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Amateur RADIO

For all two-way radio enthusiasts

Construction:
A Vertical Loop Aerial for 2m FM

Picketts Lock:
The First London Amateur Radio Show

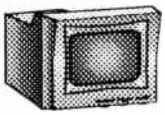
A User Review:
The Icom IC-765 HF All Band Transceiver

THE *ORIGINAL* SURPLUS WONDERLAND!

MONITORS

MONOCHROME MONITORS

THIS MONTH'S SPECIAL!



There has never been a deal like this one! **Brand spanking new & boxed** monitors from NEC, normally selling at about £140! These are over-engineered for ultra reliability. 9" green screen composite input with etched non-glare screen plus switchable high/low impedance input and output for daisy-chaining. 3 front controls and 6 at rear. Standard BNC sockets. Beautiful high contrast screen and attractive case with carrying ledge. Perfect as a main or backup monitor and for quantity users! **£39.95 each** (D) **or 5 for £185**(G)

CALL FOR DISCOUNTS ON HIGHER QUANTITIES!

Zenith ZVM-1240-EA brand new & boxed 12" amber flat screen with optional swivel and tilt base. Sunflex filter with dark tint. Standard TTL PC compatible. 18 mhz bandwidth. Very attractive "state of the art" tapered grey case. Standard 9 pin D plug (supplied) on 1 metre cord and mains cord terminated with IEC connector. 240 volts complete with operations manual. An absolute gift at: **£50 (A) 10/£500 (G). Swivel/tilt base £4.95.**

Very high resolution, fully cased 14" green or amber screen monitor with non-glare screen and swivel/tilt base. The very latest technology at the very lowest price! Fully compatible and plug compatible with all IBM PCs and clones fitted with a high res Hercules or equivalent card! Enables superb graphics and resolution, all at a give away price. Has many extra features including aux +5 & 12v DC outputs to power at least 2 disk drives, if your PC power supply is getting hot! Supplied BRAND NEW and boxed. State whether amber or green screen required.

Amber .....£79 Green .....£69 (E)

Wang green screen 12" chassis monitor with composite video input. Adjustable for tilt. Requires 12 vdc. Brand new and boxed in perfect condition. **Only £39 each or 2 for £75 (F)**

Motorola M1000-100 5" black & white compact chassis measuring only 11.6H x 12W x 22D. Ideal for CCTV or computer applications. Accepts standard composite or individual H & V syncs. Needs 12vdc at only 0.8a. Some units may have minor screen blemishes. Fully tested with 30 day guarantee and full data. **£29.00**(C)

Fully cased as above in attractive moulded desk standing swivel. Dim 12 x 14.5 x 26cm. **£39.00**(C)

JVC 751 ultra compact chassis monitor for 12vdc 0.7a. Dim 11 x 14 x 18cm. Simple DIY data included to convert to composite video input .Full data. **BRAND NEW £65.00**(B)

20" Black & white monitors by Aztek, Cotron & National. All solid state, fully cased monitors ideal for all types of AV or CCTV applications. Standard composite video inputs with integral audio amp and speaker. Sold in good used condition - fully tested with 90 day guarantee. **£95.00(F)**

COLOUR MONITORS

Decca 16" 80 budget range colour monitor. Features a PIL tube, beautiful teak style case and guaranteed 80 column resolution, features usually seen only on colour monitors costing 3 times our price! Ready to connect to most computers or video outputs. 75Ω composite input with integral audio amp & speaker. Fully tested surplus, sold in little or hardly used condition with 90 day full RTB guarantee. Ideal for use with video recorder or our Telebox ST, and other audio visual uses. **£99**(E) **3/£275**(G)

HI-DEFINITION COLOUR MONITORS

Brand new Centronic 14" monitor for IBM PC and compatibles at a lower than ever price! Completely CGA equivalent. Hi-res Mitsubushi 0.42 dot pitch giving 669 x 507 pixels. Big 28 Mhz bandwidth. A super monitor in attractive style moulded case. Full 90 day guarantee. **Only £149** (E)

20",22" and 26" AV SPECIALS

Superbly made UK manufacture. PIL all solid state colour monitors, complete with composite video & sound inputs. Attractive teak style case. Perfect for Schools, Shops, Disco, Clubs. In EXCELLENT little used condition with full 90 day guarantee.

20"....£155 22"....£170 26"....£185 (F)

COMPUTER SYSTEMS

TATUNG PC2000. Big brother of the famous Einstein. The TPC2000 Professional 3 piece system comprises: Quality high resolution Green 12" monitor. Sculptured 92 key keyboard and plinth unit containing Z80A CPU and all control circuits. PLUS 2 integral TEAC 5.25 80 track double sided disk drives. Generous other features include dual 8" IBM format disk drive support. Serial and parallel outputs, full expansion port, 64K ram and ready to run software. Supplied complete with CP/M, Wordstar and Basic. Brand new and covered by our famous 90 day guarantee and backup. Normal price of this unit is over £1400!

Our price .... only .....£299 (E)

V22 1200 BAUD MODEMS

We got a tremendous buy on further stocks of this popular **Master Systems 2/12** microprocessor controlled V22 full duplex 1200 baud modem - we can now bring them to you at ***half last advertised price!*** Fully **BT approved** unit, provides standard V22 high speed data comm, which at 120 cps, can save your phone bill and connect time by a staggering 75%! Ultra slim 45 mm high. Full featured with LED status indicators and remote error diagnostics. Sync or Async use; speech or data switching; built in 240v mains supply and 2 wire connection to BT. Units are in used but good condition. Fully tested prior despatch, with data and a full 90 day guarantee. What more can you ask for - and at this price!! **ONLY £69** (D)

FLOPPY DISK DRIVES BARGAINS GALORE !

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Massive purchases of standard 5¼" drives enables us to present prime product at industry beating low prices! All units (unless stated) are removed from often brand new equipment and are fully tested, aligned and shipped to you with a 90 day guarantee and operate from +5 & +12vdc, are of standard size and accept the standard 34 way connector.

SHUGART SA405. BRAND NEW £29.95(B)
TANDON TM100-2A IBM compatible DS £39.95(B)
TANDON TM101-4 80 Track DS £49.95(B)
CANON,TEC etc.DS half height.State 40 or 80T £75.00(B)
TEAC FD-55-F.40-80 DS half height. **BRAND NEW** £99.00(B)

3½ INCH BRAND NEW AT £19.95!!

Never before seen price for a 3½" drive. Standard size believed to be by Canon. Brand new and packaged - mint condition! 40 track SS, run from +5 & +12vdc with standard power connector.....Only..... **£19.95 or 2 for £34.50**(B)

CHOOSE YOUR 8 INCH!

Shugart 800/801 SS refurbished & tested £125.00(E)
Shugart 851 double sided refurbished & tested £195.00(E)
Mitsubishi M2894-63 double sided switchable hard or soft sectors- BRAND NEW £250.00(E)

SPECIAL OFFERS!!

Dual 8" drives with 2 megabyte capacity housed in a smart case with built in power supply! Ideal as exterior drives! **Only £499.00** (F)

End of line purchase scoop! Brand new **NEC D2246** 8" 85 megabyte of hard disk storage! Full CPU control and industry standard SMD interface. Ultra hi speed transfer and access time leaves the good old ST506 interface standing. In mint condition and comes complete with manual. Only.....**£399**(E)

MAINS SUPPRESSORS & FILTERS

The "Filtan" from Crotan is a British made high current mains spike suppressor and RF filter in one, capable of handling up to 10 amps! The attractive case has an integral 13 amp socket for your equipment plug and a flying lead terminates in a quality plug (to BS 1363A standard) to go to the mains socket. There is an internal fuse plus one in the plug. Two LED indicators, one for power on and the other lights if the internal fuse fails. Dims:6" x 3" x 2". Brand new. Distributor's price - £65.00! Continental plug version Filt-C. Either only **£15.95 each or 2 for £29.95** (B)

Belling-Lee type L2127 mains RFI filters rated at 250 volts 3 amps maximum. Comes complete with a built in mains cable (English coding), and a three pin miniature non-reversible socket and a mating plug, to go to the equipment. Ideal for those who are bugged by RF interference. Very compact. Dims 3-1/8" x 2.5" x 1.5".....**£3.95 each or 3 for £10** (A)

IBM KEYBOARD DEALS

A replacement or backup keyboard, switchable for IBM PC, PC-XT or PC-AT. LED's for Caps, Scroll & Num Locks. Standard 84 keyboard layout. Made by NCR for the English & US markets. Absolutely standard. Brand new & boxed with manual and key template for user slogans on the function keys. Attractive beige, grey and cream finish, with the usual retractable legs underneath. A generous length of curly cord, terminating in the standard 5 pin DIN plug. A beautiful clean piece of manufacturers surplus. What a deal! **£49** (B) **5/£225** (D)

Brand new and boxed 84 key PC-AT keyboards in standard IBM grey with very attractive mottled finish and "clicky" solid feel keys. 10 function keys on side. English layout and £ sign. Green LEDs for Caps, Scroll & Num locks. **£29.95** (B) **5/£135** (D)

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RECHARGEABLE BATTERIES

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Maintenance free sealed long life. Type A300.

12 volts	12 volts 3 amp/hours	**£13.95**(A)
6 volts	6 volts3 amp/hours	**£ 9.95**(A)
12 volts	Centre tapped 1.8 amp hours. RFE.	**£ 5.95**(A)
12 volts	12 volts 24 amp hours. A200. RFE.	**£29.00**(B)

NICKEL CADMIUM

Quality 12v 4ah cell pack. Originally made for the Technicolor video company. Contains 10 GE top quality D nicad cells in a smart robust case with a DC output connector. Ideal for portable equipment. Brand new. **£19.95**(B)

Ex-equipment NICAD cells by GE. Removed from equipment and in good, used condition: D size 4ah **4 for £5**(B); F size 7ah **6 for £8**(B)

SPECIAL INTEREST

Hitachi 10 pen A3 plotter - HPGL - New	£ 495
Trio 0-18 vdc bench PSU. 30 amps. New	£ 470
DEC VAX11/750 inc. 2 Meg Ram DZ and full documentation, in brand new condition!	£3900
Calcomp 1036 large drum 3 pen plotter	£ 650
Thurlby LA 160A logic analyser	£ 275
1.5kw 115v 60hz power source	£ 950
Wayne Kerr RA200 audio real time freq.res.analyser.	£3000
VG Electronics 1033 Teletext Bridge	£3750
Tektronics R140 NTSC TV test signal standard.	£ 875
Sony KTX 1000 Videotex system - **brand new**	£ 790
DEC LS11/02 CPU board	£ 150
ADDS 2020 VDU terminals - **brand new**	£ 225

ANALOG to DIGITAL and DIGITAL to ANALOG CONVERTERS

Brand new and boxed Amdek ADA-200 analog to digital and digital to analog converter packed full of features: Interfaces to most popular PC's; 2 channel input & output by software selection; integral input/output filters and address decoder; input pre-amp; over-level detecter; trigger signal detecter circuit; expansion availability and more. Input level 25mv to 50v p-p. Max. sampling frequency is 44khz and input gain variable to 200 times. Designed for use with almost any personal computer, allowing conversion of analog signals to digital data for processing by the computer plus conversion back to analog signals. The 26 page manual supplied includes data on the correct connection to various CPU's including the 8080, Z-80, 6800, 6502 and 6809 families plus data and schematics for user modification of I/O filter cut-off frequencies. Complete with 50 way ribbon cable and edge connector to go to the computer and power cable. All for a fraction of the regular price! **£49.95** (C)

POWER SUPPLIES

All PSUs 220-240vac input and are BRAND NEW unless stated. Many types ranging from 3v to 10kv always in stock.

Fine OP-8619 20 watts switch mode. +5v @ 2a. +12v @ 1a. -12v @ 0.1a. 5" x 3" x 1-1/2". **£15.95(B)**
Astec AC-8151 40 watts. Switch mode. +5v @ 2.5a. +12v @ 2a. -12v @ 0.1a. 6-1/4" x 4" x 1-3/4". **£19.95(B)**
Greendale 19AB0E 60 watts switch mode.+5v @ 6a,±12v @ 1a,±15v @ 1a. RFE and fully tested.11 x 20 x5.5cms. **£24.95(C)**
Conver AC130. 130 watt hi-grade VDE spec.Switch mode.+5v @ 15a,-5v @ 1a,±12v @ 6a.27 x 12.5 x 6.5cms **£49.95(C)**
Boshert 13090. Switch mode.Ideal for drives & system. +5v@ 6a, +12v @ 2.5a, -12v @ 0.5a, -5v @ 0.5a. **£29.95(B)**
Farnell G6/40A. Switch mode. 5v @ 40a.Encased **£95.00(C)**
Farnell G24/5S. As above but 24v @ 5a. **£65.00(C)**

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Please specify 110 or 240 volts for AC fans.

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10 inch	Round.3½ thick. Rotron 110v	**£10.95**(B)
62 mm	DC 1" thick.No.812 for 6/12v.814 24v.	**£15.95**(A)
92 mm	DC 12v. 18 mm thick.	**£14.95**(A)
4 inch	DC 12v. 12w 1½" thick	**£12.50**(B)
4 inch	DC 24v 8w. 1" thick.	**£14.50**(B)

THE *AMAZING* TELEBOX!

Converts your colour monitor into a QUALITY COLOUR TV!!

TV SOUND & VIDEO TUNER!

Brand new high quality, fully cased, 7 channel UHF PAL TV tuner system. Unit simply connects to your TV aerial socket and colour video monitor turning same into a fabulous colour TV. Dont worry if your monitor does'nt have sound, the TELEBOX even has an integral audio amp for driving a speaker plus an auxillary output for Headphones or Hi Fi system etc. Many other features: LED Status indicator, Smart moulded case, Mains powered, Built to BS safety specs. Many other uses for TV sound or video etc. Supplied BRAND NEW with full 1 year guarantee.

Telebox ST for composite video input monitors.....**£29.95**(B)
Telebox STL as ST but with integral speaker.....**£34.95**(B)
Telebox RGB for analogue RGB monitors.....**£65.95**(B)
NOT suitable for IBM or Clone type colour monitors.
PAL overseas version please call. SECAM not available.

BRAND NEW PRINTERS

Epson MX-80 F/T One of the most popular printers around! Bi-directional printing with full logic seeking. 9 x 9 dot matrix for enlarged, bold, condensed etc. Standard parallel interface. Brand label removed from front. Handles tractor, fanfold and individual paper. OK with IBM PC and most others. A tremendous buy! **FOR A LIMITED TIME ONLY.....£129.00** (E)

DED DPG21 miniature ball point pen printer plotter mechanism with full 40 characters per line. Complete with data sheet which includes circuit diagrams for simple driver electronics.....**£49**(B)

Centronics 150 series. Always known for their reliability in continuous use - real workhorses in any environment. Fast 150 cps with 4 fonts and choice of interfaces.

150-SN up to 9.5" paper.....**£155.00**(E)
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AC127	0.20	BC107B	0.11	BC207B	0.25	BD131	0.42	BD534	0.45	BF271	0.26	BFY90	0.77	GEX542	9.50	R2010B	1.45	TIP146	2.75	2SC496	0.80
AC128	0.28	BC108	0.10	BC208B	0.20	BD132	0.42	BD535	0.45	BF273	0.18	BLY48	1.75	MJ3000	1.98	R2322	0.58	TIP161	2.95	2SC784	0.75
AC128K	0.32	BC108B	0.12	BC212	0.09	BD133	0.50	BD575	0.95	BF335	0.35	BR100	0.45	MJE340	0.40	R323	0.66	TIP2955	0.80	2SC785	0.75
AC141	0.28	BC109	0.10	BC212L	0.09	BD135	0.30	BD587	0.95	BF336	0.34	BR101	0.49	MJE350	0.75	R2540	2.48	TIP3055	0.55	2SC789	0.55
AC141K	0.34	BC109B	0.12	BC213	0.09	BD136	0.30	BD588	0.95	BF337	0.29	BR103	0.55	MJE520	0.48	RCA16029	0.85	TIS91	0.20	2SC9310	0.95
AC142K	0.45	BC114A	0.09	BC213L	0.09	BD137	0.32	BD698	1.50	BF338	0.32	BR303	0.95	MJE2955	0.95	RCA16039	0.85	TV106	1.50	2SC937	1.95
AC176K	0.31	BC115	0.55	BC214	0.09	BD138	0.30	BD701	1.25	BF355	0.37	BRC4443	1.15	MPSA13	0.29	RCA161B1	0.85	TV106/2	1.50	2SC1034	4.50
AC187	0.25	BC116A	0.50	BC214C	0.09	BD139	0.32	BD702	1.25	BF362	0.38	BRY39	0.45	MPSA92	0.30	RCA16334	0.90	ZRF0112	16.50	2SC1096	0.80
AC187K	0.28	BC117	0.19	BC214L	0.09	BD140	0.30	BD707	0.90	BF363	0.65	BSW64	0.95	MRF237	4.95	RCA16335	0.85	2N1308	1.35	2SC1106	2.50
AC188	0.25	BC119	0.24	BC237B	0.15	BD144	1.10	BDX32	1.50	BF371	0.25	BSX60	1.25	MRF450A	15.95	RCA16572	0.85	2N1711	0.30	2SC1124	0.95
AC188K	0.37	BC125	0.25	BC238	0.15	BD150C	0.29	BDX53B	1.65	BF394	0.19	BT100A/02	0.85	MRF453	17.50	S2060D	0.95	2N2219	0.28	2SC1162	0.95
ACY17	1.15	BC140	0.31	BC239	0.15	BD159	0.65	BF115	0.35	BF422	0.32	BT106	1.49	MRF454	26.50	SKE5F	1.45	2N2626	0.55	2SC1172Y	2.20
AD142	2.50	BC141	0.25	BC251A	0.15	BD160	1.50	BF119	0.65	BF423	0.25	BT116	1.20	MRF455	17.50	T6021V	0.45	2N2905	0.40	2SC1173	1.15
AD149	1.50	BC142	0.21	BC252A	0.15	BD166	0.50	BF127	0.39	BF457	0.32	BT119	3.15	MRF475	2.95	T6027V	0.45	2N3053	0.40	2SC1306	1.75
AD161	0.50	BC143	0.24	BC258	0.25	BD179	0.72	BF154	0.20	BF458	0.36	BT120	1.65	MRF477	14.95	T6029V	0.45	2N3054	0.59	2SC1364	0.50
AD162	0.50	BC147B	0.12	BC258A	0.39	BD182	0.70	BF158	0.22	BF467	0.68	BU105	1.95	MRF479	5.50	T6036V	0.55	2N3055	0.52	2SC1413A	2.50
AF106	0.50	BC148A	0.09	BC284	0.30	BD201	0.50	BF160	0.27	BF493	0.35	NU108	1.69	OC16W	2.50	T9002V	0.55	2N3702	0.12	2SC1449	0.50
AF114	2.50	BC149	0.09	BC300	0.30	BD202	0.50	BF173	0.22	Bf4995	0.23	BU124	1.25	OC23	9.50	T9011V	0.75	2N3703	0.12	2SC1628	0.75
AF115	1.95	BC153	0.30	BC301	0.30	BD203	0.50	BF177	0.38	Bf4997	0.25	BU125	1.25	OC25	1.50	T9015V	2.15	2N3704	0.12	2SC1678	1.50
AF116	2.50	BC157	0.12	BC303	0.26	BD204	0.70	BF178	0.26	BFR39	0.23	BU126	1.60	OC26	1.50	T9034V	2.15	2N3705	0.20	2SC1945	3.75
AF117	2.50	BC159	0.09	BC307B	0.09	BD222	0.46	BF179	0.34	BFR40	0.23	BU204	1.55	OC28	5.50	T9038V	3.95	2N3706	0.12	2SC1953	0.95
AF118	3.50	BC161	0.55	BC327	0.10	BD223	0.59	BF180	0.29	BFR81	0.25	BU205	1.30	OC29	4.50	THY15/80	2.25	2N3708	0.12	2SC1957	0.80
AF121	0.60	BC170B	0.15	BC328	0.10	BD225	0.48	BF181	0.29	BFR88	0.30	BU208	0.95	OC32	5.50	THY15/85	2.25	2N3733	9.50	2SC1969	2.95
AF124	0.65	BC171	0.09	BC337	0.10	BD232	0.35	BF182	0.29	BFR90	1.50	BU208A	1.15	OC42	1.50	TIP29	0.40	2N3773	2.75	2SC1985	1.50
AF125	0.65	BC172B	0.10	BC338	0.09	BD233	0.35	BF183	0.29	BFR91	1.75	BU208D	1.35	OC44	1.25	TIP29C	0.42	2N3792	1.35	2SC2028	1.15
AF126	0.45	BC173B	0.10	BC347A	0.13	BD236	0.49	BF184	0.35	BFT42	0.35	BU326	1.20	OC45	1.00	TIP30C	0.43	2N4280	3.50	2SC2029	1.95
AF127	0.65	BC174	0.09	BC461	0.35	BD237	0.40	BF185	0.28	BFT43	0.35	BU326S	1.50	OC70	1.00	TIP31C	0.55	2N4427	1.95	2SC2078	1.45
AF139	0.40	BC177	0.15	BC47B	0.20	BD242	0.65	BF195	0.11	BFW10	0.55	BU407	1.24	OC71	0.75	TIP32C	0.42	2N4444	1.15	2SC2091	0.85
AF150	0.60	BC178	0.15	BC527	0.20	BD246	0.75	BF197	0.11	BFW11	0.75	BU408	1.50	OC72	2.50	TIP33C	0.95	2N5294	0.42	2SC2098	2.95
AF178	1.95	BC182	0.10	BC547	0.10	BD376	0.32	BF198	0.16	BFW16A	1.15	BU426A	0.75	OC75	1.50	TIP34B	0.95	2N5296	0.48	2SC2166	1.95
AF239	0.42	BC182LB	0.10	BC548B	0.10	BD379	0.45	BF199	0.14	BFW61	0.60	BU500	2.25	OCB1	1.00	TIP41A	0.45	2N5298	0.60	2SC2314	0.80
ASY27	0.85	BC183	0.10	BC549A	0.10	BD41D	0.65	BF240	0.20	BFW92	0.85	BU508A	1.95	OC84	1.50	TIP41C	0.45	2N5496	0.95	2SC2371	0.36
ASY77	1.50	BC183L	0.09	BC550	0.14	BD434	0.65	BF241	0.15	BFX29	0.30	BU526	1.90	OC139	12.50	TIP42C	0.47	2N5641	16.50	2SC9310	0.95
				BC557	0.08	BD436	0.60	BF245	0.30	BFX84	0.26	BU807	2.25	OC171	4.50	TIP47	0.65	2N5643	16.50	2SK19	0.55
				BC558	0.10	BD437	0.60	BF256LC	0.35	BFX85	0.32	BUY20	2.15	OC200	4.50	TIP48	0.65	2SA329	0.95	2SK33	0.55
				BC639/10	0.30	BD438	0.75	BF257	0.28	BFX86	0.25			OC201	5.50	TIP50	0.65			3SK88	0.48
				BCY33A	19.50	B0510	0.95			BFY1B	1.35			OC205	10.00	TIP120	0.60				

