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Radio & Electronics

The communications and electronics magazine

World

**UP IN THE AIR:
PRIMARY GROUND
RADAR SYSTEMS**

**USER REVIEW:
LOWE HF125 GENERAL
COVERAGE RECEIVER**

**PC BOARDS:
THE EASY WAY TO
MAKE YOUR OWN**

**MOS DEVICES:
THE WHYS
AND WHEREFORES**



**BUILD A SIMPLE
ANEMOMETER**

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Safety in the shack

Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk - safety in the shack please, at all times.

Whilst every care is taken when accepting advertisements we cannot accept responsibility for unsatisfactory transactions. We will, however, thoroughly investigate any complaints.

The views expressed by contributors are not necessarily those of the publishers.

Every care is taken to ensure that the contents of this magazine are accurate, we assume no responsibility for any effect from errors or omissions.

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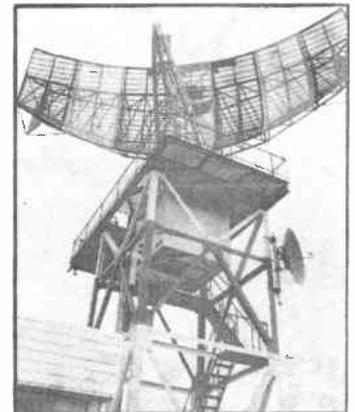
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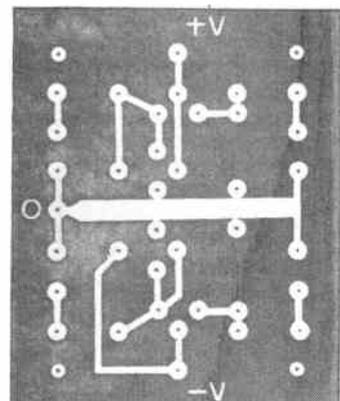
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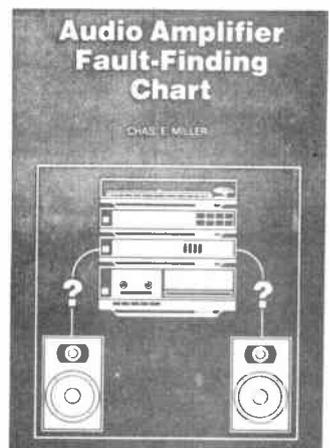
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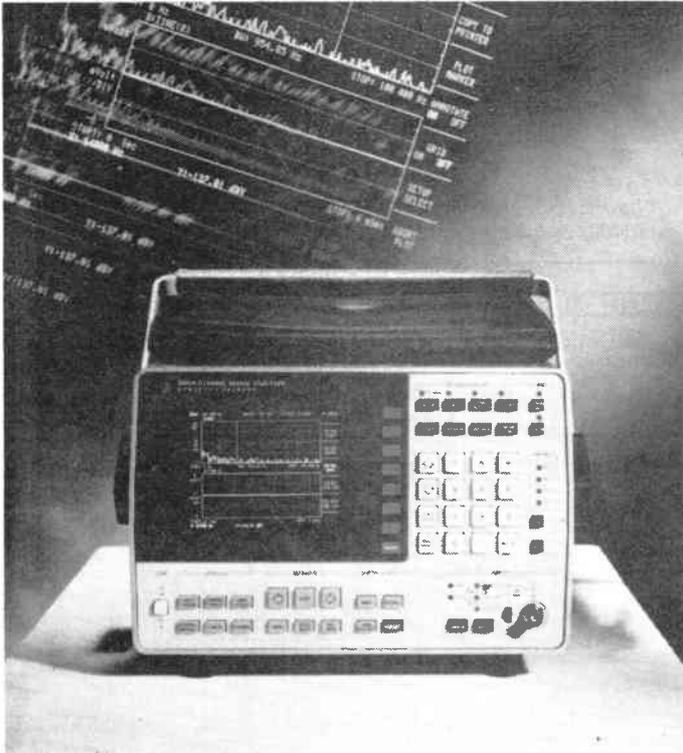


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PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.

Readers, don't forget to mention **Radio & Electronics World** when making enquiries



SIGNAL ANALYSER

Hewlett Packard's 3561A dynamic signal analyser, designed to meet spectral analysis test needs in vibration, acoustics and electronics applications, is available for hire from Electroplan Rental.

The 3561A offers a rugged, portable solution for machinery vibration analysis in predictive maintenance, dynamic balancing, run-up or coast-down analysis applications. This versatile tool measures complex vibration signals, separates them into their individual frequency components, and displays the complete spectrum graphically for easy interpretation.

Comparison with previous spectral signatures reveals the rate of deterioration of system components, allowing maintenance to be scheduled for minimum downtime. Built-in trace maths facilitates fast, accurate balancing of rotating machinery. Spectra are rapidly captured and mapped to enable effective detection of critical speeds during run-up and coast-down testing.

For acoustic analysis the instrument features fast, error-free computation for 1/3 and 1/1 octave analysis. An 'A'-weighting filter can be switched in if required.

Equally valuable in electronics applications, the analyser performs demanding distortion, noise floor, spurious response and modulation measurements, network analysis, and time domain waveform recording using a 40k-sample time buffer. The instrument delivers a factor of 100 speed improvement compared with swept analyser techniques.

With a frequency range from 125 μ Hz to 100kHz, this high-performance instrument offers a wealth of features for accurate but simplified system analysis. Powerful frequency-domain analysis capability provides 401 line resolution and a full 80dB dynamic range in all frequency spans. A zoom facility reveals closely spaced details, with 640 μ Hz resolution over the measurement range. Baseband spans go down to 0.01Hz full scale, and

a split screen allows simultaneous baseband and zoom displays.

The instrument is available on short-term hire or at reduced longer-term rates. Electroplan's purchase option plan allows the user to spread capital outlay or to evaluate equipment before purchasing.

*Electroplan Rental,
PO Box 19,
Orchard Road,
Royston,
Herts SG8 5HH.
Tel: (0763) 47251.*

DIGITAL STORAGE OSCILLOSCOPE

The digital storage oscilloscope BOS from Rohde & Schwarz can handle single shots or rarely occurring events (such as glitches), fast signals with a low repetition rate, pretrigger events or very slow signals which just give a flickering, hard-to-view trace on an analogue oscilloscope.

Thanks to the built-in IEC/IEEE-bus interface, the variety of mathematical operations for signal processing and the ease of operation, the BOS is ideal both for the lab and for use in fully automated, computer-controlled test systems.

The maximum sampling rate of 100MHz and the 10224-word memory make it possible to record a time interval

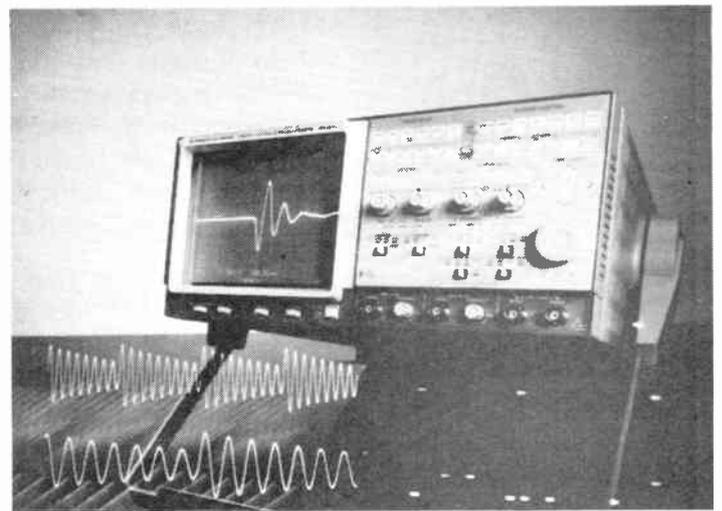
longer than 102 μ s; which is sufficient to record and analyse a complete video line. The input signals from both channels and stored signals can be added, subtracted, multiplied, integrated, differentiated and squared to give complex waveforms. The recording, calculation and display are repeatedly performed.

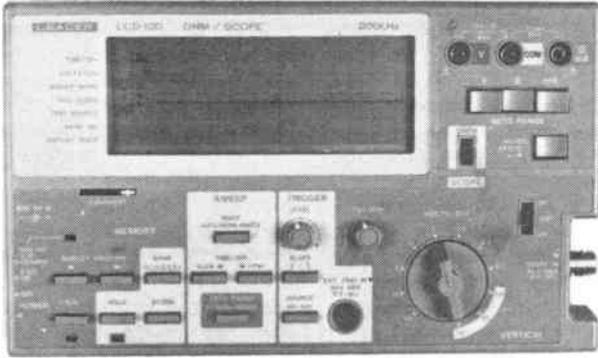
The BOS is fitted with a 7in CRT, which allows easy reading of signals. Essential setting parameters are tabulated on the screen, and two cursors aid trace evaluation. Relative voltage and time measurements between any two points on the trace, and absolute voltage measurements and time difference measurements from the trigger point are also possible. A recorded signal can be displayed as a sequence of dots and with either linear or sine interpolation.

*Rohde & Schwarz,
Mühldorfstrasse 15,
D-8000 München 80.
Tel: (0 89) 41 29 26 25.*

BATTERY PORTABLE OSCILLOSCOPE

Thandar Electronics Ltd have introduced a new combined battery portable digital storage oscilloscope and multimeter. Designated the LCD-100, the oscilloscope section incorporates a large





64 dot x 160 dot liquid crystal waveform display area. The vertical axis has 6 bits (64 point) resolution and a sensitivity of 10mV/div to 20V/div over 11 ranges in a 1-2-5 sequence. The horizontal axis has a resolution of 8 bits (256 points) and a sweep speed of 5µs/div to 20µs/div. The sweep mode provides automatic sweep, trigger sweep, single sweep and pre-trigger operation. Internal and external synchronisation facilities are provided, with positive and negative sweep.

Four memories are provided, with 256 words per memory, of which three are non volatile. The multimeter section utilises the LCD display to provide a large read-out of voltage, current and resistance. All modes are auto ranging.

The LCD-100 is compact in design with a size of 226(w) x 136(d) x 38(h). It comes complete with probes, a carrying strap and mains adaptor. At a price of only £595.00 + VAT it offers an ideal solution to field service and general portable applications.

*Thandar Electronics Limited,
London Road,
St Ives,
Huntingdon,
Cambs PE18 4HJ
Tel: (0480) 64646.*



FUNCTION GENERATOR

A new 2MHz function generator manufactured by Black Star Ltd offers the user features not previously available from a low cost general purpose instrument. The Jupiter 2000 has a frequency range of 0.02Hz to 2MHz. The frequencies are in seven overlapping ranges, with fine frequency control by a calibrated vernier control. Versatility is enhanced by the three position attenuator and two main outputs.

The attenuator gives attenuation ratios of 0dB, -20dB and -40dB from both 50Ω and 600Ω outputs with a maximum output amplitude of 20Vpp. The -40dB attenuator allows mV output levels to be set. In addition to the three main functions, sine, square and triangle waves, the Jupiter 2000 has a symmetry control, variable dc offset and TTL output.

The symmetry control allows pulse, ramp, and slewed sine waves to be generated. The TTL output is capable of driving more than 20 standard loads. Output level flatness is ±0.2dB up to 200kHz, sinewave distortion is less than 1% and squarewave rise times are better than 80ns. An external sweep input with a sweep ratio greater than 1000:1 permits frequency

modulation of the output waveforms.

The Jupiter 2000 is housed in a compact, durable plastic case and has been designed for a wide range of applications in industry and education. The recommended retail price is £149 + VAT.

*Black Star Limited,
4 Harding Way,
St Ives,
Huntingdon,
Cambs PE17 4WR.
Tel: (0480) 62440.*

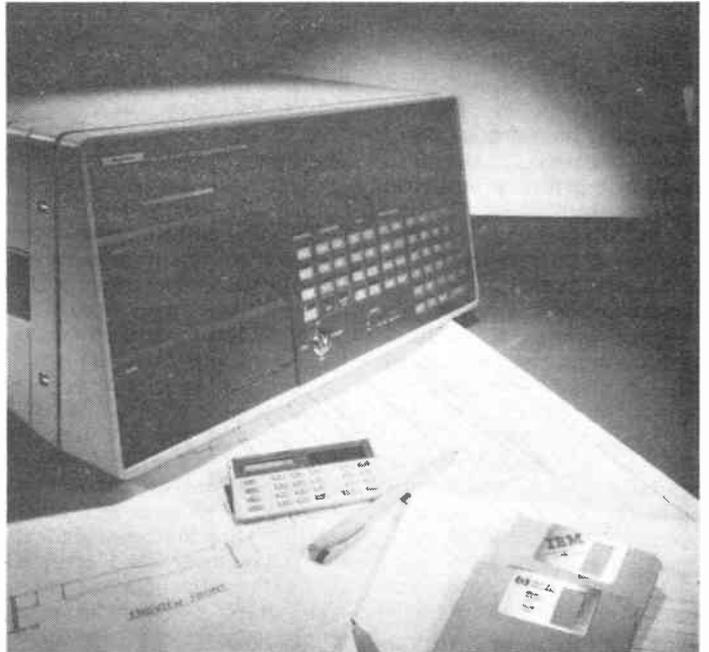
DIGITAL THERMOMETER

Electronic Temperature Instruments Ltd recently introduced the latest addition

to their range of digital thermometers. The new Therma D40 range of panel instruments covers both the measurement and control of temperature in a trio of high accuracy din size indicators.

The D40 series measurement units display temperature between -50°C to +1150°C with a resolution and accuracy of 1°C. Both digital instruments have an analogue output of 1mV per 1°C for chart recorders or ancillary control equipment.

*ETI Limited,
PO Box 81,
Worthing,
West Sussex BN13 3PW.
Tel: (0903) 202151.*



DATALOGGER

In response to market demand Schlumberger Instruments has upgraded its industry-standard Solartron Orion series data loggers, introducing a new data storage medium to improve logging speed and transportability of results.

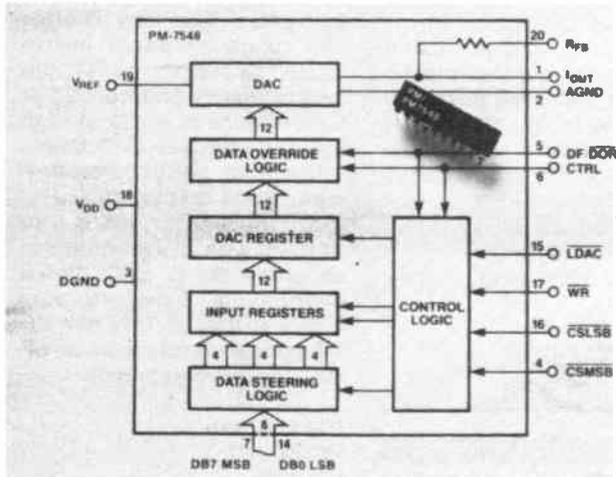
A whole range of benefits are derived from replacing Orion's magnetic cartridge system by a 3½in disk unit. By its very nature faster than tape, the new storage medium allows the data capture capability of the Orion to be fully exploited for the first time.

An improvement of 33% means that results can now be

logged to disk at a speed of 200 readings per second.

In addition, the 3½in disk is a transportable medium supporting both MSDOS and HPLIF, allowing direct transfer of Orion data written in ASCII to the vast majority of computers supporting the medium, and enhancing Orion's suitability for remote site applications. A further benefit that accrues from adoption of disk storage is its capability to record and replay simultaneously.

*Schlumberger Instruments,
Victoria Road,
Farnborough,
Hants GU14 7PW.
Tel: (0252) 544433.*



12-BIT MULTIPLYING CMOS

Now available from RR Electronics is the PM7548 DAC by Precision Monolithics Inc (PMI). The chip is a 12-bit multiplying CMOS DAC, claimed to be an improved second-source to the industry standard AD7548. It offers a versatile interface to 8-bit microprocessors with better accuracy and faster digital timing, at less cost.

The PM7548 comes in two electrical grades in the standard commercial, industrial and military temperature ranges, including a MIL883 processed version.

It has a flexible digital interface, giving 12-bit analogue accuracy to 8-bit microprocessor-controlled systems. It accepts 8-bit data bytes in left or right-justified user-selectable data format. This simplifies data formatting with different microprocessors.

Once loaded in the input register, this data can be kept there or used to update the DAC output immediately. A data override function allows an 'all zeros' or 'all ones' code to be loaded into DAC for calibration routines. This does not alter the contents of the DAC's other registers and is always available under software control.

The chip's better processor interface timing minimises the number of wait states. These timing characteristics are specified across the allowable supply voltage and temperature range.

RR Electronics Ltd,
St Martin's Way,

Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.

PCB DESIGNER

Radio and Electronics World magazine is pleased to announce a new facility for owners of the Amstrad CPC range of computers. Tony Dean, who will be familiar to readers as the author of many useful and informative articles in this magazine, has produced a new and powerful PCB designer program marketed through Cadsoft Systems.

In view of the success of this program's predecessor, which was described in the December '86 issue of *R&EW*, we feel sure that readers will be most interested in the sophisticated, updated system which Cadsoft is now producing.

At only £17.99 for a tape or £19.99 for the disc version, this program can be obtained directly from Cadsoft at the address below, and cheques should be made out to the company name.

Cadsoft Systems,
18 Ley Crescent,
Tyldesley,
Manchester M29 7BD.
Tel: (0942) 870376.

RUBBER KEYBOARD

A choice of QWERTY and hexadecimal rubber keyboards, with from 25 to 58 keys, is now available from ECW (Electronic and Computer Workshop Ltd). The keyboards can be supplied with PCB and rubber mat

backings and with both grey and black finishes, to fit most applications. Overall size for the smallest keyboard, the 25 key hex model, is just 53.5 x 40.2 x 3.5mm. This provides the numerals, hex letters and a range of additional keys, including control, shift, space, delete and return. The largest has a standard typewriter keyboard layout with a full-width space bar, two shift keys and eight function keys.

The basic keyboard units can be supplied with metal housings of various types and also with a single-chip controller device, the DTC-930, which gives a choice of parallel or serial interfaces.

Electronic & Computer
Workshop Ltd,
Unit 1, Cromwell Centre,
Stepfield,
Witham,
Essex CM8 3TH.
Tel: (0376) 517413.

BUBBLE JET PRINTER

Canon's unique bubble jet printing technology is taking a step further with the launch of the BJ130 - a fast, near-silent printer offering laser printer quality output on plain paper at a much lower cost.

Available in February at £795 recommended retail price, the BJ130 is a versatile machine capable of printing up to spreadsheet width in two modes - high speed at 220 characters per second and high quality at 110cps.

Resolution is 360dpi for letter quality printout of 36 (H)

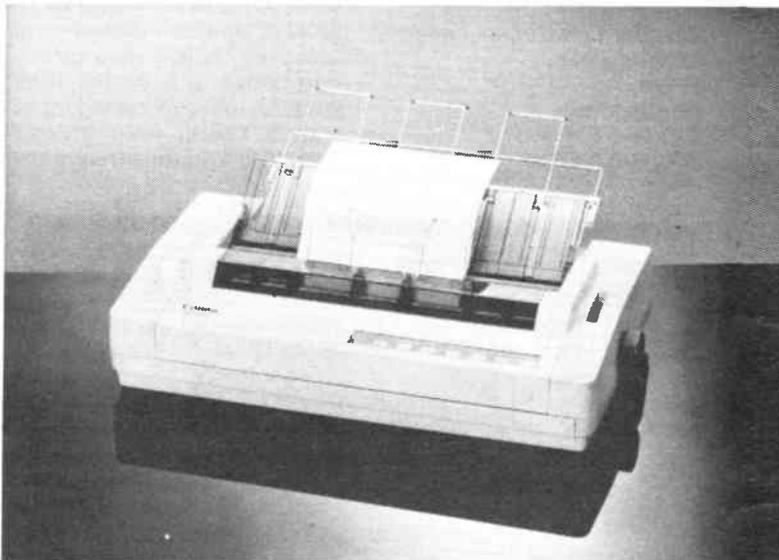
x 48 (V) dots. Compatible with both 9-pin and 24-pin dot matrix machines, the new printer is also capable of high resolution graphics at 360dpi.

The built-in character font is Courier with a choice of 7 pitches, and two additional slots for optional font packs enable printing in a wide choice of typefaces and sizes. Plain paper printing is possible due to a new Canon formulated ink developed especially for the BJ130. Each 40cc disposable cartridge contains enough for approximately 1 million characters in high quality mode, and the compact 48-nozzle print head has a life of 100 million characters (200 million in high speed draft mode).

Canon's bubble jet process operates on different principles from conventional inkjet printers, which use piezoelectric elements for ink droplet formation and ejection, thus restricting speed and increasing noise levels.

As the name suggests, the new system ejects ink by means of thermally generated bubbles. Heat is generated by applying power to minute heating elements built into each nozzle.

Each power pulse serves a twofold purpose. When the pulse is applied, the resulting heat vaporises the neighbouring ink almost instantly. The resulting bubble generates a pressure wave that ejects a drop of ink from the nozzle. Negative pressure is produced as the bubble contracts after the



pulse ends, and this draws fresh ink into the nozzle.

*Canon (UK) Ltd,
Canon House,
Manor Road,
Wallington,
Surrey SM6 0AJ.
Tel: 01-773 3173.*

HEAD REPLACEMENT

Replacement heads for a wide variety of popular matrix printers are now available with a fast order turnaround service from Leeway Data Products. Aimed at third-party maintenance companies and end-users, the print head service includes both re-manufacture to restore defective parts to 'as-new' condition, and the supply of new Matrix Print heads. Leeway also operates a trade-in scheme to give additional price advantages.

All re-manufactured heads have the extra benefit of sapphire nose pieces for extended life. With immediate effect, the service covers the popular Texas TI810, Epson FX100 and FX80 print head, but Leeway is currently busy extending this to cover all popular makes and types of matrix printer.

*Leeway Data Products,
Headway House,
Christy Estate,
Ivy Road,
Aldershot,
Hants GU12 4TX.
Tel: (0252) 333575.*

GRAPHICS DESIGN KIT

Everything that the designer needs for designing a bit-mapped graphics system based on the Texas Instruments TMS34010 video system controller chip, is now available from Online Distribution.

The graphics design kit includes a TMS34010 graphics system processor (GSP) plus socket, TMS34070 colour palette, assembler/linker/simulator package, sample function library, GSP and palette user guides, assembly language user guide, software development board user guide, schematics and application reports.

The TMS34010 can be used with business computers,

CAD/CAM terminals, printers/plotters, instruments, work stations, bit-mapped terminals and imaging systems.

*Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 217915.*

CMOS A/D CONVERTER FAMILY

A new single-chip CMOS analogue-to-digital converter family from VSI Electronics offers 10-bit resolution. Designed for use in data acquisition, digital audio, digital modem and microprocessor control applications, the RCA CA3310/3310A series incorporates a capacitive ladder design which provides a built-in track-and-hold function.

The time constant of the track-and-hold circuit is typically 100ns, enabling sampling and conversion to be achieved without the need for stabilising the analogue input signal during the conversion process.

The binary-weighted ladder performs a successive approximation function employing a capacitor charge balancing technique.

Operating from a single supply rail of 3 to 6 volts, the CA3310/3310A can handle input voltages spanning full rail-to-rail excursions. Typical current consumption is 3mA at 5 volts.

The two models in the family are characterised by linearities of ± 0.75 LSB (CA3310) and ± 0.5 LSB (CA3310A) at 13 μ s conversion time (1MHz clock).

Provision is made for internal or external clock operation. Output data lines can drive up to fifteen LSTTL loads.

Supplied in 24-pin DIL ceramic or plastic packages, the family has an operating temperature range of -55° to $+125^{\circ}$ C or -40° to $+85^{\circ}$ C respectively.

*VSI Electronics (UK) Ltd,
Roydonbury Industrial Park,
Horsecroft Road,
Harlow,
Essex CM19 5BY.
Tel: (0279) 29666.*



COMPUTER CABLES

Data Spec UK Ltd is a recently formed subsidiary of Data Spec Inc, the American parent company.

In the US, Data Spec is the largest of all the suppliers of high quality computer cables. Now their range is available in the UK at very competitive prices. As well as cables for printers, monitors and keyboards, Data Spec Inc also manufacture switch boxes, gender changers and computer care products such as disk drive cleaning kits.

Data Spec cables offer features such as full shielding, exceeding the FCC EMI/RFI emission requirements, positive strain relief for ample support, gold plated pins, large, convenient thumb screws and a lifetime warranty.

Each conductor is individually soldered, not crimped, for increased reliability. After soldering, the connections are tested under heavy current. The cable assembly is then shrouded with PDT (Polyvinyl Doping Technique). This industry-exclusive process of using a polyvinyl mold to fuse together the conductors, ensures strength and durability under adverse conditions. This process also prevents oxygen, pollutants and vibration from attacking the soldered joints and weakening the connections. Data Spec is the first manufacturer to use this process outside aerospace applications.

A specially formed metal shield is placed over the PDT mould to provide continuous

shielding from end to end, so cables exceed the FCC requirements for EMI/RFI emission standards. Custom cables can be manufactured to any specification.

*Data Spec (UK) Ltd,
22 Cheddars Lane,
Cambridge CB5 8LD.
Tel: (0223) 60857.*

COLOUR MONITORS

Following on the success of their 13 inch Vari-Scan Colour Monitors, Electrohome have just announced a 19 inch high-resolution version.

These monitors will automatically lock on to signals from 15 to 34kHz horizontal and 45 to 86Hz vertical and are therefore compatible with all the IBM graphics standards: PS/2 (APA modes 1-5), CGA, EGA and PGA. Resolution is 1,024 x 512 non-interlaced or 1,024 x 800 interlaced. An input selection switch allows the monitor to be used with analogue RGB or TTL signals.

There are three models in the range which differ only in the type of tube fitted: ECM 1910: tinted, anti-glare short persistence; ECM 1911: tinted, anti-glare long persistence and the ECM 1912: clear, polished, long persistence.

Picture size setting and centering is performed automatically and power consumption is typically 120W.

*Electrohome Ltd,
7 Civic Way,
South Wirral,
Ellesmere Port,
Cheshire L65 0AX.
Tel: (051) 356 1365.*



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AN260	2.95	LM3801	1.50	SN76226DN		TA8570	1.95	TD A1001	2.95	UPC575C2	2.75
AN262	1.95	LM3808N	2.95	SN76227N	1.05	TA8621	3.95	TD A1003A		UPC10001H	
AN264	2.50	LM3837	2.95	SN76228N	2.95	TA861B	1.95	TD A1006A		UPC1020H	1.95
AN271	3.50	LM3900	3.50	SN76533N	1.65	TA8700	1.70	TD A1010	2.15	UPC1024H	2.95
AN273	2.95	LM1011	3.15	SN76650N	0.80	TA8720A	1.95	TD A1005	2.25	UPC1024H	1.80
AN303	3.50	M5155L	2.95	SN76660N	1.95	TA8720A/B/C		TD A1035	2.50	UPC1025H	1.80
AN313	2.95	M5153L	2.30	STK011	7.95	TA8720A/B/C	1.00	TD A1044	2.15	UPC1028H	1.95
AN315	2.25	M51521L	1.50	STK014	7.95	SA/SB/T/U		TD A1074	1.95	UPC1028H	1.95
AN316	3.95	MB3705	1.50	STK015	5.95	TBA221	1.30	TD A1104	2.15	UPC1032H	1.50
AN331	3.95	MB3712	2.00	STK018	7.95	TBA395	1.50	TD A1180	1.15		
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AN7151	2.50	MC1351P	1.75	STK439	7.95	TBA530O	1.10	TD A1200			
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HA1156W	1.50	MSM5807	8.75	TA7130P	1.50	TBA800	0.85	TD A1200			
HA1306	1.95	MSM5807	8.75	TA7137P	1.00	TBA810AS	1.95	TD A1200			
HA1322	1.50	SAA500A	3.50	TA7146P	1.50	TBA810P	1.65	TD A1200			
HA1339A	2.75	SAA1025	7.25	TA7173P	3.95	TBA820M	0.75	TD A1200			
HA1377	3.50	SAA1251	4.95	TA7203	2.95	TBA820Q	1.45	TD A1200			
HA1406	1.95	SAA5010	9.35	TA7204P	2.18	TBA890	2.50	TD A1200			
HA1551	2.95	SAB3210	3.50	TA7205AP	1.15	TBA920	1.45	TD A1200			
LA1201	0.95	SAB3210	3.50	TA7208	1.95	TBA950/2X	2.35	TD A1200			
LA1230	1.95	SAS5708	1.75	TA7222AP	1.90	TBA990	1.49	TD A1200			
LA3201	0.95	SAS580	2.85	TA7227P	4.25	TBA990Q	1.49	TD A1200			
LA4101	0.95	SAS590	2.75	TA7228P	1.95	TBA990Q	1.49	TD A1200			
LA4102	2.95	SL901B	7.95	TA7310P	1.80	TC A270	1.50	TD A1200			
LA4130	1.95	SL917B	6.85	TA7313AP	2.95	TC A270SQ	1.50	TD A1200			
LA4400	3.50	SL1310	1.80	TA7321P	2.95	TC A650	2.50	TD A1200			
LA4420	2.50	SL1327	1.10								

SEMICONDUCTORS

AA121	0.25	BC182B	0.10	BD237	0.40	BF493	0.35	MRF453	17.50	TV106	1.50
AC126	0.45	BC183	0.10	BD242	0.65	BF595	0.25	MRF454	26.50	TV106/2	1.50
AC127	0.20	BC183L	0.09	BD246	0.75	BF597	0.25	MRF455	17.50	ZRF0112	16.50
AC128	0.26	BC184LB	0.09	BD376	0.32	BF739	0.23	MRF475	2.95	2N1100	6.50
AC128K	0.32	BC204	0.25	BD379	0.45	BF840	0.23	MRF477	14.95	2N1308	1.35
AC141	0.28	BC207B	0.25	BD410	0.65	BF881	0.25	OC16W	2.50	2N1711	0.30
AC141K	0.34	BC208B	0.20	BD434	0.65	BF888	0.45	OC25	1.50	2N2626	0.55
AC142K	0.45	BC212	0.15	BD536	0.45	BF903	0.40	OC25	1.50	2N2905	0.40
AC176	0.25	BC24L	0.09	BD437	0.78	BF991	1.75	OC26	1.50	2N3053	0.40
AC176K	0.31	BC213	0.09	BD438	0.75	BF742	0.35	OC28	5.50	2N3054	0.39
AC187	0.28	BC213L	0.09	BD510	0.95	BF743	0.35	OC29	4.50	2N3054	0.39
AC187K	0.28	BC214	0.09	BD518	0.75	BF740	0.55	OC32	8.50	2N3055	0.52
AC188	0.25	BC214C	0.09	BD520	0.65	BF741	0.55	OC42	1.50	2N2702	0.12
AC188K	0.37	BC214L	0.09	BD534	0.45	BF742	1.50	OC44	1.25	2N2703	0.30
AD142	0.80	BC237B	0.15	BD535	0.45	BF743	1.50	OC45	1.00	2N3704	0.12
AD143	1.25	BC238	0.15	BD538	0.65	BF742	0.85	OC45	1.00	2N3705	0.20
AD149	0.70	BC239	0.15	BD575	0.95	BF742	0.30	OC71	0.75	2N3706	0.12
AD161	0.50	BC251A	0.15	BD587	0.95	BF744	0.26	OC72	2.50	2N3708	0.12
AD162	0.50	BC252A	0.18	BD588	0.95	BF745	0.32	OC75	1.50	2N3733	0.75
AF106	0.50	BC258	0.28	BD597	0.95	BF746	0.30	OC81	1.00	2N3773	2.50
AF114	1.95	BC258A	0.39	BD695	1.50	BF748	0.25	OC84	1.50	2N3792	1.35
AF121	0.60	BC284	0.30	BD698	1.50	BF748	1.35	OC89	1.95	2N4293	3.90
AF124	0.65	BC300	0.30	BD701	1.25	BF749	0.92	OC171	4.50	2N4293	3.90
AF125	0.65	BC302	0.28	BD702	1.25	BF751	0.32	OC200	4.50	2N4444	1.15
AF126	0.65	BC303	0.28	BD707	0.90	BF750	0.77	OC201	6.50	2N5294	0.42
AF127	0.65	BC307B	0.09	BDX32	1.50	BL448	1.75	OC205	10.00	2N5296	0.48
AF139	0.40	BC327	0.10	BDX53B	1.65	BR100	0.26	R20008B	1.45	2N5298	0.60
AF150	0.60	BC328	0.10	BF115	0.35	BR101	0.45	R2009	2.50	2N5485	0.85
AF178	1.95	BC337	0.10	BF119	0.85	BR103	0.85	R2010B	1.48	2N5485	0.85
AF239	0.42	BC338	0.09	BF127	0.39	BR104	0.95	R2322	0.58	2N5499	0.95
AY106	0.95	BC347A	0.13	BF129	0.39	BRC443	1.15	R2323	0.66	2N5499	0.95
AY102	2.95	BC461	0.35	BF177	0.38	BR339	4.45	R2540	2.48	2SC495	0.80
BC107A	0.11	BC478	0.20	BF160	0.27	BSW64	0.25	RCA16029	0.85	2SC496	0.80
BC107B	0.11	BC527	0.20	BF173	0.22	BSX60	1.95	RCA16039	0.85	2SC784	0.75
BC108	0.10	BC547	0.10	BF178	0.22	BT100A/02		RCA16181	0.85	2SC785	0.76
BC108B	0.12	BC548	0.10	BF178	0.26			RCA16334	0.90	2SC789	0.55
BC109	0.10	BC549A	0.10	BF179	0.34	BT106	1.49	RCA16335	0.85	2SC789	0.55
BC109B	0.12	BC550	0.14	BF180	0.29	BT116	1.20	RCA16572	0.85	2SC931D	0.95
BC109C	0.12	BC557	0.08	BF181	0.29	BT119	1.15	S2066D	0.95	2SC937	1.95
BC114A	0.09	BC558	0.10	BF182	0.29	BT120	1.65	SKESF	1.45	2SC1034	4.50
BC115	0.55	BC639/10	0.30	BF183	0.29	BU105	1.95	T6021V	0.45	2SC1096	0.80
BC116A	0.55	BCY33A	19.50	BF184	0.28	BU108	1.69	T6027V	0.48	2SC1122	0.95
BC116B	0.50	BD115	0.30	BF185	0.28	BU124	1.25	T6029V	0.45	2SC1162	0.98
BC117	0.19	BD124P	0.59	BF194	0.11	BU125	1.25	T9022V	0.55	2SC1172Y	2.15
BC119	0.24	BD131	0.42	BF195	0.11	BU204	1.55	T9023V	0.75	2SC1207	2.95
BC125	0.25	BD132	0.42	BF197	0.11	BU205	1.30	T9045V	2.15	2SC1364	0.50
BC139BC	0.20	BD133	0.40	BF198	0.14	BU208	1.39	T9047V	2.15	2SC1413A	2.50
BC140	0.30	BD135	0.30	BF199	0.14	BU208A	1.52	T9038V	3.95	2SC1449	0.50
BC141	0.25	BD136	0.30	BF200	0.40	BU208B	1.85	THY15/80	2.25	2SC1628	0.75
BC142	0.21	BD137	0.32	BF201	0.15	BU209	1.20	THY15/85	2.25	2SC1678	1.50
BC143	0.24	BD138	0.30	BF245	0.30	BU225	1.00	TIP22C	0.42	2SC1945	0.50
BC147B	0.12	BD139	0.32	BF256L	0.35	BU225	1.00	TIP22C	0.42	2SC1953	0.95
BC148A	0.09	BD140	0.30	BF257	0.25	BU225	1.00	TIP22C	0.42	2SC1957	0.95
BC148B	0.09	BD141	0.30	BF257	0.25	BU225	1.00	TIP22C	0.42	2SC1959	1.95
BC149	0.12	BD150C	0.28	BF259	0.28	BU250	2.25	TIP31C	0.53	2SC1969	1.95
BC153	0.30	BD155	0.85	BF271	0.28	BU508A	1.95	TIP32C	0.42	2SC1985	1.50
BC157	0.12	BD160	0.15	BF271	0.26	BU526	1.90	TIP33C	0.95	2SC2028	1.15
BC159	0.09	BD166	0.95	BF273	0.18	BU807	2.25	TIP34B	0.98	2SC	



