGOL	**ALGO**rithmic **L**anguage *(computer language)*
a.l.u.	arithmetic logic unit
a.m.	amplitude modulation
amp	amplifier
amp (A)	ampere
AMSAT	**AM**ateur **SAT**ellite
ANC	American National Coarse *(screw threads)*
AND gate	all inputs must have 1-state signals to produce a 1-state output
ANF	American National Fine *(screw threads)*
a.n.l.	automatic noise limiter
ANSI	American National Standards Institute
ant	antenna (aerial)
antilog	antilogarithm
a.o.d.	above ordnance datum
a.o.t.	adjust on test
a.p.c.	anti-parasitic choke
a.p.c.	automatic phase control
a.p.c.	automatic picture control
Ar	Argon *(chemical symbol)*
AR	Amateur Radio
ARC	Amateur Radio Club
ARQ	**A**utomatic **ReQ**uest-repeat
ARRL	American Radio Relay League
ARS	Amateur Radio Society
As	Arsenic *(chemical symbol)*
a.s.b.i.c.	addressable series bus interface circuit
ASCII	American Standard Code for Information Interchange
a.s.c.r.	asymmetric silicon controlled rectifier
a.s.d.	anti-singing device
a.s.k.	amplitude shift keying
a.s.l.	above sea level
ASQC	American Society for Quality Control
ASTA	Association of Short Circuit Testing Authorities
a.t.	ampere turns
a.t.c.	automatic threshold corrector
ATC	Air Training Corps
a.t.e.	automatic test equipment
a.t.s.s.	automatic test support system
att.	attenuator
a.t.t.	avalanche transit-time *(diode)*
a.t.u.	antenna tuning unit
ATV	**A**mateur **T**ele**V**ision
aux	auxiliary
a.v.c.	automatic volume control
AVO™	Amps Volts Ohms (trademark)
AWG	American Wire Gauge

B

b	base *(of transistor)*
B	battery *(circuit reference)*
B	magnetic flux density
BA	British Association *(screw thread)*
BAEC	British Amateur Electronics Club
balun	**bal**anced to **un**balanced
BARTG	British Amateur Radio Teleprinter Group
BASIC	**B**eginners **A**ll purpose **S**ymbolic **I**nstruction **C**ode *(computer language)*
BATC	British Amateur Television Club
B battery	valve anode/screen supply
BBC	British Broadcasting Corporation

BBCES	British Broadcasting Corporation External Services
BBCMS	British Broadcasting Corporation Monitoring Service
b.c.	bayonet cap
BC	**B**road**C**ast
b.c.d.	binary coded-decimal
BCI	**B**road**C**ast **I**nterference
BCL	**B**road**C**ast **L**istener
Be	Beryllium *(chemical symbol)*
BEAB	British Electronics Approvals Board
b.e.m.f.	back e.m.f.
b.f.o.	beat frequency oscillator
BIH	Bureau International de l'Heure *(French time-standards organisation)*
bit	**bi**nary digi**t**
BK	**B**rea**K**-in
b.l.c.	black-level clamp
b–m	break-before-make
BNC	r.f. coaxial connector, bayonet coupling
b.p.f.	band-pass filter
BREMA	British Radio Equipment Manufacturers Association
BRS No	British Receiving Station Number
BS	British Standard
BSF	British Standard Fine *(screw thread)*
BSI	British Standards Institution
BSP	British Standard Pipe *(screw thread)*
BSS	British Standard Specification
b.s.s.	broadcast satellite service
BST	British Summer Time
BSW	British Standard Whitworth *(screw thread)*
BT	British Telecom
BThU	**B**ritish **Th**ermal **U**nit
BWG	Birmingham Wire Gauge
b.w.o.	backward-wave oscillator
BYLARA	British Young Ladies Amateur Radio Association

C

c	centi (10^{-2})
c	collector *(of transistor)*
c	common *(contact)*
C	capacitor *(circuit reference)*
C	carbon *(chemical symbol)*
C	Celsius (centigrade)
C	coulomb
C	r.f. coaxial connector, bayonet coupling
c.a.d.	computer aided design
c.a.m.	computer aided manufacture
CAM	content addressable memory
CATV	**CA**ble **T**ele**V**ision (or Community Antenna TV system)
CB	Citizens Band
C battery	valve grid-bias supply
c.c.d.	charge coupled device
c.c.i.	co-channel interference
CCIR	International Radio Consultative Committee
CCITT	International Telegraph & Telephone Consultative Committee
CCTV	**C**losed **C**ircuit **T**ele**V**ision
c.c.w.	counter clockwise
CdS	cadmium sulphide
CEEFAX	BBC teletext service (from "See Facts")
CEI	Council of Engineering Institutions
CENELEC	European Committee for Electrotechnical Standardisation
c.e.p.	circular error probability
CEPO	County Emergency Planning Officer
CEPT	European Conference of Postal Telecommunications Administration
c.g.s.	centimetre-gram-second *(system of units)*
ch.	channel
CH	Chain Home (radar)
c.h.l.	current hogging logic
CHU	Canadian standard frequency/time station
c.i.o.	carrier insertion oscillator
CK	**C**loc**K**
cm	centimetre
c.m.l.	current-made logic
c.m.o.s.	complementary metal oxide semiconductor
c.m.r.	common-mode rejection
c.m.r.r.	common-mode rejection ratio
c/n	carrier to noise
c.o.	carrier oscillator
c.o.	change-over *(contacts)*
coax	coaxial
COBOL	**CO**mmon **B**usiness **O**rientated **L**anguage *(computer language)*
COMSAT	Communications Satellite Corporation
c.o.r.	carrier operated relay
CORAL	**C**omputer **O**n-line **R**eal-time **A**pplication **L**anguage *(computer language)*
Cp	padding capacitor
c.p.m.	characters per minute
c.p.s.	cycles per second (hertz)
c.p.u.	central processor unit
CQ	"all stations" call
CR	capacitance/resistance
c.r.o.	cathode ray oscillograph
c.r.t.	cathode ray tube
Cs	stray capacitance
CSA	Canadian Standards Association
CSIRO	Commonwealth Scientific & Industrial Research Organisation
csk	counter**sunk**
c.s.s.b.	compatible single sideband
c/s	cycles per second
Ct	trimming capacitor
c.t.	carrier telegraphy
c.t.	centre tap
ctc	carbon tetrachloride
c.t.c.s.s.	continuous tone-controlled squelch system
c.t.l.	complementary transistor logic
c.t.t.l.	complementary transistor-transistor logic
Cu	copper *(chemical symbol)*
c.v.	constant voltage
CV	Common Valve *(military type number system)*
c.v.a.	constant volume amplifier
c.v.t.	constant voltage transformer
c.w.	clockwise
c.w.	continuous wave *(meaning Morse code)*
Cx	unknown capacitor

D

d	deci (10^{-1})
d	drain *(of f.e.t.)*
D	diode *(circuit reference)*
D layer	lowest ionospheric layer
da	deca (10^{1})
d–a	digital to analogue
d.a.c.	digital to analogue converter
d.a.v.c.	delayed a.v.c.
dB	decibel
dBA	decibels A-weighted
dBc	decibels reference to carrier
d.b.c.	dynamic beam control
dBd	decibels reference to a dipole
dBf	decibels reference to a femtowatt
dBi	decibels reference to isotropic
dBm	decibels reference to a milliwatt
d.b.m.	double balanced mixer
dBr	decibels relative
DBS	Direct Broadcast Satellite
dBV	decibels reference to 1 volt
dBVg	decibels of voltage gain
dBW	decibels reference to 1 watt
dBμV	decibels reference to 1 microvolt
d.c.	direct coupled
d.c.	direct current
d.c.c.	double cotton-covered *(wire)*
d.c.t.l.	direct-coupled-transistor logic
d.d.a.	digital differential analyser
d.d.f.s.	direct digital frequency synthesis
d.d.t.	double diode triode
DEF	defence specification
DEMKO	Danish safety standards organisation
d.f.	direction finder or finding
d.f.	double frequency
d.f.m.	digital frequency meter
d.g.	differential gain
d.i.l.	dual-in-line
DIN	Deutsche Industrie Norm (German Standards Institute)
d.m.	delta modulation
d.m.a.	direct memory access
d.m.e.	distance measuring equipt.
d.m.m.	digital multimeter
d.p.	data processing
d.p.	differential phase
d.p.	double-pole
d.p.c.m.	differential pulse code modulation
d.p.d.t.	double-pole, double-throw *(switch contacts)*
d.p.m.	digital panel meter
d.p.s.t.	double-pole, single-throw *(switch contacts)*

d.r.i	directional response indicator
d.s.b.	double sideband
d.s.b.s.c.	double sideband suppressed carrier
d.s.c.	double silk-covered *(wire)*
d.t.	double-throw *(switch action)*
d.t.c.	decision threshold computer
DTI	Department of Trade & Industry
d.t.l.	diode-transistor logic
d.u.t.	device under test
d.v.	direct voltage
d.v.m.	digital voltmeter
DX	long distance (**D**istance e**X**tra)
DXCC	DX Century Club award
DXTV	long distance television

E

e	emitter *(of transistor)*
E	earth
E	electric intensity
E	exa (10^{18})
E layer	ionospheric layer
EAROM	Electronically Alterable Read Only Memory
e.b.c.d.i.c.	extended binary coded decimal interchange code
EBU	European Broadcasting Union
ecg	electrocardiogram
e.c.l.	emitter-coupled logic
e.c.m.	electronic counter measures
ECMA	European Computer Manufacturers Association
e.c.o.	electron-coupled oscillator
e.d.p.	electronic data processing
EDXC	European DX Council
eeg	electroencephalograph
EEPROM	Electrically Erasable Programmable Read Only Memory
e.h.f.	extremely high frequency (30–300GHz)
e.h.t.	extra high tension
EIA	Electronic Industries Association
EIAJ	Electronic Industries Association of Japan
e.i.r.p.	effective isotropic radiated power
e.l.c.b.	earth leakage circuit breaker (now r.c.c.b.)
e.l.f.	extra low frequency (below 3kHz)
em	electromagnetic
e.m.c.	electromagnetic compatibility
e.m.e.	earth-moon-earth
e.m.f.	electromotive force
e.m.p.	electromagnetic pulse
En	enamel
e.n.g.	electronic news gathering
e.n.r.	excess noise ratio
e.n.s.i.	equivalent noise sideband input
EOS	electrostatic overstress
e.p.r.	electron paramagnetic resonance
EPROM	Erasable & re-Programmable Read Only Memory
ERA	Electrical Research Association
e.r.p.	effective radiated power
e.s.	echo suppressor
e.s.	electrostatic screen
es	electrostatic
e.s.	Edison Screw *(lamp cap)*
ESA	European Space Agency
ESD	electrostatic discharge
e.s.r.	electronic spin resonance
e.s.s.	electronic switching system
ESSA	Environmental Sciences Services Association
EST	Eastern Standard Time
e.w.r.	early warning radar

F

f	femto (10^{-15})
f	frequency
F	fahrenheit
F	farad
F	Flinke *(normal-blow fuse)*
F1 layer, F2 layer	highest ionospheric layers
f.a.c.t.	flexible automatic circuit tester
f.a.m.o.s.	floating-gate avalanche metal oxide semiconductor
fax	facsimile
FB	ferrite bead *(circuit reference)*
f.c.	fixing centres
f.c.	frequency changer
FCC	Federal Communications Commission
f.d.m.	frequency division multiplex
f.e.c.	forward error correction
f.e.t.	field-effect transistor
f.f.	flip-flop
FF	Super flinke *(super-quick fuse)*
f.f.t.	fast Fourier transform
f.f.u.	frequency forming unit
f.i.f.o.	first-in first-out *(memory)*
FL	filter *(circuit reference)*
f.l.l.	frequency locked-loop
f.m.	frequency modulation
f.m.f	from mounting face
f.m.t.	frequency measuring test
f.m.v.f.t.	frequency-modulated voice-frequency telegraphy
FORTH	a computer language
FORTRAN	**FOR**mula **TRAN**slator *(computer language)*
f.o.t.	optimum traffic (working) frequency
f.s.	final stage *(of an amplifier)*
FS	fuse *(circuit reference)*
f.s.d.	full scale deflection
f.s.k.	frequency shift keying
f.s.m.	field strength meter
FSTV	**F**ast **S**can **T**ele**V**ision
FTZ	German Telecommunications Engineering Centre
f.w.	full-wave

G

g	conductance
g	gate *(of f.e.t.)*
g	gram
g	grid *(of valve)*
G	giga (10^9)
G	ground
GaAs f.e.t.	Gallium Arsenide Field Effect Transistor
g.b.	grid bias
g.c.a.	ground-controlled approach
g.d.o.	grid-dip oscillator (gate-dip oscillator)
Ge	germanium *(chemical symbol)*
GHA	Greenwich hour angle
GHz	gigahertz (10^9Hz)
GLS	General Lighting Service *(lamps)*
gm	mutual conductance
GM	Geiger Muller
GMT	Greenwich Mean Time
g.m.v.	guaranteed minimum value
gnd	ground
g.o.	grandes ondes (long waves)
g.p.	ground plane
g.p.i.b.	general purpose interface bus
G–QRP	UK club devoted to low power communication
g.r.p.	glass reinforced plastic
g.t.o.	gate turn-off *(thyristor type)*
g.w.	ground wave
G5RV	h.f. antenna designed by G5RV

H

h	hecto (10^2)
H	henry
H	magnetic intensity
h.b.c.	high blowing capacity
HB9CV	antenna using two driven elements
h.c.d.	hot carrier diode
HDLC	High-level Data Link Control
h.f.	high frequency (3–30MHz)
h.e.s.	half echo suppressor
h.f.d.f.	high frequency direction finder
h.f.o.	heterodyne frequency oscillator
HO	Home Office
h.p.	horse power
HPBW	**H**alf-**P**ower-**B**eam**W**idth
h.p.f.	high-pass filter
h.p.l.	high-power logic
h.r.c.	high rupturing capacity
h.t.	"handy-talkie"
h.t.	high tension
h.t.l.	high threshold logic
h.v.	high voltage
h.v.d.t.	high voltage diode tester
h.w.	half wave
Hz	hertz (cycles per second)

I

I	current
I^2L	Integrated Injection Logic
i.a.	intermediate amplifier
IAC™	Interference Absorption Circuit (trademark)
IARC	International Amateur Radio Club
IARU	International Amateur Radio Union
IBA	Independent Broadcasting Authority

i.c.	integrated circuit
IC	integrated circuit *(circuit reference)*
i.c.	internally connected
ICAO	International Civil Aviation Organisation
i.c.a.s.	intermittent commercial and amateur service *(valve rating)*
ICCC	International Council for Computer Communication
i.c.w.	interrupted continuous wave
i.d.	inside diameter
i.d.c.	insulation displacement connector
IEC	International Electrotechnical Committee
IEE	Institution of Electrical Engineers
IEEE	Institute of Electrical and Electronic Engineers
IERE	Institution of Electronic and Radio Engineers
i.f.	intermediate frequency
IFRB	International Frequency Registration Board
i.g.f.e.t.	insulated gate field effect transistor
IHF	Institute of High Fidelity
IHFM	Institute of High Fidelity Manufacturers
ILR	Independent Local Radio
IMCO	International Maritime Consultative Organisation (now IMO)
i.m.d.	intermodulation distortion
IMO	International Maritime Organisation
in	inch
INTELSAT	**IN**ternational **TEL**ecommunications **SAT**ellite organisation
INTUG	International Telecommunications User Group
i/o	input/output
i/p	input
i.p.	in primary *(of transformer)*
i.p.	intermodulation product
IPRE	Incorporated Practitioners in Radio and Electronics
i.p.s.	inches per second
i.r.	information retrieval
ir	infra red
IRC	International Reply Coupon
IRE	Institute of Radio Engineers
IREE	Institution of Radio and Electronic Engineers
i.s.	intrinsically safe
i.s.	in secondary *(of transformer)*
i.s.b.	independent sideband
ISBN	International Standard Book Number
ISM	Industrial Scientific & Medical
ISO	International Organisation for Standardisation
ITC	International Television Centre
ITS	Institute of Telecommunications Sciences
ITU	International Telecommunications Union
ITV	**I**ndependent **T**ele**V**ision
i.v.s.	intermittent voice service *(p.s.u. rating)*

J

j	operator $j (= \sqrt{-1})$
J	joule
JAIA	Japan Amateurs' Industries Association
JAN	Joint Army Navy *(US military type number system)*
JARL	Japanese Amateur Radio Society
JEDEC	Joint Electron Device Engineering Council *(US valve and semiconductor numbering system)*
JETDS	Joint Electronics Type Designation System
j.f.e.t.	junction field effect transistor
JK	JK flip-flop
JK	jack *(circuit reference)*
JUGFET	**JU**nction **G**ate **F**ield **E**ffect **T**ransistor

K

k	kilo (10^3)
K	cathode
K	1024
K	dielectric constant
K	kelvin *(temperature)*
KEMA	Holland's standards organisation
kg	kilogram
kHz	kilohertz
km	kilometre
kV	kilovolt
kW	kilowatt
k.w.	kurzwelle (shortwave)
kΩ	kilohm

L

l.	locking *(action)*
L	inductance
L	inductor *(circuit reference)*
L	live/line *(mains supply conductor)*
laser	light amplification by stimulated emission of radiation
l.a.s.c.r.	light-activated silicon controlled rectifier
l.a.s.c.s.	light-activated silicon controlled switch
lb	pound *(weight)*
LC	inductance/capacitance
l.c.d.	liquid crystal display
l.e.d.	light-emitting diode
l.e.s.	Lilliput Edison Screw *(lamp cap)*
l.f.	low frequency (30–300kHz)
l.f.c.	low frequency choke
l.h.	left-hand
LHA	local hour angle
lin.	linear
LK	link
lm	lumen
l.m.o.	linear master oscillator
l.m.s.	long/medium/short *(wavebands)*
l.o.	local oscillator
log.	logarithmic
l.o.p.t.	line output transformer
l.p.a.	log periodic antenna
l.p.f.	low pass filter
l.s.	loudspeaker
LS	loudspeaker *(circuit reference)*
l.s.b.	least significant bit
l.s.b.	lower sideband
l.s.d.	least significant digit
l.s.i.	large-scale integration
l.t.	low tension
l.u.f.	lowest usable *(high)* frequency
l.v.	low voltage
l.w.	long wave
lx	lux

M

m	metre
m	milli (10^{-3})
M	mega (10^6)
M	meter *(circuit reference)*
M	Mittle träge *(medium blow fuse)*
mA	milliampere
m.a.	motor alternator
MAC	Multiplexed Analogue Component *(TV modulation system)*
maser	microwave amplification by stimulated emission of radiation
mb	millibars
m–b	make-before-break *(switch contact)*
m.b.c./m.c.c.	miniature bayonet cap *(lamp cap)*
m.b.k.	make-break keying
m.c.	metal chassis *(earthing point)*
m.c.	moving coil
m.c.b.	miniature circuit breaker
m.c.w.	modulated continuous wave
m.d.c.	mixed dielectric capacitor
m.d.s.	minimum discernible signal
ME	Model Engineer *(screw thread)*
m.e.s.	Miniature Edison Screw *(lamp cap)*
MeV	mega-electron volts
m.f.	medium frequency (300–3000kHz)
m.f.b.	multiple feed-back
m.g.	motor generator
mH	millihenry
MHz	megahertz
m.i.	moving iron
mic.	microphone
MIL	military *(specification)*
min.	miniature
mix.	mixer
m.k.s.	metre-kilogram-second *(system of units)*
mm	millimetre
m.m.f.	magnetomotive force
mmF	micro-microfarad (=picofarad)
m.o.	master oscillator
MODEM	**MO**dulator-**DEM**odulator
m.o.s.	metal-on-silicon
m.o.s.	metal-oxide semiconductor
m.o.s.f.e.t.	metal-oxide semiconductor field effect transistor
MOX	manually operated switching
MPT	Ministry of Posts and Telecommunications
MPU	MicroProcessor Unit
m.s.	meteor scatter

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6100 5 element	3.5	3.2	34.30
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6110 9 ele fixed	3.3	1.9	17.71
6120 9 ele portable	3.3	1.7	20.00
6130 9 ele crossed	3.5	2.0	32.43
6140 13 ele portable	4.5	2.5	31.05
6150 17 ele fixed	6.60	4.5	37.66
435MHz			
6190 19 element	3.2	1.1	20.70
6189 19 ele crossed	3.3	1.8	34.27
6200 21 element	4.6	2.6	29.62
6210 21 element ATV	4.6	2.6	29.67
144/435HMz			
Oscar Special			
6160 9 & 19 element	3.3	2.0	4.27
1,250MHz or 1,296MHz			
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BC237	58-00237	0.08
BC238	58-00238	0.08
BC239	58-00239	0.08
BC307	58-00307	0.08
BC308	58-00308	0.08
BC309	58-00309	0.08
BC327	58-00327	0.13
BC337	58-00337	0.13
BC413	58-00413	0.10
BC414	58-00414	0.11
BC415	58-00415	0.10
BC416	58-00416	0.11
BC546	58-00546	0.12
BC550	58-00550	0.12
BC556	58-00556	0.12
BC560	58-00560	0.12
BC639	58-00639	0.22
BC640	58-00640	0.22
MPSA13	58-04013	0.30
MPSA63	58-04063	0.30
ZTX108	58-01108	0.10
ZTX212	58-01212	0.10
2N2904	58-02904	0.25
2N2905	58-02905	0.25
2N3905	58-03905	0.10
2SB646A	58-03646	0.30
2SB648A	58-03648	0.40
2SD666A	58-03666	0.30
2SD668A	58-03668	0.40
2SA872A	58-02872	0.19
2SA1084E	58-01084	0.25
2SA1085E	58-01085	0.25
2SC1775A	58-01775	0.19
2SC2646E	58-02546	0.24
2SC2547E	58-02547	0.24

Small Signal RF Devices

Device	Stock No.	Price
BFY50	58-06500	0.22
BF241	58-06241	0.18
BF273	Use BF241	
BF274	Use BF241	
BF362	58-06362	0.49
BF440	58-06440	0.21
BF441	58-06441	0.21
BF479	58-06479	0.66
BF679S	58-06679	0.55
BFR91	58-07091	1.33
BFR96	58-07096	1.45
BFT95	58-10095	0.99
BFW92	58-08092	0.60
BFY90	58-09090	0.90
NE21936	58-21936	5.00
ZTX323	58-06232	0.60
2N2369A	58-02369	0.38

Small Signal FET/MOS-FET

Device	Stock No.	Price
BF256	59-00256	0.38
BF960	60-06960	0.99
BF961	60-06961	0.70
BF963	60-06963	0.99
BF981	60-06981	1.20
J310	59-02310	0.80
J176	59-02176	0.65
MEM680	60-05680	0.75
2SK55	59-01055	0.32
2SK168	59-01168	0.37
3SK45	60-04045	0.49
3SK51	60-04051	0.54
3SK60	60-04060	0.58
3SK81	60-04081	1.32
3SK88	60-04088	0.99
40673	Replaced by 3SK51	
40822	Replaced by 3SK45	
3SK112	60-04112	4.60

Audio Power

Device	Stock No.	Price
BD139	58-15139	0.29
BD140	58-15140	0.31
BD165	58-15165	0.46
BD166	58-15166	0.48
BD179	58-15179	0.38
BD180	58-15180	0.41
TIP31A	58-15031	0.35
TIP32A	58-15032	0.35
MJ2955	58-12955	0.68
2N3055	58-13099	0.58
2SB720	58-15720	0.60
2SD760	58-17600	0.60
2SJ49	60-01049	3.10

Device	Stock No.	Price
2SJ50	60-01050	4.25
2SJ83	60-01083	3.55
2SK135	60-00135	4.25
2SK227	60-00227	3.55
2SD753	58-03753	2.34
SM3159	58-03159	5.95
SM3160	58-03160	5.95

RF Power Devices

Device	Stock No.	Price
MRF237	58-14237	3.20
MRF238	58-14238	16.50
MRF245	58-14245	40.00
MRF449A	58-14449	16.50
MRF472	58-14472	1.25
MRF475	58-14475	4.60
MRF629	58-14629	4.99
PT8811	58-18811	9.50
2SC1945	58-01945	2.60
2SC1971	58-01971	2.49
2SC2053	58-02053	0.63
2SC2097	58-02071	14.75
TP2320	58-12320	10.24
VN66AF	60-02066	0.95
ZTX3866	58-03866	0.45
2N3866	58-13866	1.20

DIODES
Signal, Rectifier, etc.

