JUNE 1990 £3.45

Amateur RADIO

For all two-way radio enthusiasts

Construction:
A Simple Ni-Cad Charger

Evolution of the Radio Receiver

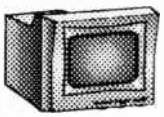
Three User Reviews:
The Grundig Satellit 500 World Receiver, the Aztex TVTX 24cm FM ATV Transmitter and the ULNA 23-24cm GaAsFET Preamplifier

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: **£59 (D) 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. **£85.00**(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 !

NEW 5¼ inch from £29.95!

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! **Only £499.00** (F) Ideal as exterior drives!

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! **£40** (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)

CALL FOR DISCOUNTS ON HIGHER QUANTITIES!

RECHARGEABLE BATTERIES

LEAD ACID

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

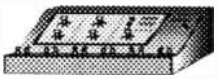
Quality 12v 4ah cell pack. Originally made for the Technicolor video company. Contains 10 GE top quality D nicad cells in a smart robust case with a DC output connector. Ideal for portable equipment. Brand new. **£19.95**(B)

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-9619 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)**

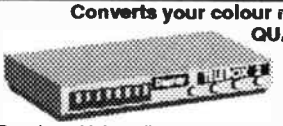
COOLING FANS

Please specify 110 or 240 volts for AC fans.

3 inch	AC. 1½" thick	**£ 8.50**(B)
3½ inch	AC ETRI slimline.Only 1" thick.	**£ 9.95**(B)
4 inch	AC 110/240v 1½" thick.	**£10.95**(B)
4 inch	AC 1½" thick	**£ 9.95**(B)
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)
150-SW up to 14.5" paper.....**£199.00**(E)
Specify whether serial or parallel required.

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All prices for UK Mainland. UK customers add 15% VAT to TOTAL order amount. Minimum order £10. PO orders from Government,Universities,Schools & Local Authorities welcome-minimum account order £25. Carriage charges (A)=£2.00. (B)=£4.50. (C)=£8.50. (D)=£10.00. (E)=£12.00 (F)=£17.00 (G)=Call . All goods supplied subject to our standard Conditions of Sale and unless otherwise stated guaranteed for 90 days. All guarantees on a return to base basis.We reserve the right to change prices & specifications without prior notice. Orders accepted subject to stock.Quotations willingly given for higher quantities than those stated. Bulk surplus always required for cash.

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We regret to inform readers that owing to the continually rising production costs and to enable us to maintain the high standard of content in ***Amateur Radio*** the price of the magazine will be £3.45 from this issue

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AC126	0.45	BC107A	0.11	BC204	0.25	BD124P	0.59	BD520	0.65	BF271	0.28	BFY51	0.32	GET111	2.50	R2009	2.50	TIO142	1.75	2SC495	0.80
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	2SC931D	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	ZRFD112	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	BC252A	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	BC258	0.25	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	BC258A	0.39	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	BC284	0.30	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	BC300	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	BC301	0.30	BD202	0.50	BF173	0.22	Bf4995	0.23	BU124	1.25	OC23	9.50	T9011V	0.75	2N3703	0.12	2SC162B	0.75
AF115	1.95	BC153	0.30	BC303	0.26	BD203	0.50	BF177	0.38	Bf4997	0.25	BU125	1.25	OC25	1.50	T9015V	2.15	2N3704	0.12	2SC167B	1.50
AF116	2.50	BC157	0.12	BC307B	0.09	BD204	0.70	BF17B	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	BC327	0.10	BD222	0.46	BF179	0.34	BFR40	0.23	BU204	1.55	OC28	5.50	T9038V	3.95	2N3706	0.12	2SC1953	0.95
AF11B	3.50	BC161	0.55	BC328	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	BC337	0.10	BD225	0.48	BF1B1	0.29	BFR88	0.30	BU208	0.95	OC32	5.50	THY15/B5	2.25	2N3733	9.50	2SC1969	2.95
AF124	0.65	BC171	0.09	BC338	0.09	BD232	0.35	BF1B2	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	BC347A	0.13	BD233	0.35	BF183	0.29	BFR91	1.75	BU208D	1.35	OC44	1.25	TIP29C	0.42	2N3792	1.35	2SC202B	1.15
AF126	0.45	BC173B	0.10	BC461	0.35	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	BC478	0.20	BD237	0.40	BF185	0.28	BFT43	0.35	BU326S	1.50	OC70	1.00	TIP31C	0.55	2N4427	1.95	2SC207B	1.45
AF139	0.40	BC177	0.15	BC527	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	BC17B	0.15	BC547	0.10	BD246	0.75	BF197	0.11	BFW11	0.75	BU408	1.50	OC72	2.50	TIP33C	0.95	2N5294	0.42	2SC2098	2.95
AF17B	1.95	BC182	0.10	BC548	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	BC549A	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	BC550	0.14	BD410	0.65	BF240	0.20	BFW92	0.85	Bu508A	1.95	OCB4	1.50	TIP41C	0.45	2N5496	0.95	2SC2371	0.36
ASY77	1.50	BC1B3L	0.09	BC557	0.08	BD434	0.65	BF241	0.15	BFX29	0.30	BU526	1.90	OC139	12.50	TIP42C	0.47	2N5641	16.50	2SC931D	0.95
				BC558	0.10	BD436	0.60	BF245	0.30	BFX84	0.26	BU807	2.25	OC171	4.50	TIP47	0.65	2N5643	16.50	2SK19	0.55
				BC639/10	0.30	BD437	0.60	BF256LC	0.35	BFX85	0.32	BUY20	2.15	OC200	4.50	TIP4B	0.65	2SA329	0.95	2SK33	0.55
				BCY33A	19.50	BD438	0.75	BF257	0.28	BFX86	0.25			OC201	5.50	TIP50	0.65			3SK88	0.48
						BD510	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	3.80	TDA1001	2.95	TDA2581	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	TDA2582	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	TDA2593	2.95	UPC1185H	3.95
AN214Q	2.50	BA521	1.50	LA4400	3.50	MC1327	1.70	SL1310	1.80	STK463	11.50	TAA310A	3.80	TBA570	1.00	TDA1035	2.80	TDA2600	6.50	UPC1191V	1.50
AN236	1.95	CA1352E	1.75	LA4420	3.50	MC1327Q	0.95	SL1327	1.10	STK0015	7.95	TAA320A	3.80	TBA651R	2.80	TDA1037	1.95	TDA2610	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	TDA2611A	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	TDA2640	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	2.65	TDA1180	2.15	TDA2655	4.50	UPC1365C	3.95
AN260	2.95	CA3140s	2.50	LC7120	3.25	MC1358	1.58	SN76110N	0.89	TA7072	2.65	TAA6320S	2.95	TBA800	0.89	TDA1270Q		TDA2680A	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	TDA2690	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			TDA1327	1.70	TDA3310	2.95	555	0.35
AN271	3.50	HA1137W	1.95	LC7137	5.50	MC3357	2.75	SN76226DN	2.95	TA7120P	1.65	TAA930	3.95	TBA810P	1.65	TDA2002	0.95	TDA3510	3.50	556	0.60
AN301	2.95	HA1156W	1.50	LM323K	4.95	MC3401L	2.50	SN76227N	1.05	TA7129P	2.50	TBA120AS/B/C	1.00	TBA820M	0.75	TDA2003	1.95	TDA3560	3.95	723	0.50
AN303	3.50	HA1306	1.50	LM324N	0.45	MC14106P	2.95	SN76228N	2.95	TA7130P	1.50			TBA820Q	1.45	TDA2010	1.95	TDA4050	2.95	741	0.35
AN313	2.95	HA1322	1.95	LM380N	1.50	MC1451BCP	7.50	SN76533N	1.65	TA7137P	1.00	SA/SB/T/U		TBA920	1.65	TDA2020	2.95	TDA4600	2.50	747	0.50
AN315	2.95	HA1339A	2.95	LM380NB	2.95	ML231B	1.75	SN76650N	1.15	TA7146P	1.50	TBA395	1.50	TBA950/2X	1.50	TDA2030	2.80	TDA9503	3.15	748	0.35
AN316	3.95	HA1366W	2.75	LM383T	2.95	ML232B	2.50	SN76660N	0.90	TA7176AP	2.95	TBA396	0.75	TBA990	1.49	TDA2140	3.95	TEA1009	1.35	7808	0.50
AN331	3.95	HA1406	1.95	LM390N	3.50	ML239	2.95	STK011	7.95	TA7203	2.95	TBA440N	2.85	TBA990Q	1.49	TDA2150	2.80	UPC41C	3.50	7805	0.50
AN342	2.95	HA1551	2.95	LM1011	3.15	MSM5807	8.75	STK014	7.95	TA7204P	2.15	TBA480Q	1.95	TCA270	2.80	TDA2151	1.95	UPC566H	2.95	7812	0.50
AN362L	2.50	LA1201	0.95	M51555L	2.95	SAA500A	3.50	STK015	5.95	TA7205AP	1.15	TBA510	2.80	TCA270SQ	2.80	TDA2152	1.95	UPC575C2	1.50	7815	0.50
AN612	2.15	LA3201	0.95	M51513L	2.30	SAA1025	7.25	STK018	7.95	TA7208	1.95	TBA510Q	2.80	TCA650	2.80	TDA2160	2.80	UPC1001H	1.95		
AN6362	3.95	LA4101	0.95	M51521L	1.50	SAA1251	4.95	STK025	11.95	TA7222AP	1.80	TBA520	1.10	TCA760	2.80	TDA2524	1.95	UPC1020H	2.95		
AN7140	3.50			MB37D5	1.50	SAA5010	5.35	STK032	7.95	TA7227P	4.25	TBA520Q	1.10	TCA800	6.95	TDA2530	1.95	UPC1024H	1.50		
AN7145	3.50			MB3712	2.00	SAA5020	5.75	STK078	11.95	TA7228P	1.95	TBA530	1.10	TCA830S	1.95	TDA2532	1.95	UPC1025H	1.95		
						SAB3210	3.50	STK085	8.95	TA7310P	1.80	TBA530Q	1.10	TCA900	2.80	TDA2541	2.15	UPC108H	1.95		
						SAS560S	1.75	STK415	7.95	TA7314P	2.95	TBA540	2.80	TCA940	1.65	TDA2560	1.15	UPC1032H	0.95		
						SAS570S	1.75	STK435	7.95	TA7321P	2.25	TBA540Q	2.80	TDA440	2.20			UPC1158H	0.75		
						SAS580	2.85									TDA2576	4.50	UPC1167C2	1.95		

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EF805S 25.00
EF806S 25.00
EF812 0.65
EFL200 1.50
EFP60 3.50
EH90 0.72
EK90 1.50
EL32 0.95
EL34 Siemans 3.95
EL34 Super 5.50
EL36 2.50
EL38 4.50
EL41 3.50
EL42 2.00
EL71 4.50
EL81 6.95
EL83 7.50
EL84 1.50
EL84 Mullard 4.50
EL84 Siemans 2.50
EL84 Super 3.50
EL85 4.50
EL86 1.75
EL90 1.75
EL91 4.50
EL95 1.75
EL152 15.00
EL360 6.75
EL500 1.95
EL504 1.95
EL509 5.95
EL519 6.95
EL802 3.65
EL821 6.95
EL822 12.95
ELL80 22.50
EM34 12.50
EM81 2.50
EM81 3.50
EM83 1.65
EM84 1.65
EM85 3.95
EM87 2.50
EN32 16.00
EN91 2.25
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
GC10D 17.50
GN10 15.00
GS10H 12.00
GS12D 12.00
GT1C 9.50
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
KT66 USA 11.95
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 6.95
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
MS4B 5.50
MU14 3.50
N37 12.50
N78 9.85
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
ORP43 2.50
ORP50 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 0.85
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 0.85
PCF805 1.25
PCF806 1.00
PCF808 1.25
PCH200 1.50
PCL82 0.95
PCL83 2.50
PCL84 0.75
PCL85 0.95
PCL86 0.95
PCL805 0.95
PD500 5.95
PEN25 2.00
PEN40D 3.00
PEN45 3.00
PEN45DD 3.00
PEN46 2.00
PFL200 0.95
PL36 1.75
PL38 1.50
PL81 1.50
PL82 0.60
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
PY801 0.95
QB3-300 72.00
QB3-1750 139.50
QB5-3500 595.00
QQE02-5 19.50
QQE03-12 7.95
QQE03-20 35.00
QQE06-40 45.00
QQV02-6 19.50
QQV03-10 5.50
QQV03-10 Mullard 15.00
QQV03-20 25.00
QQV06-40A 27.50
QQV06-40A Mullard 39.50
QQV07-50 Mullard 55.00
QQZ03-20 Mullard 42.50
QQZ06-40 Mullard 45.00
QS75/20 1.50
QS95/10 4.85
QS108/45 4.00
QS150/15 8.95
QS150/30 1.15
QS150/40 7.00
QS1205 3.95
QS1213 5.00
QU37 9.50
QV03-12 6.50
QV05-25 3.50
QV06-20 29.50
QV08-100B 145.00
QY3-125 85.00
QY4-250 105.00
QY4-400 110.00
R10 4.00
R18 2.50
RG1-240A 14.50
RG3-250A 6.50
RG3-1250A 35.00
RR3-250 15.00
RR3-1250 35.00
S11E12 35.00
S104/2K 10.00
SC1/1300 6.00
SP61 3.50
STV280/40 11.95
TB2-5/300 95.00
TB2-300 195.00
TB3-750 115.00
TB3-2000 450.00
TBL2-300 395.00
TBL2-500 495.00
TD03-10/D/E/F 35.00
TT15 45.00
TT21 45.00
TT22 39.50
TT100 69.00
TY6800 125.00
TY2-125A 105.00
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
UBC41 3.95
UBC81 1.50
UBF80 0.95
UBF89 1.00
UBL21 2.95
UC92 2.50
UCC84 0.70
UCC85 1.00
UCF80 1.00
UCH21 2.50
UCH41 2.50
UCH42 3.95
UCH81 1.95
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 6.00
UU7 6.00
UU8 9.00
UY41 3.50
UY85 0.70
V235A/1K 250.00
V238A/1K 295.00
V246A/1K 250.00
V246A/2K 315.00
V241C/1K 195.00
V453 12.00
VLS631 10.95
VP4B 9.50
VP41 4.95
VR101 2.50
VR105/30 2.50
VR150/30 2.50
VU39 2.50
W21 4.50
W61 4.50
W77 5.00
W81M 4.50
W739 1.50
X24 4.50
X41 4.50
X66/X65 3.50
X76M 1.95
XC23 3.50
XC24 1.50
XC25 0.50
XFW47 1.50
XFW50 1.50
XG1-2500 75.00
XL628FT 7.50
XNP12 2.50
XR1-1600 25.00
XR1-3200A 79.50
XR1-6400A 149.50
Y65 5.95
YD1100 75.00
YL1020 42.50
YJ1060 265.00
YL1060 195.00
YL1070 195.00
YL1071 195.00
YL1290 65.00
Z77 1.20
Z300T 6.00
Z302C 12.00
Z359 9.00
Z700U 9.50
Z759 15.00
Z803U 16.95
ZM1020 8.50
ZM1021 5.00
ZM1023 7.95
ZM1082 9.00
ZM1084 10.00
ZM1162 9.00
ZM1175 6.50
ZM1177 9.00
1A3 4.50
1AE4 3.50
1AX2 3.50
1B22 10.00
1B27 65.00
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
2C40 37.00
2C42 29.50
2C43 60.00
2C51 2.50
2CY5 1.50
2D21 2.25
2D21W 3.15
2E22 49.00
2E26 7.95
2J55 295.00
2K25 59.00
2K26 95.00
2K29 250.00
2K48 140.00
2K56 250.00
2X2A 5.00
3A/107B 12.00
3A/108A 9.00
3A/109B 11.00
3A/110B 12.00
3A/141K 11.50
3A/146J 7.50
3A/147J 7.50
3A167M 10.00
3A3A 3.95
3A4 1.50
3A5 4.50
3AT2 3.35
3B22 25.00
3B26 24.00
3B28 15.00
3BZ6 1.50
3C45 39.50
3CX3000A7 650.00
3CYS 1.50
3D21A 29.50
3E22 49.50
3E29 39.50
3EJ7 1.95
3H 0.40
3J.170E 1450.00
3L 0.40
3Q4 2.50
3V4 3.50
4-65A 85.00
4-250A 105.00
4-400C 95.00
4-1000A 495.00
4B32 35.00
4BQ7A 1.75
4BZ6 1.95
4C28 25.00
4C35 95.00
4C250R 285.00
4CV35,000 1650.00
4CV100,000 2950.00
4CX125C Elmac 150.00
4CX250B 45.00
4CX250BM 85.00
4CX250K EIMAC 115.00
4CX250R 115.00
4CX350A 100.00
4CX1000A 425.00
4CX1500B 475.00
4CX5000A 1000.00
4D21/4-125A 85.00
4D32 125.00
4E27A 125.00
4GS7 2.25
4GV7 2.25
4JC6A 2.95
4KT6 1.50
4T85P 150.00
4X150A 35.00
4X150D 55.00
4X500A 350.00
5A/102D 9.50
5A152M 9.00
5A163K 10.00
5A170K 6.25
5A-180M 9.00
5A-206K 10.00
5B-110M 10.00
5B-254M 11.50
5B-255M 11.50
5B-256M 15.00
5B-257M 15.00
5B-258M 14.50
5C22 125.00
5CL8A 2.50
5J180E 1950.00
5LJ8 2.95
5R4GY 4.95
5R4WGY 5.95
5T4 6.95
5T8A 1.95
5U4G 2.95
5U4GB 4.50
5V4G 2.50
5W4 4.95
5X4 4.95
5Y3GT 3.50
5Z3 4.50
5Z4G 2.50
6/30L2 0.70
6A203K 9.00
6A7 4.95
6A8 2.50
6AB4 3.50
6AB7 4.50
6AC7WA 2.00
6AG5 2.50
6AG7 2.50
6AH6 3.50
6AJ4 3.50
6AJ7 2.00
6AK5 1.95
6AK6 2.50
6AL5 0.85
6AM4 3.25
6AM5 4.50
6AN6 1.95
6AN5 4.50
6AN8A 4.50
6AQ5 1.75
6AQ8 1.50
6AS5 1.50
6AS6 2.50
6AS7G 4.50
6AT6 1.95
6AT8 1.75
6AU4GT 2.95
6AU5GT 4.50
6AU6 1.50
6AV6 1.95
6AW8A 3.50
6AX4GT 1.95
6AY3B 1.95
6AZ8 4.50
6B4G 10.50
6B8G 2.50
6B10 1.95
6BA6 1.50
6BA7 4.50
6BA8A 3.50
6BC8 1.50
6BR3 2.95
6BE6 1.50
6BG6G 3.00
6BH6 1.95
6BH8 1.50
6BJ6 1.50
6BK4 6.50
6BL6 85.00
6BL8 1.15
6BM8 115.00
6BN6 1.65
6BN8 3.95
6BQ5 1.50
6BQ7A 1.50
6BR7 4.95
6BS7 5.50
6BW6 3.95
6BW7 1.50
6BZ6 2.50
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
6CF6 1.95
6CG7 3.50
6CG7 GE 5.25
6CH6 6.95
6CL6 3.25
6CL8A 2.95
6CM7 2.95
6CS6 0.75
6CS7 0.95
6CW4 8.00
6CX8 3.95
6DC6 2.35
6DJ8 1.50
6DJ8 Special 3.50
6DK6 1.50
6DQ5 11.95
6DQ6B 2.50
6DT6A 1.50
6DW4B 3.50
6E5 3.95
6EA7 GE 4.50
6EA8 2.50
6EB8 3.50
6EJ7 0.85
6EM5 2.50
6EM7 GE 4.50
6EU8 1.75
6EV7 2.95
6EW6 1.50
6EW7 4.50
6F1 2.00
6F5 5.50
6F7 5.50
6F13 3.00
6F14 1.00
6F17 2.75
6F23 0.60
6F24 1.25
6F25 1.25
6F28 1.25
6F32 1.25
6F33 7.50
6FH5 6.50
6FH8 15.00
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
6H6GT 2.50
6HB7 1.95
6HF5 12.50
6HF8 3.50
6HM5 2.50
6HQ5 3.50
6HS6 4.95
6HS8 2.95
6HZ6 3.50
6J4 2.15
6J5GT 2.50
6J6 2.00
6J7G 4.15
6J86A GE 9.50
6JE6C GE 12.50
6JM6 9.50
6JU8A 2.50
6JS6C GE 10.95
6JZ8 5.95
6K7G 2.00
6K8G 3.00
6KD6 GE 11.95
6KG6A 6.95
6L1 2.50
6L6GC 3.50
GL6GC USA 9.50
6L6GT 3.50
6L7 3.50
6L15 3.15
6L19 3.95
6LJ8 2.50
6LD20 2.50
6LF6 GE 12.50
6LU8 9.25
6LQ6 GE 12.50
6P28 2.00
6Q7GT 2.50
6R7 3.15
6S4A 1.95
6SA7 1.95
6SC7 1.95
6SH7 1.95
6SJ7GT 1.95
6SK7 1.95
6SL7GT 2.50
6SN7GT 3.15
6SQ7GT 1.50
6SS7 1.95
6T8 1.50
6U6GT 3.50
6U7G 3.50
6U8A 1.50
6V6G 1.45
6V6GT 2.50
6W4GT 1.95
6Y6G 3.95
6X2N 1.00
6X4 1.50
6X5GT 1.00
6X8A 2.25
7A6 4.50
7AU7 1.50
7B6 3.50
7B7 2.50
7D8 4.50
7J7 5.50
7K7 7.50
7L 1.50
7Q7 4.50
7Y4 2.50
8B8 2.50
8B10 2.50
8BQ5 1.95
8CW5 1.50
8EB8B 1.50
8FQ7 1.95
10D2 1.25
10DE7 2.50
10DX8 2.50
10EB8 1.95
10EW7 2.95
10F1 1.95
10GK6 1.95
10P14 2.50
11E3 55.00
11R3 5.50
12A6 3.95
12AD6 2.50
12AE6 5.50
12AH7GT 4.95
12AL5 1.00
12AT6 1.75
12AT7 1.95
12AT7WA 3.50
12AU6 1.50
12AU7 0.95
12AV6 1.95
12AV7 2.50
12AX4GTB 2.50
12AX7 1.50
12AX7WA 2.50
12AX7S 7.95
12AY7 3.95
12B4A 4.50
12BA6 2.50
12BE6 1.95
12BH7A GE 6.50
12BL6 1.75
12BR3 1.95
12BY7A GE 6.95
12C8 2.50
12CA5 1.95
12CX6 1.95
12DQ6B 3.50
12DW4A 3.50
12DZ6 3.95
12E1 19.50
12E14 38.00
12FX5 1.95
12FX5GE 1.95
12GN7A 6.95
12J5GT 3.95
12J7GT 3.50
12JZ8 2.95
12K7GT 1.50
12K8Y 1.95
12KU7 1.95
12S7GT 1.50
12SA7GT 1.95
12SG7 4.75
12SK7 1.95
12SJ7 1.50
12SN7GT 1.85
12SW7 3.50
12SY7 4.50
12X4 1.95
13D7 3.20
13DE7 2.50
13DR7 2.95
13E1 145.00
13EM7 3.50
14B6 4.50
14R7 3.50
15E 5.50
16AQ3 1.95
16GY5 2.95
16H 0.40
16L 0.40
17A8 3.50
17AX4GTA 1.95
17BE3 2.50
17DW4A 2.95
17EW8 1.50
17JZ8 8.50
18D3 6.00
18GB5 3.50
19AQ5 3.50
19AU4GT 2.50
19BG6 3.50
19G3 19.50
19G6 9.00
19H4 35.00
19H5 33.50
20CV 9.50
20D1 2.50
20LF6 7.95
20L1 0.95
20P1 0.85
20P4 1.95
20P5 1.15
21JZ6 10.50
21KQ6 4.95
21LU8 3.75
24B1 39.50
24B9 39.50
25BQ6 1.75
25DQ6B 2.95
25L6GT 1.75
29C1 19.50
29KQ6 6.50
30C15 0.50
30C17 0.40
30C18 1.48
30FL2 1.35
30FL12 0.95
30FL13 1.10
30FL14 1.25
30L1 0.45
30L15 0.60
30L17 0.50
30P4MR 1.00
30P12 1.00
30P18 0.60
30P19 1.00
30PL1 2.50
30PL13 0.60
30PL14 1.75
31JS6C 7.50
33A/158M 19.50
35A3 3.95
35A5 4.50
35C5 4.50
35L6GT 2.00
35Z3 1.95
35Z5GT 3.50
38HE7 10.95
40KD6 8.50
40KG6A 4.95
47 6.00
50A5 1.50
50B5 1.95
50C5 0.95
50CD6G 1.95
50EH5 1.50
50JY6 2.95
53KU 4.50
75B1 3.50
75C1 4.50
80 4.50
83 8.50
83A1 7.50
85A1 6.50
85A2 2.95
90AV 17.50
90C1 3.50
90CG 17.50
90CV 17.50
91AG 9.00
92AG 28.00
92AV 25.00
95A1 6.50
100E1 10.00
108C1 2.50
150B2 6.50
150C1K 9.00
150D2 2.50
150C4 2.50
185BT 1.50
211 14.95
230D 15.00
231D 15.00
250TH 150.00
307 5.00
328A 15.00
572B 59.00
705A 12.50
713A 25.00
723A/B 75.00
724A 275.00
725A 276.00
726A 75.00
801A 15.00
803 14.95
805 16.95
807 5.50
811A 6.95
812A 12.50
813 Philips 35.00
813 19.50
829B 22.50
833A 65.00
845 23.00
866A 8.50
872A 20.00
873 60.00
954 1.00
955 1.00
1802 1950.00
1849 315.00
1927 25.00
2040 25.00
2050A GE 9.95
4212H 250.00
4471 35.00
4687A 9.50
5544 79.50
5559 55.00
5636 5.50
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
5823 9.50
5829WA 6.50
5840 3.50
5842 11.00
5847 10.95
5863 95.00
5879 9.50
5886 13.95
5894 39.50
5899 4.50
5963 1.75
5965 2.15
6057 3.75
6058 2.50
6060 2.25
6072 6.95
6080 8.50
6080WA 9.50
6132 10.50
6136 2.50
6146B 9.50
6146B GE 15.00
6146W 12.50
6155 72.00
6156 125.00
6157 2.50
6158 3.20
6166 650.00
6189 4.50
6201 6.45
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 8.50
7475 5.00
7486 155.00
7527 125.00
7551 8.50
7581A 11.95
7586 15.00
7587 19.50
7591A 10.50
7815 59.50
7868 8.50
7895 17.50
8156 9.95
8950 10.50
18042 10.50
9002 6.50
9003 8.50
6CB6 2.50
8417 8.95

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OPEN MON-THUR 9AM-5.30PM
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For further information contact *Hero Electronics Limited, Dunstable Street, Ampthill, Bedfordshire MK45 2JS: Tel: (0525) 405015.*

WARRIOR'S NEW STATUS

On 5 April 1990 **HMS Warrior 1860** was granted a permanent callsign – GB4HMS.