Integrated Circuits

AN103	2.50	AN7145M	3.95	LA4102	1.50	MB3756	2.50	SAS590	2.75	STK437	7.95	TA7609P	3.95	TBA550Q	3.50	TDA1001	2.95	TOA2581	2.95	UPC1181H	1.25
AN124	2.50	AN7150	2.95	LA4140	2.95	MC1307P	1.00	SL901B	7.95	STK439	7.95	TA7611AP	2.95	TBA560C	1.45	TDA1003A	3.95	TOA2582	2.95	UPC1182H	1.50
AN214	2.50	AN7151	2.50	LA4031P	1.95	MC1310P	1.95	SL917B	6.65	STK461	11.50	TA7629	2.50	TBA560Q	1.45	TDA10005	2.25	TOA2593	2.95	UPC1185H	3.95
AN214Q	2.50	BA521	1.50	LA4400	3.50	MC1327	1.70	SL1310	1.80	STK463	11.50	TAA310A	3.50	TBA570	1.00	TDA1035	2.50	TOA2600	6.50	UPC1191V	1.50
AN236	1.95	CA1352E	1.75	LA4420	3.50	MC1327Q	0.95	SL1327	1.10	STK0015	7.95	TAA320A	3.50	TBA651R	2.50	TDA1037	1.95	TOA2610	2.50	UPC1350C	2.95
AN239	2.50	CA3086	0.46	LA4422	1.50	MC1351P	1.75	SL1327Q	1.10	STK0029	7.95	TAA350A	2.95	TBA673	1.95	TDA1044	2.15	TOA2611A	1.95	UPC1353C	2.45
AN240P	2.80	CA3123E	1.95	LA4430	2.50	MC1352P	1.00	SN7414	1.50	STK0039	7.95	TAA550B	0.95	TBA750	1.95	TDA1170	1.95	TOA2640	3.50	UPC1360	2.95
AN247	2.50	CA313EM	2.50	LA4461	3.95	MC1357	2.35	SN7421	0.85	TA7061AP	1.50	TAA570	1.95	TBA750Q	2.85	TDA1180	2.15	TOA2655	4.50	UPC1365C	3.95
AN260	2.95	CA3140B	2.80	LC7120	3.25	MC1358	1.58	SN76110N	0.89	TA7072	2.65	TAA6320S	2.95	TBA800	0.89	TDA1270Q		TOA2680A	2.75	UPC2002H	1.95
AN262	1.95	CA3140T	1.15	LC7130	3.50	MC1496	1.75	SN76115N	1.25	TA7073	3.50	TAA661B	1.95	TBA810AS			3.95	TOA2690	2.45	UPD2114LC	2.50
AN264	2.50	ETT6016	2.80	LC7131	5.50	MC1723	0.50	SN76131N	1.30	TA7108P	1.50	TAA700	1.70		1.65	TDA1327	1.70	TOA3310	2.95	555	0.35
AN271	3.50	HA1137W	1.95	LC7137	5.50	MC3357	2.75	SN76260N	2.95	TA7120P	1.65	TAA930	3.95	TBA810P	1.85	TDA2002	0.95	TOA3510	3.50	556	0.40
AN301	2.95	HA1156W	1.50	LM323K	4.95	MC3401L	2.50	SN76227N	1.05	TA7129P	2.50	TBA120AS/B/C		TBA820M	0.75	TDA2003	1.95	TOA3560	3.95	723	0.50
AN303	3.50	HA1306	1.50	LM324N	0.45	MC14106P	2.95	SN76228N	2.95	TA7130P	1.50		1.00	TBA820Q	1.45	TDA2010	1.95	TOA4050	2.95	741	0.35
AN313	2.95	HA1322	1.95	LM380N	1.50	MC14518CP	2.50	SN76533N	1.65	TA7137P	1.00	SA/SB/T/U		TBA920	1.85	TDA2020	2.95	TOA4600	2.50	747	0.50
AN315	2.95	HA1339A	2.95	LM380NB	2.95	MC14528B	1.95	SN76660N	1.15	TA7146P	1.50	TBA395	1.50	TBA950/2X		TDA2030	2.80	TOA9503	3.15	748	0.35
AN316	3.95	HA1366W	2.75	LM383T	2.95	MC14538BCP	1.95	SN76666N	0.90	TA7176AP	2.95	TBA396	0.75		1.50	TDA2040	3.95	TEA1009	1.35	7808	0.50
AN331	3.95	HA1406	1.95	LM390N	3.50	MC14539BCP	1.95	STK011	7.95	TA7203	2.95	TBA440N	2.85	TBA990	1.49	TDA2050	6.50	UPC41C	3.50	7805	0.50
AN342	2.95	HA1551	2.95	LM1011	3.15	MC14584BCP	1.95	STK014	7.95	TA7204P	2.15	TBA480Q	1.95	TBA990Q	1.49	TDA2052	3.95	UPC566H	2.95	7812	0.50
AN362L	2.50	LA1201	0.95	M5155L	2.95	MC14585BCP	2.50	STK015	5.95	TA7205AP	1.15	TBA510	2.50	TCA270	2.50	TDA2061	3.50	UPC575C2	1.50	7815	0.50
AN612	2.15	LA3201	0.95	M51513L	2.30	MC14724BCP	2.95	STK018	7.95	TA7208	1.95	TBA510Q	2.80	TCA270SQ		TDA2080	1.95	UPC1001H	1.95		
AN6362	3.95	LA4101	0.95	M51521L	1.50	MC14731BCP	2.95	STK025	11.95	TA7222AP	1.80	TBA520	1.10		2.50	TDA2090	2.95	UPC1020H	2.95		
AN7140	3.50			MB3705	1.50	SAS560S	1.75	STK032	7.95	TA7227P	4.25	TBA520Q	1.10	TCA650	2.50	TDA2092	3.95	UPC1024H	1.50		
AN7145	3.50			MB3712	2.00	SAS570S	1.75	STK078	11.95	TA7228P	1.95	TBA530Q	1.10	TCA760	2.50	TDA2093	2.95	UPC1025H	1.95		
						SAS580	2.85	STK085	8.95	TA7310P	1.80	TBA540	2.80	TCA800	6.95	TDA2512	2.95	UPC1028H	1.95		
								STK415	7.95	TA7314P	2.95	TBA540Q	2.80	TCA830S	1.95	TDA2522	2.95	UPC1032H	0.95		
								STK435	7.95	TA7321P	2.25			TCA900	2.50	TDA2523	2.95	UPC1158H	0.75		
														TCA940	1.65	TDA2524	2.95	UPC1167C2	1.95		
														TDA440	2.20	TDA2530	1.95				
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EN92 4.50
EY51 0.80
EY70 7.50
EY81 2.95
EY82 1.15
EY83 1.50
EY84 5.95
EY86/87 0.65
EY88 1.50
EY91 5.50
EY500A 2.95
EY802 0.70
EZ35 1.00
EZ40 3.50
EZ41 3.50
EZ80 0.75
EZ81 1.50
EZ90 1.50
FW4-800 4.50
FX2535 195.00
G55/1K 9.00
G180/2M 6.95
G240/2D 9.00
GC10B 17.50
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GN10 15.00
GS10H 12.00
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GU20 35.00
GU50 17.50
GXU1 13.50
GXU3 24.00
GXU50SS 14.50
GY501 1.50
GY802 1.50
GZ32 4.50
GZ33 4.50
GZ34 4.50
GZ37 4.50
HBC90 1.95
HL41 3.50
HL90 3.50
KT8C 7.00
KT33C 3.50
KT36 2.95
KT44 5.95
KT45 5.95
KT61 5.00
KT63 2.95
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KT66 GEC 25.00
KT66 TEON-EX 5.00
KT67 9.00
KT77 Gold lion 11.95
KT81 7.00
KT88 USA 12.95
KT88 Selectron 15.00
KTW61 2.50
KTW62 2.50
KTW63 2.00
KTZ63 2.50
LB7-20 95.00
LS9B 5.95
M508 195.00
M5143 155.00
M5199 295.00
M8079 6.00
M8082 7.50
M8083 3.25
M8091 7.50
M8096 3.00
M8098 5.50
M8099 5.00
M8136 7.00
M8137 7.95
M8161 6.50
M8162 5.50
M8163 5.50
M8190 4.50
M8195 6.50
M8196 5.50
M8204 5.50
M8223 4.50
M8224 2.00
M8225 3.95
ME1400 3.50
ME1401 9.50
ME1402 29.50
MHLD6 4.00
MP25 195.00
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OA2 1.50
OA2WA 2.50
OA3 2.50
OB2 1.50
OB2WA 2.50
OC3 2.50
OD3 2.50
OM4 2.50
OM5B 3.00
OM6 1.75
DRP43 2.50
DRP50 3.95
P61 2.50
P41 2.50
PABC80 0.95
PC86 0.75
PC88 0.75
PC97 1.10
PC900 1.25
PCC84 0.40
PCC85 0.55
PCC88 0.95
PCC89 0.70
PCC189 0.70
PCC805 0.70
PCC806 0.80
PCE82 0.80
PCF80 0.65
PCF82 0.50
PCF84 0.65
PCF86 1.20
PCF87 1.25
PCF200 1.80
PCF201 1.80
PCF801 1.35
PCF802 0.65
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PCF806 1.00
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PEN40D 3.00
PEN45 3.00
PEN45DD 3.00
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PFL200 0.95
PL36 1.75
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PL81 1.50
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PL83 0.85
PL84 0.85
PL500 1.50
PL504 1.50
PL508 1.50
PL509 4.85
PL519 4.95
PL802 6.00
PL802T 3.50
PL820 2.95
PY32 0.50
PY33 0.50
PY81 0.85
PY82 0.85
PY83 0.85
PY88 0.95
PY500A 1.95
PY800 0.95
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QB3-300 72.00
QB3-1750 139.50
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QQE02-5 19.50
QQE03-12 7.95
QQE03-20 35.00
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QS150/30 1.15
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QS1205 3.95
QS1213 5.00
QU37 9.50
QV03-12 6.50
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R10 4.00
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RG3-1250A 35.00
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SP61 3.50
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TB2-300 195.00
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TD03-10/D/E/F 35.00
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TY6800 125.00
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TY8-600W 365.00
U19 8.50
U26 0.90
U35 3.50
U37 9.00
U41 6.95
U50 3.00
U82 3.00
U191 0.70
U192 1.00
U193 1.00
U251 2.50
U801 3.50
UABC80 1.00
UAF42 1.95
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UBC81 1.50
UBF80 0.95
UBF89 1.00
UBL21 2.95
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UCH42 3.95
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UCL81 1.00
UCL82 1.75
UCL83 2.50
UF41 2.25
UF42 2.25
UF80 1.75
UF85 1.20
UF89 2.00
UL44 3.50
UL84 1.95
UL85 0.85
UM80 1.65
UM85 1.65
UU5 3.50
UU6 5.00
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UY41 3.50
UY85 0.70
V235A/1K 250.00
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1A3 4.50
1AE4 3.50
1AX2 3.50
1B22 10.00
1B27 55.00
1B3GY 1.95
1B35A 45.00
1K3 2.50
IL4 2.50
1N5GT 2.50
1P28 25.00
1R5 1.50
1S5 1.50
1T4 1.50
1U4 1.75
1U5 1.50
1X25 2.50
2A3 12.15
2AS15A 11.50
2B7 4.50
2B22 69.50
2C36 70.00
2C39A 25.00
2C39BA 39.50
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5R4GY 4.95
5R4WGY 5.95
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5T8A 1.95
5U4G 2.95
5U4GB 4.50
5V4G 2.50
5W4 4.95
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5Z4G 2.50
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6AK5 1.95
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6AM5 4.50
6AM6 1.95
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6AS5 1.50
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6AT8 1.75
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6AU5GT 4.50
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6BG6G 3.00
6BH6 1.95
6BH8 1.50
6BJ6 1.50
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6BL6 85.00
6BL8 1.15
6BM6 115.00
6BN6 1.65
6BN8 3.95
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6BW6 3.95
6BW7 1.50
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6BZ7 2.95
6C4 1.95
6C5 2.50
6C6 3.50
6C8G 2.50
6C9 4.95
6CA4 4.95
6CA7 3.50
6CB5 3.95
6CD6GA 4.50
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6CG7 GE 5.25
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6CW4 6.00
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6DJ8 Special 3.50
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6DQ5 11.95
6DQ6B 2.50
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6DW4B 3.50
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6EM5 2.50
6EM7 GE 4.50
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6EV7 2.95
6EW6 1.50
6EW7 4.50
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6F7 5.50
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6F14 1.00
6F17 2.75
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6F24 1.25
6F25 1.25
6F28 1.25
6F32 1.25
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6FH5 8.50
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6FL2 4.50
6FQ7 3.50
6FQ7 GE 5.25
6GE5 3.95
6GH8A 2.50
6GJ7 0.85
6GK6 3.95
6GM6 2.65
6GS7 2.15
6GV8 0.95
6GW8 2.50
6GY5 4.95
6GY6 2.50
6H1 9.50
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6HQ5 3.50
6HS6 4.95
6HS8 2.95
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6J5GT 2.50
6J6 2.00
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6JM6 9.50
6JU8A 2.50
6JS6C GE 10.95
6JZ8 5.95
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GL6GC USA 9.50
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6L19 3.95
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6V6GT 2.50
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6X2N 1.00
6X4 1.50
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7A6 4.50
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14B6 4.50
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16H 0.40
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17A8 3.50
17AX4GTA 1.95
17BE3 2.50
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25DQ6B 2.95
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30C17 0.40
30C18 1.45
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30FL12 0.95
30FL13 1.10
30FL14 1.25
30L1 0.45
30L15 0.50
30L17 0.50
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30P12 1.00
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5642 9.50
5643 9.50
5651 2.50
5654 1.95
5670 3.25
5672 4.50
5675 28.00
5678 7.50
5687 4.50
5696 4.50
5702 3.50
5704 3.50
5718 3.50
5725 2.50
5726 2.50
5727 2.50
5749 2.50
5750 1.85
5751 2.95
5763 6.50
5814A 3.25
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5899 4.50
5963 1.75
5965 2.15
6057 3.75
6058 2.50
6060 2.25
6072 6.95
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6080WA 9.50
6132 10.50
6136 2.50
6146B 9.50
6146B GE 15.00
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6156 125.00
6157 2.50
6158 3.20
6166 650.00
6189 4.50
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6350 3.50
6360 4.50
6386 14.50
6442 75.00
6463 7.50
6550A 9.95
6550A GE 13.95
6870 11.50
6883B GE 14.95
6973 10.50
7025 2.50
7025S 6.95
7027A GE 12.50
7092 125.00
7119 9.00
7189 5.50
7199 10.50
7247 3.50
7475 5.00
7486 155.00
7527 125.00
7551 8.50
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7586 15.00
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STRAIGHT & LEVEL

ON THE COVER

On the front cover this month is the CRF-V21 fax/RTTY receiver, available from Sony. This receiver covers the world-wide frequency range, and is equipped with various functions.

The radio section of the CRF-V21 has a frequency range covering LW/MW/SW, from 9kHz to 29.99999MHz. FM is also available, from 87.5MHz to 108MHz. SSB and narrow FM can be received, therefore, not only general radio broadcasts but amateur transmissions can be heard.

The fax/RTTY satellite fax broadcast section enables the user to receive and print graphic information, such as weather charts or weather pictures. RTTY data is produced in either letters or pictures.

Also available as standard is an automatic timer function which is used to pre-program the rig to receive and print graphic information in your absence.

So as to avoid missing a station, you can 'priority tune' it, even though you are receiving another station. An NP-22H rechargeable battery is supplied so that the CRF-V21 can be used outdoors.

The CRF-V21 measures 412mm × 285mm × 169mm (WHD) and weighs 9.5kg. The CRF-V21 costs £2,999.99 including VAT.

For further information contact *Sony Consumer Products Company UK, Sony House, South Street, Staines, Middlesex TW18 4PF. Tel: (0784) 467000.*

PROTRANS DESIGN SYSTEM

Voltech Instruments have begun marketing the Protrans software package on behalf of Proware. It is a complete design program for 50Hz mains single-phase power transformers using standard E/I metric and imperial laminations.

Protrans designs transformers rated from less than 0.5VA to greater than 5000VA (up to 9999VA with reduced accuracy). It allows for designs with one or two primary windings, each with up to three voltage taps, and ten secondary windings up to 999V or 99.99A output.

The software package edits designs by changing the lamination pattern, grade, flux density, bobbin or stack size. Finished designs can be stored for future reference.

A comprehensive printout of the design and construction materials required is supplied, and on-line information includes help screens and function keys for DOS shell, restart, library view and quit.

The package runs on the IBM PC/XT and PS2 or compatibles, and requires a minimum of 256K bytes of RAM.

For further information contact *Voltech Instruments, 78 Gordon Road, Carshalton Beeches, Surrey SM5 3RE. Tel: 081-647 7834.*

PCB FAULT DIAGNOSIS

Compute Era Systems Limited (CES), as UK distributor for ABI Electronics, have introduced a range of stand-alone PCB fault diagnosis equipment.

The DDS-40 is designed to test digital devices with up to forty pins. This stand-alone system provides many features to enable rapid testing of digital ICs whilst in circuit. An integral VDU comes as standard.

No pre-testing, programming of fixturing is required for standard devices, so both DDS-40 and DDS-40XP offer functional testing out of circuit as well as in circuit. Save and compare functions plus programming in Basic are features of the DDS-40P and XP versions.

All models in the range incorporate features which induce V-I curve testing, logic trace function, unknown device search mode, and an on-screen 'help' facility.

For further information contact *Compute Era Systems Limited, 18th Floor, Station House, Harrow Road, Wembley, Middlesex HA9 6DE. Tel: 081-903 8657/6068.*

AIRKNIFE TECHNOLOGY

Hollis Europe have introduced an enhanced version of its hot AirKnife solder de-bridging and non-destruct stress-test system.

The AccuKnife system significantly enhances processing capabilities for wave-soldering systems. The system also features a digitally displayed temperature control and built-in safety limit switch, which checks for high temperatures.

In addition to increased air-pattern uniformity, the AccuKnife is conveyor mounted, as opposed to machine-frame mounted. This allows it to be positioned closer to the board and wave exit point than its predecessors, allowing significantly lower operating pressures to be used. As a result, this system is less likely to blow solder from through-plated holes or those with hole-to-lead ratios.

The better performance of AccuKnife is linked to the greater use of 25mil pitch SMDs (Surface Mount Devices), increased densities and widening interest in low temperature soldering.

Uniformity of airflow is maintained within ±2.7 percent and the exit temperature of the airstream within ±2 percent.

For further information contact *Hollis Europe Limited, Unit 1, Riverside, Medway City Estate, Strood, Kent ME2 4DP. Tel: (0634) 716733.*

10kW WATTMETER

STC Instrument Services have introduced the feedback electronic wattmeter, type EW604, which provides wide-ranging measurements at low cost.

The instrument will measure waveforms with any power factor from 250mW to 10kW (fsd), while the frequency range is from dc to

All the latest news, views, comment and developments on the amateur radio scene

20kHz. Voltage capability is 5V to 1000V and current range is 50mA to 10A.

Operation is extremely simple. Once the current and voltage ranges have been selected the watts measurement = meter reading × amps × volts.

For further information contact *STC Instrument Services, Dewar House, Central Road, Harlow, Essex CM20 2TA. Tel: (0279) 641641.*

APPEAL

Peter Dolphin G3ELH has launched an appeal on behalf of James Kalassery VU2ARL, who runs a radio club in Cochin in India.

The Society for the Promotion of Amateur Radio have considerable difficulty in obtaining technical books and magazines for teaching beginners in India.

If you would like to donate books that you no longer require, write to: *the Editor, Zero-Beat, PO Box 2437, Kannanthanam Chambers, Cochin 682 016, India.*

USERS' GROUP

W E Moore of Rossendale is planning to set up an Eddystone Users' Group and publish facts and data from Eddystone factory manuals in a group newsletter. The group will operate on a non-profit-making basis.

Send an sae for further information to: *W E Moore, 112 Edgeside Lane, Waterfoot, Rossendale BB4 9TR.*

BOOK REVIEW

Ian Poole G3YWX is the author of **An Introduction to VHF/UHF for Radio Amateurs**.

Although the book is written with the newcomer in mind, giving an outline of VHF/UHF operation, the experienced VHF/UHF operator will find it a useful reference.

It comprises nine chapters and includes propagation, aerials, transmitters and receivers, DXing, mobile and repeater operation.

Trafford Amateur Radio Club's second Great Northern Radio Rally at the G-MEX exhibition centre

An Introduction to VHF/UHF for Radio Amateurs (ISBN 0 85934226 3) costs £3.50, and is published by Bernard Babani (Publishing) Ltd, The Grampians, Shepherds Bush Road, London W6 7NF.

G-MEX RALLY

Around 3,000 radio amateurs and electronics enthusiasts attended Trafford Amateur Radio Club's second Great Northern Radio Rally, which was held at the G-MEX exhibition centre in Manchester on 4 March 1990.

Nearly 100 traders who attended the event reported that it was a great success, especially the antenna dealers, whose largest arrays were dwarfed by the huge arched roof of the former central railway station building.

CLUB NEWS

The Horndean and District Amateur Radio Club meets on the first Thursday of the month at 7.30pm at the Horndean Community School, Barton Cross (off Catherington Lane), Horndean, near Portsmouth, Hampshire.

For further information contact *S W Swain, 35 Mavis Crescent, Havant, Hants PO9 2AE.*

The Plymouth Radio Club will hold its annual Radio and Electronics Fair at Plymstock School, Church Road, Plymstock, Plymouth, Devon. Doors open at 10.00am.

The fair will include a RSGB Zonal Meeting, Morse testing, bring and buy and a radio car boot sale. Also available are refreshments and a licensed bar.

For further information contact *J Fisher G0IVZ. Tel: (0752) 340946.*

The Doncaster and District Raynet Group will hold their Radio Rally and Electronics Fair at Bircotes Sports Centre, Whitehouse Road, Bircotes, near Bawtry, Doncaster, on 28 May 1990. Doors open at 11.00am (10.30am for the disabled).

Booking forms and further information are available from: *P Smith, 23 Florence Avenue, Balby, Doncaster. Tel: (0302) 857 526.*

The Ripon & District Amateur Radio Society will hold the thirty-third Northern Mobile Rally at the Great Yorkshire Showground, Harrowgate, North Yorkshire, on 20 May 1990. Doors open at 10.30am.

For further information contact *the rally manager, Mike G0MKK. Tel: (0423) 564353/507653.*

The Hornsea Amateur Radio Club meets every Wednesday at The Mill, Atwick Road, Hornsea, East Yorkshire.

The Club's programme of events for May includes:

On 16 May, Richard G4Y8V will give a lecture called 'Amiga' Further Revelations; on the weekend of 19-20 May there will be a 2m contest; and on 23 May, Rick G1YVL will give a lecture called Power Factor.

For further information contact *Jeff G4IGY. Tel: (0964) 533331.*

The Bedford and District Amateur Radio Club will organise a special event station at the Bedford River Festival on 28 May 1990. It is intended to operate on 2m, 6m and as many of the HF bands as possible.

For further information contact *the club chairman, L R Smith G1ZOJ, 1 Perring Close, Sharnbrook, Bedford.*

A USER REVIEW

THE ICOM IC-765 HF ALL BAND TRANSCEIVER

The IC-765 HF all band transceiver is the latest addition to Icom's stable and comes second in line to the 'flagship' of the range, the IC-781. I have always been very impressed with Icom's products and this rig carries their good name still further forward.

The IC-765 is painted in a dark-grey matt finish with the front panel a darker shade of grey. The front rubber supports on the base of the rig have extendable legs which raise the front of the unit to a more comfortable operating position if required.

If you examine the specifications, you will see that the IC-765 has to be tried in order to appreciate all its facilities. In my view, this rig has all the facilities I would want for amateur radio use.

The front panel

On the front panel are thirteen rotary switches, of which three are concentrically mounted and have two functions. Three others are of the switched type, and these are: AGC, meter and PRE/ATT (preamplifier and attenuator). The concentric rotary switches worked, from left to right: AF/RF gain, CW pitch/squelch and mic gain/RF power.

Above these are five horizontally mounted switches operating, from left to right: NB (noise blanker), NB wide, fast/slow (varies the keying speed), VOX and full BK-IN (selects semi or full break-in).

Above these are three rotary controls, from right to left: NB level, elec-key speed (used in conjunction with the fast/slow switch) and VOX delay.

The bottom left-hand side of the panel comprises five small controls, from left to right these are: a push-switch for the UT-36 voice synthesiser unit, Rx tone, monitor gain, VOX gain and mic tone. These four switches each have a control rod which appears when the switch is released after being pressed. It allows the switch to be rotated to any position and then pressed back into the panel where it is retained by a ratchet.

The five different mode switches are in a vertical column on the left-hand side of the tuning knob. An orange-coloured data switch is provided to inhibit the microphone input, except when the PTT switch is pushed. It is also used for packet or AMTOR.

The top left-hand area of the panel contains the main power on/off switch, the transmit/receive switch and three vertical push on/push off microswitches. From left to right these are: compression, moni (monitor) and tuner.

There are two LEDs above the tuner switch, one is coloured green and the other red; the red LED is labelled wait and the green one is labelled tuner.

To the right of the tuning knob is the keyboard, labelled from one to zero, which includes the decimal point and ent (enter).

Specifications of the IC-765

General

Frequency coverage	
Receive	0.1 - 30MHz
Transmit	1.80000 - 1.99999MHz
	3.40000 - 4.09999MHz
	6.90000 - 7.49999MHz
	9.90000 - 10.49999MHz
	13.90000 - 14.49999MHz
	17.90000 - 18.49999MHz
	20.90000 - 21.49999MHz
	24.40000 - 25.09999MHz
	28.00000 - 30.00000MHz
Modes	LSB, USB, CW, AM, FM, RTTY
Power supply requirements	220V - 240V ac
Antenna impedance	
when tuner is switched off	50 ohms
when tuner is switched on	16.5 - 150 ohms
Power consumption	
Receive maximum audio	80VA (at 100V ac)
Stand-by	75VA (at 100V ac)
Transmitting maximum	650VA (at 100V ac)
Transmitting minimum	250VA (at 100V ac)
Usable temperature range	−10°C to +60°C (+14°F to +140°F)
Frequency stability	Less than ±200Hz under normal conditions (up to one hour after power is turned on for one minute)
	Less than ±30Hz after every hour
	Less than ±350Hz at 0°C to +50°C (+32°F to +122°F)
	Less than ±100Hz when optional CR-282 CR-282 is installed
Dimensions	424mm × 150mm × 390mm (WHD)
Weight	17.5kg (38.6lb)

Transmitter

Maximum power output	SSB	100W PEP
	CW, RTTY and FM	100W
	AM	40W
Modulation	SSB	Balanced modulation
	FM	Variable reactance modulation
	AM	Low level modulation
FM maximum deviation	± 5kHz	
RTTY shiftwidth	170Hz, 850Hz	

Above the keyboard are five switches, from the top: TS (tuning speed), A=B (VFO equalising switch), split (two separate VFOs), VFO A/B, VFO/memo and, at the bottom, two up and down switches which adjust the frequency.

The tuning knob is approximately 60mm in diameter and, in addition to having a finger detent, has the usual smoothness of operation that one expects from an Icom product. There is a rubber ring around the diameter of the tuning knob which adjusts the tension of rotation via a brake, which is accessible from the bottom panel of the transceiver under the tuning knob.

The display area

The multi-function meter acts as an 'S' meter in receive but has six different functions when in transmit mode. These are: swr, PO (relative power in watts), ALC, comp (level of speech compression), Ic and Vc.

Between the multi-function meter and the display area are four LEDs showing transmit (red), receive (green), data (orange) and FM tone (red).

The display area measures 300mm by 32mm and the seven frequency readout digits are 10mm high. Sixteen messages can be shown on the display and, in addition, two two-digit displays cover RIT/TIT and memory channel. The mode in use is displayed above the frequency readout, and below it is the filter in use and whichever type of memory (scan) etc.

The far right-hand section of the front panel includes, at the top, two horizontal rows of three microswitches. The top row comprises, from left to right: function, select and scan; the function and select microswitches are illuminated by an LED. The centre one, select, controls the start of a selected memory scan, and scan starts and also stops the selected scan. The bottom row of microswitches are, from left to right: IF shift, CW 250Hz and notch.

Below these are two rotary controls. From left to right these are: IF shift which has a centre position detent, and the notch control.

Underneath these rotary controls is a line of five microswitches. From left to right these are: RIT, TIT (Transmitter Incremental Tune), clear, which cancels any incremental tuning of either receive or transmit, M to VFO and write.

On the bottom-right of the panel are two more rotary controls, from left to right: RIT/TIT and memory-CH (memory channel selector).

The rear panel

On the left-hand side of the rear panel there is a vertical column of five sockets. From top to bottom: a standard SO239 socket, labelled antenna; a pair of phono sockets for ALC voltage and RELAY to control an external linear amplifier; another pair of phono sockets, labelled receive ant in and out; a multi-purpose spare phono socket, and the transverter output jack.

On the top row next to the antenna socket is the 8-pin DIN ACC(2) socket for which is used as RTTY keying (13.8V out, maximum 1A) and transmit/receive operation etc. On the far right-hand side is a 3.5mm extension speaker socket.

The bottom row comprises two ¼in jack sockets which operate the electronic keyer and a standard straight key. Next to these is a 3.5mm remote socket.

The far right-hand side of the rear panel comprises, from top to bottom, a 13.8V dc outlet, rated at a maximum of 2A, the mains fuse (5A for 220V-240V) and the ac euro-style mains input socket. The centre area of the rear panel comprises a substantial finned heatsink which contains the final transistors.

On the top of the rig there is a hatch which lifts off to reveal five controls. These are: a slide-switch to operate a marker which generates a marker signal every 100kHz; a marker calibration control (calibrator) which adjusts the reference oscillator frequency; anti-VOX control; electronic keyer weight control, and the scan-speed control.

The IC-765 in operation

An Icom HM-12 electret condenser microphone is provided with the IC-765. This microphone has several up/down buttons which are brought into operation via a slide-switch on the back of the unit. The up/down buttons are used to change the memory channels when the rig is in memory mode and select the frequency (up or down) in 5Hz steps when in VFO mode.

When the function switch is pressed a warning light appears in its top left-hand corner, showing that the secondary switch functions are activated. Pressing the function switch followed by the

Spurious emissions	More than 60dB below peak output power			
Carrier suppression	More than 40dB below peak output power			
Unwanted sideband	More than 55dB (with 1kHz modulation)			
Microphone impedance	600 ohms			
Transmitter incremental tune range	± 9.99kHz			

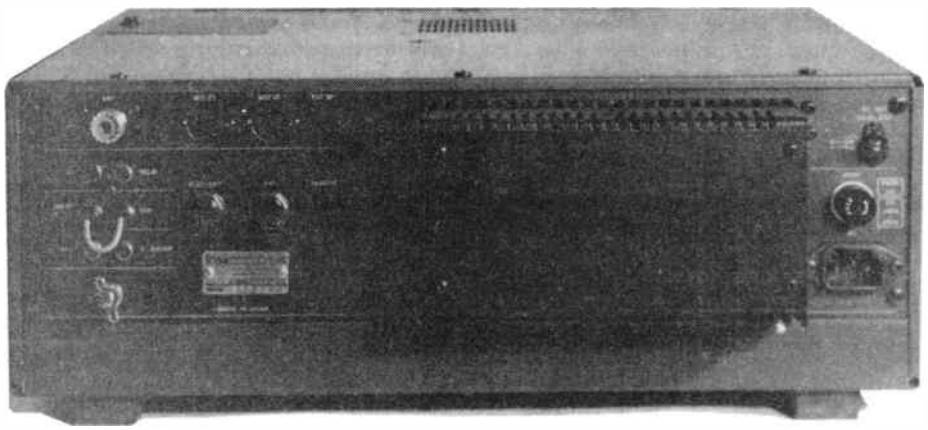
Receiver

Receive system				
SSB, CW, RTTY, AM	Quadruple conversion superheterodyne			
FM	Triple-conversion superheterodyne			
Intermediate frequencies				
	SSB	CW RTTY	AM	FM
1st	69.0115MHz	69.0106MHz	69.0100MHz	69.0100MHz
2nd	9.0115MHz	9.0106MHz	9.0100MHz	9.0100MHz
3rd	455kHz	455kHz	455kHz	455kHz
4th	9.0115MHz	9.0106MHz	9.0100MHz	–

Sensitivity (preamp switch is on)	
SSB, CW, RTTY (for 10dB S/N)	0.1 - 0.5MHz Less than 0.7μV
	0.5 - 1.8MHz Less than 1.0μV
	1.8 - 30MHz Less than 0.15μV
AM narrow (10dB S/N)	0.1 - 0.5MHz Less than 4.4μV
	0.5 - 1.8MHz Less than 6.3μV
	1.8 - 30MHz Less than 1.0μV
FM (for 12dB SINAD)	28 - 30MHz Less than 0.3μV
FM squelch sensitivity	28 - 30MHz Less than 0.3μV
Selectivity (IF shift off)	
SSB	More than 2.2kHz/–6dB but less than 4.2kHz/–60dB
CW, RTTY	More than 500Hz/–6dB but less than 1kHz/–60dB
AM	More than 6kHz/–6dB but less than 18kHz/–50dB
FM	More than 15.0kHz/–6dB but less than 30kHz/–50dB
Spurious rejection	
Image frequencies	More than 80dB
Intermediate frequencies	More than 70dB
Audio power output	More than 2.6W at 10% distortion with an 8 ohm load
Audio output impedance	8 ohms
RIT variable range	± 9.99kHz

Antenna tuner

Output matching range	16.7 - 150 ohms unbalanced (tuner switch on)
Auto tuner accuracy	VSWR 1.2:1 or less



The rear view

numerical keys on the keyboard allow you to make a direct entry of any frequency. Pressing the function switch plus the clear key adds the shift frequency to the displayed frequency, and pressing function and write clears the memory information on display.