Device	Stock No.	Price
BA244	12-02447	0.17
BA379	12-03797	0.35
ND4981-7E	12-49817	0.51
OA91	12-00916	0.07
OA47	12-00476	0.10
TDA1061	12-10617	0.95
PW02	12-62006	0.75
SO4	12-24006	0.45
W005	12-10506	0.28
IN4001	12-40016	0.06
IN4002	12-40026	0.07
IN4004	12-40046	0.07
IN4148	12-41486	0.05
IN5404	12-54046	0.16
IN6263	12-62637	0.62

Varicap

Device	Stock No.	Price
BA102	12-01025	0.30
BA121	12-01215	0.30
BB105B	12-01055	0.30
BB109B	12-01095	0.27
BB204B	12-02045	0.36
BB212	12-02125	1.95
ITT210	12-12105	0.30
MVAM115	Use KV1235	
MVAM125	Use KV1225	
KV1210	12-12105	2.45
KV1211	Use KV1236	
KV1225	12-12255	2.75
KV1235	12-12355	2.75
KV1236	12-12365	2.55
KV1310	12-13105	0.40
KV1320	12-13205	0.40

INTEGRATED CIRCUITS
Linear

Device	Stock No.	Price
LM10CN	61-00010	3.68
MF10	61-00011	5.05
L149	61-00149	1.86
ZNA234	61-02340	8.50
U2378	61-00237	1.28
U247B	61-00247	1.28
U257B	61-00257	1.28
U267B	61-00267	1.28
LM301AH	61-03010	0.98
LM301AN	61-03011	0.44
LM308CN	61-03081	0.65
LM311CN	61-00311	0.46
LM324	61-03240	0.48
LM339N	61-03390	0.68
LM346	61-00346	3.72
LF347	61-00347	1.82
LM348	61-03480	1.26
LF351	61-03510	0.49
LF353	61-03530	0.76
LM380N	61-00380	1.00
LM381	61-00381	1.81
LM382	61-00382	1.81
ZN419CE	61-00419	1.98
ZNA423	61-02430	1.40
ZN425E/8	61-04250	4.50
ZN426E/8	61-04260	3.48
ZN427E/8	61-04270	6.80
ZN428E/8	61-02480	5.50
ZN429E/8	61-04290	2.50

Device	Stock No.	Price
ZN432CJ10	61-04320	29.90
ZN433CJ10	61-04330	24.79
ZN450E	61-04500	7.61
NE542	61-05420	1.20
NE544	61-00544	1.80
NE555N	61-05550	0.21
NE556N	61-05560	0.50
SL560C	61-05600	2.24
NE564	61-00564	4.29
NE565	61-00565	1.00
NE566	61-00566	1.40
NE567	61-00567	1.30
NE570N	61-00570	3.85
uA709HC	61-07090	0.64
uA709PC	61-07091	0.52
uA710HC	61-07100	0.64
uA710PC	61-07101	0.59
uA711CN	61-07110	0.85
uA741CH	61-07410	0.66
uA709PC	61-07411	0.22
uA741CN	61-07470	0.70
uA748CN	61-04780	0.40
uA758	61-00758	2.35
TBA820M	61-00820	0.78
TDA1028	61-01028	2.11
TDA1029	61-01029	2.11
ZNA1034	61-01034	2.10
LM1035	61-01035	4.50
TDA1054M	61-01054	1.45
TDA1062	61-01062	1.95
TDA1072	61-01072	2.69
TDA1074A	61-01074	5.04
TDA1083	61-01083	1.95
TDA1090	61-01090	3.05
HA1196	61-01196	2.00
HA1197	61-01197	1.00
TDA1220	61-01220	1.40
LM1303	61-01303	0.99
MC1310P	61-C1310	1.90
MC1330	61-01330	1.20
MC1350	61-01350	1.20
HA1370	61-11370	1.90
HA1388	61-01388	1.75
LM1458N	61-14580	0.45
MC1496P	61-01496	1.25
SL1610	61-01610	2.10
SL1611	61-01611	2.60
SL1612	61-01612	2.10
SL1613	61-01613	2.55
SL1620	61-01620	2.17
SL1621	61-01621	3.50
SL1623	61-01623	3.50
SL1625	61-01625	1.90
SL1630	61-01630	1.62
SL1640	61-01640	3.50
SL1641	61-01641	3.50
MC1648	61-01648	3.25
TDA2002	61-02002	1.25
ULN2240	61-02240	3.25
ULN2242	61-01090	3.05
ULN2283	61-02283	1.00
CA3080	61-03080	0.96
CA3089	61-03089	1.84
CA3123	61-03123	1.40
CA3130E	61-31300	0.80
CA3130T	61-31301	0.90
CA3140E	61-31400	0.46
CA3189E	61-03189	2.20
CA3240E	61-32400	1.27
MC3357	61-03357	2.85
MC3359	61-03357	2.85
ULN3859	61-03859	2.95
KM3701	61-03701	85.53
KM3702	61-03702	74.84
LM3900	61-39000	0.60
LM3909N	61-39090	0.68
LM3914N	61-03914	2.80
LM3915N	61-03915	2.80
KB4400	61-04401	0.90
KB4412	61-04412	1.95
KB4413	61-04413	1.95
KB4417	61-04417	1.80
KB4420B	61-04420	1.09
TDA4420	61-14420	2.65
TDA4421	61-14421	2.65
KB4423	61-04423	2.30
KB4424	61-04424	1.65
KB4430	61-04430	2.30
KB4431	61-04431	1.95
KB4432	61-04432	1.95
KB4433	61-04433	1.72
KB4436	61-04436	1.53
KB4437	61-04437	1.75
KB4438	61-04438	2.22
KB4441	61-04441	1.35
KB4445	61-04445	1.29
KB4446	61-04446	2.75
KB4448	61-04448	1.65
NE5044	61-05044	2.26
MC5229	61-05229	9.60
NE5532	61-55320	2.20
KM5624	61-05624	4.35
SD6000	61-06000	3.75
SL6270	61-06270	2.00
SL6310	61-06310	2.00
SL6600	61-06600	3.75
SAS6610	61-06610	1.48
SL6640	61-06640	2.30
SL6690	61-06690	3.75
SL5700	61-06700	3.20
SAS6710	61-06710	1.48
ICM7555	61-75550	0.98
ICL8038CC	61-08038	4.50
MSL9362	61-09362	1.75

Device	Stock No.	Price
MSL9383	61-09363	1.75
TK10170	61-10170	1.87
TK10321	61-10321	2.75
HA11223	61-11223	2.15
HA11225	61-11225	1.45
HA12002	61-12002	1.22
HA12017	61-12017	0.80
HA12402	61-12402	1.95
HA12411	61-12411	1.20
HA12412	61-12412	1.55
LF13741	61-13741	0.33
MC14412	61-14412	6.85
MK50366	61-50366	3.36
MK50375	61-50375	3.85
MM53200	61-53200	3.90

Prescalers, Freq. Display Synthesis

Device	Stock No.	1-24
U264	61-02640	2.27
U265	61-02650	3.16
U266	61-02660	2.43
11C90DC	61-01190	12.95
MSL2312R	61-02312	3.94
MSM5523	61-05523	11.30
MSM5524	61-05524	11.30
MSM5525	61-05525	7.85
MSM5526	61-05526	7.85
MSM55271	61-55271	9.75
ICM7106CP	61-07106	9.55
LC7137	61-07137	7.50
ICM7216B	61-72161	23.95
ICM7216C	61-72162	23.95
SP8629	61-08629	3.85
SP8647	61-08647	6.00
SP8793	61-08793	7.70
HD10551	61-10551	2.45
HA12009	61-12009	6.00
MC12016	61-12016	6.90
HD44015	61-44015	4.45
HD44752	61-44752	8.00
MC145151P	61-14151	6.00
MC145152P	61-14152	12.30
MC145156P	61-14156	4.60

VOLTAGE REGULATORS

Device	Voltage	Stock No.	Price
7805	+5V	27-78052	0.40
7806	-6V	27-78062	0.40
7808	+8V	27-78082	0.40
7812	+12V	27-78122	0.40
7815	+15V	27-78152	0.40
7818	+18V	27-78182	0.40
7824	+24V	27-78242	0.40
7905	-5V	27-79052	0.49
7906	-6V	27-79062	0.49
7908	-6V	27-79082	0.49
7912	-12V	27-79122	0.49
7915	-15V	27-79152	0.49
7918	-18V	27-79182	0.49
7924	-24V	27-79242	0.49
78L05	+5V	27-78050	0.40
78L06	-6V	27-78060	0.40
78L08	-8V	27-78080	0.40
78L12	+12V	27-78120	0.40
78L15	+15V	27-78150	0.40
78L24	-24V	27-78240	0.40
79L05	-5V	27-79050	0.55
78GKC	+adj.	27-78993	3.95
78GUIC	+adj.	27-78992	1.10
78H05	+5V	27-78054	4.25
78H12	+12V	27-78124	5.45
78HG	+adj.	27-78994	7.45
79HG	-adj.	27-79994	7.45
LM317MP	-adj.	27-03175	1.75
LM337MP	-adj.	27-03175	1.75
LM317K	-adj.	27-03173	2.35
LM317U	+adj.	27-03172	2.15
L200	+adj.	27-02006	1.95
uA723	+adj.	27-07230	0.85

CMOS/74LS TTL

Please call for current CMOS price and availability due to world shortages etc.

FIXED RESISTORS

E12 values sold in packs of 10 per value only

⅛W 5%	30p/10 pack
¼W 5%	15p/10 pack
¼W 1%	35p/10 pack

Order by value & type

POTENTIOMETERS

Supplied with PC/wire on tags. Round shafts 6mm dia. with 7mm bush. M8 × 0.75 washer and fixing nut supplied

Value	Stock No.	1-24
500R Lin	48-50113	0.33
1k Lin	48-10213	0.33
5k	48-50213	0.33

Device	Stock No.	Price
10k Lin	48-10313	0.33
20k Lin	48-20313	0.33
50k Lin	48-50313	0.33
100k Lin	48-10413	0.33
500k Lin	48-50413	0.33
1M Lin	48-10513	0.33
5k Log	48-50214	0.33
10k Log	48-10314	0.33
50k Log	48-50314	0.33
100k Log	48-10414	0.33
500k Log	48-50414	0.33
1M Log	48-10514	0.33
5k Lin	48-50217	0.67
10k Lin	48-10317	0.67
25k Lin	48-25317	0.67
5k Log	48-50218	0.67
10k Log	48-10318	0.67
25k Log	48-25318	0.67
50k Log	48-50318	0.67
100k Log	48-10418	0.67

Dual Gang

Value	Stock No.	1-24
5k Lin	48-50215	0.60
10k Lin	48-10315	0.60
25k Lin	48-25315	0.60
100k Lin	48-10415	0.60
250k Lin	48-25415	0.60
1M Lin	48-10515	0.60
1k Log	48-10216	0.60
5k Log	48-50216	0.60
10k Log	48-10316	0.60
25k Log	48-25316	0.60
50k Log	48-50316	0.60
100k Log	48-10416	0.60
250k Log	48-25416	0.60
1M Log	48-10516	0.60

Single gang, pull push DPST switch

Value	Stock No.	1-24
5k Lin	48-50219	0.94
10k Lin	48-10319	0.94
25k Lin	48-25319	0.94
100k Lin	48-10419	0.94
55k Log	48-50220	0.94
10k Log	48-10320	0.94
25k Log	48-25320	0.94
50k Log	48-50320	0.94
100k Log	48-10420	0.94

Dual gang 41 detents primarily for volume controls.

Value	Stock No.	1-24
10k Log	48-10322	0.68
100k Lin	48-10421	0.68

Dual gang with click, for tone and balance controls.

Value	Stock No.	1-24
50k Lin	48-50323	0.65
100k Lin	48-10424	0.65
100k Balance	48-10425	0.65

Sub Min Ceramic Plate 63VDC

Value	Stock No.	Pk of 10
2.2pF	04-22901	0.40
2.7pF	04-27901	0.40
3.3pF	04-33901	0.40
3.9pF	04-39901	0.40
4.7pF	04-47901	0.40
5.6pF	04-56901	0.40
6.8pF	04-68901	0.40
8.2pF	04-82901	0.40
10pF	04-10001	0.40
12pF	04-12001	0.40
15pF	04-15001	0.40
18pF	04-18001	0.40
22pF	04-22001	0.40
27pF	04-27001	0.40
33pF	04-33001	0.40
39pF	04-39001	0.40
47pF	04-47001	0.40
56pF	04-56001	0.40
68pF	04-68001	0.40
82pF	04-82001	0.50
100pF	04-10101	0.50
120pF	04-12101	0.50
150pF	04-15101	0.50
180pF	04-18101	0.50
220pF	04-22101	0.50
270pF	04-27101	0.50
330pF	04-33101	0.50

Medium K Ceramic Plate 63VDC

Value	Stock No.	Pk of 10
390pF	04-39102	0.50
470pF	04-47102	0.50
560pF	04-56102	0.50
680pF	04-68102	0.50
820pF	04-82102	0.50
1000pF	04-10202	0.50
1200pF	04-12202	0.50
1500pF	04-15202	0.50
1800pF	04-18202	0.50
2200pF	04-22002	0.50
2700pF	04-27202	0.50
3300pF	04-33202	0.50
4700pF	04-47202	0.50

All prices exclude VAT postage and packing 60p Please quote stock numbers when ordering

In stock items despatched within 48 hours.

ms	millisecond
m.s.b.	most significant bit
m.s.d.	most significant digit
MSF	Rugby Standard Frequency/ Time station
m.s.i.	medium-scale integration
m.s.k.	minimum shift keying
m.t.b.f.	mean time between failures
m.t.i.	moving target indication *(radar system)*
m.t.t.f.	mean time to failure
m.t.t.r.	mean time to repair
m.u.f.	maximum usable frequency
MUX	multiplex
m.v.	mercury vapour
mV	millivolt
m.v.	multi-vibrator
m.w.	medium wave
mW	milliwatt
mΩ	milliohm
MΩ	megohm

N

n	nano (10^{-9})
N	neutral *(mains supply conductor)*
N	newton
N	r.f. coaxial connector, screw coupling
NAB	National Association of Broadcasters
NAND gate	all inputs must have 1-state signals to produce a 0-state output
NANBA	North American National Broadcasters Association
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organisation
n.b.f.m.	narrow band frequency modulation
NBS	National Bureau of Standards
n.b.v.m.	narrow band voice modulation
n.c.	neutralising capacitor
n.c.	normally closed *(switch contacts)*
n.c.	no connection
n.d.b.	non-directional beacon
NEMA	National Electrical Manufacturers Association
NEMKO	Norwegian safety standards organisation
nF	nanofarad
n.f.	noise factor (figure)
n.f.b.	negative feed-back
NFD	National Field Day
NGR	National Grid Reference
NiCad	Nickel Cadmium *(battery)*
NiFe™	Nickel Iron *(battery)*
n.l.	noise limiter
n.l.	non-locking *(switch action)*
nm	nanometre (10^{-9} metres)
Nm	newton metre
n–m.o.s.	negative-channel metal oxide semiconductor
n.o.	normally open *(switch contacts)*
NOAA	National Oceanic & Atmospheric Administration
NOR gate	any one input or more having a 1-state will yield a 0-state output
npn	negative-positive-negative *(semiconductor)*
NPO	a zero temperature-coefficient dielectric
n.r.z.	non-return to zero
n.r.z.i.	non-return to zero inverted
NSN	Nato Stock Number
n.t.c.	negative temperature coefficient
NTIA/ITS	National Television & Information Administration/ Institute for Telecommunications Sciences
NTSC	National Television System Committee
n-type	semiconductor material with excess electrons

O

o.c.	ondes courtes (short waves)
o/c	open circuit
o.c.t.	output clock trigger
o.d.	outside diameter
o.e.m.	original equipment manufacturer
o.f.	outside foil *(of capacitor)*
OIRT	International Radio & Television Organisation
OM	"old man"
o/p	output
op-amp	operational amplifier
o.p.	out primary
OR	any one input or more having a 1-state signal is sufficient to produce a 1-state output
ORACLE	IBA teletext service (Optional Reception of Announcements by Coded Line Electronics)
OS	Ordnance Survey
osc.	oscillator
o.s.	out secondary
OSCAR	Orbiting Satellite Carrying Amateur Radio
o.t.a.	operational transconductance amplifier
OTHR	over the horizon radar
o.t.l.	ouput-transformerless

P

p	pico (10^{-12})
P	peta (10^{15})
Pa	pascal
p.a.	power amplifier
p.a.	public address
PAL	Phase Alternation Line *(TV colour system)*
p.a.m.	pulse amplitude modulation
PASCAL	a computer language
p.b.	push button
p.b.t.	pass band tuning
p.c.a.	polar cap absorption
p.c.b.	printed circuit board
pcb	polychlorinated biphenyls
p.c.d.	pitch-circle diameter
p.c.m.	pulse-code modulation
p.d.	potential difference
p.d.a.	post deflection acceleration
p.d.m.	pulse-duration modulation
p.e.c.	photo-electric cell
p.e.p.	peak envelope power
PERT	Program Evaluation and Review Technique
p.e.v.	peak envelope voltage
pF	picofarad
p.f.m.	pulse frequency modulation
PIA	Programmable Interface Adaptor
p.i.v.	peak inverse voltage
PL	plug *(circuit reference)*
PL259	r.f. coaxial plug, screw coupling (also called 'UHF')
p.l.d.s.	programmable logic development system
p.l.l.	phase locked loop
p.m.	permanent magnet
p.m.	phase modulation
p.m.e.	protective multiple earthing
p–m.o.s.	positive-metal oxide semiconductor
p.m.r.	private mobile radio
pnp	positive-negative-positive *(semiconductor)*
p.o.	petites ondes (medium waves)
PO	Post Office
pot.	potentiometer
p–p	peak to peak
p.p.	push-pull
p.p.i.	plan position indicator
p.p.m.	parts per million
p.p.m.	peak programme meter
p.p.m.	pulse phase modulation
p.p.m.	pulse position modulation
p.r.f.	pulse repetition frequency
PROM	Programmable Read Only Memory
p.r.v.	peak-reverse voltage
p.s.k.	phase shift keying
p.s.u.	power supply unit
p.t.c.	positive temperature coefficient
ptfe	polytetrafluoroethylene
p.t.o.	permeability tuned oscillator
p.t.m.	pulse time modulation
p.t.t.	push-to-talk
p-type	semiconductor material with electron deficit
p.u.	pick-up
p.u.	power unit
p.u.t.	programmable unijunction transistor
pvc	polyvinylchloride
p.w.b.	printed wiring board
p.w.m.	pulse-width modulation

Q

Q	quality factor
QA	Quality Assurance
q.a.g.c.	quiet automatic gain control
q.a.v.c.	quiet automatic volume control
q.f.	quality factor
q.i.l.	quad-in-line
Q_L	loaded Q
q.m.b.	quick make & break *(switch action)*
q.p.p.	quiescent push-pull
QST	ARRL magazine and collective callsign
Q_U	unloaded Q

R

R	resistance
R	resistor *(circuit reference)*
rad	radian
Radar	**RA**dio **D**etection **A**nd **R**anging
RAE	Radio Amateurs' Examination
RAFARS	Royal Air Force Amateur Radio Society
RAIBC	Radio Amateurs Invalid & Blind Club
RAM	Random Access Memory
RAYNET	Radio Amateurs' Emergency Network
RC	Radio Control
r.c.c.	resistance-capacitance coupling
r.c.c.b.	residual current circuit breaker (formerly e.l.c.b.)
r.c.t.	reference clock trigger
r.c.t.l.	resistor-capacitor-transistor logic
rcvr	receiver
R & D	Research & Development
r.d.f.	radio direction finding
RECMF	Radio and Electronic Component Manufacturers' Federation
r.f.	radio frequency
r.f.c.	radio frequency choke (coil)
r.f.c.	radio frequency control
r.f.i.	radio frequency interference
r.g.b.	red-green-blue
r.h.	relative humidity
r.h.	right-hand
r.i.t.	receiver incremental tuning
r.l.	return loss
RLC	Resistance/Inductance/ Capacitance
RMC	Repeater Management Committee (formerly RWG)
RMA	Radio Manufacturers Association
r.m.s.	root-mean-square
RNARS	Royal Naval Amateur Radio Society
ROM	Read Only Memory
r.p.m.	revolutions per minute
RQ	request-repeat
RRD	Radio Regulatory Department
RS	set/reset flip-flop
RS	Rough Service *(lamps)*
RSARS	Royal Signals Amateur Radio Society
RSGB	Radio Society of Great Britain
RST	Readability Strength Tone
RS232	serial asynchronous communications protocol
r.t.	radio telephony
r.t.a.	real time analyser
r.t.d.	resistance temperature detectors
r.t.l.	resistor-transistor logic
RTRA	Radio and Television Retailers' Association
RTTY	**R**adio **T**ele**TY**pe
RWG	Repeater Working Group (now Repeater Management Committee)
RX	receiver
r.z.	return to zero

S

s	second
S	siemens
S	switch *(circuit reference)*
S	signal strength
s.a.e.	stamped addressed envelope
SAE	Society of Automotive Engineers
s.a.s.e.	Self-addressed stamped envelope
s.a.w.	surface acoustic wave
s.b.c.	small bayonet cap *(lamp cap)*
s.b.s.	silicon bilateral switch
s/c	short circuit
s.c.c.	single contact cap *(lamp cap)*
s.c.c.	single cotton-covered *(wire)*
s.c.r.	silicon controlled rectifier
s.c.s.	silicon controlled switch
SECAM	Sequential with memory (or Sequential colour and matrixing) *(TV colour system)*
SELCAL	selective calling
SEMKO	Swedish safety standards organisation
SERT	Society of Electronic and Radio Technicians
s.e.s.	Small Edison Screw *(lamp cap)*
s.f.	signal frequency
s.f.	single frequency
s.g.	screen grid
s.g.	specific gravity
s.h.f.	super high frequency (3–30GHz)
Si	silicon *(chemical symbol)*
SI	International System of Units
s.i.d.	sudden ionospheric disturbance
s.i.l.	single-in-line
SINAD	ratio: Signal + Noise + Distortion/Noise + Distortion
SINPO	a signal reporting code
SINPFEMO	a signal reporting code
s.l.c.	straight-line capacitance
s.l.f.	straight-line frequency
SLD	superluminescent diode
SK	socket *(circuit reference)*
S-meter	signal strength meter
s.m.	silvered mica *(capacitor)*
SMA	r.f. coaxial connector, screw coupling
s.m.b.	slow make and break *(switch action)*
SMB	Sub-Miniature Bayonet *(r.f. coaxial connector)*
s.m.d.	slow-motion drive
s.m.p.s.	switch-mode power supply
SMPTE	Society of Motion Picture and TV Engineers
s.m.r.	series mode rejection
s/n	signal to noise (ratio)
SO239	r.f. coaxial socket, screw coupling (also called 'UHF')
s.o.s.	silicon-on-sapphire
s.o.t.	select-on-test
s.p.	series/parallel
s.p.	single-pole
s.p.c.	stored program control
s.p.c.o.	single-pole changeover
s.p.d.t.	single-pole, double-throw *(switch contacts)*
sp-E	sporadic-E
s.p.s.t.	single-pole single-throw *(switch contacts)*
Sr	steradian
s.r.b.f.	synthetic resin bonded fibre
s.r.b.p.	synthetic resin bonded paper
SRC	Science Research Council
s.r.p.s.	series-resonant power supply
s.s.	singing suppressor
s.s.b.	single-sideband
s.s.b.s.c.	single-sideband suppressed carrier
s.s.c.	single silk-covered *(wire)*
s.s.g.	standard signal generator
s.s.i.	small-scale integration
s.s.n.	smoothed sunspot number
s.s.t.c.	single-sideband transmitted carrier
SSTV	**S**low **S**can **T**ele**V**ision
s.t.	single throw *(switch action)*
s.t.l.	studio transmitter link
s.u.s.	silicon unilateral switch
s.v.m.	scan velocity modulation
s.w.	short wave
s.w.f.	short wave fade
s.w.g.	standard wire gauge
s.w.l.	short wave listener
s.w.r.	standing wave ratio
s.w.t.l.	surface-wave transmission line
sync	synchronous or synchronising
S–100	a computer bus standard

T

T	tera (10^{12})
T	tesla
t	time
T	transformer *(circuit reference)*
T	Träge *(slow-blow fuse)*
T^2L	transistor-transistor logic
TAI	International Atomic Time
TAPR	Tucson Amateur Packet Radio
t.a.s.i.	time assignment speech interpolation
TASO	Television Allocation Study Organisation
t.a.t.g.	tuned anode-tuned grid
t.b.	timebase
TB	transmit blocking
t.c.	time constant
t.c.	tinned copper
t.c.	tone control
t.c.	top cap
tcxo	temperature-compensated crystal oscillator
t.d.m.	time division multiplex
t.d.m.a.	time division multiplex access
t.d.m.s.	telegraph distortion measuring set
t.d.r.	time domain reflectometry
TEM	Transverse ElectroMagnetic
TEMA	Telecommunications Engineering and Manufacturing Association
t.e.p.	trans-equatorial propagation
TE waves	Transverse-Electric waves
tfc.	traffic
t.f.t.	thin-film transistor

t.h.	triode-hexode
t.h.d.	total harmonic distortion
t.i.d.	transient intermodulation distortion
t.i.m.	transient intermodulation
t.i.r.	total indicated reading
TM waves	Transverse-Magnetic waves
TNC	terminal node controller
TNC	r.f. coaxial connector, screw coupling
t.p.i.	threads per inch *or* turns per inch
t.p.t.g.	tuned plate-tuned grid
Tr	transistor *(circuit reference)*
TR	transmit/receive
t.r.f.	tuned radio frequency
t.r.s.	tough-rubber sheathed
TT	Super träge *(quick-blow fuse)*
t.t.l.	transistor-transistor logic
t.u.	terminal unit
TV	**T**ele**V**ision
TVI	**T**ele**V**ision **I**nterference
TVRO	**T**ele**V**ision **R**eceive-**O**nly
t.w.t.	travelling wave tube
TX	transmiter

U

UART	Universal Asynchronous Receiver-Transmitter
u.h.f.	ultra high frequency (300–3000MHz)
UHF	r.f. coaxial connector (see PL259/SO239)
u.h.t.	ultra high tensile
UJT	**U**ni**J**unction **T**ransistor
UKAEA	United Kingdom Atomic Energy Authority
u.k.w.	ultra kurzwelle (u.h.f.)
UL	Underwriters Laboratories (US safety standard)
UNC	Unified National Coarse *(screw thread)*
UNF	Unified National Fine *(screw thread)*
UOSAT	**U**niversity **O**f **S**urrey s**AT**ellite
USART	Universal Synchronous Asynchronous Receiver-Transmitter
u.s.b.	upper sideband
UTC	Co-ordinated Universal Time
u.u.t.	unit under test
uv	ultraviolet

µ	micro (10^{-6})
µA	microampere
µF	microfarad
µH	microhenry
µs	microsecond
µV	microvolt
µW	microwatt

V

V	volts
VA	volt/amps
VADCG	Vancouver Amateur Digital Communications Group
v.c.a.	voltage-controlled amplifier
v.c.f.	voltage-controlled filter
v.c.o.	voltage-controlled oscillator
VCR	valve cathode ray *(WWII mil. type code)*
v.c.r.	video cassette recorder
v.c.t.	voltage clock trigger
v.c.v.s.	voltage-controlled voltage source
vcxo	voltage-controlled crystal oscillator
VDE	German standards organisation
v.d.u.	visual display unit
v.f.	video frequency
v.f.	voice frequency
v.f.o.	variable frequency oscillator
v.f.t.	voice frequency telegraphy
v.h.f.	very high frequency (30–300MHz)
VHS	Video Home System
VIA	Versatile Interface Adaptor
v.i.r.	vertical interval reference
v.i.r.	vulcanised india rubber
v.i.t.s.	vision interval test signal
v.l.f.	very low frequency (3–30kHz)
v.l.s.i.	very large scale integration
v.m.o.s.	vertical metal oxide semiconductor
v.o.c.	voice operated carrier
v.o.g.a.d.	voice operated gain adjusting device
VOM	**V**olt-**O**hm**M**eter
VOX	voice-operated switch
VR	valve receiving *(WWII mil. type code)*
VR	voltage regulator
v.s.b.	vestigial sideband
v.s.w.r.	voltage standing wave ratio
VT	valve transmitting *(WWII mil. type code)*
v.t.r.	video tape recorder
v.t.v.m.	vacuum-tube voltmeter
VU	valve unidirectional (rectifier) *(WWII mil. type code)*
v.u.	volume unit
vxo	variable crystal oscillator

W

W	wiper (contact)
W	watt
WAC	Worked All Continents *(Award)*
WARC	World Administrative Radio Conference
WAS	Worked All States *(Award)*
WAZ	Worked All Zones *(Award)*
Wb	weber
WCY	World Communications Year
w.g.	wave guide
w.h.y.	what have you *(e.g. PW Swap Spot)*
w.p.m.	words per minute
WRTH	*World Radio TV Handbook*
w.t.	wireless telegraphy
w.v.	working voltage
w.w.	wire wound
WWV/WWVH	US Standard Frequency/time stations
WX	weather
W1AW	ARRL Headquarters station

X

X	horizontal axis *(graph or oscilloscope display)*
X	reactance
X	unknown *(quantity)*
XL	crystal *(circuit reference)*
XOR gate	either input having a 1-state, but not both, to produce a 1-state output (exclusive OR)
Xtal	crystal
X–Y	X–Y plotter or display
XYL	"wife" (from ex-YL)

Y

Y	susceptance
Y	vertical axis *(graph or oscilloscope display)*
Yig	yttrium iron garnet *(microwave ferrite)*
YL	"young lady"

Z

Z	impedance
z.f.	zero frequency *(d.c.)*
Z-mod	intensity modulation of an oscilloscope trace
ZL special	antenna using two driven elements

Miscellaneous

Ω	ohm
+ve	positive
−ve	negative
µ	micro (10^{-6})
#	number
λ	wavelength (Lambda)
∝	current gain of a transistor (alpha)
β	current gain of a transistor (beta)
ω	angular velocity = $2\pi f$ (omega)
'5RV	See G5RV

Useful Addresses

AMSAT-UK: 94 Herongate Road, Wanstead Park, London E12 5EQ.
ARRL: 255 Main Street, Newington, Conn. 06111, USA.
BAEC: "Dickens", 26 Forrest Road, Penarth, S. Glamorgan.
BARTG: 27 Cranmere Court, Richmond Road, Kingston-upon-Thames, Surrey KT2 5PY.
BATC: 13 Church Street, Gainsborough, Lincs.
BREMA: 20th Century House, 31 Soho Square, London W1.
BSI: British Standards House, 2 Park Street, Mayfair, London W1A 2BS.
BYLARA: "Little Croft", Shurdington Road, Cheltenham, Glos GL53 0NJ.
CGLI: 76 Portland Place, London W1N 4AA.
CQ Journal: 76 North Broadway, Hicksville, NY 11801, USA.
Danish SW Club International: DK-2670 Greve Strand, Denmark.
DTI: 1 Victoria Street, London SW1H 0ET.
DX Association of GB: Five Acres, Whiteditch Lane, Newport, Saffron Walden, Essex CB11 3UD.
EDXC: PO Box 4, St. Ives, Huntingdon, Cambridgeshire PE17 4FE.
G-QRP: 17 Aspen Drive, Chelmsley Wood, Birmingham B37 7QX.
Ham Radio: Greenville, NH 03048, USA.
IARU: IARU HQ, PO Box AAA, Newington, Conn. 06111, USA.
IEE: Savoy Place, London WC2R 0BL.
IEEE: 345 East 47th Street, New York, NY 10017, USA.
IERE: 99 Gower Street, London WC1.
International SW League: c/o Hayden Drinkwater, 88 The Barley Lea, Coventry CV3 1DY.
ITU: Place des Nations, CH-1211 Geneve 20, Switzerland.
JARL: 1-14-2 Sugamo, Toshima, Tokyo 170, Japan.
RAFARS: RAF Locking, Weston-Super-Mare BS24 7AA.
RAIBC: 9 Rannoch Court, Adelaide Road, Surbiton, Surrey KT6 4TE.
Royal Corps of Transport ARS: Signals Division, ASMT Leconfield, Normandy Barracks, Leconfield, North Humberside.
RECMF: Gossard House, 7 Savile Row, London W1.
RNARS: HMS Mercury, Leydene, Petersfield, Hants.
RRD: Radio Regulatory Dept., Licensing Branch (Amateur), Waterloo Bridge House, Waterloo Road, London SE1 8UA.
RSARS: Major R. Webb, 8 Signals Regiment, Catterick Camp, N. Yorks.
RSGB: Alma House, Cranborne Road, Potters Bar, Herts EN6 3JN.
SERT: 57-61 Newington Causeway, London SE1 6BL.
UOSAT: University of Surrey, Guildford, Surrey GU2 5XH.
Worldwide DX Club: Postfach 1214, D6380 Bad Homberg 1, Federal Republic of Germany.

