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Radio & Electronics

The communications and electronics magazine

World

**TRIODE VALVE:
THE WHYS AND
WHYFORES EXPLAINED**

**HF PREAMP:
LIVEN UP YOUR
DEAF RECEIVER**

**DIGITAL FILTERS:
AN OUTLINE FOR THE
NON-MATHEMATICAL**

**SPECTRUM RTTY:
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AMP PRINCIPLES**



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YAESU

Full Range Stocked

Model	Description	RWC Price
FAS14R	Remote ant switch (FC757AT)	79.50
FBA5	Empty battery pack	7.80
FC700	ATU/power meter/dummy I'd	129.00
FC757AT	Auto ATU inc WARC bands	299.00
FI65	Comp. I/face for Apple II	54.50
FL2100Z	H/F 1.2KW linear 1.8-30 MHz	749.00
FNB2	10.8V nicad bk for FT208/708	24.50
FNB3	Nicad for FT203/9/703/9R/RH	36.50
FNB4	Nicad pack for FT209RH etc.	43.50
FP70	20A power supply	169.00
FP757GX	Switched mode power supply	159.00
FP757HD	Heavy duty power unit	185.00
FRA7700	Active ant. for FRG7700/8800	44.50
FRG8800	All band RX	569.00
FRG9600/MK2-RW	60-950 All-mode scanning RX	469.00
FRT7700	Receiver ATU for FRG7700/8800	49.50
FRV7700A/B/C/D	VHF conv. for FRG7700/8800	49.00
FRV8800	VHF converter	85.00
FT203R-FBA5	2mtr H/H 1.5W	192.50
FT203R-FNB3	2mtr H/H 2.5W	219.00
FT203R-FNB4	2mtr H/H 3.5W	225.00
FT209R-FBA5	2mtr H/H C/W empty b/case	239.00
FT209R-FNB3	2mtr handheld 3.7W	269.00
FT209R-FNB4	2mtr handheld 5W	265.00
FT2700RH	V-UHF 25W transceiver	339.00
FT2700RH	VHF 25W transceiver	339.00
FT290R	45W 2mtr transceiver	P.O.A.
FT290R	2mtr multimode	349.00
FT290R	6mtr multimode transceiver	249.00
FT703R-FBA5	70cm H/H 1.5W	219.00
FT703R-FNB3	70cm H/H 2.5W	235.00
FT703R-FNB4	70cm H/H 3.5W	245.00
FT709R-FNB3	70cm H/H 1.8W	235.00
FT709R-FNB4	70cm H/H 3W	269.00
FT709R-FNB4	70cm H/H 4W	270.00
FT726R	2mtr base station	869.00
FT757GX MK2-RWC	All band all mode 100W TXR	869.00
FT790R	70cm multimode transceiver 2W	P.O.A.
FT980	Gen coverage + Ham band transceiver	1739.00
FVS1	Voice synthesizer for FT270/2700	23.55
LOG BOOK	YAESU amateur radio log bk	2.00
MD1B8	Base station desk m phone	69.95
MH12A2B	Speaker MIC for FT203-9 etc	18.95
MH1B8	Fist/mobile MIC for FT757 etc	16.50
MMB11	Mobile bkmt for FT290R	29.50
PA3	Mobile DC unit for FT208, 209 etc	18.50
PA4C	AC power unit for FRG9600	13.50
QTR24D	World zone clock	37.50
SAT726	Oscar/Sat unit for FT726	112.50
SB1	Switch unit	17.50
SB2	Switch unit for YH1	15.00
SB3	Switch unit	15.25
SP55	External loudspeaker	15.50
YH1	H'set/boom MIC for SB1/2/3	16.50
YH2	H'set/MIC for FT203/209 etc	16.50
YH55	Mono headphones	16.95
YH77	Lightweight mono h'phones	16.50
YHA15	Helical antenna for FT290R	6.99
YM24A	Speaker MIC for FT208/708	25.50
YM49	Speaker MIC for FT290R	18.50