The Victorian battleship is the weekend home of the Fareham Radio Club, who operate from the assistant surgeon's cabin. Previously they used a temporary callsign.

This latest move has elevated the ship to a status enjoyed by few other amateur radio stations in the UK. These include the National Wireless Museum on the Isle of Wight, the Science Museum in London and **HMS Belfast** on the Thames.

News of the ship's new status has already started to spread via the amateur radio media, and operators on board have noticed a marked upsurge in interest from other amateur radio operators.

NEW LICENSING SCHEME

A new licensing scheme for amateur radio novices announced on 19 April by the DTI's Radiocommunications Agency, aims to encourage more young people to take an interest in the hobby.

The scheme, planned for introduction within the next twelve months, will allow novice amateurs to operate at low power and on limited segments of the wavebands allocated to amateur radio.

There will be two classes of novice licensee.

Class A novice licensees, who will have had to pass a 5wpm Morse test, will be able to operate on HF, as well as VHF and higher sub-bands. Class B novice licensees will be limited to VHF and higher bands.

The Novice Licence (A) will be available also to holders of the full Amateur Radio Licence (B) of at least a year's standing, provided that they have passed the 5wpm Morse test.

NEW SATELLITE SERVICE

Visnews has started a regular satellite service from Moscow. Since 23 April Visnews has made three transmissions to London each day to meet the increasing demand for news feeds out of the Soviet capital.

Each feed carries coverage of Soviet news and reports from television correspondents now based in Moscow.

The new service is transmitted via the Intersputnik satellite following an agreement with Soviet authorities.

CLUB NEWS

The Stevenage and District Amateur Radio Society meets every Wednesday at the ground floor lecture room, 'D' Block, Ridgemond Training Enterprise, Ridgemond Park, Stevenage.

For further information contact *P Daly. Tel: (0438) 724991.*

The Bury St Edmonds Amateur Radio Society meets on the third Tuesday of every month at the County Upper School, Beetons Way, Bury St Edmonds.

The club's programme of events for June includes a talk by Margery Hey, entitled The Work of the RAIBC on 17 July and a talk by Pat Gowan, entitled Satellites and Their Working.

For further information contact *Ian Gowan G0KRL. Tel: (0359) 70527.*

The Spalding and District Amateur Radio Society will hold a Club Rally on 3 June at Springfields Gardens, Spalding.

For further information contact *the acting secretary, D Hoult. Tel: (0775) 750382.*

The Royal Naval Amateur Radio Society will hold its twenty-ninth Annual Mobile Rally on 10 June, from 10.00am to 5.00pm, at **HMS Mercury**, East Meon, Petersfield, Hampshire.

There will be a large variety of amusements to cater for all ages, as well as a talk-in on 2m and 70cm. Parking is free. Admission costs £1.00 for adults, children free.

For further information contact *C G Harper G4BZU, 34 Neva Road, Bitterne Park, Southampton, Hants SO2 4FJ. Tel: (0703) 557469.*

The Newbury and District Amateur Radio Society will hold a radio boot sale on 17 June at the Ackland Hall and Recreation Ground, Cold Ash, Newbury, Berkshire, between 10.00am and 3.00pm.

There will be refreshments available and admission and parking will be free.

For further information contact *Mike G3VOW. Tel: (0635) 43048.*

The Wimbledon and District Amateur Radio Society meets on the second and last Friday of each month at 7.30pm at the St Andrew's Church Hall, Herbert Road, London SW19.

The club's programme of events for June includes a joint meeting with the Sutton Library Computer Club on 8 June, and a quiz between CATS and WDARS on 29 June.

For further information contact *Nick Lawlor G6AJY, 115 Bridgewood Road, Worcester Park, Surrey KT4 8XS. Tel: 081-330 2703.*

The Reading and District Amateur Radio Club meets at a new venue from 14 June 1990.

The new venue is the Woodley Pavilion, Woodford Park, Haddon Drive, Woodley, Reading.

The meetings will continue to be on the second and fourth Thursdays of the month.

For further information contact *the club secretary. Tel: (0734) 744042.*

THE SOFTWARE FILE

by Stephen Phillips

Program notes

This month's program 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. Because of the loose writing, serious programmers will throw up their hands in horror. The point is that the program assumes a simple Basic on a simple machine so that it can be used by more people.

The program

Previous programs in this series which have dealt with aerial computations generated a lot of letters. If this is what you want, then here is another one to add to the collection.

This program will design aerials of the Quad variety. These aerials are characterised by high gain, broad bandwidth and ease of matching, thus, making them supreme candidates for home construction.

The listing

CLS in line forty clears the screen. SCREEN 2 selects a graphic display and KEY OFF blanks the function key help line at the bottom of the screen. The LOCATE x,y statement in line 110 and other places simply locates the cursor at a specific line and column before printing to the screen. If your machine does not support this or a similar statement, simply leave them out; all the printing will then take place at the left-hand edge of the screen.

Inputs

Line 120 asks for the design frequency and line 130 checks that it is within acceptable limits. Lines 160-300 give a menu choice of element spacings and lines 310-370 take the input and set a variable to the required figure for later computation. Line 390 calculates the various lengths and spacings and these are displayed in lines 410-560. Line 570 and up asks if you want to rerun the program and then takes the appropriate action.

Checking

To check the program enter Freq . . . 30 and use spacing choice 3. You should get the following answers (all dimensions in feet): driven length . . . 32.8; driven sides . . . 8.20; reflector length . . . 34.44; reflector sides . . . 8.61; spacing . . . 6.56.

```
 10 REM
 20 REM      ★ ★ ★ COPYRIGHT AMSOFT 1990 ★ ★ ★
 30 REM
 40 CLS:SCREEN 2:KEY OFF
 50 LOCATE 10,17
 60 PRINT "This program will design two element QUAD aerials."
 70 LOCATE 12,15
 80 PRINT "It is usable over a frequency range of 2 to 150 MHz.
 90 FOR T=1 TO 5000:NEXT T
100 CLS
110 LOCATE 10,20
120 INPUT "Frequency in MHZ .....";F
130 IF F>2 OR F<150 THEN 160
140 BEEP:LOCATE 10,57:PRINT
150 CLS:GOTO 110
160 CLS
170 LOCATE 5,30
180 PRINT "Element spacings."
190 LOCATE 6,28
200 PRINT "----------"
210 LOCATE 10,20
220 PRINT "For .1 spacing ..... 1"
230 LOCATE 12,20
240 PRINT "For .15 spacing ..... 2"
250 LOCATE 14,20
260 PRINT "For .2 spacing ..... 3"
270 LOCATE 16,20
280 PRINT "FOR .25 spacing ..... 4"
290 LOCATE 19,20
300 PRINT "Which choice ....."
310 AN$=INKEY$
320 B=VAL(AN$)
330 IF B<1 OR B>4 THEN 310
340 IF B=1 THEN A=.1
350 IF B=2 THEN A=.15
360 IF B=3 THEN A=.2
370 IF B=4 THEN A=.25
380 CLS
390 L=984/F:D=L/4:T=L*1.05:R=T/4:S=L*A
400 LOCATE 5,19
410 PRINT "Design for a";F; "MHz QUAD with";A; "spacing"
420 LOCATE 6,17
430 PRINT "----------"
440 LOCATE 8,20
450 PRINT "Driven element length in feet ....";USING "###.##";L
460 LOCATE 10,20
470 PRINT "Length of each side in feet .....";USING "###.##";D
480 LOCATE 13,20
490 PRINT "Reflector length in feet .....";USING "###.##";T
500 LOCATE 15,20
510 PRINT "Length of each side in feet .....";USING "###.##";R
520 LOCATE 18,20
530 PRINT "Element spacing in feet .....";USING "###.##";S
540 LOCATE 19,17
550 PRINT "----------"
560 LOCATE 22,20
570 PRINT "Rerun or end the program R / E ...."
580 AN$=INKEY$
590 IF AN$= "R" OR AN$= "r" THEN 100
600 IF AN$= "E" OR AN$= "e" THEN STOP ELSE 580
```

A USER REVIEW

THE GRUNDIG SATELLIT 500 WORLD RECEIVER

The Grundig Satellit 500 world receiver is a commercial receiver designed for the home market and follows in the footsteps of the well-known Satellit 400. The Satellit 500 incorporates many new features and is a complete departure from its predecessor. In spite of this, it measures only 30.5mm × 17.5mm × 6.5mm (WHD). The case is made of rigid plastic with a black metallic finish.

Brief description

The left-hand side of the front panel is taken up by the loudspeaker, and the right-hand side comprises most of the controls. The LCD measures 40mm × 95mm and, if used with a mains power unit, such as the Grundig NR90, is illuminated from the left-hand side; the keypad switches are lit from the rear. Fifteen different sources of information are shown at any time, excluding the frequency figures.

Twenty-four hour clock

When the receiver is off the twenty-four hour clock, which takes the time from the second clock in the machine, is shown on the right-hand side of the display area. The top line of the display shows which clock is in use, ie, time 1 or time 2.

The set is switched on by pressing the left-hand white key on the top row of switches under the mode title. This key is not marked 'on/off' but has a vertical line in the centre with a circle on the left, and a broken circle with a vertical line through it on the right. This marking replaces the standard on/off logo.

The clock figures move to the left together with the mode in use, FM or AM appears next to them.

Below this is the indication batt check which appears for ten seconds. The bar above shows the condition of the batteries or Ni-Cad cells if used. After ten seconds the battery charge indication disappears and is replaced by a field strength meter. The current required at 12V dc is around 300mA, varying as the volume is altered.

There are seven boxes along the top of the display area and these are, from left to right:

Automatic (showing that the switching times for on and off have been programmed); sleep (for programming the sleep time); time 1/time 2 (controlled by two switches in the column marked timer); bandwidth; LSB; synch (giving 100Hz fine tuning on AM) and USB.

Bandwidth, synch, LSB and USB are selected using the front panel switches under the mode title. The reception in use (FM or AM) is shown next to the time indication. Above this is an indication showing whether the reception is in mono or stereo.

Stereo reception on FM

When an external speaker or headphones is inserted into the 3.5mm external speaker socket an FM decoder is brought into circuit, resulting in FM stereo reception and the indication of a double O above mode FM.

The mono/stereo key, when pressed for mono will also activate a trimming device which affects the input circuit selectivity. This tuning knob can be turned to achieve the best reception possible, and makes an amazing difference to the quality of the received signal. Normally, though, the automatic circuit trimming works well enough.

Reverting to the mode selection buttons, when the AM button is pressed LW, MW and SW are shown in sequence. Continually pressing this key selects the particular band you want to use.

The second horizontal row of keys are A-Z/0-9, mono/stereo and bandwidth. The A-Z/0-9 key incorporates one of the most ingenious uses of memory I have

The table

Specifications of the Satellit 500

Power supply requirements

Batteries 4 × 1.5V	HP 2 batteries or accumulators IEC K35/62
	Built-in rechargeable lithium battery for data protection
External dc supply	Mains unit NR 90 or 9-12V dc

Output power

Mono and stereo	7.5 ohms
Mains/music power according to DIN 45324	1 or 2 × 1.5W
Peak power	1 or 2 × 3W

Built-in aerials

Telescopic aerial	FM and SW
Ferrite rod aerial	MW and LW

Connecting sockets

To drive amplifier installations and for mono tape recordings:
Line out (phono socket)
Headphones with 3.5mm jack-plug, 32-2000 ohms, and for stereo tape recordings
External loudspeaker (left-hand channel) with 3.5mm jack-plug
External aerial: DIN 45325 (75 ohm coaxial socket for all wavebands)

Wavebands

FM	87.5-108MHz
SW	1612-30000kHz
MW	513-1611kHz
LW	148-353kHz

IF frequencies

FM	10.7MHz
AM	IF 1 54.5MHz, IF 2 450kHz

come across. It records all twenty-six letters of the alphabet and figures 0 to 9, as well as a star and hyphen. This enables the operator to choose a name for the particular station on that memory channel. It works in the following manner.

Under the frequency display is a blank space. When the A-Z/0-9 key is pressed, a cursor flashes in the left-hand side. When the tuning knob is rotated, single letters followed by figures 0 to 9 appear in sequence. You just stop at the desired letter or figure and press the key again. The cursor moves one space to the right and the same sequence is repeated for the other two positions.

When the correct four letters and/or figures are shown, a final press of the key enters them into the memory, together with the tuned station and memory channel used. Every time you want, say, memory channel number five, the name you have allocated to it will also appear below the frequency readout with the number of the chosen memory channel.

The front panel

Memory scan

The third horizontal row of keys in the mode area comprises two keys, free and store. One press of the free key gives the next free channel, but if it is held down the set displays all of the free memories in sequence. The store key, coloured yellow, stores a station in the memory.

The next row consists of memory scan and USB. Memory scan can be pressed at either end to allow scanning up the memories (1 to 42) or down (42 to 1).

The first line in the mode assembly consists of the search and LSB keys. Search can also be pressed at either end. In the short wave range, if search is pressed briefly the unit selects the various metre bands and will scan in 5kHz steps if it is held down. At the end of the selected band the scanning mechanism reverts to the start. Further information is given if the scanning passes through a frequency which is already stored in the memory; details will appear in the memory section of the display, including any name which has been assigned to a particular station.

Direct key input

The right-hand side of the control area is taken up with the direct key input, figures 1 to 0, a decimal point and CL (clear). Below these are two more keys, frequency m-band and memory. Any frequency can be keyed in and immediately made available by pressing the frequency m-band key. It is also possible to key in up to twenty-two short wave bands by pressing, for example, four-nine. The figures have to be in metres, not frequency.

The right-hand side of the set contains the tuning knob and an AGC or variable RF control. The tuning knob has a finger detent and rotates in steps which are altered according to the mode used. With AM reception each notch alters the tuning frequency by 1kHz, but when in SSB mode or in the synch position, each notch moves the frequency by 100Hz. This makes the tuning of amateur SSB signals very easy. In the case of FM (VHF) reception, each notch moves the frequency 25kHz.

Next to these controls is a Belling-Lee type female socket for an external aerial, together with two small slide-switches: one for external or internal aerials, and the other is marked sensitivity DX/local.

The left-hand side of the unit comprises four rotary controls and five sockets. From top to bottom, these are: treble, marked with the musical treble clef and ±; the next one down alters the bass response, marked with the bass clef and ±; volume control, and lock control, which is used to prevent the tuning being altered.

In addition there are five sockets, from top to bottom: line out (phono), headphones, external loudspeaker and switch output (for controlling an external unit) – all are 3.5mm jack sockets – and, lastly, a 5.5mm socket for an external power supply.

The unit is fitted with a telescopic aerial and concealed handle, which is released from the back. There is also a support which can be extended from the back so that the receiver is supported for easy operation.

Operation

The standard of construction and sound output is of a high quality and is superior to many similar receivers. When used on FM with an extension speaker, it can be used as a normal radio.

Operating on SSB on the 20m amateur band is excellent, particularly when making use of the switchable bandwidth, which gives a choice of 1.9kHz (narrow) or 3.4kHz (wide).

The AGC/MGC knob gave good variable gain control when in the MGC position and the stability is of a high order, being around ±20Hz.

This stability enabled RTTY signals to be copied on SSB and the reception of fax weather pictures from a number of stations. I prefer listening to Offenbach DCF 54 when receiving fax but its frequency is 134.2kHz, just below the range of the Satellit 500, which only goes down to 148kHz. To overcome this problem, I used a Datong VLF converter, which brought the signals out on the 10m band, 28132.4kHz to be precise. The unit was stable at that frequency and gave perfect pictures.

I then tried tuning in several stations on the 7MHz band by adjusting the switched bandwidth, synchron demodulator and the manual gain controls as necessary and, in most situations, they managed to pull the station out of the QRM.

Conclusion

The Satellit 500 is suitable for any class of short wave listener. The beginner can get the general feel of receiving stations, whether those stations are strong broadcasters or weak DX, and the experienced user will derive great satisfaction from its advanced technology, excellent sensitivity and selectivity.

In fact, as the receiver can be used as a communications unit, it is comparable with those receivers used for the reception of RTTY and packet on fax. The Satellit 500 costs £299.00 including VAT, and is available from most large department stores.

The World of D | A | T | A

BY DON FIELD G3XTT

Data communications is now so much a part of my amateur radio activities that I wonder how I ever managed without it. To start with, the bulletins which circulate on the packet network allow me to keep in touch with what is going on in the amateur radio world from day to day.

I can read the RSGB weekly news bulletin even before it goes out on a Sunday morning. The VK2SG RTTY notes, put on to the UK network by G3XTL, keep me in touch with RTTY activity world-wide. Then there's the Chiltern DX Club Packet Cluster system, which I like to be connected to whenever I am around the shack so that I don't miss any alerts of HF band DX activity (a second Cluster, GB7DXC, is now operational from Cheltenham on 144.650MHz, run by John G4PDQ). From the Cluster I can also get propagation forecasts, beam headings, QSL information, and much more.

RTTY DXing

Turning to the HF bands, I get a lot more satisfaction from RTTY DXing, which tends not to be so frantic as SSB or CW DX chasing. For example, I have worked 3W3RR in Vietnam and YV0AA on Aves Island in the Gulf of Mexico for new ones on the mode. The latter was interesting in that it was a data modes *only* expedition. They simply didn't bother with CW or SSB. Definitely a sign of the times! Also on HF, of course, there is increasing AMTOR activity to be chased, as well as AMTOR and packet mailboxes.

All in all, I am beginning to find that one terminal unit simply isn't enough, and neither is one computer! That's even before I start using the PC to type this column, or desk-top publish the Chiltern DX Club newsletter! To some extent these limitations could be overcome by using a multi-tasking operating system such as desqview and, of course, some TNCs allow both an HF and VHF session to take place simultaneously. A year or two back, though, I would not have expected this facility to be needed.

My current project is to connect my TS-940S to the computer to allow frequency selection via remote control, again interfaced to the packet system, but what is holding me back is that I am already using both COM ports on the PC for other things (the TNC on one and a land-line modem on the other). Oh dear! It's all a far cry from my original Sinclair ZX81. I wonder how the rest of you cope?

Data Convention

The RSGB has decided not to hold this year's Data Convention at the same time as the AMSAT Colloquium. Instead, it is likely to take place in late October or early November, somewhere in London. If you can't wait that long the organisers of the McMichael Rally, which takes place on 22 July at the Haymill, Burnham, near Slough, are planning a mini-Data Convention to be held in parallel with the rally.

Connectionless mail protocol

The March issue of **Connect International** carried an item by Derek G1TLH, which proposed a connectionless mail protocol for VHF packet radio. His article echoes some of the things I have been saying here previously. He argues that the majority of traffic flowing on our VHF packet network is bulletin traffic as against personal mail, if only because most bulletins have to be forwarded to every mailbox in the country.

'Why restrict ourselves,' he writes, 'to a protocol designed for wire-based networks? Why not develop a broadcast protocol which allows a message to be received simultaneously by every mailbox in range of the transmitting station, rather than having to send the same message several times?'

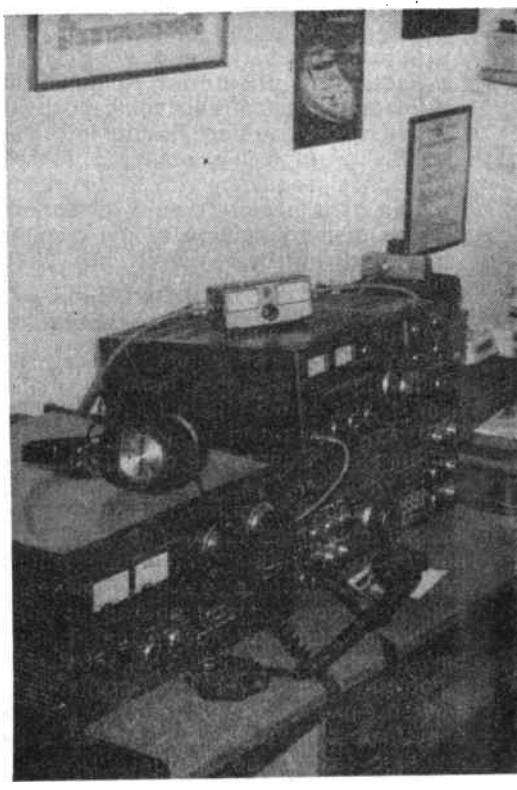
In my own area in the Thames Valley, one mailbox takes bulletins from the main network and then forwards them to five other mailboxes in the area, so there could be a great saving in congestion; albeit this forwarding now takes place on 70cm and does not, therefore, contribute to congestion problems on 2m.

Of course, the problem associated with a broadcast protocol for packet radio is that one, or more, of the receiving stations may miss packets and require a retransmission. Therefore, some means must be found to allow this to occur. For example, the transmitting station can leave a quiet period after each transmission to listen for any requests for a retransmission. The basic idea certainly seems sound, though I suspect it will not take off.

Derek also argues that as amateurs we should justify our rights to valuable VHF frequencies by pushing forward the boundaries of technology, rather than just borrowing from the commercial world.

In practice this has, to an extent, already happened. Amateurs took a step forward by making the X.25 protocols work over a radio link in the first place. From now on, though, any advances will be constrained by the vast number of AX25 TNCs already in use, representing a major financial investment which amateurs will be unwilling to change overnight.

The G3XTT shack with HF and VHF radios, PK232 TNC and the computer



Of course, firm-ware can be changed relatively easily, and mailboxes are all running PCs of some description, whose application software can be changed. But any change will require a co-ordinated response and, as I have said here before, the major problem with an amateur organisation is that co-ordination cannot be legislated (even in the professional world agreement to change can take a very long time).

Mailbox co-ordinator

Having said that co-ordination is wellnigh impossible, there are those who do their best. John G4MTP has recently stepped down as RSGB mailbox co-ordinator, and Neil G6HIU has taken his place. Not an enviable job – almost by definition the mailbox co-ordinator can never please everybody all the time, but please give Neil your support.

Contest results

The March issue of the RTTY Journal carried the results of the 1989 Allesandro Volta RTTY DX Contest and the 1989 SARTG World-Wide RTTY Contest.

In the former contest, G4SKA took second place on 14MHz, while G0ATX took top honours on 21MHz, with W6/G0AZT coming in fourth. In the latter contest, G0ATX took the world ninth position in the all-band category behind some of the very big boys (HD8S on the Galapagos Islands came in first), W6/G0AZT came thirty-second, and G4SKA was the world leader on 14MHz single band. G1DPL entered the SWL category, coming third. It would be nice to see more UK entries in these various events.

RTTY

While on the subject of RTTY, I have said on a number of occasions that multi-mode TNCs are inevitably a compromise on this mode. If, like me, your TNC is in constant use on VHF, you might like to buy or build a separate terminal unit for RTTY.

What you may not know is that the BARTG (British Amateur Radio Teledata Group) is able to supply two such terminal units. The best known is the ST5MC, which can interface to both mechanical teleprinters and computers, and comes ready-built and tested for £79.00.

The other model is the Versaterm, designed especially to work with computers. This is supplied in kit form only and requires an external power supply. The kit costs £51.95 plus £4.50 for p&p. In this form it provides a TTL output. An RS232 board is also available and this costs £1.99.

The ST5MC is available from Stuart G3PPD, and the Versaterm from Peter G6LZB. Suitable software to drive these terminal units is available from a number of sources, such as G4VRQ and G4BMK.

Software spot

Not directly related to datacomms, but I thought it would be interesting to mention some useful amateur radio software from time to time. After all, almost all of those who use datacomms use a PC of some variety (though, I know that some of you still stick with mechanical teleprinters or with 'dumb' terminals).

One shareware package I have been playing with during the last few days goes by the name of Geoclock. Geoclock runs on an IBM PC (or clone) with a hard disc and EGA or VGA monitor, and paints a map on the screen with major towns marked. On to this it overlays the position of the sun and terminator (dawn/dusk boundary). These are then updated every few seconds.

The time is taken from the PC's internal clock, or you can set any time and date you want.

The shareware version of the program is supplied with a world map, but if you register with the author you get a whole series of maps for different parts of the world. The program has a number of other features, such as being able to draw lines on the map and calculate distances between any two points on the earth's surface. The program supports a mouse as well as the keyboard, so selecting locations can be very fast indeed.

I can provide an evaluation copy of the software in return for a blank formatted disc (any variety) and the return postage. Registration costs $30.00, and full details of how to register are provided on the disc.