Greek Alphabet

Name	Capital	Small	Commonly Used to Designate
Alpha	A	α	Angles, coefficients, attenuation constant, absorption factor
Beta	B	β	Angles, coefficients, phase constant
Gamma	Γ	γ	Angles, electrical conductivity, propagation constant
Delta	Δ	δ	Increment or decrement (cap or small), determinant (cap), permittivity (cap), density, angles
Epsilon	E	ϵ	Dielectric constant, permittivity, base of natural logarithms, electric intensity
Zeta	Z	ζ	Co-ordinates, coefficients
Eta	H	η	Intrinsic impedance, efficiency, hysteresis, co-ordinates
Theta	Θ	ϑ θ	Angular phase displacement, time constant, reluctance, angles
Iota	I	ι	Unit vector
Kappa	K	κ	Susceptibility, coupling coefficient
Lambda	Λ	λ	Wavelength, attenuation constant, permeance (cap)
Mu	M	μ	Permeability, amplification factor, prefix micro
Nu	N	ν	Reluctivity, frequency
Xi	Ξ	ξ	Co-ordinates
Omicron	O	o	
Pi	Π	π	3·1416
Rho	P	ρ	Resistivity, co-ordinates
Sigma	Σ	σ	Summation (cap), electrical conductivity, leakage coefficient, deviation
Tau	T	τ	Time constant, volume resistivity, time-phase displacement, transmission factor, density
Upsilon	Υ	υ	
Phi	Φ	ϕ φ	Scalar potential (cap), magnetic flux, angles
Chi	X	χ	Electric susceptibility, angles
Psi	Ψ	ψ	Dielectric flux, phase difference, co-ordinates, angles
Omega	Ω	ω	Resistance in ohms (cap), solid angle (cap), angular velocity

PW RADIO DATA

Will continue next month with a comprehensive list of codes to help you recognise valves and semiconductors — what they do and who made them

Euro Licence?

Recent communication with Mr. P. McDonald of the DTI RRD has revealed that discussions are under way (and have been for some time) in an attempt to establish a CEPT (Council of European Posts and Telecommunications) standard amateur licence for member states. If adopted, such a licence would remove the need for reciprocal licensing within member countries and would involve changes to the existing licence.

Our understanding is that this could for instance lead to UK adoption of the German power levels, currently at 750W on v.h.f. Separate requests for a maximum power level increase, made by the RSGB, have been held until work on this CEPT proposal has reached a conclusion. It is understood that the issue of special high power (1kW max.) permits has once again started. The lack of this special experimental permission has been seriously handicapping e.m.e. operations on both v.h.f. and u.h.f. The next meeting of the CEPT committee, which meets every six months, is due during April.

If it is not already published by the time you read this, the revised UK licence schedule is due out early in 1984, and will be followed by a revised licence document.

RAE

Would Mrs. E. A. McLachlan of Glasgow, whose letter about the RAE appeared in our January 1984 issue, please contact the *PW* editorial offices, confirming her full address.

2m f.m. Contest

The Stevenage and District Amateur Radio Society will be running a 2m f.m. contest on Sunday 15 April 1984, between 1300 and 1700 GMT in both the 144.500–144.845MHz and 145.200–145.475MHz sections of the band.

The contest will be open to both members and non-members of the society and there will be three classes of entry: 1. Stations running up to 25 watts output. 2. Stations running more than 25 watts output. 3. Short Wave Listeners.

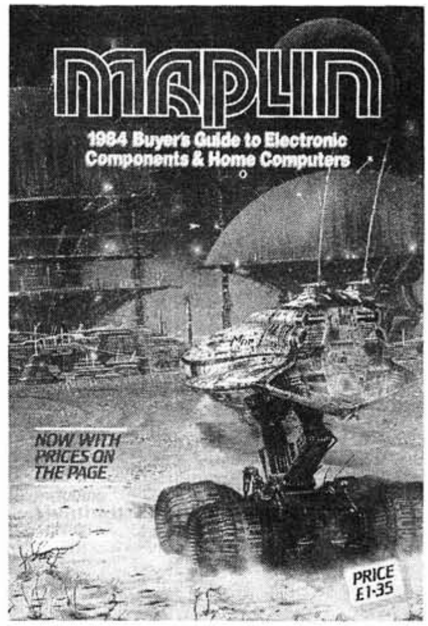
Further information is available, in return for an s.a.e., from: *The Contest Secretary, Bernard Dean G6NZC, 82 Lingfield Road, Stevenage, Herts. SG1 5SN.*

New Maplin Catalogue

The 1984 edition of the "Maplin Buyer's Guide to Electronic Components and Home Computers" is now available and this contains nearly 500 pages—an increase of 20 per cent over the 1983 edition.

Among a host of products and components for the electronics enthusiast is a recently introduced section covering the "Heathkit" range, 37 pages of book listings and 60 pages of computer products. On "special offer" is a range of Atari micro software.

The 1984 catalogue is obtainable, for £1.35, from Maplin stores in Birmingham, Hammersmith, Manchester, Southampton and Southend, or branches of W. H. Smith. By post the catalogue costs £1.65 and orders should be sent to: *Maplin Electronic Supplies Ltd., PO Box 3, Rayleigh, Essex SS6 8LR. Tel: (0702) 554155.*



Move and Grow

Solent Component Supplies has recently moved to larger premises at 53 Burrfields Road, Portsmouth.

The move is an integral part of the development and consolidation of the external interests of the parent company—A. F. Bulgin & Co. plc of Barking—recently extended by the acquisition of the Brentwood based distribution operation of Broadercasting Ltd., better known by the trading name of Ambit International. Coupled with the group reorganisation has been the establishment of a comprehensive trade counter facility that now also includes the range of Ambit International's catalogue lines.

Finally, to celebrate their recent move and expansionary mood, Solent has published a new catalogue covering their many franchises.

Both the Ambit and Solent catalogues are available on application to: *Solent Component Supplies, 53 Burrfields Road, Portsmouth. Tel: (0705) 669021.*

Please Note!

Would readers please note that the Sandwell Plant Ltd. advertisement on page 88 of the February 1984 issue contained an incorrect telephone number.

The "after hours" number should have read Hitchin (0462) 733254, also the company inform us that they no longer open on Saturday mornings.

Jupiter Cantab Ltd.

At a Meeting of Creditors held on 8 November 1983, Jupiter Cantab Ltd. was put into the hands of a Liquidator, J. D. Cross F.C.A., senior partner of Chater & Myhill, Chartered Accountants, of Cambridge.

The Jupiter Ace home computer, using a sophisticated and user-friendly version of the FORTH language, was launched by the company at the end of 1982, and was greeted with enthusiasm by the computer press and home computer enthusiasts alike. Problems arose when the company expanded into the UK and overseas retail and distribution markets, and large orders were placed which were either not taken up or not paid for. The consequent strain on the company's cash flow made the further research and development required impossible and despite the promise of moving into the ideal control and robotics markets, time ran out for Jupiter and the Ace's true potential remained unrealised.

The Liquidator is now offering for sale the business of the company and further details can be obtained from: *Chater & Myhill, Sussex House, Hobson Street, Cambridge, CB1 1NJ. Telex 817975 (CHAMY G).*

More on page 57

FUSES selection & use

Part 2

by E. A. Rule

Selecting the Best Fuse

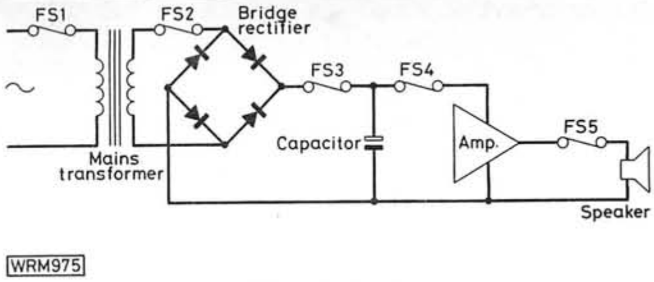
In this section we can only give a general guide as there are many factors which can affect the choice. Tests should always be carried out to establish that the correct type has been selected by simulating fault conditions.

Size. This really depends on the type of equipment, but try to pick one of the common standard sizes as replacements are more readily obtainable. For all new projects the 20 × 5mm is the best choice for domestic electronics.

Current Rating. This will depend on the steady state or r.m.s. value of the current under the worst case load conditions, but remember that extremes of temperature could modify the rating. For resistive loads and many semiconductor loads, use the quick-acting fuse, but if inductive or capacitive loads are used a slow-blow type may be essential. Check that under fault conditions the **minimum** current is enough to "blow" the fuse. Arcing is more likely in a d.c. circuit than a.c. and this should be considered when deciding on the voltage ratings.

Circuit Position. It is often difficult to decide which is the best position for the fuse in a particular circuit and sometimes more than one fuse should be used if maximum protection is required. The circuit in Fig. 2.4 shows some of the more usual positions for fuses and the table gives a list of which fuse protects which components. Considerable time has to be spent studying a circuit to decide on the best method of protection, but in general it is only essential to fuse circuits which may have a fire risk under faulty conditions or where possible damage to semiconductors may occur. **Never, never put a fuse in any mains neutral or earth circuit.** The correct place for a fuse is always in the "live" circuit, so that the equipment is disconnected from its supply once a fuse has "blown".

Fuse Holders. The type of fuse holder used is just as important as using the correct fuse. Fuses are heat-operated devices and the type of holder used can greatly affect the speed at which a fuse "blows". Tight-fitting clips are of course required to ensure good electrical contact and to also prevent local heating of the fuse element due to poor contact resistance. Fuses should also be mounted in a horizontal position so that any heating is even along their



Component	FS1	FS2	FS3	FS4	FS5
Mains transformer	□ ★				
Bridge rectifier	□	□ ★			
Capacitor	□	□	□ ★		
Amplifier	□	□	□	□ ★	
Speaker	□	□	□	□	□ ★

★ These components may 'blow' fuse

□ Components protected when fuse has blown

Fig. 2.4

length. Fuses operating at, or close to, their maximum rating will produce heat and should not be mounted in confined areas. All extra heat produced will allow the fuses to "blow" at a lower current and these various factors are one reason why it is important to simulate fault conditions and check the action of fuses in particular situations.

There is also the safety aspect of fuse holders. Holders constructed to the latest BSI specification make it impossible to touch the actual live parts of either the fuse or holder when inserting or removing a fuse. They are designed so that before any metal parts are exposed, the electrical contact between the fuse and circuit is broken. The specification also states that the action of removing a fuse must require the use of a tool (coin), it should not be possible to just use the fingers. A fuse should of course always be wired into circuit so that when the master switch is "off" the fuse is disconnected from the "live" supply. Fig. 2·5 (a) and (b) shows how a fuse could still be "live" even when the equipment is switched off. It is always advisable to unplug equipment before changing fuses; never assume that it is safe just because the unit is switched off, a badly designed circuit could still be "live" and a fatal shock received. If you have any doubt, pull the plug out!

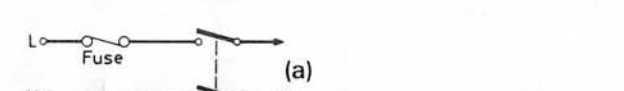


Fig. 2.5: Circuit (a) and (b) are dangerous. In (a) the fuse is "live" all the time, even though the switch is double-pole. In (b) it could be live if the mains supply is reversed. Circuit (c) is safe because whatever way the mains is connected, the switch isolates the fuse when the circuit is off

Replacement of Fuses. Always replace a blown fuse with one of the same type and ratings. If a fuse keeps blowing, there is a reason for it and a fault should be suspected. Fitting a fuse of higher rating just to prevent a fuse blowing can create a fire risk or danger of electric shock. The common 13 amp mains plug is almost always supplied with a 13 amp fuse fitted. Why this is allowed the author has never understood, because there are very few occasions when this high current rating is required. Most domestic radio equipment, for example, takes less than 3 amps (720 watts) and this should be the maximum value of fuse fitted. If possible, domestic electronic equipment should have a 1 amp fuse which will still allow powers up to 240 watts. Many transistor radio/cassette units only draw power of about 40 to 60 watts and ideally the fuse should be rated at 0·25 amps. Regretfully these don't seem to be available from any of the electrical shops. Also, it is not generally known that many of the mains/battery radio/cassette units on the market **do not switch the actual mains supply off,** but leave it permanently connected to the mains transformer. These sets switch the secondary d.c. supply only and they often do not have any fuse fitted in the mains circuit, so you can imagine what would happen if a fault occurs in the transformer and you have a 13 amp fuse fitted in the plug! When you go out of the house you may well **think** you have switched the radio off, but in actual fact **it is still on** because the on/off switch only switches the secondary circuits, so while you are away the risk of a fault causing a fire is very real. Always switch off from the wall socket, better still, remove the plug.

Continental Fuse Codes

Continental fuses are often marked in a different way to those from the UK and USA. The graph in Fig. 2.6 shows the time/current relationship for the various types of fuse

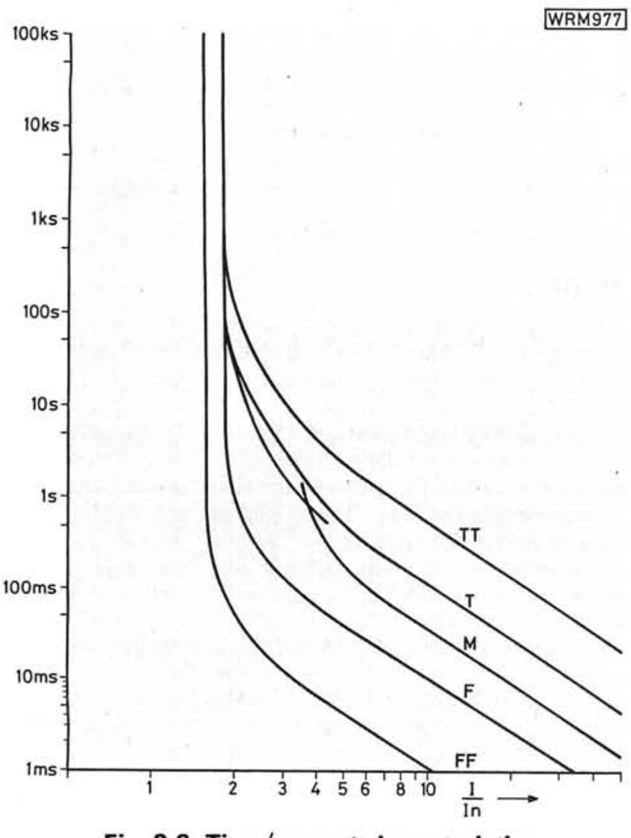


Fig. 2.6: Time/current characteristics

and it will be noted that the terms slow-blow, etc., do not appear, but that the letters "TT", "T", etc., are used instead. The letters designate the type of fuse based on the description in German, and are as follows:

"FF" *(Super-Flinke).* These are super-quick-acting fuses and are used in circuits for the protection of semiconductors or other components where the normal speed fuse would be too slow.

"F" *(Flinke).* Normal blow, used in circuits where there is little or no current surge but a quick action is required to protect components if a high overload current occurs.

"M" *(Mittleträge).* Medium time fuses, used in applications where relatively small switch-on surges may occur or small transient surges during normal operation.

"T" *(Träge).* Slow-blow, these are the type used where capacitive or inductive (motor) load causes a large surge current upon switching on.

"TT" *(Superträge).* Used where very high surge currents are found or when a high surge current is maintained for longer periods of time.

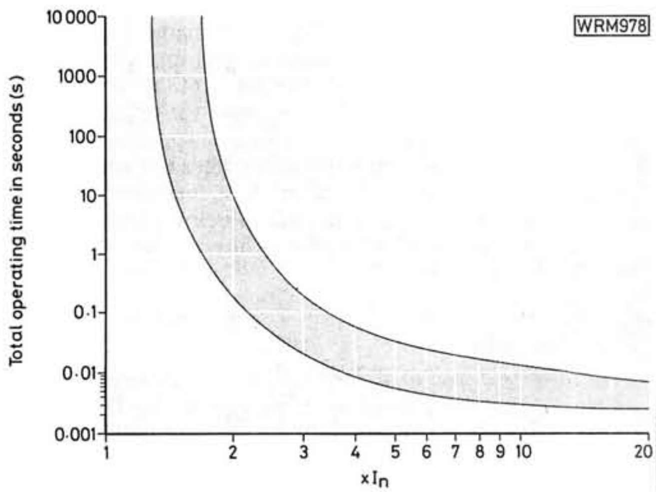


Fig. 2.7: Time/current characteristic curves

For completeness Fig. 2.7 shows the more common type of time/current chart for a particular type of fuse and shows the upper and lower limits of the variation in properties of one type of fuse. In other words, fuses, like all components, have a manufacturing tolerance and this must be taken into account when deciding on the best type of fuse for a particular circuit.

The author is indebted to Messrs. Littelfuse Olvis Ltd. and Kenneth E. Beswick Ltd. (Alert) for much of the information contained in this article. Both companies have been manufacturing fuses for the electronics industry for over 50 years and their co-operation is greatly appreciated. ●

Top-Band Dir

by Chris Plummer G8APB

Top-Band "d.f.ing" (direction finding) has been carried out in the UK for around 60 years, and many still regard it as a "black-art". Basically it is just a combination of skill with a radio set, map reading and a lot of luck in the ultimate game of "hide and seek". It is a pastime for the young and old alike, from seven to seventy, at a national level.

The equipment is regarded by many as highly specialised, but really its only requirements are a directional antenna, such as a ferrite rod or loop, and a screened case. The rest of the electronics could be a retuned medium-wave receiver. Most of the protagonists in local club and national events use a purpose-built set. In past years these were battery valve sets, but with the advances in technology most of the best receivers in use today use the circuitry to be described below. They can cost no more than £10–15 even if you buy a case and all new components.

The Theory

Simple trials with an ordinary medium-wave portable receiver tuned to your favourite early morning "TWIT"—sorry, T. Wogan Esq.—on Radio 2 will show up broad maximum signals broadside to the ferrite rod and deep minimums or nulls off the ends. On earlier sets with frame antennas this will be a maximum in line with the frame and a null when broadside on. This is known as the *Cos Ø* relationship.

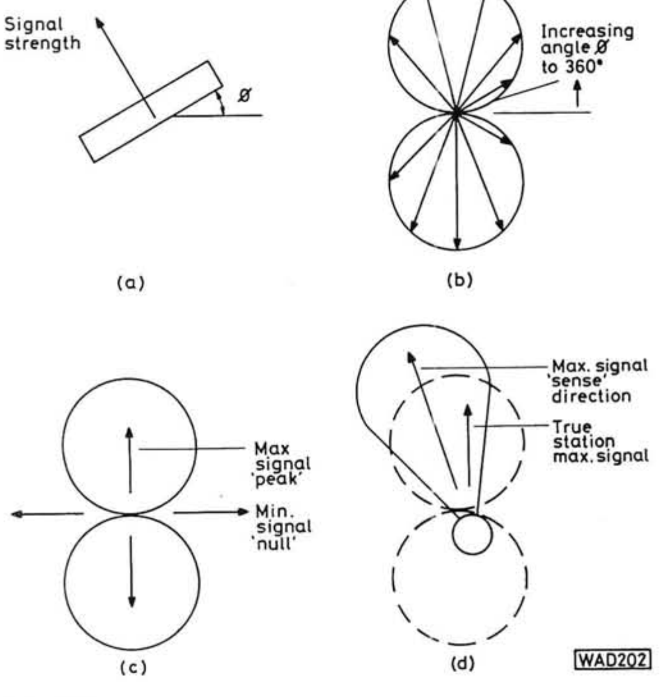
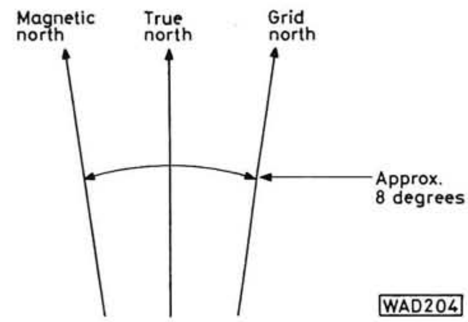


Fig. 1.1

If you plot signal strength as a function of the angle through which the set is turned from a reference point (angle Ø), the relationship is *Cosine Ø* (Fig. 1.1).

As can be seen from the double-circle pattern, Fig. 1.1(c), there are two equal, fairly broad, maximum signals, and two much narrower minimums or "nulls". Thus to get an accurate bearing on a station one or other of the "nulls" is used. This gives one of two directions, and under normal circumstances, such as sailing in the Channel, this would be sufficient as a cross-bearing would be obtained from another transmitter or from a different position some time later. However, for radio direction finding it is simpler if only one bearing or null need be found. This is done by introducing a signal from a separate whip antenna amplified to a level and phased such that it can cancel part of the pattern, producing the pattern in Fig. 1.1(d). It is then relatively easy to decide by comparison of front and back signals which is the correct direction. It is inadvisable to use solely the large maximum as a bearing as it is usually offset from the true direction of maximum signal.

Fig. 1.2



Maps

Once a bearing is obtained, noting that a hand bearing compass is calibrated 0 to 360 degrees, i.e. 0 degrees for magnetic north, through 90 degrees for east, 180 degrees for south, 270 degrees for west etc., the bearing is plotted on a 1:50000 Ordnance Survey map of the area. Care must be taken to make allowance for the difference between the magnetic bearings of the compass and grid north on the lines on the map. This difference is normally about 8 degrees west of north.

Inspection of the edge of the map will give you the variation for that map (Fig. 1.2), but it must be noted that the correction also varies with time, about half a degree per eight year period, as the magnetic pole moves slowly, so check the "revision" date of the map.

It is in fact simpler than it sounds, particularly if you mount your compass with an 8 degree offset on the receiver or antenna, so that you actually read the compass in "Grid" degrees.

Having obtained a bearing relative to "Grid north", pinpoint your actual location on the map, align the centre of a circular protractor at your location and plot the bearing

ection Finding

Part 1

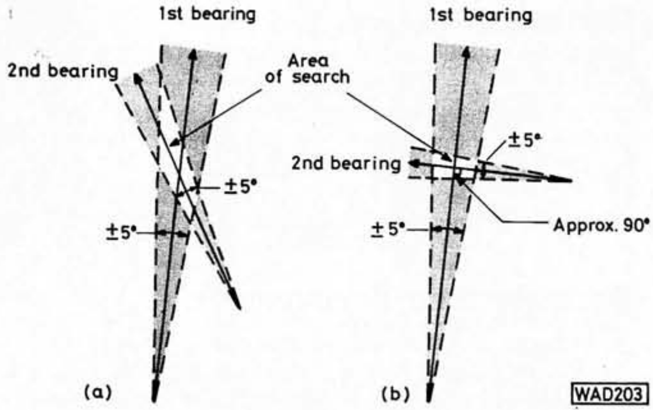


Fig. 1.3

on the map with ruler and soft pencil. It is possible, but rather fiddly, to use an overlay of "Clingfilm" with a crayon and this also keeps the map dry.

Bearings

You have now produced the first bearing, but remember that at best this is only accurate to ±5 degrees; at worst, due to various factors it is only accurate to ±25–30 degrees. You should then choose a second location for your next bearing so that this second bearing crosses the first at as near 90 degrees as possible. This can reduce the search area required, and it is a good idea where possible to reduce your distance from the hidden station so that the search area is reduced even more (Fig. 1.3).

As transmissions and time goes on, further bearings are taken, gradually closing in on the transmission source, and transport is finally abandoned. "Bush-beating" is soon

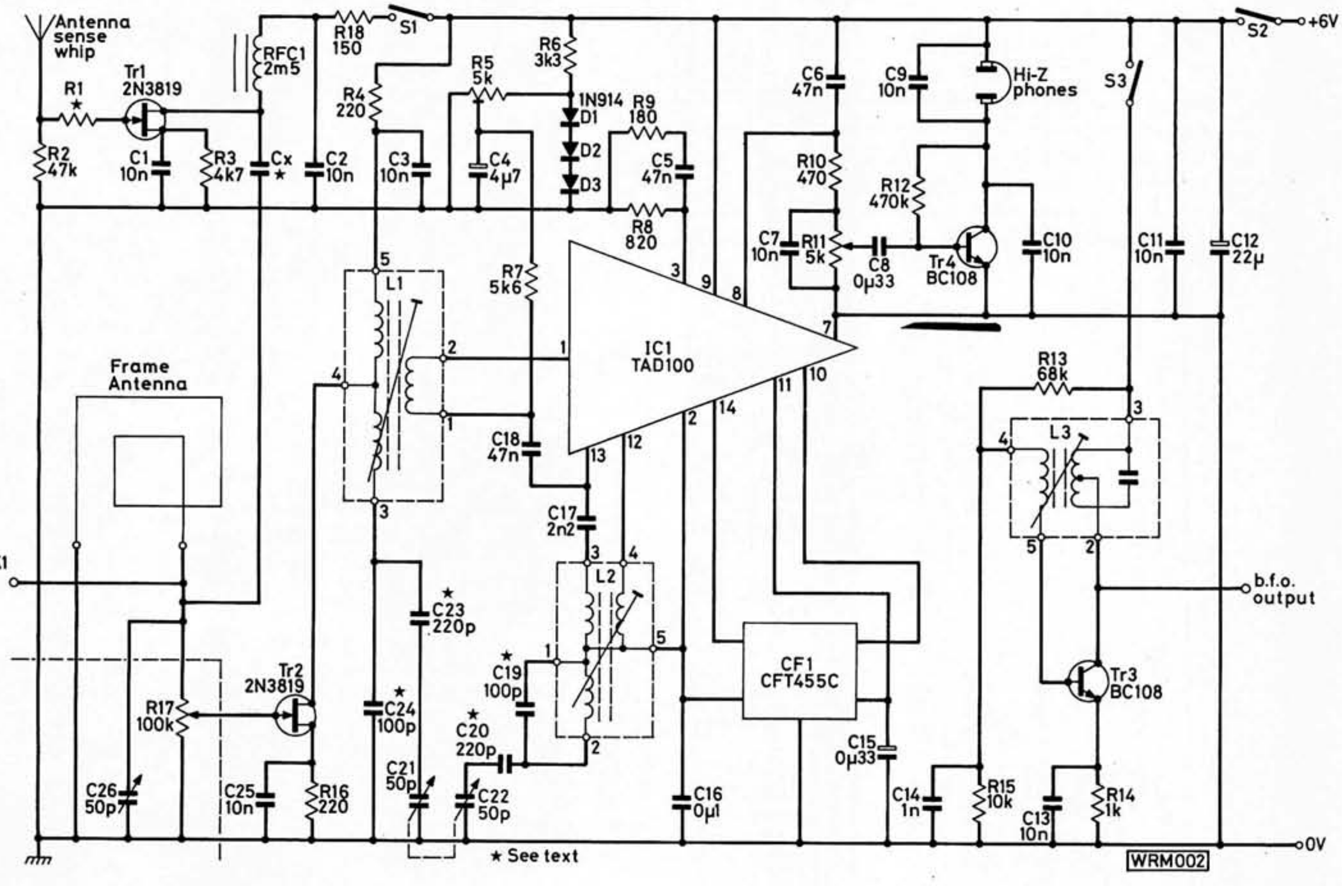


Fig. 1.4: The circuit diagram of the receiver to be described with constructional details in Part 2. The basic circuit is designed around the TAD100 i.c. This i.c. contains the oscillator, mixer, detector and audio pre-amp stages. The TAD100 has internal a.g.c. and this is disabled by a d.c. bias voltage on pin 1 applied via the mixer coil L1. Tr2 forms a j.f.e.t. r.f. amplifier while Tr1 operates as the sense amplifier. This is an untuned stage amplifying the signal from the sense whip antenna before combining it with the signal from the main antenna. Tr3 is the b.f.o. and is a conventional transformer feedback oscillator. The audio amplifier, Tr4, will drive any high-impedance headphones

taken up by the operator and helpers, i.e. look under or in anything big enough to hide the "fox". On arriving closer to the transmitter some attenuation will have to be inserted in the input of the receiver to avoid it overloading. At this time the advantages of the screened case become apparent as the only signal entering the set will be from the antennas, not through the sides of the receiver case.

After maybe many frustrating minutes or even hours you will probably find your hidden (sadistic) station. What you hope you have done is to find it or possibly them before anyone else.