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DL70 2.50	ECL86 0.98	HBC91 1.08
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DL91 3.95	EF22 3.50	HF94 1.95
DL92 1.25	EF37A 2.80	HK90 1.95
DL93 1.10	EF39 1.50	HL41 3.50
DL94 2.50	EF40 4.80	HL90 3.50
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DL10 13.50	EF50 2.50	HL13DD 3.50
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DM70 2.50	EF55 4.95	KT33C 3.50
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E800C 19.80	EF86 Mullard	KT66 9.95
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E80F 16.50	EF89 1.50	KT66 Sp 17.50
E80L 25.50	EF91 1.50	KT66 Sp 17.50
E81CC 5.50	EF92 2.15	KT66 Sp 17.50
E81L 12.00	EF93 1.50	KT66 Sp 17.50
E82CC 4.50	EF94 1.50	KT66 Sp 17.50
E83CC 4.50	EF95 1.95	KT77 Gold Ion
E83F 5.50	EF97 1.50	KT77 10.95
E86C 9.50	EF98 0.95	KT78 USA 7.00
E88C 7.95	EF183 0.65	KT88 USA 10.95
E88CC 3.50	EF184 0.65	KT88
E88CC-01	EF731 4.50	KT88
Mullard 9.95	EF100 11.00	KT88
E90C 9.50	EF904S 19.90	KT88 Gold Ion
E90F 7.95	EF905 25.00	KT88 Gold Ion
E91H 4.50	EF906S 25.00	KT88 Gold Ion
E92CC 3.95	EF912 0.65	KTW61 2.50
E99F 0.99	EF1200 1.50	KTW62 2.50
E130L 18.80	EF960 3.50	KTW63 2.50
E180CC 18.80	EF960 3.50	KTW63 2.50
E180F 6.80	EF960 3.50	KTW63 2.50
E182CC 9.00	EL32 0.95	LS9B 6.95
E186F 8.50	EL33 0.95	M508 195.00
E188CC 7.50	EL34 2.50	M5143 155.00
E235L 12.50	EL34 Mullard/	M5199 295.00
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E288CC 17.50	EL36 Mullard	M8083 3.25
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E179 1.95	EL44 6.95	M8137 7.00
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E894 1.95	EL88 1.75	M8224 2.00
E895 1.95	EL89 1.75	M8225 3.95
E896 1.95	EL90 1.75	M8226 3.95
E897 1.95	EL91 1.75	M8227 3.95
E898 1.95	EL92 1.75	M8228 3.95
E899 1.95	EL93 1.75	M8229 3.95
E900 1.95	EL94 1.75	M8230 3.95
E901 1.95	EL95 1.75	M8231 3.95
E902 1.95	EL96 1.75	M8232 3.95
E903 1.95	EL97 1.75	M8233 3.95
E904 1.95	EL98 1.75	M8234 3.95
E905 1.95	EL99 1.75	M8235 3.95
E906 1.95	EL00 1.75	M8236 3.95
E907 1.95	EL01 1.75	M8237 3.95
E908 1.95	EL02 1.75	M8238 3.95
E909 1.95	EL03 1.75	M8239 3.95
E910 1.95	EL04 1.75	M8240 3.95
E911 1.95	EL05 1.75	M8241 3.95
E912 1.95	EL06 1.75	M8242 3.95
E913 1.95	EL07 1.75	M8243 3.95
E914 1.95	EL08 1.75	M8244 3.95
E915 1.95	EL09 1.75	M8245 3.95
E916 1.95	EL10 1.75	M8246 3.95
E917 1.95	EL11 1.75	M8247 3.95
E918 1.95	EL12 1.75	M8248 3.95
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E923 1.95	EL17 1.75	M8253 3.95
E924 1.95	EL18 1.75	M8254 3.95
E925 1.95	EL19 1.75	M8255 3.95
E926 1.95	EL20 1.75	M8256 3.95
E927 1.95	EL21 1.75	M8257 3.95
E928 1.95	EL22 1.75	M8258 3.95
E929 1.95	EL23 1.75	M8259 3.95
E930 1.95	EL24 1.75	M8260 3.95
E931 1.95	EL25 1.75	M8261 3.95
E932 1.95	EL26 1.75	M8262 3.95
E933 1.95	EL27 1.75	M8263 3.95
E934 1.95	EL28 1.75	M8264 3.95
E935 1.95	EL29 1.75	M8265 3.95
E936 1.95	EL30 1.75	M8266 3.95
E937 1.95	EL31 1.75	M8267 3.95
E938 1.95	EL32 1.75	M8268 3.95
E939 1.95	EL33 1.75	M8269 3.95
E940 1.95	EL34 1.75	M8270 3.95
E941 1.95	EL35 1.75	M8271 3.95
E942 1.95	EL36 1.75	M8272 3.95
E943 1.95	EL37 1.75	M8273 3.95
E944 1.95	EL38 1.75	M8274 3.95
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E946 1.95	EL40 1.75	M8276 3.95
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E949 1.95	EL43 1.75	M8279 3.95
E950 1.95	EL44 1.75	M8280 3.95
E951 1.95	EL45 1.75	M8281 3.95
E952 1.95	EL46 1.75	M8282 3.95
E953 1.95	EL47 1.75	M8283 3.95
E954 1.95	EL48 1.75	M8284 3.95
E955 1.95	EL49 1.75	M8285 3.95
E956 1.95	EL50 1.75	M8286 3.95
E957 1.95	EL51 1.75	M8287 3.95
E958 1.95	EL52 1.75	M8288 3.95
E959 1.95	EL53 1.75	M8289 3.95
E960 1.95	EL54 1.75	M8290 3.95
E961 1.95	EL55 1.75	M8291 3.95
E962 1.95	EL56 1.75	M8292 3.95
E963 1.95	EL57 1.75	M8293 3.95
E964 1.95	EL58 1.75	M8294 3.95
E965 1.95	EL59 1.75	M8295 3.95
E966 1.95	EL60 1.75	M8296 3.95
E967 1.95	EL61 1.75	M8297 3.95
E968 1.95	EL62 1.75	M8298 3.95
E969 1.95	EL63 1.75	M8299 3.95
E970 1.95	EL64 1.75	M8300 3.95
E971 1.95	EL65 1.75	M8301 3.95
E972 1.95	EL66 1.75	M8302 3.95
E973 1.95	EL67 1.75	M8303 3.95
E974 1.95	EL68 1.75	M8304 3.95
E975 1.95	EL69 1.75	M8305 3.95
E976 1.95	EL70 1.75	M8306 3.95
E977 1.95	EL71 1.75	M8307 3.95
E978 1.95	EL72 1.75	M8308 3.95
E979 1.95	EL73 1.75	M8309 3.95
E980 1.95	EL74 1.75	M8310 3.95
E981 1.95	EL75 1.75	M8311 3.95
E982 1.95	EL76 1.75	M8312 3.95
E983 1.95	EL77 1.75	M8313 3.95
E984 1.95	EL78 1.75	M8314 3.95
E985 1.95	EL79 1.75	M8315 3.95
E986 1.95	EL80 1.75	M8316 3.95
E987 1.95	EL81 1.75	M8317 3.95
E988 1.95	EL82 1.75	M8318 3.95
E989 1.95	EL83 1.75	M8319 3.95
E990 1.95	EL84 1.75	M8320 3.95
E991 1.95	EL85 1.75	M8321 3.95
E992 1.95	EL86 1.75	M8322 3.95
E993 1.95	EL87 1.75	M8323 3.95
E994 1.95	EL88 1.75	M8324 3.95
E995 1.95	EL89 1.75	M8325 3.95
E996 1.95	EL90 1.75	M8326 3.95
E997 1.95	EL91 1.75	M8327 3.95
E998 1.95	EL92 1.75	M8328 3.95
E999 1.95	EL93 1.75	M8329 3.95
E1000 1.95	EL94 1.75	M8330 3.95

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PC90 1.25	RPY43 2.50	X41 5.00
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PC95 0.50	RPY82 2.50	X76M 1.95
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PCF82 0.65	S104/1K 10.00	XN172 1.50
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PCF87 1.25	S130P 5.95	XRI-1600A 48.50
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PCF201 1.80	SC1/1300 6.00	Y5 8.95
PCF201 1.80	SC1/1400 6.00	YD100 75.00
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PCF802 0.85	SP1 3.50	YJ1060 265.00
PCF805 1.25	SP11 5.00	YJ1060 195.00
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PCL86 0.85	TB2-300 195.00	ZA1001 12.00
PCL87 0.85	TB3-750 95.00	ZM1005 8.00
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PCL90 0.85	TB3-2000 12.00	ZM1022 6.00
PCL91 0.85	TB3-750 95.00	ZM1023 6.00
PCL92 0.85	TB3-2000 12.00	ZM1024 6.00
PCL93 0.85	TB3-750 95.00	ZM1025 6.00
PCL94 0.85	TB3-2000 12.00	ZM1026 6.00
PCL95 0.85	TB3-750 95.00	ZM1027 6.00
PCL96 0.85	TB3-2000 12.00	ZM1028 6.00
PCL97 0.85	TB3-750 95.00	ZM1029 6.00
PCL98 0.85	TB3-2000 12.00	ZM1030 6.00
PCL99 0.85	TB3-750 95.00	ZM1031 6.00
PCL00 0.85	TB3-2000 12.00	ZM1032 6.00
PCL01 0.85	TB3-750 95.00	ZM1033 6.00
PCL02 0.85	TB3-2000 12.00	ZM1034 6.00
PCL03 0.85	TB3-750 95.00	ZM1035 6.00
PCL04 0.85	TB3-2000 12.00	ZM1036 6.00
PCL05 0.85	TB3-750 95.00	ZM1037 6.00
PCL06 0.85	TB3-2000 12.00	ZM1038 6.00
PCL07 0.85	TB3-750 95.00	ZM1039 6.00
PCL08 0.85	TB3-2000 12.00	ZM1040 6.00
PCL09 0.85	TB3-750 95.00	ZM1041 6.00
PCL10 0.85	TB3-2000 12.00	ZM1042 6.00
PCL11 0.85	TB3-750 95.00	ZM1043 6.00
PCL12 0.85	TB3-2000 12.00	ZM1044 6.00
PCL13 0.85	TB3-750 95.00	ZM1045 6.00
PCL14 0.85	TB3-2000 12.00	ZM1046 6.00
PCL15 0.85	TB3-750 95.00	ZM1047 6.00
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PCL17 0.85	TB3-750 95.00	ZM1049 6.00
PCL18 0.85	TB3-2000 12.00	ZM1050 6.00
PCL19 0.85	TB3-750 95.00	ZM1051 6.00
PCL20 0.85	TB3-2000 12.00	ZM1052 6.00
PCL21 0.85	TB3-750 95.00	ZM1053 6.00
PCL22 0.85	TB3-2000 12.00	ZM1054 6.00
PCL23 0.85	TB3-750 95.00	ZM1055 6.00
PCL24 0.85	TB3-2000 12.00	ZM1056 6.00
PCL25 0.85	TB3-750 95.00	ZM1057 6.00
PCL26 0.85	TB3-2000 12.00	ZM1058 6.00
PCL27 0.85	TB3-750 95.00	ZM1059 6.00
PCL28 0.85	TB3-2000 12.00	ZM1060 6.00
PCL29 0.85	TB3-750 95.00	ZM1061 6.00
PCL30 0.85	TB3-2000 12.00	ZM1062 6.00
PCL31 0.85	TB3-750 95.00	ZM1063 6.00
PCL32 0.85	TB3-2000 12.00	ZM1064 6.00
PCL33 0.85	TB3-750 95.00	ZM1065 6.00
PCL34 0.85	TB3-2000 12.00	ZM1066 6.00
PCL35 0.85	TB3-750 95.00	ZM1067 6.00
PCL36 0.85	TB3-2000 12.00	ZM1068 6.00
PCL37 0.85	TB3-750 95.00	ZM1069 6.00
PCL38 0.85	TB3-2000 12.00	ZM1070 6.00
PCL39 0.85	TB3-750 95.00	ZM1071 6.00

PRODUCT NEWS

ARCHIMEDES PODULE

Wild Vision's latest podule for the Acorn Archimedes is called The Chromalock. This is a low cost genlock and full colour video overlay system which allows the high-quality graphics of the Archimedes computer to be superimposed onto a video picture.

The Chromalock is ideal for use in making video productions. Captions, titles, animation, etc can be overlaid onto the video picture during editing – or may be superimposed in real time onto the signal from the camera.

Interactive video systems can also use the Chromalock to display computer graphics over the pictures from a video disc player. With the Chromalock, a normal PAL composite video monitor can be used instead of the special monitors normally required in interactive video systems.

In scientific and industrial video applications the Chromalock can be used to add information such as time and ambient conditions to video recordings. It also provides a simple way of making on-screen measurements with the aid of the computer.

The Chromalock has a very stable genlock circuit with fast response time, enabling it to lock on to any reasonably stable PAL/CCIR standard video signal. Its state of the art design means it will lock to the output of most domestic VCRs without the noise problems associated with some designs. The Chromalock also encodes the computer's RGB output into a PAL signal, with wideband full fidelity colour encoding.

In addition to the Archimedes Podule, the Chromalock is also available in PCB form for fitting into the Acorn Master 128 and Model B or B+ computers.

*Wild Vision,
6 Jesmond Road,
Newcastle upon Tyne,
NE2 4PQ.
Tel: (091) 281 8481.*

DX-TV CONVERTER

An upgraded version of the D-100 DX-TV Converter System has recently been announced by the distributors, HS Publications of Derby. The D-100, used by long-distance TV enthusiasts throughout the world, enables VHF and UHF reception of foreign TV signals on a standard UHF television receiver. Also, off-screen reception can be conveniently recorded using a normal video recorder.

Designated the Special D-100, the new version is capable of multi-system sound reception and will resolve any of the four FM intercarrier systems, namely 4.5MHz (USA), 5.5MHz (W Europe, Africa and the Middle East), 6.0MHz (UK and Eire) and 6.5MHz (Russia and Eastern-bloc countries). It may also be used to monitor the Eastern-bloc FM band which lies within Band I, and Italian radio station links.

Capable of DX reception at VHF (Bands I and III) and UHF (Bands IV and V), the new version will also tune into specially assigned channels in Band II which are located just above Band I. This allows

the reception of extra Eastern-bloc transmitters and countries such as Albania.

The D-100 simply plugs into a normal UHF TV receiver for monitoring the vision and connects to the telescopic aerial of an FM radio for the sound channel. No internal modifications are necessary.

The price, including carriage in the UK, is £89.99 and the unit comes complete with full operating instructions. A version without the sound take-off is available at £77.99, including carriage. This also features switched IF bandwidths. Sound reception via the TV is possible provided that it is capable of resolving the appropriate standard.

Further details about the D-100 systems, plus information about other DX-TV products, are available by sending an SAE or, for readers overseas, one IRC.

*HS Publications,
7 Epping Close,
Derby DE3 4HR.
Tel: (0332) 38 16 99.*

HOT GAS REWORK

NEW from Oryx is a unique hot gas rework station, the SMR1, which has been developed to offer the engineer a simple and inexpensive method of reworking surface mounted devices.

The unit consists of a bench station with pressure gauge and gas control, plus a safety stand for the tool. Working from any suitable standard butane gas supply (typically, a 185g canister), the unit will provide hot gas up to 230°C in

a controlled fine jet to enable the operator to concentrate heat into small areas.

Used in conjunction with the Oryx electronic hotplate, it makes an ideal surface mount component repair kit, at a low cost.

*Greenwood Electronics,
28 Portman Road,
Reading RG3 1NE.
Tel: (0734) 595843.*

HAND-HELD CASES

Two electronic case ranges, designed exclusively for development and production of hand-held portables have been launched by West Hyde. The growing market for pocket sized, hand-held equipment has led to the development of two extremely versatile ranges from one of the UK's leading enclosures companies. Named TINOS and ELOS, these low-cost (from £1.44) cases are available in a total of nine different sizes.

The TINOS range have a textured finish on one side to provide a firmer grip, also a battery compartment for PP3 9V batteries and rounded corners throughout.

The ELOS, whilst being the more general purpose range, and without a battery compartment, carries as standard moulded pads to provide a base for a PCB and sub-chassis mounting.

*West Hyde
Developments Ltd,
9-10 Park Street Ind Est,
Aylesbury,
Bucks HP20 1ET.
Tel: (0296) 20441.*



EMI/RFI COVERS

A range of sophisticated EMI/RFI screened covers have been designed so as to ensure they offer an attractive and cost effective solution for constructing shielded cable harnesses.

The covers, complete with jackscrews, feature a new rapid assembly technique, thus reducing installation costs to a minimum and making them very cost effective to use. Two versions of the inner cover are available—one for braided cable (using a special crimp tool), the other suitable for braided or metal foil screened cable (screen termination by use of a special plastic grommet).

The plastic outer covers are made from UL approved material. Standard size covers accepting cable with an overall diameter of 4.5 to 11.2mm (depending on connector size) are available ex-stock. Covers to fit other sizes of cables are available on a short lead time.

*Greenwood Electronics,
28 Portman Road,
Reading,
Berks RG3 1NE
Tel: (0734) 595843.*

CARBON FILM RESISTORS

Now in stock at RR Electronics is the CFR range of quality carbon film resistors by Neohm. Performance conforms to DIN44051 and complies with CECC40100 and MIL-R-11.

The devices feature robust construction and uniform performance, and the baked-on colour coding resists sol-

vents and abrasion. There is excellent stability against changes in load and moisture; very low noise levels result in high reliability. The five ranges are all stocked on tape and banded in boxes.

Value ranges stocked are 2R2 to 1M for 1/8W in E24; 1R to 10M in E24 for 1/4W and 1/2W and E12 for 1.0W and 2.0W. The standard tolerance is 5 percent for the full range.

*RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.*

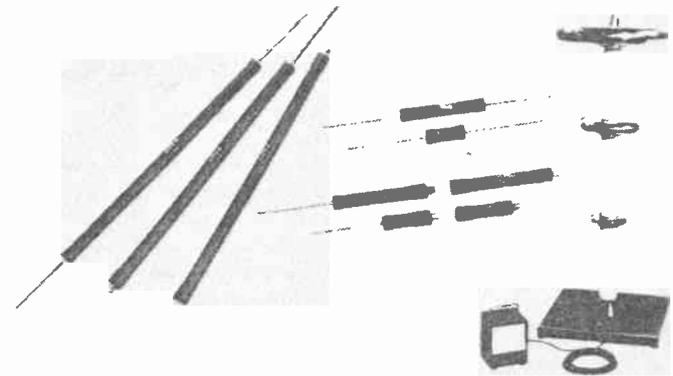
HIGH VOLTAGE RESISTORS

A precision high voltage resistor series that withstands 50kV dc voltage continuously in air and up to 100kV when immersed in oil is the latest innovation from the special Products Division of Welwyn Resistors.

The series, coded T40, comprises three types with resistance values in the ranges 1kohm to 4Gohm, 15Gohm and 45Gohm. Tolerances of plus or minus five, two and one per cent and temperature co-efficients of plus or minus 100, 50 or 25ppm/°C are available.

Based on a ruthenium oxide thick film deposited onto a high purity ceramic former, the T40 series has a protective sleeve to provide mechanical protection and electrical insulation. A typical application would be in the precision divider chain of high voltage measurement equipment.

Welwyn Special Products



offers a complete service for the design, prototyping and production of resistors for specific customer applications.

*Welwyn Resistors,
Bedlington,
Northumberland NE22 7AA.
Tel: (0670) 822181.*

package and operates from a supply voltage of 20V.

*Clere Electronics Ltd,
Kingsclere,
Newbury,
Berks RG15 8NL.
Tel: (0635) 298547.*

MULTILINGUAL CONTROLLERS

Two new LCD controllers from NEC are designed to eliminate the problems involved in generating multi-font character sets. They can handle all known character sets including European, Arabic, Cyrillic, Greek, Hebrew etc.

The controllers – μ PD7228, which generate the standard ASCII character set, and μ PD7229, with up to 160 user definable characters – can drive either 8 rows \times 50 columns or 16 rows \times 42 columns dot matrix displays and are fully compatible with each other.

Character set generation on μ PD7229 is simplified by an interactive software package for running under MS-DOS on PC compatible microcomputers.

Typical applications for these controllers would include passenger information displays at international airports where messages may be required to alternate between different languages and character sets.

*NEC Electronics (UK) Ltd,
Cygnus House,
Linford Wood
Business Centre,
Sunrise Park Way,
Linford Wood,
Milton Keynes MK14 6NP.
Tel: (0908) 691133.*

RESONANT MODE CONTROL

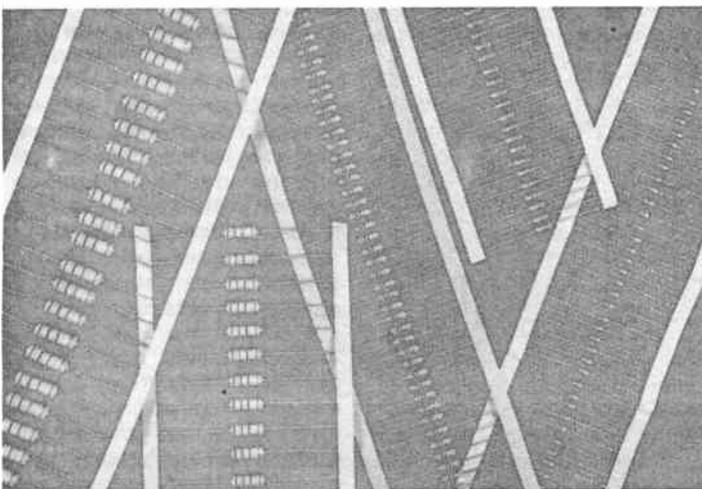
A new IC from Cherry Semiconductor, the CS3805 is designed for resonant mode power supply control applications. Various functions are included on the IC, which has two outputs operating in either a complementary or a single-ended mode.

In the complementary mode, the outputs are each capable of driving power MOSFETs directly.

Alternatively, a normally grounded pin can be opened to put the IC into single-ended operating mode. In this mode the frequency is doubled, and the two outputs are identical. The outputs can then be paralleled for increased drive capability. The operating frequency range is 300kHz to 1MHz in the single-ended mode, and 150kHz to 500kHz in complementary mode.

Functions on the IC include soft start, undervoltage/over-voltage, lockout, remote shutdown and overload shutdown with delayed start. All the shutdown modes are synchronous; the last output pulse is completed in each case. The IC then automatically defaults to soft start once the fault condition has been removed.

The CS3805 is supplied in a 16-pin dual-in-line plastic



NEWS DESK

Stabilized Satellite

Hughes Aircraft Company is to develop a new body-stabilized satellite – the HS601 (see photograph) – to meet high-power communications needs into the 21st Century. The first of the new line is expected to be ready for service by 1991.

Hughes Aircraft Company predicts an increase in satellite communication applications requiring spacecraft generation power levels as high as 6,000 watts, in both commercial and government markets. A medium-sized satellite of today generates about 1000 watts.

Such applications include broadcasting television programmes directly into homes through antennas 1 foot in diameter; two-way mobile communications to cars, trucks, trains and aircraft and private business communication networks through very small aperture terminals (VSAT).

The HS601 will benefit from proven concepts, such as large area solar cells, integral

propulsion using a liquid bi-propellant system, and high-performance nickel/hydrogen batteries capable of powering the satellite through eclipse operations, when its solar cells are blanketed by the Earth's shadow. The satellite will use flexible microprocessor-based control electronics and lightweight aluminium honeycomb and composite materials of construction.

While certain versions of the HS601 could measure 85 feet from tip to tip across the two solar arrays, the satellite will compact to a launch configuration approximately 8 feet square. It matches the envelope and load requirements of today's launch vehicles, including Titan, Atlas Container, Ariane, Long March and the Space Shuttle.

The HS601 body is composed of three modular structures. The primary structure carries all launch vehicle loads and contains the propulsion subsystem; a honeycomb shelf houses bus electronics and battery packs

and another honeycomb shelf holds the communications equipment and isothermal heat pipes. Antennas, antenna feeds and solar arrays are fitted directly to the primary structure.

Space Symposium

The AMSAT-NA Annual Meeting and Space Symposium was held in Southfield, Michigan, just north of Detroit. Awards for meritorious achievement are being presented to Doug Loughmiller KO5I, Al Brinckerhoff WB5PMR, Keith Pugh W5IU and Jack Crabtree AA0P for their outstanding Field Operations work. Tom Clark W3IWI, Bob McGwier N4HY and Dick Jansson WD4FAB, are receiving achievement awards for their outstanding work in engineering. Bob Diersing N5AHD, is receiving an award for his work in excellent work in publishing the AMSAT Technical Journal.

Craig Underwood from UoS attended the AMSAT-NA meeting and presented a paper on the UK Satellites In Education initiative based at Surrey, and its role in UoSAT.

Flying high

A low cost flight progress strip system (FPSS) which is expected to have a considerable effect on air traffic control procedures and chan-

ging practices across the world was announced today (Thursday, 19th November) in Kuala Lumpur, following a collaboration between the Malaysian Department of Civil Aviation; Computer Base (M) of Kuala Lumpur, and Marconi Radar of Chelmsford, England.

The FPSS system – which uses stored data on FIR (flight information region) routes and flight schedules – provides flight strip printing; calculation of air navigation charges to permit rapid invoicing, and traffic movement statistics.

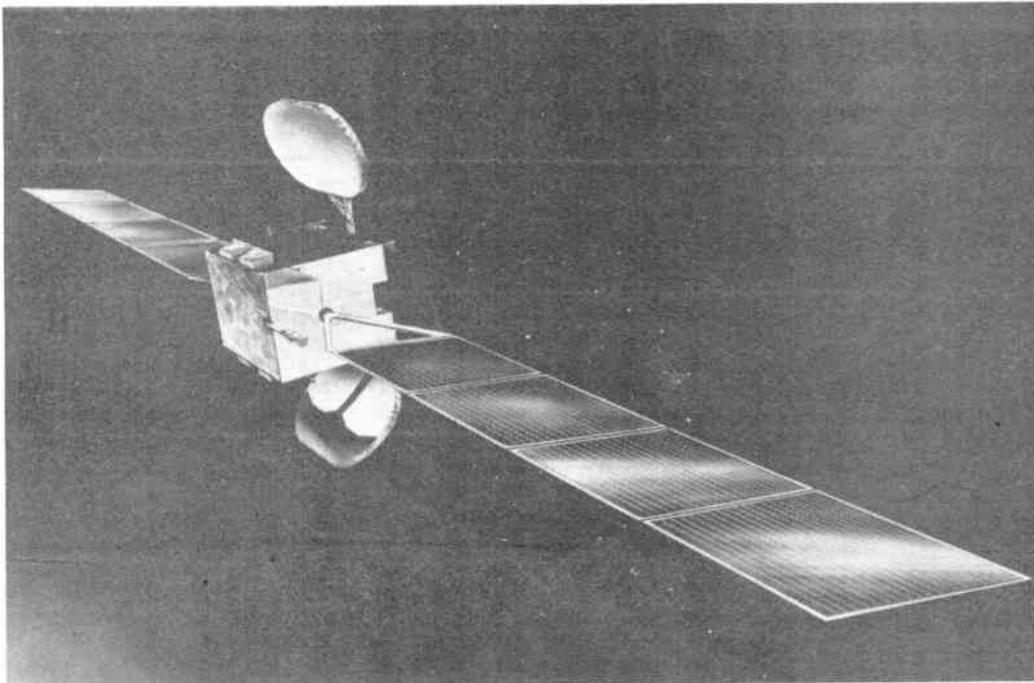
In the absence of radar facilities, air traffic control is effected by the use of 'flight progress strips' – card or paper strips which are placed in holders on the air traffic control consoles. These are marked by the air traffic controllers to record aircraft's progress through airspace and provide records of instructions passed to aircraft. Even when radar facilities are in use, the strips are maintained by controllers to provide a back up system of control in the event of radar failure.

The basic information regarding aircraft and their flight movements is normally entered by hand on pre-printed strips. The preparation of these is a tedious, unpopular and time-consuming task; even a relatively 'quiet' air traffic control centre typically requires 1000 strips per day.

The flight progress strip system is autonomous – requiring no input from existing ATC facilities – and is based on a multi-user computer with 1Mbyte of memory plus hard disc. The basic system can be extended with the addition of software – and possible hardware depending upon the extent of usage – to provide the preparation and issue of NOTAMs against filed flight plans, as well as search and rescue packages to optimise and co-ordinate any search activity.

Yes, but

EUTELSAT's Assembly of Parties, the organisation's top level policy-making body, agreed yesterday to draw the attention of all concerned to



the need for very strict observance of all of the conditions for coordination of the ASTRA satellite with the EUTELSAT system.

These conditions are: that the satellite is to be used for one-way audiovisual transmissions only; there is to be no material change in the operational scope of the satellite; there is to be no loss of business from EUTELSAT to the ASTRA satellite over and above the four transponder leases foreseen by Luxembourg and the United Kingdom; there is to be no material extension of the services to be provided, or use of the satellite beyond 1998.

In addition there will be an increased joint effort and aggressiveness by EUTELSAT and its signatory organisations (the PTTs and authorised telecommunication operating agencies of Europe), in marketing EUTELSAT services and capacity throughout Europe.

Any breach of these conditions will require new consultations, as would participation by any party or signatory other than Luxembourg and the United Kingdom in use of the ASTRA satellite.

Yeda awards 1988

The 1988 Young Electronics Designer Awards scheme was officially launched on 27th November with renewed sponsorship from electronics distribution company Cirkit Holdings PLC and leading semiconductor and computer manufacturers Texas Instruments Ltd.

Governed by the YEDA Trust, the awards scheme offers exciting prospects for young people in the junior (under 15), intermediate (15-18) and senior (19-25) age groups, who attend educational institutions in the United Kingdom.

To enter the scheme, students must produce an electronic device of their own which is original, effective and has a useful application in everyday life. A prestigious trophy and valuable cash prizes are presented to the winners in each category and in the senior age group there are the prospects of a job in electronics and course

sponsorship.

Each secondary school or college with one or more entrants reaching the regional judging stages in May qualifies for a special award of useful electronic equipment from Cirkit. Furthermore the finalist whose project is adjudged to have the most commercial potential will win a sophisticated computer system and software valued at around £10,000 from Texas Instruments for his or her educational institution. Every finalist wins a personal prize as does their teacher, and there are many more attractions for the successful entrant.

The YEDA scheme was launched four years ago with the objective of encouraging the development of practical electronics at the educational level. It was devised in response to repeated criticism by industry that school leavers were not adequately prepared for the commercial world. It was also designed to create an increased awareness in the critical need for Britain to produce more world-beating products using electronics, if the country is once again to become a major force in international markets.

For further information and entry forms contact The YEDA Trust, 24 London Road, Horsham, West Sussex, RH12 1AY. Tel: (0403) 211048.

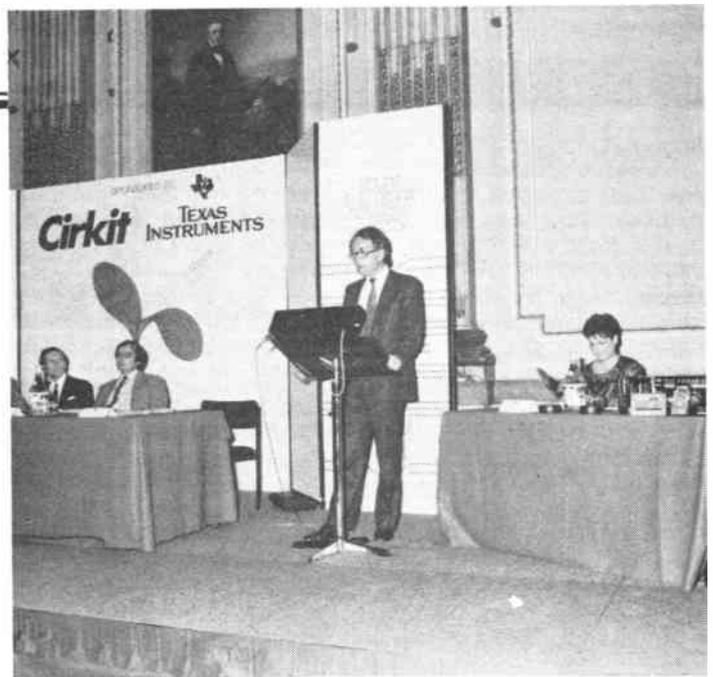
Sony radio awards

Nomination forms will soon be on their way to the nation's radio stations inviting them to select the best programmes of 1987 to enter for their industry's Oscars – the Sony Radio Awards.

Nominations are open to all BBC radio stations, including World Service, all Independent Local Radio stations and British Forces Broadcasting, and they are able to nominate programmes for awards for drama, music, current affairs and many other categories.

This year's award winners included Derek Jameson, The Archers, Brian Hayes, Mike Smith, Roy Hudd and Billie Whitelaw. But who will take the stage at the Grosvenor House on April 25th when the 1988 Awards are presented?

'Radio, uniquely, touches



John Eggleston, Professor of Education, University of Warwick, announcing the launch of the 1988 Young Electronic Designers Awards scheme at the 1987 YEDA presentations ceremony

the lives of everyone who lives in the UK, every day. It does so because of the variety and richness of its output. The standards of performance, production and service to the audience are very high indeed. It makes judging difficult – but fun', says the new Chairman of the Sony Radio Awards Committee, Gillian Reynolds.

23rd IEE Appleton lecture

Professor David Olver will deliver the 23rd Appleton Lecture entitled 'Millimetre wave systems – past, present and future', at the Institution of Electrical Engineers (IEE) on Thursday 7th January 1988 at 5.30pm. David Olver is Professor of Electrical and Electronic Engineering at Queen Mary College, University of London, where he lectures and researches on microwaves and antennas.

Millimetre waves lie in the region of the electromagnetic spectrum between microwaves and infrared. They have been widely used for scientific investigations, but their use for commercial or military purposes has been much slower to develop. The millimetre wave spectrum contains regions of both high and low atmospheric absorption. Both these regions can be used in different applications. Wide bandwidths are available for communication systems. Narrow beams can be obtained from small anten-

nas and millimetre waves have the ability to penetrate fog, clouds and smoke.

In his lecture Professor Olver will describe the advantages and disadvantages of millimetre waves, explain the characteristics which can be exploited and ask the question – 'is there a bright future for millimetre wave systems?'

Commercial, scientific and military needs are emerging which require millimetre waves and the number of possible uses is large. These include radioastronomy, remote sensing weather forecasting, satellite communications, local urban communications, secure data communications, intelligent missiles and short range surveillance radar.

Dry your digit-eyes

The launch of Epic's *An Introduction to Digital Electronics* heralds a new era in technical training. This interactive video-based course is the latest in a growing series.

Digital electronics is now a part of almost every aspect of our working lives. The dramatic increase in its use leaves technicians from all branches of industry with a great deal to learn. This poses a challenge to training managers, who must provide the highest quality training and at the same time keep a sharp eye on costs and lost productivity.

The solution comes from Epic Industrial Communica-

tions, a company who have won awards for their innovative and effective training methods. Epic has worked hand-in-hand with the electricians' union, the EETPU, to devise interactive video learning programmes from the material used at the Union's training centres around the

country.

The interactive course caters for two main methods of learning. The first is conventional, teacher-led classroom use. The second is for students to work on their own and in their own time, with expert help and guidance available at the touch of a

button.

Under the headings: 'Digital Logic', 'Combinational Logic Circuits', 'Sequential Logic Circuits' and 'Integrated Circuits', topics can be studied in a strong modular format at either Introductory or Operational levels.

Since the course is modular in design, it can be purchased as a complete package, or in units.

At Introductory level, the four units range from £250 to £350 each (£1200 for the set) and at Operational level, from £650 to £950 each (£3,060 altogether). Discounts are available for volume purchases of three or more packages. It is available to run on IBM compatibles or BBC computers.

Wot's all this, then?

Cambridge-based Philips Telecom, formerly Pye Telecom, has recently re-equipped the Cambridgeshire police with PFX 99-channel personal radios.

The £300,000 order for Philips personal radios includes a wide range of accessories and brings the Cambridgeshire police into line with other forces who have re-equipped with the versatile PFX.

The frequency synthesised PFX is manufactured in the UK and has outstanding audio quality, combined with excellent performance and reliability. Operating on up to 99 channels and with a wide-switching bandwidth, the Philips PFX enables any combination of portable to portable or portable to fixed base station to be used in the police's radio frequency bands.

Hand-held or body worn, the PFX is easy to operate through push-button controls and features an illuminated LCD to indicate its operational status. Its robust construction is designed for rough usage under the most stringent environmental conditions.



BELLE VUE/NORBRECK RADIO AND ELECTRONICS EXHIBITION

by the Northern Amateur Radio Societies Association
at the

NORBECK CASTLE HOTEL EXHIBITION CENTRE QUEENS PROMENADE, NORTH SHORE, BLACKPOOL

(Formerly held at Belle Vue, Manchester)

on **Sunday, January 31st, 1988**

Doors open at 11am

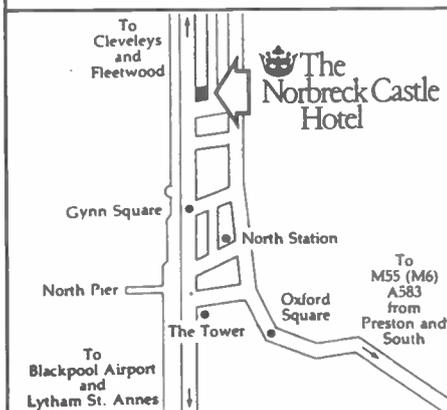
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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Last month we reported on the furore which had arisen at the Geneva ITU Conference at the proposal by the Mexican delegation that part of the 70cm amateur band be taken over for commercial mobile use. Now a further attack on this band has suddenly arisen, with a proposal by the Japanese Amateur Radio League (JARL) that Japanese amateurs be allowed to transmit FM in the satellite band, ie 435 to 438MHz.

The problem has arisen because there are around 727,000 radio amateurs in Japan, a third of whom are in the Tokyo area! They use 144/430MHz FM rigs for their local QSOs. The problem of finding a clear spot to transmit in, and of keeping it when one is finally found, can well be imagined! At times, all channels in these FM bands are in use at the same time! When this happens, the temptation to move into the Satellite Service band is too great to resist, particularly as when the satellites are not in the vicinity of Tokyo the band appears empty. So the request to be able to use this satellite part of the 430MHz band has now reached official quarters with the hope that permission will be officially granted. In Japan, radio amateurs are required to keep to the Band Plan agreed by JARL and being a very disciplined lot of folk, you are not very popular if you do not keep to the rules!

The very nature of amateur satellite communication exposes it to interference from sources such as FM transmission, particularly as those causing the interference may not know they are doing so, as the uplinks and downlinks to and from the satellite are on different frequencies. It is quite possible for really important functions on the satellite, such as satellite control signals, to be interrupted by such interference, with devastating results.

The international beacon project

The 'IBP' is one of those projects which rarely comes in for any publicity. Recently however, it has come up for attention because its 20 metre beacon frequency of 14.000MHz is being badly interfered with by the users of the new Packet radio system. Packet radio should be carried out in the RTTY-preferred sections of the IARU Region 1 Band Plan.

A very good account of the IBP project appears in the November 1987 issue of

the RSGB's *Radio Communication*, by Alan Taylor G3DME, the project's international co-ordinator. The project started as a 10 metre propagation study project, sponsored by IARU Region 1. The beacon DL0AR was used by the Max Planck Institute specifically for auroral propagation studies. In 1968, DARC, the German amateur radio organisation, outlined a scheme for an organised network of beacon transmitters to be run by radio amateurs on 21, 28 and 50MHz, together with a companion organisation of receiving stations. They were to operate a time-sharing arrangement on a common frequency.

The trials and tribulations of getting this ambitious scheme operational were many and only that for 28MHz got under way, thanks to the devotion and dedication of a small group of amateurs who undertook the tasks involved. This 10 metre beacon project was supplemented in 1983 by a network of beacons established by the Northern California DX Foundation (NCDXF) on 14.1MHz. This network was set up as a contribution to the World Communications Year, 1983.

At a meeting of the International Amateur Radio Union Administrative Council, held in Buenos Aires in 1986, a number of guidelines were suggested for the reconstruction of the IBP. One of these was that a world-wide network similar to that operated by the NCDXF be set up on 28.200MHz. It was also agreed that there would be advantages in linking the IARU IBP and the NCDXF. Subsequently, the NCDXF was asked to appoint an officer to act as assistant IBP co-ordinator, and John Troster W6ISQ is now serving in this capacity. It was additionally agreed that the reorganised IBP will include a world-wide network on 21MHz, similar to that operated by NCDXF on 14.1MHz, which is to be on 21.150MHz. It is hoped that close co-operation between the IARU and NCDXF will result in the three world-wide networks on 14, 21 and 28MHz being co-located and that eventually fifteen stations will be established.

If you have never heard what Packet radio sounds like on the air, listen on 14.100MHz almost any time and you will hear it. It sounds like a couple of tropical birds calling to each other across the jungle! The QRM which it causes to the 14.1MHz beacons is very considerable,

and it does seem essential that steps should be taken by the Packet radio fraternity to get their transmissions established on some other frequency.

Transpolar ski trek

The joint Russian-Canadian Polar Expedition which we mentioned in our November column, will leave the Severnaya Zemlya archipelago in February. It is expected to last from ninety to one hundred days, during which a distance of 2000 kilometres will have been covered. The expedition will end at Cape Columbia on Ellesmere Island.

This is the first time that amateur radio has been used to provide the basic radio communications for a scientific expedition of this magnitude. The Canadian Radio Relay League will be acting as the overall co-ordinator for all the amateur radio communication systems. The leaders of the expedition, Dr Dimitry Sliparo UA3AJH and Leonid Labutin UA3CR, are two of the Soviet radio amateurs who will be on the expedition.

The 24MHz band

The 24MHz band – one of amateur radio's 'new' bands – is showing signs of activity, presumably because of the increase of solar activity in the new solar cycle. This band, which is shared, suffers from many high power commercial signals, but a space can be found for amateur activity, mostly at the ends of the band, from 24.890 to 24.990MHz.

At the time of writing, signals appear most frequently in the afternoons from say 1400GMT to 1600GMT. There is a beacon on 24.901MHz from Brazil, with the callsign PY2AMI, which is worth looking for, as it will give a good idea of how DX conditions are to that part of the world.

Contact lens warning

A recent issue of *The Westlink Report* draws attention to a hazard which contact lenses may cause. They quote two incidents in which severe damage was done to the eyes of contact lens wearers. The first was of an electrical worker who switched an uncovered electrical circuit breaker into the 'on' position, thereby causing a substantial spark. The second was of a welder who flipped up his protective face shield to better position a welding rod. The rod

contacted the metal, which again produced a bright flash. In both cases severe damage was done to the cornea of their eyes. Later investigation revealed that in both cases the electric arc had generated microwaves which dried up the fluid between the eye tissues and the contact lens, thus bonding the cornea to the lens.