This is one of a number of software packages I hope to be able to demonstrate at the RSGB HF Convention at the end of September. Basically Geoclock is similar to the computer version of the popular DX Edge, but is cheaper and more versatile.

Bandplan

Finally, the news from the IARU Region I Conference in Spain is that the 20m bandplan for data modes was confirmed, with packet and RTTY to share the existing RTTY segment (14070 to 14099kHz). The idea is that, as far as possible, packet users should stick to the top end of this slot, and RTTY and AMTOR operators to the bottom end.

The decision will no doubt cause an outcry from those who believe packet requires an exclusive band allocation, though a 30kHz bandwidth should be enough to accommodate around fifty separate QSOs, provided everyone uses narrow bandwidth filters.

From my own observations band occupancy is only this high during contests; as I have said before, the problem seems to be the wide or inadequate filters used by most RTTY and packet operators. It is quite practical to copy data transmissions through a narrow CW filter, whereas most operators use the SSB filter on their rigs. Of course, audio filtering can also be used, and BARTG can supply a circuit board for such a filter as I have mentioned before. The TNC manufacturers could also help by incorporating suitable filters in the on-board modems.

Datacomms is undoubtedly the fastest growing aspect of amateur radio at the moment, but the relatively low attendance at the RSGB data conventions and other similar gatherings suggests to me that only a handful of users are actually contributing to the way forward, and the rest can be classified as 'black box operators'. While it is not always possible to get along to conventions and rallies, a column like this can be a useful medium for an exchange of ideas.

So, do please send me your comments and input so that I can make this column as relevant as possible.

SECOND-HAND

by HUGH ALLISON G3XSE

Rainham Rally

This rally got off to a great start. As I pulled into the carpark an amateur on a motorbike parked behind. He had the rig and aerial mounted on the bike, and the headphones and mike were inside his crash helmet. He turned his bike engine off and heaved the bike on to its stand. He then walked off towards the rally site. Unfortunately he was still connected to the bike by the mike and headphone lead, since he hadn't taken his hat off. The bike was pulled over and he was jerked backwards. He said lots of naughty words.

The rally itself was brilliant. One stall had a big box of ex-taxi transceivers at 10p a throw – I bought the lot, after a haggle, for a quid. One had a commercial, crystal-controlled toneburst in it (I suspect it had been used on 2m at some time), which was ideal for a mate's 70cm rig. I've already used a PA transistor out of another transceiver to repair a 2m box for a hard-up friend.

I only spent £25.00, all-up, to purchase a standard car-bootful of assorted junk. This included an enormous 26/30MHz valve linear, which is now doing big things to my 29.6MHz FM signal.

I noted second-hand IC2Es, boxed and in good condition, selling briskly at between £75.00 and £90.00.

All in all, an excellent show. As we drove away, my wife summed it up well when she said: 'What a friendly little do'.

Another bodge

Sometimes I get involved with some real oddball rubbish. On this occasion it was a Japanese HF all-mode, old bands rig made for the USA, 120V ac. I'd never heard of Hero – the make – before.

Well, some hero had plugged it into 240V. The fuse had blown so the owner had linked it out and plugged it back in – I'll bet the fire was worth watching. The resultant heap had then been bought at a club junk evening by a friend, for a very reasonable fiver.

We surveyed the damage. The main PCB was burnt in one corner, mainly rectifiers and stuff, and the mains transformer was a charred heap. We performed the last rites on the latter, as it was a gonner.

Versatility is the name of the game and a toroidal-type mains transformer that was to hand seemed to have the right sort of voltages coming out – well, more or less. At least it had the right 240V in. We could only guess at some of the rails by looking at the working voltages of the smoothing capacitors, and then trying three-quarters of them. By the way, the original transformer had been a proper laminations type, and our toroid didn't really fit, but we got it in. All right, when I say that, the covers were a bit of a struggle to get back on. Looked OK though; well, from a distance maybe.

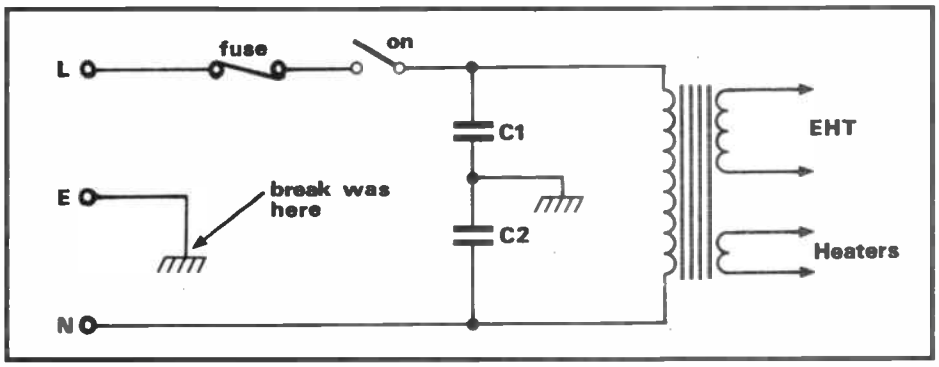


Fig 1: *Linear mains input circuit C1 and C2 = 0.01 250V ac working 'filter' capacitors*

Anyway, we turned the mains on and I don't think there were two more astonished people on Earth when it burst into life first go. Unbelievably, it transmitted too. The new transformer was not running too hot, warm I admit, but acceptable.

No sidetone

We went on the air, and got good reports on SSB. We were elated. On CW all was well but there was no sidetone. This explained something that had been puzzling me. There seemed to be *two* audio stages and there were definitely two speakers. One of the audio stages had caught the full blast of the burn-up and was beyond reasonable repair. This must have been the separate sidetone oscillator and amplifier; unusual that. The new owner said he could live with this; an RF-powered oscillator would make a good project.

I prodded about with the 'scope probe. The keying rail went up the base of a transistor which could have been part of a multivibrator that gave the tone. This was still being turned on and off by the key but couldn't oscillate 'cos its mate was a gonner and all relevant tracks were vapourised.

Some time ago I read an article written by a brilliant man who had had the clever idea of using one of those self-contained bleep modules as a sidetone in a mini QRP rig. You know the sort of thing; quartz sounder with built-in oscillator. We had got a keying transistor keying nothing now, so it seemed worth a try; in one went, and it worked a treat. Strangely enough, it seemed a bit loud, but a length of Sellotape across its squarking hole soon quietened it down.

Safety

I know this column has a bit of a reputation for making light of some technical things, and it's quite hard to preach on a serious subject, but here goes.

An acquaintance, a confirmed CB freak, bought a valve, mains-powered linear. OK, very naughty, particularly as it had two EL509s in it. Anyway, he plugged the linear into the mains, turned it on, then went to connect the aerial into the linear, and the linear into the CB set. He had the PL259 in his hand and, as he steadied the linear to do up the PL259, he received, to use his own words, 'the mother and father of all belts'.

If you study **Fig 1**, you will see a normal mains transformer, 'filter', switch set-up. What you will not see is that the earth wire, mains, green and yellow, is secured to the chassis via a solder tag held on by a pop rivit. The rivit is aluminium, the chassis steel, and corrosion is rampant. The result is no earth connection to the chassis.

The two capacitors in the 'filter' now obligingly become a capacitive potential divider, the chassis whizzes up to 120V and, with a weak heart or some other –3dB fault in *your* life support system, it could be Silent Key time. The moral is: check the earth pin on the mains socket to chassis with an avo, on low ohms, every time you get a new bit of kit.

Naughty linears

OK, I've got to say this. How big is a foreign watt? I think it is twice the size of ours. Now, the above linear, resplendant with a new locknut and bolt securing earth to chassis, just had to be tried out on 29.6. It had a big meter on the front, 'calibrated' 0→500watts in 100W divisions.

We prodded the linear into action by worrying it with four watts from a legal Icom CB set on ten. Wham, the needle headed off for the 500W mark. A quick tweak and we'd got 500W indicated; most impressive. Shame the 50Ω Bird Termaline made it only 70 coming out. We provoked the linear with 25W FM from a Trio wonderbox – it stopped being linear

in a big way at 20W in – and we'd got 175W out. Incidentally, the valve tester had said the EL509s were good.

A 'scope on the EHT revealed the fault, it was woozy (another advanced technical term; means high voltage rail drops dramatically when you suck amps out). My guess was the EHT winding on the mains transformer was wound with too thin a wire. All in all, *yuck*.

Talking of linears

A friend bought a home-made linear, 4 × PL509, for £10.00. 25W up gave 25 out – not too good really. He tested the bottles, which were OK. There were lots of volts in all the appropriate places. He quickly found the input coupling capacitor, marked 100pF, had gone 1.5pF – well, it had until the leg fell out of it.

Voice synthesiser boards

Over the past year or so I've bought several different brand new but surplus speech synthesisers. All have featured National Semiconductors chips and are of the 'only say what's programmed in' type, ie, an address in of 00001 will make it always say 'one'. I've paid between 10p and £2.50 for a board and all were in remarkably good condition. I've never bought a duff one yet.

I think I'm correct in saying that National have now made the range obsolete – certainly the reps I have spoken to know nothing about them. There is a lot of information about them in old (several years old) National data books. Incidentally, the boards are quite easy to recognise; you don't often come across boards with a dozen or so chips on them plus a loudspeaker.

Connections. There are three rows of pins, and careful examination will identify the rails. The audio output chip can be a great help here, often it's an LM386, so you can soon find the +12 rail. The boards often need −12 and +5 as well. The +5 can easily come from a regulator chip from your +12. The idea is to look for an edge connector pin that goes round most of the chips, then see which way up the electrolytics on that rail are pointing. Ten minutes spent thinking it out should enable you to get it going. I've got every one going that I've bought, and so far without the indignity of resorting to handbooks.

In use

The idea is that you load in the address of the word you need, then hit an enable line. With no address, ie, '0000', but with the enable line hit, most say: 'This is digitalker'. Beware of the address lines, which are of mega-high impedance and may rise up from 0 all by themselves. A 10/100k resistor on each address line, to hold it down to earth, may be needed to prevent gibberish.

I've given most of mine away to people who have used them in gizmos for blind people. Sure, the boy and I have enjoyed mucking about with them as they are great toys in their own right, but I haven't found a serious use for one myself.

Belcom AMR104H

I was repairing this old eight-channel 2m crystal-controlled scanning receiver, which was mains or 10V (power pack built in). It was not working on channel eight, and as the owner used his receiver a lot, he wanted all channels to work. It wasn't the crystal at fault, but the flexible PCB. As it was copper-based I bridged the break with a bit of wire and all was well.

I noticed that the receiver was really singing; the signal generator was on 10μV output, 3kHz deviation. Down went the attenuator. At 1μV he was still going like a dingbat, so I cut the deviation and measured the quieting. It was 30dB! The signal generator would go down to .1μV, but it must be admitted that there was plenty of leakage coming out. That said, most receivers have pegged out by then, only modern super gear will give 10dB or so quieting at that level, yet the said Belcom was doing just that. Not bad for a ten-year-old heap.

When I handed the rig back to the owner I remarked on the sensitivity. He said that was why he kept it, it always seemed to work well.

Now here's a strange thing

I bought a new style transistor Pye Reporter, the library book-sized transceiver rather than the massive old valve heap (you know the one, empty the amps out of a car battery in half an hour). Well, 20p seemed within my budget. It was 70MHz, tuned up on the band, with simplex crystals – one Tx, one Rx. It had obviously been a low band FM variant all its life, because the plate said the factory had made it to transmit on 71MHz and receive on 86. So why had it got a 1750Hz made-for-the-amateur toneburst generator fitted in? Not that I'm complaining . . .

Digi scan 4+4

These are ancient, transistorised, VHF 'two band' crystal-controlled scanner/receivers. They are laughably big and heavy when compared with today's 'lose-it-in-the-palm-of-your-hand' multiband super rigs. The Digi weighs in at a massive 8lb and is a 9½ × 9½ × 3in lump. That said, there's plenty of fresh air under the covers, ready and able to take any modification. I've even seen transceivers made out of them.

Band coverage is stated to be 30-50, 150-174 and 450-470MHz. The good news is that 30-50MHz will do either 10m or 6m (but not both). The 150-174MHz range will do 2m, and the 450-470MHz range is happy on 70cm. I don't know why they put such effort into building something that wasn't specified to do the amateur bands!

Now to explain the 4+4 bit. The receiver was sold as a 10.7MHz IF, in a box with a crystal oscillator and scanning electronics. You could then buy the appropriate front end boards for the various bands; it only takes two of the three options. All the ones I've come across have had 2m and 70cm installed. They aren't brilliant receivers, 1μV for about 15dB quieting, but are OK for local repeater or natter channel monitoring. Watching the built-in power supply, most are 120V ac – run 'em on external 12V.

The price is the best bit about them. £20.00, full of 2m and 70cm crystals, is tops. I bought one recently for 25p from a car booter. The seller told me: 'Bought the bloody thing new years ago. It's worked great on 70cm but never worked on 2m. I sent it back but they couldn't sort it out either.' Now, if you had a front end board with clip-in wires and the pins were silk screened, would you clip the yellow wire into a spade marked 'BRWN' and a brown wire into one marked 'YLW'? I thought it was a reasonable bet to swap them over, whereupon 2m sprang into life. Arrgh.

Low/mid/high band

Low band taxi transceivers are roughly 60 to 86MHz. These are thus suitable for 70MHz conversion, your 4m. Mid band transceivers are sort of 100 to 120MHz, and are handy as spares. These aren't very easy to take down to 4m; the L/C ratio gets a bit swamped if you just add capacitors everywhere. The result is deaf receivers. They are also bad news to take up to 2m. I've seen some reasonable airband receivers made. High band transceivers are roughly 135 to 175MHz, and are very suitable for 2m conversion.

Got all the above? Now comes the hard part. High/mid rigs. These were popular with the police, among others, who transmitted on one band and received on the other. It is possible to buy a rig set up to transmit on 160MHz but receive on 100. You are a lucky man if the receiver will join the transmitter on 2m. Now the good news. A lot of the older rigs had the receiver laid out on the main PCB, while the transmitter was on a separate metal chassis, connected into life-giving power etc, by just a few wires between the PCB and chassis.

Firms like GEC, Pye and Cossor, among others, did it this way. The trick is to dig deep into the piles at rallies. This old stuff is almost free at rallies, particularly 'odd mix' ones. Buy two. One mid/high, the other high/mid. Often the only information you will have is that on the identification plate, unfortunately with no instruction as to which band refers to the transmitter and which to the receiver. However, most have operating frequencies scratched on to the plate so you can soon work it out. Simply put the high band receiver out of one, and the high band transmitter out of the other –

and rip up the mid band stuff to repair the bits you bust in the process. The day of the under-a-quid 2m solid-state rig has arrived!

A proper repair

The story goes something like this. The child of an acquaintance of a colleague had been given this radio-controlled boat by her grandfather. The boat and electronics had been made by the grandfather's friend.

So how come I had to repair it? I don't know much about early proportional control systems – I thought it all started with a chip at one end and ditto at the other, but this thing had gone and done it with discrete transistors. The complaint was that it was intermittent.

My first move, as with anything intermittent and containing Ni-Cads, was to clean up the battery contacts and batteries. This obviously scored a hit of some sort – the receiver servos had been twitching away without the transmitter on (and receiver aerial disconnected), and they now sat quietly.

I next had to lavish care on the transmitter. A 'scope showed the level of the urge coming out (a technical way of saying RF output) was all over the place – a loose screw securing the aerial. After tightening, the 'scope on the aerial showed that a gentler tip of the transmitter case would give a pretty row of pulse out, whereon the receiver servos behaved as they should. Another tap and the pretty row of pulses disappeared and the servos whizzed round like things possessed.

I opened up the transmitter, which was very neatly made on a printed circuit board. A brief attempt at fault-finding revealed a horrifying number of multivibrators, astables and whatever – acres of board covered with bits that could be broken down to mainly two transistors, four resistors and a couple of capacitors. Circuits? You must be joking.

A nightmare. Only one way out, the coward's way. I took the board out (which was surprisingly easy to do), up-ended it and re-soldered every joint. It took only five minutes.

I stuffed it all back in the case, and bingo, it worked perfectly, no intermittents.

A proper repair.

Picketts Lock

I have heard various opinions on the first London Amateur Radio Show. However, there is one common theme: prices of second-hand gear were termed 'a bit strong'. Could this be the place to sell your junk, rather than buy? The bring and buy went great guns with even mega-expensive stuff selling quickly. New stuff was occasionally available at a reasonable discount – £550.00 gear going at £500.00, for example. As to the crowds, comments varied from: 'I could get round easily' to 'Bit of a crush at times'. As a local amateur put it: 'It was nothing to do cartwheels about, but I'd go again'.

Wythall

I only discovered this rally last year, and thought it was good then. This year it was superb. Excellent signposting from the motorway; three large car parks, able to take 1,500 cars, full by 11 o'clock, and what bargains. There were 25W NEC full commercial specification UHF crystal-controlled transceivers, in showroom condition, still on 420MHz but able to be set up on 70cm, selling for a tenner. (Mine is now on the local repeater and works a treat.) There were also matching hand-helds at the same price.

Gear was changing hands everywhere, from boxfuls of old rubbish at a quid the lot to new stuff selling for mega-bucks, and all business was conducted in a good-humoured, friendly atmosphere of well organised chaos.

DX DIARY

News for HF operators compiled by Don Field G3XTT

Now that summer is here the HF bands will no doubt be full of portable operators, taking their radios with them to the sun. If you aren't able to join them, then this is the time to sort out the antenna farm (if that's not too grand a title for what most of us have in the back yard!) and take a break from perpetual scanning of the bands.

Although the summer season brings longer openings on the higher bands (because of the longer hours of daylight), most DX activity takes place between September and April when propagation tends to favour the Northern Hemisphere where the majority of the world's amateurs live.

Looking back at the DX season just past, there has been plenty to keep even the most ardent DXer glued to his rig. Not only the Bouvet Island operation, but Laos, a new country by way of Walvis Bay, and, more recently, operations from Bhutan (Jim Smith showed up in March as A51JS and was worked from the UK on 40 to 10m on CW, SSB and RTTY), Bangladesh (a Japanese operation signing S21U, followed by K5VT signing S20VT), and Jarvis Island (AH3C/KH5J) which may count for a new one, but otherwise counts as Palmyra.

All these, and many less rare operations, have kept the bands buzzing, and caused DXers much lost sleep, days off work with 'DX-itis' and arguments with the other half as a result of spending too much time in front of the rig.

In that context it was interesting to see the Amateur's Code reproduced recently in several publications. The fifth point is often neglected by ardent DX chasers, whether HF or VHF inclined – 'The amateur is balanced, radio is his hobby. He never allows it to interfere with any of the duties he owes to his home, his job, his school or community.' Now is the time to make amends!

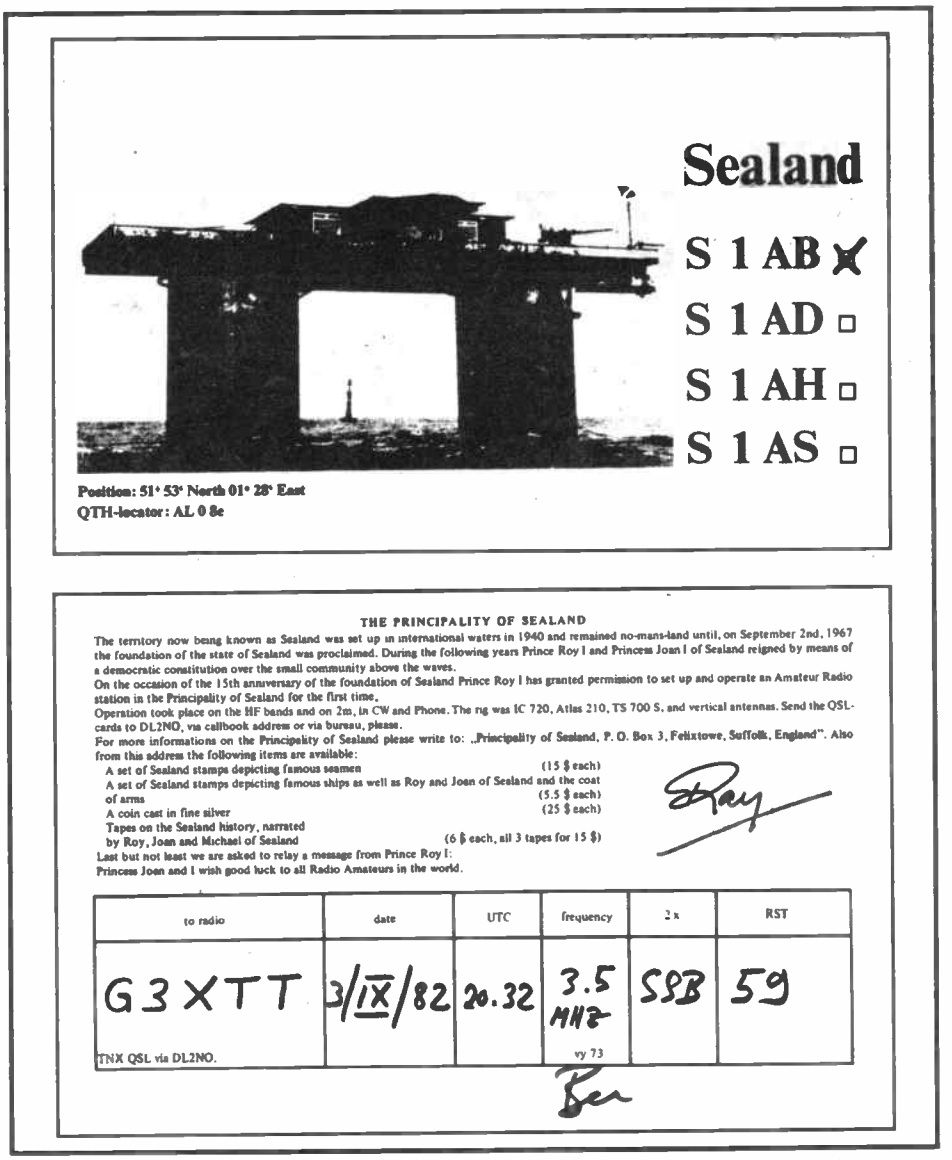
The highlight of the month

I suppose the Jarvis Island operation was the highlight during April. It started up towards the end of a spell of poor band conditions. The 'A' index had been over 50 for several days, with high levels of auroral activity, killing all propagation over the north pole on 10 and 15m.

For the first day or so of the expedition, UK stations were only able to work Jarvis Island on 20m, albeit with the band open for most of the day. Within days, however, 15m provided strong signals from the expedition, and they were also worked in the UK on 40m CW.

While all this was going on, KH8/VK2EKY was putting in daily appearances on 20m (I also managed to work him on 40); the Hungarian boys were active from Kampuchea as XU8CW and XU8DX, having failed to obtain permission to operate from Myanmar (or Burma, as most of us know it), and Ron ZL1AMO was busy as ZK2RW from Niue.

A word about some of the other operations which took place shortly before Jarvis Island came on the air. At rather short notice, DJ6SI, DJ6JC and DK2WV showed up from Abu Ail, saying that this could be the last operation with Abu Ail counting as a separate country, because jurisdiction for this tiny rock plus lighthouse was being transferred to the Yemen. I have not been able to confirm this. Anyway, they were active, with big signals into the UK on 80 to 10m, on CW, SSB and RTTY.



Remember this? The QSL card from the 1982 operation from 'Sealand', a wartime fort outside UK territorial waters. Do any readers know what became of this self-proclaimed principality, and Prince Roy and Princess Joan?

As I said, Jim Smith managed to get on the air from Bhutan and handed out several thousand contacts despite running barefoot to wire antennas, a very chilly operating room and hosts who insisted that he spend at least some of his time sightseeing (how unreasonable!). Let's hope that this operation, the first from here for many years, opens the door to further activity in the near future.

Cutting through bureaucracy

Bangladesh has also been off the air for about eight years, so it was a very pleasant surprise when JA1UT and JA3UB showed up signing S21U. They made only just over 1,000 contacts, mainly with Japan, but once again the significance of the operation was that somehow they had managed to cut through the bureaucracy and get permission to operate (the ARRL has already accepted the operation for DXCC credit).

Vince Thompson K5VT, who was in Nepal on business shortly afterwards, took advantage of the thawing of the licensing regime in Bangladesh and showed up as S20VT for an operation over the Easter period. Unfortunately Vince soon tired of the pile-ups, so many DXers failed to get a contact. However, word is that the Japanese will return, so it's just possible that Bangladesh will once again become a regular on the bands.

One that didn't come off, at least it hasn't as I write this, is Spratly. 3W3RR continued to tell all and sundry that an operation would 'definitely' take place, but at the same time said that a large amount of money needed to be raised in order to charter a helicopter. Don't hold your breath!

Tracking your score

For many amateurs, DXing is about collecting countries, islands, states etc, just as others might collect stamps or train numbers. However, it can get very tedious keeping track of what you have worked, and which ones you have confirmed by way of QSL cards. Fortunately, there is now a number of computer programs available to help with this.

This month I will confine myself to one which I received recently from Pierre HB9AMO, best known as a top-band DXer. Pierre has written a program for the IBM PC (and compatibles) which allows you to keep track of which DXCC countries you have worked and confirmed on each of the nine HF bands. The program is menu driven and will instantly show your totals on the screen, or allow you to print out a complete listing. Pierre has also written a program to calculate sunrise and sunset times for anywhere in the world.

Both programs are freely available, and I am willing to provide copies to anyone who sends me a formatted disc (any variety) plus return postage. If you become a satisfied user, then a donation to HB9AMO would not come amiss.