Confusion

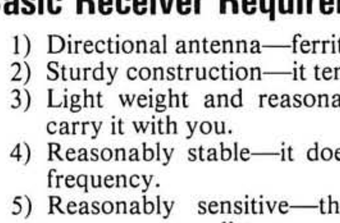
Just to confuse you, most of the organised events transmit on a random schedule of not more than 15 minutes between transmissions and *not less* than two minutes on-air time, with a few fixed-time transmissions to help the needy. Sadistic organisers also hide the transmitters and crews as well as they can in bramble bushes, holes in the ground and up trees etc., just to fool you!

Basic Receiver Requirements

1) Directional antenna—ferrite rod or frame/loop.
2) Sturdy construction—it tends to take a beating.
3) Light weight and reasonably small—you have to carry it with you.
4) Reasonably stable—it does not help if it drifts off frequency.
5) Reasonably sensitive—the station may be low power or some distance away.
6) Capable of being made less sensitive at will—you still need a bearing close in.
7) Simple to operate—keep it simple stupid (KISS).

Part 2

In the second part of this article the construction details of of the author's set will be given. Further details of "d.f.-ing" in general can be obtained from the RSGB, Alma House, Cranborne Road, Potters Bar, Herts. EN6 3JW, or the author, 27A Thorn Lane, Four Marks, Nr. Alton, Hants., GU34 5XB, Tel. Alton 62839.



I was thinking of buying a one transistor 1–30MHz 200W all-mode transceiver.

... heard by R. Khatchadourian, Greece

I have no definite plans for antennas as yet and am having to make do with an indoor 8-element dipole.

... heard on GB3GN by GM6JZA

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.

News

UK Novice Licence Proposal

The following has been received from Ian Abel G3ZHI, Secretary of the Amateur Radio Novice Licence Campaign (ARNLC), and forms the first published proposal for such a licence:

Proposals

1. Morse would be the method of communication; the speed would be 5 words per minute.
2. The technical examination would essay the following objectives:
   a) An understanding of radio theory, including methods of propagation, transmitter interference;
   b) Technical operations and operating procedures;
   c) Appropriate regulations.

   All the above at a level appropriate to what is envisaged.
3. The examination would be set by City and Guilds or by the Radio Society of Great Britain.
4. Morse would be examined by appointed amateurs, such appointments being made by the RSGB or local Radio Interference Officer.
5. Examinations would be sufficiently simple to attract and maintain interest, yet ensure that the operator has some idea of what s/he is doing.
6. Issue of a novice licence would be for a maximum of two years; after this period, the operator would need to gain the standard Radio Amateur qualification, or s/he would lose the novice licence for a year.
7. In terms of a model for working discussion, the American system in current operation would be considered.
8. *Frequencies:* The licence would be effective in c.w. sections, or other designated sections of the various high frequency bands—28, 21, 7, 3·5 megahertz—excluding 14MHz which is probably too busy.
9. *Equipment:* This would be low-power, type-approved, of 10 watt output.

Background

1. The concept of a novice licence has been established for some forty years.
2. A novice licence was promised in Parliament in 1968 by the Postmaster General at that time: E. Short; for some reason this was never brought into effect.
3. The government has now stated that it has no objection in principle; it is therefore hoped that such a licence may now be introduced.

Reasoning

1. The whole nature of amateur radio has changed during recent years.
2. The traditional entry into the hobby is now much less followed. This has been a long period as a short wave listener to learn and gain background experience in the hobby, prior to taking the Radio Amateurs Examination (usually after a course of training).
3. It is more usual now for people to come "cold" into the hobby, or from the inappropriate route of CB.
4. The concept of the novice licence essays the following aims:
   a) To make the start from "baseline" as easy as possible.
   b) To open the initial stages of the true hobby to as many as possible.
   c) To introduce a form of "incentive licensing" which will facilitate natural progression to higher capabilities.
5. Learning by **doing** is more effective; operators should become better equipped to follow the hobby competently and responsibly. An analogy to the contrary would be to consider learning to drive without access to the public roads.
6. No age limit is envisaged, as this would be arbitrary, and would restrict many who are both interested and potentially competent.
7. Stations would be both licensed and disciplined; therefore it will be seen that CB in no way fulfils this role. In fact, CB has nothing to do with the concept of a novice licence.

Repeater News

Statistics: At the time of going to press the following status summary of UK v.h.f. and u.h.f. voice repeaters makes interesting reading. 144MHz—55 operational, 5 temporarily off-air, 2 licensed but not yet operational and 5 proposals with the DTI. 432MHz—93 operational, 6 temporarily off-air, 6 licensed but not yet operational, 16 proposals with the DTI and 3 licence franchises being reallocated (change of Group).

Proposals in the Pipeline: The following are outline proposals which require further vetting, site clearance and approval by the RMG: 144MHz—Luton/Dunstable, Peterhead (Grampian), Whitehaven (Cumbria) and Calder Valley (W. Yorkshire). 432MHz—Rossendale Valley, Burton-on-Trent, N. Wales, Cumbria, South Lakeland, Huntingdon, Medway Towns and Hendon.

The first batch of vetted applications went to the DTI on 1 January 1984, and included v.h.f. repeater GB3GJ/Jersey C.I. and u.h.f. repeaters at Hinkley and North Bedfordshire.

General News: Martin Hobson GM8KPH, RSGB region 12 representative, has been appointed by the RMG to look after repeater liaison in the North of Scotland. All members of the RMG are available to give lectures, on request, to affiliated clubs and radio societies.

The FM Group London, having managed the London area repeaters for many years, have now relinquished the management of GB3EL. A new Central London group has been formed to take over with a view to reinstating GB3EL in the centre of London with coverage directed principally towards the east (during the next 12 months).

The RMG hope to gain approval from the DTI to allow parallel 10GHz inputs to existing u.h.f. repeaters GB3IW (when re-sited), GB3BS and GB3LE.

A new group has been formed to run GB3NN on RB2, following reported licence infringements of the original group whilst evaluating alternative sites. A new site has now been located and it is hoped to reinstate the repeater from this improved location within the next six months.

The DTI are considering a request from the RMG to allow channel-swap between GB3ES (currently R7) and GB3SR (currently R3). If this is cleared it should ease the current co-channel interference problems encountered by GB3NL and GB3ES.

Site changes have been requested for GB3LD and GB3ND, both onto TV mast sites. GB3PY has requested to be located in the centre of Cambridge. GB3SK is to move from Folkestone to Canterbury.

Appeal: We have been asked by the RMG and many repeater groups to remind all UK repeater system users that whilst the RSGB provides administration, back-up and holds the licences, all other items concerning the construction and ongoing maintenance are borne by the individual groups. If you regularly use a repeater, please help them to help you, by making a contribution to funds.

UOSAT-B

Following our brief report in the February issue we have received further details of UOSAT-B, the second space/science/education and cost-effective space engineering evaluation satellite, designed and now under construction by a team of electronic engineers at the University of Surrey.

UOSAT-B will closely resemble the original UOSAT-1 weighing in at 60kg and containing 36 p.c.b.s. It should be noted that in space engineering terms, the second and subsequent satellites in a particular series are given identity letters prior to launch and numbers after launch. Thus the original UOSAT (OSCAR-9) becomes UOSAT-1, and UOSAT-B, now under construction, will—if successfully launched—be known as UOSAT-2.

Launch date is currently set for 1 March 1984 at 1759–1809 GMT with the satellite forming the secondary payload with LANDSAT-5. The launch vehicle to be used is a Delta 3920 rocket which should place UOSAT-B into a polar and sun-synchronous orbit at a planned height of 700km.

Working with UOS in building the experimental hardware are the Rutherford-Appleton Laboratory (SERC), the Universities of Sussex and Kent, together with the UK, US and Canadian branches of AMSAT. The UOS is providing two educational and scientific experiments—a second speech synthesiser with a larger vocabulary and also an improved TV Camera.

The UOS project team, once again under the leadership of Dr. Martin Sweeting, is also responsible not only for the building (in under 80 days!) of the spacecraft, but also all communication, attitude control and other "housekeeping" systems necessary for support and control. The cost of UOSAT-B is estimated at £350,000 and is supported by UOS in collaboration with UK industry.

When in orbit UOSAT-2 will be overhead at 0900 and 2100hrs daily and be above horizon for several successive orbits for periods of up to 14 mins—orbital period being 98·8 mins.

Digital Communications Experiment

Of specific interest to radio amateurs will be the digital communications experiment (DCE) produced by AMSAT-USA/Canada. Using a 96K RAM under computer control, this feasibility study will provide an up-link channel for the reception and subsequent re-transmission of data/messages addressed to other amateur stations. Results of this experiment will assist the design of future amateur satellite based packet switching systems.

RAE Course

A 30-week RAE course is being run at Greenhead College, Huddersfield, Yorkshire.

Although the course will have started by the time you read this, the Course Tutor, Peter Mercer G6CPM, is happy to see late starters joining the course.

Further details from: *Peter Mercer G6CPM, tel: Huddersfield (0484) 33036.*

Special Event Station

The St. David's Day Special Event Station, organised by BBC Port Talbot Amateur Radio Society, using the special callsign GB2SDD will again be operational on Thursday 1 March to celebrate the National Day of Wales.

The established popularity of the event is evident from the volume of contacts made during the 1983 celebrations, when over 1000 QSOs were made in 24 hours.

Amateurs world-wide are again cordially invited to contact the station which will be operational throughout the 24 hours of Thursday 1 March 1984. Conditions permitting, the station will be active on all h.f. and v.h.f. bands.

All QSOs will be acknowledged with a Special Event QSL Card, and the organisers will also be very pleased to respond to reports sent in by s.w.l.s.

An attractive award is available to radio amateurs who make contact with the Special Event Station on St. David's Day, and additionally, 5 other Welsh amateur stations (from outside the UK) or 10 other Welsh stations (from within the UK) during the months of February and March 1984.

Claims for the award should be sent with copies of your log sheets, along with six IRCs, or POs, cheques etc., to the event Co-ordinator who will then pass your claim on to the QSL Manager.

For further information contact: *Event Co-ordinator, R. R. Jones GW4HOQ, "Bryn-Yhys", Strawberry Place, Morriston, Swansea, SA6 7AG.*

5 Channel Antenna Combining Unit for BBC Brighton

The Antenna Systems Division of Marconi Communication Systems Ltd. of Chelmsford, UK, has recently completed, in record time—just six instead of seven months—the design, fabrication and installation of a very complex antenna matching system for the BBC in Brighton.

The system covers five medium frequency transmissions as follows: 693kHz for Radio Three at 1kW power; 1053kHz for Radio One at 2kW power; 1215kHz for Radio Three at 1kW power; 1332kHz for the IBA Independent Radio Brighton at 1kW power and 1485kHz Local Radio at 1kW power, with the signals fed from the transmitters via 50 ohm coaxial cables, and combined into an omnidirectional antenna, which is a stayed mast with the base insulated.

It was requested that all channels should meet a bandwidth specification within 1.6:1 v.s.w.r. at ±6kHz, from carrier frequency and that cross-talk between any one transmitter to any other should be better than 60dB with an allowance of 10dB mixing loss. The intermodulation products were to be at least 60dB down on any of the carrier frequencies.

To combine two or three transmissions is fairly common, but to combine five is quite rare requiring special techniques to overcome problems such as: impedance spread due to the large number of components in the filter circuits; the production of stable rejection filters which can be set-up with precision so as to maintain the notch as close as possible to the ideal and produce minimum heat; and to keep stray capacity of the rejection filters (caused mainly by the inductors) as low as possible, in order to reduce the transformation effect along the line of the rejection filters.

Marconi Communications Systems, Marconi House, New Street, Chelmsford CM1 1PL.

New Catalogue

The first issue of a new catalogue listing more than 100 test and measuring instruments, leads, connectors, accessories and kits is now available.

Entitled "Supercat" Electronics Catalogue, it is intended for direct mail business and should prove of interest to the hobbyist and industrial user.

To obtain a free copy of this catalogue apply to: *Supercat Electronics Ltd., PO Box 201, St. Albans, Herts. Tel: (0727) 62171.*

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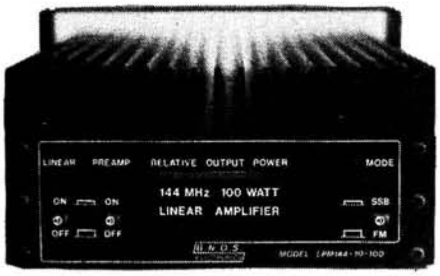

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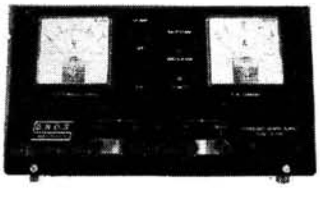

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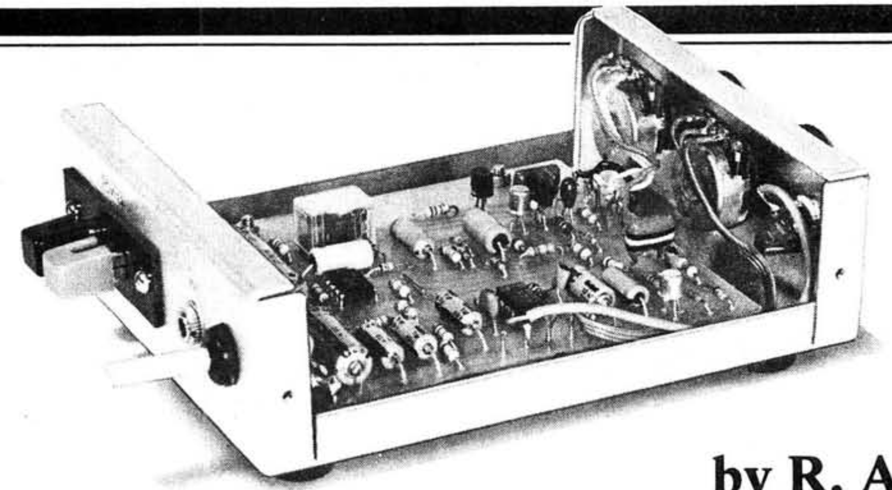


by R. A. Penfold

TRANSCEIVER VOX UNIT

A voice operated switch (VOX) to automatically operate the transmit/receive switching of a transceiver may seem like an application where a straightforward sound activated switch would suffice, but in practice there are a number of problems which can occur and for which a VOX unit should ideally be designed to overcome.

The VOX unit described in this article will work reliably with most types of f.m. transceiver. As we shall see later it should also work with transceivers using some modes other than f.m., but in a less sophisticated manner.

PTT Switching

The unit is designed for use with transceivers that have the p.t.t. (press-to-talk) switch configuration shown in Fig. 1. One pole of the p.t.t. switch is simply used to connect the non-earthy side of the microphone to the relevant conductor of the 4-way output lead during transmissions and to disconnect it during reception. If a microphone of this type is to be used with a VOX unit either the appropriate two tags of the switch must be bridged, or some means of holding the switch in the down position (transmit) must be devised since, in this application, the output of the microphone must always be connected to the input of the VOX unit if it is to function properly. A set of relay contacts in the VOX unit could be used to disconnect the microphone from the transceiver during transmissions, but this does not seem to be necessary and this feature is not included in the final design.

The other pole of the p.t.t. switch has two functions. In the first instance it disconnects the loudspeaker lead from earth during transmissions, preventing the microphone signal from breaking through to the loudspeaker. This break-through to the output stages of the receiver can be quite strong and could even cause problems with acoustic feedback if the loudspeaker was not disconnected. The second function of the p.t.t. switch is to operate the transmit/receive switching in the transceiver, which is normally in the receive mode and is taken to the transmit mode by the short circuit to earth provided by the switch contacts.

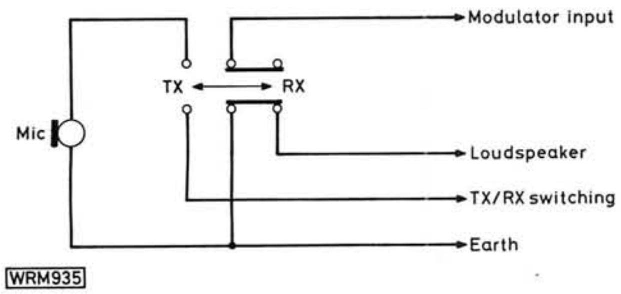


Fig. 1: A common p.t.t. microphone internal switching arrangement

Block Diagram

A block diagram of the VOX unit is shown in Fig. 2. The microphone is directly coupled to the output of the unit and also to a pre-amplifier stage. The latter has a gain control which enables the sensitivity of the unit to be set at a suitable level. Amplified audio from the pre-amplifier is fed to a rectifier and smoothing circuit—this has a fast attack time so that the circuit responds rapidly when someone speaks into the microphone. The decay time is much longer and is adjustable from a maximum of approximately two seconds down to a minimum of about one tenth of this figure. A comparatively long decay time is needed in order to prevent the unit switching back to receive mode unnecessarily during the brief pauses that occur in normal speech.

The smoothing circuit provides a d.c. signal which operates a monostable multivibrator via an inverter/buffer stage. A problem with some voice operated switch designs is that they do not always operate reliably when initially activated and can tend to operate intermittently at first. Using a monostable with an output pulse length of about one second or so helps eliminate this problem, as does the use of positive feedback from the output of the monostable to the input of the inverter/buffer stage and the consequent hysteresis that is produced. The relay is driven direct from the output of the monostable and a pair of changeover relay contacts are used to control the transceiver.

The main problem with a VOX unit is that the sound from the loudspeaker can be received by the microphone, producing spurious operation of the unit—usually resulting in a form of low frequency oscillation. This effect can be overcome by keeping the microphone well away from the speaker, keeping the sensitivity of the VOX unit low and keeping the volume control set to a low level as well. However, this is obviously not very convenient in

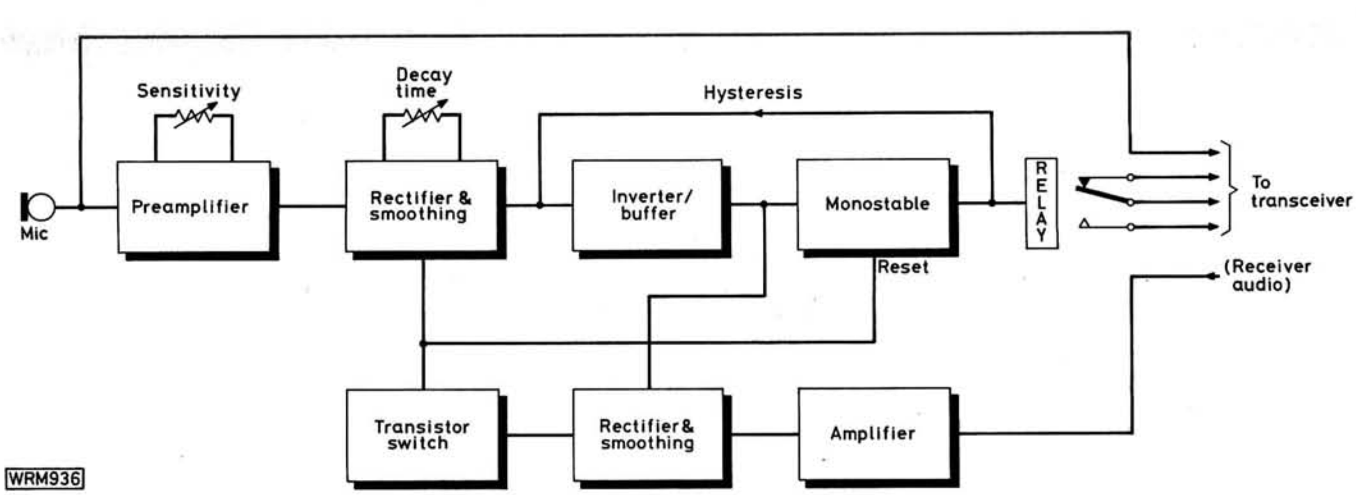


Fig. 2: The block diagram of the transceiver VOX unit

use. A better alternative is to use headphones or an earpiece instead of the loudspeaker so that there is insufficient sound generated to cause problems with acoustic feedback.

Another, more practical, method of overcoming this problem is to use the signal from the output of the receiver to mute the VOX unit during reception. A further advantage of this method is that it prevents the VOX unit from being accidentally operated while the other station is transmitting. In this design therefore the output from the audio stages of the receiver is amplified, rectified, smoothed and then used to operate a switching transistor. This holds the output voltage of the smoothing circuit in the main section of the unit at practically zero and resets the monostable.

There is a slight complication in that, as mentioned earlier, the transmitted signal tends to break through to the audio output stages of the receiver fairly strongly, resulting in the circuit oscillating instead of holding in the transmit mode. This is prevented by using the output of the inverter/buffer stage to disable the muting circuit when the circuit is in the transmit mode. This is quite acceptable since the muting circuit performs no useful role during transmissions.

For reliable operation the mute facility must be used in conjunction with the squelch of the transceiver to ensure that there is a reasonably low background noise level when the station that you are communicating with is not transmitting. Without squelch action it is possible that noise of various types will be strong enough to hold the VOX unit in the receive state and the system could prove to be unreliable. The unit can also be used as a straightforward voice activated switch with a transceiver that does not have a squelch facility.

The Circuit

The complete circuit diagram appears in Fig. 3. The pre-amplifier is a two-stage type having an operational amplifier (IC1) used in the non-inverting mode as the first stage and a common emitter amplifier (Tr1) as the second stage. Both stages have a voltage gain of around 44dB; this high combined gain is needed because of the low signal level provided by the microphone (which is unlikely to be more than about 1mV r.m.s.). Potentiometer R7 is a straightforward volume control type gain control which is connected between the two stages of the pre-amplifier.

The output of the pre-amplifier is fed to a simple rectifier and smoothing circuit which consists of D2, D3, C11, R13 and R15. Potentiometer R13 enables the decay time to be varied, the attack time being relatively short due to the comparatively low source impedance of the input signal to the rectifier circuit.

A positive bias voltage is developed across C11 and is fed to the gate of v.m.o.s. transistor Tr2 by way of R12. There is a small voltage drop across R12 due to the potential divider action across this component in conjunction with R14, D4 and the relay coil. If the microphone signal is strong enough the bias voltage will be sufficient to bias Tr2 hard into conduction so that the trigger input of IC2 (pin 2) is pulled down below the trigger threshold voltage

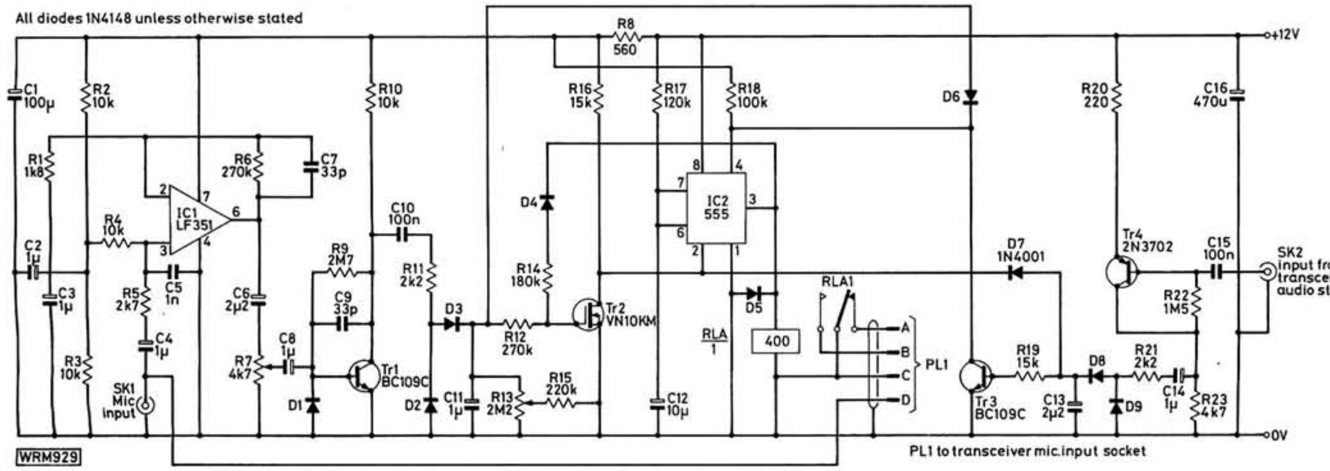
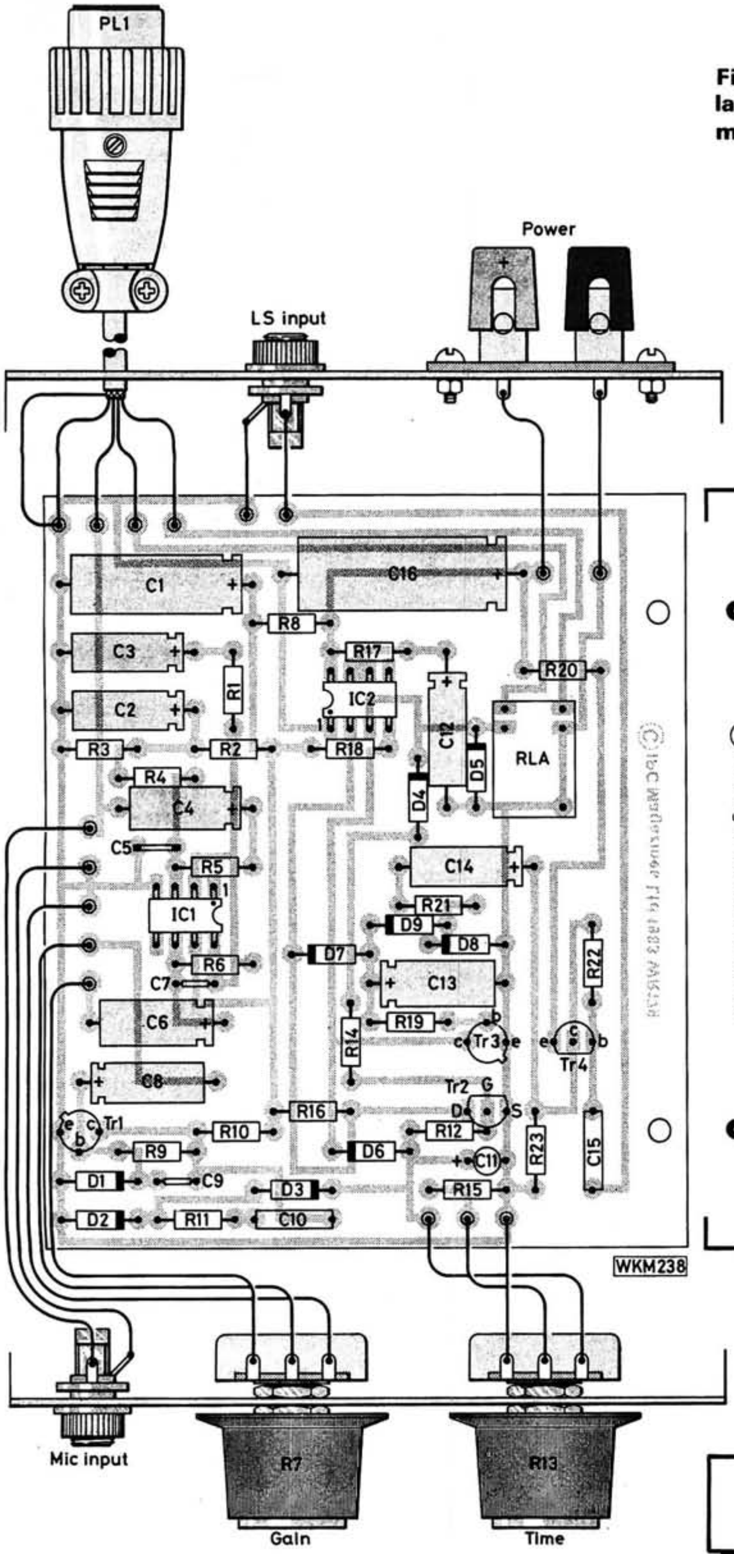
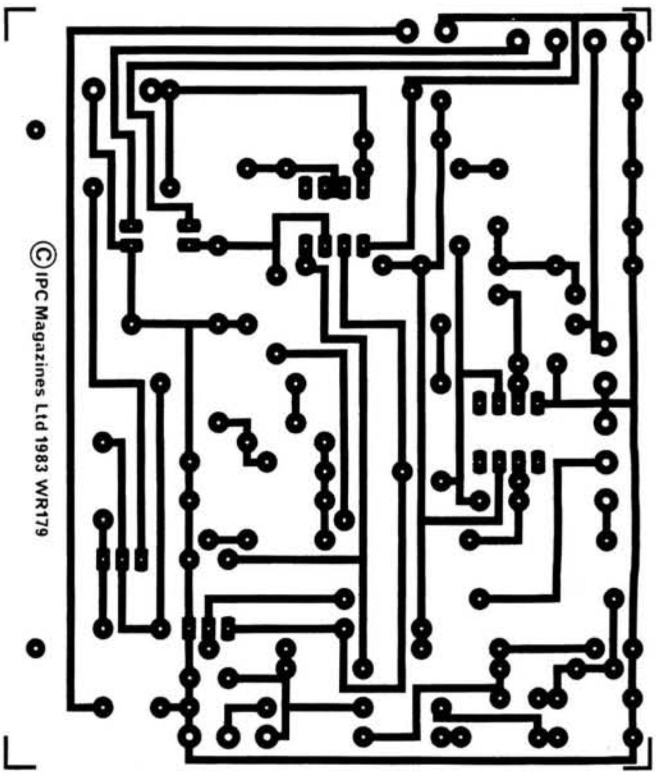


Fig. 3: Full circuit diagram of the VOX unit

Fig. 4: Full-size component placement and p.c.b. layout details of the transceiver VOX unit. Reference must be made to the equipment's circuit diagram for interconnection details





of one third of the supply voltage. This results in IC2 producing an output pulse of nominally 1·32 seconds (which operates the relay). However, after this time has elapsed the output pulse will not end until Tr2 switches off and the trigger input is taken back above the trigger threshold voltage.