The IC-765 has ninety-nine memory channels plus P1 and P2, which record one frequency and one mode on each memory channel as the scan edges of the programmed scan are in operation.

Memory channels 1 to 89 can be used as 'one frequency one mode' and channels 90 to 99 will accept 'independent transmit and receive frequencies and mode' for split operation. They can also be used as normal memory channels. The rig is fitted with three scan functions: programmed scan, memory scan and selected memory scan.

The owner's manual

The owner's manual comprises fifty-six pages, the last two of which describe the options which are available from Icom as add-ons. The owner's manual contains a useful series of five paragraphs titled Tech Talk from Icom. The series poses several technical questions and goes on to answer them using a simple question and answer format.

Conclusion

I was able to contact various stations, particularly 28MHz. The other bands including the main ones – 21MHz and 14MHz, produced a good crop of contacts.

The IF shift worked with its usual effectiveness and the sensitivity on the low frequencies was excellent, particularly on 7MHz in the evening. I was able to copy Offenbach DCF 54 fax on 134.2kHz, despite an interfering signal transmitting continuously almost on top of it.

My overall impression is of the effortless way in which it produced results, whether I used phone, RTTY, CW or listened in to parts of the frequency covered by the receiver.

The IC-765 including an internal ATU, PSU and the HM-12 600 ohm up-down microphone, costs £2,499 including VAT. My thanks to Icom (UK) Ltd, Unit 9, Sea Street, Herne Bay, Kent CT6 8LD, tel: (0227) 363859, for the loan of the rig for this review.

1990
LONDON AMATEUR RADIO SHOW

by Ian Davidson

When members of the Southgate Amateur Radio Club were planning their club's future activities for 1990, someone suggested holding a car boot sale. It was from this humble beginning that the idea for the first London Amateur Radio Show took shape. However, they soon hit upon the problem of where to hold the event.

After a few more discussions and some enquiries, the idea of taking over somewhere like the Picketts Lock Centre in Edmonton started to seem possible. After all, Picketts Lock had good access from the North Circular Road and there was ample parking space. In addition, there was plenty of space for exhibitors, and there were catering facilities and attractions for the radio enthusiasts' families.

From there on it was simply a matter of a lot of hard work for the club to put the event together.

The event

The show was held on 9 and 10 March. It had attracted a good deal of attention from the amateur press, which was borne out by the steady stream of traffic arriving at Picketts Lock from before the event's opening at 10.00am to well after lunch on the Saturday. In fact, the car parking facilities were well used with almost every space filled.

Inside the Centre, having paid the £1.00 entrance fee, I saw plenty of helpers from the Southgate Club, all wearing SARC sweatshirts. Exhibitors were allocated plenty of space, since the organisers had booked two halls and a balcony for the event.

This space was needed because there were more than eighty exhibitors, ranging from organisations like the RAFARS and RNARS, to companies like Icom, KW Electronics and ARE. There was even a bring and buy stall which seemed to be doing a brisk trade.

Paddle keys

For the CW enthusiast there were two key manufacturers, R A Kent and G4ZPY. On the Kent stand, their famous straight key kit, paddle and keyer were on display. G4ZPY was showing off a wide selection of keys, from the satin finished pump-handled key set on lakeland stone and priced at £26.95 to his top of the range Trophy key, finished in twenty-two carat goldplate. G4ZPY was also showing the kit key which he had just launched.

For those interested in aerials, a number of stands were bristling with metalwork. Sandpiper Communications were particularly noticeable. Next to them was Capco with their long aerials. Some of their aerials had been dismantled to show their construction.

ATUs

KW Communications had a good selection of equipment on show from their new emporium – the new Ten Tec Omni V looked very smart. Another item they had on display for part of the show was the Ten Tec 254 Tranzmatch ATU. Unfortunately, they had sold them all before I arrived.

Talking of ATUs, Nevada were exhibiting their TM1000 tuning units. They had two on show which were opened up, showing a very impressive set of coils and capacitors. The Tranzmatch is rated at 1kW, and from the size of the components this seems to be a conservating rating. Another feature is the roller-coaster coil which gives an exact match at all settings.

Icom (UK) Limited

The Icom stand was well worth a visit. They had a good selection of equipment on display, including a couple of new and interesting items.

The first was the tiny IC-R1 receiver. This palm-sized receiver, measuring 49mm × 102.5mm × 35mm, covers from 100kHz to 1300MHz and can resolve AM, FM and FM wide, as well as having 100 memories and a time clock!

The second very new item at the show was the IC-R100 receiver. This is housed in a small mobile transceiver-sized case and has a frequency coverage from 100kHz to just over 1.8GHz. It includes 100 memories, a tuning knob with variable tuning increments, AM, FM and FM wide modes, a clock and much more.

Another new item on the Icom stand was the IC-970 VHF/UHF base station. This comprehensive transceiver would grace anyone's shack. It covers 2m and 70cm as standard, but has an optional 23cm plug in. In addition, this receiver is capable of covering from 50MHz to 900MHz.

Morsum Magnificat

Other interests were also represented at the show. The **Radio Bygones** and **Morsum Magnificat** stand was manned by Geoff Arnold and ***Amateur Radio's*** Tony Smith (of Morse Report fame). Their stand attracted a steady amount of interest over the day.

RSGB Morse tests

Those interested in Morse or at least taking the Morse test visited the RSGB stand, which was conducting Morse tests in a quiet area of one of the halls. Whenever I passed the stand there always seemed to be some activity going on, so it must have been popular.

Comments

As I walked around the show, I saw everything from components to kits, and computers to transceivers.

The show was very well supported by the public. A number of people commented that there was plenty of traders and that it did not get too crowded because both halls and the balcony had been well set out.

The only problem seemed to be in locating the venue. Next year the organisers should post more road signs and provide a larger map.

Apart from this the Southgate Amateur Radio Club did a really excellent job in organising what must now be a major event in the amateur radio calendar.

SECOND-HAND

by HUGH ALLISON G3XSE

Blind bodges

Over the years I've repaired all sorts of things containing electronic components, from electronic warfare equipment for an aircraft restoration to kids' toys. There's always something new, though, and this one was a cash register.

Now, what has a cash register got to do with a two-way radio magazine? Well, I receive many letters from readers who have bought a dead gizmo at a rally and who, naturally enough, want to get it working but don't know where to start. As I have more experience at repairing things, I'm usually able to point them in the right direction. Nine times out of ten they have missed the obvious method of repair, owing to their unfamiliarity with the equipment.

Well, for the first time in ages there was this electronic gizmo in front of *me* that I was unfamiliar with. The manufacturer had gone bust years ago, no circuits and, oh joy of joys, several cowboys had recently tried to fix it. Consequently, it was now almost beyond repair.

Move one. I took the covers off and had a good look inside. It really was full of electronic gubbins – nothing brown and nasty and no burnt out components anywhere. Move two. A good sniff – don't laugh, you can often find a well-cooked bit of electronics with your nose. No clues there either.

Right then, time to power the bugger up. I plugged it in and switched on at a distance, using a length of extension cable in case it went bang.

The cash register didn't go bang, it just sat there doing nothing, ie, no display, no beeping. It had to be time to switch on the avo. I unplugged it from the mains and located the mains transformer. This was my first good break, since its outputs were connected to a plug/socket. The avo on ohms showed three windings, two low, one high. I plugged in the register to the mains and checked the windings on ac volts, which showed 18V, 18V and 120V. I then plugged the transformer output back in and followed through to the rectifiers and regulators, which showed +12V, −12V and +100V dc. The +12V went through a chip and I got +5 too, sod it.

It's often a good move to follow the highest voltage around a board first. As higher voltage components are liable to break down more often, knowing where the volts lurk will prevent you from receiving an electric shock later on. At one point the voltage went through a small diode, 1N4148-flavoured, to a 1μF electrolytic. There were no volts present across the electrolytic; always a clue to a fault in the vicinity. The diode was 'pointing' towards the electrolytic (advanced technical term, which means that it will conduct in that direction), so I unsoldered the diode and avo'd it. Shame I broke it while taking it out though.

Now, in my book, 1N4148s on a 100V line stinks. I thought they were 50V or so but I could be wrong. I might look it up one day. Unfortunately a replacement 1N4148 was lying among the usual pile of rubbish littering the bench – I was looking for something stronger, but I found the 1N4148 first . . .

It worked. I flicked it on and off several times and it still kept working. I put the covers back on and phoned the owner to come and collect it.

What can be learned from your scribe's pathetic fumblings in the dark? Start at the power supply and work out. Got the bugger going though, didn't I?

Pocketphone conversion

Long-time readers of this column will know I have a soft-spot for old, blue ex-police pocketphones, each having a separate transmitter and receiver. Nowadays they're dirt cheap, especially the receivers. Two or three quid should buy you a good one; the transmitter may cost a fiver if it's got a battery. A pair of pocketphones, xtalled, with charger, may cost £15.00 tops.

An occasion arose where a club wanted to set up a 70cm base station. The idea was for the 70cm portable receiving stations to reply to the base station on 2m. The reasoning behind this was that most amateurs have 2m portable equipment, 70cm gear is a bit rarer. Duplex operation was required.

The club lashed out twenty quid for ten reasonable pocketphone receivers, with batteries and a charger. They worked perfectly on their original commercial frequency of 456.3MHz. Club members were arguing as to which frequency they should recrystal all the receivers on to 70cm when I offered to do it for free.

Sums time. 456.3MHz (original frequency). IF 10.7MHz. Crystal therefore injects on 456.3MHz − 10.7MHz = 445.6MHz. What is the other mix? 445.6MHz − 10.7MHz = 434.9MHz. The quick way is to look on the back of the pocketphone, where the frequency is often marked, then subtract 21.4MHz (= 2 × 10.7MHz).

As the 70cm base station was synthesised, this was no problem. After a five-minute re-tweak on each pocketphone, they were on 70cm. I saved the club £50.00. Miserable sods could have bought me a pint for my troubles . . .

Araldite

Araldite is marvellous stuff, where would a bodge artiste be without it? I always keep two packs on the bench, one for rapid and one for ordinary use.

There was this rather nice communications receiver on the bench that someone had bought at a rally. Synthesised but drifting. The counter showed reference that the oscillator was drifting. I took off the cover and noticed that the glass-cased crystal had come out of the oven bit. I was about to reach for the rapid Araldite when my apprentice piped up. 'Rubbish,' I replied – well, not those actual words, but that was the general idea. After all, I was carrying out repairs before he was born.

Undeterred my apprentice whipped two KT66s out of the bin. These valves work on the space charge principle and, apparently, are supposed to glow red when working, unlike transistors. The two in the bin were suffering acute cathode flaking. I gave them a shake and they resembled snow scene ornaments. My apprentice mixed one lot of rapid and one lot of ordinary Araldite and put a ring round each valve, on the glass bit. He bet me a day's coffee that the rapid Araldite would break within twenty-four hours.

Guess what? Next day, I bought the coffee.

Limited tuning range

A synthesiser with a limited tuning range can be a real pain. A common example might be, say, a 2m rig that should tune from 144MHz to 146MHz but will tune, say, only 144.8MHz to 146MHz. Another good example is a rig which is supposed to tune from 28MHz to 30MHz, such as a CB based machine, but decides that 29MHz to 30MHz is enough. The problem, often as not, is that you can drag the action to work down to the lower bit of the band but you lose the top lock you had.

The solution to the problem is to use two signal generators. Sure, your average well-equipped amateur has hundreds of expensive synthesised signal generators lying about, I hear you say. The trick is to be versatile. A crystal that will give an output at either end of the range can quickly be fitted with a single transistor oscillator.

A tunable general-coverage receiver can have its local oscillator borrowed. For example, I've used a legal FM CB transmitting on channel forty on 27.991MHz as a bottom marker on a 'tunable' synthesised receiver, which is supposed to tune from 28MHz to 30MHz but with a 25kHz overlap. A hand-portable on low power with an elastic band around the Tx/Rx button also gives a useful carrier. The trick is to use one generator which is unmodulated, with the other singing at 1kHz.

I find two generators are helpful when setting up a restricted frequency range synthesiser. You can leave one up one end then follow down with the other. When you adjust the failing rig to bring in the lower end, leave things be and whip up to find the other generator, which will hopefully still be there. This trick works particularly well with older 2m rigs that have a MHz switch, ie, from 144.5MHz to 145.5MHz.

A common cause of a restricted tuning range is that either the VCO centre frequency has drifted (reset with the appropriate pot or core) or the synthesiser mixer bandwidth has sharpened up. I must admit to occasionally using a 1k resistor as a bodge cure.

Mistakes do happen

How did someone manage to mistake a valve for a transistor? Let me tell you the story.

In the 'seventies Electronic Developments produced a handy 70cm linear. A couple of watts in gave about 25W out. More if you thrashed it. I've heard of 70W or so out for 10W in, with lots of volts across it and a decent blower shifting the air about.

Electronic Developments produced two versions: one with a built-in power supply, just add mains and drive, and the other version comprised the RF bit, add your own power supply (I'd recommend a blower).

Construction of the latter was unusual, to say the least. Two mid-sized, die-cast boxes were mounted one on top of the other, with the bottom box housing the input circuitry and the top, the output gubbins. Good idea and stable, never seen one hoot.

The following information caused a local amateur some grief. The input socket for the volts to power the bugger came in via a 4 pin mic socket – the sort of thing seen on the front of all CB sets. Unfortunately, he didn't know that the active device was a valve; he thought it was a transistor! Apparently he'd found his linear in a box of rubbish and had no idea what it was.

In a way, I admire his approach. He connected the linear to the driving rig (FT708) via coax, then connected the load to the output socket. Took 12V negative to the linear chassis, put it on to transmit, wopped 12V positive up each power pin and waited for something to happen. Well, on one pin, it all happened. The pin took a few amps for a couple of seconds, then stopped taking the amps. He'd found the 6V heater and had burnt it out.

While chatting to him over the air, I heard the story. I asked why he hadn't opened it up and looked inside prior to worrying it with volts? He replied, 'No crosshead screwdriver to hand!'

The cure? In with a replacement 2C39. He found a well made ex-MoD 6.3 and 500V power supply, we strung it all up and it worked a treat.

These linears are still sought after little boxes, dead reliable and able to stand years of abuse. Obviously the voltage requirements rule out mobile use and make the equivalent, more modern transistor linears, more attractive. Even so, I've seen pristine 'deck only' variants sell for £40.00 recently, £50.00 for a built-in PSU type.

Scruffy examples cost about £15.00 less but are still a good buy 'cos there's nothing in 'em to wear out, except the valve, and I've bought good 2C39s for between 10p and £1.00 at flea markets. Note, there's no aerial changeover relay, so you will need to do some work before you can use it.

Infra-red security lights

Quite a few of these 'switch on when an intruder is about' security lights are appearing on the surplus market, new but not working, often on catalogue return stalls. A quid or two is the going rate.

Faults. About 80% of them have a faulty daylight sensing photo resistor. This deactivates the unit during daylight hours. Just for fun the resistor might be hiding under a removable rubber bung. The resistor, if working, should go high resistance in the dark and down to a 100 ohms or so in daylight. The resistor seems to fail at 25 ohms in the dark, 20 ohms if illuminated.

Since the circuit is designed to stop all the action when resistance is low, they don't work.

Some of these devices have a really long on period once activated, which can be a nuisance when checking one out. Solution? Rip out the hold capacitor. Often there is a pot to adjust the on time; look for an electrolytic in the area, often 47μF to 330μF, and unsolder a leg.

Incidentally, if you are forced into a stage by stage, fault-finding fight with one of these, it's perfectly possible to follow the sensing through with a 'scope. If you put your hand in front of the infra-red detector its output will change by a few tens of millivolts, rising to a 100mV or so when a soldering iron goes past a couple of inches away. This hits an op-amp or two – we are talking of a volt or so swing now – a transistor maybe (switching on full rail, a volt or so), then goes into a 'delay' chip and on to the photo resistor. This pokes a transistor which throws the relay about. Not being too technical for you, am I? Remember there's lots of mains-carrying tracks about, to fuses, the transformer *and* into the relay and output pins to control the light. Take care.

Drifting pots

On to the bench with an early synthesised transceiver. Well, it's supposed to be synthesised but tunes wherever it wants to go. Not a good thing.

I took the covers off and found that the varactor diode volts were jammed against one end, its dc 'static' conditions were not right. I set up the transceiver according to the instructions in the handbook. The rig now worked as sweet as a nut.

A week later the owner brought the rig back, so I accused him of mucking about with it. He denied this. I took the covers off, pots were where I had left them (I'd sealed them with typing correction fluid; I've got some nasty habits). Put the avo on the dc 'static' line; the thing was drifting. Now it was basically a pot across a regulated line. The regulated line was not drifting, therefore it had to be the pot. It was a nasty Bakelite type and had a few ominous bulges in it. I replaced this with a ten-turn 1k pot. The rig has worked a treat ever since.

Halves

No, not the sort of thing you rush to buy as the landlord shouts 'Time', but half rails. In your average wonderbox there are digital ICs. In the good old days, these were 7400 types, running on 5V. A supply fault would often end up with the ICs giving output levels of about 2.5V. Nowadays, CMOS may be running on, say, 7.5V or 10V, so the half rail will be 4V to 5V.

I had this transceiver on the bench in front of me. I cried help and asked an apprentice to check it with a digital analyser. He gave up too. I set the 'scope for zero volts on the bottom line, with 5V on the top. I used a probe to check the chips and looked for anything that was not up the top or down the bottom.

What are the reasons for a half rail? Well, perhaps the earth is off, disconnected, dry jointed on the IC pin or at some point around the board; there's no rail; there's a duff chip – either the driving or the loading one; or the switches are grotty – eg the point should be a '0' but is in fact a half and goes up to a '1' when something is turned or pulled.

In this case the switch had got something in it. The inverse of the point being a half instead of a '0' is where the very low input current of a CMOS chip is not sufficient to 'wet' the switch contacts. Here, the answer is to remove the switch from the circuit and blast away at it with half its rated current, preferably at its full rated voltage.

Incidentally, one really good way to ruin an IC is to present a chip with an input when it has no rail on it. The best way to achieve this is to have, say, thumbwheel switches on the front of a set getting their voltage from one rail, and the binary adders, or whatever you've got them connected to, running on another. Remove, short out or blow up the IC supply and you have the joy of replacing some ICs as well.

I should know; I've just done it. Again!

The World of D | A | T | A

BY DON FIELD G3XTT

Packet radio is spreading, with amateurs in the USSR, Poland and elsewhere in the eastern bloc now having permission to operate on this mode. At the same time, interest in traditional RTTY continues to grow, with a constant high level of band activity, especially during contests such as the BARTG event which was held in March.

The process seems to be self-fuelling. Increased interest leads to the development of new products, such as BARTG's PC-RTTY software for the IBM PC, and the AMTOR and RTTY software for the IBM PC, available from Grosvenor Software (G4BMK). These products help to attract more data mode operators on to the bands. I hope to look at some of these products in the future and pass on my observations in this column.

Mind you, some of the technology seems to be coming full circle. One of the US magazines reports that not only has Packet Cluster replaced 2m FM as a means of DX alerting, but K3RL of the Frankford Radio Club has developed 'Frankie', a system in which his packet computer is tied to a voice synthesiser in order to announce DX information over the old-fashioned 2m voice repeater!

Problems with packet

New ways of doing things are all very well, but 'new' is not always 'better'. The following letter from DJ4XN to DJ6TJ first appeared in **CQ/DL Magazine**. While intended to be a light-hearted swipe at HF packet, it may ring a few bells!

'Radio amateurs like to keep up with the latest technology – much to the delight of the business community of a certain far-eastern island.

'Packet radio seems to be the latest craze. I am the proud owner of a C-64, a home-made interface with AM-7911, TS-440S, TL922 and a program with all mode comms. My systems can certainly stand up to comparison with much more expensive hardware.

'As I understand it, the original idea behind packet radio was to provide a means of communications, on VHF, which would enable those in poor locations to communicate with stations situated some distance away by linking them up via other stations.

'My experience of VHF packet radio is limited. However, readers might be interested in my account of what seems to be a fairly typical packet QSO on the HF bands.

'In theory, there should not be much difference between packet radio on VHF and on HF, except for the difference in speed, ie, 300 baud on HF as opposed to 1200 baud on VHF. What happens in practice, however, is a different story. Yes, the system does work – providing there is never more than one station on the same frequency at any time. The moment another station appears (and wasn't multiple use supposed to be one of packet radio's main selling points?), things will start to go wrong.

'Here, then, comes an account of a typical packet QSO on HF packet:

'My partner's station (S2) is transmitting, mine (S1) is on "receive". Also on receive, on the same frequency, is another station (S3). S3 can hear S2, but propagation is such that he cannot hear me.

'As my partner drops the carrier, my station goes to "transmit" – as does S3, as we both assume that we have a clear frequency. S2 receives both of us, but cannot read either signal as mine interferes with S3's and S3's interferes with mine. As soon as the frequency is clear S2, therefore, requests a repeat of my transmission. At the same time, however, S3 is called by another station, S4 (who is not receiving S2 and therefore assumes the frequency to be clear). I am receiving both S2 and S4 but cannot read either. My station duly transmits another request for retransmission of S2's transmission requesting a repeat of my transmission. At the same time S3 requests a repeat of S4's transmission, as he was unable to copy S4's packet due to interference from S2.

'S2 cannot read me (due to interference from S3), so he now requests a repeat of my transmission requesting a repeat of his transmission requesting a repeat of my transmission.

'At the same time, S4 directs a transmission at S3 asking for a repeat of his transmission requesting a repeat . . . etc.

'I realise I'm not getting anywhere so, in frustration, I switch on the amplifier. At last, S2 is copying my request for a repeat of his transmission requesting a repeat of my transmission requesting a repeat . . . etc. He sends an acknowledgement, but my receiver cannot read him and asks for a repeat of his transmission so, equally frustrated, S2 turns on his amplifier. With a bit of luck we should now be able to hear each other and have a QSO but, unfortunately, it's S3's turn to get frustrated and turn on his amplifier, so we're back to square one.

'There is nothing more I can do, so I go off to lunch, leaving the rig to its own devices.

'An hour later I return to the shack and – bingo – there is a message on the screen. "Great", I think, "we made it after all" – until I take a closer look at the message. It says "Timeout". So much for efficient communication.

'Some weeks' later a QSL card arrives from S2: "tnx fr ufb packet QSO", it says, "RST599+20dB".'

Packet protocols

DJ4XN's letter is by no means untypical, even on VHF. The trouble, of course, is that packet protocols were devised for use in hard-wired systems in which each station on the network can 'hear' every other station. Radio just isn't like that, but the nearer we can get to such a situation (as in the 'ideal' network I described last month) the better the system will work. HF radio, unfortunately, is the worst of the lot, because propagation is so variable.

Of course, there are other inefficiencies in our packet protocols. Stan Horpeza WA1LOU, one of the 'founding fathers' of packet radio, highlighted one of the major inefficiencies in a recent article in the American magazine **QST**.

Stan noticed that bulletin traffic has increased faster than personal mail, and that many people read each bulletin. Thus, from any one BBS, a bulletin may be down-loaded many times.

Various proposals have been put forward for a 'broadcast' protocol to allow these bulletins to be sent once only, or at infrequent intervals, and to be received by many stations simultaneously. However, new protocols can-

not be implemented overnight.

Stan's 'quick and dirty' solution is as follows:

'Leave your station running on the frequency of your local BBS and use the LCALLS command to enter the call of that BBS into your TNC. Next, turn on the MONITOR and BUDLIST functions (MON ON and BUD ON). Now your terminal will display only those packets which are sent by your local BBS. Whenever anyone reads a bulletin it will be displayed on your terminal as well.

'If your terminal is a computer and its terminal-emulation software is capable of saving received data, let it save everything that is received over an extended period of time (an hour, six hours or twelve hours, computer memory permitting). At your leisure, you can read everything that was transmitted by the BBS during that time period, and it is likely that you will read some bulletins you had intended to read the next time you connected to the BBS. If you have a word processor with a search-and-replace function, you can clean up the bulletins by deleting all of the displayed headers, BBS prompts, BBS beacons and other extraneous matter transmitted by the BBS.

'This', says Stan, 'while not the final solution, can be implemented by most packet radio users without any hardware or software modifications'.

If everyone were to adopt this approach it would be the first step towards reducing congestion.

Bush telegraph

The IEE Review recently carried an interesting item about the use of packet radio in Sierra Leone to provide communications between remote villages.

The network operates in the 27MHz citizen's band using modified CB transceivers under the control of a microprocessor-based controller which monitors batteries levels and other parameters, as well as acting as the packet TNC.

A complete installation including solar panels to recharge the batteries, plus the antenna system, costs about £314.00, and for this modest outlay the impact on village life has been dramatic. Villagers are able to exchange news, summon assistance and much more.

Beacon band

There is still a lot of interference to the 14.1MHz beacon chain from thoughtless packet operators. Do remember to keep well clear. If you are operating packet in the upper sideband mode of your transceiver, then remember that you will need to be at least 3kHz below the beacon frequency to be sure that you are unlikely to cause problems.

RTTY Journal

I now subscribe to the RTTY Journal, owned, edited and published by Dale Sinner W6IWO, 9085 La Casita Avenue, Fountain Valley, California 92708, USA.

For anyone seriously interested not only in RTTY but in the other data modes this magazine, which has been running for almost thirty-eight years, is excellent. It is published ten times a year and costs $18.00 surface mail, or $24.00 airmail to subscribe from the UK. Definitely to be recommended.

While on the subject of journals, Gateway, the ARRL packet radio newsletter, is to merge with QEX, the monthly newsletter for experimenters. This is not surprising, as many of the technical developments currently taking place in the hobby are related to packet radio. In future, Gateway will appear as one section in QEX.

Recent RTTY activity

To give you a flavour of the DX to be found on the HF bands on RTTY, the following have been reported recently in DX NewsSheet (along with many others as well): 4K2OT (Franz Josef Land), BY1QH (China), D44BC (Cape Verde), H44SH (Solomon Islands), V85DA (Brunei) and YI1BGD (Iraq).

Satellites

The Japanese amateur satellite Fuji-OSCAR-20 (FO-20) was launched successfully in February. This satellite functions as a BBS using mode JD (145MHz uplink, 435MHz downlink). A 1W telemetry beacon transmits PSK (Phase-Shift Keyed) packets on 435.910MHz.

If you want to monitor this beacon you will need to attach a 1200 baud PSK modem to your TNC. That's it for now. 73 de Don.

TODAY'S TECHNOLOGY

by Ian Poole G3YWX

The word 'technology' probably triggers thoughts of the latest advances such as direct digital frequency chips or MESFETS offering incredibly low noise figures. However, don't dismiss the more established technologies; many electronic items invented years ago are still going strong today in one form or another.

Take for example the ordinary semiconductor diode. Although there have been advances made in its implementation, it is still essentially the same as the old cat's whisker detectors invented around 1906.