UK AMATEURS ON DXCC HONOR ROLL

Mixed DXCC		Phone DXCC	
G4CP	367	GW3AHN	361
G3AAE	364	G5VT	359
GW3AHN	364	G3FKM	356
G3FKM	362	GI3IVJ	351
G3FXB	362	G3UML	342
G5VT	359	G3NLY	341
GI3IVJ	356	GM3BQA	340
G2FSP	353	G3JEC	339
GM3ITN	353	G3KMA	334
G3HCT	352	G3TJW	334
G3IOR	351	G3ZBA	334
G2FYT	349	G3MCS	333
G3KMA	348	G5AFA	331
G3GIQ	342	G3SJH	327
G3UML	342	G3ZAY	326
G5RP	341	G3RCA	321
GM3BQA	341	G4DYO	320
G3HTA	339	GW3CDP	319
G3JEC	339		
GI3OQR	339	**CW DXCC**	
G3JAG	336		
G2DMR	335	G3KMA	318
G3LQP	335		
G3ALI	333		
G3MCS	333		
G3RUX	333		
G3KDB	332		
G3MXJ	330		
G3ZAY	330		
G3NSY	329		
G3VIE	325		
G3RCA	322		
G3YJI	320		
G4DYO	320		
GW4BLE	319		
G3RTE	313		

Forthcoming DX

Time to look at what the coming month has in store. DX News Sheet reports that JA9IAX was due to arrive on Marcus Island (Minami Torishima) during May for a three-month tour of duty at the weather station. He will be very active on all bands, especially on CW, and will make a point of looking for European stations. JJ1TBB will handle the QSL chores.

A large US-Soviet team (eighteen operators in all) is planning to sign UF7V from Oblast 013 from 1 to 15 July. Operation will be on 80 to 10m, CW and SSB.

A Spanish group will sign ED9IC from the Chafarinas Islands from 14 to 17 June. This counts as AF36 for Islands on the Air chasers. KL7IEI will operate from Nunivak Island (NA74 for IOTA) from 27 to 30 May. And another one for IOTA chasers; a group of W4 amateurs will operate as WA4VCC/C6 from Treasure Cay in the Bahamas (IOTA reference NA80) between 6 and 12 June.

N200, WA3TYF and SV0AA were scheduled to be in Rhodes signing /SV5 between 19 May and 3 June. QSL to their home calls.

South Atlantic

Some way off still, but WA4JQS is already sending out information about a major operation from South Georgia and South Sandwich, scheduled for 15 November until 15 December.

The plan is to land an eight-man team on each island, and to operate all bands and modes round the clock to soak up the tremendous demand (South Sandwich in particular is high on the list of Most Wanted Countries).

A large amount of equipment has already been pledged by various sponsors, so it looks as though the operation will get off the ground in a big way.

DXCC Honor Roll

The annual listing of DXCC membership (those who have updated within the past two years) appeared in the March issue of **QST**. There are far too many UK callsigns in the list to include here, so the table shows only those who have achieved Honor Roll status. The country totals shown by the callsigns include deleted countries, and it should be noted that when the list went to press in **QST** there were 321 current countries (this has now increased to 324).

It would be nice to see some other UK stations joining G3KMA in his solitary position as the only UK station on the CW Honor Roll. Sadly, at least two of the UK callsigns which appear in the Honor Roll listings are now Silent Keys, but several more recently licensed Gs are moving up the listings and should soon appear on the Honor Roll, especially following the recent spate of DXpeditions from rare countries.

At this point congratulations are in order for Mike Parker G4IUF, the latest UK amateur to receive the 5-band Worked All Zones award. In many ways, this one is even tougher than getting on the Honor Roll.

Living in the north of England, Mike finds LF band DXing easier than for those of us in the south, but on the higher bands he often sits in frustration hearing southern UK stations working DX which is inaudible in North Yorkshire.

1990 World Radiosport Championship

Amateur Radio has always been treated in the USSR and China on a par with other sports such as athletics, rowing or football. Radio amateurs compete under controlled conditions to select Masters of Sport and medallists. Now the idea has come to the West with the first US-USSR Goodwill Games which will be held in

Seattle between 20 July and 5 August.

These games will include all the usual sporting events, as well as cultural activities (for example, the Bolshoi Ballet will visit the US at this time), and there will also be a major international trade exhibition.

This all seemed too good an opportunity to miss and a committee chaired by Martti Laine OH2BH/W6 is organising an amateur radio event as part of the games. A number of identical stations will be set up in Seattle, each consisting of an Icom IC-765, an Icom IC-735, a triband beam, and wire antennas for the LF bands. Up to seventeen two-man teams from the US, the USSR and other invited countries (including the UK) will operate for ten hours using specially allocated callsigns to determine the winners.

The original aim had been to reschedule the IARU Radiosport contest to coincide, but this has not been possible. The event will take place from 2100GMT on 20 July, on 80 to 10m, both SSB and CW. The competing stations will sign /WG (World Games) after their callsigns to identify themselves.

Amateurs around the world are asked to do their bit by working as many of the competing stations as possible. Special log sheets and further information are available from WRTC, 4821 51st SW, Seattle, WA 98116, USA. I will try to get hold of a set myself to make available to DX Diary readers on request.

Of course, the reason for holding a contest along the lines I have just described is to remove as many of the variables, such as equipment and propagation, as possible and end up with a straight test of operator competence.

In practice I suspect it won't be quite like that. The Japanese competitors ought to have a head start in working Japanese stations (an easy path from W7-land), while the Americans should be very familiar with propagation from what is, after all, their home territory. Still, it should be fun!

June contests

Getting back to the more run-of-the-mill contest activity, I suppose the main contest for June is the All Asia SSB Contest which runs for the whole weekend of 16-17 June. Contest exchange is signal report plus age, with YL operators giving '00' (there's discrimination for you!).

The World-wide South American Contest (a CW contest not unlike the CQWW events) is on 9-10 June, and the RSGB Summer 1.8MHz Contest is on the evening of 23 June. The latter is always an interesting one – lots of summer static but the occasional DX such as PY or LU. Finally, the Canada Day Contest takes place on 1 July.

Leningrad Hamvention

Finally, if you are of a mind to travel, the Leningrad Hamvention takes place from 3 to 6 August, with presentations by top DXers and contestants and a chance to operate from the USSR. The Finnish Amateur Radio League has put together a tour package for Western visitors to the Hamvention, and further details are available from them at SRAL, PO Box 44, SF-00441 Helsinki, Finland.

BITS TO BUILD

AN AUDIO FREQUENCY SIGNAL GENERATOR

A quick look around many amateur radio constructors' test benches often reveals a gap in their range of test equipment. Many of them do not include a reliable audio signal generator. This may seem odd because, in theory, building an oscillator to produce audio signals is a simple matter. Amateurs may consider that radio frequency test equipment is all that is required, but we use audio frequencies in both transmitting and receiving equipment.

The truth of the matter is that a *useful* audio frequency signal generator is not easy to make. To be really useful it has to be more than an audio 'noise maker'.

A good audio frequency signal generator will produce a sine-wave output for audio test work capable of tuning all of the usable audio range and be stable at any given frequency. Ideally, it should also have an output with a fast risetime to drive a digital frequency meter, or provide syno pulses for digital equipment.

Such equipment is not cheap to buy and may be at the end of the list of required test equipment after the full range of radio frequency and dc test items has been obtained. Such a signal generator, although not difficult to build, does require careful design. Many audio oscillator circuits are not suitable as serious items of test equipment.

The JD013 generator

This article describes the JD013 audio frequency signal generator, available from Jandek in kit form. It provides most of the facilities that the average radio amateur might require on his test bench.

The signal generator provides a sine-wave output from 40Hz to 40kHz in six switched ranges. Each range overlaps to allow for component tolerance. The output amplitude is constant throughout the audio range for a given level control setting and constant load impedance.

The output impedance is 600 ohms. With the output set to 3V peak-to-peak, it reduces to about 2V peak-to-peak with a 1kohm load applied. The current consumption from a 9V power supply (or battery) should be about 12mA. The supply may be from 8V to 20V.

The generator also includes an auxiliary output with a fast risetime for digital applications. This may be connected to a digital frequency meter to give an accurate indication of the oscillator frequency.

The auxiliary output voltage is dependent upon the supply voltage. With a supply of 9V, it will be about 7V peak-to-peak. The waveform approaches a square-wave on the five lowest ranges. On the highest range, the amplitude will be reduced and the waveform distorted.

The circuit

The circuits used in the audio generator are shown in **Figs 1a** to **c**. The circuit is a Wein Bridge Oscillator using a single operational amplifier (op-amp); IC2a is the generator. In the Wein Bridge Oscillator feedback is provided through a network, which only allows zero phase-shift at one specific frequency.

If an amplifier, having sufficient gain, has positive feedback via such a network it will oscillate. In **Fig 1**, IC2a has a feedback path from pins 7 to 5 via the network in **Fig 1b**. The frequency at which the signal is sharply maximised, hence the oscillation frequency, is controlled by the values of resistance and

Figs 1a to c: *Circuit diagrams of the audio generator*

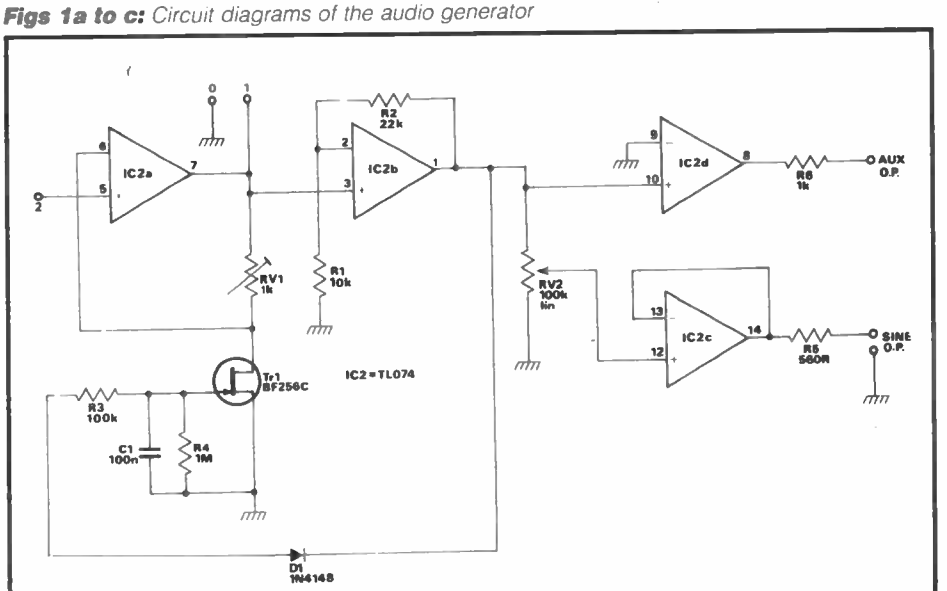


Fig 1a

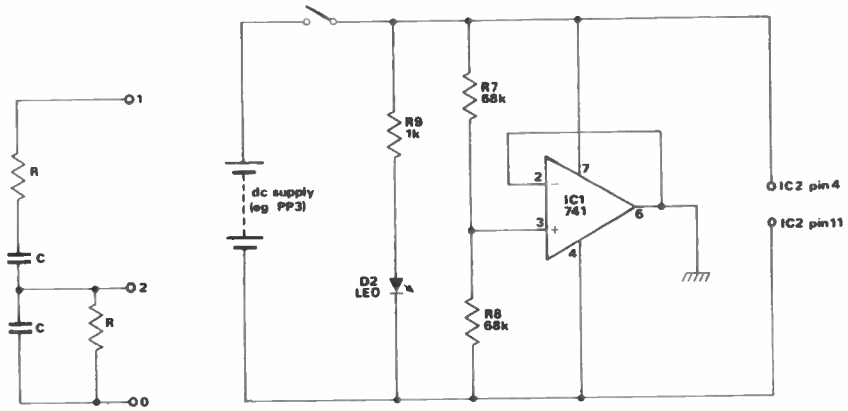


Fig 1b

Fig 1c

$$\text{frequency} = \frac{1}{2 \times Pi \times C \times R}$$

eg If C=33nF and R=3k3 then:

$$\text{frequency} = \frac{1}{2 \times Pi \times 0{\cdot}000000033 \times 3300} = 1461\text{Hz}$$

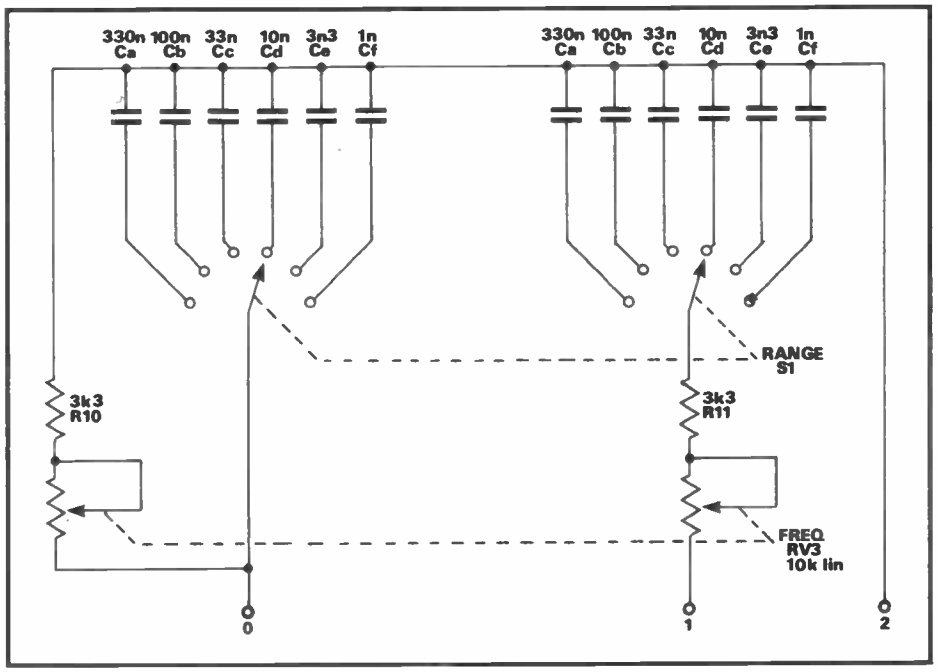


Fig 2: *Frequency selection and control circuit*

capacitance in **Fig 1b**. The frequency is equal to ½ Pi CR; an example is given in **Fig 1**.

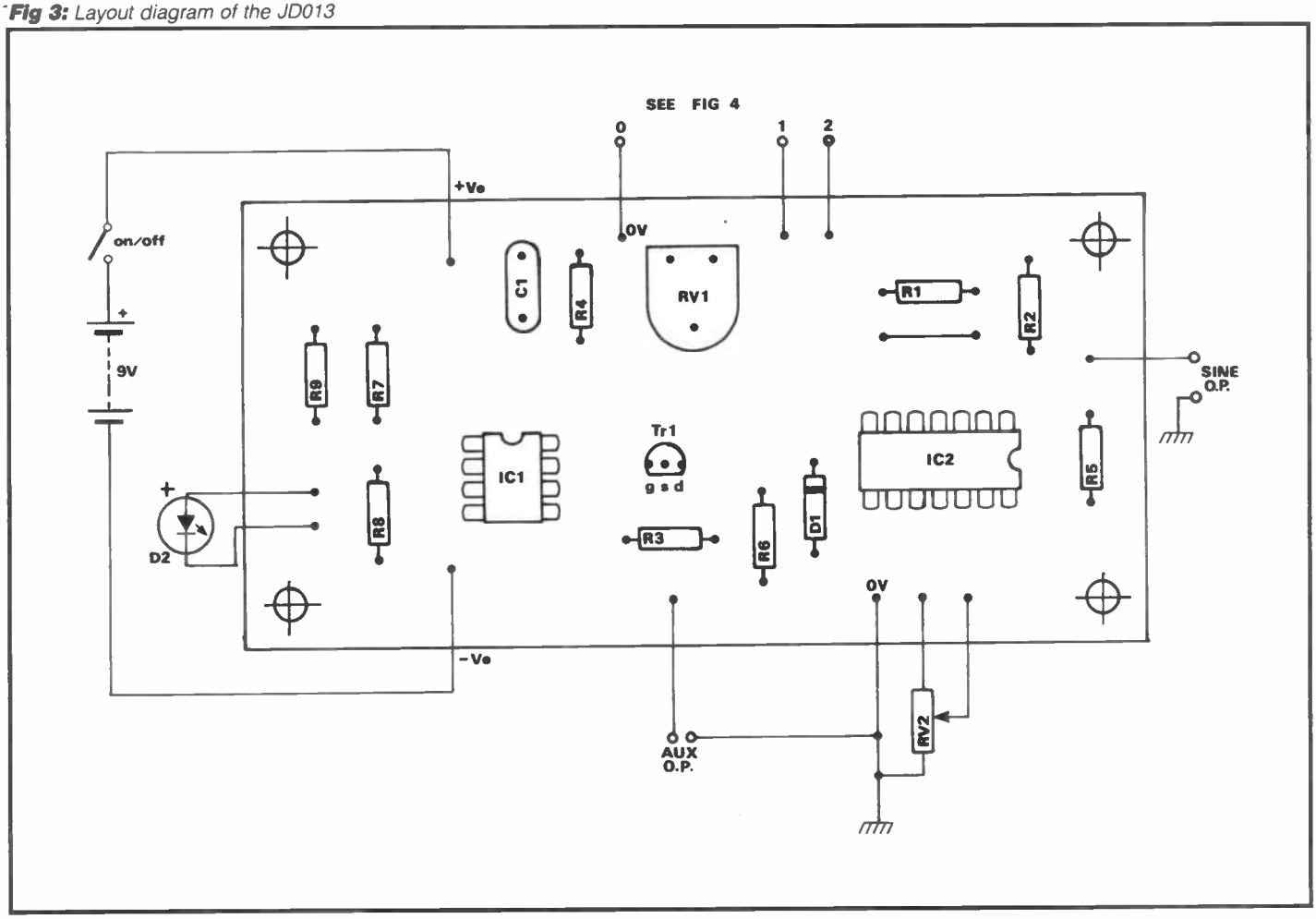
To produce a sine-wave, the gain of IC2a must be maintained at exactly three. This is achieved via a simple gain control feedback loop around the FET Q1. The output of IC2b is rectified by D1, and the resulting dc voltage is used to bias Q1. Q1 is then used as a variable resistance in the gain controlling feedback loop of IC2a. A preset control gives fine adjustment of the gain, which allows a sine-wave to be generated.

IC2b acts as a buffer and provides the voltage for the gain control loop. Two buffered outputs are taken from IC2b; one has a potentiometer to provide a level control to give the sine output via another buffer amplifier, IC2c. A direct output from IC2b drives another buffer, IC2d, for the auxiliary output. This hard-driven buffer provides the high risetime output.

The op-amps IC2a, b and c require a dual-rail power supply. Naturally it is easier and cheaper to have a single rail supply or a single battery. The dual-rail supply is provided by the single op-amp circuit shown in **Fig 1c**. A PP3 9V battery is an adequate supply source in this circuit.

The frequency selection and control circuit is shown in **Fig 2**. If you compare this diagram with **Fig 1b**, you will notice that the network consists of a series resistance and capacitance circuit and a parallel resistance and capacitance circuit. The frequency is controlled by the values of R and C.

Fig 3: *Layout diagram of the JD013*



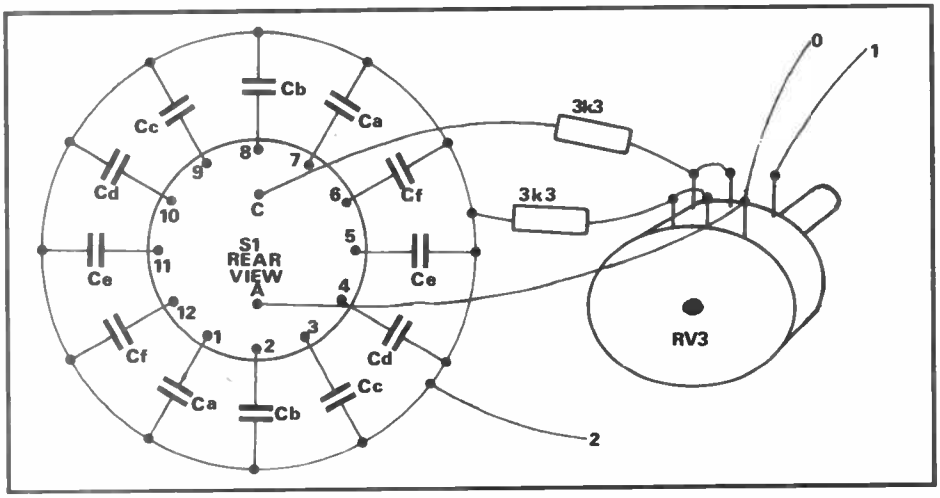


Fig 4: *Wiring diagram of S1 and RV3*

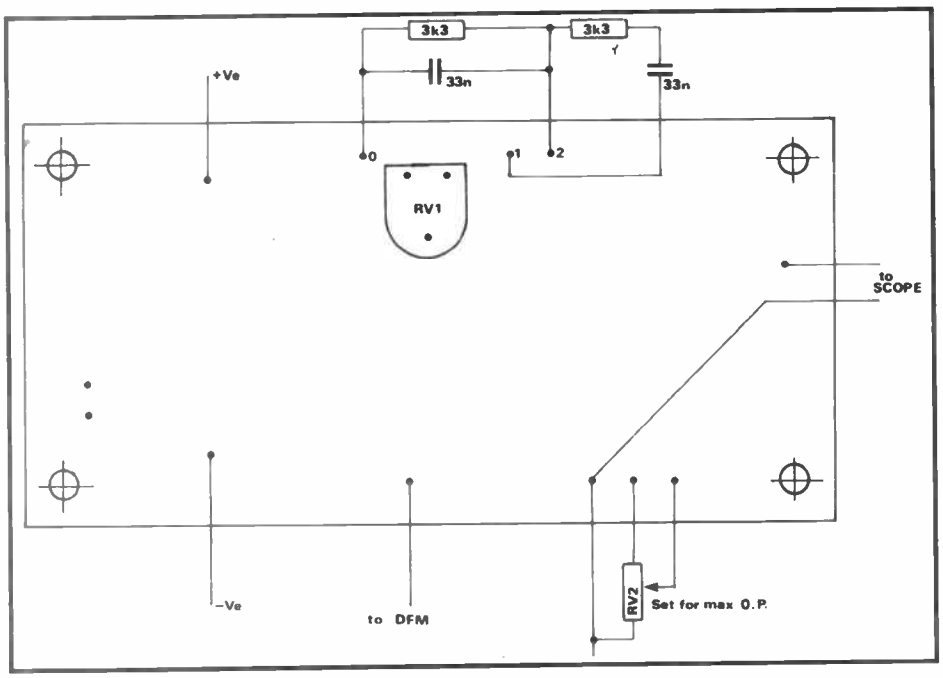
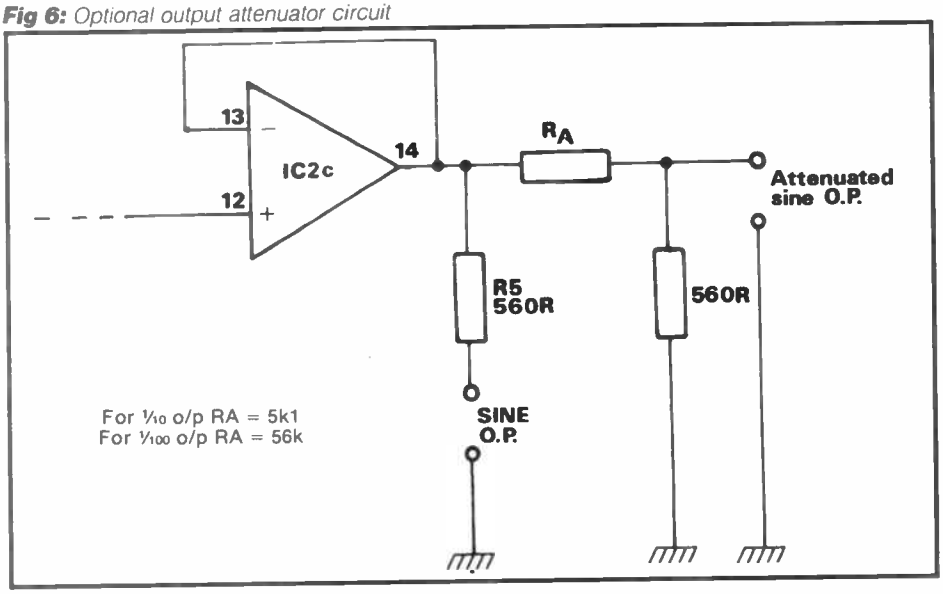


Fig 5: *JD013 board testing layout*

Fig 6: *Optional output attenuator circuit*



In this arrangement the capacitance is switched to provide the ranges, and the resistance is varied with a pair of ganged linear potentiometers to allow coverage of the switched ranges. This requires the use of a two-pole, six-way switch (S1) and a ganged potentiometer (RV3).

The wiring of these components is probably the most difficult part of building this project. As suggested in the parts list, good-quality capacitors must be used in the circuit, because the stability of the oscillator depends upon the quality of these components.

Building the generator

The layout of the JD013 PCB is shown in **Fig 3**. The wiring for S1 and RV3 is shown in **Fig 4**. The PCB is simple to build, requiring only accurate component placement for it to work first time. Do not forget the link wire! Some components require correct polarity or pin placement, and these are IC1, IC2, Q1, D1 and D2.

Building a PCB is largely a matter of individual technique, but to avoid missing out or misplacing components, I follow a common convention: link wires (easy to forget), terminals or pins, resistors, capacitors, diodes, transistors and integrated circuits, then check for vacant holes or remaining components.