During the output pulse D4 becomes reverse biased so that D4 and R14 are effectively taken out of circuit. Bearing in mind that the input impedance of Tr2 is extremely high, this eliminates the voltage drop through R12 and boosts the sensitivity of the circuit slightly. When the output pulse ends, D4 and R14 are effectively switched back into circuit and reduce the sensitivity of the circuit back to

BUYING GUIDE

All components for this project are readily available from normal stockists

Approximate Cost

£15

Construction Rating

INTERMEDIATE

★ components

Resistors
Carbon film ¼W 5%

220Ω	1	R20
560Ω	1	R8
1·8kΩ	1	R1
2·2kΩ	2	R11,21
2·7kΩ	1	R5
4·7kΩ	1	R23
10kΩ	4	R2–4,10
15kΩ	2	R16,19
100kΩ	1	R18
120kΩ	1	R17
180kΩ	1	R14
220kΩ	1	R15
270kΩ	2	R6,12
1·5MΩ	1	R22
2·7MΩ	1	R9

Potentiometers
½W Carbon track

4·7kΩ Log	1	R7
2·2MΩ Lin	1	R13

Capacitors
Polyester

0·1μF	2	C10,15

Ceramic

33pF	2	C7,9
1nF	1	C5

Electrolytic double-ended

1μF 63V	5	C2–4,8,14
2·2μF 63V	2	C6,13
10μF 16V	1	C12
100μF 16V	1	C1
470μF 16V	1	C16

Tantalum bead

1μF 16V	1	C11

Semiconductors
Diodes

1N4001	1	D7
1N4148	8	D1–6,8,9

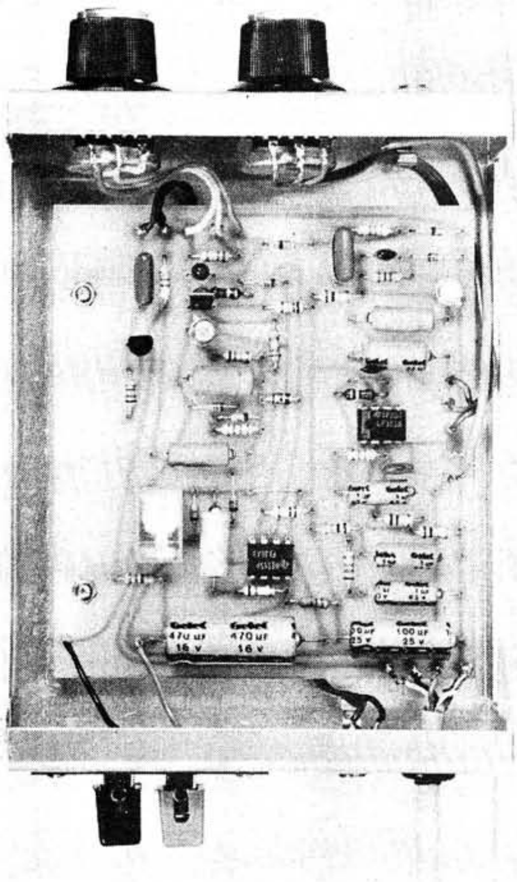
Transistors

BC109C	2	Tr1,3
VN10KM	1	Tr2
2N3702	1	Tr4

Integrated circuits

LF351	1	IC1
555	1	IC2

Miscellaneous
3·5mm jack (2); 4-way locking audio connector (or appropriate connector); 12V relay 400Ω coil, 1A s.p.d.t. contacts p.c.b. mounting; 133 × 102 × 38mm metallic case; control knobs (2); supply input terminals (2); p.c.b.; 4-way screened output lead and connecting wire.



The author's prototype VOX unit

its original level. This is an important feature as it counteracts the tendency for the circuit to immediately trigger back to the transmit mode due to the stray pick-up of noise spikes that are generated as the relay switches off and the transceiver reverts to the receive mode.

Erratic operation can also be caused by stray pick-up of the strong r.f. field produced during transmissions, but the filtering provided by R5, C5, C7 and C9 is adequate to prevent this.

The receiver's output signal is coupled to Tr4 and after amplification is fed to a rectifier and smoothing circuit which drives Tr3. In the presence of a suitable input signal Tr3 is biased hard into conduction so that it resets IC2 and discharges C11 via D6. Diode D6 is included to prevent R18 from holding Tr2 permanently in the on state. When the circuit is in the transmit mode Tr2 shunts D7 across C13 so that the sensitivity of the muting circuit is greatly reduced and it becomes ineffective.

For correct operation the circuit requires a nominal 12 volt d.c. supply and consumes about 9mA in the receive mode, rising to approximately 40mA in the transmit mode due to the additional current consumption of the relay.

Construction

Most of the components including the relay are mounted on the single-sided p.c.b., the track pattern and component layout for which is also shown in Fig. 4. Some constructors may not require the automatic muting of the circuit in the receive mode, so the unit can then be built as a straightforward VOX unit by omitting R19–23, D6–9, C13–15, Tr3 and Tr4. Additionally R18 can be replaced with a wire link.

The wiring and general layout of the unit can be seen from Fig. 4 and the photographs. An aluminium box measuring approximately 133 × 102 × 38mm makes an ideal case for this project, but any metallic case of about this size should be suitable. A two-way spring loaded terminal strip fitted on the rear panel of the unit provides a convenient way of connecting the project to the power supply.

A four-way screened lead couples the unit to the output plug and the outer braiding plus one of the inner conductors carries the earth connection. Most transceivers (usually those without up/down scanning on the microphone) have a 4-pin locking microphone connector. Reference to the circuit diagram of the transceiver and the diagrams provided in this article should make the correct method of connection to the output plug perfectly clear—regardless of the number of pins. Again, transceivers are usually supplied with a circuit diagram which includes a wiring diagram of the microphone and it is this part of the diagram that provides the information needed in this case.

The microphone used with the VOX unit can be the p.t.t. type normally used with the transceiver, but as explained earlier it will be necessary to add a link wire on the p.t.t. switch or devise some way of holding the switch permanently in the down (transmit) position. Adding the link wire is not likely to be difficult since most p.t.t. microphones can be opened to reveal the switch simply by removing the screws from the rear of the housing. Of course, any microphone having a suitable output level and impedance can be used and most transceivers are designed for use with a low impedance dynamic microphone. However, the inexpensive (200 ohm) types for use with cassette recorders have an output level which is a little lower than the ideal and slightly higher impedance types (600Ω–2kΩ) seem to be better for this application. Socket SK1 must obviously be a type which matches the plug fitted to the particular microphone used.

When initially testing the unit it does not need to be connected to the transceiver. It is really just a matter of checking that speaking into the microphone causes the relay to almost instantly switch on and that R13 gives substantial control over the delay before the relay switches off once the operator has ceased speaking into the microphone. Also, potentiometer R7 should control the sensitivity. The maximum operating range of the unit depends to a certain extent on the sensitivity of the microphone used, but the unit should operate well at a range of up to one metre or so (unless a very insensitive mic is used) which is adequate for this application.

When the unit is functioning properly it can be connected to the microphone socket of the transceiver and SK2 fed with the audio output of the receiver section of the transceiver. The signal for SK2 is simply taken from the chassis of the transceiver and one of the loudspeaker terminals (it will probably not matter which loudspeaker terminal the signal is extracted from).

The author's prototype operates very reliably and there should be no problems with spurious triggering provided the microphone is not positioned very close to the loudspeaker. The only important point to bear in mind is that the unit must be used in conjunction with the squelch control of the transceiver. This must be adjusted so that there is no audio output from the transceiver when the station you are communicating with is not on the air.

Results will probably be best with R7 set for maximum sensitivity—this control will only need to be backed off slightly if a noisy environment causes problems with spurious triggering. The optimum setting for R13 is found empirically to be one which does not give an excessively long delay and at the same time does not result in the unit reverting to the transmit mode during brief pauses in speech. ●

PW REVIEW

REFTEC MTR 934–2 934MHz CB Transceiver

For some time now—in fact ever since the 934MHz CB service was announced—we have been itching to get our hands on a pair of 934MHz rigs. Our experience with 430MHz amateur equipment and the results of tests with 1296MHz gear indicated that this band should have great potential.

We have patiently waited and waited, our appetites whetted by the loan of a couple of Reftec rigs which we used, with success, at the 1982 Electronic Hobbies Fair at Alexandra Pavilion. At last our patience has been rewarded and we have had two—well $1\frac{1}{2}$ at times—Reftec 934MHz rigs together with the necessary antennas for what have proved to be very interesting but at times frustrating tests.

Transceiver Description

Externally the Reftec MTR 934 is indistinguishable from many of the current 27MHz CB transceivers. Controls are sensibly kept to the basic minimum consistent with straightforward operation.

Choice of the currently available 20 u.h.f. CB channels is obtained by rotation of the 35mm diameter selector switch knob which features 40 positive indexing steps and 360° repeating sweep. Subsequent upgrading to 40 channel capability (when regulations permit) will require a switch replacement, but the 7-segment l.e.d. indicator and p.l.l. programming capability are already accommodated in the basic design. Signal level indication is provided by means of five red l.e.d.s arranged as a horizontal bar and on transmit these all illuminate together with a single red l.e.d. TX status indicator.

Other front panel features include a calibrated rotary volume control, 4-pin microphone connector (of the familiar oriental screw locked variety) and a non-latching squelch enable button. This latter device is of push-to-make, push-to-break format, allowing use of the internally pre-set squelch or disablement of the facility where appropriate.

Rear apron features include a 2-pin d.c. supply receptacle, which although fitted with locator key will allow momentary reverse polarity connection—a protection diode is fitted internally! External speaker output, which was found to be essential for mobile activity, is via a 3·5mm jack and the antenna connector is a 50Ω BNC socket.

Internally the transceiver comprises four main p.c.b.s which respectively accommodate the p.l.l. synthesiser/TX board; receiver/audio; display driver/channel selector and finally the p.a. strip. With the exception of the display driver board, all p.c.b.s are double-sided roller tinned and screwed to the folded steel chassis section. A close inspection of the reasonably compact assembly revealed several points at which additional decoupling/padding components had been added, often in "piggy-back" fashion where track pads were not available. Whilst this does suggest "amateur" type construction technique, the resulting performance was not impaired and presumably later models will incorporate what amount to on-going development modifications.

A fully detailed account of the circuit details is hampered by the absence of a circuit or block diagram, however certain deductions can be made.

On receive, incoming signals pass to a dual-gate m.o.s.f.e.t. r.f. amplifier and helical filtering before being applied to a further m.o.s.f.e.t. mixer. The local oscillator for the first i.f. conversion is derived by combination of a fixed frequency crystal oscillator and p.l.l. synthesiser. The fixed oscillator runs at 72·052083MHz (original UK channel spec.) and is subsequently multiplied by six to 432·312498MHz and applied to a mixer stage. The p.l.l. uses a 6·4MHz crystal reference with programmable v.c.o. outputs at 24MHz (CH1) thus the output of this mixer stage must be doubled to obtain the l.o. input to the m.o.s.f.e.t. receive mixer. After filtering and i.f. amplification the first i.f. frequency (21·400MHz) is once again mixed with a second fixed frequency conversion oscillator running at 20·945MHz to obtain a conventional 455kHz second i.f. which is then processed to audio via the familiar MC 3357 i.f. detector and LM 380 audio output combination.

The transmit side of life line-up, is basically similar using a fixed crystal oscillator running at 73·835416MHz to feed the same six-up multiplier, modulated p.l.l. output, mixer and doubler used by the receiver l.o. After filtering the transmit frequency signal feeds a discrete two-stage p.a. the final device of which is an SD1410, capable of 6W output.

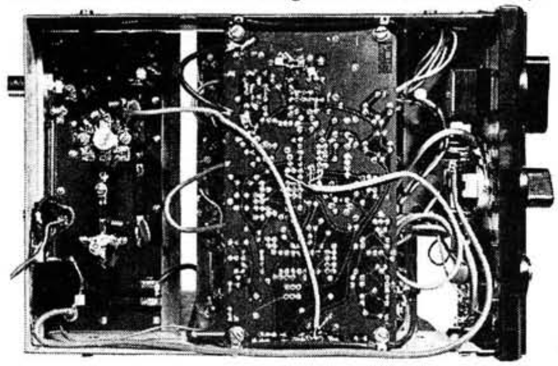
System Evaluation

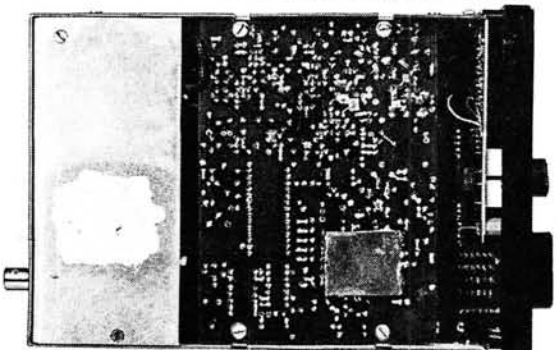
Our experience at the 1982 EHF indicated great potential, with good solid copy between our base station, half buried in the hillside at Ally Pally, and a mobile station over a radius of around 6km.

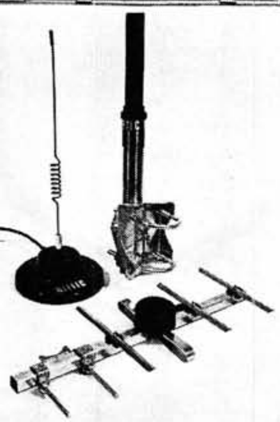
For our tests in Poole we decided to erect a 4-element colinear antenna onto a tripod on the roof of our office block. This put the base of the antenna at just under 10m both above ground level and also sea level—our office is only millimetres above high water mark!

The base station rig was connected to the antenna via 15m of Andrew LDF–450 Heliax cable, while the mobile station used an omni-directional quarter plus half-wave colinear antenna on a mag-mount placed centrally on the roof of a Maxi hatch-back.

The first test run showed great promise but was terminated abruptly when one of the rigs decided to shift its receive frequency by some 15kHz. In spite of the rig in the vehicle apparently going totally deaf—caused by the frequency offset—the mobile operator continued to transmit his position at regular intervals just in case the base station could still hear him. From this information we were able to determine that mobile to base station at least, contact could be maintained, over reasonably hilly terrain and through built-up areas at ranges of up to about 15km, following a pattern very similar to 430MHz working. Signal penetration into built-up areas was noticeably greater than on 430MHz. The "machine gun" crackle effects on received audio prevalent at 430MHz due to multipath reflections are replaced at 934MHz by background "sharsh" which is a combined function of the much more frequent phase reversals due to the shorter wavelength and vehicle velocity.







★ specifications

TRANSMITTER

Output power:	8W +0/−3dB at 13·8V d.c. *(5·5W 300mW at 9·5V)*
Modulation:	F3
Deviation:	10kHz Max. *(2·5kHz)*
Frequency response:	300Hz–3kHz ±6dB
Output impedance:	50Ω
Spurious emissions:	As MPT1321
Microphone impedance:	600Ω

RECEIVER

Sensitivity:	Better than 1μVp.d. for 10dB SN/N *(2μV e.m.f. for 12dB SINAD, 0·8μVp.d. for 10dB quieting)*
Adj. channel rejection:	>60dB
I.F. frequencies:	21·4MHz and 455kHz
Audio output:	1W r.m.s. into 8Ω, 3·5mm jack *(1W, 6% distortion)*
Internal speaker:	76mm diameter, 8Ω

GENERAL

Channels:	20
Channel spacing:	50kHz
Frequency range:	934·025–934·975MHz (Old UK range) 934·0125–934·9625 (New CEPT range)
Frequency control:	p.l.l. synthesiser
Frequency stability:	±5kHz −5°C to 45°C
Power requirements:	13·8V d.c. Max. (Negative earth), 12·5V d.c. nom. 0·6A receive *(450mA)*, 2·5A transmit *(2A)*
Accessories:	Mobile mounting bracket, 1m supply lead with 2A in-line fuse, dynamic microphone
Dimensions:	210 × 140 × 55mm
Weight:	1·36kg
Antenna connector:	50Ω BNC
S-meter readings:	l.e.d. No. 1 = *10μV e.m.f.* 2 = *20μV e.m.f.* 3 = *25μV e.m.f.* 4 = *33μV e.m.f.* 5 = *36μV e.m.f.*

Test results shown in *italics*.

These initial results together with lab. tests showed promise so we arranged with Selectronic, who supplied the first two rigs, for the loan of a third sample. This duly arrived by Securicor, and was found to also have receiver offset!

Selectronic gave us instructions over the phone and we re-aligned the receiver side l.o. to correspond to the other good rig we had. The "professional" colinear antenna was re-erected on the roof and the tests carried out yet again. These confirmed the first tests but "both ways" and the equipment gave no further problems. Tests finished when the cold beat the small 6Ah battery being used to power the base station rig. This indicated that at low voltages, approaching the point at which the system self-inhibits, not only did the r.f. power reduce to a minute level (<300mW) but that the output frequency also shifts by several kHz. Subsequent lab. tests confirmed that this happens at around 9·5V, so in practice this will not be a problem so long as a regulated power supply is used for the base station. The voltage at the battery terminals of a car should not drop that low in normal use. If it does then it's time to get a new battery!

Problems were found with the level of suppression on the vehicle. The Maxi is suppressed as detailed in *PW* April and May 1981 and at 430MHz gives no problems whatever. At 934MHz, however, there is chronic alternator whine which appears superimposed on the audio as soon as the squelch opens and is also present on the transmitted signal. The supply for the rig is taken directly from the battery terminals via a fuse to reduce noise pick-up from the vehicle wiring. Obviously better suppression of the alternator and wiper motor is needed for 934MHz operation (Reftec advise owners to fit line chokes to the d.c. input leads). Ignition noise breakthrough was non-existent so the level of ignition suppression described in the article is sufficient.

Several equipment problems were encountered as indicated earlier. Some of these could be fairly laid at the feet of poor quality control. For example we found that two of the rigs suffered from severe microphony and in one case it was found that an electrolytic capacitor had broken away from the p.c.b. taking its pad and a piece of track with it. Construction in places was what one would expect from a low-cost "oriental" transistor radio with some components standing well clear of the boards and occasional leads not trimmed. For a rig costing around £300 and working at frequencies approaching 1GHz, wobbling components with long leads are just not acceptable. However, the performance, when the rigs were working, was reasonable and as long as Reftec can improve on their quality control to ensure that loose components, long leads, loose ferrite beads and bad soldered joints do not pass inspection then the system has a great deal to offer.

Selectronic have since advised us that new production techniques have been implemented by Reftec, principally concerning the flow soldering of p.c.b.s together with rigorous quality control at all stages of manufacture and final alignment.

The Future

There are about six hundred 934MHz users in the UK, mainly located around the well-populated areas. Almost all the stations are of the base type with mobile use being of limited range by comparison. During normal weather conditions most users manage a range of 48 to 65km.

Antenna systems vary but most base stations consist of a colinear at about 10–12m a.g.l. with many also using a 4-element Yagi. Mobile to base communication is reasonable between 16–25km on average although much greater distances have been achieved from high mobile locations. One of the longest contacts that has been made was between a mobile station using a standard $\lambda/2$ over $\lambda/4$ mobile colinear from Boughton Hill near Faversham in Kent to a trawler in the North Sea 48km off Flamborough Head, a distance of over 288km. Since that date many long distance contacts have been made during good tropospheric propagation conditions, some of which have been over 350km.

Most users tend to be also interested in other radio bands. Many are licensed amateurs, others s.w. listeners and some from 27MHz CB radio. Almost all are family type people over 20 years old, many retired people who find it a friendly and sensible band. The only problem really comes from poor installation of the equipment but if the users have the correct knowledge of u.h.f. radio installation no such problems should occur.

As for the future, there are many interesting things in store. Now that Switzerland have some sets with the 40-channel European standard it cannot be long before the UK also has this allocation and, possibly with a suitable repeater network, an extremely useful personal radio system will exist for the many people who need to keep in contact with each other.

Our thanks to Mike Machin of **Selectronic, 203 High Street, Canvey Island, Essex (Tel: 0268 691491)** for the loan of the review equipment and additional information.

Dick Ganderton, John M. Fell

Swap Spot

Have Sony ICF-2001 communications receiver, recently overhauled by the makers. Would exchange for any 432MHz gear of comparable value. Roy Bailey G6WLE. Tel: Great Shefford 441. *U178*

Have 48K Spectrum with over 30 commercial cassettes including "Forth" plus many handbooks and manuals. Cost over £400. Interested in Bearcat BC-100FB hand-held in perfect condition only. Tel: 061-794 1783 (Manchester). *U180*

Have SSM Europa 144MHz transverter with spare p.a. tube, 40 watts output. W2AU 1:1 balun plus 10m copper wire. Avo 8 Mk5 latest model. Would exchange for MMT 144/28 or MML 144/100LS or 700EX 144MHz f.m. transceiver. Terry G4OXD. Tel: 0462 35248 (Hitchin). *U208*

Have little-used Typhoon 150 solid-state linear amplifier (150 watts a.m./f.m./c.w.; 300 watts p.e.p. s.s.b.). 2–30MHz variable pre-amplifier and remote control panel with power meter. Would exchange for similar 144MHz/430MHz linear or w.h.y. in v.h.f./u.h.f. equipment. Tel: Rickmansworth 720002 (after 6pm). *U211*

Have Cortina MkII, 1600GT, 1970 with long MOT, taxed, twin Webers, fourway manifold, giant airfilter, pairs reversing lamps, fogs, five new Goodyears, qualifies membership 1600E owners' club. Would exchange for FRG-7700, ICR-70, TRR-2000 or similar. Tel: Northwood 23685 (noon to 1900). *U227*

Have Fidelity 2000 f.m. New, reconditioned and used parts for Triumph T20 Tiger Cub. Would exchange for general coverage receiver, 144MHz receiver, 934MHz CB, 27MHz antenna or w.h.y. J. Mackenzie, 9 Lammarview, Chirnside, Duns, Berwickshire, TD11 3UN. *U238*

Have Lafayette general coverage communications receiver model KT-340. Would exchange for video camera with stand, suitable for use with ATV. Graham G6LMG. Tel: 077 385 6159 (Nr Matlock). *U248*

Have Storno CQF632 70MHz base station (25 watts) plus control box. Would exchange for ZX81 plus RAM pack or Spectrum. Tel: 0344 777001 evenings and weekends. *U249*

Have high quality Durst photography equipment complete, $2\frac{1}{4}$ and 35mm accessories, materials, etc. Would exchange for complete 432MHz transceiver of equivalent value. Tel: St. Helens 20370. *U250*

Have ZX Spectrum 16K and printer plus tapes and mags. Would exchange for FRG-7, FRG-7700, R600, R1000 or similar. Good h.f. transceiver considered. Steve. Tel: Truro 864465 (after 6pm). *U263*

Have Binatone 5 star CB transceiver, also Binatone s.w.r. meter, antenna matcher, Amstrad CB1500 antenna, assorted leads and Bremi BRS27 stabilised power supply. Would exchange for Sinclair Spectrum or similar. M. Scivier, 20 Timberhill, Ashtead, Surrey KT21 2NY. *U267*

Have two f.m. 40 channel mobile CB rigs. Both new and boxed with full guarantees. York 863, Fidelity 2000. Would exchange for hand-held radio telephone high-band, 148–174MHz in working order. Tel: 0935 25225 (Yeovil). *U269*

INTRODUCING MOONBOUNCE

by Ian F. White G3SEK

Moonbounce is a way of communicating worldwide on v.h.f., u.h.f. or microwaves. Radio amateurs who are actually involved in moonbounce usually refer to it as e.m.e. (rhymes with dreamy!).

E.m.e. stands for "earth-moon-earth", and this describes exactly what happens; your signal leaves the earth, is reflected back off the moon, and comes back to earth. The reflected signal spreads out (Fig. 1), and can be received at any place on earth where the moon is above the horizon. E.m.e. operation is far from simple, for it means getting involved at quite a high technical level in many different aspects of amateur radio, as we shall see. But don't be put off by that—if you treat moonbounce as a long-term objective and are prepared to take your time over it, you will learn a great deal as you work your way steadily through all the jobs involved.

What makes moonbounce attractive to a growing number of amateurs is the challenge it offers; this unique mode of worldwide v.h.f./u.h.f. communication is just within our reach, but it calls for the very best of equipment and operating skill. You need an ultra-sensitive receiver, the biggest antenna you dare to put up, and as much transmitter power as you can legally get to the antenna—even then signals will usually be very weak indeed.

It's hard to imagine just how weak moonbounce signals can be, if you only ever listen to good f.m. and s.s.b. signals. Unlike f.m., s.s.b. can provide usable copy "right down into the noise", but most e.m.e. QSOs take place at signal levels where even s.s.b. gives up and only c.w. gets through. Mind you, e.m.e. signals are pretty feeble by normal c.w. standards too—a signal report of RST 319, defined in the handbooks as "readable with considerable difficulty, very weak", is **good** by e.m.e. standards! In fact there is a special system of reporting for weak e.m.e. signals, and this is part of an agreed set of operating procedures designed to keep a contact alive despite the weak and fading signals. Transmit and receive periods are synchronised to worldwide Standard Time, and everything is repeated and repeated until the other operator acknowledges that copy is complete. It can take half an hour or more just to make a bare minimum QSO by exchanging callsigns, reports and acknowledgements. Well, I told you e.m.e. isn't easy!

If you haven't already done so you *will* have to take the Morse test, and then learn how to make QSOs with signals that are right down in the noise. This will take time, but you can develop the operating skills through conventional v.h.f./u.h.f. DX-chasing while you are building up your station hardware towards e.m.e. capability.