Another example is the trusty thermionic valve. Even though it has been superseded by the transistor in many areas, its basic technology is still used in applications such as travelling wave tubes (TWTs) and klystrons.

Then there is the quartz crystal (**Fig 1**). Today these are probably used more than ever as cheap, reliable and effective tuned circuits. They may not be the latest invention, but there is no other device to beat them for performance and cost. However, the way in which they work is not always understood very well.

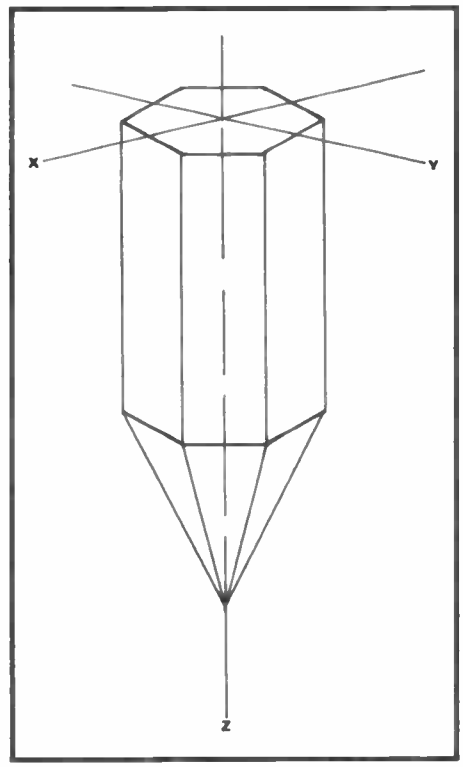


Fig 1: *A natural quartz crystal*

Crystal clear

Essentially a crystal depends on the piezoelectric effect to work. This effect converts a mechanical stress in a crystal to a voltage and vice-versa. For its operation a quartz crystal uses this effect in both directions so that an electrical impulse is converted into a mechanical movement and back again.

It is in the mechanical movement that the resonant properties of crystals are found. Quartz resonators can exhibit Q factors of several thousand, whereas tuned circuits made from conventional inductors and capacitors are only in the hundreds at the very best.

The mechanical qualities of the crystal are obviously vital for it to perform correctly. The actual shape of the crystal is important because the crystal resonators are cut from larger crystals and the orientation of the cut will determine the final properties of the resonator itself.

The AT cut is the one most commonly used in radio applications and this is taken from the original crystal as shown in **Fig 2.** This cut gives the best Q factor, the highest level of activity and keeps down the level of unwanted responses and oscillations.

A crystal has a number of resonances depending upon the way in which it vibrates. It may oscillate in an extensional mode as in **Fig 3(a)**, or it may have a flexural type of oscillation as shown in **Fig 3(b)**. It may even vibrate with a shearing type of oscillation as in **Fig 3(c)**.

As there are so many different ways in which a crystal can vibrate, for an oscillator can excite several of them at any one time. Fortunately many of the modes have only a very limited piezoelectric effect connected. But a poorly cut crystal may lead to small spurious responses and oscillations when one mode excites another (**Fig 4**).

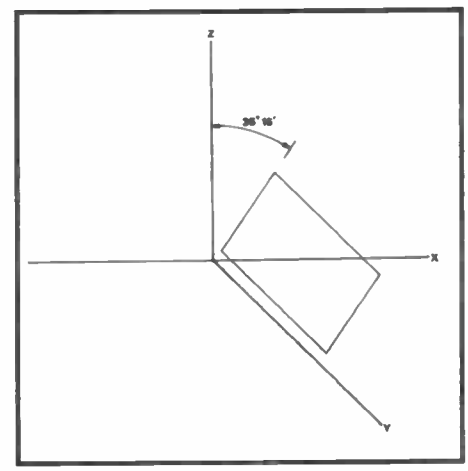
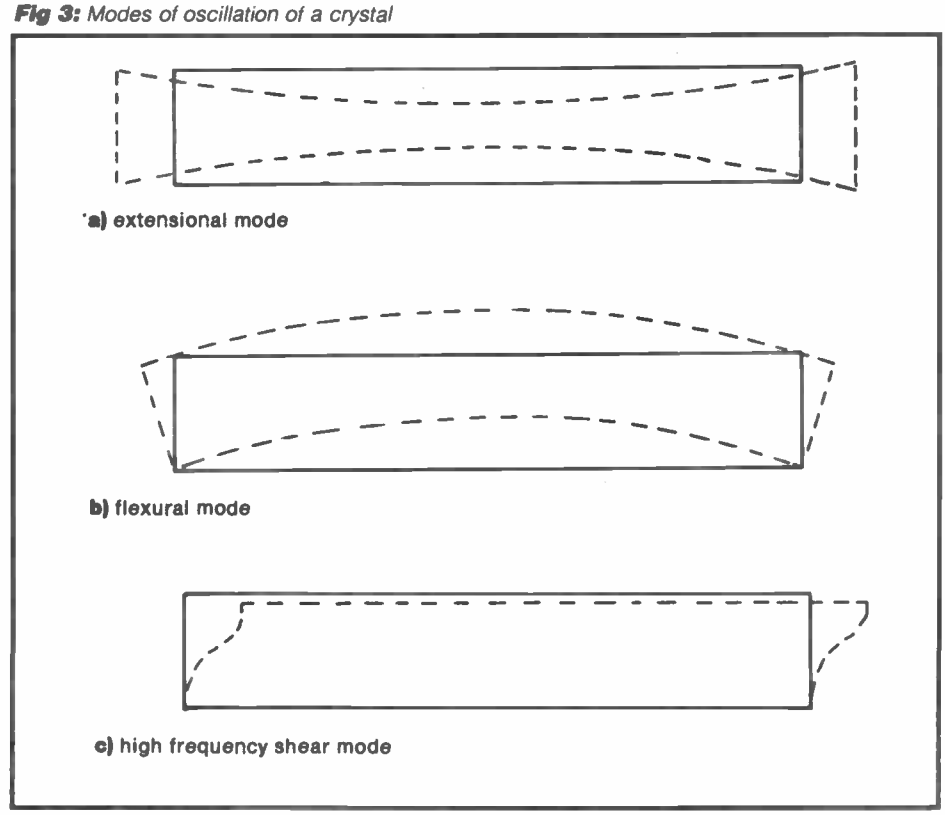


Fig 2: *The AT crystal cut with relation to the crystal axes*

Fig 3: *Modes of oscillation of a crystal*



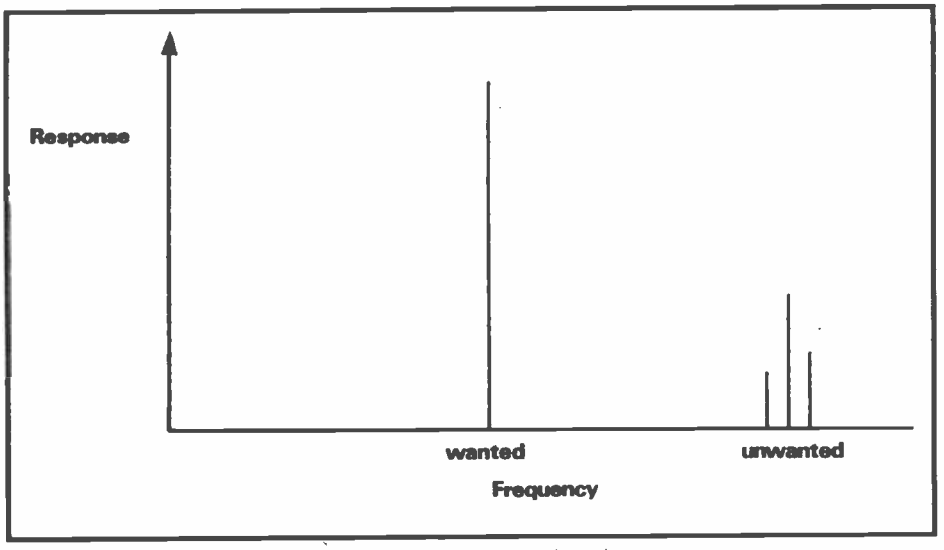


Fig 4: *The responses of a crystal showing the unwanted modes*

Sometimes it can mean that the crystal oscillates on completely the wrong frequency. This is particularly likely to happen if the oscillator circuit has no tuned circuits in it as in a digital clock oscillator circuit.

The AT cut crystal has very few spurious responses, and even these are likely to be well removed from the wanted one. This is because it uses a high frequency shear mode of vibration and the resonant frequency is dependent upon the thickness of the crystal. Most of the other modes are dependent upon other, much larger dimensions and hence their resonances will be much lower in frequency.

When one considers all that can go into the design of a simple crystal it makes them seem like very good value for money!

Surface mount technology

The use of surface mount technology is still on the increase and many of the new pieces of amateur radio equipment manufacturered in the East use it. As with any new technology there are teething problems which have to be sorted out, and some people are concerned about maintaining equipment which uses surface mount devices.

One of the problems concerns the components; they are very small and either don't have any markings at all or have a special code on them. In addition to this the components often have to be removed in a certain way; for example a resistor or capacitor has to have both ends heated simultaneously before it can be moved.

The other major concern emanates from the manufacturing process. Once placed on the boards the components have to be secured and prevented from moving before and during soldering. This was done by gluing the components to the board with a small amount of adhesive. Unfortunately many manufacturers used a form of adhesive that didn't degrade during soldering, which meant that it was very difficult to remove the components at a later date without damaging the board in the process.

However, now there are new methods of soldering being introduced, and the use of adhesives is slowly becoming less widespread.

There are basically three methods of soldering which can be used with surface mount components.

The first uses a wave of molten solder which passes over the board. This is carefully controlled so that each pad and component is correctly soldered. Even so, the actual amount of solder on each joint is not particularly well defined and solder splashes can cause shorts between tracks. Furthermore gluing is still needed to prevent the displacement of components.

The second method is called vapour phase soldering. Here solder paste is applied to the board, and then the components are added. Once the board is complete it is lowered into a container of liquid boiling at just over 200°C. The vapour from the liquid melts the solder paste and solders the joints.

Although this method does not need glue to hold the components in place, it does have other drawbacks. The main one is that the temperature cannot be controlled as well as in other methods, and hot and cold spots can lead to uneven soldering, which in turn can lead to an effect called 'tombstoning'. This is where the surface tension of the solder at one end of the component causes the component to stand on end.

The third method involves infra-red heating. Again solder paste is used and there is no need for any adhesive. Generally the boards pass through the solder machine on a belt. Because the temperature can be accurately controlled the defects are greatly reduced.

The major drawback of this form of soldering is the high cost of machines, but let us hope that as more surface mount units are made the use of infra-red soldering becomes more widespread, negating the need for glue.

News clips

Plessey have recently introduced a direct conversion receiver chip which is capable of operating at up to frequencies of 200MHz or so. The chip is intended for use as an FSK data receiver and contains an RF amplifier, direct conversion mixer, base band amplifier and filters, as well as many other circuits for demodulating the data.

The sensitivity of a receiver using the chip is said to be around 0.14 microvolts at 150MHz and with the on-board filters it is possible to achieve 70dB rejection at 25kHz. On top of this only one resistor is needed to adjust the filters.

Although this chip, the SL6639, is intended for use in low power paging units, there may be applications within amateur radio. Who knows, a wrist watch two metre receiver may be on the horizon.

On the semiconductor device front Toshiba have recently introduced some new RF power FETs. The TIM2121-01 and -05 are internally matched to 50 ohms saving costly matching circuitry. They have gains of 5dB and 5.5dB and power outputs of 1W and 0.5W respectively.

Toshiba certainly seem to be putting a lot of effort into development because they have also recently announced a pair of new UHF amplifier modules. The first of them uses silicon bipolar technology to give a power output of at least 12W with an overall efficiency of at least 30%. The second amplifier uses MOSFET technology. This offers an overall efficiency improvement of 5% to 10%. This can be of particular significance when operating from batteries.

Improved performance

Point contact devices are still in use today. Essentially they are the same as the very early devices used when semiconductors were just being introduced. However point contact devices have been developed considerably since then, and have the advantage of having very small values of capacitance. This makes them ideal for use as small signal detector devices at high frequencies.

Now Hewlett-Packard have come out with some gallium arsenide planar doped-barrier diodes. They are less expensive and give an improved performance. For example their HP 8474B detectors are flat to within ± 0.35dB up to 18GHz. The HP8474E is the highest frequency diode in the series and this is flat to within ± 0.7dB up to 50GHz.

However, don't get carried away with the cost reduction. Diodes like these ones cost over £200.00 each!

DX DIARY

News for HF operators compiled by Don Field G3XTT

Old Sol has been rather disappointing of late. Just when we might have expected very good propagation on the higher bands, the opposite has been true. Looking back, although solar activity increased steadily during 1988, a plot of monthly mean solar flux during 1990 shows the figures remaining almost constant, so it may be that the best of this sunspot cycle has been and gone. Be this as it may, the solar flux was very low during January and February, though it did manage a sudden spurt in time for the ARRL SSB Contest in March.

In terms of band activity, when conditions peaked there were some rare Pacific ones on 10m such as AH3C and AH9AC. However, for the most part you had to move to the lower bands to work into the Pacific.

The Colvins showed up from Tahiti and had a good signal on 20 and 15m, signing FO0XXL. DK1CE/H44, DL5UF/H44, ZK1XL (S Cook Islands) and P29VMS (Bernhard DL2GAC, putting on more remote islands for the IOTA gang) also showed from the Pacific, to add to the general level of interest on the bands.

Operation from Bhutan

The main talking point on the bands of late has been the prospect of some very rare ones being activated in the not too distant future. At the time of writing nothing is firm but Jim Smith VK9NS appears to have obtained permission for an operation from Bhutan, and has also been invited by the Prime Minister of Bangladesh to meet and talk about the possibility of amateur radio operation from there.

Jim is very bullish about the prospects for both of these, and activity could well commence round about the time you read this.

Jim also expects to be at the RSGB HF Convention (to be held at the Penguin Hotel in Daventry on 30 September), and has offered to talk about his Bhutan operation, so there's confidence for you!

There was also talk in mid-March of some Japanese amateurs having obtained permission to operate from Bhutan, so maybe that one will have come off as well by the time you read this column.

Having mentioned the HF Convention, I might also say that Einar LA1EE has agreed to attend in order to give a slide presentation of the Bouvet Island operation. This should be well worth seeing.

There have been increasingly strong rumours about a possible operation from Burma, but don't hold your breath.

UB5JRR, currently operating as 3WRR, planned a late-March operation from Spratly which, if everything went according to plan, should be history by the time you read this. Spratly, of course, has been off the DX map since the ill-fated German expedition some years ago in which one operator lost his life and others were injured after being attacked. The South China Seas are not to be taken lightly.

QSL card from ZS6PT's Marion Island operation. It may be some time before this one is on the bands again

Forthcoming DX

QRZ DX reports that YB0TK, an airline pilot, flies to Angola once a month and has permission to operate as YB0TK/D2. Meanwhile, LU6ELF/D2 continues to be active and is now acceptable for DXCC. His QSL manager, N4THW, planned to operate from Jorge's station, but has been unable to get permission.

KD7P was reported to be planning a trip to Kure Island (KH7) for April or May, with a view to operating on CW (KH6LW, who visits there fairly frequently, is a phone man).

PS7KM, in a letter to G4LJF, reports plans for an operation from St Peter and Paul Rocks in May, and from Trindade Island for two months starting the first week in June. The latter would be especially welcome – most operations last only for the time that the supply vessel is there, which is never more than two or three days.

DX News Sheet reports that DF1SD, DF7TU, DJ0YI and HB9BUN will operate the ITU station in Geneva signing 4U5ITU from 25 to 29 May, including the CQ WPX CW Contest. Their operation (outside the contest) will include the WARC bands, and there may also be some RTTY activity.

It is worth mentioning here that all licensed amateurs are allowed to operate the ITU station in Geneva provided they contact the station manager beforehand. I remember doing so myself back in 1972, and enjoying the pile-ups that always result.

KN0E, who has been very active from Johnston island as KN0E/KH3, plans to be on as KH1J from 30 April until 8 May. He is an excellent operator and can expect to be busy from KH1 which is getting quite rare once more.

F2JD is expected to be in Honduras from mid-April until the end of May signing /HR1, /HR5 and, possibly, /HR6 (NA57 for the IOTA awards).

New one for the IOTA list

Talking about IOTA, JI6KVR will operate from the Uji Gunto archipelago off Japan from 25 to 27 May, and this will be a new one on the IOTA list. KL7IEI will operate from Nunivak island (IOTA reference NA74) from 27 to 31 May. SI8MI will be aired from Market Reef from 28 May to 3 June, and the Grantham Radio Club will operate from the Inner and Outer Hebrides from 27 May until 3 June, mainly for the WAB gang.

The SI8MI operation is worth a point of explanation. Only the Finnish side of Market Reef (yes, the border runs down the middle of this tiny rock!) counts for DXCC (the argument being that it is separated from Finland by the Aland Islands). The Swedish side counts only as Sweden for DXCC purposes, though it will, of course, count for IOTA as well.

The lighthouse is on the Finnish side, so the SI8MI operators will have to camp out on bare rock and put up their own antenna supports. In fact, I can't really see the point in bothering!

LA7DFA will be on Jan Mayen Island

until 27 July, signing JX7DFA. Look for him mostly on CW, on 80m through to 10m.

W2BJI was due to be on as V47KJI from St Kitts until 28 April, and then until 30 April as V21AJI from Antigua.

SM5KDM should now be operational from Lesotho as 7P8CL for about eighteen months. He will operate on 7, 14 and 21MHz, both CW and SSB. QSL to his home call.

The East Leeds Amateur Radio Club will operate from Morukulien from 6 to 11 May using the callsigns SJ9WL and LG5LG. Morukulien is in a small area of 'no-man's-land' between Norway and Sweden, so contacts do not count for DXCC, but the prefixes are unusual, and the station is used to raise funds for charity. Those who contact it are urged to put in a little extra with the QSL card. G0MFF will handle cards for this particular operation.

DXCC

Walvis Bay has now been added to the DXCC country list, taking the total of current countries to 324. QSLs may be submitted to the ARRL after 1 June for credit.

Endorsements for 160, 17 and 12m are now available for the Five-band DXCC Award. You must hold the regular Five-band Award first, and a special application form, available from the ARRL, is required when applying for the endorsements.

DARC 40 Award

The German national amateur radio society (DARC) was founded forty years ago, and is sponsoring an award to commemorate the occasion.

To gain the award you need to score forty points for working German club stations (recognisable by the prefixes DF0, DK0, DL0 and DA0). The Table shows how points are scored (as you can see, you may use a mixture of the HF and VHF bands). You may only include a maximum of three DA0 stations in the application, one each on HF, 2m and 70cm.

	HF	2m	70cm
Telephony	2	4	6
Telegraphy	4	6	8
Other modes	6	8	10
DAO Station	10	10	10

To apply for the award, send a log extract plus DM15, twelve IRCs or US$8.00 to DARC Amateurfünkzentrum, DARC 40, PO Box 1155, 3507 Baunatal, West Germany.

Contests

The Russian CQ-M Contest is on 12-13 May (twenty-four hours from 2100GMT on the Saturday), and is both CW and SSB. It is a good opportunity to work rare oblasts and countries such as JT (Mongolia).

In the period 19-21 May there are two contesting events, the ARI (Italian) Contest and the ITU Contest. Both are dual-mode, so the bands are likely to be pretty crowded.

Finally, the big event of the month is the CQ WPX CW Contest on 26-27 May. This runs for forty-eight hours, though single-operators are restricted to thirty-six hours of operation.

Silent key

Bob Tanner ZL2BT passed away on 7 March. Bob was in his eighties but remained very active on the bands until recently and was especially known for his strong SSB signals on the lower bands, particularly 80m and 160m where he was something of a propagation beacon. He will be much missed.

QSL Information

As promised, here are some more QSL routes for recent DXpedition operations:
A61AC via ON7LX: Ramon Carine, Zeedijkweg 3, B-8021 Loppem, Belgium.
P29VMS via DL2GASC: Bernhard Stefan, Aachstrasse 25, D-7772 Uhldingen 1, W Germany.
SDM7PKK *(for his Pacific Operations):* Mats Persson, Betesv. 22, S-24010 Dalby, Sweden.
ZS9/DK7PE via DK7PE: Rudolf Klos, Kleine Unterg 25, D-6501 Nieder Olm, W Germany.
9L1US via WA8JOC: Kenneth Scheper, 5875 Cedaridge Drive, Cincinnati, OH 45247, USA.

A SIMPLE QRP POWER METER

by Joe Pritchard

When the new licence regulations required us to keep track of transmitter power in the log, I realised that the days of estimating output power were gone for good, and that I would have to find a more scientific means of measuring the power from my rig.

As I'm active only on QRP 2m in various modes, I decided to search through my junk-box and home-brew a simple QRP power meter to measure the power output of the transmitter. The meter plugs into the transmitter aerial socket instead of the aerial and measures only the output power of the transmitter into a specified impedance, rather than into the aerial itself.

This article explains how to construct this project using readily available materials and also looks at the theory behind it.

The theory

The basic principle of such a meter is to feed the RF output from the rig into a dummy load, detect the voltage at the load and use that voltage to drive a current through a meter; the reading on which, is a measure of transmitter output power. Such a meter is purely passive and requires no power supply, therefore, it is a good first-time home-brew project for a new licensee.

The theory behind these meters is as old as amateur radio itself, so I claim no originality for the circuits used. However, they work and they're cheap; what more could a thrifty amateur ask for?

Fig 1 shows the basic configuration of such a meter. Although this circuit was originally intended for 2m use, there's nothing to stop you using the meter on other frequency bands as, on the whole, it is frequency independent. Frequency dependence is apparent only in the performance of the diode, which we'll investigate later.

The first task is to provide a load into which the signal can be transmitted. My transceiver, the Yaesu FT-290 Mark Two, has a 50R aerial impedance and so any load we use must be as close to 50R as we can manage, otherwise problems will arise, such as the following:

1. The ALC (Automatic Level Control) of the transmitter may, if the impedance into which the transmitter is working is grossly different to that expected, reduce the output of the transmitter when working into the meter. This would give a lower reading on the power meter, rather than on the actual aerial.
2. An impedance mismatch will give a spurious power reading, even if the ALC of the transceiver doesn't reduce the transmitter output power.
3. Alternatively, if the mismatch is *really* gross, the output power transistors will blow, and 'Goodnight Vienna'!

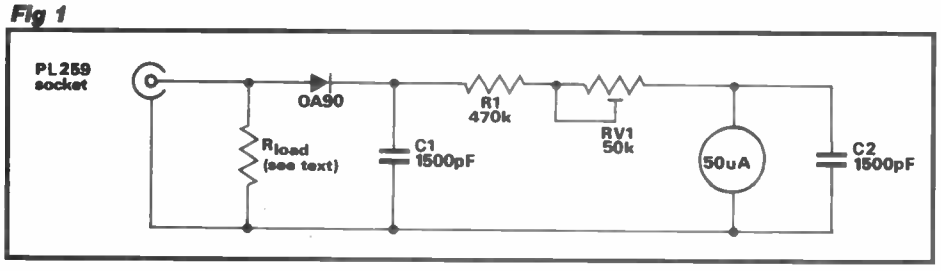
The load resistor

You must first decide upon what is the absolute maximum power that you want to measure; I'm happy measuring up to 3W, so let's call this value 'max power' – we'll use it to make some calculations later. However, the first use of this power is to estimate the power dissipation of the 50R resistor at the input. As always, overestimate the power dissipation. I used a 5W unit but if you don't have a value that's a little higher than the power you want to measure, you can easily generate a 50R load by paralleling several resistors of a lower power dissipation, as follows.

Assume that a 5W 50R resistor is required. Using six 300R, 1W resistors, you could parallel them **(Fig 2)** and thus get a load of nominally 50R with a dissipation of 6W. Measure the value of this assembly of resistors, as their final value will obviously depend upon their tolerance of the resistors selected for the job. Remember, some careful selection of the resistors may be needed.

It's also important to remember that the load should be *non-inductive*, otherwise self-resonances are likely at particular frequencies of operation and will lead to spurious readings on the meter. The typical 'wire-wound' resistor is *not* suitable for use in such a circuit, but a non-inductively wound wire-wound resistor is all right, as it is designed to be non-inductive by winding the resistor in a particular way.

Fig 1



The diode

Since the meter is effectively measuring the peak RF output power from the transmitter, the diode must be able to respond appropriately at the frequency range in question. Both the internal capacitance and transition time of the diode, must be low to allow operation at VHF, so a big rectifier pulled out of an old 9V power supply isn't suitable!

If you're prepared to spend some money, a 'hot carrier' diode is the best bet, as these are designed for use at VHF and UHF. For example, the HP2800 diode would be perfect for this job but, as an alternative, the 1N914 silicon diode or an OA90 germanium diode could be used. If you use the 1N914 diode or any other silicon diode, then the Vdrop shown in the following equations should be 0.6V and for the OA90, or any other germanium diode, the Vdrop is 0.2V. In general, any fast-switching diode can be used here.

C1, R1 and the meter

C1 acts as a reservoir capacitor for the output from the diode. The voltage at the junction of C1 and R1 will attain the largest voltage which appears at the diode, and this voltage will drive a current through the meter. The capacitor across the meter is simply a bypass capacitor, and these values are suitable for a wide range of frequencies.

R1, VR1 and the meter form a basic voltmeter circuit and with this sort of power-measuring circuit, the voltmeter must draw as little current as possible from the diode detector, as this will reduce any errors.

Let's now see how we calculate the resistor value for a given meter type and measure a particular power range.

With respect to the power, it will give rise to a voltage at the junction of C1 and R1 of:

SQR (100*maxpower) – Vdrop

So for a maximum of 5W, we would get a voltage of:

SQR (100 (100*5) – Vdrop

If a germanium diode were used you would get a voltage reading of 22.16V – call it 22.2V for practical purposes. Therefore, your metering circuit should be capable of reading up to, say, 25V.

The value of the resistor must now be determined. To do this, establish what current is required for a full-scale deflection on the meter and its internal resistance. If you assume that you're designing for a full-scale deflection on the meter to represent 25V, then 25V at the junction of R and the diode must push a current through the meter sufficiently to cause a full-scale deflection.

The FSD current and internal resist-

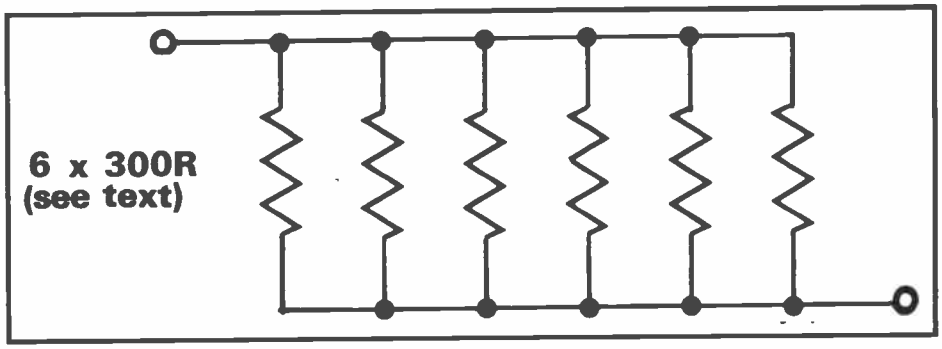


Fig 2

ance can be obtained from the specifications of the meter. For example, I used a 50μA meter with a quoted resistance of 4300R. Thus, the voltage must provide a current of 50μA through the total resistance of R and the 4300R resistance of the meter. Therefore, for this design, eg,

Rexternal = Vfsd/Ifsd – Rinternal

where Vfsd is the voltage we wish to give a full-scale deflection, Ifsd is the meter current that will give an FSD, Rexternal is the total combined resistance of VR1 and R1, and Rinternal is the internal resistance of the meter.