At this stage, check the board to see if it works before wiring S1 and RV3. This is done by adding one set of components for the Wein Bridge Network, as shown in **Fig 5**. The values shown are for capacitors Cc with R10 and R1 added.

During the test set RV1 at maximum (anti-clockwise). The test shows the use of a digital frequency meter and an oscilloscope. If neither of these is available, the output can be monitored by connecting a pair of headphones or a crystal earpiece to the 'scope' output. If this method is used, RV2 will need to be set low.

Apply 9V to the power connection terminals. There will be no output at this stage. Slowly rotate RV1 clockwise so that, eventually, a sine-wave is observed on the oscilloscope. As RV1 is advanced the amplitude will increase to the point where the top and bottom of the waveform become flattened. Slowly stop rotating RV1 to give a sine-wave output of about 3V peak-to-peak.

The frequency of the output can be measured using a digital frequency meter at the auxiliary output, as shown, or it can be measured on the oscilloscope. It should be in the order of 1460Hz, depending upon the tolerance of the components. RV1 should now be left in its present position.

If the output is only being monitored aurally, a more subjective set-up of the board is possible. RV1 should be rotated until oscillation is heard. On increasing RV1 to the point where flat topping occurs, the previously clean-sounding

sine-wave will become distinctly harsh. The final placement of RV1 should be mid-way between the point at which oscillation occurs and the onset of distortion.

Do not be put off by the lack of these items of test equipment. The aural method of setting up the board works well. Indeed, musical-oriented constructors may be able to calibrate the output against a known musical pitch.

After you have completed the board, the components wired around pins 0, 1 and 2 for these tests, should be removed. The range switch and frequency control potentiometers may now be wired with care (see **Fig 4**).

The number and figure markings on the wafer switch refer to those on the switches supplied with the Jandek kit. A circular bus bar made from stiff-tinned copper wire provides a connection point for the ends of the capacitors which connect to point two on the PCB. Follow this diagram with care, checking the values and positions of the capacitors before and after they are mounted.

The output from the generator may be high for some applications, and an attenuator is a useful addition to the circuit when testing high gain audio amplifiers. The circuit for such an attenuator is shown in **Fig 6**. Values are given for RA for attenuation of ten times or 100 times. Note that it is possible for constructors to add switching in and out for the attenuator.

Calibrating the generator

The calibration of the generator depends upon the test equipment available to the constructor. The simplest method is to connect the output to a digital frequency meter which reads down into the audio ranges.

A simple and cheap audio oscilloscope could be used to calibrate the frequency. It may not be of much use for higher frequency work but it will certainly calibrate this unit.

A more subjective method is to calibrate the output aurally against the notes of a piano (as far as possible) and look up the frequency on a pitch/frequency chart, often found in music books.

The housing for the generator is supplied by Minffordd Engineering and is an aluminium box, type A48, measuring 6in × 4in × 2in (WHD). The controls take up a lot of space, so I used the bottom of the box as the front panel. The layout is shown in **Fig 7**. The PCB was also mounted on the inside of this front panel. **Fig 7** shows that the back of the case (originally the lid) can be removed, and the PCB with its controls can be removed via the front panel.

The frequency control knob should have a large diameter for ease of tuning. A scale can be added to this control, although space is limited for a six-line scale. In practice, I use the digital frequency meter via the auxiliary output to measure the output frequency. Other constructors might choose to add a logging scale and have a calibration graph.

Conclusion

The Jandek audio frequency signal generator is easy to build, and the quality of the board and components is high. The constructor has to provide the knobs, sockets and on/off switch, but the rest of the components are supplied with the kit.

The kit costs £9.75 plus £1.00 p&p and is available from: Jandek, 6 Fellows Avenue, Kingswinford, West Midlands DY6 9ET, tel: (0384) 288900.

The aluminium box, type A48, costs £1.80 plus £1.00 p&p and is available from: Minffordd Engineering, Sun Street, Ffestiniog, Gwynedd LL41 4NE, tel: (0766 76) 2572.

Parts List

Resistors

R1	10k	R2	22k	R3	100k	R4	1M0	R5	560R
R6	1k0	R7	68k	R8	68k	R9	1k0	R10	3k3

RV1 1k0 preset
RV2 100k 1in pot
RV3 10k dual 1in pot

Capacitors

C1 100n polyester (marked with green dot)
Ca (2 off) 330n polyester
Cb (2 off) 100n polyester
Cc (2 off) 33n polyester
Cd (2 off) 10n polyester
Ce (2 off) 3n3 polystyrene
Cf (2 off) 1n0 polystyrene

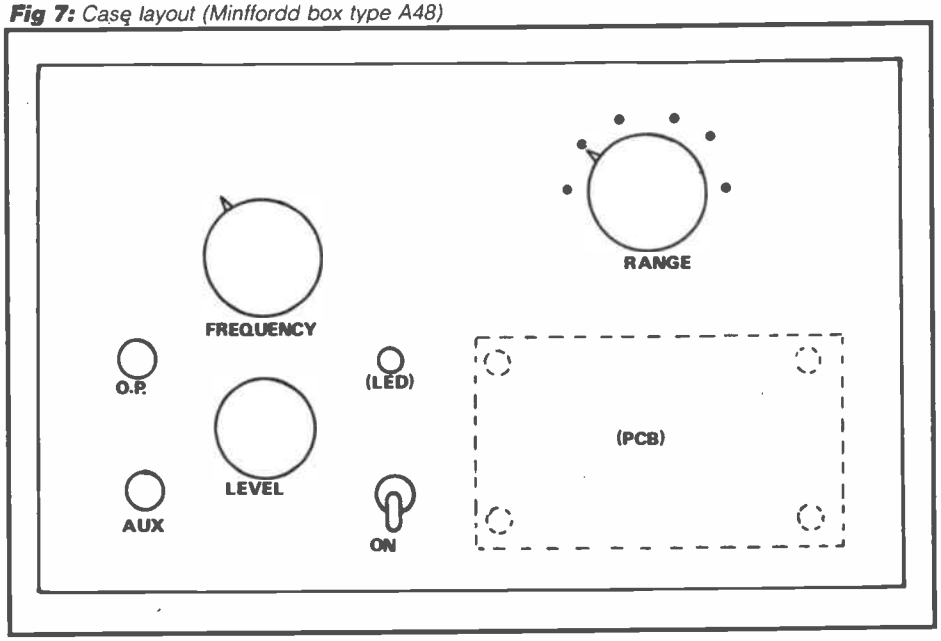
Semiconductors

Q1 BF256C D1 1N4148 D2 LED
IC1 741 operational amplifier
IC2 TL074 quad operational amplifier (or equivalent)

Miscellaneous

8-pin DIL socket
5-pole 6-way switch
14-pin DIL socket
12×1mm terminal pins

Fig 7: *Case layout (Minffordd box type A48)*



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Simple design for operating convenience.

Even with its tremendous versatility and a wide variety of functions, the IC-2SE is easy to use. All functions are performed by a total of just six switches and three controls. The IC2SE includes both simple and multi-function modes. The result is two transceivers in one: both an easy-operation and multi-function transceiver. Simple mode ensures totally error-free operations. Multi-function mode allows you a variety of function settings depending on your operating requirements.

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- Function display that clearly shows all information required for operations.
- Splash resistant design and durable aluminum die-cast rear panel for dependable outdoor operations.

Options

• **BA-11, Bottom Cap.** Protective cap for terminals on the base of the IC-2SE

• **Battery packs and case.**

BP-81	7.2V, 110mAh
BP-82	7.2V, 300mAh
BP-83	7.2V, 600mAh
BP-84	7.2V, 1000mAh
BP-85	12V, 340mAh
BP-86	Case for six R6 (AA) size batteries

• **BC-72E, AC Battery Charger.** Desk top charger for the BP-81 - BP-85.

• **CP-12, Cigarette lighter cable with noise filter.** Allows you to use the IC-2SE through a 12V cigarette lighter socket. Also charges the BP-81 - BP-85.

• **FA-140SB, 144MHz flexible antenna.** Flexible antenna for 144MHz band operation. Some type supplied with the IC-2SE.

• **HM-46, Speaker/Microphone.** Combination speaker and microphone equipped with an earphone jack. Clips to your shirt or lapel.

• **HS-51, Headset.** Headset with VOX function that allows you hands-free operation.

• **Carrying Cases.**

Carrying Case	Battery Packs, Battery Case
LC-53	BP-81
LC-55	BP-81, BP-83 or BP-86
LC-56	BP-84 or BP-85

• **MB-30, Mounting Bracket.** Mounts the IC-2SE in a vehicle or on a wall.

• **OPC-235, Mini DC Power Cable.** For use with a 13.8 V DC power supply

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The IC-2SE has 48 fully-programmable memary channels and ane call channel. Each memory and call channel stores an operating frequency and other information required far repeater aperations.

Convenient Repeater Functions.
The IC-2SE is equipped with programmable affset frequencies far accessing repeaters. All memory channels and a call channel store repeater information for your convenience. The IC-2SE includes a newly designed 1750 Hz tone call transmit function. A 1750 Hz tone call transmits when the PTT switch is pushed twice quickly.

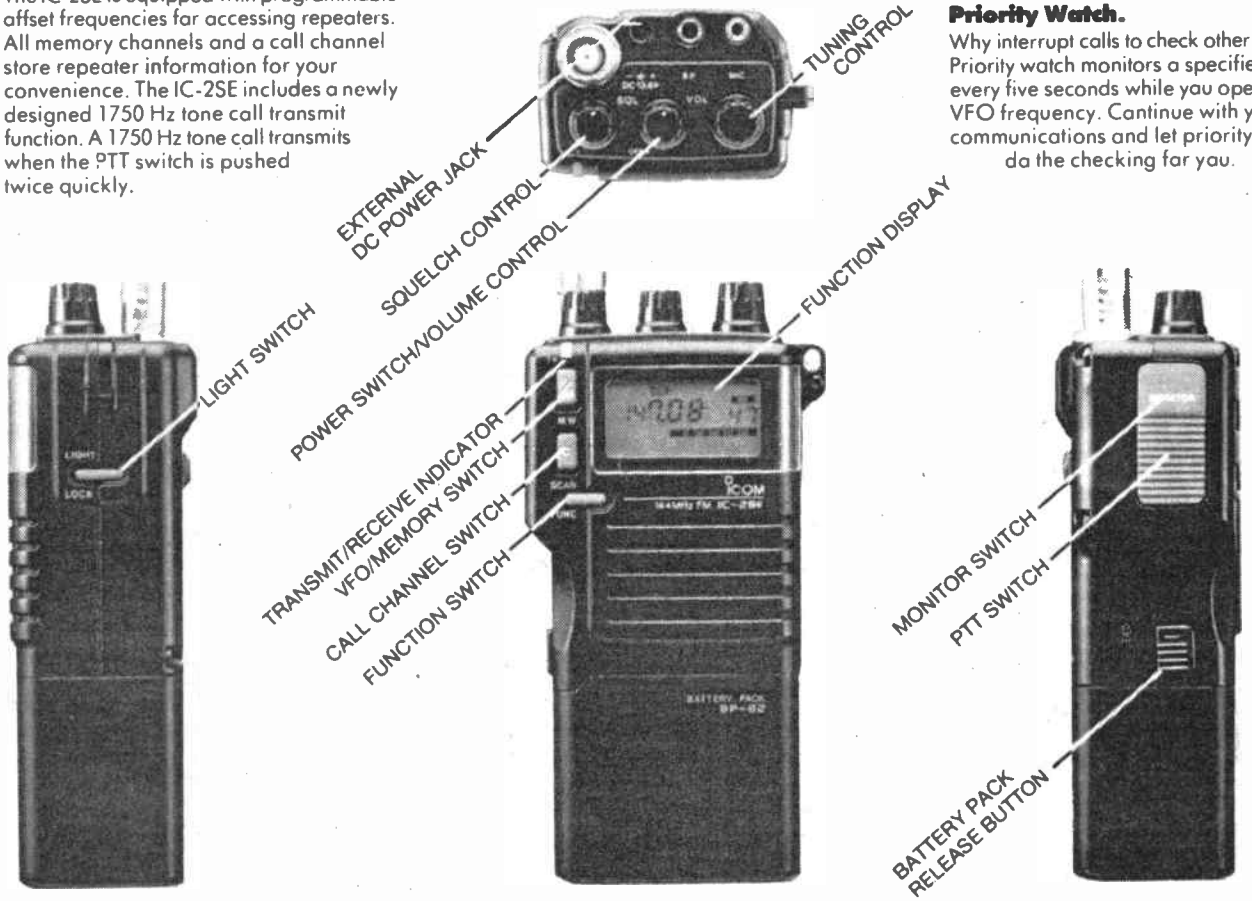
Power Saver for longer operating time.
The pawer saver ensures lawer current flow during standby canditions. Operating times are much longer than with older, more conventional transceivers.

Built-in Clock with timer functions.
The IC-2SE is equipped with an advanced 24-hour system clock with timer function. The transceiver autamatically turns an when real time matches a pre-programmed time. This is perfect for scheduling QSO's. Auto pawer-aff timers and other settings can be made in clack mode.

Convenient Scan Functions.
The IC-2SE is equipped with VFO and memory scan.
- **VFO Scan.** VFO Scan repeatedly scans all VFO frequencies. In addition, unnecessary frequencies can be skipped.
- **Memory Scan.** Memory scan repeatedly scans memory channels.

Auto Power Off Timer Function.
If you ever forget to turn the IC-2SE off, don't worry. It will turn itself off. Power-off time can be selected or deactivated using multi-function mode. Preserve battery pack power for the times when you need it most.

Priority Watch.
Why interrupt calls to check other statians? Priority watch monitors a specified station every five seconds while yau operate on a VFO frequency. Cantinue with yaur communications and let priority watch da the checking far yau.



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A SIMPLE NI-CAD CHARGER

by Bernard Nock G4BXD

Nowadays, Ni-Cads can be installed in all types of equipment, and are much cheaper to use than zinc batteries. The purpose of this project is to construct a simple and cheap Ni-Cad charger to charge a 10V battery pack for an Icom hand-held.

Power supply

Using a battery eliminator and a few readily available components, a constant current power supply can be constructed. The circuit diagram of the original power supply is shown in **Fig 1** and consists of a transformer to step the mains voltage down to the required output.

The secondary winding has several 'taps' which allow for the switching between different voltages, usually via a slide-switch. From the taps the low ac voltage goes into a rectifier circuit containing four diodes, called a bridge configuration, where it is converted to low dc. A capacitor smooths the raw dc and the voltage is fed down the lead to the multi-way plug.

All of these components are used in the conversion with the exception of the switch. The additional components are tagged on to the end of this circuit to produce the circuit shown in **Fig 2**. The diodes D5 and D6, and R2 hold the base voltage steady whilst R1 is adjusted to regulate the required current.

Note that it is the difference between the base and emitter voltage that limits the current through TR1, a BC461 (or similar) PNP transistor, having a gain of 100 or more. The value of R1 is given in the Table, or by dividing 650 by the current in milliamps to give the resistance in ohms.

Opening the case

The first task is to open the case of the battery eliminator using a Stanley knife to cut around the edges of the two halves of the moulded case. Now sketch the layout of the battery eliminator, so that you have a record of where everything is (see **Fig 3**).

Inside the eliminator

The usual set-up is for the primary of the transformer to be soldered to the live and neutral pins on the moulded box. The earth pin is a dummy and not connected.

There is usually a small PCB which contains the diodes, capacitor and switch; the switch may have a length

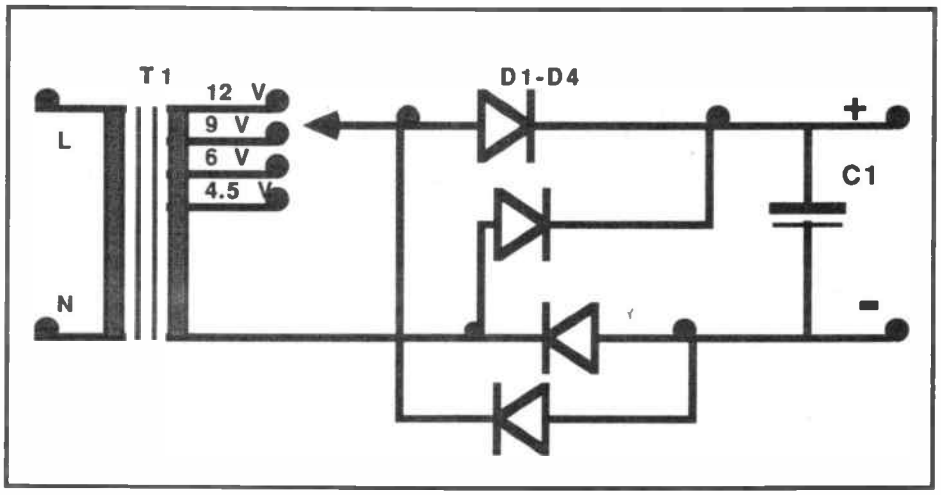


Fig 1

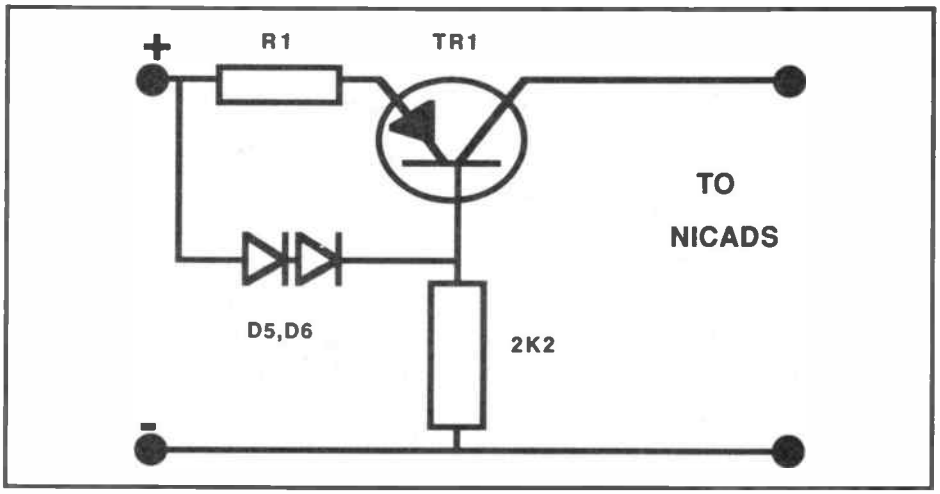
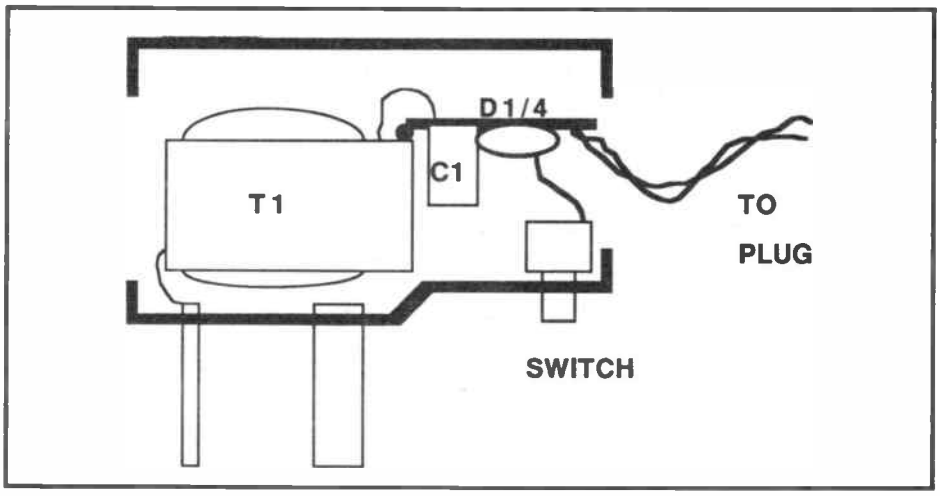


Fig 2 (above); Fig 3 (below)



of ribbon cable joining it to the PCB.

Onsolder and remove the switch and place a wire link between the moving contact point and the highest tap point on the board (for charging in the prototype), but if you are charging only low voltage cells, then connect the link to a lower voltage tap. The output lead can be removed for the time being.

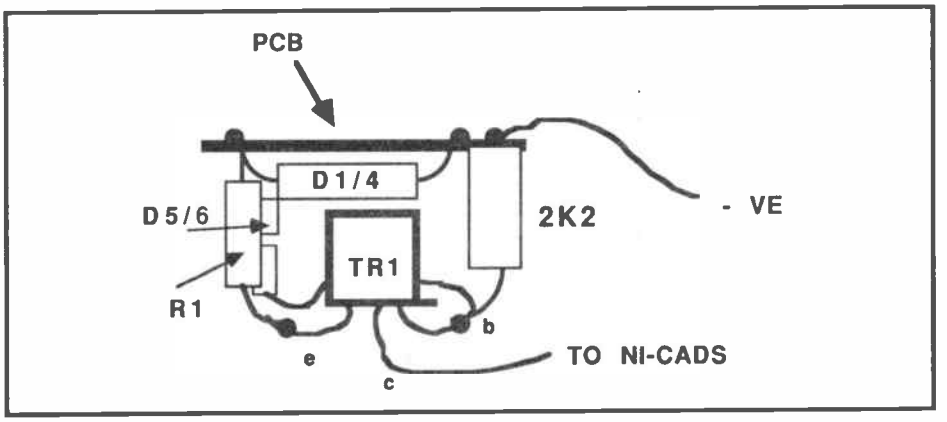
Place a ½W resistor in the 2k2 position and insert one end into the hole in the PCB for the negative lead. This will provide an anchor point from which to hang the other components (see **Fig 4**).

Solder one end of the diode pair to the legs of the bridge diodes as they go through the board to save having to make more holes in the PCB. The limiting resistor can also have one lead soldered to the leads of the diodes.

Hang the power transistor from the free ends of the components. The transistor does not need a heatsink, unless you intend to run the current at the highest possible level.

If a heavy current is used, drill extra ventilation holes into the top of the case before reassembly.

The new lead is now ready to be fitted, so connect the negative wire to a suitable point on the PCB, and the positive lead to the free collector lead of the transistor. The lead can be either terminated in the old multi-way plug set or fitted with the right plug to suit the equipment it was built for. Finally, reassemble the case with Superglue.



Conversion Table

Current (Ma)	10	20	30	40	50	60	70	80
R1 (ohms)	69	33	22	18	14	12	10	9

As there is no earth connection, do not use the charger on equipment connected to other items. Remove the batteries or disconnect other equipment before charging.

THE EVOLUTION OF THE RADIO RECEIVER

by Ian Poole G3YWX

Today's radio sets are the culmination of work carried out for over a century. They are highly sophisticated and very efficient. They are also a far cry from the earliest wireless reception equipment of the late 19th century.

The development of today's radios represents countless years of work by many men. Some like Marconi, Hertz, Lodge and Armstrong are remembered in the history books, but most of them are unknown.

The evolution of the radio receiver is fascinating. It shows how much innovation, thought and sheer hard work have been carried out by its pioneers. It also explains why radios are like they are today.

First receivers

The first experiments with radio were performed by Hertz. He used a spark gap and an induction coil to produce a signal (see **Fig 1**). Then to detect the signal, he used a second induction coil with a much smaller spark gap. He also discovered that generating a spark in the first circuit would produce a small spark in the second one. As we would expect today the range of this signal was very limited. In fact, it was only a matter of metres.

The next major development was the coherer (see **Fig 2**). This instrument was a crude detector but, despite its insensitivity when compared with today's detectors, it was far more sensitive than anything which had previously been available, with the result that it soon gained universal acceptance.

The coherer consisted of a closed glass tube with an electrode at either end. Normally the filings presented a high resistance between the electrodes. However, when there was a discharge, as in a spark, the filings would 'cohere', causing the resistance between the electrodes to fall. This could then be used to actuate a bell.

Unfortunately the only way to 'decohere' the filings and reset the coherer was to make them vibrate. This problem was easily solved by using the sounder or bell actuator to tap the coherer tube when it sounded. This made it possible to read Morse signals relatively quickly.

Although the coherer was the best detector available at the time, its sensitivity was still the major limiting factor in detecting radio signals. Its operation was not well understood, and this hindered any new developments from taking place.

Guglielmo Marconi

It took Marconi to improve matters. He modified the basic coherer design by changing its shape, size and the constituents of the metal filings. In fact, it was Marconi who discovered that platinum helped improve its performance.

A further but elementary improvement was that of tuning. By tuning the output of a spark gap transmitter, Marconi found that energy could be concentrated into a small band of wavelengths, rather than being spread over the entire spectrum. Similarly, receivers could be made more efficient. Marconi registered the patent for this idea in 1900, which was only just in time because other people were working on the same idea.

The valve

It was soon realised that the detector was the weakest link in the receiving system and that if major improvements were to be made to radio, then detectors would have to be improved first.

Apart from Marconi improving the coherer, many people were working to solve the detector problem in a variety of different ways. One of the first new ideas was the rectifying valve, discovered by Dr JA Fleming, of University College in London.

The original idea could be traced back to Edison in America. Whilst investigating the problems of filament failures in light bulbs, Edison performed a number of experiments.