E.m.e. communication depends on the capabilities of both your own station and the one you are working. If you

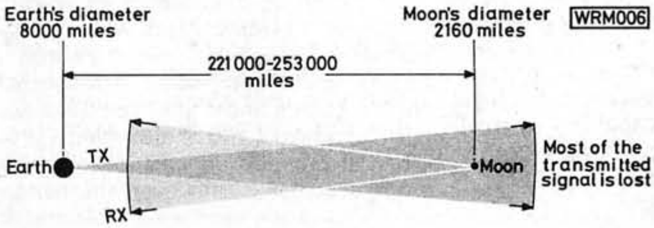
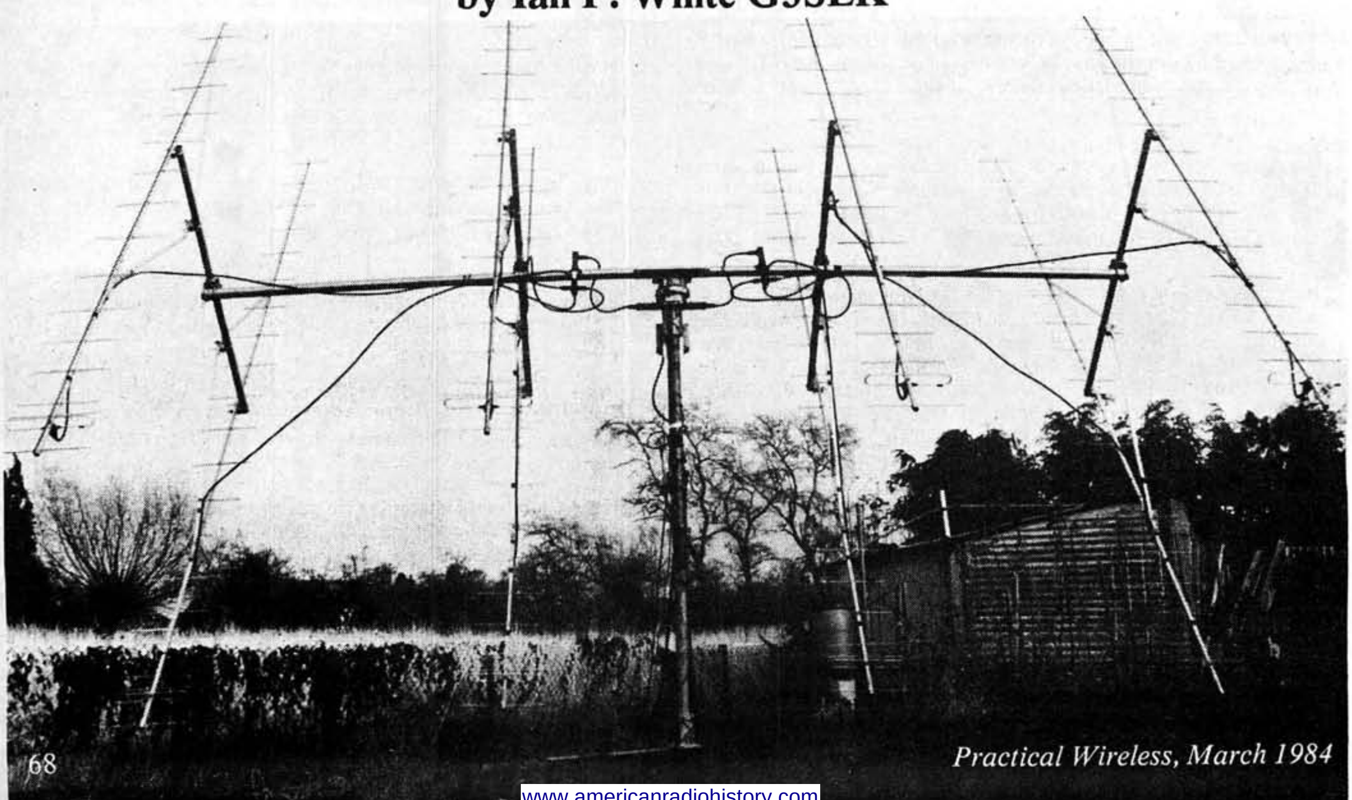


Fig. 1: The e.m.e. path drawn to true scale. Most of the transmitted signal is lost into space and so too is most of the signal reflected back from the Moon



have a reasonably effective v.h.f./u.h.f. DX station (e.g. a good receiver, 100W of r.f. and one long Yagi) you are some way short of full e.m.e. capability, yet you may still be able to work the "big guns" like K1WHS whose enormous 144MHz array of 24 14-element Yagis makes up for what your own station lacks. Similarly the big radio-astronomy dish "borrowed" for the K8HUH operations last May allowed the G4RFR team and many others to work West Virginia via the moon with quite modest systems (by e.m.e. standards!).

If you do become "moonstruck" and decide to get involved in e.m.e., you won't be satisfied for long with having to rely on other people's capabilities in order to make e.m.e. contacts. You will soon want to be able to hold up your own end of a QSO, so this article will state what you need for **full** e.m.e. capability on the band of your choice.

Unlike other propagation modes, moonbounce offers a very simple test of station capability. Your radio signal takes 2·5 seconds for the round trip to the moon and back, so you ought to be able to hear your own moon-echoes. One of the biggest thrills in amateur radio is the first time you let go of the key and actually hear your own signal come back off the moon! Echo-testing provides an instant check of whether everything is working correctly, and once you can regularly hear your own echoes you have the capability to work anyone else who can do the same—if propagation conditions will let you, that is.

EME Propagation

The propagation conditions which can make or mar an e.m.e. QSO are different from those for terrestrial communication. One of the main factors in e.m.e. is Faraday rotation.

We all learned for the RAE that signals at v.h.f. and above are not reflected by the ionosphere, but fewer people realise what happens to them instead—they get **twisted.** Owing to something called the Faraday Effect, the earth's magnetic field rotates the plane of polarisation of the signal as it passes outwards through the ionosphere, and after the signal has been reflected from the moon its polarisation will be rotated some more on the way back to earth. Bearing in mind that a 45° polarisation mismatch knocks 3dB off the signal strength, even a little Faraday rotation can take a weak moonbounce signal right out. Faraday rotation can also lead to one-way propagation, so that one station can hear the other but cannot be heard. Sometimes you may be able to hear your echoes but can't make a QSO—and fortunately you can sometimes work people when your own echoes are inaudible. The effects of Faraday are different on each band, so I will discuss them in more detail later.

The moon is not a smooth object, which is why the returning signal is scattered back to cover a whole hemisphere of the earth. The returning signal is made up of contributions from different parts of the moon's surface, some of which tend to add up in phase, and others which tend to cancel. Since the moon wobbles slightly in its orbit (or "librates") the way that these contributions add or cancel is constantly changing, leading to fading. This libration fading becomes progressively deeper and more rapid at higher frequencies.

Faraday rotation and libration fading between them conspire to make moonbounce signals weak, fluttery and unreliable—and are two of the things that make moonbounce such a challenge. Also, the moon moves in a slightly elliptical orbit around the earth, so moonbounce signals are some 2dB stronger on average at perigee, when the moon is at its closest to the earth, than they are at apogee, when it is furthest away. Since 2dB is quite a lot, e.m.e. activity is usually greatest on weekends close to the moon's monthly perigee.

Some of the conditions for good terrestrial DX are actually bad for moonbounce. For instance aurora can cause ionospheric absorption, and tropospheric ducting can bend your signals round the curvature of the earth so that they miss the moon entirely. Under these circumstances you might as well relax and enjoy the terrestrial DX!

Choice of Band

At this point the moonbounce trail forks, and you have to choose which band to aim for. The realistic alternatives are 144MHz, 432MHz and 1·3GHz. Each has its advantages and disadvantages, and if you are going into e.m.e. with an open mind you should choose the band which has the best combination of features to match your own facilities and talents.

144MHz: This is the most familiar band to v.h.f. DXers, which may lead you to think that 144MHz is also the easiest band for moonbounce. Certainly the receiving side is very straightforward; the background sky noise is relatively high, so it isn't too hard to achieve an adequately low noise figure using a suitable masthead pre-amp. However, you need high power (of which more later) and a **big** antenna. Four long Yagis such as 19-element Boomers, 16 or 17-element Tonnas or 14-element Parabeams are about the **minimum** for reliable echoes, which means that your antenna array will be **at least** 4·5m square by 6m deep.

After you have allowed the array room to rotate in azimuth (horizontal direction) and elevation, it will have claimed quite a lot of your back garden. However, if you

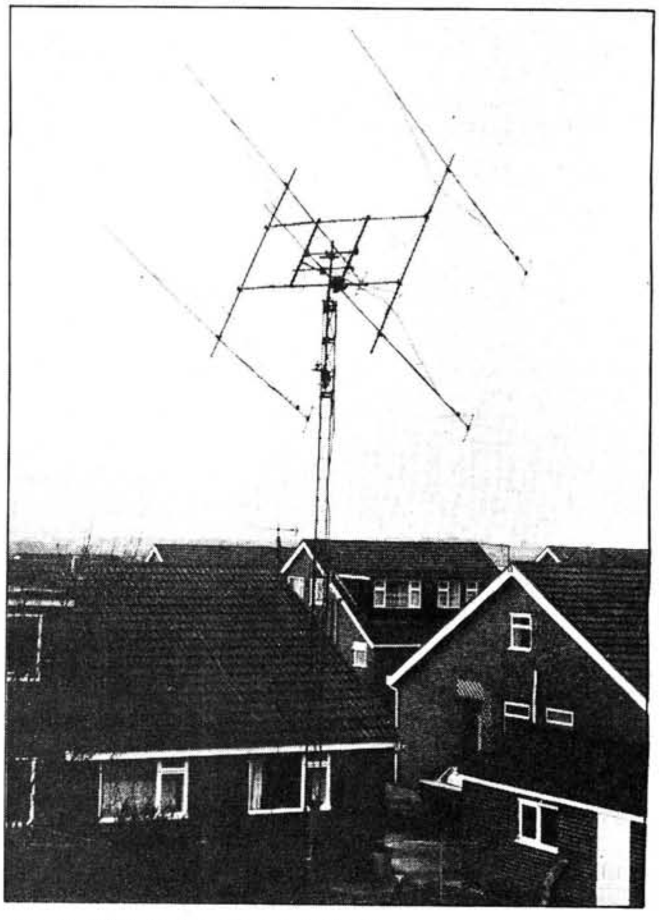


Fig. 2: The impressive 144MHz e.m.e. antenna array of Doug Parker G4DZU, comprising four 19-element Cushcraft Boomers

have the room and you do not flinch at large-scale mechanical engineering, 144MHz may be the band for you.

On 144MHz everybody uses linear polarisation, and you learn to live with Faraday rotation. Since even quite small changes in ionospheric conditions can cause large rotations at 144MHz, the chances are that the polarisation will come right sometime during the course of the QSO. Circular polarisation would overcome Faraday rotation completely, but is difficult to arrange in a Yagi array, especially since the sense must be instantly reversible and anyway, the prevailing standard **is** linear polarisation. A few ambitious amateurs have tackled the formidable engineering problems of rotating a linearly-polarised 144MHz e.m.e. array in polarisation as well as azimuth and elevation, but most are content with fixed polarisation.

432MHz: For some years this has been the favourite band for moonbounce since low-noise receivers and adequate transmitter powers are quite easily achieved and the antennas are not too big. With a true receiver noise figure (including relays, cables and all incidental contributions) of less than 1dB and say 26–27dBW of transmitter power, the minimum size of antenna for echoes would be something like 8 21-element Tonnas, or a dish of 4·5–6m diameter. Such an antenna will fit reasonably into many British back gardens.

Faraday rotation changes rather slowly at 432MHz and can be a worse problem than on 144MHz because the polarisation may never come right during your QSO. Many stations on 432MHz use Yagi arrays, so the prevailing standard is once again linear polarisation. However, stations using dish antennas can rotate polarisation quite easily, since only the small feed antenna need be rotated and not the whole dish. On 432MHz the choice between Yagis or a dish is finely balanced, and the possibility of easily rotating the plane of polarisation is a strong point in favour of a dish; on the other hand Yagis may be less obtrusive and have a lower windload.

1·3GHz: E.m.e. on this band has a curious history. The first-ever amateur moonbounce QSO was made on 1·3GHz back in 1960, but at that time the necessary low-noise parametric pre-amplifiers and high-power amplifiers were too much of a problem for all but a handful of extremely advanced amateurs.

What has now brought 1·3GHz out of the doldrums has been the development of low-noise GaAs-f.e.t.s, which provide a much easier way for moonbouncers to take advantage of the very low background sky noise on this band. Equipment for 1·3GHz is definitely more difficult than the equivalent for 144MHz, but things are now developing very quickly; more and more good designs for equipment are appearing, some of them being produced commercially. With today's equipment it is possible to hear echoes from 20dBW of transmitted power, using a dish as small as 3·7m in diameter. Everyone on 1·3GHz e.m.e. uses a dish antenna and circular polarisation is the norm since it is relatively easy to generate in the feed horn. But, having said goodbye and good riddance to Faraday rotation problems, the moonbouncer on 1·3GHz has to cope with deeper and more sudden libration fading than on the lower bands. There really are not any easy options on e.m.e.!

Ultimately the choice of band for moonbounce is yours. At the one extreme 144MHz is electronically straightforward but demands large-scale engineering; at the other extreme 1·3GHz offers the possibility of e.m.e. from a small back garden, if you are willing to tackle the greater problems in receiving and generating the r.f. The final decision depends entirely on your own particular combination of talents, facilities and interests. Whichever band you do decide to tackle, it will be a major challenge.

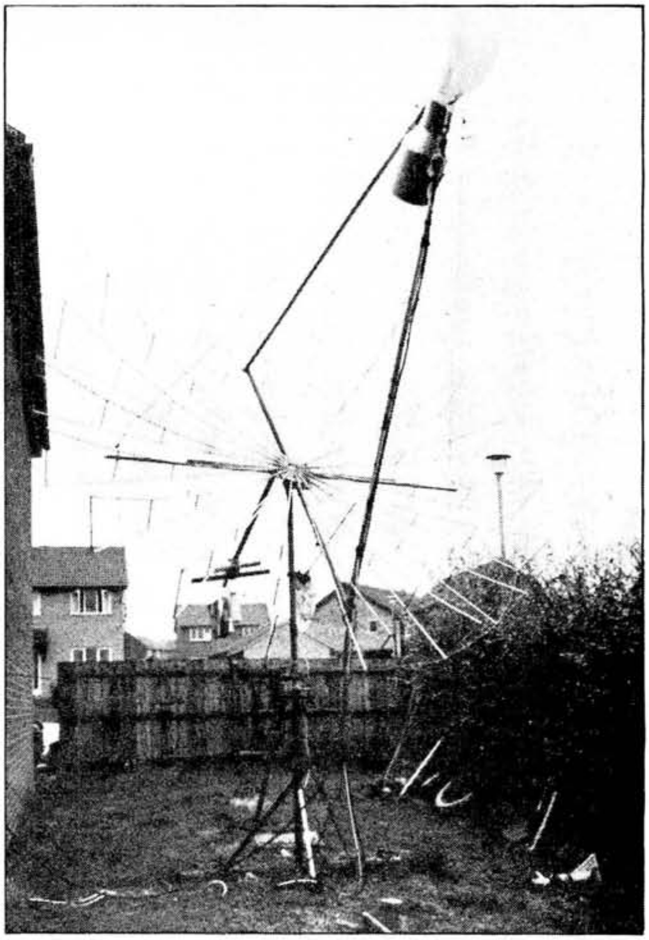


Fig. 3: Compact "backyard" 4m 1·3MHz e.m.e. dish used by G4KGC/G3WDG

Photo by G4PMK

If you are going to succeed in e.m.e., you have to start out by assembling a top-line station as judged by normal standards—and then go much further. **Every single part of your station has to perform to its full potential.**

The precious decibels that make all the difference are picked up by careful attention to small details—half a dB here, another 0·2dB there, and so on. To optimise your system performance, you need to understand how each item fits into the system and you need to be able to make measurements on the individual items and the system as a whole. For example you need to know how each item in the receiving chain—antenna, cable, power dividers, relay, more cable, second relay, pre-amp, post-amp, etc.—should be contributing to the total system noise figure. You then need to be able to verify the situation by measurements of gains, losses and noise figures. Guesswork and wishful thinking will **not** get your signal back from the moon, and the measurement techniques required to know what is **really** going on in your system are a whole major topic in themselves!

Very few amateurs need to get to grips with r.f. system engineering in the way that you have to for moonbounce. You cannot buy an e.m.e. station; even if you buy most of the individual items ready-made, you still have to integrate them into an optimised system. This often requires additions or modifications to commercial equipment designed for the ordinary amateur market. In particular you have to assemble and check the antenna system for yourself, even though you may buy all the individual parts (e.g. Yagis). For the higher-frequency bands, you have to make your own dish. The expansion of satellite TV may improve the availability of useful new and surplus dishes as it has in the

USA, but you will still have to make the feed yourself and integrate it into the antenna system.

Two useful checks on the receiving performance of an e.m.e. system are sun noise and ground noise. The noise level when the antenna is pointing at the sun is a good overall indication of antenna gain and receiver noise figure, if compared with that received when pointing at a quieter region of the sky. Sun noise varies with solar activity and a more reliable test is to use the thermal noise emitted by the warm earth as a standard noise source, although the level of ground noise is lower than that received from the sun. A good moonbounce receiving system will also be able to detect the major galactic noise sources such as Cassiopeia A and Cygnus A whose levels are accurately known.

In addition to optimising the r.f. system, the prospective moonbouncer has plenty of other jobs to do. With our weather in the UK you cannot rely on visual tracking so you have to be able to steer the antenna by prediction, either from the almanacs or preferably from a home computer program. This is not too difficult, but home computing is yet another side-track off the moonbounce trail! High-gain e.m.e. antennas can have very narrow beamwidths and will need to be accurately re-aimed every ten minutes or so. You will need some means of local or remote readout of azimuth and elevation. Since you will have very little time to nip out into the garden during an e.m.e. QSO, remote antenna steering and readout are obviously desirable, but constitute yet another additional job. The jobs mount up, don't they, which is why it is best to look upon moonbounce as a long-term objective with plenty of pauses and diversions along the road.

Finally an awkward point which I have deliberately left to the end. As you may have noticed, the c.w. power levels required for e.m.e. are generally above the UK power limit. Owing to a quirk in our licence conditions the power limit is 6dB less on c.w. than on s.s.b., so a special experimental permit is needed for "high-power" c.w. This is an administrative problem, not a technical one, for any conservatively rated legal-limit s.s.b. p.a. could probably generate the necessary c.w. power with nothing more than a turn of the mode switch on the exciter. If you are technically competent and really need a permit, e.g. when you can show that everything else in your e.m.e. system is ready and working, then you can probably get one.

Moonbounce is one of the most challenging of all the different aspects of amateur radio, and if you do decide to try it you will find yourself embarked on a project in the highest traditions of "self-training in the art of radio communication". You will also enjoy it! Have you been "moonstruck" yet . . . ?

Bibliography

Lots of good technical advice for e.m.e. on any band is contained in the definitive article on 432MHz e.m.e.: *"Requirements and Recommendations for 70-cm E.M.E."* by Joe Reisert, W1JR, in the American magazine *Ham Radio,* June 1982.

Another major source of e.m.e. information is the continuing series of *Eimac E.M.E. Notes,* available from William Orr, W6SAI, c/o Eimac Division of Varian, 301 Industrial Way, San Carlos, California 94070, USA.

For information on current e.m.e. developments, there is a new monthly American magazine, *The Lunar Letter.* This covers all aspects of v.h.f./u.h.f. DX, particularly via e.m.e. As well as reporting the month's activities on 144MHz, it reprints the previous month's "432 and Above E.M.E. Newsletter" from K2UYH. The UK distributor is Doug Parker, G4DZU (QTHR). ●

Kindly Note

PW RADIO PROGRAMS 3,4 and 5 CASSETTES.
Unfortunately some errors have been found in these computer tapes and should be edited after loading the programs into the computer.
Do not try to record over the original program—make a new copy.

PW RADIO PROGRAMS-3 Spectrum "ORBITS"
Edit Line 127Ø to read:
127Ø LET BEH = ACS (BE/BH)

PW RADIO PROGRAMS-4 ZX81 "DATA"
In Line 132Ø the word AT is recorded on the tape incorrectly. It should be edited using Function C.
132Ø IF BS = "Y" THEN PRINT AT 16,2;" ∗∗∗∗ THE COIL IS ""SLUG- TUNED"""""
If it is desired to use the program beyond frequencies attainable using single-layer coils then edit Line 53Ø to read:
53Ø LET Z = INT (Z*1ØØ+.5)/1ØØ

PW RADIO PROGRAMS-5 Spectrum "DATA"
Edit Line 48Ø to read:
48Ø LET C = C*1Ø**−12
If it is desired to use this program beyond frequencies attainable using single-layer coils then edit Line 53Ø to read:
53Ø LET Z = INT (Z*1ØØ+.5)/1ØØ

Microwave Dish Construction, February 1984
Our apologies to author John Tye for getting his callsign wrong in the article heading. He is really G4BYV. Sorry John!

Did You Know...

That at first, Marconi's father was scathing about his son's discoveries?
One night in December 1894, an excited 21-year-old Marconi called his mother to his laboratory and showed her his experimental apparatus: a transmitter comprising accumulators, induction coil, Leyden jars and Hertzian oscillator on one side of the room; and on the other side a coherer, battery, relay and electric bell which together made up the receiver. Then he pressed the signalling key of his transmitter, and to his mother's awe and astonishment the bell on the other side of the room started ringing. When, next morning, Signora Marconi proudly told her husband of their son's achievement, the inventor's father remarked dismissively that it seemed a roundabout way of working a perfectly ordinary bell at a few yards' distance!

Eric Westman

on the air

AMATEUR BANDS by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR, 57 The Kingsway, Ewell Village, Epsom, Surrey, KT17 1NA. Logs by bands in alphabetical order.

When discussing antennas the expression "resonance" crops up frequently and it is all too easy to assume that the reader knows what this means. From correspondence, though, it is fairly obvious that an easily understood explanation would be more than welcome in some quarters. So here goes.

Think of something quite different from antennas, the tuning fork, now more or less confined to school science laboratories, which, when struck, emits an essentially single audio tone. The frequency emitted is determined by a number of factors including the mass of the fork, the length of the tines (prongs) and their cross-sectional area, and even ambient temperature. When vibrating the tines are generating waves of compression and rarefaction in the surrounding air mass which we perceive as an audible note.

If the tines are placed inside a suitable coil of wire the coil can be connected into an oscillator circuit which will then oscillate at the natural frequency of the tuning fork, suitable for use as a frequency standard at low frequencies, Fig. 1.

The simple tuned circuit comprising an inductor and capacitor, Fig. 2(a), can be considered very similar to the tuning fork insofar as it has a natural "resonant" frequency determined mainly by the values of the two components, the well-known formula for determining the frequency being $f = 1/2\pi\sqrt{LC}$ but this is not important here. If we connect a very high impedance voltmeter across our tuned circuit and then somehow apply an r.f. signal to the circuit and swing the frequency above and below the resonant frequency, we shall find that the voltmeter reading will change as shown in Fig. 2(b) forming the familiar response curve. The "sharpness" or magnification factor (Q) is determined mainly by the quality of the inductor and capacitor. If the coil is wound with very thin wire on a cardboard former, and if the capacitor has solid dielectric between its plates, then the Q is likely to be rather poor. Hence the use of silver-plated, heavy copper wire for inductors, particularly at v.h.f., and air-spaced tuning capacitors.

Now, it is important to realise that an inductor also has self-capacitance, mainly between the turns forming the coil, adding to the value of the tuning capacitor. Let us assume that the tuned circuit of Fig. 2 has a resonant frequency of 14MHz. If we remove the capacitor the inductor will be tuned solely by its self-capacitance and the resonant frequency will now be much higher, but it can be restored to 14MHz by increasing the number of turns on the coil. What if we slowly pull out the turns of the coil into a straight wire? Again, the resonant frequency will rise but can be lowered to 14MHz by increasing the length of the wire. Even a straight wire possesses inductance!

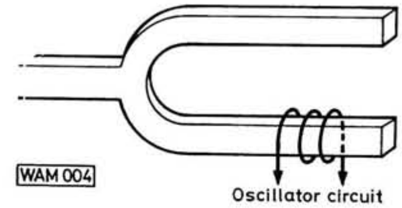


Fig. 1: The tuning fork has a natural mechanical resonance and, usually, being made of a magnetic material, may be used in conjunction with a coupling coil to stabilise the frequency of a low frequency oscillator

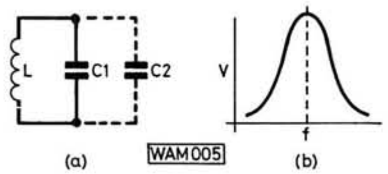


Fig. 2(a): A simple tuned circuit comprising an inductor L and capacitor C1 has an additional capacitor element C2 formed by the self-capacitance of the inductor. In Fig. 2(b) the response curve of a typical tuned circuit is shown and that of a simple half-wave antenna will be similar

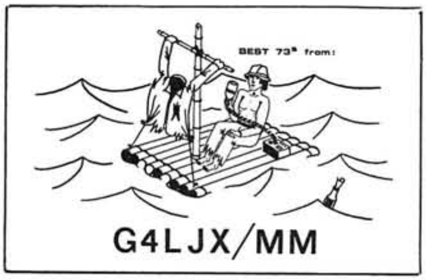
So we now have our straight wire antenna and, hopefully, it will now be seen to be a simple resonant circuit comprising inductance and self-capacitance and the formula of 143/f(MHz) will give the length of a half-wave antenna in terms of metres sufficiently accurately for all practical purposes on the h.f. and l.f. bands. The wire antenna will still possess a response characteristic as it did when a simple tuned circuit, and a value of Q. For the same reasons as before it should be of reasonably heavy copper wire with a covering of enamel or pvc to prevent corrosion, which can have a very adverse effect on the Q factor since the r.f. signals tend to flow on the surface of the wire at high frequencies. Again, the means of supporting the wire are very important as poor insulators at the ends will not help. For that reason the rigid elements generally used in rotary beam antenna systems and supported only at the centre have a very much better Q than end-supported wire antennas.

In the same way that the tuning fork can be made to radiate sound waves by being struck, so the antenna can be made to radiate electromagnetic waves by being energised from a source of radio frequency energy, in other words, a transmitter. In practice the wire can be fed at one end, at the centre by coaxial cable or open wire tuned feeders and a variety of other means. It must be remembered when looking at any antenna design that any attempt to interfere with the basic half-wave wire will reduce its efficiency as a radiator. Shortening it and then adding loading coils, or traps to restore resonance in order to get the antenna to work on harmonics of its fundamental frequency, are necessarily a compromise.

General

Up in Dunston, Stafford, **A. H. Ryall** found he was able to get up a 40m long wire if he allowed the ends to drop down to almost ground level from the centre which was about 15m high, giving an included angle at the centre of the wire of around 100 degrees. He asked for comments on the layout. Intending to use 75 ohm twin feeder at the centre would mean that the antenna would only really be suitable where it is resonant as a half-wavelength, namely on the 3·5MHz (80m) band. It would also work after a fashion on its third harmonic, now corresponding roughly to our new WARC band on 10MHz. My suggestion to the writer was to use open-wire tuned feeders into an antenna tuning unit which would give a very efficient antenna over all the h.f. and l.f. bands.

Bob Salmon G4LJX (home *QTH* Plymouth) has been on one of his /MM jaunts again, this time in the yacht *Solan Goose* from Penzance via Tenerife to Antigua in the West Indies. All went well until about 560km from his destination when "the mast fell down". Just like that! As the normal antenna is an insulated part of the backstay he was suddenly QRT. A length of wire about 12m long was lashed up between a floating marker buoy and the yacht enabling him to get



Little did Bob Salmon realise how close he came to emulating the cartoon on his own QSL card when he lost his mainmast!

some prompt 5 & 8 reports from the UK on 14MHz! It also proved quite effective on 7 and 21MHz. Eventually the boom, spinnaker pole and some spare alloy tubing were used to make an emergency mast sufficient to get Bob to Antigua. The rig on board was an Icom 720A with a Drake MN7 a.t.u. which he has found very satisfactory for /MM operation.

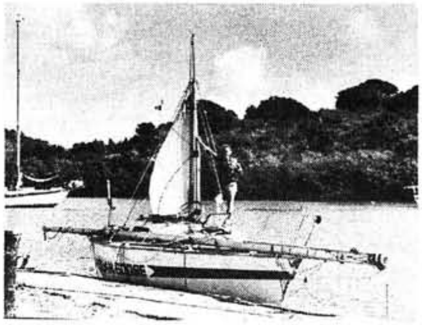
What with the Christmas postal delays and the hubbub over the Space Shuttle amateur band operation, reports from readers are a bit on the thin side this month. I'm sure that W5LFL did his best to copy as many stations as he could but the whole method of operation caused such chaos on the 144MHz band as to bring it into even greater disrepute in the eyes of many amateurs. It made the average pile-up on 14MHz seem like small beer but that was inevitable with everyone being invited to call at the same time. The last-minute changes in operating frequencies plus the inability of many people to keep to the close timekeeping required made a mockery of the whole operation. The RSGB did its best with regular bulletins on 3650kHz and the 144MHz band but what was the use of them at five in the evening before the average amateur had got home? A lot of thinking will need to be done before the next similar operation, and presumably there is bound to be one 'ere long.

On the DX Bands

The DX302 receiver and 20m-long antenna of **Marcus Walden** in Harrogate has done very well on the bands, particularly on 3·5MHz where he logged such as A71AD, C31MO, FM7WS, HZ1AB, JA6XMM, JY7YJ, T77V and 4X4BO. Straight to 14MHz and FB8WJ (QSL F8RV) on Crozet Island for a very rare one indeed, S79WHW, TU2NW, VP8AEN (QSL GM4ITN), VP8MT (QSL GW4KGR), XT2BM (QSL WD4RHL), YI1BGD, 4K1GDW on the South Shetlands, 9L1DR (POB 502 Freetown), 9Q5RW and 9X5NH. Goodies on 21MHz included C53EY, FR0FLO on Reunion, KC7UU/P/5N6, YC0DNK, 5Z4PR and 6W8CK. By the way, Marcus's antenna is in the attic! He also mentions the problem of hearing any DX on the 7MHz band which would appear to be an overloading or cross modulation problem with the powerful BC stations inhabiting the band killing the receiver's front end. Try connecting a 1kΩ carbon potentiometer across the set's antenna and earth terminals taking the antenna itself to the rotor. Reduce the signal as far as possible by turning the pot back when strong interfering signals are present. The only answer to cross-mod is to reduce the signal strength at the receiver input, and not at any later stage.