In this country it is interesting to note that after considerable discussion by the medical authorities advising the Fire Service authorities, the use of contact lenses is now forbidden to Fire Service personnel likely to be engaged in fire fighting duties. So, if you wear contact lenses, be careful!

DTI information sheet

The Radio Communications Division of the Department of Trade and Industry is frequently called upon to give guidelines on amateur radio club licences and the interpretation of licence conditions as applied to clubs and societies. They felt, therefore, that it would be useful to issue an information sheet to clarify the administrative requirements and responsibilities of amateur radio clubs and societies in relation to obtaining a club licence. This is Information Sheet No 5 and it can be obtained from the DTI

Amateur Licensing Section, Radiocommunications Division, Waterloo Bridge House, Waterloo Road, London SE1 8UA. (Tel: 01-275 3316).

There are apparently 1500 club call-signs in use at the present time, covering many aspects of amateur radio, both general and specialised. The information sheet outlines the stages one should follow in setting up a club, such as electing a committee, appointing a person responsible to hold the licence on the club's behalf, the choice of a suitable name for the club, the class of licence to be applied for, the responsibilities of the person holding the licence and so on.

Novice licence campaign

A lot of folk are trying to get the authorities to bring in some form of amateur radio transmitting permit to allow the 'raw beginner' to the hobby to 'get on the air'. One of these is Ian Abel G3ZHI. He writes: 'The concept of a novice class of amateur radio licence is not new. Some 30 countries already have one. We were promised one in parliament way back in 1968 by the then Postmaster General, Mr E Short, but nothing came of it. The DTI are now actively reconsidering the idea'.

Readers interested in Mr Abel's campaign should contact him at 52 Hollytree Avenue, Maltby, Rotherham, Yorks. (Tel: Rotherham 814911).

The return of AO-10

Oscar 10 is now back to its previous state of activity, and appears to be working as well as it did before it shut early last August. This occurred because of reduced available power to critical levels, due to unfavourable sun angles. Evaluation of the satellite's condition was accomplished by VK5AGR, ZL1AOX and DB2OS, of the satellite's control team. They came to the conclusion that the satellite's battery was in good condition and the Mode B transponder was functioning normally. However, caution has been issued by the team, who are of the opinion that during the next few months, when solar illumination is greater than 75%, the satellite will be experiencing solar eclipses for up to 99 minutes in every orbit. In order to avoid damage to the battery, users must avoid using the satellite while it is in eclipse. This had been the case previously, but the eclipses then tended to occur around perigee. In the next few months, however, very long eclipses occur well after perigee.

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A Plessey AR5 23cm surveillance radar. The microwave dish is part of a link to feed the output of the radar to the air traffic control centre at the opposite side of the airport. This installation is at Bandar Seri Begawan airport in Brunei

Sir Robert Watson-Watt's original proposals for the development of radar were made with the intention of detecting enemy aircraft, and the classic 'Davenport Experiment', which proved the viability of the proposals, used a Heyford bomber as the target. Since that time, the safety of aircraft in flight has been increasingly dependent on radar and radar-derived systems.

The basic principle of radar is well-known. However, less well-known is the fact that there are two types of radar, primary and secondary, both with specific roles to play in the air traffic control environment.

Primary radar operates on the well-known principle that a highly directional pulse of radio frequency energy is radiated. This impinges on the target and a very small proportion is reflected back to the radar station.

This is received, and from the direction of the aerial and a measurement of the time interval between transmission and reception of the pulse, the bearing and distance of the target can be calculated. No other information can be gleaned from primary radar returns.

With secondary radar, much lower power is used with a series of three or more pulses being radiated. These are received by a receiver within the aircraft,

which responds with a series of coded pulses.

On reception at the ground station, the bearing and distance of the target can be determined as in primary radar, but in addition the coded replies contain information as to the identity of the aircraft, its height, and in a development now being introduced, various other messages.

This article deals with the primary radar used in air traffic control, and I will be dealing at length with secondary radar in my next article.

Basic principles

Primary radar equipment is required to emit a high power burst of RF energy in a narrow beam for a brief period of time – typically one microsecond – and then switch to the receiving mode. The number of pulses radiated by the radar transmitter in one second is known as the Pulse Recurrence Frequency (PRF). Any echoes from targets are received, amplified, processed to remove returns from static objects such as hills, buildings, etc and then fed to the display equipment. The installation must therefore comprise: aerial, transmitter, receiver, signal processing and display equipment.

The purpose of the aerial is to radiate

the output signal from the transmitter in a sharp beam in the horizontal, but rather broader in the vertical plane. The most common type of aerial in use today is a simple waveguide feed, illuminating a large reflector specially shaped to generate the required directional characteristics in both horizontal and vertical planes.

The transmitter consists of two circuits: the radio frequency generator and the modulator. The generator may take one of two forms, either a single self excited oscillator, such as a magnetron or a multi-stage transmitter using a klystron or a travelling wave tube in the output stage. The output power generated depends on the ultimate purpose for which the equipment is intended. This may vary from a few kilowatts peak for a ground movement radar to several megawatts for long distance surveillance.

Most radio enthusiasts are familiar with the operation of the modulator in amplitude modulation. The modulator in radar equipment, however, has a completely different purpose, for its action is to switch the transmitter on and off at the appropriate times. Frequently, the modulator also supplies the necessary power to the transmitter for the required period of transmission. As no mechanical device could operate with the necessary stability at the required speed, the switching is entirely electronic.

Radar receivers have characteristics which set them apart from normal radio receiving equipment. They have to respond to signals which may vary in strength in the ratio of a million to one, whilst a wide bandwidth and short time constants are required in order to pass the narrow pulse widths without distortion.

The strength of the returns varies with the distance of the targets from the transmitter. It is therefore possible to apply a gain control voltage which is at maximum as the transmitter fires, effectively desensitising the receiver, and then gradually reduces as the range increases. This is known as Sensitivity Time Control (STC) and, in effect, ensures that the received echoes, whatever their range, are of substantially similar strength as the receiver detector.

The output of the receiver detector contains signals not only from the wanted aircraft targets, but also from hills, buildings or any other objects which may have been illuminated by the transmitted beam. The purpose of the processing circuits is to eliminate all but the wanted aircraft returns. This may be achieved by analogue or digital means, the former being terms MTI (Moving Target Indication) and the latter, MTD

GROUND RADAR

BY BRIAN KENDAL G3GDU

(Moving Target Detection).

Both systems take advantage of the fact that any wanted target is moving and hills, buildings, etc, are static. The principle is that the returns from two or more pulses are compared, and any which remain static are eliminated.

This technique, however, has disadvantages, for if a target moves an exact number of wavelengths in the interval between two pulses, or it remains at constant range by flying at a tangent to the transmitter, then the processing circuits will cancel the return.

These are obviously serious disadvantages, but the former is overcome in a very simple manner. As the problem is caused by the distance flown between two consecutive pulses being an exact multiple of the wavelength in use, the spacing between consecutive pulses is varied by a few microseconds. This is known as Staggered PRF.

The latter problem is less serious, for it is unusual to lose more than half a dozen 'paints' as the aircraft passes. This is known as tangential fading. With the unwanted returns removed, the signals are now in a form suitable for feeding a display.

The simplest form of display today is the Plan Position Indicator (PPI) display using a long persistence CRT. In this, the timebase scans from the centre of the tube towards the edge with its position varying in sympathy with the bearing of the aerial, with signal returns causing a bright-up of the trace. The display therefore presents a map of the airspace surrounding the radar station with the aircraft showing as bright dots or short arcs.

This system is perfectly satisfactory provided that the distance between the radar head and the display position is short. If not, for example if a remote radar station is feeding displays at an Air Traffic Control Centre several hundred miles distant, the cost of the high quality coaxial cables to carry the very wide bandwidth becomes prohibitive and other means must be found.

This problem led to the development of Plot Extraction Equipment which converts the target positional information from a bearing and distance to a digital word, describing the position in cartesian co-ordinates. The bandwidth of this is well within that of normal landlines, thus minimising the difficulties of transmitting the plots from the radar head to the Air Traffic Control Centre (ATCC).

At the ATCC, these signals may be processed further, or alternatively used to drive one of two types of PPI display. The first of these is the raster display,

which operates in a similar manner to a normal television and the second is the recursive display, in which the plots are held in computer memory and individually written in a sequence determined by the software.

Radar tasks

Primary radar performs three main tasks within the civil aviation environment. These are: long range surveillance, airfield control and ground movement control. Each of these presents particular requirements, which must be catered for in the design of the equipment.

Long range surveillance

The requirement of a long range surveillance radar is that it shall be capable of receiving a return from an aircraft at a considerable distance, often in excess of two hundred miles. It shall then provide positional information such that the controller will be able to direct the aircraft through the airways system, maintaining adequate separation from other aircraft until it leaves the area covered by the radar, or until it leaves the airways control to approach its destination airport.

To meet this requirement, the equipment must operate on the lowest possible frequency in order to minimise interference from rain and weather. In the past, these pieces of equipment have operated on frequencies around 600MHz, but due to increasing congestion on the UHF bands, the more recent equipment operates on frequencies around 1.3GHz.

In order to operate at the longest possible range, high mean power must be radiated. This can be achieved, not only by radiating the highest possible peak power, but also by extending the length of the pulse. Unfortunately, however, the pulse length is also a factor in the ranging accuracy achievable. For this reason, pulse lengths have for many years been limited to one or two microseconds, which give a range accuracy of $\frac{1}{10}$ and $\frac{1}{8}$ mile respectively.

These relatively short pulses present a considerable limitation on long range equipment and as a consequence a technique known as pulse compression has been introduced over the past ten years.

Pulse compression

Pulse compression is a technique which permits a radar to radiate a long pulse (typically $60\mu\text{s}$) yet provide the range definition of a short pulse.

The method used is that, as the long pulse is radiated, so its frequency is swept over a frequency band of several tens of megahertz. This pulse hits the

target and is reflected back to the radar head, where it is received and fed to a Surface Acoustic Wave filter (SAW) which inserts a time delay dependent on the received frequency.

Thus, if the radiated pulse is 60 microseconds long, signals received on the frequency corresponding to the beginning of the pulse will be delayed 59 microseconds, those in the middle of the pulse about $30\mu\text{s}$ and the very last part of the pulse will not be delayed at all. At the output of the filter therefore, the returns for the whole pulse will be 'piled up' in a single microsecond, which will give the range definition, but due to the adding process, the signal strength will correspond to that of the longer pulse.

A further advantage accrues from this technique, for an irregular shaped target such as an aircraft does not show the same reflectivity at all frequencies, and the chances are that there will be further enhancement of signal strength compared with single frequency operation.

Such improvements cannot, however, be gained without some penalty – in this case that the minimum range is limited by the duration of the pulse for, obviously, nothing can be received whilst the transmitter is radiating. In the case of a $60\mu\text{s}$ pulse, this corresponds to a minimum range of about 5 miles.

Such a state of affairs obviously cannot be tolerated, so a short pulse which may or may not be compressed is radiated in turn with the long pulse, and processed by a separate receiver chain. The output from this is then superimposed on the main display.

Airfield control radar

On leaving the control of the Air Traffic Control Centre, the aircraft is handed over to the Approach Control of the destination airfield who will vector it onto the final approach path using Airfield Control Radar.

These pieces of equipment normally operate on a wavelength of 10cm, giving greater bearing accuracy but shorter range than the long range radar equipment. The maximum range is normally in the order of 60 to 80 miles, but this is rarely used, for the main interest of the controllers is in the immediate vicinity of the airfield. The accuracy is normally sufficient to control a Surveillance Radar Approach procedure to a distance of two miles from the threshold of the runway, at which time the aircraft will be at a height of 600ft. As there is no height finding element in the radar, the aircraft is continually informed throughout the procedure at what height he should be.

Aerials used for airfield control radar

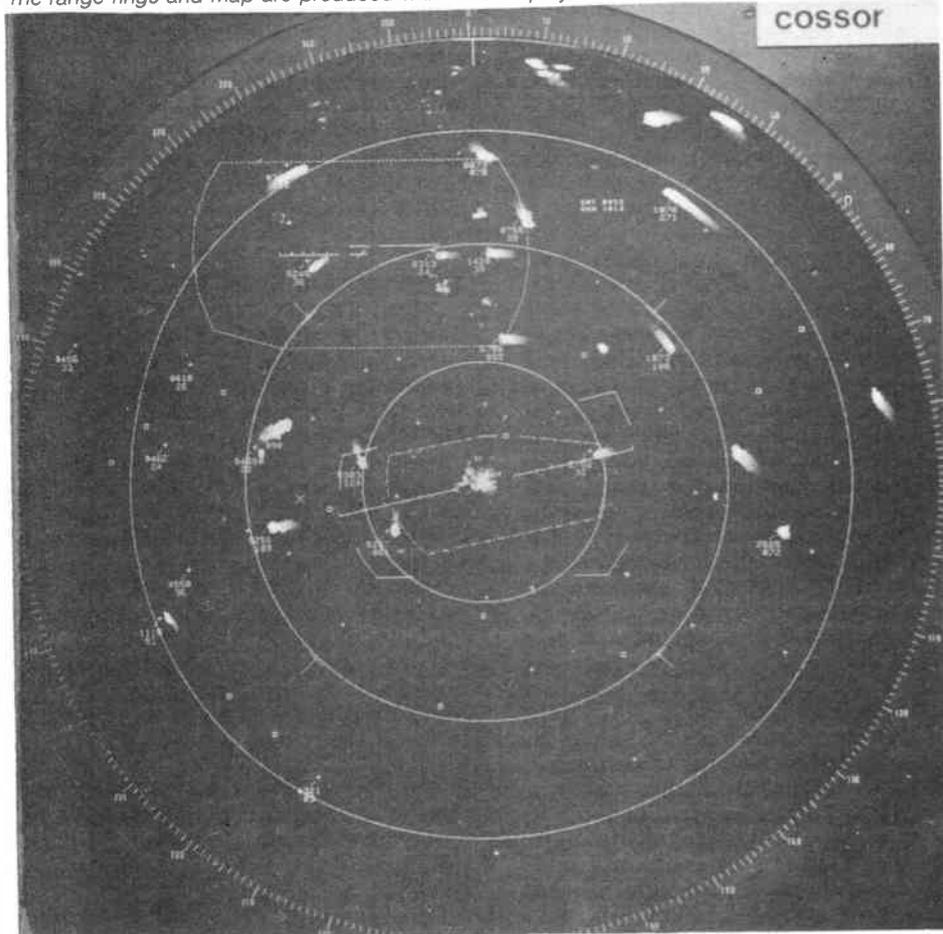


A 3cm short-range surveillance radar designed by Racal Avionics. Known as the LAR200, this is used on marine equipment with the addition of signal processing equipment (Photo Racal Avionics)

are somewhat similar, but proportionately smaller than those used for long range surveillance. In these, a single waveguide feed illuminates a dish reflector suitably shaped to provide the desired radiation pattern.

Most transmitters use a magnetron, giving about 0.5 megawatts for a pulse length of one microsecond. The receiver

Cossor's latest high definition display. The bright 'blobs' are primary radar returns, the fine crosses with labels are secondary returns whilst in some cases the primary return overlays the secondary. The range rings and map are produced within the display



chain incorporates MTI or MTD, the output of which drives PPI displays in the approach control room.

An interesting derivative of the PPI display is the Distance From Threshold Indicator (DFTI), which is a small tube (6 inch) driven from the ACR which displays only the part of the PPI showing the final few miles of the final approach path, for the benefit of the tower controllers.

At 10cm wavelength, raindrops in quantity are sufficiently large to return an echo which could mask wanted targets. This effect is minimised by the incorporation of a 'polariser' in the aerial system which converts the transmission from linear to circular polarisation.

Migrating birds also give a sufficiently strong return to show on the airfield control radar displays whilst the tropo conditions beloved by 2m and 70cm operators can, from time to time, provide a screenful of 'ghost' returns.

Called 'anaprop', these are usually due to the unusually good propagation causing the display of returns from previous pulses. Simple calculation can often determine the location of the target displayed.

Under such circumstances the author has, in the past, observed the coast of Denmark from South Wales and the Norwegian coast from Scotland. These, however, fade into insignificance in comparison with returns from the East African coast being displayed on a radar

near Bombay which the author saw in a training film in his National Service trade training.

Ground movement control

The Ground Movement Control function is carried out using Airfield Surface Movement Indicator equipment.

The purpose of this radar is to indicate the position of aircraft, vehicles or any other obstructions on the airfield. Security is a more recent use, for the equipment is sufficiently sensitive to identify any intruders within the airfield perimeter.

The earliest ASMI equipment operated on Q band (8mm), as at the time it was not possible to obtain adequate definition at longer wavelengths. With this, it was quite possible to differentiate the grass areas from the concrete, discern individual runway lights and airport workers walking across the tarmac. When a large object such as an aircraft came into view, it was often possible to identify the type, for the geometry of the wings, engine pods etc were clearly visible. Overall, the quality of the PPI picture was such that it was hard not to imagine that you were viewing a television picture of the field from a camera at a few thousand feet.

Excellent though this equipment was at the time of its design, it was reaching the limits of available technology, with the consequence that it was extremely expensive to run and maintain. It therefore tended to be used only when visibility was bad. In more recent times, however, the development of signal processing techniques has meant that similar definition is now available from 3cm equipment, one of the most recent being the Racal AR18X type of equipment, which is now being installed at many of Britain's airports.

The author recently saw a demonstration of this equipment where the two 'targets' – a man and his briefcase, standing separately on the tarmac nearly three miles from the radar head, were clearly visible.

In addition to the normal display, the display equipment will 'paint' a map on the tube, giving a navigational grid or any other information which may be required. Incorporated with this feature is the facility to 'blank out' areas outside the airfield perimeter.

Primary Radar has come a long way since those first faltering steps at Orfordness and Bawdsey prior to the war. With the rate of development ever increasing, it is hard not to believe that the apparently fanciful forecasts in science fiction literature are not accurate predictions for the future.

In this article I have just brushed the surface of the intricacies of primary radar. To do full justice to the subject would take several large volumes, but I hope that I have said enough to enliven a little interest in this fascinating subject.

In my next article in this series, I shall be describing Secondary Surveillance Radar including the latest development known as Mode S.



ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

The time has come for our three-monthly round-up of your activity on the air, so I shall dip into the mailbag and fish out a few letters (actually it's a letter tray, but mailbag sounds better!).

Down to business, and the first letter is from Jean G0AWX in Bishopsworth, Bristol.

'Please do not start a ladies' page. . .', she starts in block capitals. 'That is the plea from two ATVerS in Bristol. If I say one is Viv G1IXE and the other myself, I feel sure you will listen, won't you?! You see, we wish it to be known that at least two lady members rather enjoy being one of the 'boys'... simply because the real 'boys' always spoil us dreadfully anyway, and we do understand one or two details about our branch of the hobby. Ha! This is meant as fun, hope it made you smile. And just to flatter you, I want you to know I truly enjoy your page, thank you.'

Wow, what can I say after that? Nothing, except very many thanks. I know if I try and cap it with some clever-dick comment I shall probably regret it ever after! So, quickly on to the next letter. . .

Foreign news

It comes from Stanislav Pazur, our regular correspondent from Warsaw, who informs us that the Polish ATV Club, the Radiovideograph PRV Club, held its third annual meeting during May in Slupsk. 'They are interested in SSTV, MSTV, FSTV, ATV, Fax and Data. There are 48 radio amateurs and three club stations in the club. Leading lights among them include SP2JPG, who has SSTV contacts confirmed with 49 countries; SP3LPM, who has contacts with 23 countries and SP3CMX - contacts with 11 countries (also 54 on RTTY).'

More snippets of foreign news: Michael ZL1ABS hails from Auckland, New Zealand and has been doing a lot of home construction projects. Some of the parts he uses are unavailable in New Zealand, and he has to obtain them by mail order from England. He writes: 'Bonex Ltd have been marvellous with components not available in ZL. They even sent a free catalogue last time.' I must admit that the BATC sometimes receives letters of hate from ATVerS who have been 'ripped off' by mail order traders, but comments about Bonex of Acton are always favourable. They hold a wide range of electronic components, including the Toko inductors and chokes, and sell them at reasonable prices. They are seldom out of stock, either, unlike another Toko distributor.

Michael continues: '70cm is still the prime band for ATV here in ZL. So much 70cm equipment is being built, though it

usually provides for sound and colour too. Not having specialist ATV companies, we have to build much of our equipment locally. The Auckland VHF Group is doing ATV-related kits - a pre-amp, converter and QRP transmitter, which will help. If anybody is ever visiting Auckland and wants to talk ATV, my number is (09) 415 9584. The ATV net is on 443.25MHz AM TV, with a sound co-ordination frequency of 146.575MHz FM. Activity is on Sundays 20.45-22.30 or later.'

Balloonatic TV

In the past we have discussed ATV from radio-controlled helicopters and model aircraft, also F3YX's exploits in a hot-air balloon. Now comes word from the States, where Bill WB8ELK has put ATV aloft in a helium balloon. Here's the official report. . .

After some delays and re-schedules, the WB8ELK helium-filled balloon ATV experiment was finally launched at 13.25 on Saturday 15th August, 1987. Launch was from Findlay, Ohio, and Bill was aided by fellow members of the Findlay ATV group. The radio package comprised a 1 watt ATV transmitter (PC Electronics Kreepie-Peepie), a custom-built computer video graphics generator switching between two colour pictures of a balloon. A GLW Morse ident generator also transmitted a 100mW signal on 144.340MHz FM. Power for the set-up came from ten Polaroid lithium cells, which gave 500mA at 12 volts for around seven hours.

The balloon itself was a 5ft weather balloon of the type used by the National

Weather Service for radiosondes. It was provided with a parachute for recovery, aluminium foil strapped to it for better observation and radar reflection, and of course the VHF/UHF transmitter package. The 2 metre antenna was a quarter-wave vertical whip, while the 439.25 ATV transmit aerial was a horizontally polarised turnstile. The total package weight came in at 2lb 11oz and our final lift weight was 2lb 15oz, giving us only 4oz lifting force and resulting in a slower than planned ascent of approximately 700 to 800 feet per minute.

Maximum altitude 70,000 feet

Some accidents were sustained: during the launch the turnstile antenna was damaged as it was dragged through a cornfield during initial takeoff, and this later resulted in deep fades as the antenna spun around. Also the vision transmitter ceased working just before 1500, at about 60,000 feet. Five minutes later the CW generator left the air at approximately 70,000 feet; one theory is that the lithium batteries may have burst due to the near vacuum at this altitude.

The balloon was tracked visually for three hours by Jim WA8VWY in his Cessna: light winds kept it within 18 miles of Findlay during this period. Later it looked like a bright star and disappeared, never to be found again. Bill says that anyone capable of looking through binoculars at a tiny speck in the sky for hours while lying in a ditch filled with poison ivy, has to be dedicated! (So was Bill: he put an estimated US \$300 to 500 of his own money into the project. About \$50 worth of hardware was donated).

ATV goes airborne with WB8ELK's helium balloon transmitter

WB8ELK

HELIUM BALLOON LAUNCH
FINDLAY, OHIO

LAUNCH - 1:25:30 PM EDT
MAX ALT. - 70,000 FEET
MAX DIST. 2M - 400 MILES
MAX DIST. ATV - 250 MILES

2M 100 MW VERT.
ATV 1W HORIZ.

WB8ELK

SEND SIG RPRT
AND ANTENNA
HEADING WHEN
LAST SEEN for
SPECIAL QSL !

ATV ON THE AIR

Balloon DX

Some spectacular results were obtained from this experiment. The highly elevated TV signal was received as far to the east as Buffalo, New York (W2RPO, 290 miles) and to the west towards Chicago (250 miles) by N9AB (P2), and two others (P3 signals). Several other reports were received.

Within three minutes of launch the balloon passed through an inversion layer at 25,000 feet, producing reception for a minute in Cleveland, Pittsburgh, Detroit and Canada. The two metre beacon travelled even further, with reports from up to 400 miles distant. All in all, this experiment was a lot of fun and even instructive. Who is going to emulate them over here?

SSTV

Roland G4UKL (Falmouth, Cornwall) passes on some SSTV news from both sides of the Atlantic. 'Firstly, the IVCA is holding a light-hearted SSTV contest to find the most beautiful girl to be transmitted over the air'. (Oh dear, will Viv and Jean allow this? Yes, I suppose they will if they lump themselves in with 'the boys!'). 'The rules are simple... the girl can be your daughter, daughter-in-law, the girl next door, or any pretty girl you know but it must not be your wife! Minimum attire is a bikini. The girl may be of any age.

'Here is the rub... the entries have to be transmitted or relayed to Steve N9CNT and backed up by a tape or picture. Steve will then make up a composite tape of all entries received and send them to the international net controllers. They will take a vote from net members and the winner will be decided

upon from the nets' count. One station, one vote - and only on one net. The rub is the difficulty with present propagation conditions getting a picture across to Steve, but many will try.

'Which leads me onto the next item. There is to be a European net on Saturdays at 1400UTC, which will link up with the North American net at 1500UTC. Because no single station could hope to control all of Europe, there are going to be two net controllers. Michel DJ0GF will work from Lake Constance and I (Roland G4UKL) will relay from Cornwall. Appropriately, I am not very far from Poldhu where the first Marconi transatlantic transmissions were made.

'IVCA will continue to advocate the use of 14.345 \pm 3kHz as the SSTV frequency spectrum and will, when the time is right, QSY all nets to that frequency, leaving 14.230 as the calling frequency. My own view is that having the SSTV slot right in the middle of the band was a disastrous initial mistake: it should have been tacked onto the RTTY zone around 14.100.

'To make matters worse, there is a difference of frequency allocation between the IARU areas. In Europe most operators just ignore the present SSTV band plan; you may have heard the comment that 14.230 is the International Tuning-up and CQ calling frequency. I can testify to the validity of this.

'One final word about 14.230. In Cornwall, when there is any sniff of propagation, there is a peculiar signal to be heard varying between S2 and S5. It consists of a peculiar whirring noise with a periodic Morse call of UD. It peaks at my QTH from the east and clearly is some form of beacon. I wondered if this was

being heard elsewhere? At its loudest it corrupts SSTV'.

Hmm... a mystery. I'm sure one of our well-read fraternity can solve this. Our final letter is also from Falmouth, from our old friend Johnny Brown G3LPB. He writes: 'Re SSTV news. Here I am always building gear (mostly from scrap) and enjoying every moment of it; at present I am learning the computer side. I had a letter from Grant Dixon, he is a marvellous chap. They were both here a few months back, marvellous to see him so active after his fall.

'My operating is a bit of SSTV on 20 using the original standards, but these are fast dying. SSTV has become lots of rich people sending pics from their Robots, and even these have been doctored up. Colour SSTV to me is really a waste. It's a bind to fill three memories and then play back. Again I use an adapted TV for this, but my interest at the moment is in the computer side'.

Closedown

There are no other reader contributions and virtually nothing at all on fast-scan. That is strange: I am told that last Autumn's lift was a real cracker, but not a single written report has been received here. Does no-one want to claim a record? Anyway, watch out for bright, dry snaps during snowy periods: you can get some excellent tropo DX in mid-winter. Of course, what the weather will be like when you read this is nobody's guess, but the number of berries on the bushes outside makes me think it *will* be a cold winter!

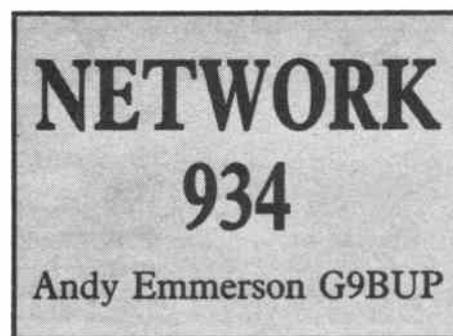
Let's have those letters then: send them to me care of the Editor. See you next month... 

Over the past few months we have been speculating about the possibility of a little DX across the North Sea to Holland once they establish their personal radio system (PRS). Well you can forget it! Although it was intended to introduce this service soon, pressure from the CEPT (the 'club' of European national telecommunications administrations) has caused them to drop the idea in favour of a harmonised Pan-European digital system, which can be used in all countries which adopt it.

--No doubt similar pressure would be brought to bear on any other country which was to consider an analogue system now, so that effectively isolates Great Britain and Switzerland with their analogue 934MHz systems!

The future is in your hands!

So what does that mean to you and me? It means that if you want to retain your 934MHz radio, if it is really important to you, you'll have to make the most of it. At the moment, 934MHz is one of the most under-exploited resources in the radio



NETWORK
934
Andy Emmerson G9BUP

spectrum, and it needs far more activity to make this change. As we have seen in this column previously, there are other people with their eyes on 934MHz - the industrial RF thermal heating people, for example. And how do the powers-that-be judge the activity on 934? By listening and by checking the media to see how much interest is shown, how many times the subject is mentioned.

Well, how many other magazines have a full article on this subject each month? Er...none! And how many letters and

QSL cards do I get from you each month? One, if I'm lucky!

Are you going to do anything about it? If not, are you happy about giving up your present style of operating when the new digital system comes in around 1990? Are you content to write off your investment? The choice is entirely yours...

What is the future?

What the CEPT thinks you want is an interference-free, private radio-telephone type facility, where you dial up the call number of the person you want and if they are on the air, their set will squeak and you'll be connected.

It's called PARS, personal advanced radio system, and its facilities are quite clever.

No-one else will be able to butt in, nor will you be able to 'earwig'. Although you will be able to put out a CQ call, the new system will probably support DX nets on a particular frequency, nor will you be able to select a particular channel for a net or private chats. Is this really what you want?

Back to the future

Many people will, of course, prefer this new system. They are afraid of radio jargon, shun CB radio 'types' and their image, and don't like technology which requires you to turn knobs and use a bit of skill. On the other hand, a telephone-style system with assured privacy, would be right up their street, and for this reason you can bet your bottom dollar that if PARS ever gets off the ground *and* is affordable *and* is properly marketed, it will sell like hot cakes.

My guess is that there are too many ifs in this equation, but as a present-generation 934 user you get to lose either way. If PARS is a success you will be left out on a limb, a relic of a previous civilisation. The government says that existing operations will be allowed to continue after PARS starts, but what if a large majority of PARS users – perhaps businessmen – say that old system 934 users are causing interference and that they need more channels exclusively for PARS?

Equally, what if PARS gets bogged down in bureaucratic problems in the EEC or CEPT? What if the manufacturers decide it's just too expensive? What if there are only a thousand old-style 934MHz people left on the band? Can the

government justify maintaining their expensive little private channel facility? Just think it through...

Perhaps you think I am being pessimistic, but can you fault my logic? Let me know what *you* think, share your thoughts with others. What are *you* doing to get new people on the band? We need something optimistic in 1988!

A little activity...

A couple of reports received indicate that users of 934MHz are not all hibernating. A despatch is promised from the Coastal Ducting Group of Tyneside, sounds good so I'll hold my breath!

John UK581 (formerly UK152, but someone else snaffled his old call!) says he had a ball during the October lift. From his Chasetown (Staffs) home base he went out to the local high spot, Redmoor Common up on Cannock Chase, and found conditions were so good that a hand-held was quite adequate for working the DX. And what DX! Barry in Jersey and other stations in Gillingham (Kent), Haywards Heath (Sussex) and Carmarthen (Wales). He also monitored the 933MHz PRS band on his scanner, hoping to hear some Swiss stations, but to no avail. (I must say I also

listened during this period and found the band surprisingly quiet).

He has also been making some crossband tests with Tony AJ26 five miles away in Birmingham. Using a hand-held and a Delta-1 with a frequency separation of about 1MHz they were able to work duplex (dual frequency simplex actually) without any problems – it was just like a telephone conversation, no waiting for the end of each over before one could reply. They used separate transmit and receive aerials, using a scanner for receiving and a normal transceiver for transmitting. Interesting, huh?

Signoff

That's all again for another month. I hope that some of this has exercised the grey matter and I really do hope it stimulates you into letting me know *your* views. I cannot believe that you are prepared to see your 934MHz station jeopardised, but you'll have to do something soon to avoid this!

Let's hear your news and views about the crisis on 934!

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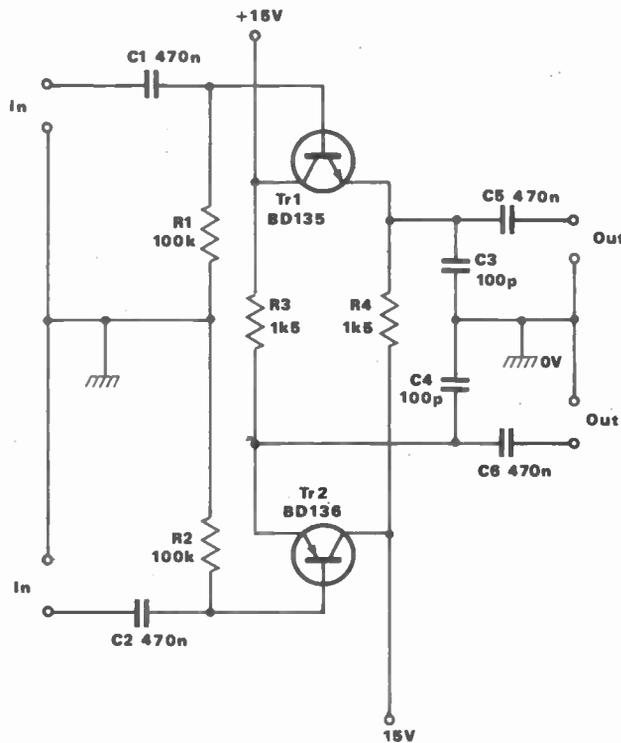
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MAKING YOUR OWN PC

Fig 1 A simple stereo line-amplifier



The photographic method for the production of printed circuit boards gives excellent results, but it is rather expensive.

For the average amateur, who wants to make one or two PC boards every now and then, it is hardly worth the investment. Here is a direct etching method which is quite simple but accurate and reliable.

What do we need?

1. Lots of graph paper, imperial size with 0.1in grid, or metric with 5mm grid.
2. Carbon paper for typewriter use and/or translucent film.
3. Transfer symbols: 0.1in circles, 1mm and 1.5mm lines, DIL for integrated circuits.
4. Polyfix or Seno cleaning block, or steel wool, or abrasive powder.
5. Etching fluid on a base of ferric chloride.
6. Methylated spirit.
7. Solder flux/protective lacquer.

How do we proceed?

A simple stereo line-amplifier (see Figure 1) will serve as an example to show the different stages of production.

1. Starting from the theoretical circuit of Figure 1, we make a first sketch with

Fig 2 Layout of the Fig 1 circuit

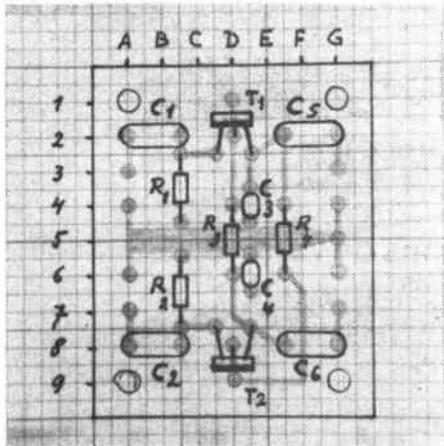


Fig 4 Layout transferred to PCB

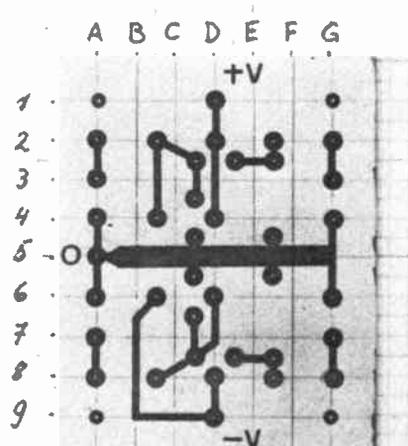


Fig 7 The correct (a) and wrong way (b) to provide earthing connections to an IC



Fig 3 Underside of the PCB

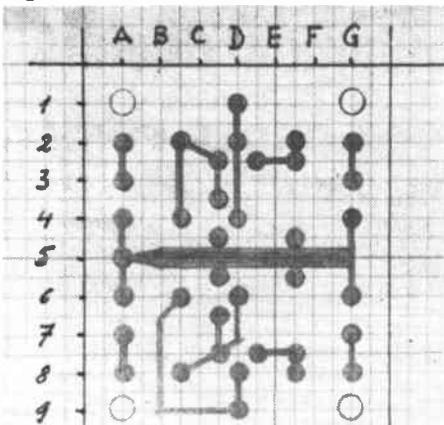


Fig 5 Completed PCB

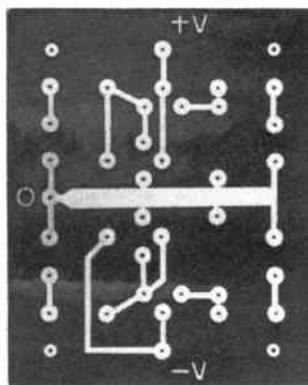
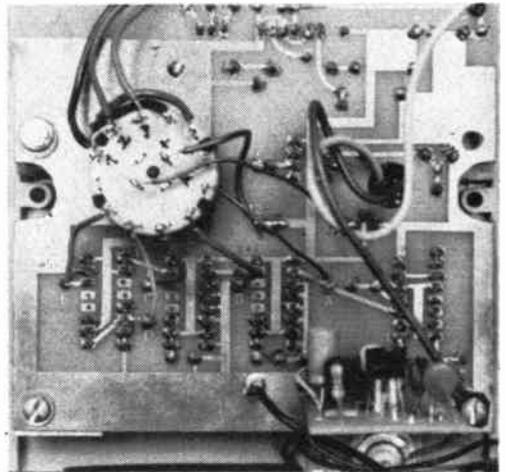


Fig 6 A portable DFM



BOARDS

by L Boullart

the location of the components and the copper tracks. In my experience, it is preferable to make this drawing as seen from the component side. Once you are used to it, three or four trials should result in a definite version for a suitable lay-out, such as the one shown in *Figure 2*.

2. Next, a drawing of the underside of the PC board is required. This can be done by laying a piece of carbon paper (with the carbon side up) against the back of *Figure 2*. Or again, a piece of translucent film can be put on top of *Figure 2*. In both cases the end result will be as shown in *Figure 3*.

Now mark the vertical lines A, B, C, D, . . . and the horizontal lines 1, 2, 3, 4, . . . every 0.2 inch or every 5mm as the case may be. These marks will serve as reference points for the exact location of the soldering circlets and their connecting tracks.

3. A piece of printed circuit board of the required dimensions is sawn off and the copper side thoroughly cleaned with the cleaning block or the steel wool or the abrasive powder. Be careful not to touch the surface with your fingers afterwards!
The PC board is then fixed to another

piece of graph paper with adhesive tape. The reference letters and ciphers are copied from the drawing of *Figure 3*. Draw the appropriate lines with a soft pencil on the copper side of the PC board as shown in *Figure 4*. These pencil lines will easily dissolve during the etching process.

4. Now we can rub off the symbols, beginning with the 0.1 in circlets – and in accordance with the reference points. In our case: 2A, 2B-C, 2D, . . . 2-3C-D . . . Next come the connecting lines. Unless your eye-sight is still 20/20, a large magnifying glass on a fixing stand will be very useful during this stage of preparation.

5. When all the symbols have been put in place (see *Figure 4*) the PC board is ready for etching. With a ferric chloride solution, the etching process takes between 1 and 1½ hours, but this is hastened by a little heating. A 75 watt bulb above the etching tray will do the job very nicely.

When all the superfluous copper is etched away, remove the PC board from the etching liquid and rinse it with plenty of water.