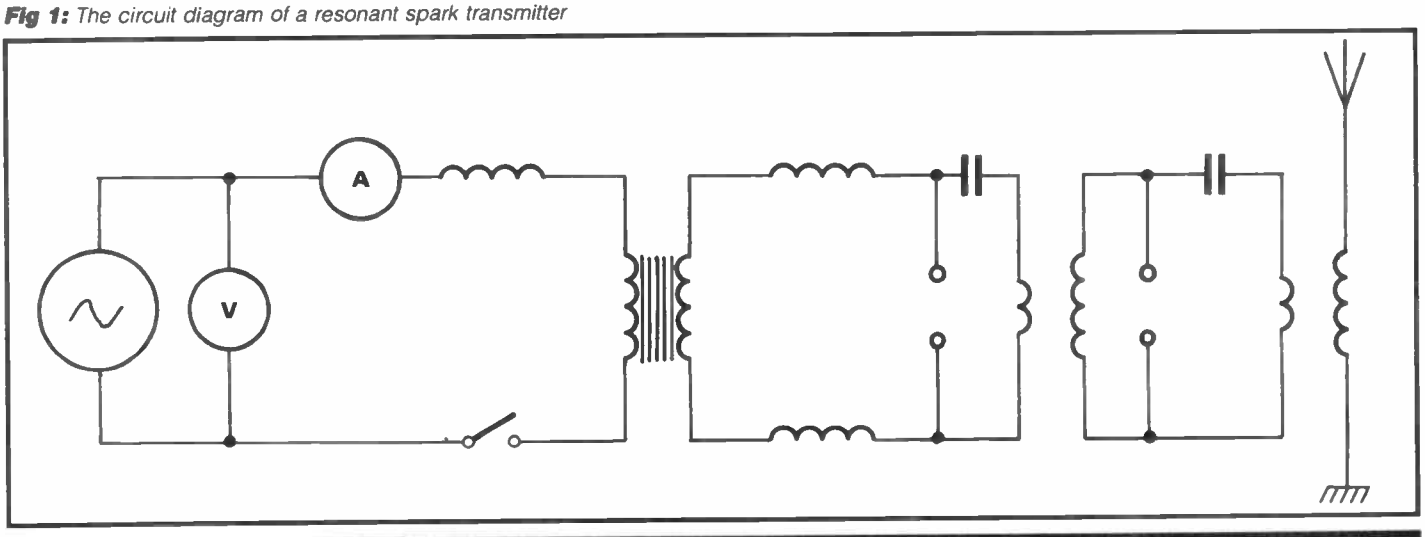
In one experiment he probed inside a bulb with a wire. He noticed that current would flow between the filament and the probe if the negative end of the battery was connected to the filament and the positive to the probe. He also noticed that if he connected it the other way round, no current would flow. Surprisingly, although Edison found the phenomenon interesting and demonstrated it to other people, including Fleming, he did not use it.

It was not until 1904 when Fleming, acting as a consultant to Marconi, had, as he put it, 'A sudden and very happy thought'. Could the Edison Effect detect radio waves? To this end, he instructed his laboratory assistant to set up an experiment. To his delight the valve worked and he patented the idea. Although Fleming's valve was a major step forwards, its success did not last long.

Other detectors

A couple of years later the crystal detector arrived on the scene. By today's standards, crystal detectors gave inconsistent results and were often

Fig 1: *The circuit diagram of a resonant spark transmitter*



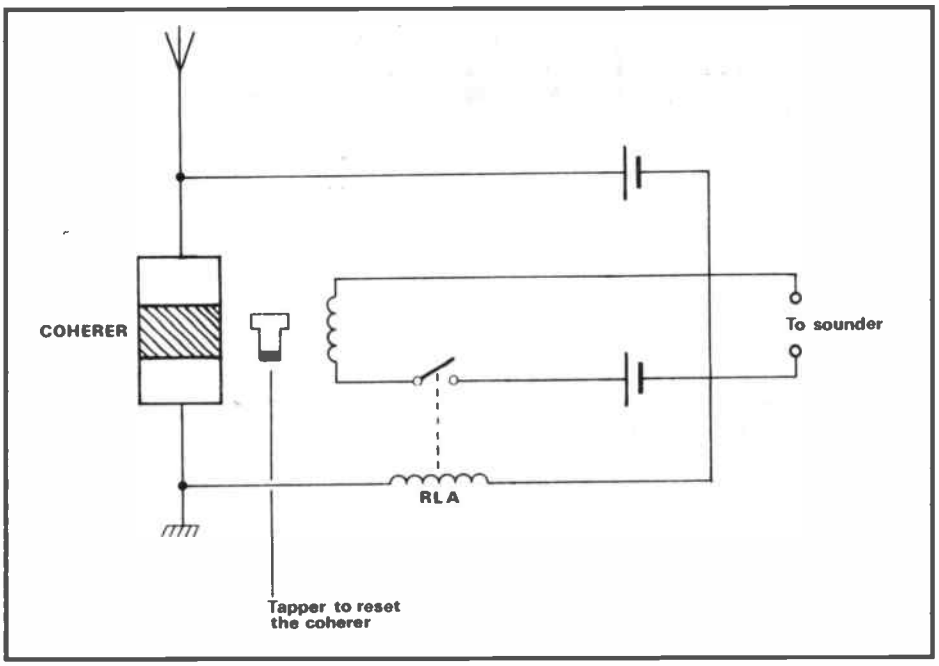


Fig 2: *Circuit diagram of an early untuned coherer receiver*

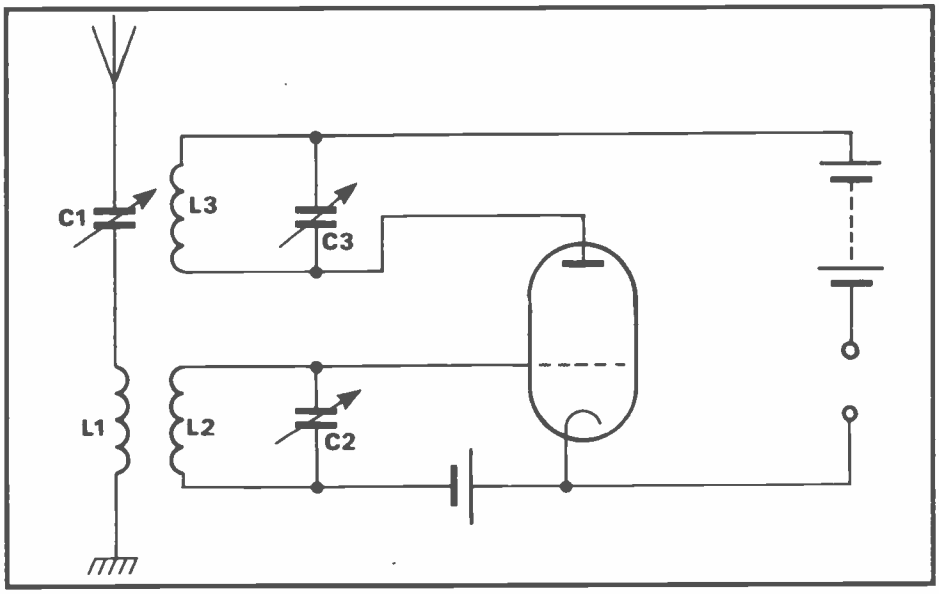


Fig 3: *Round's autodyne circuit*

inefficient, but they had one major advantage – cost. They consisted of a crystal of galena and a thin, springy piece of wire. The point of contact between the galena and the wire gave only a very elementary point contact diode.

In order to improve these diodes, many people tried different substances. Not surprisingly, silicon proved to be one of the best.

The triode

Another idea which made a major contribution to the early radio scene was the triode valve. This discovery was made in the USA by Lee de Forest. He realised that if he were to gain a foothold in the market he would need to develop an efficient detector, one which was not covered by existing patents. His work produced the triode, which was essentially a development of Fleming's diode.

Despite this fact the courts ruled that the triode was not an infringement of Fleming's earlier patent, so de Forest was free to use his idea. This ruling infuriated Fleming and he remained bitter about it for years afterwards.

Surprisingly, little was understood about the workings of the triode valve. For the first four years it was used only as a detector in a leaky grid-style configuration. No one thought of using it as an amplifier until 1910.

Once the triode valve was used as an amplifier, it was soon discovered that it would oscillate. This was definitely a mixed blessing. Previously, high frequency oscillators had been very difficult to make, as they had generally relied on electromechanical ideas. Now it was possible to make a relatively compact, all electronic oscillator.

On the other hand, the problem was stopping the valves oscillating when they were needed as amplifiers. Their very high interelectrode capacitances and the absence of refinements, such as screen grids, made these amplifier valves very difficult to tune. Even so, people managed it and they enabled major leaps to be made in radio performance.

Tuned radio frequency

The triode made a great impact on receiver design. Before triode amplifiers were available, most receivers were 'crystal' sets using either crystal or electrolytic detectors. This meant that the only way to improve reception was to enhance the aerial system. This was very costly and limited the sites where receiving stations could be built.

Quantum leap

The amplifying valve was a quantum leap in receiver technology, and changed the whole field of radio communication.

Initially valves were used only for audio amplification because they were prone to oscillate at frequencies above a few kilohertz, and they also lacked gain.

It was not long before a better understanding of the basic principles of radio communication led to further improvements. In fact, the unwanted positive feedback was used to increase the gain of a circuit.

This idea of a regenerative detector stage was discovered in 1913 by several people, all of whom claimed it as their own. Lee de Forest was one, another was a brilliant young college student named Edwin Armstrong and, in Europe, Langmuir and Meissner also came upon the idea. It is still unclear as to who was first, but Edwin Armstrong is generally credited with the discovery.

These new regenerative receivers proved very successful. By adjusting the amount of feedback the circuit could be set to the point where it was on the verge of oscillating. This greatly increased both the gain and selectivity over anything else which could be achieved.

Need for better receivers

Whilst these developments were taking place the political scene in Europe was rapidly deteriorating. This was to speed up the development of radio technology more quickly than anything else.

With the First World War being fought in Europe, military leaders soon realised the importance of radio communications. Not only could information be

transmitted rapidly and easily, but the enemy's transmissions could be intercepted as well.

Despite the improvements made by regenerative TRF (Tuned Radio Frequency) receivers, the main problems with existing techniques were still associated with a lack of sensitivity and selectivity. So it was that a number of people started working on new ideas to overcome these shortcomings.

One of the first results was a new form of direct conversion receiver. Although the basic principle of this receiver had been established some years previously it had not been widely used, mainly because of its inefficient use of valves. The mixer and oscillator did not contribute to the gain and since valves were expensive, this was not acceptable.

The problem was overcome by a British Army Captain, HJ Round. He produced the autodyne receiver, which used one valve to function both as an oscillator and mixer (see **Fig 3**). Even so, it was not ideal because it proved difficult to make the valve operate efficiently at high and low frequencies. In spite of this, it proved to be a useful stepping-stone to further development.

The superhet

The next major stage in receiver development was provided by a French engineer, Lucien Levy. While investigating the problem of selectivity, he hit upon the idea of converting signals to a lower frequency where filter Qs would be higher. As an added bonus, he found that higher levels of gain could also be achieved. However, he retained the idea of a variable filter at the IF stage, so this was not the superhet as we know it today.

The person who is honoured with the development of the superhet is Edwin Armstrong. His original design contained an impressive total of eight valves (see **Fig 4**). With a fixed IF stage, this gave sensitivity and selectivity which had not been possible before.

Unfortunately, Armstrong's discovery came as the war ended and the superhet, although revolutionary, was not used very much because of its cost.

Commercial use

After the war the commercial uses of radio were slowly exploited. Broadcasting started to increase and people began to build or buy their own radios. Domestic receivers were either crystal sets or valve TRF receivers.

TRF receivers were adequate for broadcasting, as well as for many amateur uses, because valve performance had improved with better production techniques. However, the main reason for their improved performance was the inclusion of screen and suppressor grids, which had a higher gain and were less likely to oscillate.

The rapid rise in popularity of radio and the increasing number of stations brought back all the old problems of selectivity. Now the superhet was able to prove its worth, and by the mid-1930s it was used in most new sets.

Many new refinements were introduced. Originally the sets were very large and cumbersome. Domestic users wanted smaller radios which were easier to use. Ganged tuning capacitors were introduced to enable the local oscillator and RF stages to be tuned by a single control. Many other refinements were added, with the result that radios became cheaper and easier to use.

Another war

The basic principle of the superhet was now well established and almost every receiver used it. However, further refinements and improvements were still to come: improved sensitivity, better image

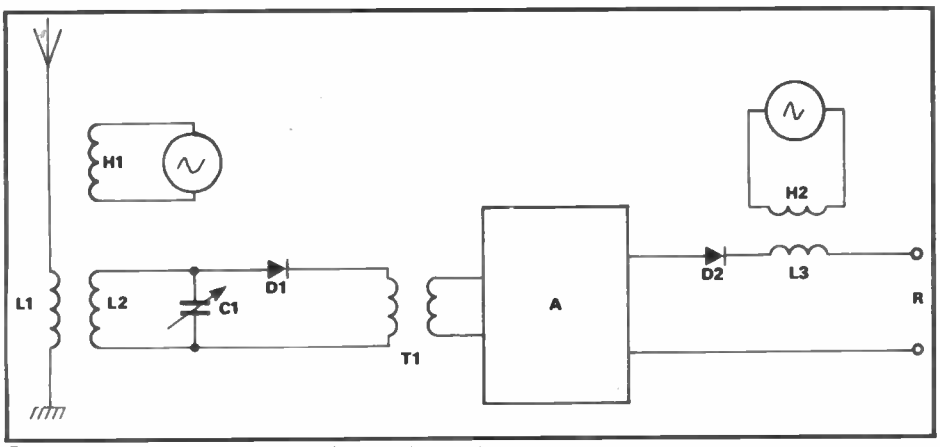
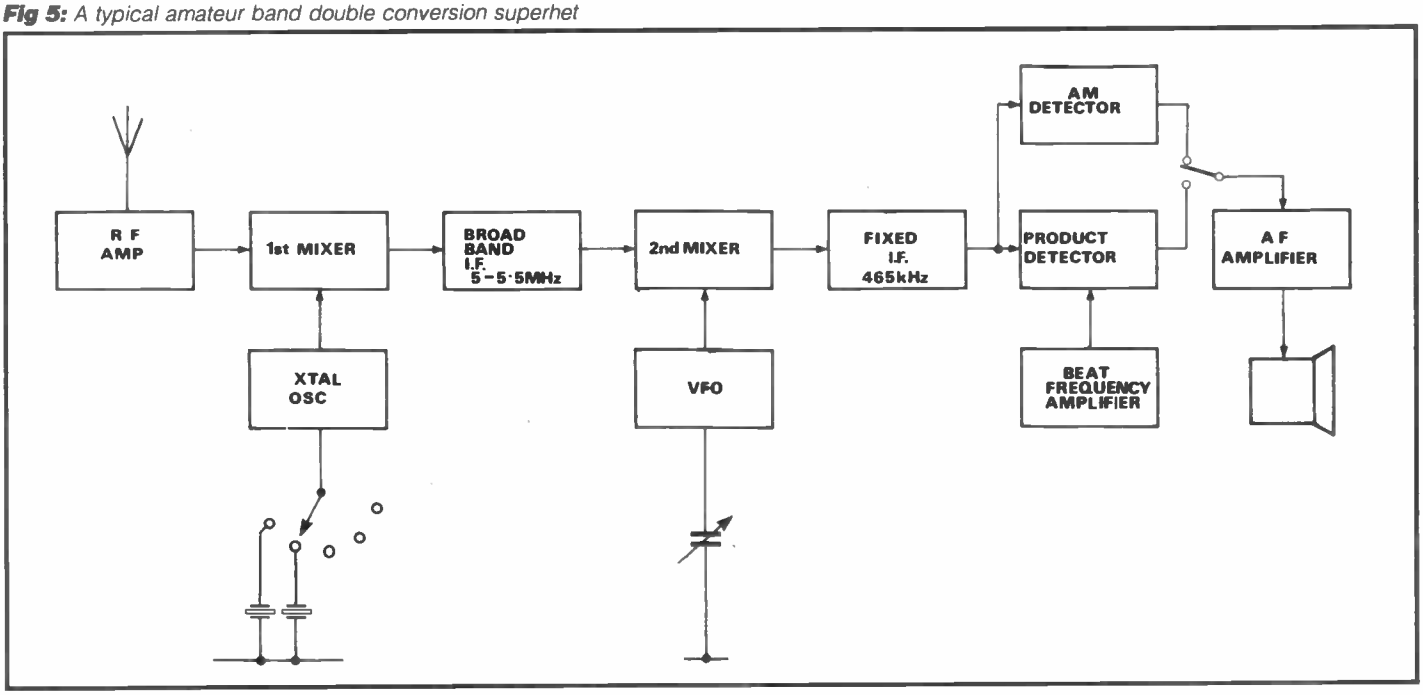


Fig 4: *Circuit showing Armstrong's superheterodyne patent*

Fig 5: *A typical amateur band double conversion superhet*



performance, better selectivity and sensitivity. To enable further development, some influencing factor was required.

When the Second World War broke out the necessity for good communications was more important than ever before.

To meet these needs many famous sets were designed. The 19 set for tanks, the R1155 for aircraft and the AR88 are but three which were used during the war. Of these, the AR88 represented the pinnacle of receiver design for the time. Even today, these receivers give a good account of themselves and are still sought after by enthusiasts.

Quest for stability

After the war modes like single sideband came into greater use. Existing receivers used a variable frequency oscillator for the first or only conversion. This meant that the receiver was not sufficiently stable at higher frequencies. Drift of even a few Hertz necessitated frequency retuning. Consequently, new techniques were adopted.

The first method employed a crystal-controlled first conversion, as shown in **Fig 5.** By converting the signals down to a comparatively low tunable second IF, the VFO was not switched and ran at a lower frequency. Both factors significantly added to the receiver's stability.

This method was popular with radio amateurs because it allowed a number of small bands to be tuned with constant bandspread, high stability and good image performance.

Many similar designs appeared for commercially made equipment, as well as in magazines for the home constructor. Some of the most famous must be the G2DAF receivers, which appeared in the RSGB publications **Bulletin** and **Radio Communication** during the '50s and '60s.

This approach did not lend itself very well to wideband communications receivers, because a large number of small bands was needed. This problem was overcome by Racal with the launch of their new receiver, the RA17, in 1958. It used a revolutionary method called the Wadley loop, which virtually eliminated drift – but at the expense of a few extra valves.

Frequency synthesisers arrive

Although various forms of direct synthesis had been available for some time, they were expensive and had to be very well filtered to remove unwanted spurious signals.

The introduction of the integrated circuit enabled complicated circuits to be made more easily. This meant that indirect frequency synthesisers using the phase-locked loop could also be considered. Nowadays, all except a few receivers for the professional and amateur markets use synthesisers.

In spite of this, there is still much debate about the phase noise caused by synthesisers, however, these synthesisers have meant that stable receivers covering wide bands of frequencies can be made comparatively easily.

Other changes

The integrated circuit also brought about major reductions in size. Receivers which had required two people to lift them could now be made easily portable. Hand-held receivers and transceivers were also made possible, and equipment incorporating many more facilities became commonplace.

What about the future? Smaller and more compact receivers are certain to appear. Improved sensitivity at higher frequencies is another area for development. There are also other forms of synthesisers, known as direct digital synthesisers, which will improve phase noise performance. As for other changes, we'll just have to wait and see.

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

I often receive letters from newcomers to listening explaining that they have bought a domestic receiver and have difficulty reading the tuning dial.

Although not quite so common nowadays, except with very cheap or foreign receivers, it was standard practice to mark the tuning scale with the wavelength rather than frequency. This causes some confusion, especially as the frequency rises as the wavelength falls (see **Fig 1**).

Another confusing point is that older receivers that do have the scale in frequency are often marked in 'cycles per second' (Mcs, Kcs etc), whereas current receivers are marked in Hertz (MHz, kHz etc) but, in this case, there is no real problem as Hertz = cycles, ie, only the name has been changed.

So, what does it all mean? Electromagnetic radiation, which is what radio signals are, travels at about 300,000,000 metres a second. The time taken for one complete cycle of energy to pass a given point is called the wavelength, and the number of complete cycles passing a given point in a second is called the frequency. To put it in mathematical terms:

300,000,000 = frequency (Hz) × wavelength (metres)
or 300 = frequency (MHz) × wavelength (metres)
So, frequency (kHz) = 300,000/wavelength
frequency (MHz) = 300/wavelength
or, wavelength (metres) = 300,000/frequency (kHz)
For example, frequency = 300/15 metres = 20MHz

I hear you ask, 'Isn't the 15m band 21MHz?' Well, yes and no. The bands are known by their range, not as specific frequencies, so the 15m band covers frequencies between 20MHz and about 21.5MHz. Easy, isn't it? (!)

Band reports

Firstly, Peter Cain of Newcastle sent a list of good stuff heard on the 10, 15 and 20m group which bodes well for our contestants.

On 10m, ZY0FX, 9J2BO, VR6JR, J34YL, ZP0Y, FT5XA, A45O, TZ6VV, HS0AIT, 3W3RR, FR4FD, P29NJS, 4K2OT, FK8FI, V56VO, S01EA, TL8WD, 5W1HM, YJ8RN and BY8AC all showed up. 15m offered YN3EI, 9Y4BU, 5Z4BI, V51NAM, V31BB, 9J2BO, KP2A, BV2FA, PZ5DX, HS0B, TN1AT, WZ6C/ST4, 5Z4BH, S01EA, 3W3RR, CE0ICD, FR4FD, VP2MEZ, 3D2AG, J28SI, V47KTG and XU8DX; while 20m was well up to par with V63AO, T32AF, FO0XXL, ZK1XL, DX8I, YS8AB, 9M8FH, C53GB, J39CO, FT5XH, S0LYNX, V51NAM, FO0IGB, CE0MTY, T32AW, WD4FOV/KH8, A35KB, VK9LA, ZK1DD, SA2LB, HC8GR, V85GA, DU1PJS and a whole bunch of T32s!

Peter Bowles of Newhaven also had a good time following his receipt of the ZC4 Award (No 11) for multiband reception, and offered N3CRH/TJ, VP5JM, HI8LUZ, VS6WV, EL7X, OH7XM/CT9 and 3C1EA on 10m; A41KR, 4X4HQ, VE1JL and A41KC on 15m, and JY5DL, VK5BC and HC2G on 20m.

Peter also passes on the following QSL information: 5H3TW via K3ZO (QTHR); ZC4GA via GM0ALS (QTHR); RD8D via LZ1KVZ (QTHR); 5N9BHA direct (QTHR); A41KC via KA1XN (QTHR); HC2G via HC2CG (QTHR), and 3C1EA via EA4CJA (QTHR). All QTHR as per 1990 callbook.

The UBA SWL Competition sparked off a lot of interest in 1989, and 172 logs were received from twenty-four countries. Participation in all categories was good but digital (cat three) and image (cat four) modes could have been better (get those computers operating)! The entries from the Soviet Union were considerably up on previous years, so it seems Glasnost is opening doors a bit now.

BRS 87156, G1RPA, BRS 22643, G6LAU, G6XOU, BRS 28198 and BRS 91529 all put in good efforts in the phone category, which was won by UB5-073-2589.

In the CW category, won by UT5-186-100, BRS 84869 was the only British entrant.

In the digital modes, won by Y91-01-L, G6LAU flew the flag, coming sixth.

It's nice to see some of our lads in there with the action!

If you would like to participate in the next UBA Contest contact Marc Domen ONL 6945, Postbus 38, B2200 Borgerhout 1, Belgium, enclosing a couple of IRCs.

Anniversary celebration

On 28 June 1920, the Right Honourable Winston Churchill MP conveyed the Sovereign's approval of the formation of a Corps of Signals and, on 5 August the same year, conferred the title 'Royal'.

To mark the seventieth anniversary of this historical occasion, the Scarborough Special Events Group, together with members of the RSARS, RNARS and RAFARS, propose to run a special event station from the Royal Signals Training Centre, Burniston Barracks, Scarborough from 10 June to 7 July 1990.

Operation will be around 3725 and 7055 on HF and 2m FM and SSB, plus the usual activity on the RSARS nets.

Special QSL cards will be available for accurate reports to the station GB70SIG.

Awards

Awards claims for this month include a super one from Terry Lincoln of Weymouth, who claims the Lifeboat Award!

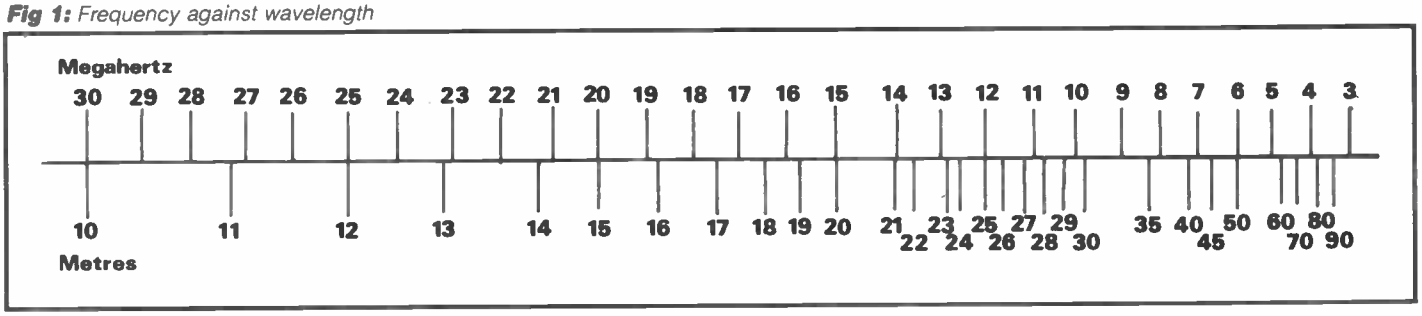
This award is for logging 100 amateur stations located in a town supporting a lifeboat. Of course, some lifeboats are actually located in awkward spots, so the nearest town counts for the points.

It sounds easy doesn't it? Well, as only *three* of these awards have been issued since 1985, the simplicity of the idea belies the actual difficulty.

Terry says, 'This has been the most interesting award I've worked for. It's taken hundreds of hours of listening and given me a good geography lesson!'

Congratulations, Terry! I will be sending your trophy to you soon.