The loop antenna used by **David Price** in Wellington, Somerset, is 40m round the loop with a loading coil in the bottom section. In view of the DX logged on the 3·5MHz band one has got to admit that it seems to work on his FRG-7 although the optimum band would appear to be 7MHz. Anyway on to his DX with 3·5MHz first and VK3DWJ, JA1CJH, TA2WCY, VO1CV, JW6MY, A92FB, 7X5AB, CT4BD, followed on 7MHz by sole one in the shape of TA2TAT. On 14MHz just ZL4BX and OY3H of note, with 5N6CJR appearing on 21MHz.

The 28MHz band was not too bad at all for **Denis Norton** in London W6 with his FRX500 and a.t.u. plus FL2 audio filter, copying CT2FH, FM7CD, KP4BZ, TU2NW, VP2EEN, YV7QP



Bob Salmon G4LJX/MM arrives in Antigua after sailing across the Atlantic in the *Solan Goose*. The fallen mast is lashed to the deck and a makeshift mast sufficed for the last 560km

and a couple of ZS6s. Down to 21MHz and H5AE for a fine one in Botswana, VK6AJZ, ZS2RJ, 6V3HL in Senegal and cards to WA4VDE, and TF5TP. Only outstanding ones on 14MHz were XT2BR, 5Z4PR and that 6V3HL again. Finally, to 3·5MHz and C31YF, CT3BM, DF3NZ/P/ST2, EA9JV, TA2WCY, T77V, 4X4BO and UK6KAF. Antennas used by Denis include a 20m-long wire and an omni-directional job on 28MHz.

The ARRL contest meant a few new ones for **Dave Shapiro** up in Prestwich, Manchester, with his 20m-long wire and dipole for 28MHz which seemed to come alive for the event, or was it just the usual lack of activity! Once people start talking about the downward slope of the sunspot cycle the band seems to become deserted automatically, which is a pity. So the DX200 plus a.t.u. of Dave caught VO1JR, HH2MC, OY8R, and JW6MY on 3·5MHz, then VQ9DF on 14MHz, with 6V3HL in Senegal on 21MHz. More on 28MHz meant J28DX, VP2EEW, KA5BPE/C6A, HC1HC, PJ2VR, FM7CD, W9NXD/P/HR2 and TG9NI, ZF2AG and HI8GB.

Club Time

Abergavenny & Nevill Hall ARC GW4GFL Meetings every Thursday at 7.30 at the Pen-y-val Hospital, A'Gavenny, with RAE classes held on Tuesdays at 7.15pm at the Nevill Hall Hospital. D. Jones GW3SSY says applications for the March and May RAE may be sent to the sec of the club as the club is a registered examination centre. The sec (name and call unknown) lives at 80 Croesonen Parc, Abergavenny and has a telephone (0873) 78674.

Acton, Brentford & Chiswick ARC G3IIU Tuesday February 21 sees a discussion on receiver pre-amplifiers, at 7.30, at the usual venue of the Chiswick Town Hall, High Road, Chiswick, London W4, at which new members and visitors will be most welcome, says sec W. G. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3.

Axe Vale RC First Friday at 7.30 in the Cavalier Inn, Axminster, which makes it difficult to get the dates of events to you in good time but note that March 2 is dominated by G3RSJ dealing with Static Protection for integrated circuits. More on the club from sec Bob Newland G3VW on Lyme Regis 5282 or PRO Roger Jones G3YMK on Upottery 468.

Bangor & District ARS Still meets at the Sands Hotel, Bangor, on the first Friday at 7.45pm with visitors promised something of interest to them. Stewart Mackay GI4OCK, 11 Dellmount Park, Bangor, Co Down, Northern Ireland, will be glad to talk to you on Belfast 650222 Ext 2304 during the day or on Bangor 54049 at home.

Biggin Hill ARC Third Tuesdays by the look of it, at St Mark's Church Hall starting at 8.30. The February date, the 21st, will see a demonstration of 10GHz operation. To come are evenings checking out members' gear, another junk sale, a demo of QRP operation, a display and demo by a local dealer, plus construction techniques. Your contact is Ian Mitchell G4NSD, Greenway Cottage, Tatsfield, Kent, by mail or Tatsfield 376 by 'fone.

Bromsgrove & District ARC G3VGG Very briefly, the club meets on the second Friday of the month at the Avoncroft Art Centre, says sec Jim Calder G6EAM, 30 Camberley Road, Kingswinford, W. Mids, also known as 8580.

Bury RS Hope this is in time to remind you of the Ham Feast at the Mosses Centre, Bury, on Sunday, February 5 at 11am with talk-in on S22, with bring and buy plus food and drink facilities. Meetings normally held at the Centre every Tuesday at 8 with main monthly meeting centred on the second Tuesday, like the 14th of February when G3NKL describes the secrets of good earthing. It's Brian

Tyldsley G4TBT, 4 Colne Road, Burnley, or ring him on B'ley 24254.

Cambridge & District ARC G2XV Meeting during term time in the Visual Aids Room of the Coleridge Community College, Radegund Road, Cambridge, at 7.30 every Friday the club has a well-organised programme of events for several months to come. February 10 has a video show "In Your Shack" with the following week being more informal with code sessions and operation of the club's station G2XV. David Wilcock G2FKS, 6 Lyles Road, Cottenham, Cambridge can also be reached on (0954) 50597.

Chichester & District ARC First Tuesday and third Thursdays at 7.30, the Fernleigh Centre, 40 North Street, Chichester, club contact being maintained on S11 145·275MHz on Weds at 7pm. Main event in February is a talk on the video repeater station GB3VR by G8KOE in the Green Room of the Centre. One recent feature likely to be repeated very soon was an AR software evening when computer programs were exchanged as well as demonstrating the use of microcomputers in AR work. Your hon sec is T. M. Allen G4ETU, 2 Hillside, West Stoke, Chichester, Sussex, or simplified in West Ashling 463.

Cornish ARC Meetings of the AR section are held at the Church Hall, Treleigh, on the old Redruth bypass, while the computer division gathers at the SWEB premises in Penrhyn Street, Redruth, the meeting on Friday February 10 being on FORTH as an alternative language, by Bert Hammett. More detailed information on both areas of activity from S. Rodda G4PEM, Cliff Hotel, Penrose Terrace, Penzance, but it will be faster on Penzance 3948.

Crawley ARC Only info available to me indicates that the club meets either at Trinity Church Hall, Ifield, Crawley, Sx, or at the QTH of a member, apart from events such as skittles evenings and d.f. hunts. Ring David Hill G4IQM on Crawley 882641 for latest on club activities.

Derwentside ARC (Consett) G4PFQ June Wallis G1AAJ says the club meets every Monday at 7.30 in the RAFA HQ, Sherburn Terrace, Consett, Co. Durham, with RAYNET and Morse code classes regular features. In the past year v.h.f. and h.f. gear has been installed in the club for use by members. More from June at 10 Middlewood Road, Lanchester, Durham, or buzz (0207) 520477.

Dudley ARC G4DAR February's main meeting will be on the 28th when Joe Jacobs will describe TV outside broadcasting techniques from the 50s to the 80s. Otherwise the club is open on the second and fourth Tuesdays at 7.45pm at the Central Library in Dudley according to Mrs C. Wilding G4SQP, 92 Ravenhill Drive, Codsall, Wolverhampton, W. Mids, alternatively Codsall 5636, who is the club sec.

East Kent RS G3LTY G6EKR The annual junk sale took place on February 2 and hope you didn't miss it. The 16th will be mainly a natter-nite plus work on the club's current constructional project but what that is I know not! Diary note for March 1 with a talk on QRP working by G3ROO. So, it's the first and third Thursdays at 8pm where a spirited welcome awaits newcomers and visitors alike. More from Stuart Alexander G6LZG, 66 Downs Road, Canterbury, Kent.

Edgware & District RS G3ASR A talk by a representative from Bosch Ltd on February 9 is a feature of the month, with a discussion on contests on the 23rd, an activity very popular in the club. Meetings normally on second and fourth Thursdays at 8, at 145 Orange Hill Road, Burnt Oak, Edgware, Middx. Further details on the club from sec Howard Drury G4HMD, 11 Batchworth Lane, Northwood, Middx or on N'wood 22776.

Exeter ARS Main meeting is held on the second Monday at the Community Centre, St David's Hill, Exeter, at 7.30. For the remaining Mondays of the month it is the Emmanuel Scout Hut, Okehampton Road, Exeter, for informal chit-chats, RAE course, Morse code practice and operation on the h.f. bands. PRO is Roger Tipper G4KXR, 12 Warwick Road, Exeter—alternatively Exeter 75858.

Flight Refuelling ARS G4RFR G6SFR Sunday evenings at 7.30 will find this very active club hard at it at the Sports and Social Club, Merley, Wimborne, Dorset. You should get this issue of *PW* in time to tell you of the February 5 gathering when G8HHA will talk on the "Twisted Pair" while on the 12th G3VMO holds forth on the System X telephone exchange. The familiar Nick's Ramble is on the 19th (he really ought to be G4 something or other by now!), ending the month's activities on the 26th with A. C. Fields talking on the British Talking Book Service for the Blind. The second AGM elected Don Hunter G8YCA as Chairman and John Fell G8MCP (of *PW*) as Vice Chairman "fulfilling a lifelong ambition to become the chairman of vice"! Mike Owen G8VFY stays as sec and can be found at "Hamden", 3 Canford View Drive, Canford Bottom, Wimborne, Dorset, otherwise (0202) 882271.

Ipswich RC G4IRC GB2IRC Club journal *QUA* goes from strength to strength, the fourth issue of 1983 containing no less than 42 pages of excellent editorial plus a mass of advertising reminiscent of *Radcom*, all from editor Alan Owen G4HMF with the support of his club members of course. Features include articles on switched capacitor audio filters, a Morse practice oscillator, information on locating OSCAR 10, workshop hints and tips, the W1AW schedule is very useful, microcomputers, and so it goes on. If you want to get along to the club then it's the second and last Wednesdays at 8pm, at the Rose & Crown club room, 77 Norwich Road, Ipswich, the room being detached from the drinking areas. The other Wednesdays of the month are devoted to such as Morse code classes and RAE activities. A repeater group meeting (GB3PO/GB3IH) will be held on February 8, with an illustrated talk on the building of the Orwell Bridge scheduled for the 29th. Make a note now of the constructors' contest on March 28. Hon sec Jack Tootill G4IFF, 76 Fircroft Road, Ipswich, Suffolk is also to be found on (0473) 44047.

Leighton Linslade RC Although the club meets on the first and third Mondays normally there will be no meeting on February 20 because of school holidays. Venue is the Vandyke Community College, Room A64, Vandyke Road, Leighton Buzzard, from 7 to 10pm. Visitors are assured of a warm welcome says sec Peter Brazier G6JFN, Kingsway Farm, Miletree Road, L'ton B'zard, Beds, with the picturesque telephone number of Heath and Reach 270.

Lincoln SW Club G5FZ G6COL Foregathers at the City Engineers Club, Central Depot, Waterside South, Lincoln, on Wednesdays, with February 8 having a lecture and slide show on Astrophotography by G4GZA and a night-on-the-air on the 22nd. Otherwise it's Morse code and RAE sessions in between. Secretary Pam G4STO can be contacted c/o the club QTH.

Maesteg ARC This recently-formed group meets on the first and third Tuesdays at the 7777 Club, Llangwynyd, Maesteg, and naturally new members and visitors are particularly welcome, says sec M. R. Carey GW6ZIH, 47 Heol Ty-Gwyn, Maesteg, Mid-Glamorgan.

Midland ARS HQ is at 294a Broad Street, Birmingham, with meetings every night of the week around 7pm plus contest and special evening operation at weekends! Activities include computers, RAYNET, code and RAE instruction classes, nights-on-the-air, and constructional work. Sec is Norman Gutteridge G8BHE, 68 Max Road, Quinton, B'ham or 021-422 9787 but stalwart Tom G8GAZ is always to be found on S17 or on 021-357 1924 with readily available info on the club and its activities. Mag *Probe* reveals that the club 48-hour "Talkathon" using GB4MAR was quite a success with many members dropping in to keep the station on the air, and raising over £70 in sponsored funds.

Nene Valley RC G4NWZ G6GWZ February 8 is natter-nite and h.f. band operation on the air, the 15th having a lecture on 50MHz operation by G4BAO although, apparently, this could be transferred to the 22nd. The weekend of 18th/19th sees the club running the special event station GB4WGG for the Wellingborough GGs. A video show of the Heard Island DXpedition H1DXA is scheduled for the 29th. So, it's Wednesdays at the Dolben Arms, Finedon, near Wellingborough, Northants, at 8pm with sec Lionel Parker G4PLJ at 128 Northampton Road, W'boro available for further info.

North Bristol ARC G4GCT Every Friday evening at the Self-Help Enterprise, 7 Braemar Crescent, Northville, Bristol, where Ted Bidmead G4EUV of 4 Pine Grove, N'ville, Bristol will be glad to welcome visitors and potential new members.

North Wakefield RC On February 16 a video show will deal with the subject of satellite communications, at the Carr Gate Working Mens Club at 8pm where the club meets every Thursday. A reminder of the principal feature for March, a visit to the Yorkshire TV studios on the 8th. Details from sec Steve Thompson G4RCH, 3 Harlington Court, Morley who responds to (0532) 536633.

Radio Club of Thanet G2IC A junk sale of radio equipment is scheduled for Feb 14 at the Grosvenor Club, Grosvenor Place, Margate, Kent, at 8pm, while on the 28th a representative from RAF Manston will describe the activities of the air-sea rescue service. Second and fourth Tuesdays is the drill with more info from Ian Gane G4NEF, 17 Penshurst Road, Ramsgate, Kent.

Radio Society of Harrow G3EFX G8JMR With the club winning the 432MHz QRP contest last year the Contest Forum on February 3 will have special significance, with an interchange of ideas for the '84 season. The club meets Fridays at 8 at the Harrow Arts Centre,

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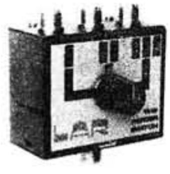

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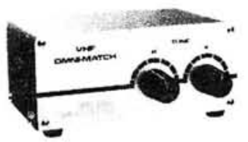

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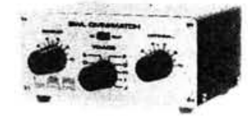

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High Road, Harrow Weald, Middx. Distant member G4AWP is now signing VP8ALD from South Orkney. David Atkins G8XBZ can be found on 0923 779942 being the sec, with president Chris Friel G4AUF also available, on 01-868 5002.

Salop ARS Weekly at 8, the Albert Hotel, Smithfield Road, Shrewsbury, on Thursdays, the 9th and 23rd of February being natter-nites plus G3VRI speaking on an, as yet, unknown subject. Make sure you make a note of March 1 when the RSGB film on G6CJ's *Aerial Circus* will be shown. Sec is Diane Parslow G6UDB, 1 Willington Close, Little Harlescott Lane, Shrewsbury, Salop also known as (0743) 62737.

South Bristol ARC Continues to gather at the Whitchurch Folk House, East Dundry Road, Whitchurch, every Wednesday evening, with February 8 devoted to a 430MHz night run by G4SDR, the 15th to RAYNET matters, the 22nd to a QRP night organised by G4MCQ and the 29th (yes, it's a leap year!) to video matters by G4ELA. A new contest site has now been obtained on Dundry Ridge which should please the contest-minded members. Sec is Len Baker G4RZY, c/o 62 Court Farm Road, Whitchurch, Bristol, otherwise (0272) 834282.

Southdown ARS First Mondays at 7.30 for a prompt start at 8, at the Chaseley Home, South Cliff, Eastbourne, with February 6 likely to be a visit from a rep of the Coastguard Service. More from Peter G8IQO on (0323) 763123.

Southend & District RS Opposite the church are the Council Offices in Rayleigh, Essex, where the club meets every Friday starting at 7.30. As for what actually goes on there you'll have to contact the Liaison Officer who is John Weston G6XBM, 67 Victoria Road, Rayleigh, Essex or try R'leigh 742128.

South Manchester RC G3FVA G3UHF G8SMR The Sale Moor Community Centre, Norris Road, Sale, every Friday at 8. February 10 promises a Spectacle in Sound and Colour by G6MOQ with the fair sex being especially invited to this audio-visual event. A Top Band d.f. hunt is scheduled for the 25th but more details from Dave Holland G3WFT, 32 Woodville Drive, Sale, Cheshire, likewise 061-973 1837.

Stevenage & District ARS The TS Andromeda, Fairlands Valley Park, Shephall View, Stevenage, Herts, is the club HQ on the first and third Tuesdays at 8. A crowd puller in G3TIK is expected when he talks on the ESA launch site in French Guiana on February 7. The 21st concentrates on a visit by members of the Cambridge repeater group. AGM is slated for March 20 so make a note now and don't forget to go along. Morse code classes are held before meetings, from 7.15 to 8pm. If you are within range try for the club net on Sundays at 7pm on 145·250MHz f.m. Finally the sec is Cliff Barber G4BGP, 13 The Sycamores, Baldock, Herts and home of (0462) 893736.

Sutton & Cheam RS Meets either at the Downs Lawn Tennis Club, Holland Avenue, Cheam, Surrey, or at the Sutton College of Liberal Arts, Sutton, but Jack Korndorffer G2DMR, 19 Park Road, Banstead, Sy, can give you the latest on club events in the pipeline, or try dropping in on one of the club nets, Mondays 10pm 144·390MHz s.s.b., Tuesdays 1030am on 3770kHz s.s.b. or Sundays 1030am 144·500MHz f.m.

Wimbledon & District RS St John Ambulance HQ, 124 Kingston Road, Wimbledon, London SW19, will find the club in action on the second and last Fridays of the month with a film show night on February 10 and a home quiz with members of the Coulsdon Amateur Transmitting Society (why do I never hear from them, I ask myself). Your man for more info on activities is Geoff Mellett G4MVS, 26 Paget Avenue, Sutton, and on 01-644 8249.

Wirral ARS G3NWR Watch it! There is also the Wirral & District mob! This one meets at the Guide Hut, Westbourne Road, West Kirby, on the first and third Wednesdays at 7.45 for an 8pm start so don't be late. The sec is Cedric Cawthorne G4KPY, 40 Westbourne Road, West Kirby, but generally available on 051-625 7311. Looks like Cedric and company will be taking the *PW* Top Band QRP transmitter (November/December 1983) as the club project 'ere long, according to club mag *News & Views*.

Wirral & District ARC G4MGR G8WDC The club's thrice-yearly mag *Airwave 325* is now supplemented by *Update 325* an up-to-the-minute release compiled from off-air reports by members via the club's computer network and thought to be the first of such compilations. Certainly it ought to give other clubs food for thought. Second and fourth Wednesdays at the Irby Cricket Club, Irby, Wirral, with inter-member net on S13 (145·325MHz). A technical film night is planned for February 8 with a visit from a local radio trader on the 22nd. Drinking and waffling (D & W) evenings are also held at local hostelries with more details of that and the club's activities from sec Gerry Scott G8TRY on 051-630 1393.

MEDIUM WAVE BROADCAST BAND DX

by Charles Molloy G8BUS

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

Before the would-be medium wave DXer can even get started on the band he is faced with the problem of finding a suitable receiver. A communications receiver is an obvious choice but this type of set is expensive and one of the better table or portable sets may already be in use, giving satisfactory service on the short waves. Problems occur though, if a portable is used for m.w. DXing as few of them work well with a long (random) wire antenna on the crowded m.w. band, and they are not suitable for use with a m.w. loop antenna. Although it is possible to get round the second problem with smallish sets by mounting them on the loop as described last month, at best this is a makeshift solution. Is there anything else we can try? The answer, surprisingly perhaps, is—why not try a car radio?

Car Radios for DXing

Why use a car radio? One advantage is that it can be connected directly to a m.w. loop as there is no internal antenna. Generally a car radio will be a better designed piece of equipment than a domestic set as it has to work under more adverse conditions. It has to be sensitive in order to pull in stations on the long and medium waves with only a short whip antenna. Some of these sets have a tuned r.f. stage which is a feature rarely found in a domestic receiver. A second-hand radio from an expensive vehicle can be a fine acquisition. I had a lift while in the Lake District last year in a car which was fitted with a radio that has both digital readout and scanning, and I was fascinated as it searched round the l.w., m.w. and v.h.f. bands for a decent signal under adverse conditions.

In order to use a car radio away from a vehicle, you will need a loudspeaker and a 12 volt d.c. supply. Current consumption will probably be too high for dry batteries so the choice is either a mains-derived supply or a car battery. The latter is preferable as the mains is a prolific source of electrical interference, noise, TV buzz, etc. A light-duty car battery (or even an old one that is past its best) will do. Since a car radio is well screened, then it is worth connecting a good earth to it—not the mains earth!

It is easy to use a loop with a car radio. The lead from the loop is terminated on a car radio type plug which is inserted in the socket on the radio. If you want to try an outdoor antenna then use a screened (coaxial) lead from the point of entry. This way you should get rid of a lot of electrical noise. Be careful though when using an outdoor antenna as you may easily overload the receiver which is designed for use with a whip. A short outdoor antenna with an a.t.u. should help pull in the DX.

DXing with Simple Gear

"I thought I'd start DXing on the medium waves after midnight so I got my receiver out which is a portable Russian Astrad" writes reader **Shoyab Patel** who was at home in Dewsbury in Yorkshire at the time, during the college half term. He plugged in an 8 metre-long external antenna to his set, the antenna going through the bedroom window to the top of the roof and then through an attic window where it was tied to a nail!

"With this set-up I was amazed to pick up at 0200 on October 20 the Caribbean Beacon in Anguilla on 1610kHz with a good signal—with programming in English. The next day (night) at 0130 I heard Radio Globo in Rio de Janeiro on 1220kHz. Paraguay and Uruguay were playing football and the commentary was in Portuguese."

Our reader concludes by saying that these two stations are his first transatlantic catches, heard on a simple receiver which he thought wasn't capable of pulling in DX. A very fine beginning that shows that the DXer is at least as important as his receiver. Ingenuity, persistence and a willingness to listen at an inconvenient hour, all pay off on the medium waves.

Latin American DX

The long sea path across the South Atlantic favours propagation from the east coast of South America. Brazil and Venezuela are countries regularly heard on the medium waves by DXers in the UK and it is quite easy to distinguish between the two. Spanish is the language of Venezuela while Portuguese will be heard from Brazil. If you are not familiar with the sound of Portuguese then try on 666kHz or 783 or 1035 during the evening for Portugal. Any QRM should be easily dealt with by a loop or portable as signals are coming from the south.

Listen after midnight on 1220kHz for Radio Globo in Rio, on 1300kHz for Radio Iracema in Fortaleza, on 940kHz for Radio Jornal in Rio and on 1100 for Radio Globo in Sao Paulo. Radio Margarita in La Asuncion can be found on 1020kHz, Radio Vision in Caracas on 950 and Radio Coro on 1210, these three being in Venezuela. Further north from the Caribbean there are two regulars. Radio Caraibes International located in Dominica dominates 1210kHz while the Caribbean Beacon is on its own on the unofficial out-of-band channel 1610kHz.

There are other stations to be heard but those mentioned are the ones most often logged. Remember that we are listening over a path of several thousand miles. Slow cyclic fading is normal so we have to sit on a channel for a minute or two to make sure we are not on the trough of a fade. Regular reception night after night is not to be expected. Stations that come roaring in one night can be inaudible the next, but if you are unsuccessful the first time then have a look for some North American DX instead. Now that we are getting nearer the sunspot minimum it will be unusual if there is no DX at all to be heard in the small hours.

Although I do not understand Portuguese I enjoy listening to Brazil. Eavesdropping into local radio brings out the flavour of a way of life very different to our own while some of the local music is superb.

Readers' Letters

"You mention Radio Ljubljana on 918kHz in the December issue" writes **W. M. Rigby** of Morecambe, who goes on to say that he picked up a broadcast in English from this station at 0030. Good material for a reception report! Yes, the unidentified on 747kHz would be Bulgaria which sometimes comes in well before the carrier from Flevoland in Holland comes on sometime around 0500. Try the same channel for Aleppo in Syria, I've heard it around this hour.

"It has been a long time since I sent in a report, although this time it is more of a query" says **Fred Ainslie** of Hartlepool who continues "On two nights this week I have heard a station on 1510kHz identifying itself as WMRE, the memory station. Its format seems to be nostalgic music—I was wondering if it is WITS ex WMEX". Yes, for many years WMEX was the 50kW outlet at Boston on 1510kHz. Then it suddenly changed to WITS and more recently it became WMRE.

Fred, who uses a home-brew receiver along with a 1·5m square loop located in the loft, added "I can now check the band at a reasonable hour before deciding whether to stay up—it has also pacified the XYL who has got rid of the loop which used to clutter up the dining room all day hi." The loop is used with a differential amplifier located beside it. Tuning is remote, using a cassette motor and drive belt, and power is fed from the RX for the differential amplifier and motor via three-core cable." The tuning arrangement was taken from *PW* March 81 and the differential amplifier from the same issue (Active Antenna).

Recent DX pulled in with this set-up justifies the complication. Stations heard include ZDK Antigua on 1100kHz, along with R. Globo on the same frequency, R. Anzoategui in Venezuela on 1210, St. Kitts on 825, Upper Volta on 747, plus of course R. Globo on 1220 and R. Vision on 950. From North America on November 5/6 came WQXR on 1560, WHN 1050, WINS 1010 all in New York City, WTOP 1510 in Washington, WCAU 1210 in Philadelphia, CKLM Montreal in French on 1570 and also in the same language, Radio St. Pierre et Miquelon, which is located near Newfoundland on 1375kHz. Glad to hear from you again Fred, not many home-brew sets around these days.

Reader **F. H. Bell** disagrees with my interpretation of DX as an abbreviation for Distance where the last seven letters are replaced by an X. "In mathematics X represents an unknown quantity therefore DX should mean Distance unknown." An ingenious explanation made I suspect with tongue in cheek. How does it apply to TX for transmitter?

"I wonder if you have come across a circuit to cut out or reduce the interference of the line timebase oscillator" writes **R. Ives-Keeler** from Grimsby who is bothered with QRM from neighbours' TV. I wish I had a simple answer. A battery-operated set moved around the house and rotated to make use of the directional internal antenna should help. The last word is from **John Dennis Court** who mentions the new ILR Signal Radio in Stoke on 1170kHz m.w. and 104·3MHz v.h.f.

SHORT WAVE BROADCAST BANDS *by Charles Molloy G8BUS*

Reports: as for Medium Wave DX, but please keep separate.

"My present equipment is a Yaesu FRG-7 and the antenna I use is a long wire of about 8 metres in length. However I don't think I am getting the best performance from this. What is the ideal length of a long wire antenna and how high should it be off the ground? Perhaps you would also explain in your feature the exact function of an a.t.u." asks **Christopher Williams** who lives in Northampton.

The Long Wire

I prefer to call this type of antenna a "random wire" as the word "Long" is related to wavelength rather than antenna length. If you want to listen to weak signals on the tropical bands then an antenna of 30 metres or even longer will be an asset. If you attempt to use the same antenna on a busy international band then receiver overloading with cross-modulation and similar problems may be the result. What we need here is an antenna of 5m to 10m in length. If you can, erect two antennas, one long and the other short. A simple switch will enable you to try each in turn at different times on different bands. You will get away with a longer antenna on the 15MHz band when chasing Latin American DX in the evening than you will when the band is packed with strong signals during the day. There is no "ideal length" for a random wire antenna.

Height is more important than length. Buildings are part of the ground so far as our antenna is concerned. If possible a random wire should take the form of an inverted "L" with the downlead acting as a vertical antenna. Such a configuration will be omni-directional which is what we want for general listening on a number of bands. A large part of the antenna will be well clear of the house and the haze of electrical interference that surrounds it.

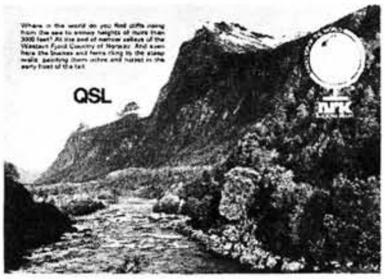
If you can only put up one antenna then make it as long and as high off the ground as you can and be prepared to use an attenuator frequently. A simple at-

QSL Card from Cairo sent in by Kevin Lewis

QSL Card from VNG sent in by Kevin Lewis

Pennant from Argentina sent in by Andrew Hill

QSL Card from Polonia sent in by Kevin Lewis



QSL Card from Norway sent in by Philip Hodgson

tenuator can be made with a 1kΩ potentiometer. Connect the moving (centre) tag to the receiver, the antenna to one outer and an earth to the other. An alternative, which I prefer, is to fit a variable capacitor between the antenna plug and the receiver antenna socket. A value of 50pF will be suitable on the s.w. bands and a larger value for the tropical bands.