The transfer symbols are then removed with methylated spirit. The result is

shown in *Figure 5*. Quite neat as you can see!

6. As a rule, the holes are drilled with a 0.8mm drill, except for some components: preset potentiometers, wire-wound resistors, etc.

7. The PC board is cleaned once more and covered with a thin layer of soldering flux/protective lacquer.

Some final remarks

The method as described above is quite suitable for much more sophisticated circuits, such as the one shown in *Figure 6*, a portable DFM. For use on printed circuit boards, use a small soldering iron – approximately 15 watt – with a fine point, especially on IC connections.

While we are on the subject, one last hint: keep the soldering area as small as possible; this will speed up the soldering process with less possibility of damage to delicate components.

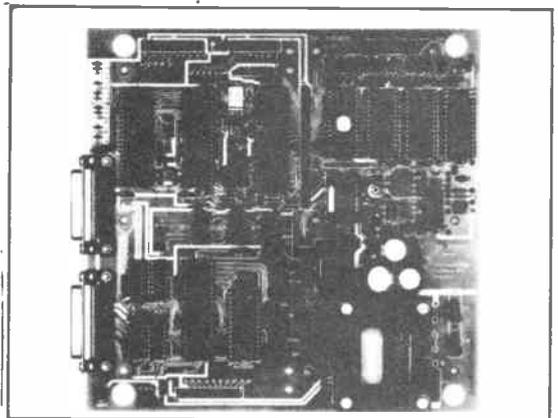
A skilled craftsman can make a good soldering joint in less than a second, but on a large copper area this may take several seconds. *Figure 7* shows the correct and the wrong way to provide earthing connections to an integrated circuit.



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BASE STATIONS



IC-275E/475E 25 Watt 2 metre/70cm. Multimode Transceivers.

Tech Talk from ICOM: THE EXCITEMENT OF SATELLITE COMMUNICATIONS

An ever increasing number of radio amateurs are joining the excitement of Phase 111 - type satellite communications. This new medium combines the communications range of the 20 and 80 metre bands with the line-of-sight reliability of 2 metres. It's equivalent to a totally new band, and a vast technical background is not necessary for enjoying the action. ICOM is able to help you enjoy the fascinating new capabilities of OSCAR and future amateur satellites. Its all mode 2 metre and 70cm base transceivers bring the operating conveniences of low band units to the VHF and UHF amateur bands. They can be used for local FM operations via repeaters or for SSB/CW communications via Phase 111 satellites. The IC-127IE all mode 23cm transceiver is in a class of its own, providing mode L satellite uplink capability. (Mode L: 1269MHz uplink, 436 downlink) (Mode U: 435 uplink 145 downlink). Satellite relayed signals are somewhat weak in nature and the IC-275E's low noise/high

sensitivity receiver gives the highest performance for hearing everyone regardless of their uplink performance. The noise blanker prevents pulse type electrical interference from masking desired DX signals, the selectable AGC can follow fast fades associated with spin modulation. There are also the 99 mode memories which can be used for intermixed FM repeater and SSB/CW operators. When the IC-275E is equipped with the optional mast mounted AG25 GaAsFET pre-amp, it becomes a satellite operations dream come true. ICOM's IC-475E 70cms transceiver has a front panel continuously adjustable power output to allow for daily signal variations. This overcomes the practice of over loading a satellites on-board receiver. The IC-475E also includes 99 all mode memories for the ultimate in operating flexibility. Using the ICOM CT16 satellite communications interface these base stations will track together via the ICOM CI-V system. If you are interested in joining today's most exciting era of amateur communications ie, OSCAR and future Phase 111 satellites, ICOM is the logical choice for top performance equipment.

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MORE BASE STATIONS

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ICOM, a pioneer in 1.2GHz technology are proud to introduce the first full feature 1240-1300MHz base station transceiver. Features include: multimode operation, 32 memories, scanning and 10 watts RF output. The IC-1271E allows you to explore the world of 1.2GHz thanks to a newly developed PLL circuit that covers the entire band, a total of 60MHz, SSB, CW, and FM modes may be used anywhere in the band making the IC-1271E ideal for mobile, DX, repeater, satellite or moonbounce operation. The IC-1271E has outstanding receiver sensitivity, the RF amplifiers use a low noise figure and high-gain disc type GaAs FET's for microwave applications. The rugged power amplifier provides 10 Watts

which can be adjusted from 1 to 10 Watts. A sophisticated scanning system includes memory scan, programme scan, mode-selective scan and auto-stop feature. Scanning of frequencies and memories is possible from either the transceiver or the HM12 scanning microphone. 32 programmable memories are provided to store the mode and frequency in 32 different channels. All functions including memory channel are shown clearly on a seven digit luminescent dual colour display. The IC-1271E has a dial-lock, noise blanker, RIT, AGC fast or slow and VOX functions. With a powerful 2 Watt audio output the IC-1271E is easily audible even in a noisy environment. The transceiver operates with either a 240V AC (optional) or 12 volt DC power supply.

IC-AG1200 Masthead pre-amp. Designed to use with the IC-1271E, the D.C. voltage and T/R switching for the amplifier is superimposed on the R.F. coaxial cable and switched by the pre-amp switch on the IC-1271E front panel. The new pre-amp provides excellent performance as a low noise microwave amplifier (0.6 noise figure typical).

IC-575, 28/50MHz Dual band multimode base station.

The ICOM IC-575 base station was developed to meet the demand for advanced communications for the recently acquired 6m band. Similar in appearance to the IC-275/475 2m and 70cm base stations, the beauty of this new transceiver from ICOM is that it gives you the best of both worlds, 6 & 10m in one compact unit. The IC-575 covers 28-30MHz and 50-54MHz. Operating modes are SSB, CW, AM & FM. Power output is 10 watts (AM 4 watts) with a front panel control to reduce output for QRP operations. A pass band tuning circuit narrows the I.F. passband width, eliminating signal in the passband. A built-in notch filter eliminates beat signals with sharp attenuation characteristics. Some PLL systems have difficulty meeting the lockup time demands placed on them by new data communications. This is why ICOM developed the DDS (Direct Digital Synthesizer) method. With a lockup time of just 5msec the DDS method allows the IC-575 to handle data communications such as packet or AMTOR. 99 programmable memories can store frequency, mode, offset frequency and direction. A total of four scanning functions for easy access to a wide range of frequencies, memory scan, programmed scan, selected mode memory scan and lock out scan. The IC-575 has an internal A.C. power supply, but can also be used on 13.8v DC for mobile or portable operation. Optional accessories available are the UT36 voice synthesizer, the IC-FL83 CW narrow filter, SP7 external loudspeaker, HP2 communication headphones and SM8/SM10 desk microphones. Other transceivers available in this range are: IC-275E 2m multimode 25w, IC-275H 2m multimode 100w, IC-475E 70cm multimode 25w, IC-475H 70cm multimode 75w.



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Front view of the display unit

The anemometer to be described began life partly as an electronic experiment, and partly for use as an accessory aboard a cruising yacht. However, it is currently gracing the chimney stack of our house and likely to remain there as I'm interested to know just how much wind is in force as the tiles abandon the roof.

There are two parts – the wind driven head and the display unit. The head unit consists of the familiar three-cup rotor on the shaft of which is a masked disc, with alternate opaque and transparent segments. The masked disc rotates in the light path of an optical slotted switch chopping the infra-red ray. The display is a simple rev counter with an analogue indication using a millimeter, calibrated in two ranges, 0-25 and 0-70 knots.

Circuit

Figure 1 shows the circuit of the optical slotted switch which is followed by a couple of buffer inverters, Tr1 and Tr2. The slotted switch is a Radiospares catalogue No 306-061, or any which are general purpose silicon npn transistors. The components are mounted on a piece of Veroboard approximately 25 x 50mm. As the cups rotate in the wind the masked disc chops the infra-red light path producing a square wave at the output of the inverters.

The rev counter uses a 555 timer IC in a monostable configuration (see Figure 2). The square wave signal from the head unit is integrated and the negative-going edge triggers the monostable. The output of the monostable is a train of pulses, the length of which is determined by RV2 (or RV3) and C1, and the rate of the frequency of the incoming square wave.

The output pulses drive the millimeter, which is slugged by C2, to reduce needle swing at low speeds. This

is somewhat of a compromise and the optimum value of C2 will depend on the mechanical response (damping) of the meter and the preference of the observer. Too much slugging (C2 high) will result in slow (or on) response to wind speed variations (gusts), and too little slugging (C2 low) will allow too much needle oscillation. It is a question of select on test.

Switching of RV2 and RV3 gives two different scales, one for the more usual low speeds say 0-25 knots, and the other for higher speeds of 0-70 knots.

increases in rate, a point is reached where the output is almost a permanent high state. Further increase in the input frequency actually causes a decrease in the output as some of the input pulses are ignored. If this were to occur at FSD, say 25 knots, then a real increase in wind speed to say 30 knots would result in an apparent decrease, or an indication of, say, 20 knots.

Adjustment of RV2 and RV3 is easily done by comparison with a car speedometer (need I add that this will be easier if someone else drives the car?).

BUILD A SIMPLE

Don't be taken unawares by hurricane the South East last October – build Mr G D

Adjustment and calibration

RV1 is adjusted first, and is not critical. Temporarily substitute a capacitor for C1 so that the output pulse length is several seconds. Trigger the monostable and adjust RV1 so that the needle deflection is rather more than full scale. The reason for this is that as the output pulse train

Choose a calm day and mount the head unit above the car. Select the speed at which you wish to indicate FSD on the low speed range, say 25 knots, and drive at that speed, 29mph. Switch in RV2 and adjust for FSD. Intermediate speeds are then calibrated using the existing scale and marked in later. A new scale can be

Fig 1 Anemometer head

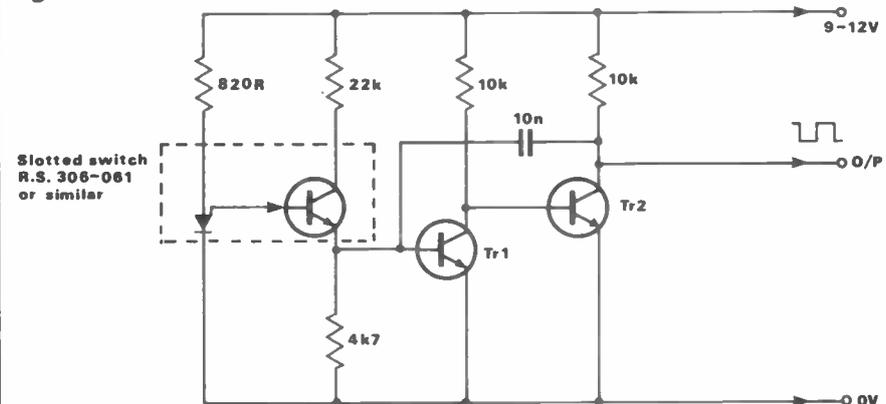
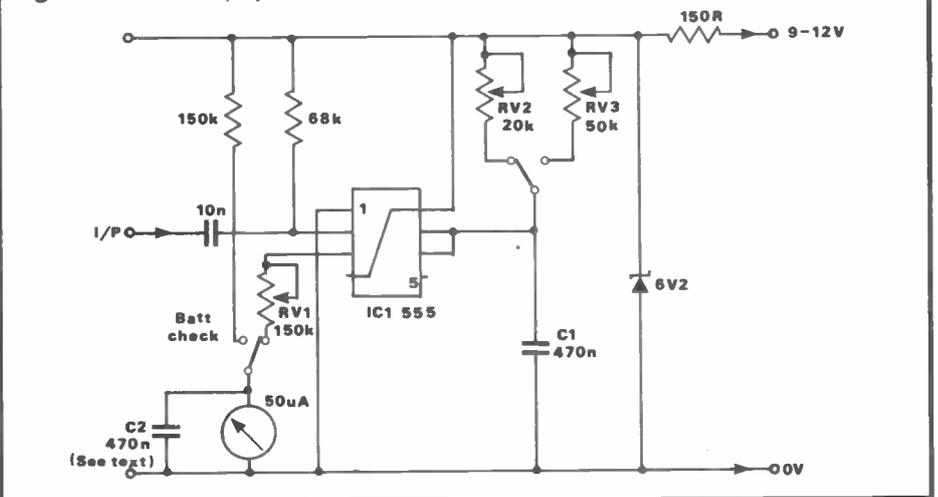


Fig 2 Anemometer display circuit



made from white card and glued over the existing scale.

The high speed range is done in the same way, choosing say 70 knots (82mph, hmm!) for FSD, and adjusting RV3. Although this seems crude the results were reliably reproducible indicating an adequate degree of accuracy for our purposes.

Construction

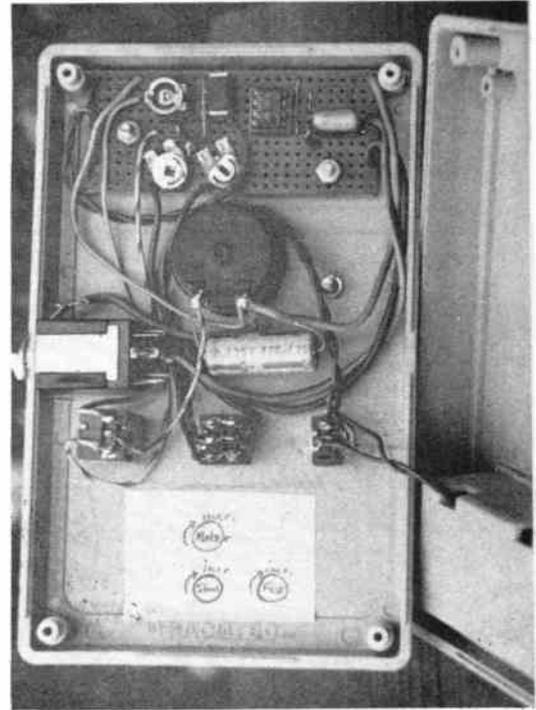
As with many projects, perhaps the most difficult part for the home constructor is co-ordinating the

mechanics so that the electronics can function as they are intended. For instance, in this case, a waterproof housing for the head unit and friction-free bearings for the 3-cup rotor are very important. Figure 3 shows the details of the head unit.

The cups took some finding, until my wife suggested egg poachers, which I found for a few pence each at a hardware store. Each cup is screwed on to the end of a short piece of solid 6mm aluminium rod, the other end of which is threaded and screwed into a small triangular plate

ANEMOMETER

winds – such as those experienced by Wilson's simple windspeed meter



Interior of the display unit

Fig 3 Anemometer head details

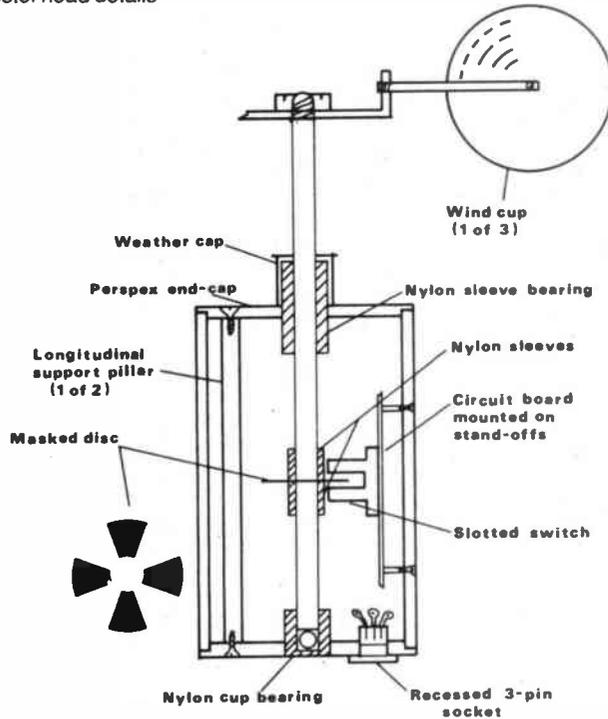
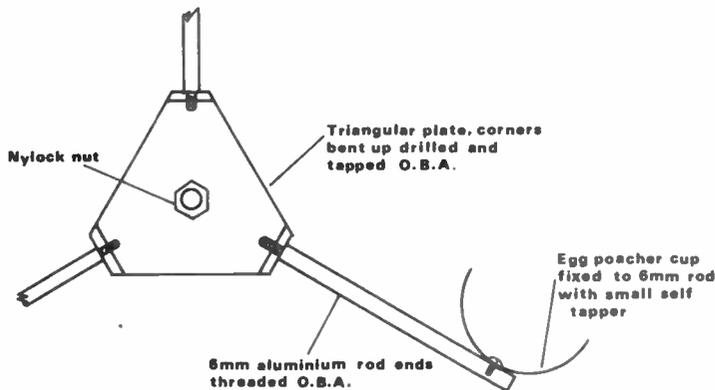


Fig 4 Rotor detail – viewed from above



(see Figure 4). This plate is tapped and screwed onto the stainless steel rotor shaft which is threaded at its top end. A nylock nut secures the cups to the rotor shaft.

The electronics are housed in a length (about 3in) of 2½in plastic drainpipe, which is sealed at each end with flanged perspex end-caps.

The end-caps are held by screws on to two longitudinal pillars which are a few thou' less in length than the main housing, so the end-caps are held tightly in place.

The rotor shaft passes through a nylon bearing in the upper end-cap and rests on a ball bearing in a nylon 'cup' bearing in the lower end-cap. Both bearings are made from nylon rod and the end-caps are reamed out to make a very tight push fit. The upper bearing is protected from the weather by a plastic cap which is in fact the protective cap from an 'N' type coax plug.

The masked disc is held in place on the rotor shaft by a tight push-fit nylon sleeve above and below the disc. The masked disc is made from perspex and covered with black adhesive tape. With a craft knife the taped disc is scored diametrically by four lines 45 degrees apart. Then alternate segments of tape are peeled off.

The circuit board containing the slotted switch is mounted to the side of the housing on stand-off pillars long enough for the disc to engage the slot. A recessed 3-pin socket provides a fairly weather-proof electrical connection.

At the time of building this unit I had access to a lathe and a good workshop, thus simplifying the construction of the head unit. Even so, with an electric drill, a few good tools, and most of all, plenty of ingenuity, a satisfactory head unit should be within the capabilities of most DIYers.

SATELLITES TO BRING A RADIO RENAISSANCE?

by J Slater

The acres of newsprint that have been used to describe satellite broadcasting over the last five years have, understandably, concentrated on the possibilities for the transmission and reception of television programmes. Even though the extensive sound capabilities of the MAC (Multiplexed

Analogue Components) system which is to be used for European direct broadcast satellites have been well documented, many writers have restricted themselves to the idea that the multiplicity of sound channels available will be used merely to provide sound tracks in different languages to accompany television

programmes as they are broadcast throughout Europe.

In fact, the MAC system, with its digital data being broadcast at the incredibly high rate of 20.25 million bits per second (although not directly relevant, just to give yourself some idea of the numbers involved, compare this with the 44.1 kilohertz sampling frequency used for compact discs) can offer far more than just sound to accompany the pictures, and it is perfectly reasonable to consider the MAC data as a completely separate signal from that of the picture information.

Whilst it is true that a small portion of the data will be needed for synchronisation and control of the television picture, and that this data at 20.25Mbit/s is only transmitted for about 9 microseconds of each television line, we are still left with an average of around 3 million bits of information per second which can be used for any purpose that we choose.

The data is gathered together in the form of 'packets' of 751 bits before transmission, and each Packet can be used to carry information relating to just one of the many sound programme channels being carried. Packets have their own individual address codes, which allow the receiver to pick out all the Packets from the datastream that correspond to the wanted sound channel, whilst ignoring those that are carrying information relating to other audio channels.

Since a single high quality audio channel, capable of providing a quality comparable with that of a compact disc requires around 350Kbit/s of data, depending upon the protection system used, it is therefore possible to carry up to eight high quality sound channels, or 16 medium quality channels, or any combination of the two, provided that our total data requirement does not exceed about 3Mbit/s. This means that a satellite carrying television programmes could have two stereo channels to accompany the pictures, and could also carry six high-quality mono radio channels, or a combination of mono and stereo radio services which would be receivable throughout the service area of the satellite.

The Germans have decided to take the idea of radio broadcasting from satellites a step further, and are intending to devote a complete 27MHz wide DBS satellite channel on TVSAT to carry nothing but sound programmes. The whole of the time that would normally be given over to broadcasting the television picture on one channel will be given over to data, so that the

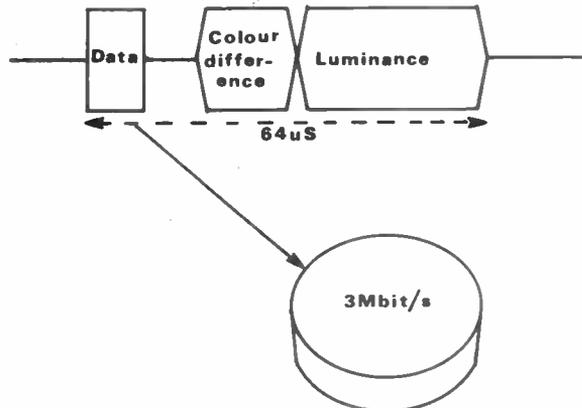


Fig 1 MAC waveform

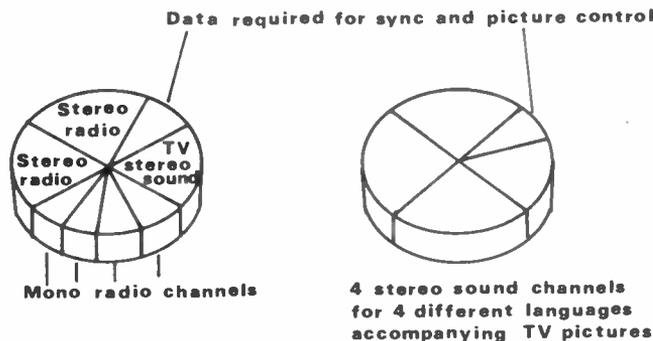


Fig 2 MAC data can be considered as a cake containing data at 3M bit/s, which can be divided up in various ways

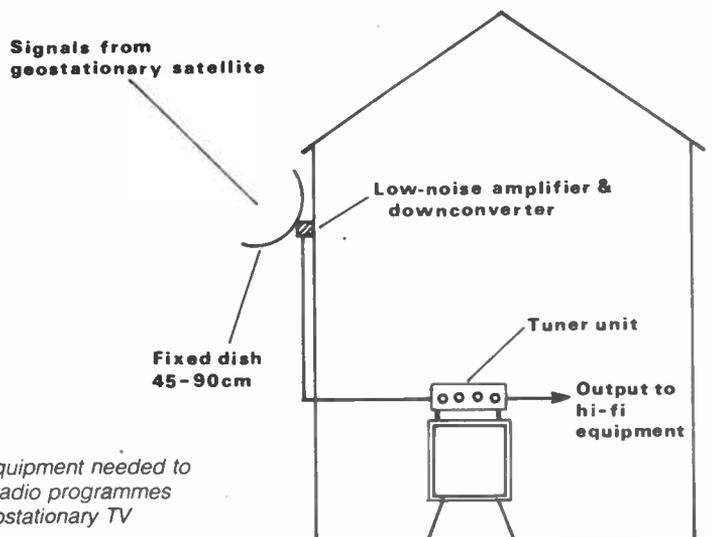


Fig 3 Equipment needed to receive radio programmes from Geostationary TV satellite

satellite could theoretically be transmitting a continuous digital signal at 20.25Mbit/s, allowing over fifty high quality radio programmes to be carried. In practice, it seems that the MAC signal to be carried by the German satellite will actually carry data at the lower rate of 10.125Mbit/s, but even this will provide more than enough radio channels to satisfy the average listener!

Nor are radio signals restricted to transmission on MAC DBS satellites; already the various medium-power distribution satellites which carry signals intended for cable head-ends are being used to carry extra radio services, by adding extra radio-frequency subcarriers which can be modulated with radio programmes. One user is the BBC, which uses both Eutelsat F-1 and Intelsat to carry its World Service radio programmes. Eutelsat also carries BBC broadcasts in some 20 different languages, and the intention is that radio stations and cable operators throughout Europe will be able to rebroadcast these signals at high quality, thus extending the reach of the programmes into homes that would not normally bother to try to receive poor quality short-wave broadcasts.

Although radio broadcasting from satellites in this way is perfectly feasible, it does suffer from the fact that, to receive the signals from geostationary satellites primarily designed for the transmission of television signals, the listener will need some form of antenna suitable for reception of signals at 12GHz, and that this antenna will have to be kept pointing towards the geostationary satellite with a pointing accuracy of within a few degrees.

This is fine for fixed installations in the home, where the output of the satellite radio receiver can be fed to the hi-fi unit, but presents great difficulties if the listener wishes to use a portable radio which can be carried from place to place, as most present-day listeners do.

As one who is very much interested in the possibilities of replacing the usual satellite dish aerial with some form of flat plate aerial, I am confident that within the next few years it should be possible to have such an antenna, a type of phased array, built into the back of a briefcase. This should provide excellent radio signals from the satellite, and even if the gain of such an antenna is lower than a dish of equivalent size, it should still prove possible to get noise-free audio signals from the digital transmissions.

The real problems will be that it will be somewhat difficult to position a briefcase for optimum reception from the geostationary satellite, which is at an angle of elevation of around 30 degrees, and that it will be necessary to line up the aerial to within just a few degrees of the satellite's azimuthal bearing. It is also true that receiving equipment for 12GHz is likely to be more expensive than that for lower frequencies.

To try to gain the benefits of radio reception from satellites without these disadvantages, a group of experts from

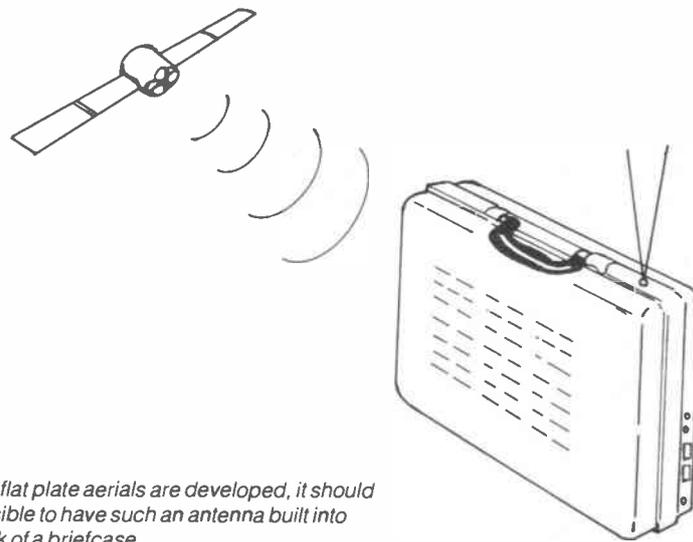


Fig 4 If flat plate aerials are developed, it should be possible to have such an antenna built into the back of a briefcase

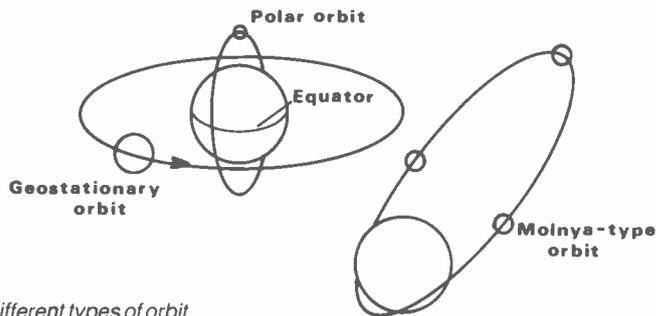


Fig 5 Different types of orbit

the UK will be attending next year's World Administrative Radio Conference, known by the unlikely initials of WARC-ORB 88, with a brief to obtain a modest frequency allocation intended exclusively for satellite broadcasting. This frequency would ideally be much lower than that of the DBS frequencies, perhaps somewhere in the range of 500MHz to 2.5GHz, allowing for cheaper equipment, and for simpler aerials.

So far, any frequencies that have been proposed by the broadcasters have been dismissed as 'impossible' by the various regulatory powers, but it is hoped that a good many other countries will support this idea at the conference, so that the authorities will be made to think seriously about releasing a small portion of a suitable frequency band. Such frequencies need not be used only from geostationary satellites, with the complex receiving aerials that these require, but could also be transmitted from satellites positioned in long elliptical orbits, often known as Molnya orbits, first used by the Russians in the mid sixties.

If three satellites are put into one of these long elliptical orbits passing over the poles, then each of the satellites will appear to be sensibly overhead for about a third of the day, before the next satellite passes into the overhead position.

This means that the receiving aerial can be pointed more or less directly upwards, and if it has a reasonable angle of coverage there will always be some signal received. Some of the meteorological satellites use this

technique, and if VHF or UHF frequencies are used, a pair of crossed dipoles mounted horizontally can act as a very effective and cheap receiving antenna. This type of antenna can be fixed, but even if it is mounted on the roof of a moving vehicle or in the top of a portable radio it will always be able to 'see' a signal from the satellite directly above it.

This technique could lead to a truly effective and practical system of radio broadcasting from satellites, and may well prove to be a cheaper method of providing national radio coverage than building hundreds of terrestrial transmitters. The Technical Advisory Committee of the European Consumer Electronics Manufacturers Association (ETAC) and the engineers of the European Broadcasting Union believe that if a band about 80MHz wide could be allocated to this type of service, each country in Europe could transmit about 16 different radio channels.

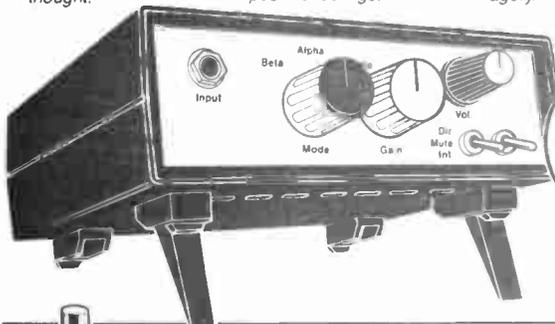
Manufacturers believe that providing customers with such a wide choice of high quality digital radio programmes could lead to a rebirth of radio listening, and to a huge market for a standard European satellite radio receiver. The problem is likely to be, however, that the propagation characteristics of frequencies between 500MHz and 2GHz which make it such a desirable band for satellite radio, make it just as useful to a whole host of other users, and powerful arguments will have to be mustered at WARC-ORB 88 if Europe is to gain access to this exciting new means of radio transmission.

Are we about to create a race of Supermen?

Brainwave

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α ALPHA – Relaxation, pleasure, tranquility, positive feelings.
θ THETA – Imagination, creativity, hypnagogic imagery.

monitor



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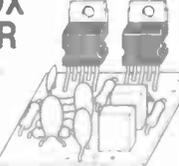
Two amplifier modules were described, both based on the powerful L165V IC. The single IC version has a maximum power of 20 Watts with a suitable speaker and power supply. The bridge version can produce up to 40 Watts. The specified supply voltage and tolerance are given. The specified supply voltage and tolerance are given. The specified supply voltage and tolerance are given.

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DATA FILE...

Ray Marston takes an in-depth look at applications of the NE567

tone-frequency decoding and switching IC

In the last three editions of *Data-File* we have explained the basic operating principles of modern Phase Locked Loop (PLL) systems and taken a detailed look at the circuitry and applications of popular PLL ICs, such as the 4046B and NE565, and at the associated NE566 'function generator' IC manufactured by Signetics. In this month's edition of *The File* we conclude our look at this subject by investigating another Signetics PLL device, the NE567 tone decoding and switching IC.

NE567 basics

The Signetics NE567 is a highly stable phase-locked loop device, which has the primary function of acting as a low-voltage power switch, turning on whenever the IC receives a sustained input tone that is within a narrow range of pre-set frequency values; ie, it acts as a precision tone-operated switch.

The NE567 is a fairly versatile device and can be used as either a variable waveform generator, a conventional PLL device, or as a precision tone switch. When used in the tone-switch mode its detection centre frequency can be set at any value from a few Hz to about 500kHz, its detection bandwidth can be set at any value up to a maximum of 14% of the centre frequency, and the output switching delay can be varied over a wide range of values, all via a few external components.

Pin notations

The NE567 is housed in an 8 pin DIL package. *Figure 1* shows the outline and pin notations of the IC, and *Figure 2* shows the internal block diagram (plus a few essential external components) of the device, which houses a conventional PLL circuit (comprising a VCO, a phase detector, and a feedback filter), plus a quadrature phase detector and an output-driving amplifier and open-collector output transistor. The IC functions as follows:

The VCO section of the IC can be varied over a wide range via external components R1 and C1, but can only be voltage-controlled over a very narrow range (a maximum of about 14% of the free-running value) via control pin 2. Consequently, the PLL circuit can 'lock' to only a very narrow range of pre-set input frequency values.

The IC's quadrature phase detector compares the relative frequencies and

phases of the input signal and the VCO output, and produces a 'valid' output-driving signal (which turns Q1 on) only when these two signals coincide (ie, when the PLL is 'locked'). The centre frequency of the NE567 'tone switch' is thus equal to the free-running frequency of the VCO, and its bandwidth is equal to the lock range of the PLL.

Basic connections

Figure 3 shows the basic connections of the NE567 tone switch circuit. The input tone signal is ac coupled (via C4) to IC pin 3, which has an input impedance of

about 20k, and the external output load (R_L) is wired between pin 8 and a positive supply voltage with a maximum value of 15V (note that pin 8 can sink load currents up to 100mA maximum value). Pin 7 of the IC is normally grounded and pin 4 is



Fig 1 Outline and pin notations of the NE567

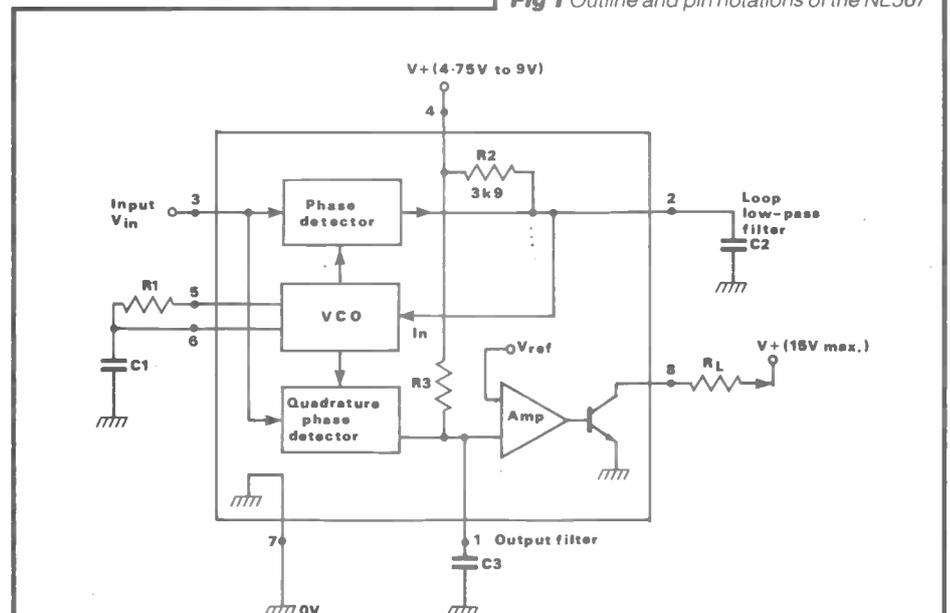


Fig 2 Block diagram and basic external connections for the NE567

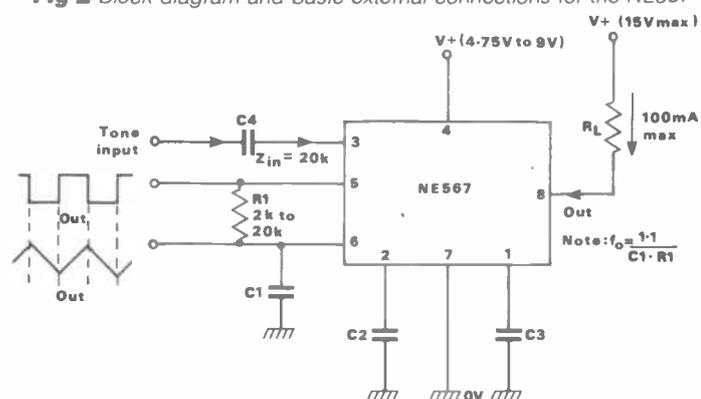


Fig 3 Basic 'tone switch' connections of the NE567

DATA FILE

PARAMETER	MIN	TYPICAL	MAX
General			
Operating voltage range	4.75V		9.0V
Supply current quiescent		7mA	
Supply current, active ($R_L = 20k$)		12mA	
Input			
Input impedance (pin 3)		20k	
Smallest detectable V_{in} (AT $I_L = 100mA$)		20mV	
Output			
Max pin 8 voltage	15V		
Max pin 8 sink current	100mA		
Fastest on-off cycling rate		$f_o/20$	
Off-state output leakage current		.01 μA	25 μA
On-state saturation voltage (at $I_L = 100mA$)		0.6V	1.0V
Output fall time ($R_L = 50\Omega$)		30ns	
Output rise time ($R_L = 50\Omega$)		150ns	
Centre frequency (f_o)			
Highest f_o	100kHz	500kHz	
f_o thermal stability (ppm/ $^{\circ}C$)		35 \pm 60	
f_o stability vs supply voltage		0.7%/V	2%/V
Detection bandwidth (BW)			
Largest BW (% of f_o) at $f_o = 100kHz$	10%	14%	18%
Largest BW skew (% of f_o)		3%	6%
BW variation with temp, at $V_{in} = 300mV$		$\pm 0.1\%/^{\circ}C$	
BW variation with V_{supply} , at $V_{in} = 300mV$		$\pm 2\%/V$	

Fig 4 Main parameter values of the NE567

wired to a positive supply with a minimum value of 4.75V and a maximum value of 9V; ideally, this supply should be stabilised.

The centre frequency (f_o) of the VCO is set via R1 (any value from 2k Ω to 20k Ω) and C1, and equals $1.1/(R1 \cdot C1)$. The VCO generates an exponential sawtooth waveform that is available at pin 6, and a square wave that is available at pin 5. The bandwidth of the tone switch (and thus the lock range of the PLL) is determined by C2 and the internal 3k9 resistor (R2) of the IC, and the output switching delay of the circuit is determined by C3 and internal resistor R3. We'll take detailed

looks at the selection of each of these components shortly. In the meantime, Figure 4 lists the main parameter values of the NE567 IC.

VCO design

The VCO section of the NE567 is quite easy to use, as shown in Figures 5 and 6. It generates a not-very-useful non-linear ramp waveform on pin 6, and an excellent square wave, with 20 nanosecond rise and fall times, directly on pin 5 of the IC. This square wave has a peak-to-peak amplitude equal to the supply voltage value minus 1.4 volts, and can be externally loaded by any resistance

value greater than 1k Ω without adverse effects (Figure 5). Alternatively, the square wave output can be applied (in slightly degraded form) to a low impedance load (at peak currents up to 100mA) via the pin 8 output terminal, as shown in Figure 6.

The operating frequency f of the VCO is determined by the R1 and C1 values, and equals $1.1/(R1 \cdot C1)$, where f is in kHz, R1 is in kilohms, and C1 is in μF . In practice, R1 must be restricted to the 2k Ω to 20k Ω range. To find the C1 value needed to generate a given frequency from a given R1 value, use the formula $C1 = 1.1/(f \cdot R1)$; to help aid the reader in using the VCO section, Figure 7 is presented as a component-selection guide. Thus, to give 10kHz VCO operation, C1/R1 values of about 55nF/2k Ω or 5n5/20k are needed.