Fig 1: *Frequency against wavelength*



Incidentally, if anyone wants to try for this award, a map showing the locations of RNLI lifeboats is available from the RNLI Headquarters. Write to me enclosing an sae for details.

The next award claim comes from John Miller G6XII of Gilwern, who approached me at the Swansea Radio Rally with a claim for the Premier Prefix Award for logging 1,000 different prefixes!

Among these loggings were such niceties as 5T5DV (Mauritania), FM5IQ (Martinique), J87CD (Grenadines), VK7GE (Tasmania), VP5SL (Turks & Caicos), V44KQ (St Kitts), PY0FZ (Fernando de Naronha), J52US (Guinea Bissau), PJ8UQ (St Maartin), FP8AW (Miquelon), HH7PV (Haiti), 6W7OG (Senegal), V47NXX (Isle of Neves), P43RR (Aruba Island), HD8DZ (Galapagos), HK0EFU (San Andre Island), AX0NE (Maquarie Island), D44BC (Cape Verde), FH4EE (Mayotte), KH6JEB/P/KH7 (Kure Island), 4K2OT (Franz Josef), XV2A (Vietnam), 4L1NV (Vaalam Island), JX7DFA (Jan Mayen) and many more. Congratulations, John!

Caroline Ingham, aged ten, tunes in to the TDOTA

Contests

The Guides' Thinking Day on the Air (TDOTA) Contest passed with a whimper this year (24-25 February) as far as readers were concerned, principally because I didn't announce it in this column! Nevertheless, Hedley Falkinder of Malton remembered the event and sent in a good list of Guide stations heard and scored 112 points.

Caroline Ingham (aged ten) of the Seventh Mirfield Guides sent in a diary of the event, complete with photographs and maps of where the stations she heard were located. It was very nicely presented and Caroline is the recipient of this year's trophy.

Rosalind Davies of the Second Norristhorpe Guides, Angela Stocks and Karen Martin of the Third Batley Parish Guides also sent in very good logs. They all passed their Guide Radio Communication badge as a result of their efforts. I also received a sample station log from GB0BWD (Batley West District). Thanks to Lynne Geering G8LMS for her efforts in encouraging the girls to take part.

Encouraging youngsters

You don't have to be a licensed amateur operator to encourage youngsters to take an interest in radio.

With the Jamboree on the Air (JOTA) and TDOTA logging contests, organised by the International Listeners Association, it is easy to create an air of friendly rivalry between individual youngsters or groups and enable them to gain points towards their organisations' communications badges, and the kids really do get stuck into it. Some of their logs are a pleasure to see.

Why not contact your local Scout or Guide unit and ask if you can set up a receiving station for one or both events? It's a good way to encourage newcomers!

Swansea Rally

The annual Swansea Radio Rally took place as usual in April – not, as it happened, a good time for many of us.

The rally was very well attended by the dealers and, in fact, there was a list of 'standby' dealers who awaited cancellations, but to no avail.

Public support was also very good with the usual heavy couple of hours from the off and an 'injection' of new faces around midday.

So, what's wrong with that? Well, it so happened that the previous week was the first of the new 'Poll Tax' era and, as many visitors explained, spare cash was short. Many things that might have been purchased were left unsold.

To be fair, the Swansea club did a good job organising the event, and the two halls of the Swansea Leisure Centre were full. The main hall contained the majority of the dealers, with excellent shows being put on by Dee-Com, Merlin, ACS, Allweld, Taurus, Sandpiper and Poole Logic and others. The second hall contained Ward, Nipco, Amdat, TAR, Uppington and Transworld Comms. Various societies and support groups were arranged in the centre island including Raynet, RAFARS, RNARS, WAB, RSARS, ILA and the repeater groups.

There was also a separate room in which amateur radio videos were shown throughout the day.

It was a busy but very enjoyable day and, for my part, as the ILA representative, I thank Roger GW4HSH for his courtesy in asking me to take part in another fine radio rally.

Thanks to all of you who came over to say hello and to those who helped run the stand, namely, Vernon GW0DST and Alf ILA 072.

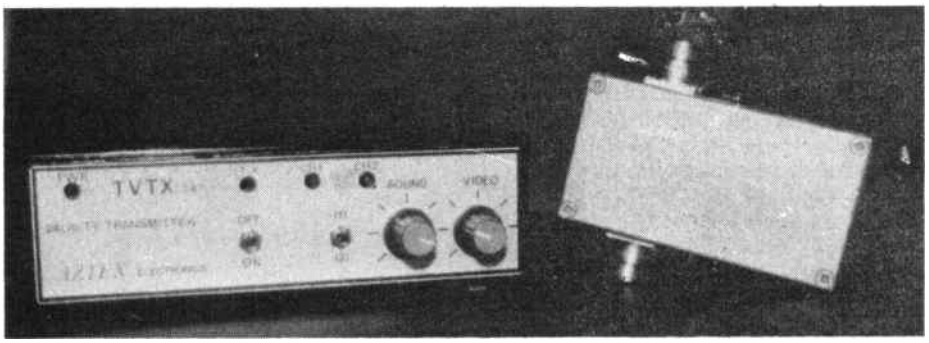
If you happen to be at Longleat in June, I hope to meet you! Meanwhile, have a good month.

Please send your reports and award claims to 1 Jersey Street, Hafod, Swansea SA1 2HF.

The Aztex TVTX 24cm FM ATV Transmitter and the ULNA 23-24cm GaAsFET Preamplifier

by Mike Wooding G6IQM

The Aztex TVTX 24cm FM ATV transmitter was first seen at the Leicester Show last year and created a lot of interest. So, I contacted the Severnside TV Group, through which it is marketed, and arranged for a unit to be despatched to me for review. At the same time, I requested to look at their 23-24cm GaAsFET preamplifier.



The 24cm FM ATV transmitter

Aztex has taken into account the need to incorporate a stable output in the design of this transmitter by using an SP5060 phase-lock loop chip and surface-mounted components.

The video pre-emphasis network, whilst based on the standard CCIR circuit, gives an HF component lift which is better than that given by a standard CCIR network. This overcomes the HF losses within the modulator, as well as providing normal HF lift.

Some kind of dc restoration on the signal was also necessary before injection into the modulator, and the circuit used to achieve this prevents the video content from altering the black level position.

The two sound inputs are actively mixed using a TL072 op-amp before they are fed to the modulator. There is a separate PCB-mounted preset for adjusting only the line input; the front panel sound control adjusts the composite level of both inputs. A subcarrier injection level preset on the PCB is also provided.

The design

The unit is supplied complete and is housed in a die-cast box, measuring 188mm × 120mm × 57mm, with a removable lid secured by six cross-head screws. The front panel comprises four LEDs, and these are from left to right: PWR, indicating the connection of the dc supply; transmit, and CH1 and CH2, showing which channel is selected. There are also a main on/off switch, a channel select switch and two potentiometers, one for the sound and the other for the video deviation.

On the rear of the transmitter are: an N-type socket for the aerial; a BNC socket for the video input; two sockets for the audio inputs; a phono socket for the line input, and a ¼in socket for the mic. The dc input is a 3-pin plug with a matching line socket and lead.

Specifications of the Transmitter

Frequency	
Channel One	1249MHz
Channel Two	1255MHz
RF output power	2½W(typical)
Harmonics	<50dBC
Modulation system	FM with built-in pre-emphasis
Audio subcarrier	Preset to 6MHz
	>=17dB below carrier (variable with peak setting)
Video input	1V peak-to-peak into 75 ohms
Audio inputs	Dynamic mic
	Adjustable line input (VOR etc)
Power Consumption	1.6A @ 13.8V

Internally the transmitter is neatly laid out with the main PCB incorporating the audio amplifier, modulator/subcarrier generator circuitry and the video circuits. The main PCB is held in place with four nuts, bolts and spacers, thus removal for servicing is simple.

A small die-cast inner box containing the RF circuitry occupies approximately one third of the main case. This box provides a further level of screening between the baseband and RF sections of the transmitter. The RF output N-type socket is mounted through the case into the inner box and is soldered directly to the PCB, thus there are no RF cables floating around inside. Interconnections between the RF box and the main printed circuit board are via several feed-through terminals carrying the baseband signal, power supply and frequency switching control signals.

The RF assembly is bolted to the main case with the same bolts securing the internal PCB via spacers. The N-type aerial socket is bolted to the RF box and a clearance hole has been drilled through the main case. Thus, removal of the RF assembly and RF circuit board for servicing can be achieved with care. The circuitry features state-of-the-art surface mount technology.

Three adjustable knobs are provided inside the transmitter, and these are: a preset potentiometer for audio subcarrier injection level; a trimmer capacitor for the audio subcarrier frequency, and a preset potentiometer for the line audio level. Supply protection is via a miniature wire-ended fuse, soldered between two posts on the PCB.

Frequency stability

Two transmit frequencies are available on the transmitter, and these are selected via a front panel-mounted toggle-switch. As the unit has a crystal-controlled PLL exciter, I expected the frequency stability to be good and, as Table 1 shows, it is. The review unit exhibited a drift down of 2200Hz over a thirty-minute period.

Time	Frequency
Switch on	1249.02623
10 sec	1249.02611
20 sec	1249.02581
30 sec	1249.02569
40 sec	1249.02559
50 sec	1249.02558
60 sec	1249.02549
70 sec	1249.02543
80 sec	1249.02541
90 sec	1249.02538
100 sec	1249.02537
110 sec	1249.02535
120 sec	1249.02534
3 min	1249.02503
10 min	1249.02403
15 min	1249.02411
20 min	1249.02401
30 min	1249.02389

Table 1

Power output and harmonics

The RF power output was monitored over a period of half an hour at 1249MHz (see Table 2). After twenty minutes, during which the power output dropped 0.37W (0.65dB), the output remained constant at 2.34W. A similar check was carried out at 1255MHz; the switch-on power was slightly higher at 2.84W, with the final output power settling at 2.54W.

The harmonic content of the unmodulated output was very low, probably owing to the out-of-band rejection of the SC1043 PA output. The second harmonic was measured at slightly less than 50dB down on the carrier. Third and subsequent harmonics were not detectable above the −75dB noise floor of the analyser.

Video and audio characteristics

The CQ-TV-developed system for ascertaining a modulation index of 0.5 was used; ie, I applied a 5MHz sine-wave to the video input and, viewing the output on a spectrum analyser, adjusted the video amplitude (deviation) from the signal generator so that the sidebands coincided with the recommended moduation index of 0.5. The output from the signal generator into the transmitter was then measured and this level used as the reference output level from the Philips TV pattern generator for the plots shown in **Figs 1** to **3**.

Fig 1 shows the spectrum obtained using a plain red pattern, **Fig 2** shows the spectrum using 100% saturated colour bars and **Fig 3**, the spectrum with a Philips PM5534 test card.

The audio subcarrier generator, unless otherwise specified, is set to 5.9996MHz for UK use. However, the subcarrier oscillator trimmer capacitor is accessible with the unit's cover removed, and the subcarrier can be easily reset to 5.5MHz, or whatever, for Continental use.

At maximum video deviation the sub-

Table 2

Time	Power
Switch on	2.72W
5 min	2.54W
10 min	2.46W
15 min	2.37W
20 min	2.35W
25 min	2.34W
30 min	2.34W

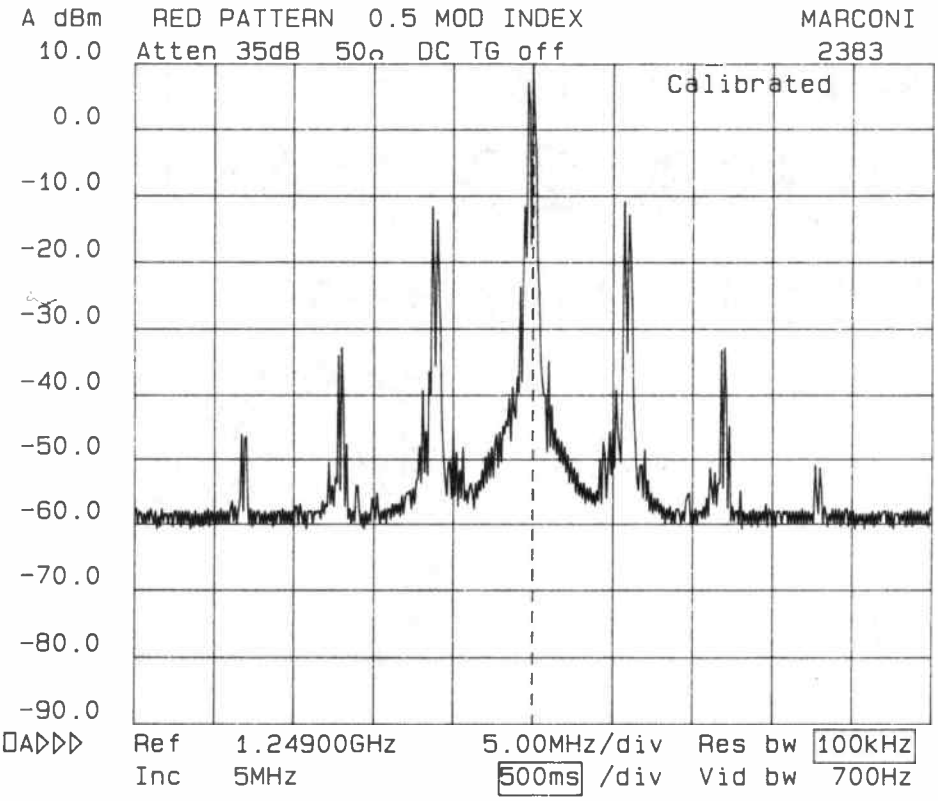


Fig 1

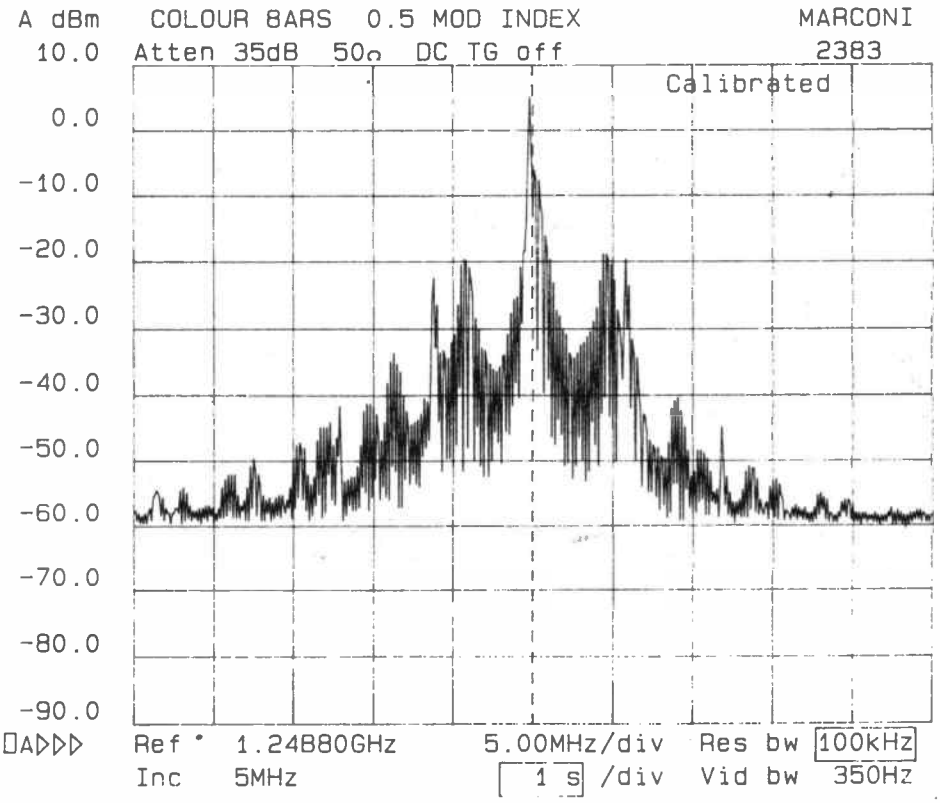


Fig 2

carrier level was measured at 17dB below carrier, however, as the video deviation is reduced (using the front panel video control) the relative difference becomes greater. At minimum video deviation the subcarrier was measured at 32dB below carrier (dBc).

With a standard video input level of 1V p-p the front panel video control was set at 50% to achieve a normally deviated picture. At this setting the audio subcarrier was measured at around 24dBc, which proved to be adequate for good audio with P5 contacts. Nevertheless, I adjusted the subcarrier injection control on the main PCB and brought the relative level back to 17dBc at this video control setting. This provided very good audio fidelity commensurate with picture reception.

Note: If the input video level to the transmitter is adjusted so that the video control on the transmitter is fully clockwise in operation, then the audio subcarrier level will be satisfactory without internal adjustment.

On-air tests and conclusions

Overall, I am very impressed with the workmanship and presentation of the transmitter. Upon receipt it was simply a matter of connecting 13.8V, plugging in the camera and mic, connecting the aerial, switching on and adjusting the video and audio controls.

Furthermore, the output level of around 2.5W is enough to drive a 2C39A valve linear (in my case, to an output of approximately 60W). The colour-handling characteristics of the unit gave excellent results, as did the audio response, when tested over a P5 path.

My only criticisms are the lack of rear panel socket identification and the use of the soldered-in PCB mounted fuse.

With regard to the rear panel, while no-one is likely to confuse the aerial socket with the power socket, confusion could occur over the two audio inputs and the video input. However, the manufacturers tell me that this is being attended to.

Turning to my other criticism, I think that changing the soldered-in PCB mounted fuse, should failure occur, could be a problem for some users.

However, on the whole I was so impressed with the transmitter that I am now running one myself.

The ULNA 23-24cm GaAsFET preamp

The ultra low noise preamplifier is housed in a blue hammer-finished die-cast box, measuring 110mm × 60mm × 30mm, with N-type input and output sockets mounted one each side. The top cover of the box is secured by four cross-head screws.

Note: The housing is not waterproof and needs to be mounted inside a weather-sealed enclosure for external/mast mounting.

The small PCB is secured by solder tags, fixed to the PCB and secured on two of the N-type socket fixing bolts on each side. The dc supply is fed into the box via two insulated solder terminals, and features a reverse polarity protection diode.

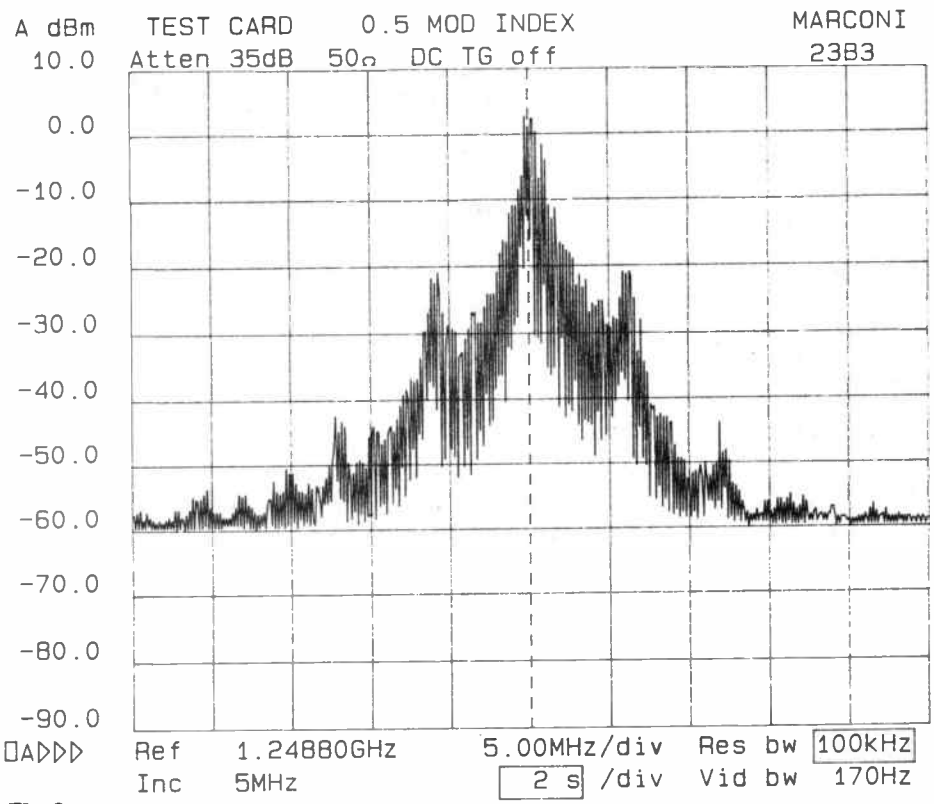


Fig 3

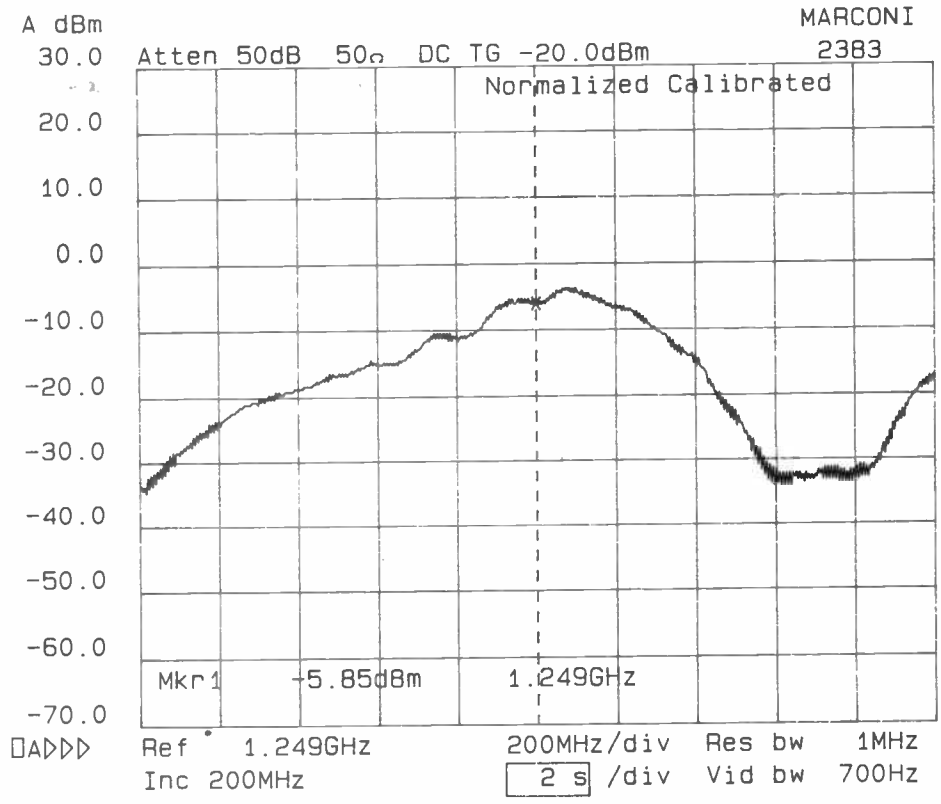


Fig 4

The GaAsFET device is one of the latest devices from Avantek, the ATF10135. It is mounted on a vertical PCB screen and soldered to the main circuit board. A brass horizontal top-screen is soldered to the vertical PCB screen and

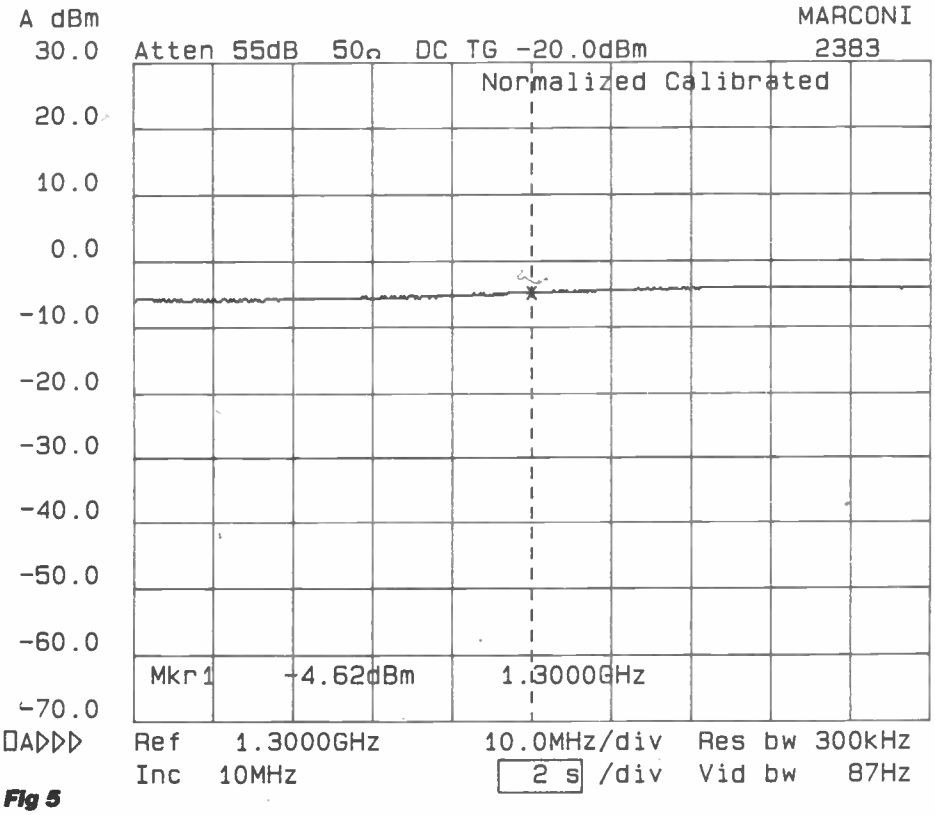


Fig 5

clamped to the side of the box under two of the output N-type socket retaining screws.