To put some values into this equation, we have:

Rexternal = 25/50E-6 – 4300
= 500000 – 4300
= 495700R

These calculations will almost always give non-standard resistance values. There are two ways around this problem. The first is to use a preset potentiometer to give the exact value required, eg, a 470k fixed resistor in series with a 50k preset, adjusted using an ohmmeter, as is done in this circuit. The second is to make do with a different value and calibrate the meter according to the actual value of resistance made up by R and the internal meter resistance. The 'ohms per volt' rating of this arrangement is easily calculated by dividing the total meter circuit resistance by the voltage required to get FSD, in this case, it's 495700/25 or 19828 ohms per volt. A good figure to aim at is 20000 ohms per volt.

Construction and calibration

The unit *must* be built into a metal case, otherwise you're likely to cause interference to other 2m users owing to radiation from the meter when a power reading is taken. All leads should be as short as possible, although this isn't as vital for the leads going to the meter.

The socket used for the input from the transmitter should be of a suitable type; I used a PL259 socket mounted on to the side of the metal box, and fitted a PL259 plug to each end of a short piece of coaxial cable to run between the transmitter and the meter. The PL259 plugs and sockets are fine for HF and VHF, but above a couple of hundred MHz they're not really suitable. **Fig 3** shows how I arranged the interior of my meter.

Once the circuit is completed, carefully check for any short-circuits, especially around the input load resistor. Once you're sure it's all right, you can calibrate the circuit. First of all, dismantle the front of the meter and remove the existing scale if possible. In any case, insert a piece of cartridge paper into the meter.

The easiest way to do this is to use a multimeter and apply a dc voltage to the input socket. Measure this input voltage, and note where the QRP power meter needle reaches on the scale. Mark this carefully with a felt-tip pen, then remove the paper and write the power value on it according to the following equation:

Power (W) = (DcVin + Vdrop) * (DCVin + Vdrop) / (2*Rload).

Where DCVin is the applied dc input voltage, Vdrop is the diode voltage drop and Rload is the load resistance, in the example given so far, 50R.

For example, a dc voltage applied of 10V would correspond to a power of:

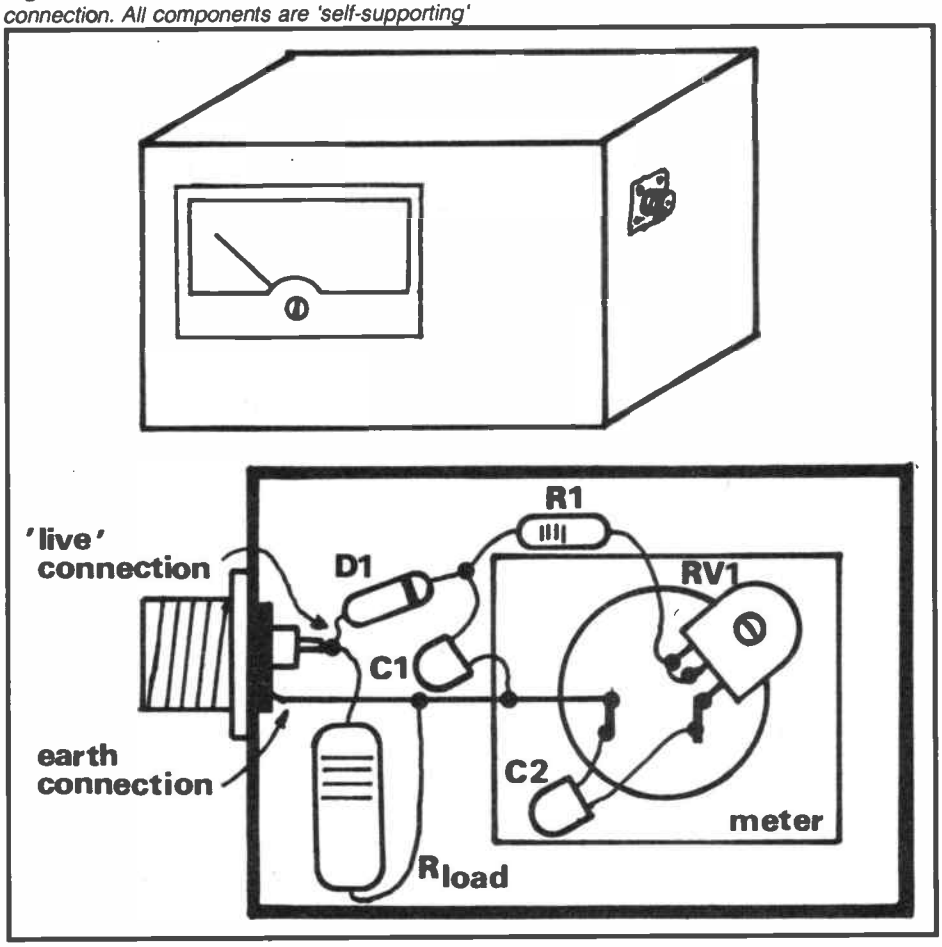
Power = (10+0.2) * (10+0.2) / 100
= 10.2 * 10.2 / 100
= 1.04W

Repeating this for a few voltage readings will give a calibrated QRP power meter. Some inaccuracies are likely at the low end of the scale, because the diode used will require a certain minimum RF voltage applied (Vdrop) before it starts conducting.

In use, simply disconnect the aerial lead from the transceiver and plug in the meter. Connection can be made via a suitable length of 50R coaxial cable with PL259 connectors. Key up the transmitter, and in SSB mode give a couple of good whistles (or, dare I say it, use a tone generator into the microphone socket) and you'll be able to read off the power from the meter.

For FM, simply key the microphone and watch the reading. Keep power reading sessions as short as is required to get a power reading, then reconnect the aerial and get on the air!

Fig 3: *The interior. Earth connection is a short length of coaxial braid, tinned to form a 'bus' connection. All components are 'self-supporting'*



ICOM

IC-751A HF ALL-BAND TRANSCEIVER

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- **105db Dynamic Range.**
- **100W Output (40w A.M.)**
- **32 Memories.**
- **Electronic Keyer.**
- **CW Semi/Full Break-in.**
- **HM36 Microphone.**

The ICOM IC-751A was created for the ham operator who demands high performance whether entering contests, chasing DX or just simply enjoying the shortwave bands. It is an all mode solid state transceiver with a host of features designed for the crowded HF bands of today.

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The transmitter is rated for full 100% duty cycle with a high performance compressor for better audio clarity. With 32 memory channels and twin VFO's, scanning of frequency and memories is possible from the transceiver or the HM36 microphone supplied.

The IC-751A is supplied for 12v operation but can be used with either internal or external A.C. power supply. It is fully compatible with ICOM auto units such as the IC-2KL linear amplifier and the AT500/100 antenna tuners.

Options available:- PS35 internal AC power supply, PS15 external AC power supply, EX310 voice synthesizer, SM8 desk microphone and SP3 external loudspeaker.

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Options and Accessories:

AH-3	H.F. Automatic tuner
AT-150	A.F. Automatic matching tuner
PS-55	AC power supply
CR-64	High stability crystal
FL-100	CW narrow filter 500Hz
FL-101	CW narrow filter 250Hz
SM6/SM8	Desk microphones
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THE SOFTWARE FILE

by Stephen Phillips

Program notes

The program shown in the Table is written in GW-Basic for use on IBM computers or clones, such as the Amstrad series. However, it is written very loosely so as to make it easily portable to other dialects of Basic.

Dishes

With the current interest in microwaves and especially satellite TV, many people need to get information on the surplus dishes that are now available. This program provides you with the gain for any reasonable frequency, the −3dB beamwidth in degrees and the focal length of the dish. This, of course, is the point at which the feed system must be placed.

The program

The following description will help you to move to other versions of Basic.

CLS in line 40 clears the screen. LOCATE x, y in various lines places the cursor at vertical and horizontal points on the screen. If you leave these out then all input and output will be listed at the left-hand edge of the screen. PI is set in line 120, however, if your computer has PI set internally then this line should be deleted. Line 160 gets the diameter and line 200 the depth of the dish.

If you do not require the focal point calculating, enter 0 (zero) for the depth. If zero has been entered line 260 forces the depth to 1in so as to avoid later division by zero errors. Line 300 accepts the frequency in GHz which is then converted to MHz. If you prefer to work in MHz, simply change GHz in line 300 to MHz and then delete line 310.

Data checking

Lines 310 to 350 compute the data required and also check to see if the dish is usable at the stated frequency. If the gain is less than 10dB the program gives an 'unsuitable' message. Lines 400 to 530 generate and display the data on screen and lines 540 onward ask if the program should be rerun or closed and take the required action.

RESULTS

To check the program use the following inputs: diameter of dish... 24; depth of dish... 7; and frequency... 10.4.

You should get the following results: gain... 31.7; −3dB points... 3.3; and focal length... 5.1.

```
 10 REM ------------------------------------------
 20 REM       Copyright AMSOFT February 1990.
 30 REM ------------------------------------------
 40 CLS: KEY OFF
 50 LOCATE 10,20
 60 PRINT "This program calculates the gain of a "
 70 LOCATE 12,20
 80 PRINT "parabolic dish of any given diameter"
 90 LOCATE 14,20
100 PRINT "and also computes the focal length."
110 FOR T=1 TO 5000:NEXT T
120 PI=3.14159
130 CLS
140 REM     ------ input data routine. -------
150 LOCATE 6,17
160 INPUT "Diameter of dish in inches .....";D
170 DI=D
180 D=D/39
190 LOCATE 8,17
200 PRINT "Enter depth of dish in inches .....?"
210 LOCATE 9,17
220 PRINT "If focal length not needed enter 0."
230 LOCATE 8,54
240 INPUT DD
250 NL=DD
260 IF DD=0 THEN DD=1
270 LOCATE 9,1
280 PRINT SPACE$(70)
290 LOCATE 10,17
300 INPUT "Enter the frequency in GHz .....";FR
310 MHZ=FR*1000
320 WL=300/MHZ
330 BW=.33*((PI*D)/WL)^2
340 DB=4.343*LOG(BW)
350 DB=INT(DB*10)/10
360 LOCATE 12,17
370 IF DB<10 THEN 380 ELSE 400
380 BEEP:PRINT "The dish is too small for ";FR;"GHz,"
390 GOTO 550
400 REM     ------ Data output routine --------
410 PRINT"Gain reference a dipole is ";DB;"db."
420 WB=SQR(16500/BW)
430 WB=INT(WB*10)/10
440 LOCATE 14,17
450 PRINT"The −3dB points are at ";WB;" degrees."
460 FL=(DI*DI)/(DD*16)
470 FL=INT(FL*10)/10
480 IF NL=>1 THEN 520
490 LOCATE 16,17
500 PRINT "Focal length of dish not computed.";
510 GOTO 550
520 LOCATE 16,17
530 PRINT "Focal length of dish is ";FL;"inches.";
540 REM     ------- Check for rerun routine. ---------
550 LOCATE 19,17
560 PRINT"Another calculation ...( Y / N ).... ?"
570 I$=INKEY$
580 IF I$="Y" OR I$="y" THEN 130
590 IF I$="N" OR I$="n" THEN 600 ELSE 570
600 END
```

JUST ANOTHER WEEKEND IN THE SHACK

by Gareth Jones GW4KJW

So there you are, just settling down in the shack for a session on the bands, the kids have been walked around the block and put in the kennel for the night, and the dog has been put to bed. You have an adequate supply of food, liquid nourishment, and the services of a hot and cold running galley-slave within shouting distance, providing *Eastenders* has finished. Time to turn your receiver on and see what's about.

After half an hour tuning around and only finding the usual 'Dads' Army' nets on 80m, the Albanian weather forecast on 40m and some interminable contest on the HF bands, you think to yourself that there must be something more to ham radio than this, surely... What about VHF? Perhaps there is something new happening on 2m? (There's no harm in hoping, is there?) It's probably been a while since you last used the 2m band, so it's at least worth a look.

The first problem to overcome is to find your rather outdated 2m multimode from underneath all the accumulated gubbins. Once you have found it, dusted it off and connected it up, you turn on and find . . . well, actually, not a lot. The SSB part of the band is full, as is usual at weekends, with a lot of people frantically calling CQ DX and swapping rather dubious five and nine reports with stations they have had to ask a dozen or so times to confirm if they really are a G6 or a PA0.

Tuning to FM

Ignoring for a moment the strange noises that can be heard in various bits of the all-modes section of the band, you tune in to the FM part and hear someone in the next street speaking to a couple of new recruits to the local repeater and, thanks to his foresight in running 100W of RF into a collinear antenna, at least one other repeater on the same channel.

He is talking at great length about teaching music. His knowledge of the subject is obviously profound and he leaves his audience quite speechless, as is demonstrated conclusively by the deafening silence that greets him when he finally finishes his 'over'. It's the same sort of respectful silence that most local amateurs have given him for years.

The other repeater in this area on a neighbouring channel seems to be occupied by someone whose licence still has its ink wet. After spending some time making plaintive calls of 'Breaker on the side', in an attempt to join in with an existing QSO between two mobile stations, they finally, almost as an act of pity, let him in. Not an entirely wise move, since the newcomer then seems to go into some 'auto-rabbit' mode and reels off a list of other stations he has copied that day.

Time to move on and see what else can be heard on the bands. What about the simplex channels? There's not a lot to encourage a listener here either, just a few channels with strange noises lower down on the band.

May as well turn off I suppose, but wait, what's this? A channel with some sort of technical discussion going on? It sounds almost intelligent, could there still be hope for the 'self-training in communication by wireless telegraphy' clause of the licence? Well, yes and no. After listening for a while, you realise that you can only understand about one word in six and it dawns on you that you have stumbled across a chat, dealing, according to one of the participants, with 'the only area in amateur radio where interesting experiments are still being carried out'.

So what is this wonder? Has someone finally worked out how to beam up Scotty? No, they are talking about **Datacomms**.

What, no fanfare? It's not the purpose of this article to delve too deeply into the pros and cons of the world of data communications. In fact, it is not the purpose of this article to sing the praises of any aspect of amateur radio, as some of you may have gathered. Instead, what follows is a light-hearted glossary of the 'techno-speak' used by operators whilst tuning around the bands. It's very difficult for the uninitiated to get to grips with the strange world of the datacomms operator, and in particular that of packet radio.

The following is a mixture of radio and computer expressions. The terminology, whilst seeming to be of a highly advanced technical nature, is easily understood when put into plain language.

Glossary

ASCII: Phonetically accurate spelling of the name of a famous comedian of the 1930s, '40s and '50s.

Data Transmission Protocol: A reliable method of sequentially corrupting other radio systems from a safe distance.

Digipeating: The technical term for drumming your fingers on the table (corruption of the term digitbeating).

Disassembler: Technical term for 'sledgehammer'.

Dump: XYL's accurate description of the state of your shack.

Escape control character: Person in charge of disguises used by prisoners of war when escaping from enemy camps.

External Interrupt: Banging on the walls or doors by irate neighbours objecting to TVI blotting out *Eastenders*.

Floppy Disc: Flexible disc of magnetically-coated plastic used to store computer programs and data etc.

Full Duplex: A way of providing simultaneous clutter on two or more frequencies, used to make the bands seem busier than they actually are.

Gateway: The technical term for gatecrashing the bands.

Half-duplex: A wrestling hold.

Hard copy: This is Evidence produced by a printer and should therefore be destroyed immediately.

HDLC: The Heavy goods vehicle Driver Licence Centre.

Hertz: A famous American car rental firm.

Interrupt Procedure: What you do when the phone rings, especially when you are in the bath.

I/O: A famous song from Walt Disney's **Snow White and the Seven Dwarfs**. (I/O, I/O, it's off to work we go.)

Listing: Accurate desciption of the shack's operating table caused by the weight of packet radio equipment, computers, terminal units etc.

Memory: More storage space within computer for programs etc.

Message Flags: Non-technical term for semaphore.

Sledgehammer: Non-technical term for disassembler.

Static Memory: Storage space for programs etc, within a dead computer.

TNC: Most of you will have heard of TNT, which is a high explosive. Before TNT went off with a bang, nineteen other attempts failed: TNA, TNB, TNC . . .

Utility Program: A computer program that is widely available and yet is almost completely useless.

Video Display Unit or VDU: Essential equipment in the shack for displaying blue movies and XXX-rated horror films.

QRP WITH THE MIZUHO MX14S TRANSCEIVER

by Trevor Morgan GW4OXB

Since obtaining my licence in 1982, I have been a supporter of the principle of low power operating. In fact, my first venture on to the amateur bands was to attempt the G-QRP Club CW Novice Award which I received in 1983, endorsed 'First in GW'.

Although many of the contacts made were with European stations, and the power from the rather old crystal-controlled FT75 was a bit more than the recommended QRP level of 3W, I gained a great deal of enjoyment during this time.

Since that first effort, I have used a number of transceivers for QRP operation, including the excellent Trio TS130, my present main station rig; the Trio TS430; the Howes CTRX 80, my first attempt at homebrew; the G-QRP Club's 'Oner' and the Heathkit HW9. All of these are still part of my station set-up and are all used at one time or another, such is the ongoing interest in QRP.

A proposed first holiday abroad and the possibility of using a rig while there, had me seriously thinking about what to take. I had seen an advert somewhere, about a new range of transceivers especially for QRP operating, so I set about finding out more.

The Mizuho range has been around for some time and many 2m operators have used the 2m SSB/CW models distributed a few years ago by Lowe Electronics. However, for some time I have heard little about Mizuho's products, apart from their antenna tuners.

The MX14S

The new range of HF pocket transceivers, now marketed by Waters and Stanton, are for SSB/CW modes and are available for single bands, ie, 10, 15, 20, 40 or 80m. The model I purchased is for the 20m band – the MX14S.

The MX14S is about the same size as a regular 2m hand-held. It has a metal casing which is obviously made to withstand constant handling.

The top panel features the main controls including a large frequency control knob which allows fairly precise tuning of the crystal over either a 25kHz or 50kHz range, depending on the crystal used. It is marked clearly in two ranges to allow retuning to a selected frequency.

To the left of the frequency control knob are the on/off/AF gain control, which has a smaller knob, and the RIT (Receiver Incremental Tuning) control which allows adjustment of the receiver tuning without disturbing the transmit frequency.

Next to the RIT is a small switch which switches in a noise blanker to inhibit ignition or pulse-type interference. Below this is the antenna connection which is a BNC type socket which has a 50 ohm impedance (converters are available so that standard coaxial PL259 plugs can be connected to this).

Top panel

Two jack sockets are to the right of the aerial socket. The first is a 2.5mm one for external audio with an 8 ohm impedance which suits either a loudspeaker or headphones. The second is a 3.5mm stereo type for an external microphone with a push-to-talk line. Immediately above these is a switch to select either of two crystals.

Next in line is the RF power/'S' meter which gives comparative readings of incoming signals or an indication of an outgoing signal.

A small button to the extreme right of the panel is, in fact, a Morse key!

The rear panel has the CW/SSB selector switch, an attenuator switch to select about 10dB of incoming signal attenuation, a 3.5mm stereo socket for input of a Morse key and PTT line, the power selector switch and the external power input socket.

The main PTT switch is positioned on the left-hand side of the transceiver in a 'natural' position for the user's right index finger or left thumb.

Portable use is accomplished using seven AA rechargeable cells which can be recharged in situ by plugging in a lead (supplied) from your regular 13.5V supply. It is, however, essential to check that the unit is *off* and the selector switched to *Charge*. Failure to do this will damage the unit.

The transceiver will run from external power but this is 9.6V so a suitable transformer must be used.

The front panel houses the loudspeaker and the microphone behind a single grille.

Removing the back cover gives access to the battery compartment. Removal of the front cover gives access to the sockets for insertion of crystals. The set is supplied with one crystal which usually covers an SSB portion of the band but a wide range of crystals are available.

Under the covers

Not having laboratory equipment nor the technical expertise, I will not even attempt to explain the workings of the transceiver but, even a complete novice would appreciate the neat internal layout of the MX14S. The battery cells are easily changed and the crystals are the standard HC25U fitting and effortlessly inserted or removed.

Basically, the unit runs on a 9MHz intermediate frequency with associated matching filter. The extremely stable signal is maintained by using VXO crystals which provide really low drift performance. A high mixer injection frequency results in a single conversion design with good image rejection.

Using the MX14S

To start with, I fitted the batteries supplied with the transceiver and connected the station triband vertical directly into the aerial socket via a converter plug.

Firing up a little rig such as this, I suppose I expected a tinny, perhaps hollow, sound. Not a bit of it! I received a whacking dose of audio which had me reaching for the RF gain pretty smartly!

My first call was in response to a 'CQ' by EA5VM on 14.221 who was a solid 20dB up and a cert guinea pig. A quick exchange with a 5/5 report, so that was a fair start. Next came F89/FE5TI near Orleans who answered my CQ. Jim was pleased to give me a thorough testing and a 5/7 report was pleasing, but, switching over to the TS430 on the G5RV gave me 10dB over 9 with 100W out!

Next to come up was SM4SET. Dag gave me another 5/7 from Karlstad, with F/G3CMU in Biarritz giving a 5/5. I5QNJ rated me a 5/7 from Pistoia but the best report must have been from YT3KK who gave me 5/9!

During the next couple of days on the air before my intended trip, I was able to make a number of SSB contacts with LA4, DL1, EK2 and others in Europe; ten countries, in fact!

The receipt of the 'essential' crystal for

the QRP/CW section of the band was the proof, if any was needed, that this little rig was working very well. By wiring the Morse key as directed, the transmitter is keyed 'on' as you send, returning to receive between keying so you can hear immediately there is any response to your call.

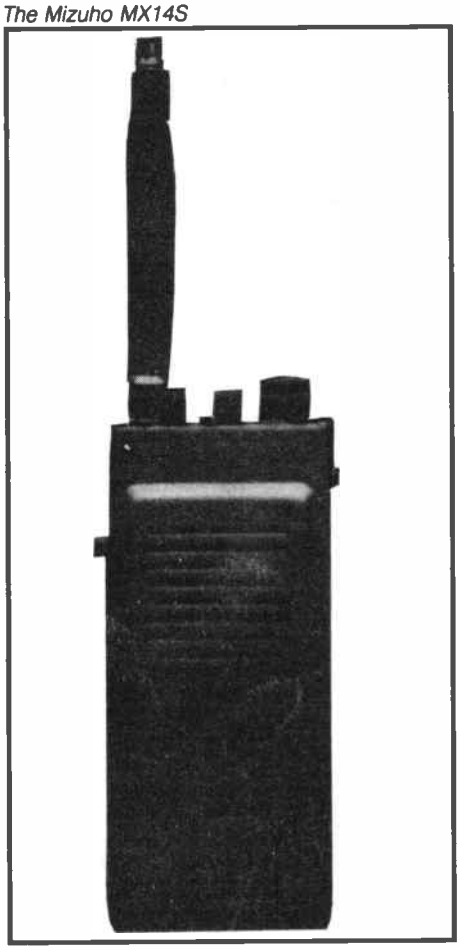
Regular contacts were made with European stations and a pile of Russians with reports varying from 5/9/9 to 5/5/9, but the clinchers had to be LU6FGZ on 14.064 (Raul found me calling CQ at 2245) and VO1AA (Signal Hill) on 14.224/SSB who dug me out of a pile-up! An exchange was made with W4GXT but as I had already made the contact on the TS430, I didn't count it.

MX14S portable

Well, the idea of buying the rig was for portable use so an aerial was necessary. I could have used my DD14 dipole, that's transportable but hardly something I could use from a park bench.

Luckily, Mizuho supply aerials especially for the MX range. These telescopic aerials fit directly into the BNC socket on the transceiver but they are over 4ft long when extended! A chat with Waters and Stanton gave me the tip to use a 15ft counterpoise wire fixed to the battery compartment screw.

The Mizuho MX14S



Technical Specification of the Mizuho MX14S

Tuning	Variable crystal oscillator with Receiver Incremental Tuning
Rx consumption	70mA
Tx consumption	600mA (peak)
Tx output	2W
Tx spurious	40dB minimum
Tx carrier	40dB minimum
Rx sensitivity	0.5μV/15dB S/N minimum
Rx intermediate frequency	11.2735
Power requirement	9.6V dc (external) or 7 × AA size Ni-Cads or 6 × AA size dry cells
Aerial impedance	50 ohms

My first attempts attracted quite a bit of attention as I was seated alongside the public footpath by Swansea Bay and it's not every day you see some twit tapping a Morse key attached to a 'walkie-talkie'! If the passers-by had heard the QSO, their thoughts of spies at work would have been confirmed by my chats with Y61YM and UC2WX! Both these stations reported solid 5/5/9 signals and DL7AMO gave the same.

It was at this time that the batteries originally supplied finally gave out. I had conducted some thirty-four QSOs with thirteen countries in a couple of days – not bad for a 2W portable!

W4/GW4OXB

My holiday in the USA was taken at an unfortunate time as, shortly after we arrived in Virginia, Hurricane Hugo lined up for its assault on the West Indies! It was also unfortunate that my XYL would rather see the sights of Washington than log my contacts. Consequently, the first couple of days netted only K3EGB (West Palm Beach, Florida), WA0QIT (Minnesota) and W4EJY (also in West Florida) on sideband.

Following the ARRL convention in Virginia Beach (where, incidentally, I saw the 10m version of this rig), we went to Richmond, Virginia. From here I contacted N4DPU (Panama City, Florida), W4PBL (Lakeland, Florida), W9SOL (Milwaukee), W4MLA/M (Palm Bay, Florida) and W9EHE (Valparaiso, Indiana) on the key, giving me contacts of well over 1,000 miles during one of the worst hurricanes in America's history!

Conclusion

The MX14S has travelled a few thousand miles with me, and has given me contacts even further afield, the best so far being the Argentinian who kept me up after my bedtime with excitement.

It is essentially a QRPer's transceiver. It is ideal for field day work from remote spots, is small enough for a mountaineer to carry and, in its 40m or 80m versions, it is just the job for putting those rare WAB squares on the air.

In the time I've had the rig, it's become a pal, sitting in my pocket or tucked in my camera bag, enabling me to listen in out-of-the-way spots.

The receiver is superb and JAs, VKs and ZLs have been heard as clearly as on my other rigs. The transmitter has performed faultlessly with excellent reports from *all* stations I have contacted.

The accuracy of the tuning is more than adequate and checks made against the main station transceivers verified this accuracy. For instance, if the MX14S was set on crystal 'A' at 30, the transceiver was on 14.230. When set on Crystal 'B' at 60, it was on 14.060 – very simple.

The RIT was very useful when stations were a little off frequency or drifting a bit.

Checking against the station SWR/watt meter (Trio SW200), the output was about 2W which is as specified (on full batteries).

Any adverse comments? Well, I could mention the lack of a CW sidetone, but I soon got used to that, although a simple sidetone unit could be made or even bought.

The inbuilt key, which is a tiny button, *is* awkward to use and results in a dented finger in little time. Even a cheap key (which I used) makes the world of difference (an ex-army type key would be ideal).

The PTT button is a little uncomfortable in continuous use.

The 9.6V supply is a right pain in the ear, but the rechargeable batteries do last quite a long time and it's easy to carry a spare charged set in a standard battery holder, using the 'dummy' battery supplied (an eight cell holder costs about a quid).

The Mizuho MX14S is available from Waters and Stanton, 18-20 Main Road, Hockley, Essex SS5 4QS, at £189.00. Accessories such as the telescopic aerial, power reducer (13.5-9.6V) and additional crystals are available as extras.

MEDIUM WAVE DXING

by Steve Whitt G8KDL

This month I have some news of useful radio propagation information, which should avail DXers having to rely entirely on WWV broadcasts at present. But first I want to take a closer look at Grey-line DXing, a technique employed by just a few radio amateurs and even fewer medium wave listeners.

Grey-line DX

One topic which is of equal interest to medium wave DXers and active HF amateurs, is the subject of Grey-line DX propagation. Most articles dealing with long-distance radio propagation usually talk about steady-state conditions, which for the medium wave DXer mean the conditions that prevail when a well-established darkness path exists between broadcaster and listener. As we shall see, there is an interesting transitional region between the light and dark halves of the globe (hence the term 'Grey-line') which can enhance radio signal propagation.