Note from Figures 5 and 6 that the VCO operating frequency can be shifted over a narrow range (only a few percent) via a control voltage applied to pin 2 of the IC; if this voltage is used, pin 2 should be decoupled via C2, which needs a value roughly double that of C1.

Modifications

The basic Figure 5 and 6 circuits can be usefully modified in a number of ways, as shown in Figures 8 to 11. In the Figure 8 circuit the duty cycle, or mark/space ratio of the generated waveform, is fully variable over the 27:1 to 1:27 range via RV1, as C1 alternately charges via R1-D1 and the LH half of RV1, and discharges via R1-D2 and the RH half of RV1 in each operating cycle. The operating frequency varies only slightly as the m/s ratio is varied.

Figure 9 shows how the oscillator can be used to generate quadrature outputs, in which the square wave outputs of pin 5 and 8 are out of phase by a quarter of a cycle (90 degrees). In this application, input pin 3 is normally grounded; if the pin is biased above 2.8 volts, the pin 8 output waveform shifts by 180 degrees.

Finally, Figures 10 and 11 show how the VCO circuits can be modified to enable

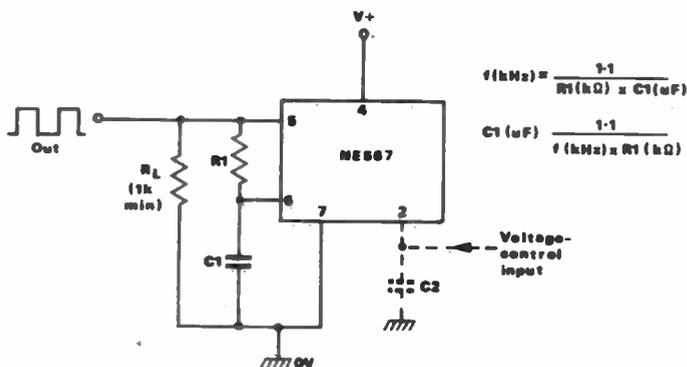


Fig 5 Precision square wave generator with 20ns rise and fall times

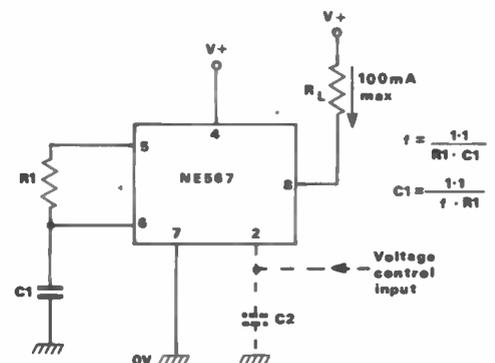


Fig 6 Precision square wave generator with high-current output

timing resistor values to be increased to a maximum of about 500k, thus enabling the C1 timing value to be proportionately reduced. In both cases, a high-impedance voltage-following buffer stage is wired between the R1-C1 junction and pin 6 of the IC. In Figure 10 this buffer takes the form of a simple emitter follower transistor stage, and causes a slight loss of waveform symmetry. The Figure 11 circuit, on the other hand, uses an op-amp voltage follower in the buffer position, and this causes no loss of symmetry.

NE567 outputs

The NE567 has a total of five output terminals. Two of these (pins 5 and 6) give access to the VCO output waveforms, and a third (pin 8) functions as the IC's main output terminal, as already described. The remaining two outputs are available on pins 2 and 1, and these give the following action:

Pin 2 gives access to the phase detector output terminal of the PLL network, and is internally biased at a quiescent value of 3.8 volts. When the IC receives in-band input signals, this voltage varies as a linear function of frequency over the typical range 0.95 to 1.05 f_0 (the VCO free-running frequency), with a slope of about 20mV per percent of frequency deviation. Figure 12 illustrates the basic relationship between the pin 2 and pin 8 outputs of the IC when it is used in the 'tone switch' mode, at tone signal bandwidths of 14% and 7%.

Pin 1 gives access to the output of the IC's quadrature phase detector. During tone lock, the average voltage of this pin is a function of the circuit's in-band input signal amplitude, as shown in the transfer graph of Figure 13. Note that the pin 8 output transistor turns on when the pin 1 mean voltage is pulled below the 3.8 volts threshold value.

Bandwidth and skew

When the IC is used in the tone-switch mode, its bandwidth (as a percentage of

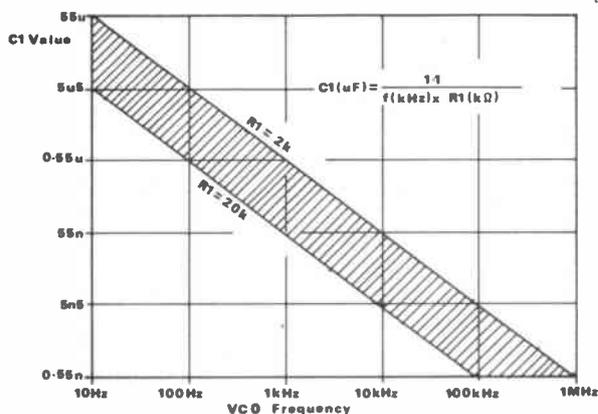


Fig 7 Component selection guide for the VCO section

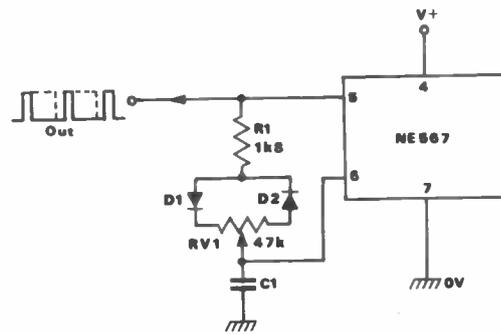


Fig 8 Generator with variable M/S-ratio output

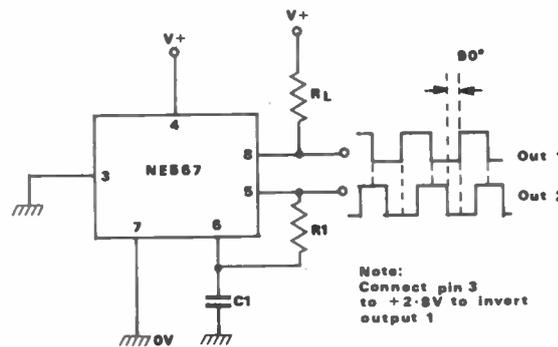


Fig 9 Generator with quadrature outputs

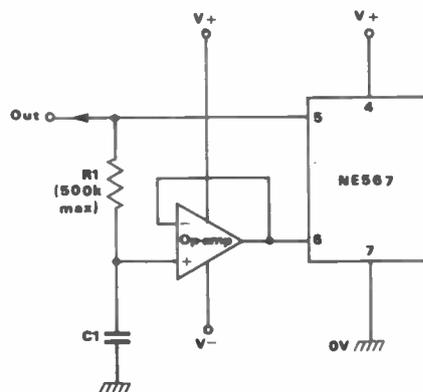


Fig 10 Use of a transistor buffer to increase the permissible value of R1

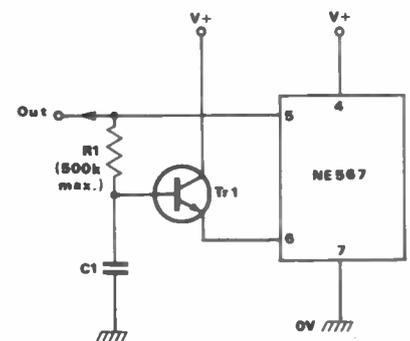


Fig 11 Use of an op-amp buffer to increase the permissible value of R1

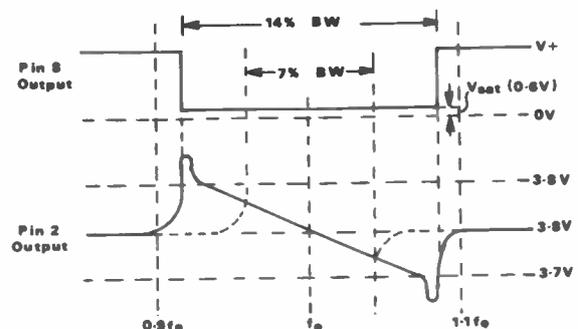


Fig 12 Pin 2 and pin 8 outputs under 'in band' conditions

f_0) has a maximum value of about 14%, but is proportional to the value of in-band signal voltage in the range 25mV to 200mVRMS (but is independent of values in the 200 to 300mV range), and is inversely proportional to the f_0 -C2 product; the actual bandwidth value being equal to 1070 times the square root of $V_{in}/(f_0 \cdot C2)$, where the V_{in} value is in V_{rms} and the C2 value is in μF . To select a C2 value in an empirical (educated trial and error) basis, start by making its value $2 \times C1$, and then either increase its value to reduce the bandwidth, or reduce it to increase the bandwidth.

'Skew' is a measure of how well the detection band is centred about the centre frequency (f_0) of the VCO, and is specified as a percentage of f_0 by the formula $(f_{max} + f_{min} - 2f_0)/2f_0$, where f_{min} and f_{max} are the frequencies corresponding to the edges of the detection band.

Thus, if a tone switch has an f_0 of 100kHz and a bandwidth of 10kHz, and its edge of band frequencies are symmetrically placed at 95kHz and 105kHz, its skew value is zero percent. If, on the other hand, its edge of band values are highly non-symmetrical at 100kHz and 110kHz, its skew value works out at 5%. In practice, the NE567 gives typical worst-case skew values of 3%. If desired, the skew value can be reduced to zero by feeding an external 'bias trim' voltage to pin 2 of the IC via a pot and a 47k series resistor, as shown in Figure 14.

Tone-switch design

Practical tone-switch circuits of the Figure 3 type are quite easy to design. Start by selecting the R1 and C1 frequency control component values with the aid of the Figure 7 graph, and then select the value of C2 on the

empirical bases described above, starting by making it twice the value of C1, and then adjusting its value (if necessary) to give the desired signal bandwidth; if band symmetry is critical, skew adjustment (see Figure 14) can be added at this stage.

Finally, to complete the circuit design, give C3 a value double that of C2 and check the circuit action. If C3 is too small, the pin 8 output may pulsate during switching transients. The C3 value can be increased to add switching delays to the pin 8 output terminal.

Multi-switching

Any desired number of NE567 tone switches can be fed from a common input signal, to make a multi-tone switching network of any desired size. Two particularly useful 2-stage switching networks are shown in Figures 15 and 16.

The Figure 15 circuit works as a dual tone decoder, and has a single output that activates in the presence of either of two input tones. Here, the two-tone

switches are simply fed from the same signal source and have their outputs NORed via a 4001B CMOS gate.

Finally, Figure 16 shows how two-tone switches can be wired in parallel to act like a single tone switch that has a bandwidth of 24%; in this case the operating frequency of the lower (IC2) tone switch is simply made 1.12 times lower than that of the upper (IC1) tone switch, so that their switching bandwidths overlap.

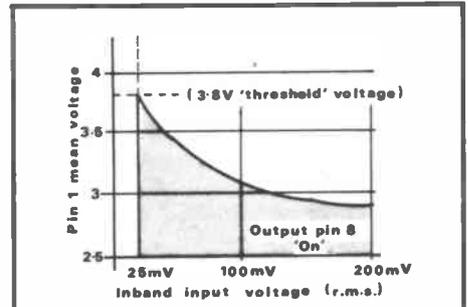


Fig 13 Voltage/signal transfer graph of pin 1

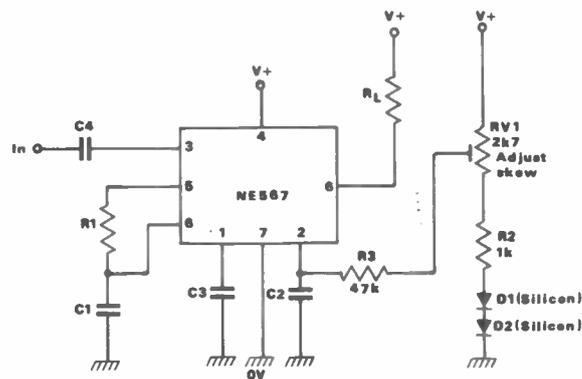


Fig 14 Tone switch with skew adjustment via RV1

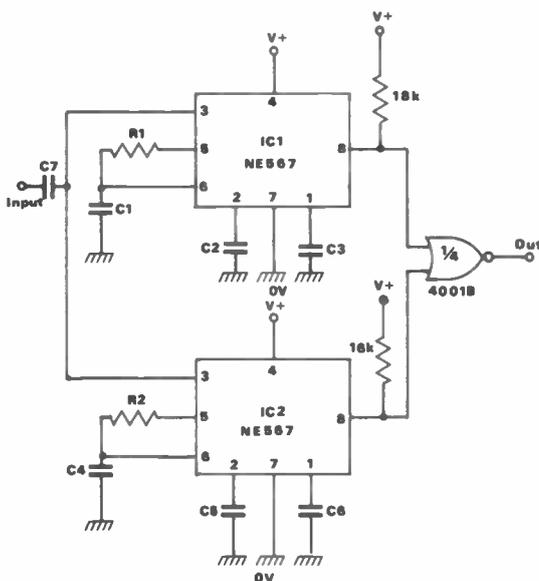


Fig 15 Dual tone decoder with a single output

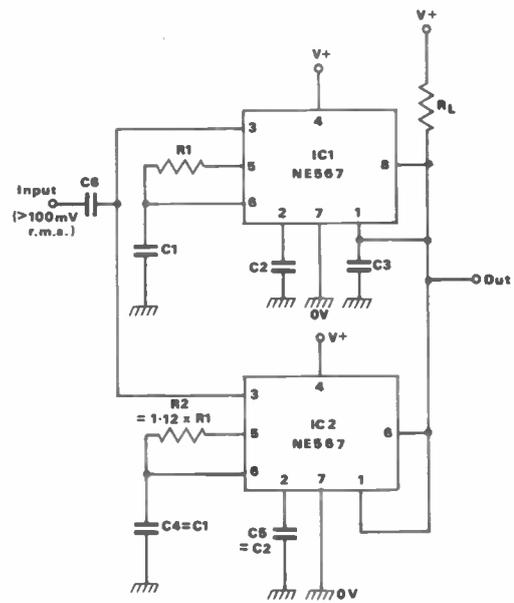


Fig 16 Tone switch with 24% bandwidth

POWER MOS DEVICES

THE WHY'S AND WHEREFORES

Power metal oxide semiconductor technology is yet another addition to the several technologies already well established in the power transistor family. This article by Brian Klemis discusses the advantages of power MOS technology, in particular from the point of view of performance and cost.

Power MOS technology differs primarily in two ways from bipolar-MOS conduction control and unipolar conduction.

The MOS structure implies that the drive terminal is electrically insulated from the rest of the device. Parasitic capacitances are the only load that the MOS represents for the driving circuit. The lack of a drive current of any significant value is certainly a major advantage. To understand the extent of this advantage, a practical case where the power supply is the same for the load and for the driving circuit can be considered. A typical case using automotive electronics is considered for 100V, 5A rated devices. As *Table 1* and *Figure 1* show, it is evident how a simple drive configuration can, in some cases, compensate for higher losses on the device itself, not to mention the driving circuit simplification. In practice, MOS devices are driven by a voltage source giving 0V or +10V drive, which may even have a relatively high (k Ω) internal resistance.

Drive power is needed (apart from leakages in the nA range) to charge and discharge input parasitic capacitances during the switching transition.

Inside the silicon chip of a MOS device only majority carriers are used for conduction. This has two major consequences:

- (1) When in the charging state, there is no need to wait for minority carriers to disappear or to fully invade a certain silicon area. MOS devices are faster than their bipolar counterparts, by at least one order of magnitude, because they do not make use of minority carriers for conduction. Phenomena like the storage time (the minority carriers must evacuate the base area) or the dynamic V_{CEsat} (the minority carriers must invade and settle in the collector area) are completely absent in MOS devices.
- (2) As there is no ' h_{FE} ' to be increased with a rise in temperature (h_{FE} is a description of the minority carrier behaviour), there is no possibility of a direct secondary breakdown (FBSOA limitation) or of a reverse (RBSOA limitation).

A MOS transistor is safely able to

absorb power pulses, and this ability is not reduced by 'power focusing' anywhere in the die. There is no secondary breakdown in MOS.

Another important consequence of unipolar conduction is the absence of 'conductivity modulation'. In a bipolar device the carriers can (in the fully saturated state) invade the collector region, and significantly reduce its resistivity. The drain region is thick and more resistive to sustain the voltage in the *off*-state. When the device is turned on, this region is responsible for the *on*-state voltage drop ($V_{DS(on)}$). The higher the voltage a device is built for, the more the resistance of the drain region contributes to the total *on*-state resistance. As a rough indication, it can be said that:

■ For devices rated 60V or less, the drain resistivity is not the prime factor responsible for its *on*-state characteristics.

■ For devices rated 200V or more, drain resistivity is the major cause of its *on*-state characteristics.

As a result, conductivity modulation makes bipolar devices more efficient (smaller chips and lower costs) than MOS in the high voltage area. The higher the voltage the more pronounced are the effects of the lack of conductivity modulation.

MOS of a similar current capability, versus power bipolars of the same voltage capability, require similar silicon area in the chip for the 60-100V range and 2 to 5 times more silicon area in the chip for the 200-500V range; they are hardly competitive at 800V and above.

MOS technology is more sophisticated than that of standard bipolar devices because of the finer geometries and more processing steps involved with the

former. As a result, a silicon chip of the same area has a higher cost due to the higher equipment costs, the longer processing time (more operations) and the lower production yields.

A comparison based on cost-per-unit-area of silicon is the simplest to make, but a comparison between the performances is much more accurate as it reveals the advantages in a specific application.

In the high voltage range of 800V and above MOS is hardly competitive; the chip would have to be enormous in size for any significant current. For high voltages the technology must be that of a conductivity modulation device. In addition, the typical applications (motor controls, high power converters) imply physical dimensions which are not compatible with very high switching speeds, as the parasitic elements such as inductances and capacitances make high frequencies impossible.

MOS and power bipolar are fairly competitive in the 200-600V voltage range. MOS allows lower switching losses traded off with higher dc losses. A reduced cost of the driving circuit tends to compensate for the high cost of the device itself. The higher the switching speed and the lower the maximum voltage, the more competitive MOS becomes.

In the lower voltage range of 60-100V, MOS conductivity modulation is not a problem. There is no significant difference between the drive supply voltage and the voltage applied to the drain. But, unlike bipolar devices, the drive power required by MOS transistors is very small (the power gain is very high) and there is negligible power loss. Hence MOS should certainly find their stronghold in this range.

Table 1 Relative performances; Darlington; power MOS devices

PARAMETER	TRANSISTOR	DARLINGTON	POWER MOS
Rated Voltage	100V	100V	100V
Operating current	5A	5A	5A
Saturated gain	10	100	—
Drive power required	0.5A x 12V = 6W	50mA x 12V = 600mW	0mW
Losses on the device at 5A	3.5W ($V_{BE} = 0.7V$)	7.5W ($V_{BE} = 0.7V$)	6W ($V_{GS} = 1.2V$)

AERIALS, FEEDERS AND

Ken Williams
discusses the
significance of the
Voltage Standing
Wave Ratio of an
aerial system

In recent years many myths have grown up regarding the significance of the voltage standing wave ratio (VSWR) of an aerial system.

Herculean efforts are made to approach the magical 1:1 ratio, with the ability to show a low figure often the only parameter considered in defining the performance of an aerial system.

In contrast, twenty years ago few amateurs even considered VSWR, and even fewer possessed any means of measuring it. The main considerations were whether the aerial would load easily, and if it would radiate an effective signal.

Of course, it was realised that standing waves on a coaxial feeder were not desirable, but these were usually checked by running a neon indicator bulb along the side of the feeder, and if the bulb didn't strike, all was considered well.

What, therefore, has caused this revolution in opinion? Possibly two of the main factors in this were the popularity of VHF operation, and the increasing use of solid-state power amplifiers on the HF bands.

In earlier HF valve transmitting equipment, the normal output circuit was the PI tank, which was capable of matching to a very wide range of impedances. The impedance presented to the transmitter was therefore of little importance, but with the increasing popularity of VHF operation, in which the normal output circuit is a link coupling of fixed impedance, the aerial now has to be matched to the transmitter, for aerial matching units were not, and are still not, common practice.

This was further exacerbated by the introduction of solid-state output stages which performed very badly under mismatch conditions, even to the point where, in poorly designed circuits, they could self destruct.

As high power solid-state output stages became available and were introduced on HF, this characteristic became more evident, for the PI tank circuits disappeared in favour of a 50 ohm unbalanced output and, particularly on the lower frequencies, an aerial may exhibit a wide variation in impedance across a single amateur band.

As a typical example, the author's Swan 100MX shows a reduction of 40% in output power as the VSWR increases from 1:1 to only 1.5:1. These factors and possibly several others led to an increasing awareness of the desirability of a low VSWR on the aerial feeder, to the point where it became obsessional, and consequently a number of myths grew up.

What is VSWR?

Theory states that optimum power transfer occurs when the characteristic

impedance of the source of a transmission is matched to that of the line and also the load. In the ideal installation, therefore, the 50 ohm output from the transmitter should be connected to a 50 ohm feeder, which in turn is matched to an aerial of 50 ohms characteristic impedance.

In real life, however, such perfection is rarely possible, for few aerials exhibit a characteristic impedance of 50 ohms, and this may vary across an amateur band.

A perfect match is therefore unlikely, and this mismatch will cause a proportion of the applied power to be reflected back down the feeder. The reflected power will then react with the forward power to set up a standing wave pattern along the feeder. This will vary the current/voltage ratio and consequently, the apparent feeder impedance. On arriving back at the transmitter, the resulting impedance mismatch will result in the power again being sent towards the aerial, etc.

A simple way of detecting and measuring the amplitude of the standing waves is to use an inexpensive reflectometer, which compares the forward and reflected voltages, and is calibrated to indicate VSWR directly. Such meters are very frequency-conscious but are reasonably accurate at low VSWR values.

As the voltage is proportional to the impedance, then on zero or very low loss lines, the VSWR also represents the ratio of the mismatched impedances.

It is important to realise that power is not lost due to mismatch. All losses are due to the ohmic and other losses in the transmission line. Furthermore, almost all power reaching the aerial is radiated, if only because it has no other place to go! The only losses within an aerial are due to wire resistance and insulator leakage - both of which should be negligible.

Feeder losses

Feeder losses are due to two main causes: dielectric and ohmic. The former are a result of the materials and type of construction of the cable. These losses increase rapidly if any water or damp finds its way into the cable. Losses also increase rapidly with frequency, typically increasing by 50% for each doubling of frequency.

Ohmic losses are due to the electrical resistance of the cable and are not likely to vary substantially, unless there is sufficient water ingress to cause corrosion inside plugs, joints, etc.

The quality of modern feeders is such that, at HF, the losses over any reasonable length are likely to be negligible, even though the VSWR may be as high as 5:1. On VHF, however, the losses rise rapidly and feeder length should be kept to an absolute minimum.

STANDING WAVES



The ARRL Antenna Handbook shows an excellent but simple method of checking the losses on a piece of coaxial cable. This only requires a source of RF power at the frequency in use, and an inexpensive VSWR meter.

The feeder to be checked is short-circuited at one end and RF power is applied via the VSWR meter at the other. The VSWR is measured and the losses determined from a graph (Figure 1). As a ready rule of thumb, it will be seen that, provided the VSWR is worse than 10:1, cable losses will be less than 1dB, and for most purposes fully serviceable. It should be noted that this loss figure is only valid for the test frequency.

Using this method several years ago, the author determined the losses on an old length of cellular coaxial cable to be over 6dB, when less than 1dB was expected. This, it was surmised, was due to water ingress. The cable was replaced, and the defective cable was thrown in the corner of the shack, coincidentally close to a radiator. The cable was forgotten until a shack clearout some twelve months later, when it was again checked. This time the loss figure had returned to specification, and the cable now has another lease of life, but to be on the safe side, it is only used indoors.

A trap for the unwary

It is generally considered that if a low VSWR can be obtained, the RF from the transmitter is being efficiently transferred to the aerial, but in a recent article in *Radio and Electronics World* (Mendacious Meters, February 1987), it was shown that a 6dB line loss could conceal an aerial mismatch of 4:1 by indicating a VSWR of only 1.35:1.

This is not quite as ridiculous as it may seem, for it only corresponds to the loss on 50ft of UR43 on the 70cm band, and a 4:1 mismatch can easily occur in home-built UHF aeriels.

At first sight, such a VSWR would seem

to indicate a reasonable transfer of power from transmitter to aerial, but the 6dB line loss concealed an actual system radiation efficiency of only 16%.

One VSWR – two impedances!

It was said earlier that the VSWR is a direct measure of the ratio between two impedances, thus a VSWR of 3:1 indicates that the value of one impedance is three times that of the other. In other words, if your meter indicates this value and the transmitter output is 50 ohms, then the aerial is either 150 ohms or 17 ohms. Furthermore, the load will no longer be acting as pure resistance, but also showing an additional inductive or capacitive reactive component.

At this point, the design of the transmitter output stage must come under scrutiny, for under these circumstances valve circuits act very differently to transistors.

With valves, as the tank circuit is brought to resonance, the load impedance is transformed to a level of several thousand ohms to match the anode circuit impedance. Small-load reactive components, either capacitive or inductive, are normally balanced out in the tank resonating function.

Transistor output stages operate in a completely different manner. The output circuit is a broadband transformer, which is designed to match a 50 ohm load to the much lower (in the order of 4 or 5 ohms) transistor output impedance. Since this transformation ratio is fixed, any reactive component in the load impedance is applied to the collector circuit. Certain reactances at this point, especially inductive, may give rise to parasitic oscillation, with disastrous results, unless suitable protection circuits have been included.

Due to the very low output impedance of the transistor output stage, it tends to act more or less like a constant voltage source. In other words, the RF output

voltage will tend to remain at a fixed level regardless of load impedance. The output power will therefore increase as the load impedance decreases.

On first sight this may seem an advantage, but it should be remembered that although thermionic output stages are naturally limited by the saturation current of the valves, no such restriction applies to solid-state, and under mismatch conditions extremely high currents may be drawn. Unless adequate protective circuitry is included, damage may ensue.

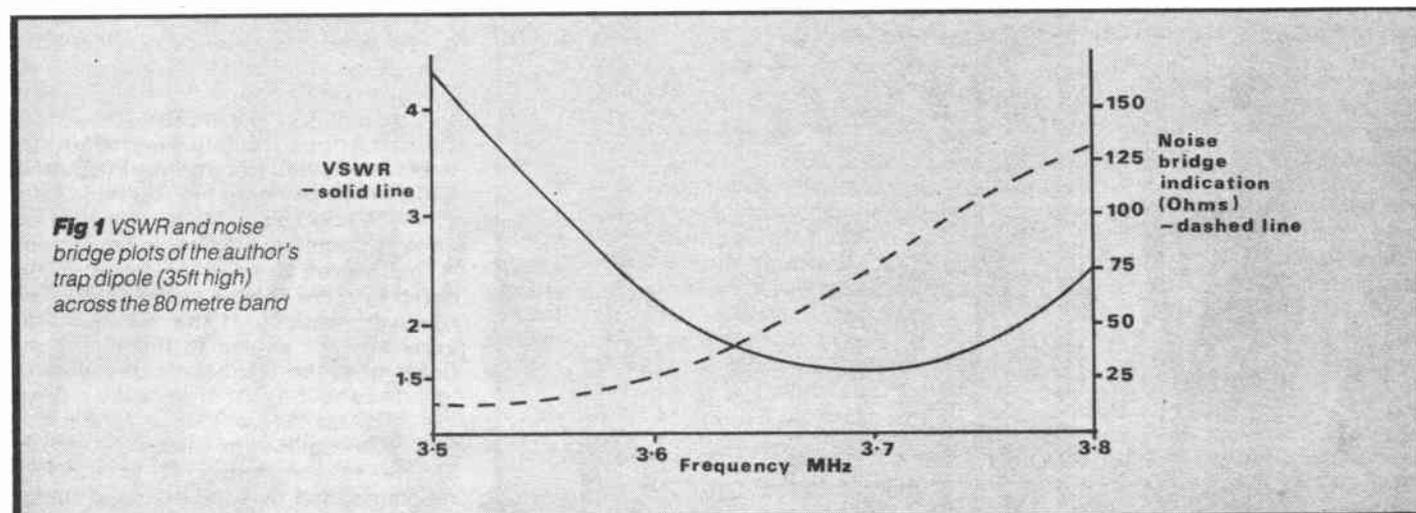
If, still considering a 3:1 VSWR, the load impedance is 150 ohms, a valve PA will usually match satisfactorily, but this higher impedance will be reflected back onto the transistors of a solid-state PA and, providing no reactive effects intervene, will merely reduce the output power available.

Too much reliance cannot therefore be placed on VSWR measurements alone for, as we have seen, they do not give the complete picture. There are other methods of determining the load impedance which will be presented by the aerial to the transmitter, of which perhaps the simplest and cheapest is the noise bridge.

A comparison of the readings of VSWR meter and noise bridge will give a far better indication of the situation than the VSWR meter alone.

Aerial matching units

So far we have only considered direct connection between the transmitter and the aerial feeder. This is the normal technique on VHF and UHF, but on HF it is common practice to fit an aerial matching unit (AMU). This unit is also frequently called an aerial tuning unit (ATU), but this is a misnomer for it does not tune the aerial. Its sole purpose is to match the 50 ohm resistive output of the transmitter to the resistive and reactive load presented by the aerial feeder.



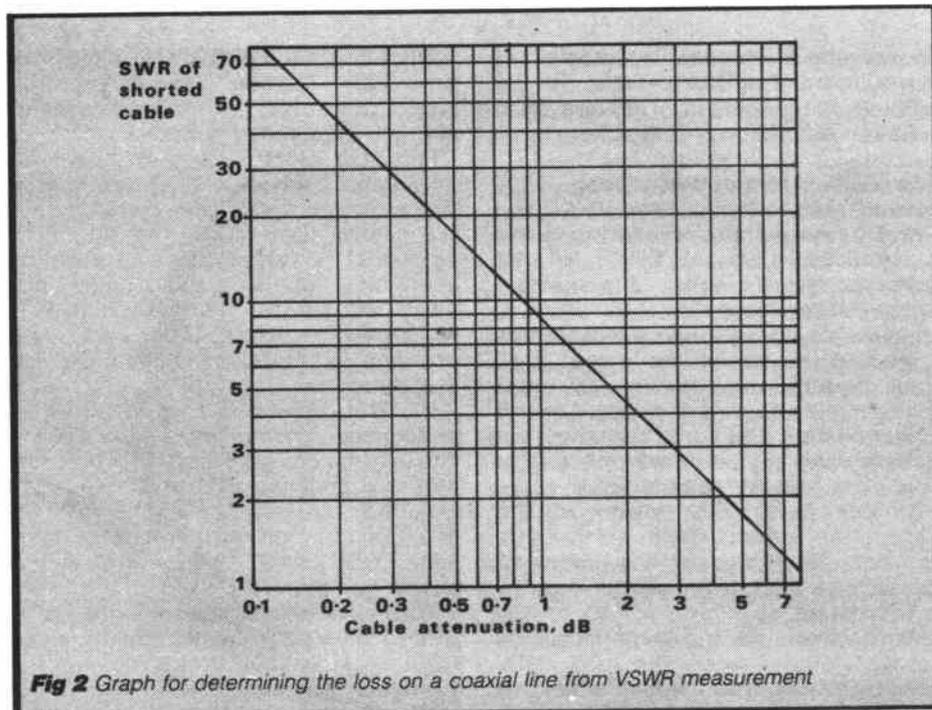


Fig 2 Graph for determining the loss on a coaxial line from VSWR measurement

Many commercial aerial matching units are also fitted with a VSWR meter. This often gives rise to a misunderstanding, for it is invariably fitted to the transmitter side of the unit.

As adjustment of the AMU almost invariably results in a 1:1 VSWR indication, users are tempted to believe that they have 'tuned out' the VSWR on the feeder. However, what they have really done is to adjust a device (ie the AMU), which transforms the reactive feeder

impedance to the resistive 50 ohms required by the transmitter. The actual VSWR on the feeder will vary very little during the matching process.

Aerials and feeder VSWR

The radiation resistance of a half-wave dipole is often quoted as about 70 ohms, and as such would offer a good match to a 75 ohm feeder, and a passable match to 50 ohms. Why, therefore, should an AMU be necessary?

The fact is that 70 ohms is the value for an aerial in free space, but as soon as either other aerial elements (such as directors or reflectors) come anywhere near, or the aerial is within several wavelengths of ground, this may vary considerably.

The radiation resistance of multi-element beam aerials may fall as low as five or ten ohms, but the design invariably includes some form of matching system to allow the feeder to 'see' a non-reactive 50 ohms.

With simple dipole aerials on VHF or even the higher HF bands, normal aerial heights are sufficient to minimise the latter effect, but on 160 and 80 metres the radiation resistance may drop as low as 10 or 20 ohms respectively at a height of 35ft. The reason for this is that the current in an aerial comes from two sources, the first of which is the power fed from the transmitter.

Some of this power, however, is radiated vertically downwards to the ground where it is reflected back to the aerial and induces further power into the wire. At some heights these will be in phase, whilst at others they will tend to cancel. A higher current means that the radiation resistance is effectively decreased, whilst a lower current results in the converse.

Aerials longer than a half wavelength exhibit a higher radiation resistance, which must be allowed for when using coaxial feeder. Matching devices usually take the form of ferrite transformers, or quarter wave matching sections.

Dipole aerials are inherently balanced devices, but coaxial feeder is not. It is therefore desirable to include some form of balun between the dipole and feeder. Most commonly this is a ferrite cored device, such as may be obtained quite easily from amateur radio 'emporiums'. Many amateurs, however, believe that an even more effective design comprises merely a coil of half a dozen turns of the feeder cable, six inches in diameter, bound tightly together.

As it comes away from the aerial, the feeder is obviously in a strong RF field, and consequently the outer screening may well suffer induced currents. These will upset the VSWR of the line, and also cause the line to radiate. This in turn may upset the radiation pattern of the aerial and also, by bringing the RF field closer to the house, exacerbate any interference to domestic electronic equipment.

The degree of coupling between the aerial and the feeder depends on their relative positions. If the feeder is led away at right angles to the aerial, the fields from the two halves of the aerial tend to cancel, and therefore the pick-up is minimised. As there is a practical limit to how far the feeder can be run at right angles to the aerial, it is normally recommended that the distance should be at least one quarter of a wavelength.

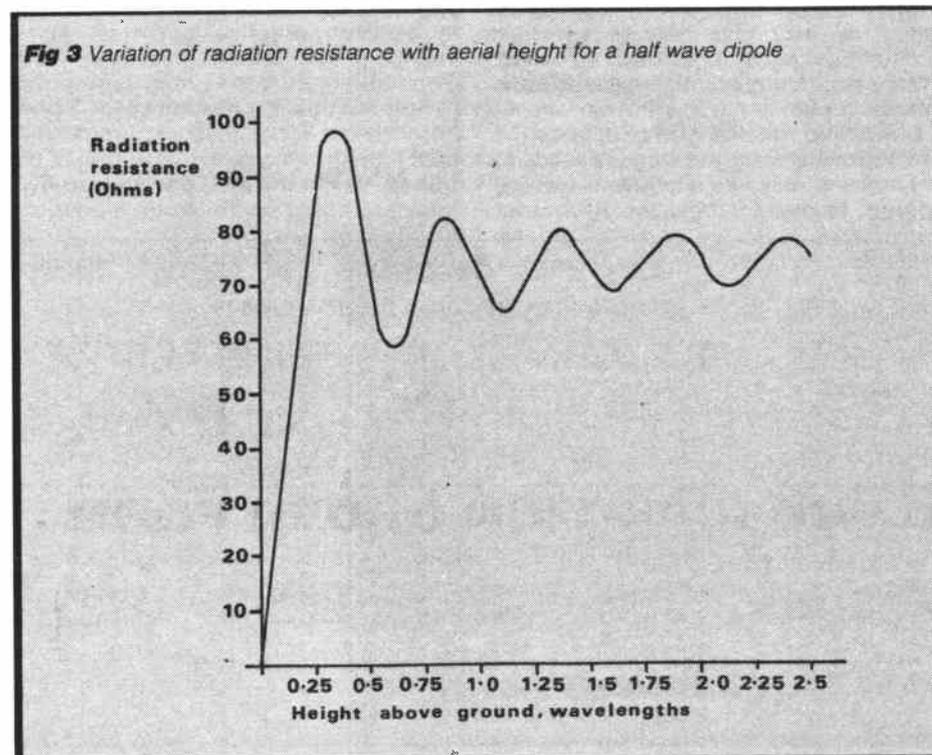


Fig 3 Variation of radiation resistance with aerial height for a half wave dipole

Summary

Many people go to great lengths to attain a very low VSWR. Whether this objective is necessary or not depends very much on the design of the station.

On HF, feeder losses are likely to be negligible even with a high VSWR, but in such circumstances, without an AMU, difficulties may arise in obtaining sufficient output from the transmitter. With solid-state PAs, damage may be caused if there is a high reactive component on the feeder.

If an AMU is in use, provided that it gives an accurate match between feed line and transmitter, any moderate (ie under 5:1) VSWR on the feeder is unlikely to make any noticeable difference to the strength of the transmitted signal. On VHF, due to not using AMUs and the high feeder losses, every effort should be made to keep VSWR to a minimum.

An aerial radiates virtually all the power supplied to it. A resonant dipole with 1.1:1 VSWR will not radiate a noticeably different signal strength from a similar, slightly off-resonance aerial with a 4:1 VSWR.

VSWR measurements are only one indication of the conditions in the aerial circuit. Correlation with measurements from a noise bridge gives a far better picture of the true situation.

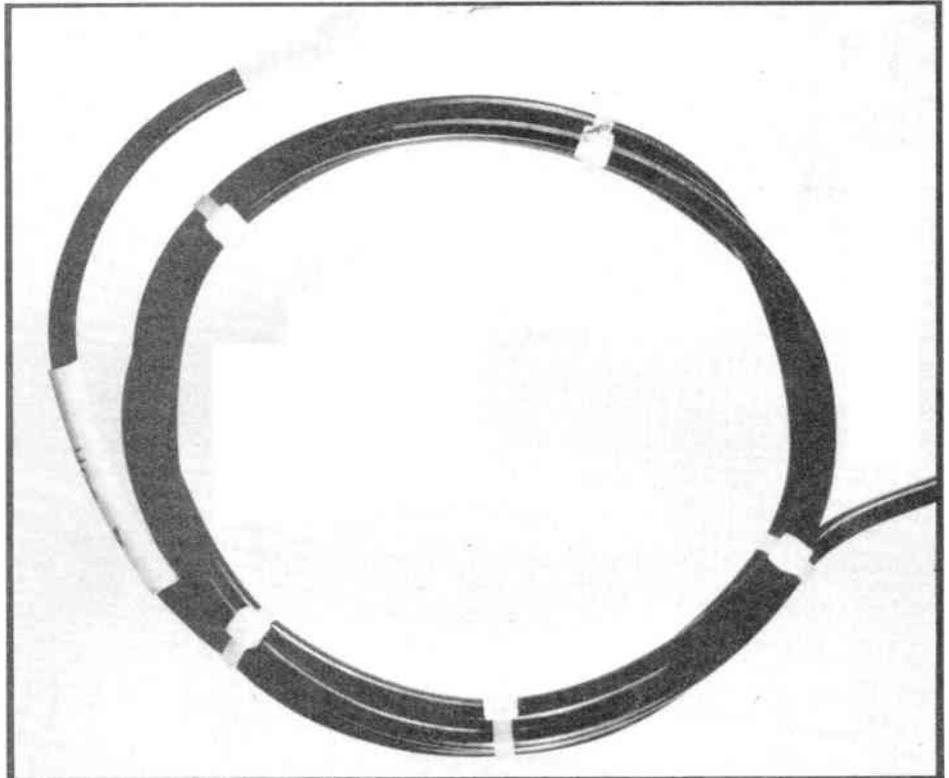


Fig 4 A simple coaxial balun

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KEN MICHAELSON G3RGD ASSESSES LOWE'S HF125 RECEIVER

It was with great interest that I opened the box containing the latest offering from Lowe Electronics Ltd. It contained a receiver intended to provide down-to-earth reception at a down-to-earth price. Nevertheless, it includes all the essential requirements for the discriminating short wave listener. There are a number of units at present on the market which have, to my mind, too many facilities available.