Antenna Tuning Unit

When used between antenna and receiver the a.t.u. acts as an impedance matcher. So why bother to match impedance? If a 50Ω antenna is connected to a receiver of 50Ω then maximum transfer of energy will occur as there is a good match. If the antenna has an impedance of 1000Ω while the receiver is only 50Ω then there will be a mismatch loss of

$$10 \log \frac{1000}{50} = 13\text{dB}.$$

Some of the energy picked up by the antenna will enter the RX but a lot of it will return from the mismatch to be re-radiated. An a.t.u., if properly adjusted, would offer an impedance of 1000Ω to the antenna and 50Ω to the RX so that maximum signal transfer can occur.

Antenna impedance changes with frequency and it will vary over a wide range as we tune across the s.w. bands. In some places there will be a good match and the a.t.u. will not bring an improvement; on other frequencies we will be able to peak up the signal, so we have to adjust the a.t.u. controls as we move from one band to another. There is no need for an a.t.u. if we use a dipole with a RX that has an input impedance of 50Ω. The antenna and RX will already be matched.

International Listening Guide

Regular readers will remember the *ILG*, which I have referred to before. This 32-page booklet, printed and compiled by personal computer, has sections covering External and Home Services in English with times and frequencies, *Short Wave Survey* covering 2700 stations grouped into morning, afternoon, evening and night segments, and a Survey of World News and list of DX programmes.

The *ILG* is published by West German DXer Bernd Friedewald DK9FI who runs the DX Listeners Service. He is offering a free copy of the latest edition of the *ILG* (it comes out four times a year). Send one International Reply Coupon (available at main post offices) to cover return postage, to DX Listeners Service, c/o Bernd Friedewald, Merianstrasse 2, D-3588 Homberg, FRG-West Germany.

Travellers' Sets

My request for information about pocket-sized s.w. receivers for the traveller and holidaymaker, brought some interesting replies. Readers **W. M. Lomax** and **Shoyab Patel** like the Sony ICR-4800 on account of its low battery consumption from two AA cells, even though the set does not cover the 7MHz, 21MHz and 26MHz bands. **Tim Makins** G4DNV/VP8AQU took one to Antarctica on a recent visit where he had no difficulty in picking up the BBC WS plus many other s.w. signals and quite a few medium wave stations from South America as well. Tim likes the way that the control buttons on the ICR-4800 can be locked in the OFF position so that the set cannot be switched on while in the pocket.

Peter Brooks G4UMI recommends *London Calling* which can be obtained from the bookshop at Bush House, as it gives hour-by-hour coverage by region and frequency. Details of this "Radio Times of the World Service" can be had from BBC, Box 76, Bush House, London, WC2B 4PH. Peter mentions the duty-free airport shop as a good source for small s.w. receivers, in particular the Sony 400S which has a s.w. range in place of the long waves on the 400L, which is the version on sale in the UK.

The National Micro 009 has attracted reader **H. G. Levin.** This small set covers f.m., m.w. and seven s.w. bands from 3·9MHz to 21·8MHz. It runs from two 1·5 volt cells and has a tuning eye. Sounds an attractive receiver, which is available in the UK.

QSLs

The introduction to the ten-page pamphlet *QSL Survey*, produced by the European DX Council starts off with "In response to discussions at the 1979 and 1980 EDXC Conferences on the question of QSLs issued by broadcasting stations and how these stations regard them in the 1980s—" The survey lists 17 questions and the replies received from 42 international broadcasters. The details required in a reception report, whether the SINPO or SIO codes should be used, the value of a single report, comments on programming, are a selection of the questions each broadcaster was asked. The replies are grouped so that the reader will know the preference of each station.

Short wave broadcasting has long since passed the experimental stage so it is surprising that reception reporting and QSL cards still exist. Some stations value reception reports while others do not. *Notes from Radio Finland* explains why that station has moved from QSLs to Audience Cards.

The 1983 survey, updated by Mike Burden of the World DX Club, is available from the EDXC, PO Box 4, St Ives, Huntingdon, Cambs, PE17 4FE, for 50p or two IRCs for Europe or for 75p or three IRCs elsewhere. Anyone interested in the QSL side of our hobby should get hold of a copy.

The fourth updated list of radio countries is now available from the EDXC price £1 or 5 IRC in the UK and Europe and £1·50 or 7 IRCs for the rest of the world. "We present this list especially compiled for those DXers who are interested to define their score in DX ladders, DX competitions and award collecting. It will also help you find out the number of heard and verified countries" writes Secretary General Michael Murray.

Part two—*Former Radio Countries* makes interesting reading. I have QSLs from Swan Island and Spanish Sahara and a tape of a broadcast from Radio Biafra, which are only three of the 42 "countries" that now belong to the history books.

The landlist, which was compiled by Torbjörn Enarsson, type-set in Vienna, printed in West Germany and distributed from the UK, reflects the international base of the EDXC.

VHF BANDS *by Ron Ham BRS15744*

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

I am often asked, especially by outsiders and newcomers to the world of radio, "what do you get out of it?" and my reply is simple, "a great deal". Apart from the technical side of building, designing and learning more about the wide range of radio gear and the various modes of transmission, there is tremendous scope and enjoyment for the non-technically minded enthusiast; the user of communications equipment.

Until the advent of the transistor in the late 1950s, the majority of people in the UK derived their entertainment from the BBC stations in the long and medium wave bands on a large domestic receiver, television and v.h.f. broadcasting was in its infancy, car and portable radios were a luxury so, apart from official bodies, specialised manufacturers and the military, short wave communications and experimentation was deeply entrenched in the field of amateur radio.

Many readers will remember the thrill of the first QSO, let alone DX, on the 144 and 430MHz bands with a home brew antenna, transmitter and converter in front of the shack communications receiver which, in turn was the general overworked dogsbody of the amateur station. However, times have changed and now millions of people, throughout the world, have come to enjoy international radio and television programmes on sophisticated domestic receivers, designed for the home, mobile and portable use.

Apart from the programme content, there are now thousands of broadcast listeners who, armed with a copy of the *World Radio and TV Handbook,* love to winkle out that long distance station and the enthusiast with a communications receiver has the short waves at his finger tips and can receive signals in all modes, a.m., f.m., c.w., and s.s.b., add an electronic adapter for displaying Morse code and teleprinter signals on a screen and in some cases there is a bank of memories so that the favourite signal can be at the touch of a button. One only has to study the adverts in this and other magazines to see the range of complex h.f., v.h.f. and u.h.f. transceivers available to the multitude of licensed radio amateurs. Many of the youngsters who have now taken to amateur radio were first encouraged, either by listening to amateurs on the air, using a CB rig, or learning to be a radio operator in the cadet forces or college, or through a friend in their local amateur radio club.

Like the broadcast DXer, the newly licensed amateur soon finds out that the propagation of radio waves plays an important part in his enjoyment and as this depends upon natural phenomena, like eruptions on the sun, the state of the ionosphere and the weather, operating conditions vary considerably with the time of year, between day and night and on some bands, hour by hour.

Although for the beginner there are general guide lines about propagation in the text books, we can best learn more about the subject through our own and other people's experiences and this is where magazine columnists, like myself, come in and, with your help, place the various events on record.

Solar

Although it is well known that solar activity, associated with sunspots, can upset radio signals by causing an aurora or disrupting the upper regions of the ionosphere, there is still a need for continual observation with both optical and radio instruments. Among the amateur observers are **Cmdr Henry Hatfield,** Sevenoaks, who built two radio telescopes, working at 136 and 197MHz and a spectroheliocope, **Ted Waring,** Bristol, who projects the sun's image on to a card for counting sunspots and myself with a radio telescope working at 143MHz. After that build up our reports this time are far from impressive, however it is as important to log nothing as it is to record an event when making routine observations of any natural phenomena.

"On the three occasions when I could see the sun, November 21, 23 and December 1, there were no sunspots visible to me" writes Ted Waring, Bristol, and as far as radio is concerned, I recorded a few random bursts of noise at 143MHz during midday observations on November 26 and December 2, 4 and 7.

28MHz Beacons

"I am sure some of these beacons shut down sometimes because they are so irregular", writes **Ted Owen,** Maldon, who can hear the Sussex beacon GB3SX 28·215MHz, daily and like **Bill Kelly,** Belfast, logs such stations as KA1YE/BWNY, W2NZH/BCN and W3VD/BCN, occasionally. The latter station was heard by **John Coulter,** Winchester, on 7 days between November 14 and December 5 and he emphasises that he logged the South African beacon ZS1STB, just once, on December 1. Keep checking the channel John, it may come up again. Although most of us found the band quiet during the month prior to December 15 and fewer beacons were heard, I was still able to prepare a monthly beacon chart, Fig. 1, from the combined logs of **Dave Coggins,** John Coulter, Bill Kelly, Ted Owen, Henry Hatfield, Ted Waring and myself, proving once again the value of many observers, like, for instance, Dave Coggins who heard the German beacons DL0IGI by meteor scatter at 2150 on November 23 and DF0AAB via sporadic-E on December 4.

Satellites

At 1325 on November 27 a fading signal, "RS5 QSU ON FQ 145830KHZ" and "UA3PFC, 15PSW, WB9AJZ" in

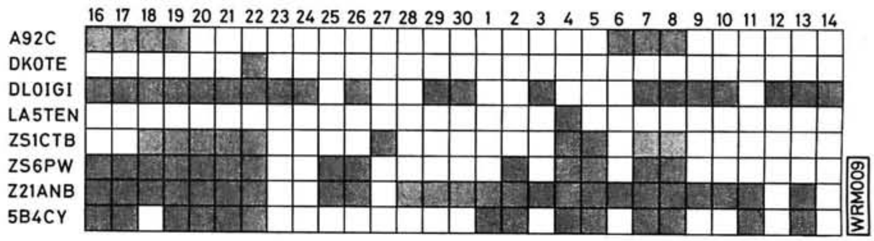


Fig. 1: Distribution of beacon signals

that order and each repeated twice, was read by my Tono Theta 550 terminal unit on 29·331MHz. John Coulter reports hearing signals periodically from European and Russian stations working through RS5 and RS7.

Around 1525 on December 4, I heard signals from W5LFL aboard Columbia on S22 with only a vertical dipole feeding my SX200N scan receiver. Bill Kelly says that some amateur stations in Ireland worked Columbia.

Tropospheric

Following questions about keeping records of atmospheric pressure, without a barograph, I suggest that a twice daily reading of the home QTH barometer is logged. say noon and midnight or whatever is convenient, and a weekly graph is made from the results. Such information in the station archive, linked with v.h.f. DX worked or heard, can provide valuable research material in the years to come.

The atmospheric pressure, measured at my QTH, averaged around 30·1in (1019mb) from 0200 on November 16 to 1400 on the 22nd when the high pressure system began to move. As usual my barograph recorded the move by showing a slow decline in pressure until it crossed the 30·0 (1015) line at midday on the 24th. At this point it began a more rapid fall to 29·6 (1002) by 1300 on the 26th and between then and midnight it dropped like a stone to 28·9 (980) as a low pressure system passed by giving heavy rain, 1·68in in two days and winds gusting at 70m.p.h. At noon on the 27th, the barograph began to rise again rapidly and by midday on December 1 it was back to the high of 30·5 (1032) and, true to form, a tropospheric opening took place as it slowly fell from midnight on the 2nd to 30·3 (1026) at 1800 on the 5th. By 2200 the pressure was on the up again reaching 30·5 at noon on the 7th only to fall again sharply to 29·3 (992) and another storm, around 1800 on the 9th after which it rose to 30.0 where it hovered from 0200 on the 10th until the 14th.

As is typical with tropospheric openings, the 144MHz repeater network really extends its range and although the co-channel interference makes it almost impossible to use normally, it becomes most enjoyable for the DXer while the disturbance lasts. I logged PD0HJC working a "G" through a repeater on R5 on December 2, PD0PDO and G6XWQ through the Leicester repeater GB3CF R0 early on the 3rd, PD0LXC working G6IZB/A on R7 and PD0MIJ calling on R3 at 0901 on the 4th and a GU6/M via R7 at 0830 on the 5th. All with a dipole feeding a SX200N scan receiver which shows just how strong signals were during the event.

"I get very good reception here from the 144MHz repeaters in Leicester GB3CF, North Birmingham GB3BX, Malvern Hills GB3MH, Longbridge GB3AM and Leamington Spa GB3YJ",

Fig. 2: Terminal unit used by Norman Jennings

writes **Eric Weaver,** Redditch, who also monitors the Hereford GB3HC RB6 and Central Birmingham GB3CB RB14 repeaters on 430MHz and adds, "there seem to be many newly licensed enthusiasts using the repeaters of late, so amateur radio is certainly not short of new recruits".

Band II

In Cardiff, **Keith Howells,** using a Pioneer SX550 stereo receiver and indoor dipole antenna logged many French broadcast stations between October 23 and 26 and identified France CULTUR, INTER and MUSIQUE, FREQUENCE NORD and RADIO VASSE-NORMANDIE, from such places as Brest, Caen, Lille, Reims and Rouen. Keith kept an eye on the TV weather chart and noted how the ridges of high pressure were associated with his DX catches.

Tony West, Bradford, purchased a SONY ICF7600D synthesised receiver covering 76 to 108MHz and with its own telescopic antenna, logged BBC radios CAMBRIDGE and LONDON and ILRs CAPITAL, CHILTERN, SAXON and SIGNAL in addition to four Belgian and French stations between 0800 and 0900 on December 2. A jolly good start Tony and I see that BBC radios SHEFFIELD and SUSSEX, ILRs LBC, CHILTERN and SIGNAL and a number of Dutch, French and German stations were heard between the 3rd and 5th in Loughborough, by **Brendan McNamee,** using an AKAI AJ500FL with its own rod antenna. Well done Brendan, I look forward to hearing more from both of you, what about some bigger antennas, hi!

"I was hoping to pick up Germany, but French stations were dominating on most channels", writes **Denis Parkes,** Brighton, on December 3. During the opening, Denis, using a MARANTZ ST400L with digital readout, 4 element antenna facing south east and a SONY TC630 amplifier, also logged RADIO GWENT on 104MHz from Wales, SIGNAL RADIO from the Midlands and a Belgian station on 100·7MHz was predominant for several days. On the 2nd, SIGNAL RADIO, Radios DEVON and SUSSEX and French stations were very strong with **John Williams,** Cheltenham, who sent a detailed reception report to SIGNAL RADIO after listening to their programmes on November 10. At that time John used a Fidelity RAD26 with its telescopic antenna at a 45 degree angle and he sent details of the programmes he heard between 1400 and midnight and a description of the 78 mile path between John's QTH and the station at Stoke-on-Trent, which should prove useful to their engineers.

With the pressure rising in early December, **Steve Green** increased his local station count to 18 which now includes DERBY, CAMBRIDGE, BRMB, HORIZON, HUMBERSIDE, MERCIA, NORTHANTS, OXFORD, SIGNAL, SOUTHERN and SUSSEX. "As the lift continued, more and more continental stations were heard in Band 11", writes Steve, who was using a PANASONIC DR29 receiver with its own rod antenna.

I first noticed the lift when out portable at 1600 on the 1st when there were strong French signals in the 96/100MHz region and by 0115 on the 2nd and although most stations were off the air, there were many carriers, tones and twerbles in the band where foreign stations usually appear. I also heard a large number of Dutch stations in the Band at 1650 on the 4th. Down on the coast at St. Leonards-on-Sea, **Harold Brodribb** heard, in addition to a crop of continental signals, local radios CYMRU, DEVON, GWENT, LONDON, LBC, SOLENT and SWANSEA. For Band II Harold has the radio section of his PLUSTRON TVR5D, BUSH VHF80 and a ROBERTS R505 and, as usual, he follows the movement of high pressure systems on the weather maps in his daily newspaper.

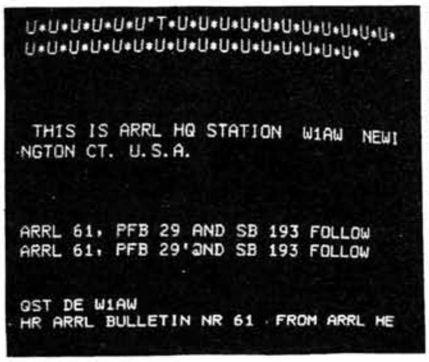


Fig. 3: RTTY copied by Norman Jennings

RTTY

Ted Double G8CDW, awards manager of the British Amateur Radio Teleprinter Group, tells me *that* **Peter Adams** G6LZB, 464 Whippendale Rd., Watford, Herts, will be organiser for future RTTY contests sponsored by the group. "The committee of BARTG would like to thank your readers for their past support of the annual events organised in order to promote interest in the RTTY mode", writes Peter. He told me that their Spring RTTY Contest will take place on the 3·5, 7, 14, 21 and 28MHz bands between 0200GMT on March 24 and 0200 on the 26th and their Spring VHF/UHF Contest will be held between 1800GMT on April 14 and 1200 on the 15th on the 144, 432 and 1296 bands. There are separate categories for single operator, multi operator and short wave listeners in the h.f. contest and logs from s.w.l.s will be most welcome in the v.h.f. event. For details of awards, rest times and general rules etc., send an s.a.e. to Peter at the above address and we wish good luck to all competitors.

Peter Lincoln copied all the usual Europeans, a few from the USA plus FY7YM, YB1BG and ZC4EPI on RTTY during the month prior to December 6 and added two new countries, GD4VGL and J28DQ to his score. Between November 11 and December 8, **Norman Jennings,** Rye, using a Telereader CWR 670E terminal unit, Fig. 2, copied RTTY signals from 40 different countries of which 23 were in Europe. Toward the end of the period Norman logged VP2ES, adding Anguilla to his score on 14MHz, also received were the pre-fixes FG7, HK4 and KP4, PY and YV in South America and VE7 and several Ws in north America. From Africa he logged EA8, TR8 and the usual ZS stations and from Asia A4X, 3V8 and 4Z4. At 1040 on December 4, Norman tuned around 7MHz and found DL2AK and ON5UP working in ASCII, caps, in French and says, "it's a change to get a different mode". Earlier in 1983, Norman logged the "U*U*U" tuning signal from W1AW, Fig. 3, the HQ station of the American Radio Relay League. Although I found the activity on the h.f. bands generally down over a similar period, I did copy the pre-fixes CT, DL, EA, F, HB9, I, IT9, LA, OE, OH, SM, SP, UA3, UT5, VP2, Y2 and YU on 14MHz, around 14·090MHz, CT, EA, I, OH, SM, UT5, W and YV on 21MHz around 21·090MHz but, like Norman, nothing this time on 28MHz. "I have just purchased a computer, so my time is now split up between tuning in to RTTY, s.w.-listening and learning to programme computer runs", writes **Ken Easom,** Cape, Republic of South Africa.

Tailpiece

Readers in the Sheerness area of Kent that wish to know more about the Swale Amateur Radio Club, should drop a line and s.a.e. to **Brian Hancock** G4NPM, Leahurst, Augustine Rd., Minster, Sheppey, Kent, ME12 2NB. The club is considering a members only contest, a radio fox hunt and demonstrations by a local computer firm as part of their early 1984 programme.

TELEVISION *by Ron Ham BRS15744*

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

Yet again the meat of this column stems around a major tropospheric opening which, however, is typical of the winter months when the extreme and relatively rapid fluctuations in atmospheric pressure and the sudden changes in temperature have a considerable effect on the path of television signals in Bands III, IV and V.

Amateur Television

"Fortunately my Sharp colour receiver tunes down slightly below Ch. 21 where I received excellent pictures from F3YX/TV mobile, on September 6", writes **Steve Green,** Malvern. During the good conditions on December 3, he saw a test card and video from G6CUQ and a CQ from G6HLS. Back in May, Roger Wallis, Solihull, received ATV pictures, Fig. 1, from G3DFL.

SSTV

While the 144MHz band conditions were good on December 3 and 4, **Richard Thurlow** G3WW, March, had a SSTV QSO lasting almost two hours with **Don Le Broca** GJ8GDX, St. Saviour. **Grant Dixon** G8CGK, Ross-on-Wye, worked PE1JTU during this time and then Richard worked each of them. Richard also gave **Jean Francois** F1EDM, Bordeaux, his first two way SSTV QSO with the UK.

During an hour long 2-way QSO, on November 20, between I3XQW and G3WW, single frame colour pictures each taking 24 seconds to complete were exchanged and Richard also received monochrome pictures, Figs. 2 and 3. He said they were "of a quality and definition never seen in my 11 years of slow scan operating". Early in December he increased his first time two-way SSTV QSO score to 1942 by working F6OUO.

Peter Lincoln, Aldershot, also received pictures from I3XQW while he was in QSO with a German station who saw a number of pictures of the Italian station's home town, Padova, Fig. 4. Earlier in 1983, Peter received SSTV pictures from stations in Bulgaria, Fig. 5, Spain, Fig. 6 and Yugoslavia, Fig. 7, on the 14MHz band.

Band I

"I am very well satisfied with the results of my first season at this fascinating hobby" writes **Eric Weaver,** Redditch, on November 18. Eric began TVDXing in June 1983 and at the time of writing he had logged pictures from 17 European countries, 41 positively identified stations and a good number of unidentified test cards and captions. During those unexpected sporadic-E disturbances in October, Eric saw the test cards ORF FS1 Austria, RSKH Czechoslovakia, JRT BGRD Yugoslavia, RTP-1 Portugal, Televerket Norway, RAI-1 Italy and the programme captions Telewizja Polska and Programa Nacional.

Alan Taylor watched pictures from RAI-1 on October 28 and 31 and then during a brief opening, early on November 18, there were strong bursts of a cartoon film over the top of a football match in the Chs. E2 (48·25MHz) and R1 (49·75MHz) region.

When at 1846 on December 9, the German 28MHz beacon DL0IGI suddenly came up to about 559, it suggested some sporadic-E disturbances, and at 1900, a long burst of ice hockey appeared on Ch. R1. At 0755 the following day DL0IGI was still audible and the Polish clock, with its tp insignia, came up for a short time.

Tropospheric

There were several good tropo openings influencing the u.h.f. bands during 1983 and among the multitude of pictures that were received in the UK it was, as always, important to identify their source. As usual, many readers were able to do that, Tim Anderson Fig. 8 with Today South West, Len Eastman Fig. 9 with a test card from Sweden, David Girdlestone Fig. 10 with a test card from Holland, Martin Messias Fig. 13 with a German TV picture, and Tony Palfreyman Fig. 14 with a Netherlands test card.

Within the life of that October 1983 opening, which is still being talked about, Eric Weaver received a children's programme showing various hand puppets and the caption End Der Kindersending from Germany, in Band III, on Ch. E6. He also watched another children's programme from Germany, followed by the caption Sudwestfunk on Ch. E11. Pictures of an anti-nuclear demonstration with Dutch captions on Ch. E10 and a large orchestra playing Mozart on Ch. E8 were also received by Eric from Belgium, with News and fifteen minutes of adverts from Holland on Ch. E6. On November 11, he watched a Remembrance Day parade followed by film of Belgian, British and French troops in action during WW-1 from Belgium on Ch. E10. In Coventry, Alan Taylor logged test cards from BRT TV1, RTBF-1 and colour bars from RTE-1 in Band III and programmes from BBC South West on u.h.f.

"Conditions have been fantastic for DX reception" writes **Philip Hodgson,** Stamford. He tells me that since the repositioning of the main TV antenna on the roof, he has received signals from S4C and HTV, TVS from Rowridge on Ch. 27, Tyne Tees from Pilsdale on Ch.

Fig. 1

Fig. 2

Fig. 3

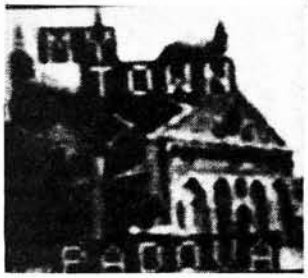


Fig. 4

Fig. 5

Fig. 6

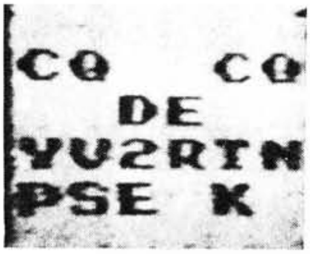


Fig. 7

Fig. 8

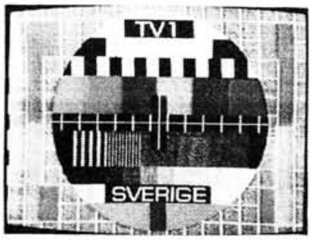


Fig. 9

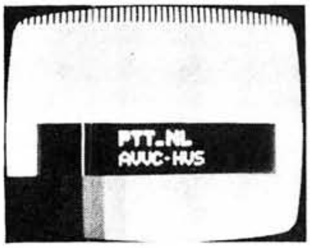


Fig. 10

Fig. 11

Fig. 12

Fig. 13

29 and Pontop Pike on Ch. 61 when conditions are good. The director of engineering at HTV was pleased with Philip's reception report and sent him some pamphlets about their activities.

Like many of us, Steve Green received pictures and test cards from Belgium BRT and RTBF on Chs. E9 and 10, Denmark DR on Chs. E6, 7 and 10, Holland NED-1 on Chs. E4 and 6 and Sweden TV2 on Ch. E11, in Band III. He also received Belgium, Holland and Germany in the u.h.f. band between December 1 and 5. Among the programmes Steve saw were *The A Team* on NED-1, *Dukes of Hazzard* on NED 2, table tennis from Denmark and a "muppet" type entertainment from Belgium. The u.h.f. band was really open at 0700 on the 4th when Steve logged 5 test cards from France TDF ANTENNA 2, 6 from Holland PTT NL-AVVC-HVC and 7 from Germany WDR-3 and DPB-ZDF between Chs. 21 and 69. On the 2nd, Chs. E10 and 11, Steve saw the words "Antiope Services, Ressau, Magazines, 201 Video Presse, 266 Hachette 277 Mado BNI Specialise 607 SCNF Bourse-11" continuously crossing the screen. Any ideas readers. Going back a bit Steve received a programme schedule from the German station ARD, Fig. 11 on August 11 and an advert from DBP-ZDF, Fig. 12, on September 6.

I noted a weak picture on Ch. E10 at 1344 on December 1. Then on the 2nd I saw test cards from Belgium and the caption BRT Schooltelevisie on Chs. E8 and 10 and the Dutch caption Pauze on Chs. E4 and 5. I saw test cards from Denmark at 0810 on the 3rd, Dutch test cards on Chs. E4 and 6 and RTE-2 colour bars on Ch. E10 on the 4th and Belgian and Dutch test cards on Chs. E4, 6 and 8 on the 5th. At 2039 on the 4th, I saw the caption Mezza Musica at the start of an orchestral programme, in colour, on Ch. E10. Then at 1444 on the 5th I received a strong test card on Ch. E7 with Kanal 7 at the top, a digital clock on the right centre and at the bottom the letters RTL-PLUS. **Harold Brodribb** also saw this card from Luxembourg at 1240 and described it as "brilliant", especially as his Plustron TVR5D was working on a Band I antenna. Between December 1 and 5, Harold also received the continental stations in Band III and IBA S4C from Wenvoe and negative pictures from French stations on several u.h.f. channels.

Station Reports

Dave Lauder, Newsletter editor of the *Long Distance Television Reception Group,* is offering sample copies of their newsletter for 50p or 4 × 12½p stamps, alternatively four issues, October 83 to June 1984 for £2 including postage. For overseas readers a sample copy is 4 IRCs and or £3 for the four issues. Dave is also preparing a Beginners Guide leaflet, similar in size to their newsletter for 50p (or 4 IRCs). For more information, drop a line to Dave at 18 Burnside Close, Barnet, Herts.

Can anyone help H. Mitchell G4DYB with a mod-circuit for a VE3EGO modified Robot 400 for 24 seconds single frame SSTV and Richard Thurlow G3WW, who needs a similar circuit for his Robot 400 plus 2 × W9NTP memories.

My thanks to Steve Green for the information that the mystery test card, Fig. 9 in our January issue, is the German FUBA card often used without identification first thing in the morning or after close down and some north German, NDR, transmitters use it all day. As this card was received on Ch. E55, Steve suggests that it originated from Dusseldorf.

SMALL ADS

The prepaid rate for classified advertisements is 36 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £12.00 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 Dept., Practical Wireless, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St, London, SE1 9LS. (Telephone 01-261 5785).

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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.

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