There exists a rarefied region of the Earth's upper atmosphere (above about 50km) that absorbs intense solar ultra-violet radiation, thereby protecting life on the Earth's surface. This radiation results in a region of ionised gases, known as the ionosphere, which, depending on diurnal and seasonal variations, consists of several fairly distinct layers of high ionisation **(Fig 1).** These layers have a profound effect upon radio waves approaching them from transmitters on the ground. Under certain conditions refraction of waves occurs, resulting in the 'reflection' of signals back to Earth whilst, at other times, these signals can be totally absorbed by the ionised gases.

Layers of Ionisation

During daylight hours, solar radiation penetrates the atmosphere far enough to form the lowest layer of ionisation, the D layer, roughly 60km above ground. The D layer so completely absorbs signals on medium wave frequencies that any radio signals radiated by a station, other than those parallel to the Earth's surface, are completely lost.

However, with the approach of sunset the D layer absorption decreases rapidly and within a few hours medium wave signals are being reflected back to the ground from higher regions of the ionosphere; depending on the circumstances, reflection occurs in the E region (about 100-120km up) or in the F layer (225-300km), giving rise to a skip distance for medium wave frequencies of about 100 to 500 miles.

Longer distance reception is possible when multiple reflections occur between the ionosphere and the Earth's surface. A few very long hops are preferable to many short ones since the losses incurred at each reflection point are reduced, the probability of encountering a region of poorly reflective ionosphere is lessened, and the overall distance travelled by the signal is also shortened. At first sight, D layer absorption during daylight hours prevents long-distance reflection from the F2 layer, which is also present only during daylight.

However, dawn and dusk are special times in an ionospheric context. **Fig 2** shows a close up of the terminator – the dividing line between night and day. Because the outer reaches of the ionosphere are considerably higher than the DXer sitting in his shack on the Earth's surface, at dawn the sunlight reaches these areas first and, as a result, all the daytime layer formations start to take shape before the Earth's surface is fully in daylight.

Similarly, since the night-time F layer is considerably higher than the D layer it will re-form into the two distinct F1 and F2 layers before the D layer has a chance to become established. Thus, there is a DX window around dawn when near ideal conditions exist – no absorbing D layer but a high level F2 layer.

A similar condition exists at dusk, since the lower D layers move into

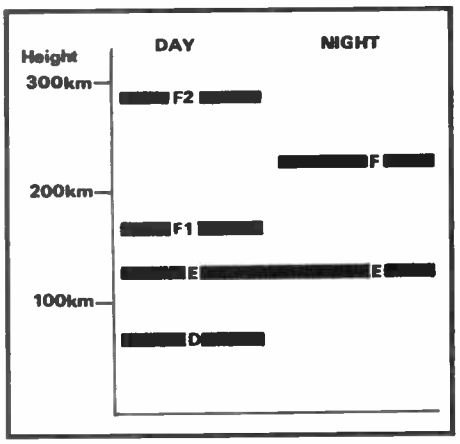
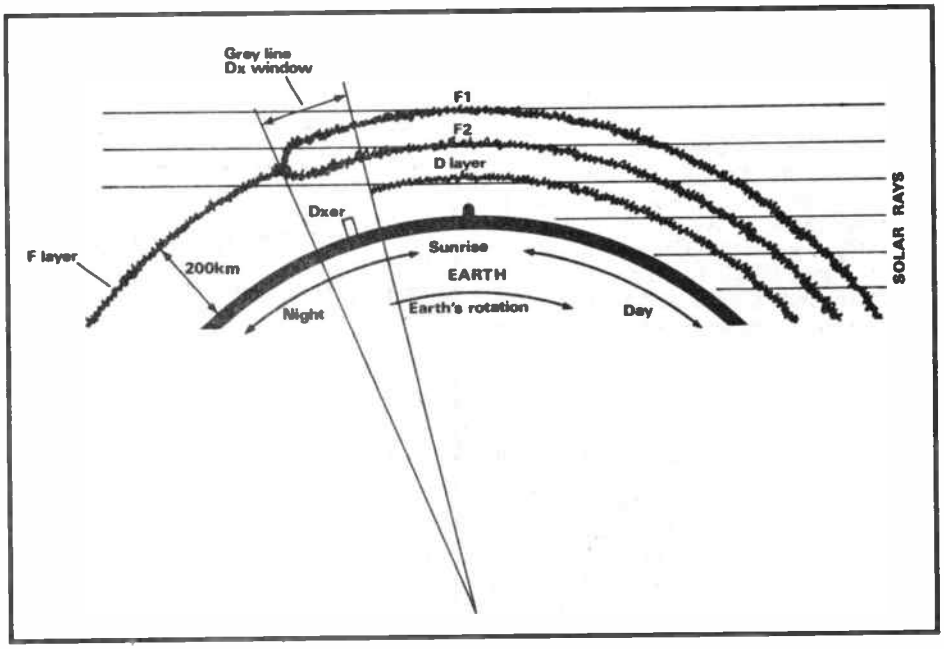


Fig 1 (right): *The ionosphere.* ***Fig 2 (below):*** *Grey-line at dawn*



Date	Sunrise bearing	Sunset bearing
1 Jan	41-221	319-139
15 Jan	36-216	324-144
1 Feb	28-208	332-152
15 Feb	20-200	340-160
1 Mar	10-190	350-170
15 Mar	5-185	355-175
1 Apr	352-172	8-188
15 Apr	343-163	17-197
1 May	334-154	26-206
15 May	326-146	34-214
1 Jun	320-140	40-220
15 Jun	318-138	42-222
1 Jul	318-138	42-222
15 Jul	321-141	39-219
1 Aug	328-148	32-212
15 Aug	336-156	24-204
1 Sep	347-167	13-193
15 Sep	358-178	2-182
1 Oct	11-191	349-169
15 Oct	20-200	340-160
1 Nov	29-209	331-151
15 Nov	36-216	324-144
1 Dec	40-220	320-140
15 Dec	42-222	318-138

Note: All bearings are degrees from True North (7°to get the magnetic bearing). These figures were calculated for a latitude of 54°N, but will give acceptable accuracy throughout the UK

Table 1

darkness some time before the higher F layers pass out of sunlight and begin to change. Indeed, this entire process is active all the way around the globe along the Great Circle Line that defines the boundary between day and night.

To exploit the Grey-line DX window both the listener and the transmitting site need to be located along this Great Circle, and the DXer has to know in which direction to point the aerial. The direction in which the aerial needs to be beamed changes with the seasons, since the Earth's axis of rotation is not through the North and South Poles but inclined at an angle of 23½°.

Practical applications

Well, that's enough of the theory behind Grey-lines; we can now look at the practical application of the technique. All you need is a Great Circle map, together with Table 1 (which shows the aerial directions needed to exploit the Grey-line at various times of the year, assuming the listener is in the UK) and a Table of local sunrise and sunset times. It is important to remember that this DX window occurs between thirty and sixty minutes before sunrise and a similar time after sunset.

Looking at the Grey-line bearings, you'll see that the technique is of particular value for African DX throughout the year, and it is possible to pick certain dates when enhanced DX from Alaska and Japan is possible.

News desk

You may have heard that an extension of the medium wave band has been sanctioned to take place in ITU Region II (the Americas) within the next few years. This will extend the band from 1605kHz to 1705kHz and should be a gold-mine for European DXers, who will be able to pick off new stations as they appear.

So far the FCC has yet to rule on the way licences will be allocated. However, the experimental station KA2XXB is the very first new station to operate in the extended band. If you tune to 1660kHz after about midnight you might hear it operating with 400W from Beltsville, Maryland in the USA.

KA2XXB was set up by the National Association of Broadcasters to study a new design of medium wave antenna intended to reduce sky-wave radiation which causes reception problems, owing to interaction with ground-wave signals at distances from fifty to 300 miles from the transmitter.

The antenna used is a 295ft high vertical equipped with horizontal radiators and an elevated 'earth' radial system. Depending on how the antenna works, this should not reduce its DX potential over thousands of miles, since these signals rely on very low angle radiation from the transmitting antenna.

Detailed reception reports should go to Kelly Williams, National Association of Broadcasters, 1771 N Street NW, Washington DC 20036, USA.

Propagation corner

Since early in 1990 Marconi Research in Chelmsford have been operating a telephone information service: the GEC Marconi Research Daily Short Term Ionospheric Forecasting Service, tel: (0245) 73331 ext 3152.

After a few rings you will hear a two-part recording which covers a 'Past Summary' and also a 'Forecast'. The Past Summary includes details on short wave fadeouts, maximum usable frequencies, A and K indices, sunspot number and 10cm solar noise flux. The Forecast is less detailed but includes an interesting figure predicting the probability of a short wave fadeout in the coming twenty-four hours.

As far as I can tell this is still an experimental service and the message contents may change in response to user comments; callers can leave a message after the recording. The recorded message is updated on weekday afternoons at 1500hrs, though the service is available twenty-four hours a day seven days a week.

Some of the stations I heard from my QTH in Ipswich at the beginning of the year. If you tune into the medium wave band after midnight you may be able to hear them

DX FILE

670 CHYQ Musgravestown, NF	Still part of Q Radio Network but no longer parallel to CJYQ on 930kHz
920 CJCH Halifax, NS	Good on Monday nights/Tuesday mornings since Yugoslavia is off 918kHz
1070 CBA Moncton, NB	CBC relay sometimes amazingly strong
1295 Conakry, Guinea Rep	Often heard 2315-2400hrs after sign-off of BBC World Service on 1296kHz
1320 CKEC New Glasgow, NS	Often good since station now on higher power
1380 CFDA Victoriaville, PQ	French station part of Radio Mutuel network
1510 CJRS Sherbrook, PQ	Look for French station. Rare compared with more regular WKKU in Boston

PROJECT BOOK

by Martin Williams

In this instalment of the power supply saga, we move on to building a simple general-purpose supply with an in-built extra. The value-for-money feature is a Ni-Cad charger which will handle a wide range of charging currents.

Circuits

This is shown in **Fig 1** and is about as simple as you are likely to find; the sort of thing the newcomer to home-brew can build on a wet Saturday afternoon.

The mains is switched using S1 and protection for the unit is by means of the fuse F1. The transformer should be rated one amp at 16 to 18V, the exact value is not critical. The low voltage is rectified by the bridge rectifier D1 and smoothing is accomplished by the electrolytic capacitor C1.

The circuit now splits into two sections. The lower part is a standard 12V supply which is regulated by IC2. This gives an output which is held constant to within a few millivolts from zero current to the full load of one amp.

The upper section uses a 7805 regulator but this one is used as a constant current generator, which is exactly what we need to charge Ni-Cad cells.

The integrated circuit is wired in such a way that it maintains a steady 5V potential across the following resistor bank, irrespective of the voltage rating of the cells that are being charged.

The switch S2 allows us to select a suitable charge rate for the cells to be charged. Reading from the top of the diagram the rates are 9mA which is suitable for PP3 type cells, and 20mA for AAA types.

The next position gives 70mA which is right for AA cells. Following that we have 230mA which is correct for high capacity C cells. If you have low capacity, 1.5 AH types reduce this resistor to 39 ohms. Finally we have 50mA which will do a good job on the large D types.

The charger will handle anything from a single cell up to a battery with a maximum of 14V.

Building

It is best to build the unit in a metal case. The exact layout used is not at all critical. The only point to bear in mind is that the regulators will need a certain amount of heatsinking. This is easily done by bolting them to the box using the usual dc isolator washers.

Important

Do make sure the charging rates match the requirements of the cells you are charging. A suitable charging rate is the AH rating of the cell divided by ten.

If you need to adjust the charge rate resistors use Ohms Law to find the ohms value of the resistor, which will drop five volts at the current required. For example, if you need a 100mA rate then you need a 50 ohm resistor; 100mA through 50 ohms drops 5V.

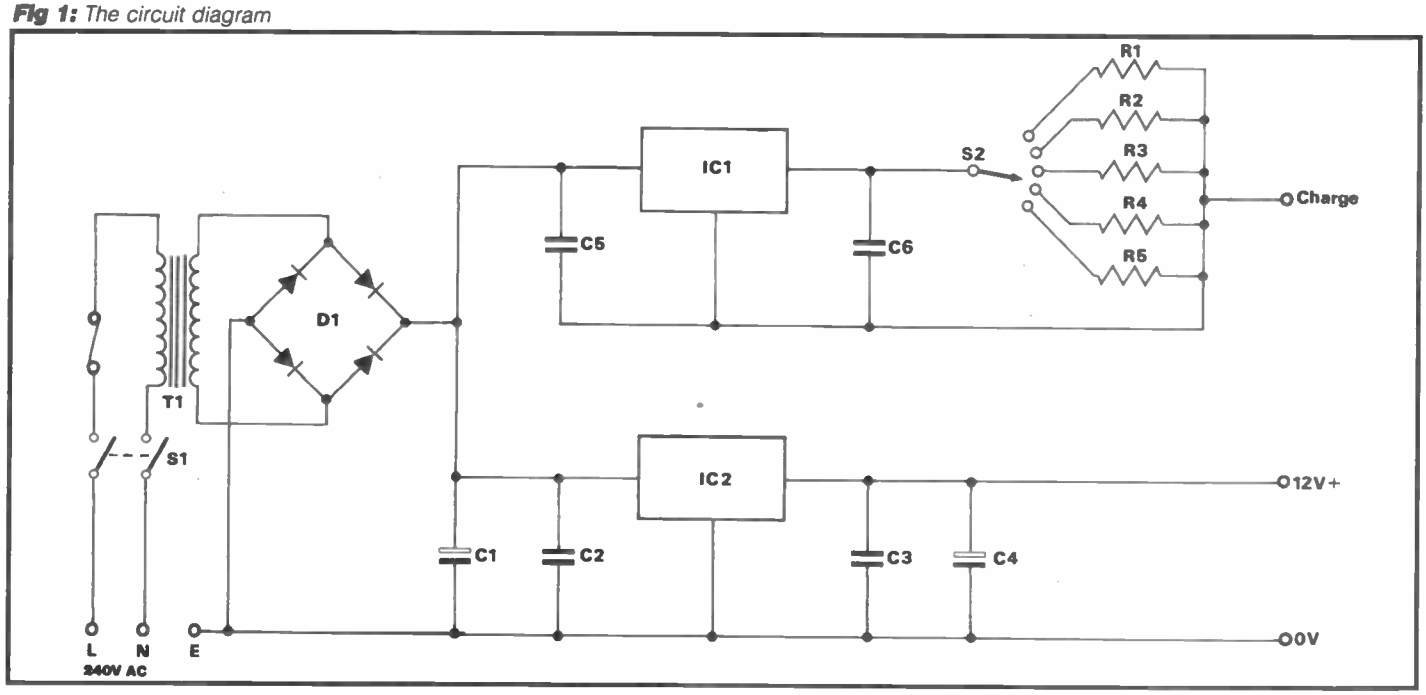
You can use both sections of the supply at the same time, provided that the total current drain does not exceed the rating of the transformer.

Table: *Components for a general-purpose supply*

Components

R1	560Ω ½W	C1	1000μF 25Vdc
R2	270Ω ½W	C2	100n
R3	68Ω 1W	C3	100n
R4	22Ω 2W	C4	4700μF 25Vdc
R5	10Ω 3W	C5	100n
		C6	100n
IC1	7805		
IC2	7812	T1	18V @ 1 amp
D1	bridge rectifier	S1	DPDT toggle
		S2	1 pole rotary
		F1	1 amp fuse

Fig 1: *The circuit diagram*



Tony Smith G4FAI takes his bimonthly look at the world of dots and dashes

More no-code moves

In February, the US Federal Communications Commission formally proposed the creation of a 'Communicator' licence for 222MHz and above which will not require a Morse test. This is intended to replace the existing Novice and Technician licences.

There have been attempts since 1974 to obtain a no-code licence in the US, but recently there has been greater pressure, with twelve separate petitions, including one from the ARRL, prompting the FCC decision to go through the necessary stages to create new regulations.

According to the W5YI Report, there will be a six month comment period and a final decision will probably be made at the end of 1990.

During the FCC meeting which considered the proposal it was stated, '. . . we are mindful of our obligations under the International Radio Regulations which require a knowledge of telegraphy where the licence authorises transmissions below thirty megahertz. Privileges for the Communicator operator, therefore, would be for transmissions on frequencies at VHF and shorter wavelengths until the licensee demonstrates a knowledge of the Morse code to the volunteer examiners . . . '

On another front, a proposal by Israel's national society, IARC, to the IARU Region 1 Conference at Torremolinos on 1-6 April, suggests that 'in view of the abolition of Morse proficiency testing for Maritime Mobile operators' the ITU be asked to agree to the abolition of the amateur Morse test and the substitution of a computer proficiency test in its place.

More on this startling proposal when news of the Conference's deliberations is available.

EUCW Straight Key Day

The European CW Association's Straight Key Day, organised on behalf of EUCW by the Scandinavian CW Activity Group, will be on Saturday 23 June and is open to all amateur CW operators who enjoy working on the hand key. There will be activity across the UK and Europe. Just call CQ SKD between 3540 and 3570; 7020 and 7040; 14050 and 14070, or anywhere in the 10MHz band for relaxed and enjoyable QSOs!

Participants having at least five contacts with other straight key stations may cast votes for the best 'fists' worked, one vote for each of the three considered best. A Straight Key Award will be sent free of charge to every operator who receives at least two votes.

Send logs and votes to SKD Manager, Daniel Klintman SM7RXD, Adjunktsgatan 3D, S-214 56 Malmoe, Sweden, before 17 July 1990.

Edgware Straight Key Evening

Another event worthy of support is the Edgware and District Radio Society's eighth annual Straight Key Evening on Friday 18 May, from 1900 BST onwards around 3.550MHz. Call CQ SKE. The club will again be running their special event callsign, GB2SKE.

Organiser, John Bluff G3SJE, says, 'As ever, the intention is to encourage all to do their bit for brasspounding, young or old, novice or expert. Friendship and relaxation is the motto.'

Morsum Magnificat

Morsum Magnificat is a non-profit making quarterly magazine for Morse enthusiasts which began in Holland in 1983, published in the Dutch language. I have been associated with the magazine since the appearance of the first English version in the autumn of 1986, and have edited and produced it single-handed in the United Kingdom since the spring of 1988.

As from the summer 1990 issue there will be a new editor, Geoff Arnold G3GSR, who is also editor of **Radio Bygones.** Geoff was previously editor of **Practical Wireless**, and is a one-time sea-going radio officer.

I shall remain associated with the magazine as consultant editor and **Morsum Magnificat** will continue with the same format and type of content as before, providing international coverage of all aspects of Morse telegraphy, past, present and future.

The address for enquiries is **Morsum Magnificat**, 8A Corfe View Road, Corfe Mullen, Wimborne, Dorset BH21 3LZ.

Forgotten technique!

After reading my last column (**Amateur Radio** March) some readers think that I have discovered a long-forgotten military technique known as 'semi-automatic overhand keying'!

I am sorry to disappoint them, but when the text left my typewriter it referred to the 'advantages of semi-automatic over hand keying for traffic handling', in other words the bug was better than the pump. The version as printed sounds intriguing and somehow authentic. Perhaps I should check out the manuals in case there really is such a thing! [Oops! *Ed.*]

CW news bulletins

It was pleasing to see in March's **RadCom** that the experimental CW news bulletins from G3LEQ are now a permanent feature of the GB2RS news service.

These bulletins are transmitted at 10.00hrs local time on 7.0475MHz with identification for the first five minutes followed by bulletins at speeds ranging from 30 to 15wpm. It is a useful exercise to attempt to read the higher speeds and then fill in the gaps as the speed drops for the repeats.

Gordon Adams G3LEQ will appreciate reports or comments on these bulletins sent to him QTHR.

The Cat's Whiskers Award

Gordon also transmits Morse proficiency runs on behalf of the North Cheshire Radio Club at 19.15hrs local time on the second Sunday of each month, and the 'Cat's Whiskers Award' is issued to successful participants.

Transmissions are on 3.600 and 145.250MHz (with others planned for 1.975 and 144.250), for five minutes each at 30, 26, 22, 18, and 15wpm. These are in plain language with numerals occurring in the text, and with four types of punctuation (. , / –).

Practice sessions at the same speeds are put out *every* Sunday. On test days there is a five-minute practice transmission at the appropriate speed before each proficiency run. Station callsigns at present are G0LEQ or G0BAA, but it is hoped to obtain a call more appropriate to the service.

Applicants should send in the script as copied, with a fee of £1.00 (or three IRCs) to cover costs, plus a signed statement confirming that no electronic or other aid has been used to decipher the transmission.

Applications or enquiries should be sent to NCRC Catswhisker, PO Box 3600, Altrincham, Cheshire WA15 9LU.

A VERTICAL LOOP FOR 2m FM

by Brian Kendal G3GDU

The full-wave loop aerial in various forms has been popular for many years on the HF wavebands but, so far, has made little impression on the VHF fraternity.

The only examples of full-wave loops commonly found on VHF are in the Jaybeam four and six-element quad beams and in the JVL-designed beam for 432MHz and 1296MHz. From time to time designs for 'Quagi' beams, which use a quad loop as the driven element, and conventional directors and reflectors have appeared, but have not gained any strong popular support.

In every case the full-wave loop has been incorporated as the radiating element of a directional beam, and no consideration has been given to the well-known advantages to users of single vertically polarised loops on HF: easy matching, minimal height, relative freedom from capacity effects owing to nearby objects, and near omnidirectional characteristics.

On HF a full-wave loop may take the form of a triangle (delta loop), square (quad loop), or rectangle – with little variation in its characteristics. However, on VHF there is little point in deviating from the most convenient form for home construction – a circle (see **Figs 1** and **2**).

This shape has a further advantage in that the gain of a full-wave loop is proportional to the enclosed area and, as every schoolboy knows, a circle encompasses the maximum area for a given circumference.

Construction

The aerial element was manufactured from a length of ½in rigid coaxial cable. However, it could equally have been constructed from copper or aluminium tubing of any diameter from ¼in upwards or, in fact, any available material.

The total length was calculated using the well-known formula: L = 1007/F where L is the circumference in feet and F is the operational frequency in MHz.

This gave a length of 6.92ft for a centre frequency of 145.5MHz. Converting the decimal fraction to inches gave 11.04in. Thus, the total length was near enough to 6ft 11in. This length was cut and the solid coaxial cable teased into a circle by hand.

Matching the loop

Loop aerials normally exhibit a radiation resistance of approximately 120 ohms. Therefore, it is possible to obtain a good match to a standard 50 ohm feeder using a quarter-wave matching section of 75 ohms impedance.

When cutting a quarter-wave matching section made from coaxial cable, allowance must be made for the velocity factor of the cable. The most convenient source of 75 ohm feeder is that used for TV. This comes in two types: standard solid dielectric and semi-airspaced. The velocity factor of the former is 0.66 and the latter is 0.87. This gave a length of matching line of either 12.7in or 16.5in, depending on the cable type.

As there was no intention of erecting the aerial outdoors, there seemed little point in waterproofing the connection between the aerial element and feeder; this considerably simplified the construction process. Accordingly, solder tags were soldered to the inner and outer of the coaxial matching section and connected with self-tapping screws to the main aerial element.

Had the aerial been intended for outdoor use, a weather-proof connection could easily have been made using a standard dipole centre insulator.

First trials

Before a new aerial can be brought into service, a series of tests is necessary to determine how well it is matched to the feeder, the bandwidth, the polar diagram and its efficiency.

To provide a suitable environment for testing, the aerial was temporarily mounted on to a 10ft wooden pole 4-5yd from the reference aerial, a ⅝ wave vertical mounted on the workshop roof.

A wooden pole was used because, for vertically polarised operation, the loop feedpoint has to be in the vertical section of the element. Consequently, the horizontal sections will be at high impedance, thus maximum effect is gained from the adjacent pole. Wood, being non-metallic has no effect on the aerial.

The first test was to check the VSWR of the aerial assembly. This was determined at various frequencies between 144-146MHz and at no place was it measured in excess of 1.05:1 (see **Fig 3**).

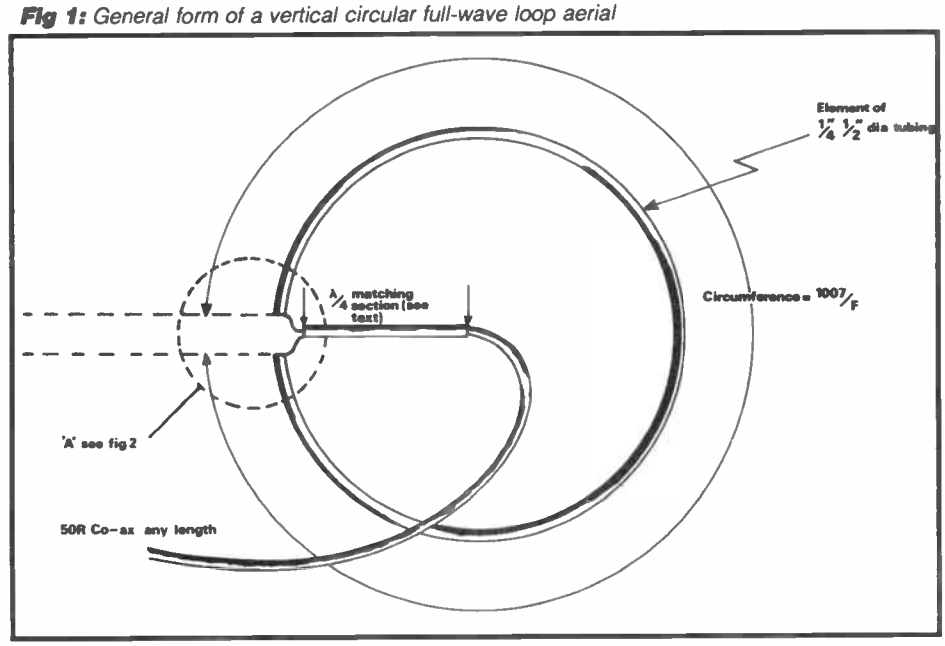
At first, this low figure caused some concern that either high feeder losses existed or that the test equipment was faulty. However, further investigation cleared both possibilities and the measured figure was accepted.

The feeder was then transferred from a transceiver to a converter/HF receiver arrangement which had the receiver's 'S' meter disconnected and replaced with an 8in meter. The 'S' meter and receiver had previously been calibrated against a standard signal generator and, owing to the extended scale of the 'S' meter, variations of 0.5dB were easily discernible.

The Wroxham beacon and a number of repeaters were tuned in turn and, in each case, the signal from the loop and the ⅝ wave whip was compared. In no case was the loop inferior to the whip, and on several stations there was a noticeable improvement.