I am of the opinion that a large number of owners of the 'all singing all dancing' type of receiver do not take full advantage of these conveniences. I wonder what, for instance one does with 100 memories. I know that someone will write in saying that he/she uses all of them and could do with more, but as far as I am concerned, I have a general coverage receiver which has 32 memories and a transceiver which has 8. The HF125 has 30, which I would consider to be about right.

However, I digress. The HF125 is quite a small unit measuring only 255mm (10in) wide by 90mm (3.5in) high by 179mm (7in) deep. The unit I had for review had all the options on it, and weighed approximately 2.5kg (5.5lbs). The case is of steel, split horizontally, and is finished with a crackle finish paint. The front panel, though, is divided horizontally, the top half being black, the colour dropping at the right hand side to accommodate the tuning control. This top half is taken up with, at the left, the S meter, then the function rotary switch controlling 'CW', 'LSB', 'USB', 'AM', 'AMS (synchronous)' and 'FM', and the frequency display area.

The backlit LCD is large enough to satisfy the most critical, being approximately 7mm (0.5in) high. It is a five digit display showing the received frequency to the nearest kilohertz. I noted that frequencies above 1600kHz are shown with a decimal point separating MHz and kHz, but those below this figure are shown directly. On the right of the HF125 below the logo, is the tuning knob with a finger depression.

On the lower half of the front panel is the phone socket, accepting a standard .25in plug.

Either mono or stereo headphones may be used, but the stereo type function as mono, and the internal speaker is automatically disconnected when the headphone plug is inserted. Next comes the gain control into which is built the on/off switch. This is followed by the

This is followed by the rotary tone control which operates very usefully: the central position, with the indicator vertical, gives a flat response; turning anticlockwise gives a treble cut; and the opposite direction gives a bass cut. I found this most helpful in cutting out interference from adjoining SSB transmissions, particularly when listening on 7MHz in the evening.

In the same line as the previous two controls are five push buttons, four of which have several functions. They are memory select, RF attenuation/restore, filter select/recall, MHz down/store and MHz up/store.

The back panel has a number of facilities available for the user. On the left hand side is a 3.5mm socket for the K125 remote keypad, by which frequencies can be entered directly, and a normal 50 ohm SO239 socket for the antenna. To the right of this is a switch controlling the active antenna, the circuitry of which is fitted inside the unit. This is intended to be used with the collapsible whip supplied. The end of this whip has a PL259 plug fitted so that it can be connected to the socket.

There are the two connections for a long wire antenna (it is given as 600 ohm), and further to the right is a preset potentiometer for adjusting the level of squelch (this pot is only present if the

D125 detector option is fitted). There is a 3.5mm socket for a tape recorder giving a fixed output of approximately 100mV, independent of the setting of either the volume or tone controls. The level is sufficient to drive most tape recorders and, in fact, provided enough signal for either my PK232 decoder or the FAX-1 facsimile decoder.

The last two sockets are the 3.5mm socket for an external speaker (which cuts off the internal one), and the 2.1mm power socket for the 12 volts input. A regulated dc supply unit is supplied with the receiver, the mains side of which accepts the normal 240 volts ac. The active antenna and the whip are part of the P125 portable option, the other part consisting of a trickle charger and an assembly of eight 1.5 volt NiCad cells.

The trickle charger board also contains the active antenna components and is mounted vertically on the main PCB with plugs and flying leads, as are the other two options, the K125 Genie Keypad and the D125 Detector Unit. The NiCad cells are automatically placed on charge whenever the 12 volt power plug is inserted into the receiver. The printed circuit board itself is beautifully made, having all the component values and positions silk screen printed on it. All the components are tidily positioned, and the board is a pleasure to examine. It is a

The HF125 general coverage receiver and K125 Genie Keypad



HF125 USER REVIEW

tribute to the designer, John Thorpe, that he managed to get so many facilities into such a small space without any appearance of overcrowding.

The HF125 is a dual conversion superheterodyne receiver, using up-conversion to a high frequency first IF of 45MHz and a second IF of 455kHz which feeds the selectivity filters, of which there are four. The receiver uses a multi-element type of filter in this position, giving a choice of 2.5kHz, 4kHz, 7kHz and 10kHz bandwidth. The whole operation of the receiver is controlled by a dedicated microprocessor system, which takes its instructions from the front panel controls and sends the information to the receiver control register and the PLL (phase locked loop) system.

Filters suitable for the band being used are automatically selected whenever the receiver mode is changed; 7kHz for AM, 4kHz for AMS and 2.5kHz for USB, LSB and CW. The 'Filter Select' button allows the user to override the automatically selected filter and use the one of his/her choice including the fourth filter of 10kHz. There is a fifth 400Hz filter available which can only be used in the CW mode, and which proved, incidentally, to be very useful under certain listening conditions.

The manual quotes a sensitivity of $<0.3\mu\text{V}$ for 10dB S/N in the SSB mode and $<0.7\mu\text{V}$ for 10dB S/N at 70% modulation in the AM mode. I did not make laboratory measurements to prove or disprove these figures, but as far as I was concerned, I had all the sensitivity that I needed in use throughout the frequency range.

I have already mentioned the five buttons on the front panel. These control the operation of the receiver, and any owner would be well advised to read the user manual very carefully to take full advantage of the facilities offered. I must make a comment here about the manual.

Although there are only 24 pages it is crammed with useful information, commencing with a discussion on aerials and earths under the title 'getting started' through to the receiver specification and three pages of circuit diagrams. The printing is clear and Lowe Electronics Ltd are, in my view, to be congratulated on its presentation.

But to continue, there are thirty memories available in two groups of fifteen called 01 to 15 and A.01 to A.15. These only store the frequency desired, not the mode, so that when storing, say Radio 2 and a RTTY station, one has to rotate the mode control from AM to USB, (or LSB if you wish) when recalling either one or other of the two choices. I do not think it necessary to give exact details of how to store a frequency in any of the memory channels as full and precise instructions for this are given in the user manual.

The same really applies to the operation of the other four buttons. However, I will comment on the clever way in which the displays are altered. If I wished to see what filter was in use or whether the attenuator was in circuit during the operation of the HF125, it was only necessary for me to press 'RF ATTN' and either 'off' or 'attn' would be displayed in place of the frequency for three seconds, after which time the display reverted to the frequency originally tuned. In order to change from either 'off' to 'attn' or the other way round, all I had to do was to press the button twice and the instructions were altered.

The same procedure applied to the filter change by pressing 'filter select'. Really, this is an ingenious use of the microprocessor. The last two buttons on the right enabled me to change the frequency up or down by 1MHz steps at a time, (see the lettering on the top of the buttons in the photograph), or by pressing both of them, to store any

frequency in one of the memory channels. This was aided by the optional K125 Genie keypad supplied with the review unit. With the keypad I could enter any frequency within the range of the receiver instantly.

I have used this receiver almost constantly during the past month or so, and, after having become used to the method of tuning and the button controls, I like it. I spent a lot of time on 80 metres both in the phone section and where my main interest lies (AmTOR). I copied a number of Packet stations on the 14MHz band and connected up my FAX decoder to copy the meteor broadcasts on a number of frequencies between about 3MHz and 10MHz.

All this was performed with no trouble at all and no significant drift was experienced during the reception of commercial RTTY or FAX meteor broadcasts. I did miss one or two facilities available on my own Icom R71E, but the comparison is not valid as the price difference is too great. On occasions I wished for greater selectivity and brought my Datong FL2 filter into circuit, curing any problem of interference. The receiver performed very well when receiving shortwave broadcast stations, and I copied RNB Brasilia on 15.265MHz in the early evening. A number of stations were copied on the 31 metre band during the evening, all of which were of listenable quality.

During a listening period between about 0900 and 1200UTC Radio Pakistan was copied on 17.660MHz at about 1030UTC, and a number of interesting stations at around 21.550MHz between 1300 and 1400UTC. Coming to the amateur bands, 21MHz was not very busy during the time that I was listening, but the 14MHz band was very much alive with Packet transmissions, AmTOR and RTTY together with the usual number of amateur phone stations further up the band. I moved up to the CB band on 27MHz and used the FM option. Not all the stations were using FM at the time that I was listening so I had to make judicious use of the mode switch. The action of switching to the FM mode brings in the squelch circuit, the level of which is set with the aid of a small screwdriver through a hole in the rear panel labelled 'FM Squelch Level'. Very cunningly, the operation of the squelch can be bypassed by pressing the 'Filter Select' button when in the FM mode. When this is done, either the word 'off' or the letters 'SQL' appear in the display area for the usual three seconds, after which the frequency reading is restored. Incidentally, the antenna used for reception was my normal 80 metre dipole, a shortened one with the ends drooped down, and tuned through the KW107 ATU.

When receiving commercial AM

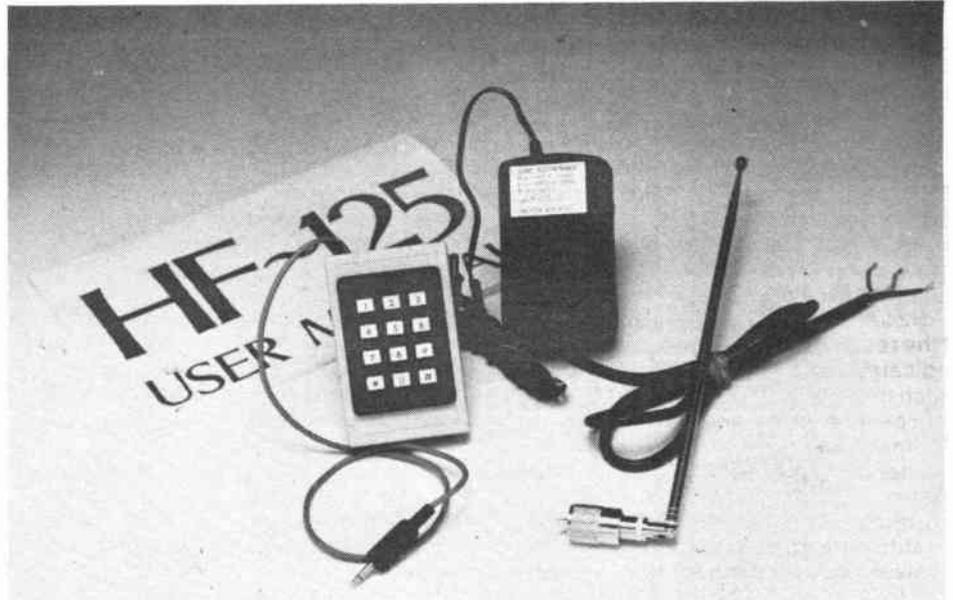
HF125 back panel showing aerial and accessory sockets



broadcast stations, the use of the synchronous AM position on the mode switch allied to careful tuning, resulted in far better reception than would have been possible with normal AM detection. It should be noted, however, that the receiver will only tune 4kHz in either direction when in the AMS mode, so I usually tuned in my station in the normal AM mode and then switched to AMS to do the final tuning. I used the unit portable, inasmuch as I took it out in the car and used the whip antenna with the active part switched in.

I achieved some very impressive results, primarily, I think, because of the fact that I was away from the shocking amount of electrical interference which plagues me at this QTH. All in all, this is a very impressive receiver bearing in mind the cost, and in my opinion, represents extremely good value for money. I have, however, one complaint. The tuning knob on the review set had a fair amount of play in the shaft and the knob itself was off centre. Furthermore, I considered that the actual movement was too free. I should have liked a little more friction in the shaft, and would hope that normally the tuning knob would be fitted so that it revolved centrally when it was turned. This control, after all, is the essence of the pleasure in operating.

The second point is a suggestion. What about fitting a carrying handle on one side of the set, for when it is taken out on portable operations? I found myself carrying the set in my arms like a baby to



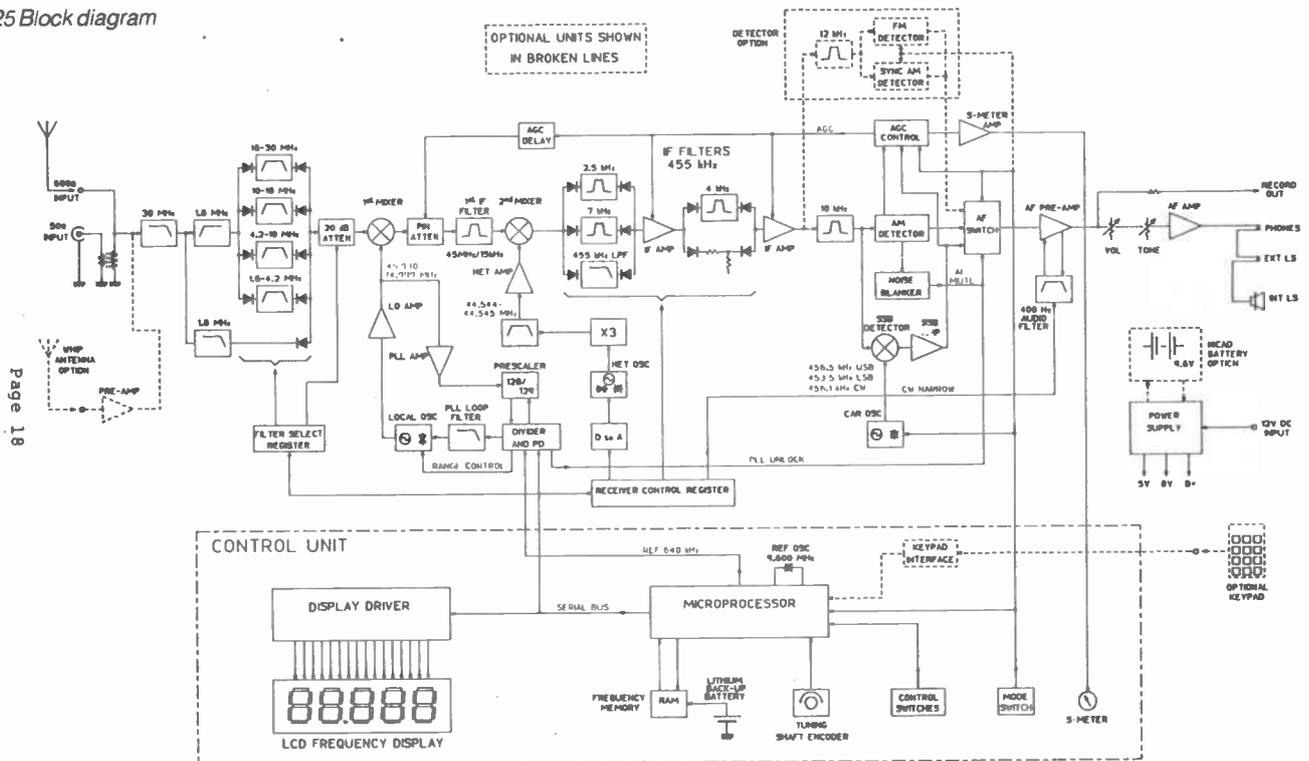
HF125 optional accessories and handbook

wherever I wanted to place it! But these are only carping comments bearing in mind the overall quality of the set, and Lowe Electronics Ltd and John Thorpe are to be congratulated for having manufactured a communications receiver at a price which is in reasonable bounds, the set having a performance equal to many imported units costing at least twice as much. It should prove an excellent choice for any short wave listener who likes to listen to commercial

broadcasts.

The basic price of the HF125 is £375 including VAT, and the options, of which there are four, the K125 Genie keypad, the D125 detector unit, the P125 portable option and the S125 external loudspeaker, average between £60 and £70 each. Thanks are due to Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE45LE, (tel: (0629) 2817, 2430, 4057, 4995) for the loan of the HF125 for the purpose of this review.

HF125 Block diagram



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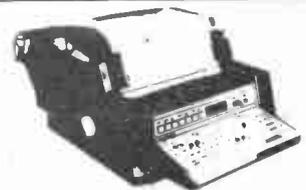
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MEDIUM WAVE

DXING



by Steve Whitt

If you are one of the many MW DXers who not only likes to hear a station but wants to collect a verification or QSL to 'prove' that reception actually took place, then you'll appreciate that hearing the station in the first place is only half the problem. I'm sure that you've wondered why not every station replies to your letters or reception reports, perhaps only around 50% of stations reply, but what can be done to increase this ratio?

Firstly, imagine yourself in the position of the station engineer and then imagine that you have received a letter from a faraway listener asking for a QSL card. Could you be bothered to reply, if you'd already received a hundred similar items in your in-tray that week? I know of station engineers that have commented '... some of the reports we get are terrible; we only reply to reports containing IRCs now, as the postage was getting rather expensive', and 'I always reply to DX reports, but never know if my letters are received'.

What a listener needs to do is to convince the station that reception really took place, and that the report is not just being made up. In addition, you need to make the station's task in replying as simple as possible and it always helps to make your reception report stand out from the crowd so that perhaps it won't end up in the 'round file'. Try the following ten steps to good reception reports:

1) *Convince the station:* Include full details of commercials and public service announcements that you heard, since virtually all stations record these details in their logs. Station slogans won't on their own convince anyone, since they are often well-known and widely reported, and also lists of records heard are not always very useful since details aren't always kept in station logs. Worst of all is something like 'man talking' or 'music' which won't help convince anyone! The golden rule is, the more detail the better.

2) *Make their job easier:* Use the station's local time in reception reports, so that they don't have any tricky time zone conversions to do. The only exception is

if the station is an international broadcaster that has been announcing a different time zone on air. It is often wise to note down the actual time announced in time checks rather than what your watch says since many stations have somewhat inaccurate studio clocks!

3) Send return postage with your letter. Best of all, include mint stamps from the station's country, but since this is easier said than done you could send International Reply Coupons, which are obtainable from the Post Office. Unfortunately, some countries do not accept IRCs for exchange into local postage stamps. For the USA or Canada it is also feasible to send a \$1 bill, since this will save a trip to the local post office.

4) Enclose a prepared sticky label with your return address already on it.

5) Write in the station's natural language, unless it is a big international broadcaster with various language departments. The natural language may not be the main language of the country they are in, and this is exemplified by the many Spanish speaking stations located in the USA.

6) *Help the station:* Local stations don't need listeners thousands of miles away; certainly they don't attract more advertising because of this. So if you can help the station by giving constructive comment on programmes (what you liked and disliked) and on technical quality (eg modulation, audio quality or frequency stability), or by identifying sources of interference, so much the better.

7) *Make your letter stand out:* BE POLITE and request a QSL card – never demand one.

8) Introduce yourself and your location; include a local picture postcard maybe, or some stickers from your local radio stations.

9) Use commemorative or unusual stamps on the envelope; there may be a philatelist at the station.

10) Give a realistic and detailed description of reception conditions, in words that are not too technical (remember it's not always the engineer who reads your letter). Never use SINPO type codes on their own.

If you follow some or all of these tips, you should not only increase your chances of getting a reply from a station, but you will help contribute to good relations between DXers and broadcasters. Finally, if you receive a reply from a station, it is an often overlooked basic courtesy to thank them. It is simple and quick (and not too expensive) to send a postcard direct to whoever wrote from the station, letting them know that their letter arrived safely and thanking them for their trouble.

Newsdesk

Faroes: The current 5kW transmitter on 531kHz is wearing out rapidly and will be replaced by a new 200kW AEG Telefunken unit with a 141m high $\lambda/4$ aerial.

Germany FRG: The DLF transmitter at Erching on 209kHz is to be replaced with a new 500kW transmitter at Aholmingin, late in 1988. The new equipment will be on air 24 hours a day, with a directional antenna pattern at night.

Portugal: 1449kHz Solar R; address: 55 Centro Comercial, Villa Magna-Monte-choro, P-8200 Albufeira, Algarve. This is our unofficial but tolerated English tourist station. FM is also used in parallel.

United Kingdom: The BBC Westerglen transmitter in Scotland (810, 909 and 1089kHz) is reported to be emitting spurious signals over the MW band and lower SW frequencies. If you hear anything nasty, let the BBC (and us) know.

International waters: R Monique/R Caroline moved off 963kHz on Sunday 14th November to end up on 819kHz. Caroline on 558 remained unchanged. Disaster struck just nine days later, when storms ripped off the 275ft tall mast from the Ross Revenge. On land this would have been a big tower, but at sea this was quite an engineering feat. Nevertheless, the fury of the North Sea took its toll and the metalwork now lies on the seabed. Fortunately no one was injured, and at the time of writing Caroline has returned on 558kHz with a temporary aerial and very low power – barely audible outside the Thames estuary.

DX file

Back in November, I journeyed to the very north of Scotland in search of super-DX. In the past I have reported on DXpeditions to Anglesey in North Wales, but this was my first such trip to Scotland. Basically, I wanted to see if there was a significant difference in the DX capabilities of the two locations. In actual fact there is little to choose between the two as regards interference from European stations, but Scotland had the edge over Wales when it comes to avoiding interference from the numerous Irish pirate stations (some of which don't restrict their radiated bandwidth too well).

Both sites benefit significantly from their westerly location, since dawn-induced fadeout of European signals is very noticeable, and there is at least an hour in the morning around local dawn

when transatlantic stations can be heard virtually interference-free.

At a local level, it seems that the Welsh sheep have a greater affinity for aerial wire and bamboo supports, since their Scottish counterparts very kindly refused to eat or destroy either! This time it was a true luxury not having to repair aerials on a daily basis. Now for a little of the technical detail and also a sample of what was heard.

Date: 8-16th November 1987

Location: Sheigra, North West Scotland (58° 07' West 58° 29' North)

Ears: Mark Hattam and Clive Rooms both with Drake R7s, and Steve Whitt with a Motorola R390/URR and Sony ICF2001D (the 390 was hardly used!).

Antennas: Four Beverages ranging from 280m to 550m in length were erected, although 90% of all DX was worked on just one aerial which was beaming to the Caribbean, Venezuela and Colombia.

Dawn-induced fadeout: As late as 1015, and many stations were heard with two or more hours of daylight between transmitter and receiver locations.

Despite potentially good ionospheric conditions, DX was predominantly low latitude. The Caribbean was consistently dominant, and 21 (of 24 possible) islands were logged and identified, but the yet-to-be-heard Virgin Islands still eluded us. South America yielded six countries, but the USA and Canada were disappointing. Although some low power stations were heard from the latter area, only the

kHz	Station	Details (times are UTC)
535	Grenada; music, BBC World Service news, time pips, ID at 2348	
555	ZIZ St Kitts; Jazz mx, full ID at 2345	
580	R Jamaica Galina; talk show at 0702hrs	
580	WKAQ R Reloj San Juan PR; All news in Spanish, many IDs around 0700	
860	HILR R Clarin, Dominican Rep; Spanish talk and references to Santo Domingo	
930	CJYQ St Johns NF; regular - as early as 1907hrs; as late as 1000hrs	
950	CMGD R Reloj Cuba; male announcer, time pips, Morse code 'RR' at 0633	
960	P4A6 R Victoria Aruba; REL programme, classical music, ID; 2330-0100	
980	CMDE R Reloj Cuba; usual stuff (see 950kHz above)	
1030	4VEH Cap Haitien Haiti; English religious programme then closedown at 2400	
1040	R Moscow WS Cuba; English to N America; <i>daytimer</i> closedown noted at 2300	
1100	ZDK Antigua; sign on and psalms, ID at 0855hrs - still good at 0930	
1190	WLIB New York NY; <i>daytimer</i> pm drivetime news show and sign-off at 2230	
1190	HJEO Ondas del Valle Cartago, Ecuador; full ID heard best around 0600	
1240	CKIM Baie Verte NF; 'VOCM AM Stereo' ID; 500W relay heard around 0815	
1300	WFBR Baltimore MD; sport, ID; 5000W station but rarely heard	
1309.8	HCGB1 R Nac Espejo, Quito; off-channel like several other Ecuadorans	
1310	HJJZ R Recuerdos Bogota; latin pops, IDs heard best around 0545hrs	
1400	CX140 RTV Zorilla, Uruguay; full ID and sign off announcement at 0300hrs	
1410	PJF1 Saba; pop music, many IDs; English programme from Netherland Antilles	
1450	CFAB Windsor NS; news, weather, ID 'AVR' heard at 1015; only 250W listed!	
1540	ZNS1 Nassau Bahamas; continuous music and ID jingle; first time in 20 years!	
1600	WKWF Key West; 'Solid Gold for Key West', full ID; listed with only 500W	

Eastern seaboard was audible (Quebec and the west were just not there). Oddly, the sole station inland was WHAS-840, totally alone! Incidentally, the best frequencies were 1400, 1410, 1450 and 1470kHz. Despite the conditions, there were still some possible UK firsts (which are italicized in the table), some other

good catches and 31 transatlantic countries identified. This only goes to show that the potential of DXpeditions has by no means been exhausted.

That's all for another issue I look forward to your comments and contributions for the DX file, so why not drop me a line care of the REW offices.

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Latest Literature

BBC BASIC86 ON THE AMSTRAD PCs AND IBM COMPATIBLES

by N Kantaris and K Thompson

The well-known and well-loved Beeb has a multitude of features that place it head and shoulders above many micros—but, of course, the IBM and Amstrad, with their vast memories and facilities are in a different class. Nevertheless Locomotive BASIC, though powerful, is not as easy to learn as BBC BASIC, to the regret of many IBM and Amstrad users who have moved from the user-friendly Beeb.

BBC BASIC86 brings the readability of the Beeb to the more powerful IBM and Amstrad, and this handy book explains how to implement BBC programming using the IBM compatibles' keyboard and logic systems.

It demonstrates how to access MS-DOS commands from within the BBC BASIC, and the various codes and statements used on the BBC, including the neat and useful 'procedure'.

BASIC86 is obviously a most interesting concept, and anyone owning either a BBC or IBM clone will find this a well-laid out guide, not only

to conversion techniques, but also to BBC BASIC itself.

Bernard Babani (Publishing) Ltd, £3.95. ISBN 0-85934-188-7

PROGRAMMING IN POP-11

by J Laventhol

Interested in computing? Fascinated by Artificial Intelligence? Then you might find a wander through this book a rewarding experience.

The POP languages are frequently used in AI applications, and AI systems such as PROLOG and LISP are often written in POP-11. Despite these shades of 2001, POP can also be used for more down-to-earth programs, such as payroll packages and file manipulators, and has proved very popular in these roles (no pun intended).

Running initially in the POPLOG system of the University of Sussex on a VAX minicomputer, the system has been expanded for large 68000-family micro-systems, and will soon be available on Apple, Atari, IBM PC and compatibles, so this fascinating language will soon be widely useable.

This book explains POP-11 simply (Von Neumann architecture is unforgettably

likened to 'painting your front room through your letterbox') without assuming any mathematical knowledge. No previous knowledge of machine details is presumed either, with a primary explanation of computer instructions from machine code upwards.

A well-written and often amusing book, representing an up-and-coming language in an enthusiastic and straightforward manner, this should prove most popular with computer language enthusiasts and undergraduates studying AI.

Blackwell Scientific Publications, £14.95. ISBN 0-632-01528-4

PRACTICAL DIGITAL ELECTRONICS HANDBOOK

by M Tooley

The first-ever release of a brand new publishing company, this useful, low cost guide introduces the basic concepts of digital circuitry and logic families.

Supplying the ground rules for using ICs, the logical functions of the elements are detailed, rather than their precise electrical characteristics. The book goes on to explain the function of logic gates,

monostables and bistables, timers, microprocessor architecture, semiconductor memories and I/O devices and interfaces.

The appendices contain a great deal of additional useful information such as chip pinouts, binary, hex and ASCII conversion tables and digital test gear projects.

PC Publishing, £6.95. ISBN 1-870775-00-7

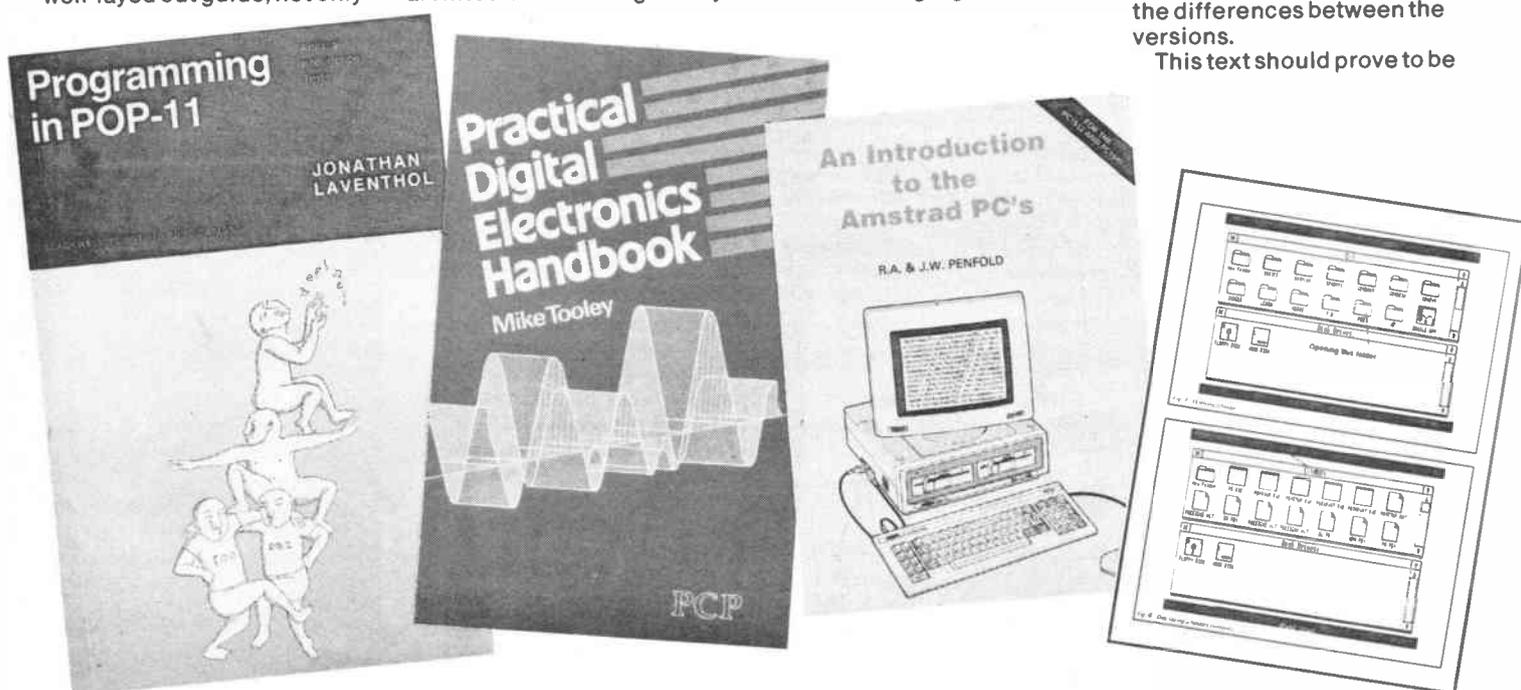
AN INTRODUCTION TO THE AMSTRAD PCs

by RA and JW Penfold

Dealing exclusively with MS-DOS3.2, the disc operating system supplied with the PC, this book contains valuable information for anyone who is considering purchasing an Amstrad PC. It would also be a particularly good idea to read the introductory chapter on IBM software compatibility before buying one of these PCs.

As a backup to the user manual, this book gives inexperienced users a clear idea of what is involved in operating a PC. Most chapters assume that the reader has access to a PC, in order that examples given can be tried. Model-specific data is explained in detail, and care is taken to point out the differences between the versions.

This text should prove to be





a most useful addition to the information already available about this powerful, versatile computer.

Bernard Babani (publishing) Ltd, £5.95. ISBN 0-85934-172-0

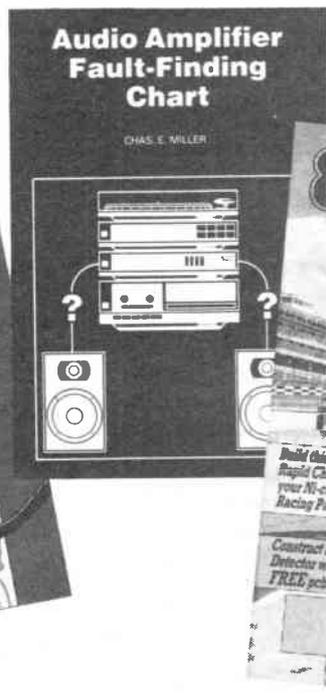
ELECTRONIC HOBBYISTS HANDBOOK

by RA Penfold
Mr Penfold, again . . . this time with his electronics hat on, and a bookful of useful information for the electronics addict and would-be radio ham.

Starting with basics, the first chapter explains the colour coding of various components. Other chapters give the characteristics of the various logic families, useful information about many kinds of PSU, circuit symbols, op-amp specifications, a detailed resumé of transistors and other semiconductors, plus the popular surface-mounting devices.

After a section dealing with useful circuits, some amateur radio information is given—band allocations, CB frequencies and channels, amateur abbreviations and a small selection of Q codes, plus details of the SINPO scales. The book signs off with a frequency-wavelength conversion chart and Morse table.

Much of the information and data will be useful to



professional engineers, designers and students, at a very low price for such a wide ranging general reference book for the electronics field.

Bernard Babani (publishing) Ltd, £4.95. ISBN 0-85934-178-X

AUDIO AMPLIFIER FAULT FINDING CHART

by CE Miller
Opening this booklet reveals a large flow-chart, detailing the steps that should be taken when troubleshooting audio amplifier faults. Looking a little like a state of the art family tree, this easy-to-follow chart is accompanied by explanatory text and a rather awe inspiring publisher's disclaimer.

It should be emphasised that some experience in this field would be a necessary preliminary qualification, otherwise, like a beginner's guide to brain surgery, intemperate meddling might prove fatal to the patient.

This booklet will provide a handy step by step checklist for the electronics enthusiast progressing towards do-it-yourself repair work.

Bernard Babani (publishing) Ltd, 95p. ISBN 0-85934-095-3

Maplin Electronic Supplies
The latest issue of *Electronics*, the Maplin



magazine, is now on sale by mail order or through the company's retail outlets.

The magazine is crammed with constructional projects, made from Maplin's components—and yes, RA Penfold gets in on the act again—as well as features on CROs, NAND gates and practical electronics. For only 85p, with a free PCB for a mini-metal detector, it can't be bad.

Maplin Electronic Supplies, PO Box 3, Rayleigh, Essex SS68LR. Tel: (0702) 554161.

Anglia Microwaves

Microwave engineers will be pleased to hear that the latest edition of the full Sivers IMA Microwave Product Catalogue is now available from Anglia Microwaves Ltd.

The catalogue has some 80 pages of specifications, detailing the Sivers IMA range of advanced microwave products, together with useful background information. Among the product lines covered are switches, rotary joints, YIGs, VCOs and CSOs, designed for use in radar, EW and instrumentation.

Sivers IMA has also

included its double-ridge line in the catalogue with sections that detail instrument and associated component ranges and 'tailor-made' units. Designed to explain many aspects of microwave practice, educational kits are listed that include all of the necessary hardware and documentation for self-instruction and group use.

Anglia Microwaves Ltd, Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ. Tel: (0277) 630000.

Schlumberger Instruments

A new booklet describes in detail how an engineer may use a BBC microcomputer, via the GPIB/IEEE488 interface, to communicate with and control Schlumberger Instruments' 3530 and 3531 Series Orion Data Loggers.

The software program features the automatic transmission of a standard channel and task set-up, to the Orion and its immediate execution. The data received from the logger is displayed on the BBC monitor. The method by which user commands may be sent at any time to the Orion is also explained.

The example program described in the booklet is written using BBC Basic 2.0 and runs on a BBC Model B computer fitted with



Operating System 1.2.

The 3530 and 3531 series of Orion data loggers handle up to 200 I/O channels, extendable to 600 with slave scanners. The inputs can be any mixture of voltage, current or resistance, while sensors such as thermocouples, resistance thermometers or strain gauges are organised without the need for special switching or signal conditioning. Timing measurements, frequency and counting, as well as status, events and inputs in binary or BCD formats, are all set up and connected quite simply.

The Orion is set up by means of front panel menus with 'soft-key' selection of the required parameters. The manual is available on request from Schlumberger Instruments, with a copy of a demonstration program.

*Schlumberger-Solartron,
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*Farnborough,
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Tel: (0252) 544433.*

STC Instruments

STC Instrument Services has produced its new catalogue, which features items ranging from DMMs and power supplies to oscilloscopes and complete computer systems.

Offering products from many leading suppliers, the 336-page catalogue has an entirely new section dedicated to the latest technical books, which includes publications for training and theory, electronic component data, component theory and applications, reference, test equipment, control and instrumentation. Computers (hardware, software, languages and operating systems, interfacing plus microprocessors and design), quality and reliability and communications are also

featured.

Amongst the new products available are over 20 Hitachi oscilloscopes/storagescopes; STC 200W power supplies; the Avo M2000 series multimeters and the sophisticated GP XR16 Production Programmer.

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

ECC Electronics

Available free on request from Online Distribution is an illustrated 28 page catalogue of components from ECC Electronics (UK) Ltd.

The range comprises electrolytic capacitors from Nippon Chemi-Con and ceramic capacitors from Taiyo Yuden, plus crystals by Sunny and relays by Takamisawa. Nippon Chemi-Con's range

includes low leakage, ultra miniature and general purpose miniature radial (single ended) electrolytic capacitors; plus a family of PCB mounting high ripple rating electrolytics for power applications. Also featured are miniature insulated aluminium electrolytics with axial leads.

From Taiyo Yuden come disc and tubular ceramic capacitors and axial-leaded inductors, and from Sunny, high-stability crystals for microprocessors and general applications.

From Takamisawa comes a family of low-cost, high-quality miniature and subminiature relays.

*Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 217915.*

Please mention *Radio and Electronics World* when ordering any of the above.

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DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Despite a gale-ravaged month, Sporadic-E activity returned with a vengeance during October. Some of the openings were prolonged, and their intensity easily matched those experienced in June and July during the main season. Unfortunately no Arabic signals were present although many unusual and unexpected transmitters located in central Europe came through.

Tropospheric DX was generally lacking, although low-level signals emerged from the Low Countries from time to time but nothing worthy of note was logged.

Dramatic month

The week commencing the 19th was particularly eventful for Sporadic-E DX reception. Italian signals from the state-owned RAI were plentiful most days, so were the many Italian private radio links broadcasting pop music. This led to a chaotic situation in Band I, especially on October 22nd, with TV pictures accompanied by severe interference. The 21st provided the most dramatic Sporadic-E opening which was present throughout the afternoon here in Derby. Reports

indicate that signals were rolling in all morning too! During the early afternoon period Poland was seen on channel R2 during station opening, changing from the clock to a 'Wroclaw' caption to be followed by programmes. Initial reaction was that the low-power TVP-2 Wroclaw outlet had been received, but a check on channel R1 revealed a similar programme.