Input and output tuning trimmer capacitors are mounted at each socket respectively, and a bias preset potentiometer is located on the main PCB.

Bench tests

The plot shown in **Fig 4** shows the gain over the frequency band from 249MHz to 2240MHz. The reference input level is −20dB and the centre frequency of the plot is 1249MHz. The 0dB gain points are approximately 600MHz and 1700MHz. The 3dB band is approximately 1150MHz to 1500MHz.

The plot shown in **Fig 5** covers a frequency band from 1250MHz to 1350MHz, with a centre frequency of 1300MHz. Over this frequency range, essentially the 23/24cm band, the response is very flat, with a positive gain slope. The reference input level is −20dB and the gain at 1300MHz is 16.1dB. The gain at 1249MHz is 15.5dB and at 1318MHz is 16.4dB.

On-air tests and conclusions

The flat, even response of the preamp over the 23/24cm band enabled me to tune to signals at both the RMT2 repeater input and output frequencies (1249MHz and 1318.5MHz) without any loss of preamplification. This was a new experience for me, as my own home-brew GaAsFET preamp is a half-band unit, which requires retuning when tuning from one end of the band to the other.

Also, the very low noise figure exhibited by the preamp means that the 15.5dB of gain appears to be more when compared with results obtained from other preamps with higher gain figures. Noise figures are a complex subject which I will not go into here, but suffice it to say that this unit with its noise figure of 1dB will take some beating.

The preamplifier is a well-made unit which performs well, and I recommend it to anyone who requires a preamp for the 23/24cm band.

Specifications of the GaAsFet Preamp

Typical gain	17dB
Noise Figure	1dB
Bandwidth	1250 to 1350MHz ±1dB
Rejection	8dB @700MHz
Dc Supply	7V to 18V

Both units are available only through the Severnside Television Group. The Aztex TVTX 24cm FM ATV transmitter is priced at £220.00 plus £2.50 p&p, and the Aztex ULNA 23-24cm GaAsFET preamp is priced at £52.00 plus £1.50 p&p. For further details contact the Severnside TV Group, 15 Witney Close, Saltford, Bristol BS18 3DX, tel: (0255) 873098.

PROJECT BOOK

by Martin Williams

One of the great disadvantages of battery operated equipment is that it suddenly stops working without warning as the battery dies. An indicator lamp can be fitted but this decays at the same rate as the battery, so it is not a lot of help. What is required is a system which could be set to switch on an indicator at some preset level.

Comparator

Fortunately such a device can be built easily and cheaply. The main part of the circuit is a 741 integrated circuit which is generally used as a high gain amplifier, but the 741 has other uses as well. This is because the op-amp has two inputs, a non-inverting and an inverting one. The difference between them is that as a voltage on the non-inverting input rises so does the output voltage, but on the inverting input the opposite occurs.

Circuit

In **Fig 1** the circuit will check the voltage on its own supply line. The LED will not come on until the supply voltage falls to some predetermined value.

One of the inputs is supplied with a reference voltage which is set by R1 and ZD1, the other is supplied through the preset VR1. These two lines may be taken to the 741 as shown, or the connections may be reversed, depending on whether you want the light to come on when the volts are over or under the preset value.

Indicator

The output of the 741 drives a BC107 which is used to switch on the light. However, this is not really required as the 741 is able to carry the LED current without assistance.

The point about the BC107 is that it can be used to fire a relay or sound an alarm, the current requirements of which would be beyond the capabilities of the 741.

Set up

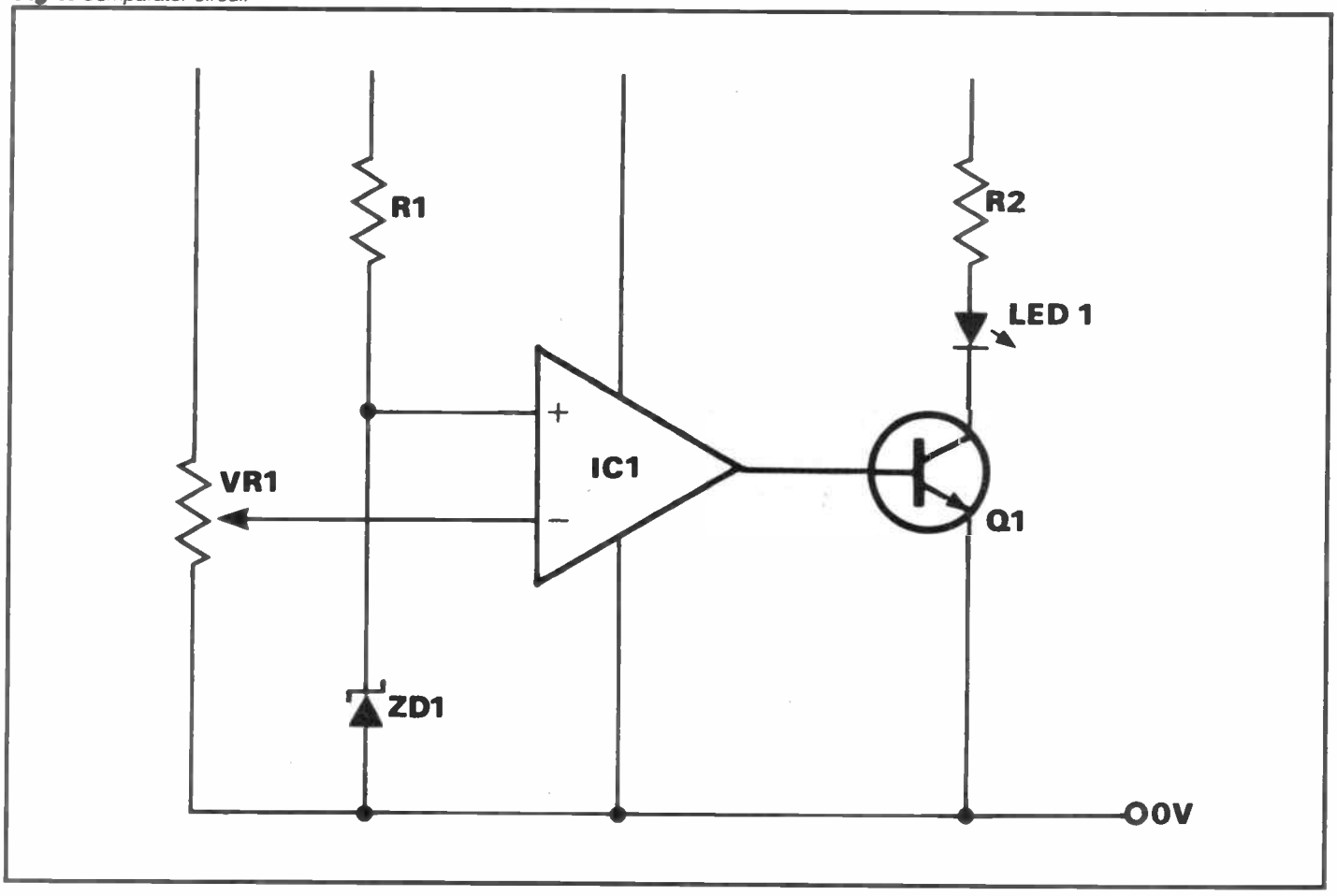
This is simply done. Firstly, connect the completed assembly to a power supply, then set the supply volts to the level at which you want the indicator to come on. Secondly, adjust VR1 until the lamp either comes on or goes off, depending on which way you have wired the inputs to the op-amp.

If you want to monitor a line other than the supply line to the op-amp, simply connect the negative lines of the two supplies together and then disconnect the top of VR1 from the op-amp rail and connect it to the line you wish to monitor.

Parts List

R1	1kΩ	.25W
R2	1.2kΩ	.25W
VR1	10kΩ	preset
IC1	741	op-amp
TR1	BC107	
IND1	LED	
ZD1	5.6V zener	

Fig 1: *Comparator circuit*



News and comment from Glen Ross G8MWR

Callsigns

As you are well aware the number of callsigns that can be issued in the existing G sequence is rapidly coming to an end. The only series left available are in the G5 and G9 sequences. Of these, it is intended to use the G5 as the next allocation for class B licensees. The G9 series has always been issued as an experimental and development licence, so it's not available to the amateur fraternity. Where do we go from here?

Alternatives

It had been assumed for many years that when the existing G series was no longer available that we would move to a similar system based on the letter M, which is also an international British allocation. There is also the possibility of using the figure two, which would result in such horrors as 2A1ABC. At the moment, we still have what remains of the G4 series for class A stations plus what is left of the G7 series and the whole of the G5 series for class B.

Fresh start

It is obvious that more class B than class A licences are issued, so it is uncertain as to which will run out first.

The DTI have decided that the new system will be implemented from the time that either series expires. All new licences will then be issued on the new system and any unused callsigns in the old system will not be issued.

New system

As expected, the proposal makes use of the M series but in a completely new form. All callsigns will consist of six digits instead of the current five and will be in the form MA2XYZ. The first letter will indicate the UK rather than a specific country. The second letter will indicate the class of licence.

The RSGB suggest that MA to MJ could be used for class A and MK to MZ for class B, with MB being used for special event stations and MC for club stations.

Countries

The figure in the callsign would indicate the country by using the following codes: 1=spare; 2=England; 3=Scotland; 4=Wales; 5=Northern Ireland; 6=Isle of Man; 7=Jersey; 8=Guernsey, and 9 and 0 are held as spares.

For example, if the class A station MA2ABC moved from England to Wales the callsign would change to MA4ABC.

One drawback of this new system is that DX stations would find it far more difficult to know which country a station was in than under the existing one. At the moment, the distinction between G3ABC and GW3ABC is very obvious.

Novice

Now we come to the shock horror bit. It is proposed that the novice licences be issued in the 2A1AAA to 2Z9ZZZ series. At least they will be instantly recognisable! The second letter in the callsign would indicate the status as Novice A or Novice B class. The figure would indicate the country, based on the codes set out earlier, and the aforementioned rules would apply when moving from one country to another.

Even more

The most exciting proposal is that club stations would be allowed to use two different prefixes. They would use the normal call for all usual operating and a special one for when greetings messages were being sent.

The codes would then become GX for England; GS for Scotland; GC for Wales; GN for Northern Ireland; GT for the Isle of Man; GH for Jersey and GP for Guernsey.

Crazy

This really does seem ridiculous. Most greetings messages go overseas so rather than using GC for Wales, why not stick to the established GW which is internationally known already? Equally, why use GS for Scotland when GM has been well established for the last seventy years? Not only would this avoid any confusion but it would retain a nostalgic link with past practices.

Comments

Although these are simply proposals for discussion, I suspect that there will not be any major alterations when the final details are announced.

The RSGB have asked for comments on these proposals, and these should be sent to the RSGB, Cranbourne Road, Potters Bar EN6 3JE.

Now is your chance to make your views known; don't moan about it when it is too late.

Morseless?

There have always been those among us who have wanted to see the Morse test dropped as a requirement for an amateur licence. The official reply has always been that it is not a local but an international regulation and, as such, it must be suffered. In fact, the walls of this regulation were breached some years ago by the Spanish authorities, who will issue a codeless licence. Now an international abandonment of the Morse requirement seems possible owing to events taking place in the USA.

ARRL

For those of you who are not aware of the US system, it consists, as it does here, of two parts.

The first is the national society, the American Radio Relay League or ARRL, which is the US equivalent to the RSGB. The second is their version of the DTI, which is known as the Federal Communication Commission or FCC. They also have more classes of licence than we do, with each class having greater privileges but requiring a higher test standard.

Classes

The present class structure is Novice, Technician, General, Advanced and Extra. The Technician and General grades are roughly equivalent to our B and A licences but with higher power levels.

To simplify things the ARRL want to replace the Novice and Technician grades with a single group, to be known as the Communicator class. The ARRL submitted a formal application for the change to the FCC on 8 February and the matter is now under discussion.

Good news

How does this affect the Morse requirement? The major news is that the ARRL have requested that the new class should not need a Morse pass. The idea is that it will be a multiple choice exam of sixty questions drawn from a question bank. Passing this would allow the user up to 200W PEP on bands ranging from HF to microwave.

The main point is that if a large number of American amateurs are allowed on the HF bands without passing a Morse test, then they have effectively driven a horse and cart through the international reg-

ulations. Once this happens, surely the rest of the world must follow?

Awards

Only two awards have been issued this month and both go to G1IWQ, who is located near Spalding. His first claim is for a 144MHz Bronze certificate with a best DX to FD1YGA at just over 800km. He also claims a 144MHz Silver award, this time with a best DX of 1104km to OK1VEI.

All the contacts were made on SSB with a maximum power of 10W.

Activity

The RSGB have announced the dates for this year's series of microwave cumulative awards.

There have been two slight changes to the rules. The first is that the series has been extended from the usual six days to seven.

The second is that they have gone back to the old idea of having activity on all the upper microwave bands (3.4GHz and above) on each day, instead of mixing bands and dates.

Scoring

The usual format of adding the score for the best three days to make your final entry still applies. This is an excellent idea because not everyone can take part in all seven events.

The dates still to come are 10 June, 22 July, 19 August, 9 September and 6 October. The last of these also hosts the IARU VHF/UHF competition which is held over the same weekend.

Packet

Packet is probably the fastest growing area in the amateur radio field, but it does have its problems. The worst of these is that the local box spends all its time talking to other boxes so as to exchange files. The original idea was that this should be done in the small hours of the morning, so leaving the box free for users during the day.

This worked well when there were not too many people on the system but, now that so many operators are using it, the volume of traffic to be passed means that the box has to spend all day talking to other boxes just to keep up.

Priority

As an example of what can happen, I made twenty attempts, spread over three days, to get into a local BBS with no result. Surely the purpose of a BBS is to serve its users, not to spend all day talking to other boxes?

What is needed is a priority interrupt built into the software to enable an end user to get in, no matter what the BBS is doing at the time.

Connecting

It would work like this. Imagine that GB9ABC is exchanging files with GB9XYZ when G9BF wants to use the system.

G9BF sends a connect request to GB9ABC and the box responds with an acknowledgement and asks him to wait until the current task is completed. It then accepts the rest of the file it is currently handling from GB9XYZ, closes the link to GB9XYZ and connects to G9BF, asking him to go ahead.

At most G9BF would have had to wait a couple of minutes to get in. He then makes use of the box and when he clears, GB9ABC reconnects to GB9XYZ and the file transfer continues.

Software

This method would give more or less immediate access to the BBS and so end the frustration that is currently building up. Commonsense tells us that no system should be involved in house-keeping tasks when there are end users waiting to use the facilities, particularly when the present way of operating means that users can be effectively 'locked out' for hours at a time. The best part of the suggestion is that it can be accommodated by a simple rewrite of the software to include the new facility.

Close-down

That's all for this month. The Sporadic-E season should be in full flow by the time you read this and that means you will want to know about our awards, so drop me an sae. The address is 81 Ringwood Highway, Coventry CV2 2GT, or contact me on packet at GB7NUN.

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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
Oct 1990	29 Aug 90	30 Aug 90	5 Sep 90	7 Sep 90	27 Sep 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

RESISTORS

Carbon Film 0.25W E12 or E24 series 1p each (min quantity 10 per value), 80p per 100, £6.00 per 1000.

**** Special Offer ****
Mixed Pack, of 1000 Carbon Film resistors, 1R to 10M, 100 different values all separately packed and labelled, only **£5.90**

Metal Film 0.25/0.5 W E96 series 10R to 1M0 4p each (min quantity 10 per value), £3.00 per 100.

Ceramic/wirewound
4W 0R1-10K 35p each
7W 0R33-12K 37p each
11W 0R68-10K 40p each
17W 1R-10K 44p each
5% discount on 10+, 10% on 25+, 20% on 100+

Skeleton Pre-Sets
E3 series 100R-1M 20% Horizontal or vertical 18p each. 5% discount on 10+, 10% on 25+, 20% on 100+

Enclosed Pre-Sets
100R-10M 20% Horizontal or Vertical 24p each. 5% discount on 10+, 10% on 25+, 20% on 100+

20 Turn ¾" Cermet Pots
10% tolerance 10R-2M 90p each. 5% discount on 10+, 10% on 25+, 20% on 100+

CAPACITORS

Radial Aluminium Electrolytic 20% tolerance

10/16/25/35 Volt
4.7, 10, 22, 33, 47, 100 ..... 12p
220, 330, 470 ..... 20p
1000 ..... 30p
2200 ..... 48p
3300 ..... 65p
4700 ..... 85p

50/63/Volt
0.47, 1, 2.2, 3.3, 4.7, 10 ..... 12p
22, 33, 47 ..... 20p
100, 220 ..... 30p
470 ..... 50p
1000 ..... 90p

100 Volt
0.47, 1, 2.2, 4.7 ..... 12p
10, 22 ..... 20p
47 ..... 30p
100 ..... 50p

Ultra miniature Aluminium electrolytic radial 20% tolerance
4V
220 ..... 18p
6.3 Volt
22,100 ..... 18p
16 Volt
10, 22, 47 ..... 18p
25 Volt
10, 22, 33 ..... 18p
35 Volt
4.7, 10, 22 ..... 18p
50 Volt
0.1, 0.22, 0.33, 0.47, 1, 2.2, 3.3, 4.7, 10 ..... 18p

CAPACITORS

Disc Ceramic 5% tolerance 150 Volt values in **pF**
15, 22, 33, 47, 68, 100, 150 ..... 4p
220, 330, 470 ..... 6p

10% tolerance value in **pF**
220, 330, 470, 680, 1000, 1500, 2200 ..... 6p
3300, 4700, 6800 ..... 8p

+80%-20% tol value **pF**
4700, 10000 ..... 6p
22000, 47000 ..... 9p

Tant Bead resin dipped 20% tolerance value in **uF**
6.3 Volt
10, 22 ..... 15p
47 ..... 25p

10 Volt
3.3, 4.7, 6.8 ..... 15p
10, 15 ..... 25p
22, 33, 47 ..... 35p

16 Volt
2.2, 3.3, 4.7, 6.8 ..... 15p
10, 15 ..... 25p
22, 33 ..... 35p

25 Volt
1, 2.2, 3.3 ..... 15p
4.7, 6.8 ..... 25p
10, 15 ..... 35p

35 Volt
0.1, 0.22, 0.33, 0.47 ..... 15p
0.68, 1, 2.2, 3.3 ..... 20p
4.7, 6.8, 10 ..... 30p

CMOS

4000	17p	4106	34p
4001	17p	4160	40p
4002	17p	4161	40p
4006	37p	4162	40p
4007	17p	4163	40p
4008	37p	4174	37p
4011	17p	4175	40p
4012	17p	4194	42p
4013	25p	4501	27p
4014	37p	4502	40p
4015	37p	4503	37p
4016	28p	4504	120p
4017	37p	4506	76p
4018	37p	4508	99p
4020	37p	4510	37p
4021	37p	4511	37p
4022	37p	4512	37p
4023	17p	4513	99p
4024	35p	4514	85p
4025	17p	4515	80p
4027	34p	4516	37p
4028	37p	4517	99p
4029	37p	4518	37p
4032	56p	4519	26p
4034	95p	4520	37p
4035	44p	4521	85p
4038	65p	4522	44p
4040	37p	4526	44p
4042	37p	4527	44p
4043	37p	4528	44p
4044	37p	4529	50p
4046	47p	4530	99p
4049	27p	4531	44p
4050	27p	4532	60p
4051	37p	4534	240p
4052	37p	4536	120p
4053	37p	4538	54p
4060	37p	4539	45p
4066	29p	4541	50p
4067	99p	4543	54p
4068	17p	4544	130p
4069	17p	4547	130p
4070	17p	4549	400p
4071	17p	4551	85p
4072	17p	4553	120p
4073	17p	4554	320p
4075	17p	4555	50p
4076	37p	4556	50p
4077	17p	4557	120p
4078	17p	4558	120p
4081	17p	4559	440p
4082	17p	4560	110p
4093	27p	call sales for 4500 series above 4560	
4094	48p		
4097	99p		
4099	46p		

DIODES

1N914 ..... 5p
1N4148 ..... 4p
1N4001 ..... 3p
1N4002/3/4/5/6 ..... 4p
1N5401 ..... 7p
1N5402/4/6/8 ..... 11p

Zener Diodes
500mW
2.4, 2.7, 3, 3.3, 3.9, 4.7, 5.1, 5.6, 6.2, 6.8, 8.2, 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 39, 43, 62, 68, 75, 82, 91
All above voltages at 5p each

1.3W
3.3, 3.9, 4.3, 4.7, 5.1, 5.6, 6.2, 6.8, 7.5, 8.2, 9.1, 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
All above voltages at 16p each

2.5W, 20W & 75W versions available

Bridges
W005 ..... 23p
W02 ..... 25p
W04 ..... 30p
W06/08 ..... 35p
2A 200V 65p
2A 400V 72p
2A 600V 90p
6A 200V 78p
6A 400V 84p
6A 600V 99p

Linear ICs
call for price

TRANSISTORS

BC107B 20p
BC108B 20p
BC109C 22p
BC184C 6p
BC212B 6p
BC239C 4p
BC307C 4p
BC548C 4p
BC558C 4p
ZTX300 ..... 17p
The above are a few examples from the 1000s of transistor types we have. We cover all ranges and types including JFET, SIPMOS, TMOS, TIP plastic & metal, FET & Darlingtons.

REGULATORS

7805 5V @ 1.5A 30p
7812 12V @ 1.5A 30p
7815 15V @ 1.5A 30p
7905 −5V @ 1.5A 30p
7912 −12V @ 1.5A 30p
7915 −15V @ 1.5A 30p

★ KITS ★ KITS ★ KITS ★

ALL KITS ARE SUPPLIED WITH MAINS TRANSFORMER, HIGH QUALITY GLASS FIBRE SILK SCREENED PCB, FULL INSTRUCTIONS, HEATSINK, SOLDER ETC. CASE NOT SUPPLIED BUT AVAILABLE

CONSTANT CURRENT NI-CAD CHARGER Charge your Ni-Cads safely, can be left on indefinitely without damage, batteries fully charged from flat in approx 18 hours. Charge up to 12 batteries in series (except PP3) **£7.50**

FAST NI-CAD CHARGER Rapidly charge your Ni-Cad racing pack from mains or 12 Volts. Charger guarantees a full charge every time, making maximum use of your pack **£10.50**

BENCH POWER SUPPLY 2.5-35 Volt @ 2 Amps The following spec ensures excellent value for money for this most essential of workshop equipment. Line Reg 0.03%, Load Reg 0.1%, Ripple Rejection 70dB, Output Res 1.5 milliOhm, Output Noise 80uV **£8.00**

10 Amp BENCH POWER SUPPLY 5-33 Volt Use for powering CB/Ham Radios, or a very high powered bench power supply. Spec as 2A version above **£32.00**

HUNDREDS OF KITS AVAILABLE – SEND FOR LIST

1990 CATALOGUE

OUR NEW CATALOGUE LISTS THOUSANDS OF COMPONENTS, SWITCHES, RELAYS, BUZZERS, SOUNDERS, FIXINGS, CHEMICALS, PCB MATERIAL, CABLE, MODULES, METERS, SOLDER, CONNECTORS, PLUGS, SOCKETS, TRANSFORMERS, INDUCTORS, PLASTIC & METAL BOXES, AND LOTS, LOTS MORE – IN FACT, EVERYTHING YOU NEED

£2.50 (INCLUDING 5 £1 DISCOUNT VOUCHERS)

ADVANCED ELECTRONIC PRODUCTS LTD
PO BOX 10, Newton Abbot, Devon TQ12 1JP
Tel: (0626) 332091 Fax: (0626) 332381

MAIL ORDER TERMS: POSTAL ORDER OR CHEQUE WITH ORDER. PLEASE ADD 75p POST & PACKING FOR COMPONENTS AND £2.75 FOR KITS TO ORDER VALUE AND THEN 15% VAT. ACCESS & VISA HOLDERS PLEASE PHONE ORDER BEFORE 4.45PM FOR SAME DAY DESPATCH. ALL ORDERS UNDER 750 Grms SENT BY FIRST CLASS POST. OVERNIGHT CARRIER £9

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 uniselector, one use is for an electric jigsaw 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.
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.
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 100 keys mounted on PCB with components only £3.00 Ref 3P89

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.

TV SOUND TUNER(ex cable). 8 channels TV Sound mains operated, with speaker, price £12.00. Our Ref: 12P19.

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.

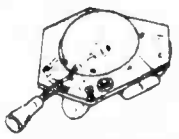
MAIL ORDER TERMS: Cash, PO or cheque with order. Please add £2.50 service charge. Monthly account orders accepted from schools and public companies. Access and B/Card orders accepted – minimum £5. Phone (0273) 734648 or 203500. Fax No 0273-23077

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. 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.

ALSO AVAILABLE WITH GEARBOX approx 4:1 reduction giving 800rpm. Our Ref: 40P8. Price £40.00.

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.5A, ±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.

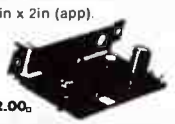
ORGAN MASTER is a three octave musical keyboard. It is beautifully made, has full size (piano size) keys, has gold-plated contacts and is complete with ribbon cable and edge connector. Comes complete with Spectrum 128 software. Brand new only £22.00. Ref 22P1

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 OPD, uncased only £3.00 ref 3P27.

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

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. 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 £9.00. Our ref 9P5.

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

PAPST FAN. 80 x 80mm 230V. Our Ref: 9P7. Price £9.00.

PAPST FAN. 120 x 120mm 230V. Our Ref: 6P6. Price £6.00.

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. Also available to switch 1000 watts. Our Ref: 25P16. Price £25.00.

VOLTAGE INVERTER KIT. 12v to 220v. Our Ref: 12P7. Price £12.00.

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 3P70, 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.

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 12P8.

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 and green. 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.