The experiment was then repeated several times but, in each case, the loop was rotated first for maximum then for minimum signal strength. Whilst this

Fig 1: *General form of a vertical circular full-wave loop aerial*



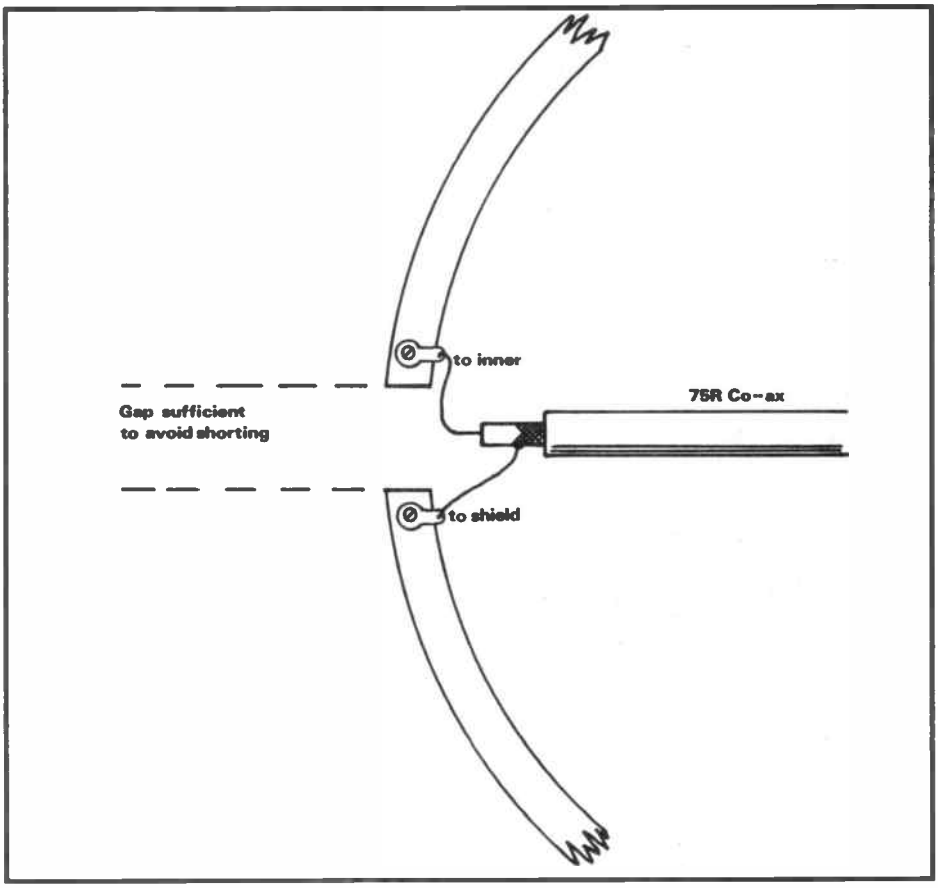
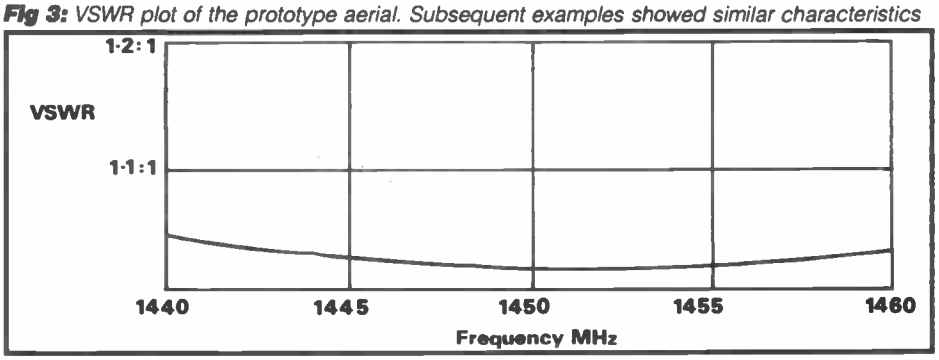


Fig 2: *Detail at 'A' on* ***Fig 1****. Note: if the array is not erected in a roofspace, a separate/centre insulator will be necessary*

Fig 3: *VSWR plot of the prototype aerial. Subsequent examples showed similar characteristics*



technique neither replaces a calibrated aerial range nor enables a polar diagram to be determined, nevertheless, it gives a valid comparison of two aerials and is possibly the only method which can be used within the confines of an urban garden.

Owing to local conditions where I live in Crawley, the signal strength of any received VHF station can vary within the distance spacing the two aerials, but by averaging the results obtained from signals received from six repeaters and the Wrotham beacon a valid comparison was made. This showed that the loop was slightly more than 2dB superior to the ⅝ wave whip when pointing at the station, and less than ½dB inferior when rotated to minimum signal strength.

Transferring indoors

Having completed the basic checks the aerial was then transferred into the loft and hung on a nail hammered into the woodwork. The VSWR was checked again to see whether nearby objects were having any effect. The VSWR plot remained unchanged from the figure obtained outside.

Several other positions were tried and, except when the loop was resting against a metal water tank, the VSWR remained the same.

Results

Although the performance of a vertically polarised circular loop aerial neither equals nor exceeds that of a well-designed collinear, at my location at least, over a period of two years, it has proved far superior to all other roofspace aerials for 2m FM. These have included dipoles, J-poles, Slim Jims and ¼and ⅝ verticals.

Overall, for a simple aerial for local FM operation the circular loop cannot be bettered. Furthermore, as it is only about 2ft high, it makes an ideal aerial for those living in houses with low-pitched roofs or, alternatively, flat-dwellers, who have no possibility of erecting outdoor aerials.

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

As I mentioned briefly last month, the International Listeners' Association had its first organised contest in February. It was very interesting to hear the comments and experiences of listeners in different parts of the country, using a wide range of equipment from top of the range receivers and aerial systems to hand-helds with little more than the provided telescopic whips.

The band used on this occasion was 20m and the scoring was one point for each station logged and one point for each different prefix, using Geoff Watts' excellent list as the bible. The total score was the total stations multiplied by the total prefixes.

There was a time limit on the contest in that the listener could submit a total of only three hours' logging time from the entire weekend. This gave both shift workers and night-owls a good chance of getting in on the act. Most contestants chose to listen in bursts of an hour or so while things were 'hot' and take breaks when the band dropped or things cooled off.

Fortunately, there were three lively transmitting contests over the weekend which ensured some nice pile-ups to catch before tuning around the rest of the band.

Results

Peter Bowles of Newhaven tuned in his R300 for his first contest and managed 739 points. Hedley Falkinder of Malton squeezed in time between power cuts to score 780 points and Luciano Marquardt had a go with the DX302/AD270 and scored 900 points. Another first-timer was Mike Philips of Windsor, who scored 1,711 points.

My own score of 2,394 points was scored listening from the hospital on the ICF7600D between cases! Paul Baylis of Vigo, Kent, latched on to JX9CAA and logged quite a few towards his 2,480 while Mick Brown of Dunstable notched up 5,712 points on his FRG7700.

Mike Parent in Ontario was also a first-timer and said that although conditions were good there, he didn't get the spate of Soviet stations he expected. However, he still managed 8,964 points. Bill Craggs of Trimdon Grange wound up the FRG7 to score 9,072 while Mike Ribton of Gillingham used the RA 117E and Delta Loop for his 10,416 which included such niceties as 4K2OT, TK5OF, VE7CWG and V29KN.

Mike observed that 78% of his loggings were European but he didn't find any pile-ups. He reckons that some Europeans use ridiculous power to speak locally (hear, hear!) and cause quite a lot of broadband QRM.

Phil Davies of Market Drayton was in there with the 840A and logged some very nice ones in TU2UI, HL4GAB, KL7XD, VK7KH, FR5ZN and PJ4CR plus a few special calls.

Herbert Yeldham of Burnham on Crouch used the FT1 and various antennas including a 274m endfed (!) to score 12,838 points. He managed to hook into all three contests and NL7KE, VU2DK, A41KM and YV1AVV took the bait.

Peter Cardwell of Sheffield really got stuck in with the new Butternut vertical and V37AT, NL7XD, YC1ZZ, HK3KQ and VR200TI were logged among the crowd. Pete used all modes including CW, RTTY and packet for his fine 17,600 points.

It was left to Ken Burnell at his new QTH in Crewe to snatch the trophy this time with 17,928 points! Among a mainly European collection 6W1AM, YT7EW, 9K2YA, PI9IRC, 4K4QQ and 7X2VX (plus one lonely Yank) were among the few DX stations logged, which just goes to show that the points were there for the taking. What if he'd got into that American Sprint contest?

Well, that sums up the first contest. There's another in April, so we'll see who chases Ken for the honours.

Award winners

A couple of award claims in this month. The first is from Ewald Bartunek of Vienna who claims Continental Awards for South America and Africa. The South American list includes: CP8UX, CX9BY, HD1OT, HJ3MCM, VP5ET, ZP5AA, OA4PWY, 4V2K, 9Y4VU, FY0P and DL9KW/YV5. The African list includes: CN0A, D44BS, D2AP, SU1ER, TL8RM, T5GG, XT2KG, ZS10JUN, 3B9FR, 3Y5X, 5H3TW, 5N29BHA, 5T5CK, 6W1NQ, 9L2NG, 9Q5AA and 9X5NA.

Some nice catches there and another two awards for Ewald. Well done!

Remember, you have to log only 100 stations from a continent to claim these awards, and they are available for broadcast or amateur stations.

Paul Baylis of Vigo, Kent, submitted his claim for the Bronze Prefix Award for 250 different prefixes logged. Nothing exotic was listed in this first effort but CU3AA/89, CR5CQK, C31LHK, HK0EFU, HV1SC, JX9CAA, OD5VT, SN0POL and T77V are worth a mention. Congratulations, Paul. It's nice to see some newcomers in the lists.

Tuning in your ears

Of course, award hunting is not everyone's cup of tea, but this type of logging does teach you where and when to listen for specific areas, and tunes your ears to listen for the weak stations hidden in the noise. Even if you are not entering for an award or contest, it's a good test to spend an hour or so seeing just how many countries or prefixes you can log instead of just wandering up and down the band.

This sort of set listening goes for broadcast listeners as well and an hour or so spent concentrating on one band at a specific time will often lead to you finding stations that you have missed during random tuning.

Try listening just off the bandedges too. Some small stations or domestic broadcast stations sneak away from the crowded main part of a band and use the quieter regions between the recognised bands. These local stations can be difficult to identify as they naturally broadcast in their own language and dialect, but music, news bulletins and commercials can provide clues.

Although many of the European domestic broadcasters are more likely to be found on the medium or VHF bands, there are still those who use short wave, particularly in mountainous areas.

Reporting to these stations is best done in the local language which can pose a problem if identification is at all doubtful.

South American stations use Spanish or Portuguese dialects and a lot of the Pacific and Caribbean islands use French or Dutch while German, French and Spanish are used in many African countries, but if you tangle with Swahili, Chichewa or Tsonga, you've got problems unless you are an ex-patriot!

Even European stations can cause problems with language. For example, the Soviet Union comprises many individual countries, each with its own language. Even Czechoslovakia has Czech and Slovak used as independent languages in the same country.

Sending reports

Reports should contain a full description of what was heard, at what frequency and at what time, and full details of your receiving station. They should be sent to the programme director or communications manager. Always send a couple of IRCs as most local stations are low budget

OUR 1990 OPEN CONTEST

The ***Amateur Radio*** Prefix Challenge takes place on 26-27 May 1990 from 0001hrs on 26 May to 2400hrs on 27 May. Total logging time allowed is six hours.

The bands to be used are 20, 15 and 10m. No more than three hours' total logging is allowed on any one band.

Scoring is one point for each station logged, and multiplier one point for each different prefix logged, ie, total score is station total for all bands multiplied by total prefixes from all bands.

Duplicate stations or prefixes unmarked will incur a penalty of ten points each. Once a station or prefix has been logged on one band it *cannot* score on any other band.

Logs should be in date/time/band order and regular log or contest sheets are preferred.

There is no fee but a first class stamp should be enclosed for return of logs.

All entries must be in by 15 June.

There is a prize for the winner, so get your headphones out, fill up your vacuum flasks and let's see who is really listening!

concerns and have no facilities for handling reports or QSL cards.

Don't expect pretty cards from these stations. Although some do send out nice cards or stickers, you may just get a thank you letter or formal slip of paper verifying your report.

WRTH 1990 edition

If you want details of local broadcast stations and where you can look for them, **The World Radio and Television Handbook** is the volume to have. Published by Billboard Limited, 7 Carnaby Street, London W1Y 1PG, it is updated annually and crammed with information.

Worth a visit

There are some good rallies to visit this month.

Drayton Manor Rally near Tamworth, Staffs, is on 13 May; the Cambridge DARC Rally is at the Coleridge Centre on 20 May, and the Plymouth Radio and Electronics Fair is at Plymstock School on 27 May.

Have you got a local rally coming up? If so, let me know.

That's about it for this month. Good Listening!

News and comment from Glen Ross G8MWR

Good news

Let us start with good news for a change. You may remember that some months ago there was a proposal to close down the amateur radio station that has been running at the Science Museum for many years. This station is known worldwide by its callsign GB2SM.

When news of its impending closure was made public it resulted in a huge protest. This has led to the decision to keep the station on the air. It will continue to be active on the HF and VHF bands and, of course, visitors to the museum are always welcome at the station.

More 50MHz

The latest European country to receive permission for 50MHz operation is Luxembourg. The LX stations were granted use of facilities on the band as from 3 March. The frequency range is somewhat restricted but is adequate for current usage, being from 50MHz to 50.425MHz. There is a power limit of 100W ERP from horizontally polarised aerials. Two stations are known to be ready for action, these being LX1SI and LX1JX.

There is also information coming in that German operators will be able to use the band as from 1 April but this date seems a bit suspicious.

Pile up

Operators on 6m seem to have the same affliction as their brothers on the higher bands. This shows itself as a desire to have another rubber-stamp contact with the DX station that was worked only a couple of days earlier. Presumably this is done just to prove that the first contact was not a fluke.

The big problem is that it's the high power boys who generally indulge in this behaviour. The result being that low power operators get very little opportunity to make a contact.

Some DX stations are becoming fed up with getting quick contacts with the same stations every time they come on the air. ZS3E has particularly asked that if you have already contacted him, do not call him again just a few days later. As he says, 'Let someone else have a chance to add a new country to the logbook.'

The 4m band

We do not hear much about the 4m band but there is life up there. This band is where mainly converted ex-commercial PMR gear is used and is one of the few places where good old-fashioned AM operation is still in regular use. There have been problems in the last few months owing to packet stations opening up. Unfortunately some of them have managed to land on frequencies which have been used for local club net purposes for a long time. As you can imagine, this has caused some recrimination.

Problems

The point about most ex-commercial gear is that it's nearly all crystal controlled and if club members have invested a fair sum of money between them for crystals to establish a local net, they do not take kindly to being told that they will have to move. Equally the packet fraternity needs to know on what frequencies the various units are located so as to make interconnection possible.

The RSGB VHF Committee recently proposed some ideas for a bandplan which would try to alleviate the problems for all users.

The plan

The present thinking is to use 70-70.075MHz for CW and beacons. 70.075-70.2MHz includes both CW and SSB modes. The area from 70.2MHz to 70.225MHz is at present unspecified, so perhaps they are just leaving a bit of space in case they have forgotten someone! 70.225MHz up to 70.4MHz is listed as an all-mode section and 70.4-70.5MHz is intended for FM usage.

There are also several spot frequency allocations, and these include 70.07MHz for unattended QRP beacons. The SSB calling frequency sits at 70.2MHz. Packet radio gets two discrete spots on your dial, one at 70.325MHz and the other at 70.487MHz.

Proposals

The established mobile calling frequency on 70.26MHz has been scrapped, but this should not cause a great deal of distress because most crystals can be tweaked enough to get them on to 70.25MHz or 70.2625MHz. Remember that these are only proposals at the moment and, even if approved, will not come into force for some time.

The RSGB, rather unusually, have thrown the matter open to public debate and have asked that you inform them of your thoughts on the matter.

All correspondence should be addressed to the VHF Committee, the RSGB, Cranbourne Road, Potters Bar.

Call plates

There is a lot of interest in the use of car number plates as amateur callsigns. If you are hoping to get one of these do not hold your breath, as they will not be available for some months yet. Also bear in mind that not all amateurs will be able to obtain a car number plate which is suited to their own callsign.

Unless some special arrangements are made the G-zero group will be out of luck, because licence plates which use zero as an identifying number are not issued. Before you write to tell me I am wrong, I know there is a civic car in Glasgow with the plate G0 (G-zero), but this was issued many years ago before the Department of Transport took over car numbering.

More snags

The various Country groups, such as GM, GW, GI etc, will have to settle for the straight G version of the callsign because two letter, one figure and three letter registrations are also not issued. This means that GM9ABC will have to settle for G9ABC, but at least the call is unique so this should cause few problems.

If your call spells a complete word or name you may not be able to afford to pay the asking price anyway, even if the plate is still available. G1LLY is already out of luck as it was sold for £32,000!

Bad news

Thinking a little further along the line, what do you suppose a well-known forty-stone wrestler would pay for G1ANT? Money is no object to an equally well-known playboy if he decides to go for G1RLY. A very highly placed clergyman could well afford a large sum for G0DLY if it became available.

All these plates fall into the very desirable category and will be sold at auction to the highest bidder, rather than flogged off at the (as yet unknown) flat fee. As a parting note on this matter, news has just arrived that two well-known actors are, quote: 'waiting for G0DOT'.

Microwaves

For some time there has been a move towards trying to reach common agreement throughout Region 1 as to what sub-bands to use for SSB operation on the higher microwave bands. In the UK these have traditionally been 2MHz segments on each band, with the various segments in harmonic relationship.

This was a neat way of doing it when most of the segments were generated using a common crystal-controlled generator system. If you wanted to move up a band you simply added a suitable multiplier stage to your existing gear.

Changes

After an extensive study throughout Region 1 it seems likely that the frequencies for the new sub-bands will be proposed at the forthcoming IARU Region 1 Conference.

The new proposals are likely to be that the existing section in the 23cm band from 1296 to 1298MHz is retained. On 13cm the proposal is to move from the existing 2320-2322MHz up to 2400-2402MHz. On 3.4GHz the existing sub-band is to be retained, while on 5.7GHz it is anticipated that a move will be made to 5668-5670MHz.

Moving up

The traditional spot on 10GHz has so far been 10.368-10.370GHz but it is expected that the new spot will be from 10.45GHz to 10.452GHz. The situation on 24GHz has always been confusing owing to the fact that the existing sub-band is located between 24.192GHz and 24.194GHz. The big problem is that this is located in the section of the band where permission is needed for each period of operation at each individual site.

What has never been made clear is why permission is not required to operate between 24.0GHz and 24.05GHz. This leads to the crazy situation where one can operate at 24.05GHz without permission but not at 24.05001GHz. The new idea is to relocate the SSB section at 24.048GHz to 24.050GHz and this has to make sense.

Beacons

The Essex Repeater Group has fired up its new 10GHz unit using the callsign GB3CMS. This operates on 10,368.96MHz (see notes above) and is located at Danbury. At the moment the beacon is running only 2mW to a slotted waveguide aerial. There are proposals to increase the beacon's power and also to move to a four-horn omnicoverage aerial system in the future.

Reports on reception of this one are solicited and should be sent to G4GUJ, who is QTHR.

Ambitious

Another 10GHz unit has come on air from Great Brickhill, which is just outside Milton Keynes. This is now running in TV beacon mode on 10.15GHz, with the callsign GB3TG, but is eventually intended to be a TV gateway with links into the 23cm TV repeater GB3TV, which is located near Dunstable. If all goes according to plan, the ultimate aim is to do full cross-linking so that a 23cm input into Dunstable would also be broadcast on the new Milton Keynes unit. However, this is all some way in the future.

At the present time the unit runs a 10mW Gunn unit mounted on a 20ft mast and feeds the usual slotted waveguide aerial. This provides about 20dB of gain, giving an effective radiated power of about 1W.

Any reports on this one should be sent to G4NJU, who is the Repeater Management Group Projects Co-ordinator, and is QTHR as far as we know.

Contest news

The VHF contest season is rearing its head again and so it is time to start giving you, at least, the dates of the various battles.

The 432MHz Trophy and SWL Contest runs over the weekend of 5-6 May. Also on that weekend is the Grand Bash, which includes all bands from 432MHz to 24GHz.

Moving on to the weekend of 19-20 May, there is the 144MHz Single Operator and SWL event.

Just to give you early warning, Sunday, 10 June hosts both the 432MHz Single and Multi-operator affair and the 432MHz FM Fixed and Open Contest.

Finally, the VHF Field day will be held over the weekend of 7-8 July.

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■ Kenwood TS-790 all mode tribander, 144/430/1200MHz, great satellite rig for OSCAR, includes 1200MHz module for £16.75, without 1200MHz module, £1,350. Icom IC-725 HF transceiver, all mode, all band, with 500Hz-30MHz receiver, £625.00. Telex/Hy-Gain 144/430MHz OSCAR satellite antenna system, circular, polarised, RHCP, LHCP, £225.00. All equipment less than three months old and guaranteed. Tel: (0753) 812546 days, (0628) 73173 evenings

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■ PK88 TNC, only two months old, with RS232, leads and manual, will sell for £100.00 ono. Tel: (0604) 881017, ask for Steve G7ENW

■ Yaesu 757, £575.00. Aerial discone, as new, 30-960MHz, cost £75.00, offers? 70 ohm cable, 40m 240V = 13.5V dc, £10.00. Television 14in monochrome, UHF/VHF, £15.00. Power mics, £10.00. Tel: (0283) 221870

■ Trio R2000 receiver in mint condition, VC10 converter fitted together with ATU (KX3), mint, original box, £500.00 no offers, buyer collects. FT290R with Ni-Cads charger, instruction manual, mobile mounting kit, Mutek front end board, carrying case, strap and telescopic antenna, vgc, £300.00, free delivery. Tel: (0222) 487299

■ FT207 2m hand-held with case and charger, £100.00. SP520 extension speaker for TS520, £25.00. HFJ five band HF vertical antenna, £35.00. TR2500 hand-held 2m transceiver, complete with case and charger, £170.00. FT200 complete with PSU speaker and digital frequency readout, £200.00. Tel: (0325) 319418

■ Sony ICF 2001D and AN1 active antenna, plus many extras, excellent condition, £200.00 ono. Tel: (0323) 507246

■ Ferrograph RTS2 recorder test set, basically built-in audio generator, milli voltmeter, WOW and flutter meter, measures distortion, gain, WOW and flutter, perfect condition, as new, complete with leads and instructions, £150.00. New LF signal generator, 15Hz-50kHz, 0.2mV-22V output, mains operated, course and fine attenuator controls, large frequency scale, £55.00. Taylor multimeter, 127A, 1000V, ac/dc down to 2.5V range, measures ohms and current ranges, 50μA movement, 5¾ × 3¾ × 1¾in (WHD), as new, £15.00. Stabilised power supply unit in kit form: new Amtron UK677, 0-20V dc, 0-2.5A, fully adjustable current limiting and voltage, with in-built meter for monitoring volts and current, switched meter function, measures 9½ × 3½ × 5½in (WHD), silver panel, black case with handles, kit includes full building instructions, £50.00. Tel: (0483) 772120

■ 70cm equipment: for ATV transceiver with 20W PSP, 2 channels fitted for up converter, thirty-six channels, inline mod checker, £130.00. 70cm collinear, thirteen-element high gain, £20.00. 70cm twenty-one-element beam, as new, £20.00. 70cm twelve-element crossed beam with phasing harness, £18.00. MM435 transverter, 70cm-10m, £60.00. P/ex any or all for HF transceiver/receiver. WHY? 70cm eleven-element beam, as new, £15.00. Two-channel R/C transceiver with xtals, £15.00. Tel: (0562) 743253

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■ AOR22 hand-held VHF FM 2m band, 142-148MHz in 5kHz steps, Ni-Cad battery complete with charger, mint condition, £30.00. Tel: (0406) 22649 Pafter 6.00pm

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148MHz, mic, mobile mount, boxed, vgc. Exchange for Belcom LS-102L, Ham Jumbo Mk3, Uniden 2830, WHY? Also Midland 7001 multimode, digital readout, ideal 10m, boxed, mic, magmount. Exchange for FC-902 ATU, CBM 64 or WHY? Write to: Ian Duffin, The Dormouse, 5 Sunset Walk, Bush Estate, Eccles-on-Sea, Norfolk NR12 0SX

■ FDK multimode 750 2m transceiver, with 1-10W, £170.00. G2 DYM anti-TVI trap dipole for 160m-10m, never used, £60.00. Tel: (0343) 820955 ask for Alfie

■ FT-200 HF transceiver, with PSU and manual, non-working but easily repairable. Exchange for FC-902 ATU or WHY? Also FT-101ZD HF transceiver, FV 901-DM VFO, FC-902 ATU, SP-901 speaker, all vgc, boxed, manuals. Exchange for FT-1 or WHY? Write to: Ian Duffin, The Dormouse, 5 Sunset Walk, Bush Estate, Eccles-on-Sea, Norfolk NR12 0SX

■ Yaesu FRG8800 receiver, complete with FRV8800 converter, mint condition, £450.00. Tel: 081-864 6555 after 6.00pm

■ Storno 500 hand-held with three channels to convert to 4m, crystalled to Rx, spare battery, leather case, in good condition, £30.00 ono. AOR-22 hand-held, VHF FM 2m band, 142-148in 5kHz steps, Ni-Cad battery, complete with charger, mint condition, £30.00 ono. Tel: (0406) 22649 after 6.00pm

■ Fluke digital multimeter '77', £50.00. Digital clamp meter, £15.00. HT probe, £15.00. AVO multiminor meter, case, £20.00. Tel: 081-554 2913 between 6.00pm-8.00pm

■ Racal RA75 receiver, 0-30mV, £175.00. Trio TS500 transceiver, own PSU, solid-state, VFO, mint condition, £300.00. Exchange President Lincoln all-wave oscillator, valved, PSU, variable, £30.00. Stalker Nine, DX expanded, £100.00. WHY? Tel: (0756) 701123

■ Yaesu FRG-8800 communications receiver, FRV-8800 VHF converter fitted, 150kHz-30MHz, 118MHz-174MHz, plus Dressler ARA30, ARA900 active antennas, 50kHz-1300MHz, all in mint condition, £630.00 ono. Part-exchange for Icom R7000 scanning receiver, 25-2000MHz. Tel: (0582) 472347 after 6.00pm

■ RN Electronics transceiver, 6m, 2m IF, 25W, £115.00. Icom 202S, mint condition SSB transceiver, both boxed £125.00. 144MHz valve linear amp, home-brew, £100.00. Tel: (0495) 757221 buyer collects

■ Icom ICA-20 VHF airband, complete VOR navigation, three months old, £320.00. Tel: (0292) 671083 ask for Mr Chan in room F-18, between 7.00pm and 10.00pm

■ PRO2009 eight channel scanner/receiver, VHF-Lo, 68-88MHz, ham 144-148MHz, VHF-Hi, 148-174MHz, ham-gov't, 410-450MHz, UHF Lo, 450-470MHz, UHF Hi, 470-512MHz, in original box, £55.00. Will exchange for VHF or SW radio. Tel: (0406) 22649 after 6.00pm

WANTED

■ KW Viceroy in working order (cosmetics unimportant), having 250pF per section split-stator capacitor, slow-motion 'gearbox' drive for AR88D; also any published mods to AR88D. Tel: (0392) 61669 after 6.00pm

■ April 1984 **Short wave Magazine** or photocopy of FT-707 FM conversion. Also Mizuho MX4 and scrap MX2 for spares. Tel: (0254) 581949

■ Beginner seeks introduction to packet radio: books, equipment, hardware, software and advice welcome. Good prices paid. Tel: (0603) 615020

■ BBC computer users' manual, TRS80 manual, BBC assembly language, C-Mount zoom lens. Exchange for Dragon software. Write to: J Brown, 45 Marlborough Avenue, Falmouth, Cornwall TR11 4HS

■ Interested in 70/50/28MHz crossband Es contacts with Paris? Also searching Jaybeam IIB4-416 yagi, first or secondhand. Tel: 1-45-99-02-90 (France) or write to: Mr Pertus, 61 Allée des Chênes, 94 440 Villecresnes

■ USA naval Rx, type TBS4 or TBS8, need not be working, good price paid. Also R1155, BC348, HRO table-top PSU, Command type receiver, BC453, BC454 or BC455. Also any parts for Command series, racks, cables etc. Will consider WWII gear, British or USA. Tel: (0665) 602487

■ Uniden 28/30, President Lincoln, or Cobra 148 GTL-DX transceiver for conversion to 10m, for CW only. Good price offered for Uniden 28/30. Write to: Ron, PO Box 99, Musselburgh EH33 2AL, Scotland

■ Sony ICF-20001D AM 153-29995 FM, 76-108 AIR, 116-136MHz, must be perfect. Tel: (0484) 844739 anytime

■ Can you help? I wish to transvert to 70cm from 2m, but no one seems to sell this type of transverter. Have you plans or info so that I can build my own, eg, PCBs and components? All costs refunded. Tel: (0604) 881017, ask for Steve

■ Batteries for hand-held Dymar 880, also aerial. Batteries for hand-held Burndept or any data relating to above. Tel: (0406) 22649 after 6.00pm

■ Signal R535 in good condition. Kenwood 5000 with VHF converter. Cash or part-exchange Icom 71E, as new, with FM, manual and boxed. Tel: 01-556 5131

■ Urgent: Marconi TF2171 digital sinc and PLL unit. Marconi Test Inst catalogues, from 1977-1984. Tel: (0473) 85203

■ Unident or President Grant, must be in perfect working order. Tel: (02833) 221870

■ Satellit 3500 or 3400 professional Rx, must be in mint condition and moderately priced. Tel: 061-743 1570

■ Icom desk mic SM 10, £70.00+ offered for example in mint condition with original box, instructions etc. Tel: (0762) 324855

■ BMK RTTY, CW and AMTOR cartridges for Dragon computer. Write to: J Brown, 45 Marlborough Avenue, Falmouth, Cornwall TR11 4HS

■ BL II two-element quad for speakers, must be in reasonable condition. Tel: (0248) 600486

Amateur RADIO SMALL ADS

★ PC COMPATIBLE SOFTWARE by G4BMK ★
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Available for most Video Recorders, Colour & Mono Televisions, Cameras, Test Equipment, Amateur Radio, Vintage Wireless, Any Audio, Music Systems, etc etc.
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Amateur RADIO SMALL ADS

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES
per single column centimetre:
1 insertion £7.00, 3 — £6.60, 6 — £6.30, 12 — £5.60.