Other signals of note that day came from Sweden, Finland and Austria. During the morning and afternoon, Sweden was seen transmitting the PM5544 test pattern with only 'TV1' at the top. The pattern was also broadcast without the clock insert. The Austrian test pattern was well received during the afternoon period, even from the low-power relay on channel E3 – this has proved to be extremely elusive during the summer months!

Solved!

A mystery test pattern noted a few months ago via meteor-shower propagation on channel E2 has now been identified. The brief signal consisted of

an FuBK pattern incorporating a small dark rectangle to the left of the frequency gratings. Fortunately all was revealed during a Sporadic-E opening on the 21st, when the test pattern again emerged. The dark rectangle carried a digital clock and the identification across the pattern read 'SR1 SAAR'. This originates from the Saarländischer Rundfunk transmitter located at Göttelborner Höhe in West Germany.

DX-TV log for October

The log this month highlights Sporadic-E activity noted at Derby throughout October. It shows what can be achieved despite a restricted amount of time spent watching the box.

11/10/87: RAI (Italy) on channels IA and IB with programmes from 1925GMT.

12/10/87: CST (Czechoslovakia) R1 showing that 'RS-KH' EZO test pattern.

13/10/87: RAI IA with identification logo followed by programmes from 2100GMT.

19/10/87: TVE (Spain) on channels E2 and E4 with a religious service in colour.

20/10/87: RAI IA programmes; DFF (East

PHOTO FILE ● PHOTO FILE ● PHOTO

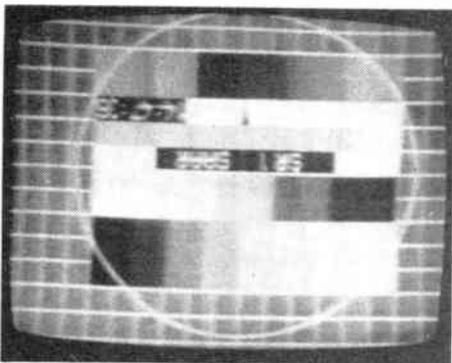


Fig 1 FuBK test card from Saarländischer Rundfunk on E2. Note digital clock insert

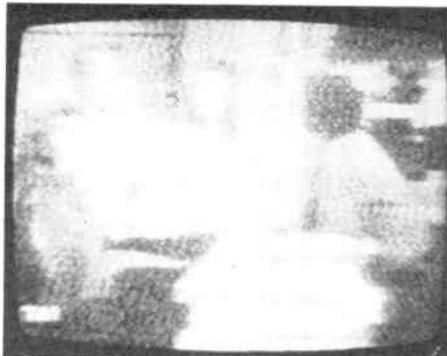


Fig 2 Programme from the Italian private station TAI received by Chris Howles on channel IA

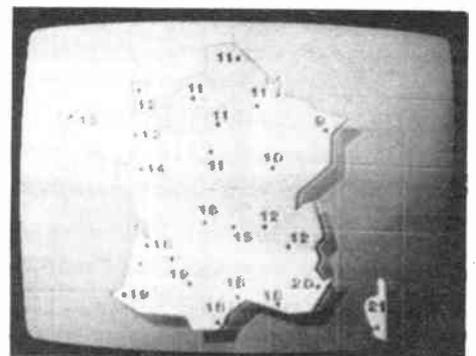


Fig 3 French TV weather chart from tf1 via recent enhanced tropospherics

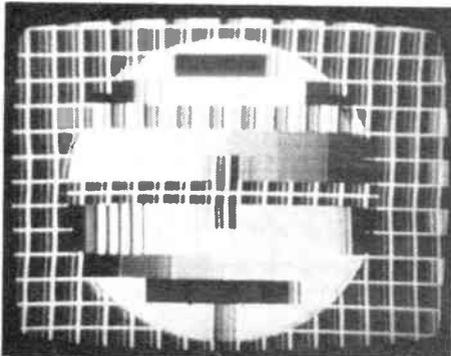


Fig 4 PM5544 test card received on 21/10/87 via Sporadic-E on channel R1 from Poland



Fig 5 DDR: F2 (East Germany) identification caption on channel E34 from Brocken

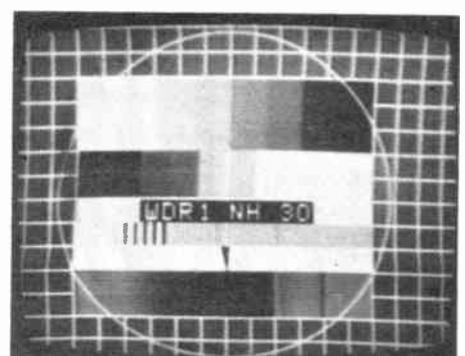


Fig 6 West German test card from the Nordhelle outlet on channel E30

Germany) on E4 the electronic test pattern with 'DDR F1' identification.

21/10/87: EESTI TV (Russia) on channel R2 with the 'EESTI TV TALLIN' block-board test card; TSS (Russia) R1 with various test patterns, including the UEIT

with 'MTR' and '0167' identifications plus the old '0249' monoscopic test card; SVT (Sweden) E2 showing a PM5534 test pattern with 'TV1' at the top; DR (Denmark) E3 and E4 radiating the 'DR DANMARK' PM5534; TSS R2 UEIT test

pattern with 'LRRTPC' identification; TVP R1 and R2 on programmes followed by the PM5544; CST R1 showing the EZO test pattern; CST R2 with an alternative test pattern, the PM5544 inscribed 'SR1 TV' at the top and 'BRATISLAVA' at the bottom; ORF (Austria) E2a, E3 and E4 with the 'ORF ES1' PM5544 test pattern; MTV-1 (Hungary) R2 radiating a multi-burst pattern; SR-1 (Saarländischer Rundfunk, West Germany) on channel E2 transmitting the FuBK test pattern with digital clock; BR-1 (Bayerischer Rundfunk, West Germany) E2 using the 'GRÜNTE' FuBK pattern; JRT (Yugoslavia) E3 with the 'RTV-LJNA' PM5544 test pattern.

23/10/87: Italian private radio stations noted in Band I via SpE propagation at 1630GMT. No TV activity seen.

24/10/87: MTV-1 R1 and R2 on programmes followed by the clock caption and blank raster after closedown at 1330GMT; RTP (Portugal) E3 with football match; RAI IA on programmes; MTV-1 R1 and R2 with multi-burst followed by the 'MTV-1 BUDAPEST' PM5544 and opening clock at 1535GMT; RTL (Luxembourg) E7 showing the 'RTL PLUS' PM5534 during a slight tropospheric lift.

28/10/87: Unidentified programme on channel R1; RAI IA on programmes.

Reception reports

Chris Howles of Lichfield has recently erected a single Triax BB Grid UHF aerial out of doors. He hopes that his DX activities can be continued in peace now that his complaining neighbour has left the district. If the reception of distant UK stations is anything to go by, Continental DX should be resolved with ease under enhanced conditions. Chris is eagerly awaiting a decent tropospheric lift to try out his new system. For the time being the Band I system will remain in the attic where it seems to perform well. The intense October Sporadic-E signals produced pictures from all over Europe, including some from the private Italian station TAI (Tele Alta Italia) on the 28th.

Mark Dent of Leeds also managed to resolve an Italian private station but on the 21st. Signals arrived from most Central European outlets and at one stage two Czechoslovakian test cards were present on channel R1. Earlier in the month, on the 12th, conditions were wide open to Spain and Portugal on all Band I channels.

The October storms failed to prevent Simon Hamer from DXing. At his New Radnor location on the 21st he noted signals from Spain on channels E2 and E3 and Russia on R1. Reception from Eastern Europe occurred too with the multi-burst (frequency gratings) test pattern appearing on channels R1 and R2 from Hungary. To round off the month, the Swedish PM5534 was noted on channel E2 on the 30th carrying the new identification 'KANAL 1 SVERIGE'.

The 18th brought in colour DX from Spain according to Bob Brooks of South Wirral. Sporadic-E reception occupied all of the morning and included Denmark on channels E3 and E4 (identified by the test card) and programmes from Russia.

Country and Location	Channel	ERP
East Germany		
Nohra Weimar	E2	
Frankfurt/Oder	E6	
Wittenberge	E7v	
Cottbus	E8	
Ludwiglust	E8	
Nauen	E10	
Premnitz	E11	
Rosslau	E11	
Bad Döben	E12	
Neuruppin	E12	
Magdeburg	E12	
Wünsdorf	E21	
Karl-Marx-Stadt	E27	
Rochlitz	E28	
Dresden	E32	
Erfurt	E39	
Hungary		
Baja	R3	20W
Győr	R5	1kW
Veszprem	R6	1kW
Székesfehérvár	R8	1kW
Papa	R9	5kW
Tököl	R10	
Budapest Mátyásföld	R11	2kW
Szombately	R11	
Fertőd	R12	1kW
Keszthely		
Mór		
Szolnok		
Cegled		
Czechoslovakia		
Stúrovo	R1	100W
Ruzomberok Zvolen	R1	
Bohosudov Krupa	R2v	100W
Praha 1	R11	50W
Jaromer	R12	
Karlovy Vary	R21	1kW
Kosice Sibená hora	R27	1kW
Pzen Krkavec	R27	20kW
Praha 2 Zizkov	R41	20kW
Trutnov	R41	
Ceské Budejovice Klet	R49	20kW
Banska Bystrica Suchá hora	R49	12kW
Bratislava Kamzik	R50	1kW
Trebitc	R50	1kW
Ostrava Hostálkovicce	R51	20kW
Brno-Mesto Brno	R52	20kW
Blansky Les		
Spisska Nova		
Széchenyi-hegy (from December, 1987)	R58	1kW
Bulgaria		
Russe		
Sofia	R36	2kW
Poland		
Legnica	R2	
Szczecin	R3	
Bialograd	R6	
Kolobrzeg	R9	
Warszawa	R51	20kW

DX-TV RECEPTION REPORTS

A late evening opening occurred too, with Denmark E3 on test card after closedown and various other unidentified programmes on E3 and E4. The 21st was extremely active with Scandinavian test cards noted as early as 0934GMT. Reception was present until late afternoon with many pictures in colour. The early afternoon produced a glut of test cards which made identification easy. The 'GRÜNTEN' FuBK (Bayerischer Rundfunk) and 'SWF RBG' (Südwestfunk) were both noted in colour from West Germany on channels E2 and E4.

For sale

Ron Ham of Storrington (Sussex) has a combined TV/radio and cassette unit for sale. It is a Panasonic 1200 and features a 12-inch mono TV covering DX channels E2 to E12 (Bands I and III) and E21 to E69 (UHF). The radio comprises LW, MW, SW and FM and the cassette deck is stereo. It is in good condition and would be ideal for a 'DX centre'.

The price wanted is £100. The reason for selling is simple. A D-100 DX TV converter system has been acquired, and this feeds the domestic VCR and TV. Ron, who is the author of propagation reports in *Practical Wireless* and *Short-Wave Magazine*, may be contacted directly at Faraday, Greyfriars, Storrington, Sussex RH20 4HE. Please enclose an SAE with any enquiries.

Russian transmitters in Europe

Relayed broadcasts from the Russian TSS-1 network are now established throughout most Eastern-bloc countries. The opening of these relay stations has created many new DX possibilities, especially since some of these operate at Band I.

Unfortunately, identifying the outlets will be virtually impossible, since the programmes will be identical to those aired via the main Russian transmitters which also occupy channels R1, R2 and R3. However, East Germany is an exception. The TSS-1 relay is listed as channel E2 and the transmission standard used is system B with 5.5MHz sound and vision spacing. This should make identification fairly easy, but there are no details regarding its power.

Many of the relays operate at UHF and there are several with reasonable power located near the main cities throughout Czechoslovakia. Some of these are situated close to the border with West Germany which means reception should be possible during intense tropospheric lifts. The České Budejovice relay on channel R49 has already been received in the Netherlands during enhanced tropospherics at the end of August.

A service for the Russian Armed Forces also operated in many Eastern-bloc countries, but using low-power outlets. Test cards are of the optical

rather than electronically derived variety, so they should be easy to recognise. However, there have been no reports of such stations so far, despite the use of Band I for some outlets.

Service Information

Italy: In the Milan area, the private station Telemarket is also operating on UHF channels E62 and E71. This is in addition to outlets on channels E2, E4 and a newly established one just below E2. On channel E70, a private station called 'Video Music' operated, while on E72 there is Tele-Monte-Carlo (TMC) relayed from Monaco.

Finland: The FuBK test pattern has recently carried a superimposed message at the top of the screen. It reads 'PAHOITTELEMME KUVASSA ESIINKYVIA HAIRIOTA'. We've no idea what this means. Perhaps some readers conversant with the Finnish language could send in a translation?

Monaco: Tele-Monte-Carlo has recently started to broadcast news programmes live from CBS in America. Transmissions begin at 0730, local time. New high-power transmitters are planned for the TMC network. Further details are not available at the moment.

This month's service information was kindly supplied by Bob Brooks (South Wirral) and David Bocca Corsica Piccolino (Vigevano, Italy).

Fig A Map to show distribution of TSS-1 relay transmitters; the reception of which may be possible via sporadic-E or enhanced tropospheric propagation



On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

Packet night

If you are keen on Packet radio, you will be interested in the meeting which Farnborough and District Radio Society is holding on February 10th. G3RRA will be talking about, and demonstrating the system – a chance to get some hands-on experience, for those who want to know more.

On February 24th, G3HEJ will be giving an instrumentation talk – we'd like to know more...

The society meets from 7.30pm at the Railway Enthusiasts Club, Hawley Lane, Farnborough. For further information, please contact Tim G4UQE on Camberley 29231.

Bits and bobs

And now...the Pontefract and District Amateur Radio Society present the 8th Annual Components Fair, which will take place on Sunday, March 20th. For anyone who likes rootling around for resistors or collecting capacitors, this fair could be just the thing.

For those who know all they want to about the difference between an ohm and a henry, there will be a licensed bar and other refreshments, a bookstall and bring and buy, not to mention a prize draw. Talk-in is on S22. Admission is free, and the fair is open from 11.00am to 4.30pm.

For the first time, space will be available for amateur and trade car boot sellers, and further information about how to take part is available from Colin G0AAO on (0977) 43101.

Commodore group

Vic 20, Plus 4, 64, 128...not some strange new code, but a selection of Commodore computers, and for those who own one of these (or any other Commodore we haven't

heard of) there is a new user group.

Forming part of the Independent Commodore Product Users Group, this club is dedicated to those who use their machines for amateur radio purposes. Simon Lewis GM4PLM is the founder, and he tells us that the group has a section in the ICPUG magazine, and would welcome anyone who has a Commodore machine and would like to use it in radio.

The group is working on a small public domain software library, and would like to hear of any programs that might suit their purposes – all costs will be refunded by a grateful group.

More info can be obtained from Simon at 69 Irvine Drive, North Clippens, Linwood, Paisley, Renfrewshire PA3 3TB, or membership details for ICPUG from Jack Cohen,

30 Brancaster Road, Newbury Park, Ilford, Essex IG2 7EP. Subscriptions are £10. All right then – how do you get a sulky Plus 4 to function properly? Answers on an electronics expert, please – we've tried postcards, they don't work...

Join up

For those of you who connect Devon with clotted cream and those rather nice cows, there is radio activity there too. No, the cream doesn't glow in the dark – the West Devon Repeater Group is, however, thriving in this particularly scenic spot.

The group has been around for four years – many congratulations, chaps. Some snags have been encountered, though, as the repeater aerials will soon need replacing – as Trevor G3ZYY says, no mean task, 350 feet above Dartmoor!

Despite the harsh conditions, performance remains excellent, and indeed in this mountainous area, 2 metre communication would be almost impossible without the repeaters.

Nevertheless, many who use the boxes do not finance them by joining the group – this is a real shame, as the

club needs the support in order to improve the facilities which so many use, but so few pay for.

Come on, West Devon – what are you waiting for? Help to keep your repeaters alive! The man to contact is Trevor G3ZYY, at 46 Beatrice Avenue, Saltash, Cornwall PL12 4NG.

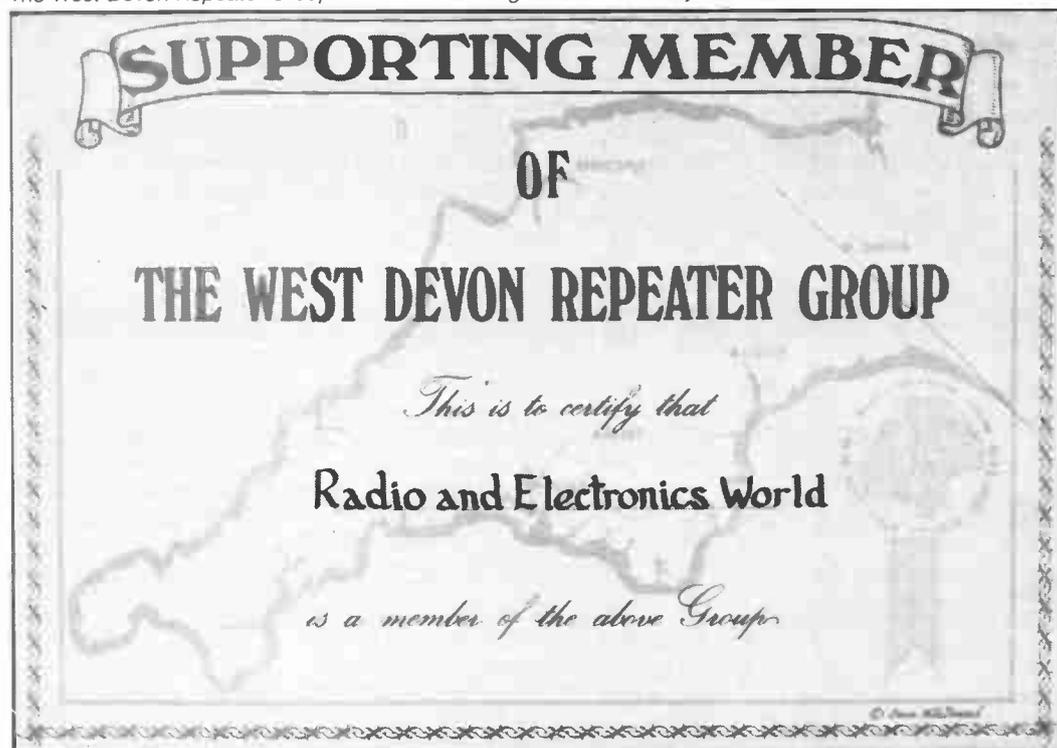
Brainstorm

The thinking caps will be out in Chelmsford on February 2nd, when CARS are holding their inter-club quiz against Braintree – they may have the Braintree, but do they have the Brainpower? CARS may have something up their sleeves besides their wrists...

Being impartial, professional journalist types, we hope the best team wins (though we may cheer wildly for CARS in a restrained kind of way).

Chelmsford Amateur Radio Society meets on the first Tuesday of the month at the Marconi College in Arbour Lane, Chelmsford, from 7.30pm. So old Giuglielmo himself may give a ghostly cheer, should they win the quiz! To find out more about club activities, contact Roy G3PMX or Ela G6HKM on (0245) 360545.

The West Devon Repeater Group has made the magazine an honorary member – Thanks WDRG



NOTES FROM THE PAST

Those Naughty Sponsors

Sponsored TV, if it has achieved nothing else, has been responsible for the utterance of some of the silliest nonsense imaginable. It seems that, as ever, the people least qualified to air an opinion on any debatable issue are the readiest to do so.

On this question Lord Mancroft quoted one eminent divine who, having denounced sponsored programmes, was asked how many of them he had seen. It transpired that he hadn't seen any TV at all. Perhaps, after all, that sort of thing is only what is to be expected. Busybodies always seize on the opportunity to prevent anybody else from doing anything.

The press generally, however hostile they secretly felt at this threatened intrusion on their advertising revenue, generally refrained from partisanship, although much of the drivel talked and written by those who opposed it was fully quoted. To be on the safe side, more than one newspaper long since applied for licenses. One of them in its company report warns the shareholder of the impact which sponsored TV will have on its advertising. It goes on to hastily assure them that they themselves intend to be in on the ground floor, if and when it is permitted.

Fault finding

Troubleshooters are not just sheriffs in the ol' Wild West, it seems – for there are diagnostic engineers as well, just as ready to combat the villain of the electronics world, the electrical fault. Like the heroes of old they stalk their prey, sending that persistent offender to Boot Hill. Er...correcting the fault, that is!

On a more serious level, the Institute of Diagnostic Engineers, recently announced the winners of their Collacott Prizes – given to members whose articles in the Institute's journal were adjudged to be of interest and value to readers, increasing the store of knowledge about events that can happen or techniques of deduction.

Group II (electrical and electronics submissions) was won by David Nickelsen for an instructional article on radio pagers (the things that go beep in the night), with a prize of £200.

For more information on how to join this exclusive group, contact the Institute at 3 Wycliffe Street, Leicester LE1 5LR.

Welsh rally

The Barry College of Further Education Radio Society is presenting the 8th Annual Welsh Amateur Radio Rally, on March 6th. The venue is Barry Leisure Centre, Barry, and the usual trade stands will be joined by a bring and buy stall, the RSGB book stall and Morse testing facilities.

The Leisure Centre, with its many facilities, will also be open, and the rally itself begins at 11.00am – 10.30am for the disabled. Enquiries should be directed to Mike Adcock GW8CMU on (0446) 711426.

Them indoors

Another group called CARS – this time, Coventry Amateur Radio Society, will be having an eventful February. The 5th

brings an indoor DF Contest, the cup qualifier – how do they do it? DFing inside sounds warm and dry, at least!

The club is on the air on February 12th, with Morse tuition, a bi-weekly event that is repeated on February 26th.

On February 19th G0AJB will be talking about computers, the big ones this time. Hope the club is in the right mainframe of mind!

CARS meets every Friday at 8pm, in Baden Powell House, 121 St Nicholas Street, Radford, Coventry. Visitors are welcome, details of club events can be obtained from Jon G4HHT on (0203) 610408.

Bury Hamfeast

The Bury Radio Society will be holding its annual 'Hamfeast' on March 13th at a new, larger venue – the Castle Sports Centre, Bolton Street, Bury. It is hoped that the move will mean that visitors to this popular event will have plenty of room to stroll around and view the many attractions.

Bar and catering facilities are available, and the site is only one mile from the M66 access point, so it's easy to find. For more information about times, booking forms and so forth, contact C Marcroft G4JAG, at the Bury Radio Society's address – the Mosses Community Centre, Cecil Street, Bury GMC.

Oops-a-daisy

Some amendments to our amendments on the 'Long Live the 60s' article in our November issue... In *Figure 2*, remove the junction of T1 and C5 from the bottom of RV2, and connect to the top end instead, leaving the bottom end open. Also, the note 'adjust RV2 for best results' should be added.

In *Figure 4*, the component across L2 should be marked RV3, not RV2.

Six lines from the bottom of the middle column on page 33, L3 should read L2.

In addition, in the article 'Why Worry about Power Supplies', by Dr CJD Catto, which also appeared in our November issue, in *Figure 3* on page 40 the + and – inputs of A1 should be transposed. In *Figure 4*, on the same page, the 2k2 resistor should join the 180R and the base of the

BC37, but not the input 0V rail also.

In *Figure 7* on page 41, the drain of the FET TR1 should join the main primary winding, ie the bottom of C3 and not the one feeding the modulator.

We apologise for any inconvenience caused to our readers.

A letter from...

Sutherland, no more and no less – the north of Scotland, where a new amateur radio society was formed at the end of October 1987. They seem like a friendly lot, too, as they say they would welcome any radio enthusiasts who find themselves way, way up north in the club's vicinity.

The club meets on the first and third Wednesdays of each month at 7.30pm in the Sutherland Arms Hotel, in Golspie. To find out more about this kind offer, or indeed what the club gets up to at its meetings, contact John GM0HBI, the club secretary. Sounds too good to resist!

Can't light a fire

Southgate ARC must be a club full of bright sparks, as the club meeting on Thursday, February 11th will be a talk on energy by the Central Electricity Generating Board. Now, about our last bill...

An informal evening is planned for February 25th, and we'd like to thank the club for their good wishes for the new year. Hope it goes well for them, too.

The club meets on the second and fourth Thursdays of the month in Holy Trinity Church Hall, Green Lanes, Winchmore Hill, London N21. Further information can be obtained from D C Elson G4YLL on (0992) 30051.

This ol' house

There are many goings-on in Sheffield ARC this month, with the club's new practical evenings, during which tuition will be given on any aspect of amateur radio which you care to mention. A sort of amateur *Any Questions*, really – if your operating is ordinary, your soldering suspect or your construction skills not too good, come

along and start asking questions.

See the experts do it properly at Sheffield, from February 1st and 29th, thereafter on the first Monday of the month.

The club will be running a special event station, GB4GOS at the Guides headquarters in Trippet Lane, Sheffield on Sunday, February 21st. This is to celebrate the Guides' Thinking Day, so if you hear them (or think you hear them?) let the club know.

The club is currently trying to find a way to sneak an aerial up at their club house, a difficult task as it is a listed building. Perhaps they should try a thatched dipole, or a Tudor beam?

The club meets every Monday at 8pm in the Firth Park Pavilion, Firth Park Road, Sheffield 5. Morse and RAE tuition takes place from 7pm.

To sir with love

Barry College of Further

Education Radio Society is celebrating its coming of age this year, and will be running GB21ST twice this year to celebrate - once in January and once in July.

February brings the club's annual dinner, though the date hasn't been arranged yet. There is a definite date for the club video night - February 4th. The topic will be aerial construction and principals (principles?). It is a college, after all - perhaps the lecturers got in on the act? Would that make it a video nasty? G6CJ will reveal all.

The club also has a quiz night on February 18th, when they will pit their wits against various local clubs.

The club meets on Thursday evenings from 7.30pm at the annexe of the Barry College of Further Education, which is on the A4226, just a few hundred yards from the old Barry Zoo - now the Welsh Hawking Centre.

All visitors are welcome,

the club has two very impressive stations on HF and VHF. Sounds like a most interesting place to visit! For further information contact Dr Kevin Johnston GW4BCB, the club's publicity officer.

Going underground

North Wakefield Radio Club start the month with a natter night on February 4th, when doubtless they will be talking about the new shack, which gets its first 'airing' on February 11th.

G0COA will be giving a talk on machine monitoring of health in the mining industry on February 18th, a very pertinent subject in an area where old King Coal reigns supreme.

The club finishes the month with its monthly meeting on February 25th. Meetings are held every Thursday from 8pm onwards at The White Horse Public House, Fall Lane, East Ardsley, and the club contact is Steve G4RCH. Thanks again to NWRC and the many

other clubs for their good wishes for the new year.

Total eclipse

The East Lancs ARC has a new PR Officer, Philip G1OPV, who tells us that the meeting for the month is on February 2nd - a film show, what's more.

To find out when and where the club meets, contact Philip on (0254) 32936.

Something's going to happen

Great things are happening at Verulam ARC this month - February 9th brings an activity evening, and then on February 23rd Angus McKenzie G3OSS himself is going to give a talk entitled 'EMC Matters'. Don't miss this!

The club meets on the second and fourth Tuesdays of the month at 7.30pm in the RAF Association Headquarters, New Kent Road, St Albans. For further information contact Hilary G4JKS on St Albans 59318.

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by J. Kligenfuss

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SHORT WAVE NEWS

FOR DX LISTENERS

By Frank A Baldwin

All times in UTC, **bold** figures indicate the frequency in kHz

Among those countries operating broadcast facilities on the low frequency bands, there are two which are rarely heard and reported by UK based listeners. The successful reception of signals emanating from Mongolia or Vietnam would represent a DX feat of no mean achievement. Nevertheless, continued and sustained efforts can bring such a result, provided the DXer is sufficiently dedicated and imbued with such an ambition.

Should the receiver exhibit a memory facility, those interested in attaining some measure of success may consider it worthwhile entering some of the frequencies listed below. In this manner, the operator is able to rapidly survey such channels should the prevailing conditions prove to be favourable for reception of the areas under discussion here.

Mongolia

Mongolia is a republic in Central Asia, being bordered by the USSR and China. The main industry consists of cattle and sheep farming resulting, naturally, in the exporting of both hides and wool.

In the east and south of Mongolia is the Gobi Desert which forms a plateau almost 4,000 feet high and in which both fossils and buried settlements have been discovered in recent times. In the north west is a high plateau which is watered by the headwaters of the Irtysh and Yenisei rivers. A feature of the landscape is its many lakes. The population is mainly nomadic.

Mongolia became independent from China during 1915 and formed a republic in 1924, China later recognising its complete independence in 1945.

Mongolian stations

The lowest in frequency is Dalanzadgad situated in South Gobi Province. It operates on **3960** with a power of

12kW, carrying the Home Service 1 in Mongolian from 2200 to 1600, also radiating the Moscow Foreign Service Mongolian programme on Tuesday and Friday from 1130 to 1200.

Unfortunately for DXers, the above transmitter is co-channelled with the 5kW Mongolian station at Uliksai which has a power of 5kW, and works to exactly the same schedule. On **4080** Ulan Bator is in parallel at the same times with the above stations but with a power of 50kW. Ulan Bator, formerly titled Urga, is the capital of the Mongolian Republic. On the banks of the Tola river, it is the Mongol holy city.

The frequency of **4750** is that of Ulgii in Bayan-Ulgii Province. Carrying the same programmes and adhering to the schedule designated above, it additionally transmits the Kazakh programme from 1330 to 1500. The best chance of hearing this 12kW station is to await the 2200 sign-on, which allows a half hour respite from the signals of the 50kW Xizang PBS in Lhasa which opens at 2230 with the Home Service in Chinese. Ulgii is sometimes heard and reported by listeners resident in Europe.

Choibalsan in the eastern part of the republic is another Mongolian transmitter which is occasionally logged by European DXers. It operates to the same schedule as that on **3960**. With a power of 12kW, the frequency is **4995**, the station being heard in Europe sometimes.

All of the above transmissions will be found difficult in the extreme to log, but frequent observations during the present season may, with some degree of good fortune, eventually result in hearing the signals from Mongolia.

Vietnam

There are Vietnamese signals on the low frequency ranges with which DXers may choose to become embattled. Again, some degree of suc-

cess entails perseverance on the part of the DXer, many of the channels specified here, like the foregoing, being subject to commercial utility services interference.

Vietnam is a Socialist Republic in South East Asia. From 1954 to 1975, the country was divided into North and South Vietnam, the Vietnam conflict ending in the defeat of the south during 1975, American forces having been withdrawn in 1973. Until 1954, Vietnam was a republic in the Federation of Indo-China within the French Union.

In the north of the country is the Red River delta, being ringed by hills and mountains, a feature of the latter being Fan Si Pan, Vietnam's highest peak. In the south is the Mekong river, maize, rice, sugar cane and sweet potatoes representing the main agricultural crops.

Vietnamese transmitters

Sometimes heard are the transmissions from Hanoi in North Vietnam on **3999**, this being listed here as the station likely to provide the most favourable opportunity of successful reception by UK listeners. It radiates the Home Service from 2145 to 0200 (Sunday until 0400) and from 0900 (Sunday from 0800) to a closing time varying from 1525 to 1630. The power is 30kW.

It should be noted that reliable information about Vietnamese regional stations is sparse indeed. For reasons best known to themselves, the Vietnamese tend to cloak schedules and power ratings in secrecy, that shown below being the latest available to the writer.

Around **4414**, the frequency varying slightly on occasions, is the regional transmitter in Lam Dong. Rarely heard far from signal source, it radiates from 1000 to 1100 and from 1145 to 1230. Like the remainder of Vietnamese stations, the power is unknown.

Gia Lai-Kon Tum radiates in both Vietnamese and local

dialects from 2300 to 2330, from 0300 to 0430 and from 1030 to 1145. Binh Tri Thein is on a variable **4681** from 1045 to 1230.

Listed on **4700** is Son La, with Home Service programmes in Vietnamese and Montagnard from 0300 to 0430 and from 1130 to 1400, but I should mention that Son La has also been recently reported on **4773.3** variable, carrying the Home Service in Vietnamese.

Ha Tuyen on **4823** is in Vietnamese and local dialects, from 2300 to 0030 and from 1230 to 1500. Than Hoa is listed on **4882** as being on the air from 2330 to 2400, and from 1030 to 1100. On **4897** the Home Service is carried by Hanoi, according to one report being heard at 2230.

Lastly, you could try setting the receiver around **5608**, on which channel the Home Service in Vietnamese is radiated from Hoang Lien Son from 0000 to 0030, from 1000 to 1030 (Saturday until 1015) and from 1145 to 1300 (Saturday until 1230).

Although all the above stations present difficult propositions for the DXer, there are those amongst us who strive for further successes—for the writer, the sole representative of that good fortune to date being represented by the Vietnamese transmitter sited at Hanoi on **3999**.

AFRICA

Cameroon

Yaounde on **4850** at 0503, a newscast in English of both local and world events.

Garoua on **5010** at 0456, drums, chants in vernacular, OM with the station identification in French, an electronic music time-check at 0500 then the news in English.

SOUTH AMERICA

Equador

Radio Jesus del Gran Poder, Quito on **5049.5** at 0101, choral rendition of the Himno Nacional and 0103 sign-off, heard after co-channel La Voz de Yopal in Columbia closed at 0101 with its station iden-

tification and 'Radial Colombiana Caracol'. R Jesus del Gran Poder has a power of 5kW and radiates from 2100 to 0105.

Bolivia

Radio Movima, Santa Ana de Yacuma on **4471.9** at 0154, announcements, musica folklorica, then a ballad in Spanish. R Movima has a power of 1kW and operates from 2200 to a closing time varying between 0300 and 0500.

Radio 2 de Febrero, Rurrenabaque on **5505.2** at 0219, songs and music, announcements, piano solo then YL with a folk song in Spanish. This Bolivian station operates irregularly from 2130 to around 0300 weekdays and from 2330 to 0200 on Sundays. The power is 0.5kW.

Guatemala

Radio Cultural, Guatemala City on **3300** at 0345, OM with a USA recorded English religious talk. This 10kW transmitter is on the air from 1000 (Sunday from 1100) to a sign-off at 0700 or 0730 on occasions. The English programme is timed from 0300 (Sunday from 2345) to 0430, otherwise in Spanish.

Peru

Radio Ancash, Huaraz on **4990.4** at 0346, folk songs and music, announcements, some local pops followed by the station identification La Voz de los Andes in Spanish. Radio Ancash closes at 0500 variable and has a power of 3kW.

Venezuela

La Voz de Carabobo, Valencia on **4780** at 0357, announcements, the station identification, choral National Anthem and off. Closing at 0400 (Sunday 0300), the power is 1kW.

Radio Capital, Caracas on **4850** at 0304, local pop songs and music, OM with the station identification in Spanish. This 1kW transmitter signs off at 0500 but on Saturday and Sunday works around the clock.

ASIA

Bangladesh

Dhaka on **4890** at 1529, OM with a talk in Bengali then the station identification and a newscast in English at 1530.

Also heard at 1600, OM with some announcements, five pips and one tone, YL with an announcement in Bengali and off. The power is 100kW.

China

Voice of the Strait, Fuzhou on **2490** at 1528, OM with a talk in Chinese. At 10kW, this Chinese regional radiates Haixia 1 programmes to Taiwan and other offshore islands, from 1200 to 1758 and from 2058 to 2330.

Voice of the Strait, Fuzhou on **4045** at 2201, YL with talk in Chinese. With a power of 10kW, the schedule is from 1000 to 1630 with Haixia 2 in Chinese and Amoy, the latter being used from 1400 to 1415, 1445 to 1500 and from 1600 to 1615. The transmission reported here is not listed.

Voice of the Strait, Fuzhou on **4330** at 1612, YL with a talk in Chinese amid interference from co-channel Xinjiang PBS, Urumqi. Also at 10kW, this one radiates Haixia 1 programmes in Chinese from 0955 to 2355.

India

AIR (All India Radio) Lucknow on **3205** at 0040, OM with a talk in vernacular. At 10kW, Lucknow is on the air from 0025 to 0215 and from 1100 to 1741. There is an English news bulletin at 1530.

AIR Kurseong on **3355** at 1538, YL with a newscast in English, this also being heard in parallel on **4800** and on **4860**. Kurseong is active from 1130 to 1741 and features English newscasts at 1530 and 1730.

Nepal

Kathmandu on **3230** at 1602, a talk in the Home Service followed by announcements, music and songs in Nepali. This channel is utilised during the winter period only, being an alternative to the summer channel of **7165**. The schedule is from 0015 to 0515 and from 1145 to 1715 with a power of 100kW.

Pakistan

Islamabad on **5090** at 0043, recitations from the Holy Quran, the station identification, a talk with several mentions of Pakistan, then more quotations from the Holy Quran. The Regional Service

in Urdu and vernaculars is listed to operate from 0045 to 0400 and features an English news bulletin at 0300.

Sri Lanka

Trans World Radio, Colombo on **11825** at 1440, OM with a talk in an Indian vernacular with mentions of the Taj Mahal, OM with the station identification, choral anthem and off. This transmission is scheduled from 1330 to 1453.

South East Asia

RRI (Radio Republik Indonesia) Bukittinggi on **3231.9** at 1545, music in the local manner, YL with songs in Indonesian, also heard in parallel on **4911**. The schedule on **3231.9** is from 2255 to 0300 and from 1030 to 1700 at 10kW.

RRI Sibolga on **5256.5** at 1503, a talk in Indonesian followed by some local style orchestral music and songs. This 1kW transmitter radiates from 2300 to 0100 and from 1000 to 2200.

RRI Pekanbaru on **5894** at 1525, folk songs and music with announcements in Indonesian. Pekanbaru is liable to frequency variation from **5894.2** to **5895.1**. The schedule is from 2200 to 0200 and from 0830 to 1000 with a power of 5kW.

PACIFIC

Guam

KTWR Agana on **9820** at 1400, the station identification then a talk in the Mandarin programme for China, timed from 1200 to 1500. KSDA Agana on **11980** at 1411, a duet, music and announcements in the Tamil presentation to South Asia, scheduled from 1400 to 1500.

Philippines

Voice of America, Tinang on **11965** at 1408, a talk during the Chinese programme for Central Asia which is aired from 1000 to 1500.

CLANDESTINE

Voice of National Salvation, Haeju, North Korea on **4119.6** at 1623, YL with a talk in Korean, chimes interval signal at 1626, more talk, chimes again at 1630, OM with announcements, orchestral anthem and off at 1632. This

clandestine has been heard several times recently, the frequency varying from **4119** to **4119.9**. It has also been logged by the writer at the unscheduled time of 2235. The power is 100kW and a parallel channel is that of **4556.7**, but not to date heard here by the writer owing to co-channel utility interference.

NOW HEAR THESE

Kalamabad, Iran on **3779.3** at 1812, OM with a talk in vernacular then recitations from the Holy Quran. The present schedule is unknown, the power is 100kW and the channel is subject to amateur SSB interference.

Pyongyang, North Korea on **2849.9** at 1612, orchestral music and choral songs in Korean. At 120kW, the Home Service 1 schedule is from 1958 to 1800.

Pyongsong, North Korea on **3350** at 1615, orchestral music, female choir then OM with a song in Korean. This Home Service transmission is timed from 1958 to 1800, also featuring regional programmes during the schedule. The power is unknown.

North Korean orchestral music is apt to be rather slow and sombre. Much of the transmission periods heard by the writer feature choral works, presumably a favourite with local audiences.

NOW LOG THESE

Taipei, Taiwan on **3335** at 1608, YL with a talk in a Chinese vernacular (Hakka) then OM with a talk. This Network 5 programme is on the air from 0950 to 2200, the power being 10kW.

Radio Mondou, Chad on **5286** at 0527, songs in vernacular, local style music, OM with an announcement in French. Mondou is active with the Home Service in vernaculars and French from around 0515 to 0800 and from 1400 to around 1800. The power is 2.5kW.

Colombo, Sri Lanka on **4902** at 1605, with chants in Sinhala. The National Service in Sinhala is carried on this frequency from 2330 to 0330 (Saturday and Sunday until 0730) and from 1030 to 1730 (Monday to Friday). The power is 10kW. 

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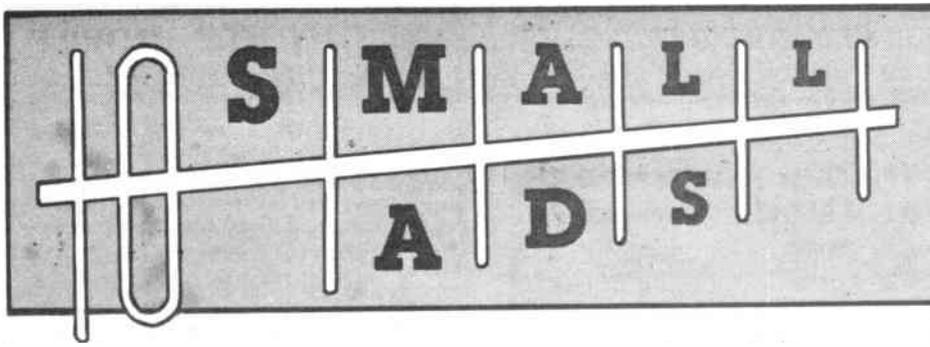
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Amateur radio equipment also in stock

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The communications and electronics magazine

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

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1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

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MERTON GARAGE AND POST OFFICE, MERTON.
Nr OAKHAMPTON, DEVON EX20 3DZ

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(SUNDAYS BY APPOINTMENT)

SPECIALIST IN 934 MHz
SUPPLIERS OF ALL 27MHz AND 934 MHz EQUIPMENT
AMATEUR ACCESSORIES CATERED FOR
08053 200

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ENAMELLED COPPER WIRE				
SWG	1lb	8oz	4oz	2oz
8 to 34	3.63	2.09	1.10	0.88
35 to 39	3.82	2.31	1.27	0.93
40 to 43	6.00	3.20	2.25	1.61
44 to 47	8.67	5.80	3.49	2.75
48	15.96	9.58	6.38	3.69
SILVER PLATED COPPER WIRE				
14 to 30	9.09	5.20	2.93	1.97
TINNED COPPER WIRE				
14 to 30	3.97	2.41	1.39	0.94

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Please add 15% VAT. Orders under £3 add 50p.
SAE for list of copper and resistance wire.
Dealer enquiries welcome.



RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: Radio & Electronics World · Sovereign House
Brentwood · Essex CM14 4SE · England · (0277) 219876

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

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

COPY enclosed..... to follow.....

PAYMENT ENCLOSED:.....

£ —

Cheques should be made payable to
Radio & Electronics World. Overseas
payments by international Money Order +
Credit Card
CREDIT CARD
EXPIRY DATE

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COMPANY

ADDRESS

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LUCKY SOUTH COAST DWELLERS

*can see the biggest display of
ELECTRONIC COMPONENTS
in the South*

FRASER ELECTRONICS

42 ELM GROVE, SOUTHSEA, HANTS

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BEFORE YOU BUY

**NEXT ISSUE
ON SALE
11th FEB
1988**

**HEATHERLITE MOBILE
MICROPHONES**

telephone 0482 871762

With control box, mic gain control,
PTT, LED on TX.

with plug, with scan buttons£26.00
with plug, without scan buttons£24.00

FOR SINGLE EARPHONE ON ANY OF
ABOVE...add£3.00

TYPE SW for portables, mic, earphone, sw
box, jacks£15.50
'please state rig'

p&p add £1.50 per order

EXPLORER VALVE AMPLIFIERS

2M EXPLORER VHF linear amp with single
4CX250B.....£535

70cm EXPLORER UHF linear amp with
single 4CX250B.....£585

HF EXPLORER linear amp 2 x 3-500Z
valves.....£1050
carriage on amps£15

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1 Beverley Business Centre,
St. Nicholas Road, Beverley,
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IC's TRANSISTORS etc, into cash, immediate
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Est Over 10 years

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Open: Tues-Sat 9-5

Quality secondhand equipment in stock. Full
range of TRIO goodies. Jaybeam - Microwave
Modules - LAR.

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FOR ICOM PORTABLES**

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ICOM



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7 DAY SERVICE

Please mention
Radio & Electronics World
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to any
advertisements

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Throughout the house on Channel 36.
Price £10.50 + P&P 50p. Phone for leaflet:

Electronic Mailorder A
62 Bridge Street, Ramsbottom
Lancs BLO 9AQ

Tel: 070682-3036 (24hrs)

**COUNTY
GUIDE**

RATES
BOXES ad sizes
20mm x 59mm single
40mm x 59mm double

Total	Ad space	3 issues	6 issues	12 issues
prepayment	single	£47.00	£88.00	£158.00
rates	double	£94.00	£176.00	£316.00

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex
CM14 4SE · England · (0277) 219876

print your copy here

NUMBER OF INSERTIONS REQUIRED

Single County Guide 3 £47.00... 6 £88.00... 12 £158.00...
Double County Guide 3 £94.00... 6 £176.00... 12 £316.00...

PAYMENT ENCLOSED

£

Cheques should be made payable to Radio &
Electronics World. Overseas payments by
International Money Order

Conditions — Payment must be sent with order form. No copy changes allowed. Ads accepted subject to our
standard conditions, available on request.

Registered No 2307667 (England)

C P I

★ **PSSS....** ★
**ALL THE SUPER
BARGAINS ARE
ON THE
INSIDE-FRONT
COVER OF THIS
MAGAZINE!!**
★  ★

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ADVERTISING RATES & INFORMATION

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES		colour rates exclude cost of separations	series rates for consecutive insertions		
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

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

DEADLINES		*Dates affected by public holidays			
issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs	
Jan 88.....	12 Nov 87.....	18 Nov 87.....	20 Nov 87.....	10 Dec 87.....	
Feb 88.....	10 Dec 87.....	16 Dec 87.....	18 Dec 87.....	14 Jan 88.....	
Mar 88.....	14 Jan 88.....	20 Jan 88.....	22 Jan 88.....	11 Feb 88.....	
Apr 88.....	11 Feb 88.....	17 Feb 88.....	19 Feb 88.....	10 Mar 88.....	

CONDITIONS & INFORMATION			
<p>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.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.</p> <p>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.</p>	<p>Printed — web-offset.</p> <p>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 publication date.</p> <p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219878</p>	<p>Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS 10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>



£1 BAKERS DOZEN PACKS

Price per pack is £1.00. * Order 12 you may choose another free. Items marked (sh) are not new but guaranteed ok.

- 1 - 5 13 amp ring main junction boxes
- 2 - 5 13 amp ring main spur boxes
- 5 - 3 flush electrical switches
- 7 - 4in flex line switches with neons
- 8 - 2 80 watt brass cased elements
- 9 - 2 mains transformers with 6V 1A secondaries
- 10 - 2 mains transformers with 12V 1/2A secondaries
- 11 - 1 extension speaker cabinet for 6" speaker
- 12 - 5 octal bases for relays or valves
- 13 - 12 glass reed switches
- 14 - 4 OCP 70 photo transistors
- 16 - 4 tape heads, 2 record, 2 erase
- 17 - 1 ultrasonic transmitter and 1 ditto receiver
- 18 - 2 15000 mfd computer grade electrolytics
- 19 - 2 light dependent resistors
- 20 - 5 different micro switches
- 21 - 2 mains interference suppressors
- 22 - 2 25 watt crossover units 2 way
- 23 - 1 40 watt 3 way crossover unit
- 28 - 1 6 digit counter mains voltage
- 30 - 2 Nicad battery chargers
- 31 - 1 key switch with key
- 32 - 2 humidity switches
- 34 - 96 x 1 metre lengths colour-coded connecting wires
- 36 - 2 air spaced 2 gang tuning condensers
- 37 - 2 solid dielectric 2 gang tuning condensers
- 38 - 10 compression trimmers
- 41 - 6 Rocker Switches 10 amp mains SPST
- 43 - 5 Rocker Switches 10 amp SPDT Centre Off
- 44 - 4 Rocker Switches 10 amp DPDT
- 45 - 1 24 hour time switch mains operated (s.h.)
- 46 - 1 16 hour clock timeswitch
- 48 - 2 6V operated reed switch relays
- 49 - 10 neon valves - make good night lights
- 50 - 2 x 12V DC or 24V AC, 4 CD relays
- 51 - 1 x 12V 2C 0V very sensitive relay
- 52 - 1 12V 4C relay
- 55 - 1 locking mechanism with 2 keys
- 56 - Miniature Uniselectors with circuit for electric jigsaw
- 57 - 5 Dolls' House switches
- 59 - 5 ferrite rods 4" x 5/16" diameter aeriols
- 61 - 4 ferrite slab aeriols with L & M wave coils
- 62 - 4 200 ohm earpieces
- 63 - 1 Mullard thyristor trigger module
- 64 - 10 assorted knobs 1/4" spindles
- 65 - 5 different thermostats, mainly bi metal
- 66 - Magnetic brake - stops rotation instantly
- 67 - Low pressure 3 level switch
- 69 - 2 25 watt pots 8 ohm
- 70 - 2 25 watt pots 1000 ohm
- 71 - 4 wire wound pots - 18, 33, 50 and 100 ohm
- 73 - 4 3 watt wire wound pots 50 ohm
- 77 - 1 time reminder adjustable 1-60 mins
- 78 - 5.5 amp stud rectifiers 400V
- 85 - 1 mains shaded pole motor 1/4" stack - 1/4" shaft
- 86 - 25" ali fan blades fit 1/4" shaft
- 87 - 23" plastic fan blades fit 1/4" shaft
- 88 - Mains motor suitable for above blades
- 89 - 1 mains motor with gearbox 1 rev per 24 hours
- 91 - 2 mains motors with gearbox 16 rpm
- 93 - 4 11 pin moulded bases for relays
- 94 - 5 B7G valve bases
- 95 - 4 skirted B9A valve bases
- 96 - 1 thermostat for fridge
- 98 - 1 motorised stud switch (s.h.)
- 101 - 1 2 1/2 hours delay switch
- 103 - 1 6V mains power supply unit
- 104 - 1 4 1/2 V mains power supply unit
- 105 - 1 5 pin flex plug and panel socket
- 107 - 1 5" speaker size radio cabinet with handle
- 109 - 10 1/4" spindle type volume controls
- 110 - 10 slider type volume controls
- 112 - 1 heating pad 200 watts mains
- 114 - 1 1W amplifier Mullard 1172
- 115 - 1 Wall mounting thermostat 24V
- 118 - 1 Teak effect extension 5" speaker cabinet
- 120 - 2 p.c.b. with 2 amp full wave and 17 other recs
- 122 - 10 mtrs twin screened flex white p.v.c. outer
- 132 - 2 plastic boxes with windows, ideal for interrupted beam switch etc
- 155 - 3 varicap push button tuners with knobs
- 188 - 1 plastic box, sloping metal front, 16 x 96mm, average depth 45mm
- 241 - 1 car door speaker (very flat) 6" 15 ohm made for Radiomobile
- 243 - 2 speakers 6" x 4" 15 ohm 5 watt made for Radiomobile
- 266 - 2 mains transformer 9V 1/2A secondary split primary so DK also for 115V
- 267 - 1 mains transformers 15V 1A secondary p.c.b. mounting
- 330 - 2 6V 0.6V mains transformer. 3a p.c.b. mounting
- 350 - 40 double pole leaf switches
- 365 - 1 7uf 660V 50hz metal cased condenser
- 453 - 2 2 1/2 in 60 ohm loudspeakers
- 454 - 2 2 1/2 in 8 ohm loudspeakers
- 463 - 1 mains operated relay with 2 sets c/o contacts
- 464 - 2 packets resin filler/sealer with cures
- 465 - 3 5A round 3 pin plugs will fit item 193
- 466 - 4 7 segment i.e.d. displays
- 470 - 4 pc boards for stripping, lots of valuable parts
- 480 - 1 3A double pole magnetic trip, saves repairing fuses
- 498 - 4 1000uf 25V axial electrolytic capacitors
- 504 - 1 Audax PM 8" speaker 15 ohm 5 watt rating
- 515 - 100 4BA 1 1/2" cheesehead plated screws and 100 4BA nuts
- 541 - 1 pair stereo tape head as in cassette recorder/players
- 546 - 1 bridge rectifier 600V international rectifier ref 35B100
- 548 - 2 battery operated relays (3-6v) each with 5A c/o contacts 2 pairs
- 553 - 2 lithium 3V batteries (everlasting shelf life)

TELEPHONE BITS

- Master socket (has surge arrester - ringing condenser etc) and takes B.T. plug.....£3.95
- Extension socket.....£2.95
- Dual adaptors (2 from one socket).....£3.95
- Cord terminating with B.T. plug 3 metres.....£1
- Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 B.T. extension sockets.....£11.50
- 100 mtrs 4 core telephone cable.....£8.50

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 3 1/2" and 5 1/4" discs. We supply the Operators Manual and other information showing how to use this with popular computers: BBC, Spectrum, Amstrad etc. All at a special snip price of £27.50 including post and VAT. Data available separately £2, refundable if you purchase the drive.

MULLARD UNILEX AMPLIFIERS

We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules - i.e. Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for £6.00 plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

CAR STARTER/CHARGER KIT

Flat Battery! Don't worry you will start your car in a few minutes with this unit - 250 watt transformer 20 amp rectifiers, case and all parts with data case £17.50 post £2.

THIS MONTH'S SNIP

is a 2 1/2 kW tangential heater, metal box to contain it and 3 level switch to control it. Special price £7.50 post paid.



VENNER TIME SWITCH

Mains operated with 24 hr switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95 without case, metal case - £2.95, adaptor kit to convert this into a normal 24hr time switch but with the added advantage of up to 12 on/off's per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30

Ex-Electricity Board. Guaranteed 12 months.

12 volt MOTORS BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3 1/2" long by 3" dia. They have a good length of 1/4" spindle - 1/10 hp £3.45 1/8 hp £5.75 1/6 hp £7.50



SOUND TO LIGHT UNIT



Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by 1/4" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form.

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24/306V. Which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only £16 plus £5 post.

LIGHT BOX

This when completed measures approximately 15" x 14". The light source is the Philips fluorescent 'W' tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit, that is the box, choke, starter, tube and switch, and fibreglass is £5 plus £2 post, order ref 5P69.

TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw, 2kw, 2.5kw, and 3kw. Prices are £5 each for the first 3, and £6.95 for the 3k. Add post £1.50 per heater if not collecting.

CONTRLD SWITCH enabling full heat, half heat or cold blow, with connection diagram. 50p for 2kw, 75p for 3kw.

FANS & BLOWERS

5" £5 - £1.25 post. 6" £6 + £1.50 post
4" x 4" Muffin equipment cooling fan 115V £2.00
4" x 4" Muffin equipment cooling fan 230/240V £5.00
9" Extractor or blower 115V supplied with 230 to 115V adaptor £9.50 + £2 post.

All above are ex computers but guaranteed 12 months. 10" x 3" Tangential Blower. New. Very quiet - supplied with 230 to 115V adaptor on use two in series to give long blow £2.00 + £1.50 post or £4.00 + £2.00 post for two

TELEPHONE LEAD

3 mtrs long terminating one end with new BT, flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref BD552 or 3 for £2 ref 2P164.

POWERFUL IONISER

Generates approx. 10 times more ions than the ETI and similar circuits. Will refresh your home, office, shop, work room etc. Makes you feel better and work harder - a complete mains operated kit, case included. £11.50 + £3 P&P.

J & N BULL ELECTRICAL

Dept. R.E., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT
MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access B/c card orders accepted. Brighton (0273) 734648 or 203500.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel.

£2 POUNDERS*

- 2P122 - 1 30a rotary switch, surface mounting with pointer knob
- 2P123 - 1 25a rotary switch, surface mounting, cover engraved, high medium low and off
- 2P124 - 1 28kv .001 mfd black condenser
- 2P129 - 1 10rpm motor 115V so supplied with adaptor for 230V
- 2P131 - 1 Crouzet motor 230V fits the Crouzet gearbox
- 2P132 - 1 Circuit heat-stat for fire warning or protection
- 2P133 - 1 Circuit breaker 20a, Crabtree ref C50
- 2P134 - 1 9V 500mA psu plugs in 13a socket
- 2P135 - 10m 10 conductor intercom cable
- 2P136 - 1 12 kw element made for tangential blowers
- 2P137 - 1 Thermo couple, stainless steel tipped for measuring internal heat
- 2P138 - 1 Mains transformer 20V 0.20V 1A upright mounting
- 2P141 - 1 rechargeable battery D size (4 AH) solder tag ended
- 2P142 - 10m 4 pair intercom cable White PVC outer
- 2P144 - 1 Mains operated relay with 4 x 8a c/o contacts
- 2P146 - 1 7.800 uF 150C d.c. smoothing capacitor
- 2P148 - 1 Technical information on 3" FDD refundable if you buy fdd
- 2P149 - 5 diff battery operated model of appliance up to 25a
- 2P150 - 1 PSU chassis with all components for 24V 2A d.c. unwired
- 2P151 - 1 Metal box 14 1/2 x 14 x 4 with lid add £2.00 post
- 2P152 - 1 Motor start capacitor 80uf 250V
- 2P153 - 1 Two station intercom unused but line reject
- 2P154a - 1 Nicad charger - plug into 13a socket 5.2V 7UA output
- 2P154b - 1 Nicad charger - plug into 13a socket 6V 3VA output
- 2P155 - 1 Mains transformer giving 16, 17, 18 & 20V 60W
- 2P158 - 1 Oven thermostat with temp calibrated knob
- 2P159 - 1 9V 500ma case with mains lead and output lead
- 2P160 - 1 13a plug adaptor fused takes 3 x 3a plugs
- 2P161 - 1 6" diagonal side cutters
- 2P162 - 1 Stereo Matrix PCB mounting deemphasis K35
- 2P163 - 1 AC Working capacitor 12uf 660V AC or 1500V dc
- 2P164 - 3 Phone leads 3 mtrs long tags one end B.T. plug other end

£3 POUNDERS*

- 3P7 - 1 DC voltage doubler or halver for 12V to 24V 12 to 6V 24 to 12V
- 3P8 - 1 24hr time switch Sengamo, new condition Guaranteed 1 year
- 3P9 - 1 2500mA psu plugs in 13a socket regulated
- 3P10 - 1 Mains transformer 50V 2A with 6.3 pilot light winding, upright mounting, fully shrouded plus £1 post
- 3P11 - 1 Stereo filter to fit in mains lead of appliance up to 25a
- 3P12 - 1 waterproof case will take 150 watt transformer
- 3P16 - 1 signal box, 3 lamps on face plate of metal box size 5 1/2 x 3 1/2
- 3P17 - 1 choke and starter to work 8" fluorescent tube at 125W
- 3P18 - 1 22V 3a mains transformer with bridge rect fitted on top panel
- 3P20 - 1 10.5a ammeter 3 1/2 ac/dc ax equipment
- 3P21 - 1 power factor correction condenser 5uf 350ac
- 3P22 - 1 200va - auto transformer 230 to 115V toroidal encapsulated £1.50 post
- 3P24 - 1 3" floppy disc for Amstrad etc.
- 3P25 - 1 7" Electricians pliers

£4 POUNDERS*

- 4P12 - 50m low loss co ax 75ohm + £1 post
- 4P13 - 3 Horstmann time and set switches 15amp
- 4P14 - 1 150w mains transformer "c" core 43V 3.5A secondary
- 4P15 - 1 powerful motor 2" stack fitted with gearbox final speed 60rpm mains operated, could operate door opener etc.
- 4P17 - 1 Uniselector 3 pole 25V, 50V coil standard size
- 4P18 - 1 Volt meter with digital display (DIGIVISDR)

COMPUTERS

ACORN ELECTRON - ZX SPECTRUM PLUS - ZX SPECTRUM 128 - COMMODORE 64 - COMMODORE C16
ALL IN STOCK AT TIME OF GOING TO PRESS
Phone for details

£5 POUNDERS*

- 5P86 - 1 Transformer upright mounting 230/240V primary 2 x 100 1a secondary
- 5P88 - 1 Transformer in waterproof metal box 24V 5A add £2 post
- 5P89 - 1 4 bank heating element each 2kw ideal convector heater
- 5P90 - 1 18" long tangential blower with motor at one end
- 5P91 - 1 14" blower, motor in middle
- 5P92 - 10m Audio co-ax double screened 75ohm super low loss for TV
- 5P93 - 1 6" Alarm bell 24V dc or ac
- 5P94 - 1 Current transformer 14V out with 1a dc input
- 5P95 - 1 Vintage photo cell
- 5P97 - 1 Impedance matching transformer 0.45 8-160 ohm 100 add £1.50 post
- 5P98a - 1 10 90a ammeter for mounting outside control panel
- 5P98b - 1 10 180a ammeter for mounting outside control panel
- 5P99 - 1 Mains operated blower centrifugal output size app. 5" x 1 1/2"
- 5P100 - 1 Mains splitter 45a switch 3 x 15a fused circuits
- 5P101 - 1 Model motor 1 rpm from 6V reversible

£7 POUNDERS*

- 7P1 - 1 Instant heat solder gun - mains with renewable tip and job light

£8 POUNDERS*

- 8P1 - 1 Charger transformer 10a upright mounting 230/240 primary 16v 10a secondary
- 8P2 - 1 16" underdome alarm bell suitable for a fire alarm or burglar alarm mains operated
- 8P3 - 1 heat sink big powerful so ideal for power transistors
- 8P6 - 1 24hr time switch - 2 on off's 16a c/o contacts 3" x 3" x 1 1/2"
- 8P7 - 1 Silent sentinel invisible ray kit
- 8P8 - 1 Papsf fan 3 1/2 x 3 1/2 x 1 1/2 230V metal bodied

£10 POUNDERS*

- 10P14 - 1 100a time switch 1 on/off per 24hr extra triggers £1 per pair
- 10P15 - 1 Max demand meter 230 ac mains
- 10P16 - 1 powerful air mover 2 small type blowers with motor in middle
- 10P18 - 1 mains operated klaxon
- 10P19 - 1 12V alarm bell really loud, mains operated, in iron case + £5 post
- 10P22 - 1 sensitive volt meter relay
- 10P23 - 1 fruit machine heart 3 fruit wheels each stepper motor operated add £3 post
- 10P24 - 1 big panel meter face size 4 1/2 x 2 1/2 200uA movement scaled 1-10
- 10P30 - 1 instrument psu on pcb has 4 outputs .12V/.5V 6A/12V .5A/5V 5A
- 10P31 - 1 7 day time switch 16a c/o contacts sep switches for each day
- 10P32 - 1 68 rpm 1/8th hp motor reversible

£15 POUNDERS*

- 15P1 - 1 kit for 115W hi fi amp
- 15P2 - 1 kit for psu to supply one or two 15P1 amps
- 15P3 - 1 time switch battery or mains operated - 16a c/o contacts, 7 day programmable has 36hr reserve

LIGHT CHASER KIT motor driven switch bank with connection diagram, used in connection with 4 sets of xmas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

BI-PAK BARGAINS



THE UNDISPUTED PACK KING FOR OVER 20 YEARS, we offer you the very best in Electronic Components and Semiconductors that your money can buy. Look at our lists and prices, they are unbeatable in value and quantity and you always have our "Satisfaction or money back guarantee". For 1988 we offer more and more Super Value Packs. All goods advertised in stock at time of going to press. Please note our new mail order address: **BI-PAK, PO BOX 33, ROYSTON, HERTS, SG8 5DF. Telephone orders: 0763-48851.**

Pak No	Qty	Description	Price
RESISTORS			
VP1	300	Assorted Resistors, mixed values and types	£1.00
VP2	300	Carbon Resistors 1/4-1/2 watt, preformed, mixed	£1.00
VP4	200	1/2-1 watt Resistors, mixed values and types	£1.00
VP16	50	Wirewound Resistors, mixed watt values	£1.00
VP140	50	Precision Resistors, 1% tolerance	£1.00
VP180	100	1 and 2 watt Resistors, assorted values	£1.00
VP287	100	Close tolerance Resistors, 0.5-2%, 10-910 ohms, mixed	£1.50
VP288	100	Close tolerance Resistors, 0.5-2%, 1K-820K, mixed	£1.50
VP289	100	Metal oxide high stab. Resistors, 1/4w 2%, mixed values	£1.50
CAPACITORS			
VP5	200	Assorted Capacitors all types	£1.00
VP6	200	Ceramic Capacitors all types	£1.00
VP9	100	Assorted Polyester/Polystyrene Capacitors	£1.00
VP10	60	C280 Capacitors, metal foil, mixed values	£1.00
VP11	50	Electrolytics, all sorts	£1.00
VP12	40	Electrolytics, 47mf-150mf, mixed volts	£1.00
VP13	30	Electrolytics, 150mf-1000mf, mixed volts	£1.00
VP14	50	Silver Mica Caps, mixed values	£1.00
VP15	25	01/250v Min. Layer Metal Caps	£1.00
VP180	25	Tantalum Bead Caps, assorted values	£1.00
VP182	4	1000uf 50v Electrolytics	£1.00
VP192	30	Min. Electrolytics, mixed values, 47mf-1000mf 6/16v	£1.00
VP193	8	Sub Min. Electrolytics, 2 x 1000/2200/3300mf, 10/16v	£1.00

Pak No	Qty	Description	Price
OPTOS			
VP24	10	125' clear lens showing Red LED's	£1.00
VP25	10	Mixed shape and colour LED's	£1.00
VP26	15	Small 125' Red LED's	£1.00
VP27	15	Large 2' Red LED's	£1.00
VP28	10	Rectangular 2' Red LED's	£1.00
VP57	25	Opto Special Pack, Assorted, super value	£2.00
VP130	6	RED 7 Seg. CA 14mm x 7.5mm RDP FND353 LED Display	£2.00
VP131	4	GREEN 7 Seg. CA 6' LDP XAN6520 LED Display	£2.00
VP134	6	RED Overflow 6' 3 x CA 3x 6630/50 LED Display	£2.00
VP133	5	GREEN Overflow 6' CA XAN6530 LED Display	£2.00
VP138	20	Assorted LED Displays, Our mix with data	£5.00
VP147	1	Par Opto Coupled Modules	£3.00
VP199	4	LD707R LED Displays, CA	£1.00
VP203	15	Triangular shape LED's, mixed colours	£1.00
VP204	10	Large Green LED's 5mm	£1.00
VP205	10	Small Green LED's 3mm	£1.00
VP206	10	Large Yellow LED's 5mm	£1.00
VP207	10	Small Yellow LED's 3mm	£1.00
VP208	10	Large LED's clear showing Red, 2'	£1.00
VP241	2	ORP12 Light Dependent Resistor	£1.50
VP242	3	Tri-colour LED's, 5mm dia, 5mA 2v, R G Y	£1.00
VP243	3	Tri-colour LED's, Rectangular 5mm, R G Y	£1.00
VP266	10	Orange LED's, 5mm large	£1.00
VP267	8	Stackable LED's, Rectangular mixed, R G Y	£1.00
VP268	15	LED Panel Mounting Clips, metal and plastic, 3-5mm	£1.00
VP269	2	Red Flashing LED's, 5mm	£1.00
VP284	2	Opto-Isolator IL74-4N27, single	£1.00
VP285	1	Dual Opto-Isolator ILD74	£1.00

Pak No	Qty	Description	Price
DIODES & SCRS			
VP29	30	Assorted volt Zeners 50mw-2w	£1.00
VP30	10	Assorted Volt Zeners 10w, coded	£1.00
VP31	10	5A SCR's T066, 50-400v coded	£1.00
VP32	20	3A SCR's T066, up to 400v, uncoded	£1.00
VP33	100	Sil. Diodes like 1N4148	£1.00
VP34	200	Sil. Diodes like OA200/BAX13-16, 40v 200mA	£1.00
VP35	50	1A 1N4001 Diodes, all good, uncoded, 50v min	£1.00
VP49	30	Assorted Sil. Rectifiers 1A-10A, mixed volts	£1.00
VP141	40	1N4002 Sil. Rectifiers, 1A 100v, preformed pitch	£1.00
VP142	4	40A Power Rectifiers, silicon, T048 300 PIV	£1.00
VP143	3	BY187 12KV Sil. Diodes, in carriers, 2.5MA	£1.00
VP184	3	4x 40v Triacs, plastic	£1.00
VP187	10	SCR's 800MA, 200v, 2N5064, plastic, T092	£1.00
VP194	50	0A81 point contact germanium Diodes, uncoded	£1.00
VP195	50	0A47 gold bonded germanium Diodes, uncoded	£1.00
VP196	50	0A70-79 detector germanium Diodes	£1.00
VP197	50	0A90 type germanium Diodes, uncoded	£1.00
VP198	40	BA248 Sil. Diodes, 350V 2A, fast recovery	£1.00
VP222	20	3A Stud Rectifiers, 50-400v, assorted	£1.00
VP274	12	SCR's (Thyristors) 1A-10A, 100-400v, T0-39	£1.00
VP275	3	5A 400V SCR's T0220, TIC106D	£1.00
VP276	5	SCR's standard type, 5-16Amp to 400v	£1.00
VP277	4	Triacs 2Amp 400v T0-39	£1.00
VP278	4	6Amp 1000v plastic Silicon Rectifiers	£1.00
VP283	5	Diac BR100 triac trigger	£1.00

Pak No	Qty	Description	Price
TRANSISTORS			
VP38	100	Sil. Transistors, NPN plastic, coded, with data	£3.00
VP39	100	Sil. Transistors, PNP plastic, coded, with data	£3.00
VP47	10	Sil. Power Transistors, similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Transistors, 4A, data	£1.00
VP50	60	NPN Sil. Switching Transistors, T0-18 and T0-92	£1.00
VP51	60	PNP Sil. Switching Transistors, T0-18 and T0-92	£1.00
VP60	100	All sorts Transistors NPN/PNP	£1.00
VP150	20	BC183B Sil. Transistors, NPN 30v 200mA Hfe240+ T092	£1.00
VP151	25	BC171B Sil. Transistors, NPN 45v 100mA Hfe240+ T092	£1.00
VP152	15	TIS90 Sil. Transistors, NPN 40v 400mA Hfe100+ T092	£1.00
VP153	15	TIS91 Sil. Transistors, PNP 40v 400mA Hfe100+ T092	£1.00
VP154	15	MPSA56 Sil. Transistors, PNP 80v 800mA Hfe50+ T092	£1.00
VP155	20	BF955 Sil. Transistors, NPN eqvt BF184 H.F. T092	£1.00
VP156	20	BF495 Sil. Transistors, NPN eqvt BF173 H.F. T092	£1.00
VP157	15	ZTX500 series Sil. Transistors, PNP plastic	£1.00
VP158	15	ZTX107 Sil. Transistors, NPN eqvt BC107 plastic	£1.00
VP159	15	ZTX108 Sil. Transistors, NPN eqvt BC108 plastic	£1.00
VP161	25	BC183B NPN Transistors, T03 VCB 500, 10A 100w Hfe15+	£1.00
VP162	5	SJE5451 Sil. Power Transistors, NPN 80v 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs Sil. Power Transistors, like SJE5451	£1.00
VP164	4	2N6289 Sil. Power Transistors, NPN 40v 40w 7A Hfe30+	£1.00
VP165	6	BF733 NPN Sil. Transistors, 80v 5A Hfe50-200 T039	£1.00
VP166	5	BF734 NPN Sil. Transistors, 100v 5A Hfe50-200 T039	£1.00
VP167	1	BU680C NPN Transistors, T03 VCB 500, 10A 100w Hfe15+	£1.00
VP168	10	BC478 eqvt BCY71 PNP Sil. Transistors T018	£1.00
VP169	10	BC521 eqvt BC394 NPN Sil. Transistors, 80v 50mA T018	£1.00
VP170	10	Assorted Power Transistors, NPN/PNP coded and data	£1.00
VP171	10	BF355 NPN T0-39 Sil. Transistors eqvt BF258 225v 100mA	£1.00

MINIATURE CARBON FILM RESISTORS 1/4 & 1/2 WATT 5% Resistance values from 10ohm - 10meg ohms Available in lots of 100 pieces per value To order state R100 1/4 watt or R200 1/2 watt, plus resistance required, eg R100 1K - 1/4 watt 1K BI-PAK price per 100 pieces R100 £1.00 per pack, R200 £1.30 per pack

Pak No	Qty	Description	Price
TRANSISTORS			
VP172	10	5M1502 PNP T0-39 Sil. Transistors, 100v 100mA Hfe100+	£1.00
VP200	30	OC71 type germanium AF Transistors uncoded	£1.00
VP201	25	OC45 germanium RF Transistors	£1.00
VP261	4	Programmable Junction Transistors, MEU22	£1.00
VP270	10	FET's UHF/VHF Amplifiers, switching & choppers data	£1.00
VP271	10	FET's general purpose like 2N3819-2N5457, data	£1.00
VP272	10	MOS-FET's Signetics, SD304	£1.00
VP280	12	ZTX300 NPN Silicon Transistors	£1.00
VP290	15	MPSA06 Sil. Transistors, NPN 80v 500mA HFE50+ T092	£1.00
VP428	10	AC128K PNP Germanium Transistor, 1A 32v	£1.00
VP429	10	AC176K NPN Germanium Transistor, 1A 32v	£1.00
VP430	4	2N3055 Sil. Power Transistors, full spec	£2.00
VP431	25	PNP Sil. Transistors, T0-39 like 2N2905A	£1.00
I.C.S			
VP40	40	TTL I.C.S all new gates - Flip Flop - MSI data	£4.00
VP54	20	Assorted I.C. DIL Sockets, 8-40 pin	£2.50
VP59	20	Assorted I.C.S linear, etc, all coded	£2.00
VP209	12	74LS00	£2.00
VP210	12	74LS74	£2.00
VP211	10	CD4001B	£2.00
VP212	10	CD4011B	£2.00
VP214	10	CD4069B	£2.00
VP215	10	7419 8 pin	£2.00
VP216	10	555 Timers 8 pin	£2.00
VP223	50	Asst 74 TTL I.C.S ALL GATES new & coded our mix	£6.00
VP224	100	Asst 74 TTL I.C.S ALL GATES new & coded our mix	£10.00

Pak No	Qty	Description	Price
VP282	1	Prog. Sound Gen. Chip, AY-3-8912	£3.00
VP283	1	Z8001 Microprocessor, 40 pin DIL	£2.00
VP284	1	Z8001P Parallel Interface Controller, 40 pin DIL	£2.00
VP293	1	Z80ACTC Counter Timer Circuit, 28 pin DIL	£2.00
VP294	1	2732D 3K EPROM	£3.00
VP295	1	6821P Peripheral Interface Adaptor (PIA)	£1.50
VP296	6	LM324 14 pin DIL Quad Op-Amp	£2.00
VP297	5	CA3130E MOS-FET I/P CMOS O/P Op-Amp	£2.00
VP298	3	MC1310P Stereo Decoder, 14 pin DIL	£2.00
VP299	3	CA3085 Pos. Volt. Regulator, 1.7v-46v, 8 pin T05	£2.00
VP300	1	27128 128K EPROM	£2.50
VP401	2	LM317T Adjust. Voltage Regulator, 1.5A	£1.00
VP402	1	2114 4K Static Ram	£2.00
VP403	4	TA720 Audio Amp I.C. 4.2w, 13v, 2-4 ohms	£1.00
VP404	1	TBA611 Audio Power Amp 4.5w	£1.50
VP432	8	CD4016B	£2.00
VP433	6	CD4017B	£2.00
VP434	10	CD4024B	£2.00
VP435	10	CD4028B	£2.00
VP436	1	7427 9-bit NAND Schmitt Trigger, 4-input	£1.00
VP440	4	7440 Dual 4-input Positive-Nand Buffer	£1.00
VP470	4	7470 And-gated Positive-edge-triggered Flip-Flop with preset	£1.00
VP480	4	7480 Gated full Adder	£1.00
VP481	4	7481 16-bit Random Access memories	£1.00
VP482	4	7480 Decade Counter	£1.00
VP491	4	7491 8-Bit Shift Register	£1.00

Pak No	Qty	Description	Price
I.C.S			
VP7492	4	7492 Divide by 12 Counter	£1.00
VP7493	4	7493 4-bit Binary Counter	£1.00
VP7494	4	7494 4-bit Shift Register	£1.00
VP7495	4	7495 4-bit Shift Register	£1.00
VP74111	4	74111 Dual J-K Master Slave Flip-Flop	£1.00
VP74141	4	74141 BCD - Decimal Decoder/Driver	£1.00
VP74151	4	74151 1 of 8 Data Selectors/Multiplexers	£1.00
VP74153	4	74153 Dual J-K master slave, flip-flop	£1.00
VP74164	4	74164 4-bit Parallel Output Serial Shift Registers	£1.00
VP74167	4	74167 Synchronous Decade Rate Multipliers	£1.00
VP74174	4	74174 Hex D type Flip-Flops	£1.00
VP74181	4	74181 Arithmetic Logic Units/Function Generators	£1.00
VP74193	4	74193 Synchronous Up/Down Clock Counters, Binary	£1.00
VP74279	4	74279 Quad S-R Latches	£1.00
BPX6	1	TTL Data Book 74 Series, incl 'LS. Complete with Pin out diagrams, 7400-74670, TTL exchange guide, Function selection guide and explanation of function tables	£1.00
BPX5	1	IC555 PROJECTS BOOK (timer), 167 pages, Over 50 project circuits to build and other information on IC555 Timers, Plus FREE with our compliments 3 IC 555 Timer worth 80p. Special offer price just £2.95	£1.00
BPX4	1	INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE, Babani Publishing's latest edition BP85, plus FREE with our compliments, 10 popular Silicon Transistors, worth £1.00. Special offer price just £3.50	£1.00

Pak No	Qty	Description	Price
MISC.			
VP17	50	Metric PVC single strand Wire, mixed colours	£1.00
VP18	30	Metric PVC multi strand Wire, mixed colours	£1.00
VP19	40	Metric PVC single-Multi strand Wire, mixed colours	£1.00
VP22	200	5G. Inches total Copper Clad Board	£1.00
VP23	10	40mm Track Sliver Pots 100K Lin	£1.00
VP42	10	Black Heatsinks, ft. T03 and T0220, drilled	£1.00
VP43	4	Power-fin Heatsinks, 2x T03 2x T066	£1.00
VP44	15	Assorted Heatsinks, T01/35/18/220	£1.00
VP56	100	Semiconductors from around the world, mixed	£4.00
VP82	1	Electronic Buzzer, 3v 25MA	£0.95
VP83	1	Electronic Buzzer, 6v 25MA	£0.95
VP84	1	Electronic Buzzer, 9v 25MA	£0.95
VP85	1	Electronic Buzzer, 12v 25MA	£0.95
VP86	1	TECASBOT Components Pack, semiconductor caps, wire, etc.	£9.00
VP87	1	Telephone Pick-up Coil with 3.5mm jack plug	£1.25
VP88	1	Hi-low Speaker with 3.5mm jack plug	£1.45
VP106	1	Piezo Buzzer, miniature, 12v	£1.25
VP108	1	Piezo Buzzer, miniature, 240v	£1.25
VP113	1	Coax Antenna Switch, 2 way	£4.50
VP114	1	Coax Antenna Switch, 3 way	£4.75
VP115	1	High Pass Filter/Suppressor, CB/TV	£0.50
VP116	1	Low Pass Filter/VHF/TV lead	£3.00
VP122	1	Precision Morse Key, fully adjustable	£1.85