AMATEUR RADIO SMALL AD ORDER FORM

TO: **Amateur Radio · Sovereign House**
Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE.....centimetres by.....columns

FOR A PERIOD OF 1 issue.....☐ 3 issues.....☐ 6 issues.....☐ 12 issues.....☐

COPY enclosed.....☐ to follow.....☐

PAYMENT ENCLOSED: (Add 15%VAT).... £ —
Cheques should be made payable to Amateur Radio. Overseas payments by International Money Order and Credit Card

CHARGE TO MY ACCOUNT.....☐ CREDIT CARD EXPIRY DATE ☐☐ / ☐☐

COMPANY .....
ADDRESS .....
SIGNATURE ..... TELEPHONE.....
.....

		C	P	I							

Telephone the advertising department on: 0277 219876 for details

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COURSE FOR CITY & GUILDS, Radio Amateurs Examination. Pass this important examination and obtain your licence, with an RRC Home Study Course. For details of this and other courses (GCSE, Career and professional examinations, etc) write or phone – **THE RAPID RESULTS COLLEGE,** Dept JS100, Tuition House, London SW19 4DS. Tel: 081-947 7272 (9am-5pm) or use our 24hr Recordacall service 081-946 1102 quoting JS100.

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AMATEUR ACCESSORIES CATERED FOR
08053 200

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Large stocks of coaxial cable, plugs, sockets and adaptors.

Jupiter MVT/5000 Scanner receiver covering 25 MHZ to 1300 MHZ. Price on request

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The very latest academy multiband radio AA/100 54MHZ to 176 MHZ. With single aerial £20 +postage. With twin aerials £22.50 + postage.
All available via mail order. Retail/Wholesale

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E•E

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Electronic Component Specialists.

A wide range of electronic components, IC's, capacitors, transistors, resistors, plugs and sockets etc.

Resistors 1/4w 5% carbon E12 1p 1% metal film 3p
Resistor pack 85 different E12 values + zero ohm link total content 1000 resistors.....**$8.95**
LEDs 3mm or 5mm red or green 6peach yellow 12peach
Cable ties 75mm 1p each **$5.95** per 1000 $£49.50 per 10,000
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SAA1027 stepping motor driver chip.....**$3.95**
FM Transmitter kit good quality sound.....**$7.94**
High quality photo resist copper clad epoxy glass boards

Dimensions	Single sided	Double sides
3x4 inches	**$0.95**	**$1.07**
4x6 inches	**$2.40**	**$2.66**
6x12 inches	**$5.37**	-
12x12 inches	**$10.95**	-

Special offers
Computer grade capacitors with screw terminals 38000uf 20v ...**$2.50** 87000uf 10v **$1.95**, 68000uf 15v **$2.95**, 1000uf 16v **$1.50**
7 segment common anode led display 12mm.....0.45
LM2931AT5.0 low drop out 5v regulator TO220 package.....**$0.85**
BS250 P channel mosfet **$0.45**, BC559 transistor **$3.95** per 100
74LS05 hex invertor **$10.00** per 100, used 8748 Microcontroler **$3.50**
Stereo LW/MW/FM Tuner/preamp assy with volume/tone controls & tuning scale. Brand new in maker carton **$5.95** faulty $2.50 circuit etc for above **$0.50**, 5-digit 6v electromagnetic counter **$1.95**
Hour counter used 7 digit 240v ac 50Hz.....**$0.95**
LCD Display 16 digit 7x5 dots dot matrix.....**$2.50**
QWERTY keyboard 58 key good quality switches.....5.00
Wide range of CMOS TTL 74HC 74F Linear Transistors kits capacitors tools, etc always in stock
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We stock a large range of electronic components, test equipment, telephone accessories, computer accessories, microphones, speakers, disco lighting, mixers, meters, stylus. So call in and have a look around.
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Amateur RADIO

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛ page	£66.00	£62.00	£59.00	£53.00
128 x 90 or 61 x 186	¼ page	£115.00	£110.00	£105.00	£92.00
128 x 186 or 263 x 90	½ page	£225.00	£210.00	£200.00	£180.00
263 x 186	1 page	£430.00	£405.00	£385.00	£345.00
263 x 394	double page	£830.00	£780.00	£740.00	£660.00

COLOUR AD RATES

colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£580.00	£560.00	£530.00	£470.00
263 x 394	double page	£1,130.00	£1,070.00	£1,010.00	£900.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour ad	mono proof ad	mono no proof & small ad	mono artwork	on sale thurs
June 1990	2 May 90	3 May 90	9 May 90	11 May 90	31 May 90
Jul 1990	30 May 90	31 May 90	6 Jun 90	8 Jun 90	28 Jun 90
Aug 1990	27 Jun 90	28 Jun 90	4 Jul 90	6 Jul 90	26 Jul 90
Sep 1990	1 Aug 90	2 Aug 90	8 Aug 90	10 Aug 90	30 Aug 90

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations. Printed – web offset.

PAYMENT
Above rates exclude VAT.
All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by the publication date.
Overseas payments by International Money Order or credit card.

FOR FURTHER INFORMATION CONTACT
Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

Commission to approved advertising agencies is 10%.

CONDITIONS
10% discount if advertising in both Amateur Radio and Radio & Electronics World.
A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

ADVERTISERS INDEX

OPEN 7 DAYS A WEEK BY APPOINTMENT ONLY

TOTAL COMMUNICATIONS

Pye Europa UHF 420/470 MHZ ..... **£40.00** each, inc P&P
Pye Westminster AM high band, boot mount with control gear but no speakers and microphones, choice of 15 ..... **£23.00** each, inc P&P
Pye 412/414 base stations, slim model unit (no cables), choice of 3 ..... **£30.00** each, inc P&P
Pye P5012/P5014 UHF hand-held with batteries and antenna, choice of 20 ..... **£35.00** each, inc P&P
Pye Olympic UHF 420/470 MHZ ..... **£25.00** each, inc P&P
ITT sets, Hi-band AM, choice of 5 ..... **£18.00** each, + P&P
Pye Cambridge AM high band, 160/175MHz, choice of 5 ..... **£15.00** each, inc P&P
Pye Cambridge AM low band, 69/89MHz, choice of 2 ..... **£15.00** each, inc P&P
Pye Olympic M203 mid-band AM, 106/140MHz boot mount, with no control gear, choice of 5 ..... **£15.00** each, inc P&P
Pye Olympic M203 low band AM, 69/89MHz boot mount, with no control gear, choice of 10 ..... **£15.00** each, inc P&P
Pye Motofhone high band AM, choice of 5 ..... **£20.00** each, inc P&P
Pye Motofhone low band AM, choice of 5 ..... **£20.00** each, inc P&P
Pye PF9 battery chargers (10-way), choice of 30 ..... **£15.00** each, inc P&P
Pye P5000 battery chargers (10-way), choice of 10 ..... **£20.00** each, inc P&P
Storno (800) battery chargers, ex-Metropolitan Police, choice of 30 ..... **£18.00** each, inc P&P
Pye Olympic high band AM, no microphones or speakers, choice of 10 ..... **£25.00** each, inc P&P
Pye Cambridge power supply, 240V input 12V output, and 24V output at 10 amp ..... **£12.50** each, inc P&P
Pye F30 base station, low band AM, choice of 25 ..... **POA**
Pye F30 base station, high band AM, choice of 36 ..... **POA**
PF2 battery chargers, choice of 10 ..... **£18.00** each, inc P&P
Pye UHF signal generator, type SG5U ..... **£27.00** each, inc P&P
Pye Westminster high band AM, choice of 10 ..... **£20.00** inc P&P
Pye Westminster (motorcycle) low band AM (ex-Automobile Association), with control gear, direct from the AA, choice of 5 ..... **£20.00** each, inc P&P
GEC high band AM, 6-channel, one off ..... **£20.00** inc P&P
Pye base station 402 receiver unit only, high band FM, choice of 10 ..... **£20.00** inc P&P
Pye base station 401 receiver unit only, high band AM, choice of 5 ..... **£20.00** inc P&P
Pye converter, 24V input 12V output, ideal for heavy goods vehicles ..... **£10.00** inc P&P
GEC 666 high band AM 6 channel choice of 10 ..... **£15** inc P&P
Various marine band radio equipment for sale from ..... **£20** per unit
Pye Europa MF5 FM low band choice of 25 ..... **£40** each, inc P&P
Pye Vanguard low band AM with control gear ..... **£14** inc P&P

Self addressed envelope for Catalogues please.

(80 minutes from M25),
(50 minutes from M11),
(30 minutes from Norwich).

UNITS 3 AND 4 THORNHAM HALL, THORNHAM MAGNA EYE, SUFFOLK, IP23 8HA.
TEL: 0379 838 333

SECOND HAND RADIO EQUIPMENT WANTED FOR CASH

BAKERS DOZEN PACKS

All packs are £1 each. Please state which one you want. Note the figure on the extreme left of the pack ref number and the next figure is the quantity of items in the pack. finally a short description.

BD2	5	13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
BD9	2	6V 1A mains transformers upright mounting with fixing clamps.
BD11	1	6½in speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
BD13	12	30 watt reed switches. It's surprising what you can make with these – burglar alarms. secret switches, relay, etc, etc.
BD22	2	25 watt loudspeaker two unit crossovers.
BD29	1	BOAC stereo unit is wonderful breakdown value.
BD30	2	Nicad constant current chargers adapt to charge almost any nicad battery.
BD32	2	Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
BD42	5	13A rocker switch three tags so on/off, or change over with centre off.
BD45	1	24hr time switch, ex-Elextricity Board. automatically adjust for lengthening and shortening day. Original cost £40 each.
BD49	10	Neon valves, with series resistor, these make good night lights.
BD56	1	Mini unlselector, one use is for an electric jlgsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
BD67	1	Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
BD103A	1	6V 750mA power supply, nicely cased with mains input and 6V output leads.
BD120	2	Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
BD132	2	Plastic boxes approx 3in cube with square hole through top, so ideal for interrupted beam switch.
BD134	10	Motors for model aeroplanes, spin to start so needs no switch.
BD139	6	Microphone inserts – magnetic 400 ohm also act as speakers.
BD148	4	Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
BD149	6	Safety cover for 13A sockets – prevent those inquisitive little fingers getting nasty shocks.
BD180	6	Neon indicators in panel mounting holders with lens.
BD193	6	5 amp 3 pin flush mounting sockets make a low cost disco panel.
BD199	1	Mains solenoid, very powerful, has 1in pull or could push if modified.
BD201	8	Keyboard switches – made for computers but have many other applications.
BD211	1	Electric clock, mains operated, put this in a box and you need never be late.
BD221	5	12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
BD242	2	6in x 4in speakers, 4 ohm made from Radiomobile so very good quality.
BD252	1	Panostat, controls output of boiling ring from simmer up to boil.
BD259	50	Leads with push-on ¼in tags – a must for hook-ups – mains connections etc.
BD263	2	Oblong push switches for bell or chimes, these can mains up to 5 amps so could be footswitch if fitted into pattress.
BD268	1	Mini 1 watt amp for record player. Will also change speed of record player motor.
BD283	3	Mild steel boxes approx 3In x 3in x 1in deep – standard electrical.
BD305	1	Tubular dynamic mic with optional table rest.
BD653	2	Miniature driver transformers. Ref LT44. 20k to 1k centre tapped.
BD548	2	3.5V relays each with 2 pairs changeover contacts.
BD667	2	4.7µF non-polarised block capacitors, PCB mounting.

There are over 1,000 items in our Bakers Dozen List. If you want a complete copy, please request this when ordering.

GEIGER COUNTER KIT includes PCB loudspeaker etc to build a 9v Geiger counter only £39.00 Ref 39P1

ALKALINE PP3 BATTERIES These are past their sell-by date but test OK, only 2 for £1.00 Ref BD758

1¼ FUSE HOLDERS 5 for £1.00 Ref BD752

UNCASED KEYBOARDS Brand new mounted on PCB with components only £3.00 Ref 3P27

TOASTERS 2 slice with browning control, may need slight attention onlyu £3.00 Ref 3P84

MICROWAVE CONTROL PANEL Brand new, mains operated including digital clock 2 relay output, good for all sorts of timer applications. Good value at £6.00 Ref 6P18

EQUIPMENT WALL MOUNT Multi adjustable metal bracket for speakes etc. 2 for £5.00 Ref 5P152

SUB-MIN TOGGLE SWITCH Body size 8mm x 4mm x 7mm SBDT with chrome dolly fixing nuts. 3 for £1. Order ref BD649.

COPPER CLAD PANEL for making PCB. Size approx 12in long x 8½in wide. Double-sided on fibreglass middle which is quite thick (about 1/16in) so this would support quite heavy components and could even form a chassis to hold a mains transformer, etc. Price £1 each. Our ref BD683.

POWERFUL IONISER

Generates approx 10 times more IONS than the ET1 and similar circuits. Will refresh your home, office, workroom etc. Makes you feel better and work harder – a complete mains operated kit, case included. **£12.50**. Our ref 12P5/1.

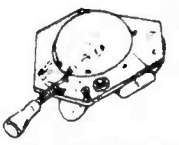
MAIL ORDER TERMS: Cash, PO or cheque with order. Please add £2.50 service charge. Monthly account orders accepted from schools and public companies. Access and B/Card orders accepted – minimum £5. Phone (0273) 734648 or 203500. Fax No 0273-23077

REAL POWER AMPLIFIER for your car, it has 150 watts output. Frequency response 20Hz to 20kHz and signal to noise ratio better than 60dB. Has built-in short circuit protection and adjustable input level to suit your existing car stereo, so needs no pre-amp. Works into speakers ref 30P7 described below. A real bargain at only £57.00. Order ref 57P1.

REAL POWER CAR SPEAKERS. Stereo pair output 100W each. 4 ohm impedance and consisting of 6½in woofer, 2in mid-range and 1in tweeter. Each set in a compact purpose-built shelf mounting unit. Ideal to work with the amplifier described above. Price per pair £30.00. Order ref 30P7.

STEREO CAR SPEAKERS. Not quite so powerful – 70W per channel, 3in woofer, 2in mid-range and 1in tweeter. Again, in a super purpose-built shelf mounting unit. Price per pair £28.00. Order ref 28P1.

VIDEO TAPES. These are three hour tapes of superior quality, made under licence from the famous JVC Company. Offered at only £3 each. Our ref 3P63. Or 5 for £11. Our ref 11P3. Or for the really big user 10 for £20. Our ref 20P20.



ELECTRONIC SPACESHIP. Sound and impact controlled, responds to claps and shouts and reverses when it hits anything. Kit with really detailed instructions. Ideal present for budding young electrician. A youngster should be able to assemble but you may have to help with the soldering of the components on the PCB. Complete kit £10. Our ref 10P81.

12in HIGH RESOLUTION MONITOR. Amber screen, beautifully cased for free standing, needs only a 12V 1.5 amp supply. Supplied with connection data for H sync, V sync & Video. Brand new in maker's cartons. Price £22.00. Ref 22P2.

COMPOSITE VIDEO KIT converts composite video to H sync, V sync & sep video. Price £8.00. Ref 8P39.

14in COLOUR MONITOR made by the American Display Tek Company. Uses high resolution tube made by the famous Japanese Toshiba Company. Beautifully made unit intended for console mounting, but top and sides adequately covered by plated metal panels. Full technical spec on its way to us. We have a limited number of these. All brand new still in maker's cartons. Price £89 each plus £6 insured carriage. Order ref 89P/1.

BUSH RADIO MIDI SPEAKERS. Stereo pair. BASS reflex system, using a full range 4in driver of 4 ohms impedance. Mounted in very nicely made black fronted walnut finish cabinets. Cabinet size approx 8½in wide, 14in high and 3½in deep. Fitted with a good length of speaker flex and terminating with a normal audio plug. Price £5 the pair. Our ref 5P141.

3½in FLOPPY DRIVES. We still have two models in stock: Single-sided, 80 track, by Chinon. This is in the manufacturer's metal case with leads and IDC connectors. Price £40, reference 40P1. Also a double-sided, 80 track, by NEC. This is uncased. Price £59.50, reference 60P2. Both are brand new. Insured delivery £3 on each or both.

REMOTE CONTROL FOR YOUR COMPUTER. With this outfit you can be as much as 20 feet away as you will have a joystick that can transmit and a receiver to plug into and operate your computer and TV. This is also just right if you want to use it with a big screen TV. The joystick has two fire buttons and is of a really superior quality, with four suction cups for additional control and one-handed play. Price £15 for the radio controlled pair. Our ref 15P27.

ASTEC PSU. Mains operated switch mode, so very compact. Outputs +12V 2.5A, +5V 6A, ±5V 6A, ±12V 5A. Size: 7½in long x 4¾in wide x 2¼in high. Cased ready for use. Brand new. Normal price £30+, our price only £13.00. Order ref 13P2.

VERY POWERFUL 12 VOLT MOTORS. ⅓ horsepower. Made to drive the Sinclair C5 electric car but adaptable to power a go-kart, a mower, a rail car, model railway etc. Brand new. Price £20 plus £2 postage. Our ref 20P22.

PHILIPS LASER

This is a helium-neon and has a power rating of 2mW. Completely safe as long as you do not look directly into the beam when eye damage could result. Brand new, full spec. £35.00. Mains operated power supply for this tube gives 8kV striking and 1.25kV at 5mA running. Complete kit with case £15. Complete kit with tube & power supply. £50.00.

ORGAN MASTER Is a three octave musical keyboard. It is beautifully made, has full size (piano size) keys, has gold-plated contacts and is complete with ribbon cable and edge connector. Comes complete with Spectrum 128 software. Brand new only £22.00. Ref 22P1

FULL RANGE OF COMPONENTS at very keen prices are available from our associate company SCS COMPONENTS. You may already have their catalogue, if not request one and we will send it FOC with your goods.

HIGH RESOLUTION MONITOR. 9in black and white, used Philips tube M24/306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others. Brand new, £20.00. Ref 20P26.

12 VOLT BRUSHLESS FAN. Japanese made. The popular square shape (4½in x 4½in x 1¾in). The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc, or for a caravan. **£8 each**. Our ref 8P26.

MINI MONO AMP on PCB, size 4in x 2in (app). Fitted Volume Control. The amplifier has three transistors and we estimate the output to be 2W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.15 each, or 13 for £12.00.**

SINCLAIR C5 WHEELS INC INNER TUBE & TYRES 13" & 16" DIAMETER SPOKED. POLYCARBONATE WHEELS FINISHED IN BLACK ONLY £6.00 EACH. 13" REF 6P10, 16" REF 6P11

NEW MAINS MOTORS 25 watt 3000 rpm made by Framco approx 6"x4"x3" priced at only £4.00 ref 4P54.

SHADED POLE MOTORS Approx 3" square available in 24v AC or 240v AC both with threaded output shaft and 2 fixing bolts. Price is £2.00 each. 24v ref 2P65, 240v ref 2P66.

MICROWAVE TURNTABLE MOTORS Complete with weight sensing electronics that would have varied the cooking time. Ideal for window displays etc. Only £5.00 ref 5P165.

SURFACE MOUNT KIT Makes a super high gain snooping amplifier on a PCB less than an inch square! £7.00 ref 7P15.

COMPUTER KEYBOARDS Brand new 100 keys, uncased only £3.00 ref 3P89.

PERSONAL STEREO INNARDS Complete with PCB and tape mech etc. 2 for £3.00 ref 3P94.

J & N BULL ELECTRICAL

Dept AR250 PORTLAND ROAD, HOVE BRIGHTON, SUSSEX BN3 5QT.

POPULAR ITEMS – MANY NEW THIS MONTH

JOYSTICKS for BBC Atari, Dragon Commodore. etc. All £5.00 each. All brand new, state which required.

TELEPHONE TYPE KEYPAD. Really first class rear mounting unit. White lettering on black buttons. Has conductive rubber contacts with soft click operation. Circuit arranged in telephone type array. Requires 70mm by 55mm cut-out and has a 10 IDC connector. Price £2.00. Ref 2P251.

SUB-MIN PUSH SWITCHES. Not much bigger than a plastic transistor but double pole PCB mounting. 3 for £1.00. Our ref BD688.

AA CELLS. Probably the most popular of the rechargeable NICAD types. 4 for £4.00. Our ref 4P44.

20 WATT 4 OHM SPEAKER. With built-in tweeter. Really well made unit which has the power and the quality for hi-fi 6½in dia. Price £5.00. Our ref 5P155, or 10 for £40.00, ref 40P7.

MINI RADIO MODULE. Only 2in square with ferrite aerial and solid dia tuner with own knob. It is superhet and operates from a PP3 battery and would drive a crystal headphone. Price £1.00. Our ref BD716.

BULGIN MAINS PLUG AND SOCKET. The old and faithful 3 pin with screw terminals. The plug is panel mounted and the socket is cable mounted. 2 pairs for £1.00 or 4 plugs or 4 sockets for £1.00. Our ref BD715, BD715P, or BD715S.

MICROPHONE. Low cost hand-held dynamic microphone with on/off switch in handle. Lead terminates in 1 3.5mm and 1 2.5mm plug. Only £1.00. Ref BD711.

MOSFETS FOR POWER AMPLIFIERS AND HIGH CURRENT DEVICES. 140V 100 watt pair made by Hitachi. Ref 2SK413 and its complement 2SJ118. Only £4.00 a pair. Our ref 4P42.
Also available in H pack Ref 2SJ99 and 2SK343 £4.00 a pair. Ref 4P51.

TIME AND TEMPERATURE LCD MODULE. A 12 hour clock, a Celsius and Fahrenheit thermometer, a too hot alarm and a too cold alarm. Approx 50 x 20mm with 12.7mm digits. Requires 1AA battery and a few switches. Comes with full data and diagram. Price £6.00. Our ref 6P12.

REMOTE TEMPERATURE PROBE FOR ABOVE. £3.00. Our ref 3P60.

A REAL AIR MOVER. Circular axial fan moves 205 cubic foot per min, which is about twice as much as our standard 4½in fans. Low noise mains operated, 6½in dia, brand new. Regular price, over £30.00. Our price only £10.00. Our ref 10P71.

600 WATT AIR OR LIQUID MAINS HEATER. Small coil heater made for heating air or liquids. Will not corrode, lasts for years. Coil size 3in x 2in, mounted on a metal plate for easy fixing. 4in dia. Price £3.00. Ref 3P78 or 4 for £10.00. Our ref 10P76.

EX-EQUIPMENT SWITCHED MODE POWER SUPPLIES. Various makes and specs but generally ±5, ±12V, ideal bench supply. Only £8.00. Our ref 8P36.

ACORN DATA RECORDER. Made for the Electron or BBC computers but suitable for others. Includes mains adapter, leads and book. £12.00. Ref 12P15.

STABILIZED POWER SUPPLY KIT 1-25v 2A adjustable, contains PCB transformer and components to build a bench supply only £20.00. Ref 20P25.

PTFE COATED SILVER PLATED CABLE 19 strands of .45mm copper, will carry up to 30A and is virtually indestructible. Available in red or black. Regular price is over £120 per reel. Our price only £20.00 for 100m reel. Ref 20P21, or 1 of each for £35.00 Ref 35P2. Makes superb speaker or aerial cable!

NEW PIR SENSORS. Infra-red movement sensors will switch up to 500W mains. UK made, 12 months manufacturer's warranty. 15-20m range, with a 0-10min timer, daylight sensor, adjustable wall bracket. Only £20.00. Ref 20P24.

MITSUBISHI 3½in DISC DRIVES. Brand new drives, ½ height, double-sided, double density, warranted. Our price £60.00. Ref 60P5.

10 MEMORY PUSHBUTTON TELEPHONES. These are customer returns and sold such so may need slight attention. Price £6.00. Ref 6P16 or 2 for £10. Ref 10P77. BT approved.

NON-MEMORY PUSHBUTTON TELEPHONES. Same condition as above with redial £3.00. Our ref 3P79. BT approved.

SPECTRUM SOUND BOX. Add sound to your Spectrum with this device. Just plug in. Complete with speaker, volume control and nicely boxed. A snip at only £4.00. Our ref 4P53.

BBC JOYSTICK INTERFACE. Converts a BBC joystick port to an Atari type port. Price £2.00. Our ref 2P261.

TELEPHONE EXTENSION LEAD. 5m phone extension lead with plug on one end, socket on the other. White. Price £3.00. Our ref 3P79, or 10 leads for only £19.00! Ref 19P2.

LCD DISPLAY. 4½in digits supplied with connection data £3.00. Ref 3P77, or 5 for £10. ref 10P78.

CROSSOVER NETWORK. 8 ohm 3-way for tweeter mid-range and woofer, nicely cased with connections marked. Only £2.00. Our ref 2P255, or 10 for £15.00. ref 15P32.

BASE STATION MICROPHONE. Top quality uni-directional electret condenser mic 600r impedance sensitivity 16-18kHz – 68dB built-in chime, complete with mic stand bracket. £15.00. Ref 15P28.

MICROPHONE STAND. Very heavy chromed mic stand, magnetic base 4in high. £3.00 if ordered with above mic. Our ref 3P80.

SOLAR POWERED NICAD CHARGER. 4 Nicad AA battery charger. Charges 4 batteries in 8 hours. Price £6.00. Our ref 6P3.

MAINS SOLDERING IRON. Price £3.00. Our ref 3P65.

SOLDERING IRON STAND. Price £3.00. Our ref 3P66.

SHARP PLOTTER PRINTER. New 4 colour printer originally intended for Sharp computers but may be adaptable for other machines. Complete with pens, paper etc. Price £16.00. Our ref 16P3.

CENTRONICS CONVERSION KIT FOR ABOVE PLOTTER only £4.00. Ref 4P57.

CAR IONIZER KIT. Improve the air in your car, clears smoke and helps prevent fatigue. Case req. Price £12.00. Our ref 12P6.

NEW FM BUG KIT. New design with PCB embedded coil 9V operation. Priced at £5.00. Our ref 5P158.

NEW PANEL METERS 50UA movement with three different scales that are brought into view with a lever. Price only £3.00. Ref 3P81.

STROBE LIGHTS. Fit a standard Edison screw light fitting, 240V 40/min flash rate, available in yellow, blue, green and red. Complete with socket. Price £10 each. Ref 10P80 (state colour required).

ELECTRONIC SPEED CONTROL KIT. Suitable for controlling our powerful 12V motors. Price £17.00. Ref 17P3 (heatsink required).

EXTENSION CABLE WITH A DIFFERENCE. It is flat on one side, making it easy to fix and look tidy. 4 core, suitable for alarms phones etc. Our price only £5.00 for 80m reel. Ref 5P153.

METAL PROJECT BOX. Ideal for battery charger, power supply etc. Sprayed grey, size 8in x 4in x 4½in. Louvred for ventilation. Price £3.00. Ref 3P75.