Full Range Stocked

Model	Description	RWC Price
AH7000	25-1300 MHz TX, RX antenna	79.00
AT150	Matching automatic ATU for IC735	
BC350	Desk-top charger for all nicads	65.95
BP3	Standard Nicad pack	27.95
BP4	Empty battery box for cells 6X	8.95
BP5	High capacity q/charge 10.8V Nicad	57.50
DC1	12V mobile regulator pk (2E)	16.95
EX243	Curtis keyer unit for IC735/745	53.00
EX257	FM unit for IC735	38.50
EX310	Speech synth. unit for 271 etc	41.95
HP1	Mono headphones	32.50
IC-AH1	3.5-30 MHz mobile ant.	189.00
IC-AT10	100W auto ATU	329.00
IC-AT15	Matching automatic ATU for IC735	289.00
IC-AT50	500W automatic ATU	455.00
IC-CPI	Mobile ch'ing lead c/lighter	6.50
IC-HM9	Speaker MIC assy.	19.95
IC-PS30	Power supply unit 25A cont.	339.00

Model	Description	RWC Price
IC-UT 16	Voice synth. for IC27 series	26.00
IC02E	2 mtr LCD k'board 2W t'ceiver	289.00
IC120	1W 1296 MHz mobile (40MHz cov)	533.00
IC271E	2 mtr all mode 25W b'stn	759.00
IC271H	High power 100W version of IC271E	959.00
IC27E	25W 2 mtr FM mobile 9 memories	379.00
IC27H	45W version of IC27E	413.00
IC28E	New 25W Super 138-174 MHz	325.00
IC290D	25W version of IC290E	499.00
IC290E	10W multimode 2 mtr mobile	479.00
IC2E	2 mtr H/H thumbwheel 2W	185.00
IC2KL	1KW PEP linear auto band switching	1250.00
IC3200E	Dual band 25W t'ceiver	499.00
IC471E	UHF m'node b'stn 32 mem	879.00
IC471H	75W version of IC471E	999.00
IC4E	70cm thumbwheel H/H 2W	279.00
IC505	3/10W 50MHz SSB(FM) transceiver	459.00
IC735	New all mode all band t'ceiver	879.00
IC745E	All band SSB/AM/CW gen cov TX RX 16 mem	975.00
IC751E	All band all mode t'ceiver 32 mem	1350.00
IC04E	70cm LCD keyboard entry handheld 2W	285.00
ICR7000	New all mode 25-26MHz	879.00
ICR71	All band short wave t'ceiver 32 mem	775.00
LC11/14	Leatherette case assy for IC02/4E	7.77
LC12/3	Leatherette case for IC2/4E	6.50
PS15	External power supply 20A	139.00

SAE FOR LATEST ICOM LEAFLETS, NEW MODELS EXPECTED

RWC TOP 100

ADONIS	AM303G	Base stn FM/SSB m phone	39.95
ADONIS	AM503G	Base stn FM/SSB comp mic	52.50
AKD	WA1	120-450MHz wavemeter	24.95
ALINCO	ALM-203R	c/w 30W amp	249.00
ALINCO	ALM-203E	2 mtr H/H transceiver 3.5W	239.00
ALINCO	EDH-25	DC/DC 12V converter	13.50
ALINCO	EMS-20	Speaker MIC for ALM203	18.50
ALINCO	ESC-3	Leatherette case and strap	14.50
AOI-MIC	DM300	600 OHM replacement microphone	6.50
AOI-MIC	DM301N	600 OHM replacement noise can. MIC	7.50
ARM-ANT	TRAV-JIM	Travelling Jim portable 2 mtr ANT	7.99
BREMI	BRS35	10A 13.8 volt power supply unit	59.50
CRITON	LS88B	6 OHM replacement ext. loudspeaker	6.60
DAWA	SA450M	2 way 2.5KW coax switch 0-900MHz	17.50
FDK	FDK 725X	2 mtr 25W FM mobile transceiver	269.00
FDK	FDK	2 mtr multimode transceiver 750XX	499.00
GAMMA	2MTR S-JIM	Gamma twin slim Jim type ant.	9.50
GAMMA	3-5A PSU	3-5 AMP power supply unit	19.50
Hi-mound	HK703	Straight key	29.25
Hi-mound	HK704	Straight key	19.25
Hi-mound	HK706	Straight key	16.55
Hi-mound	HK707	Straight key	15.50
Hi-mound	HK808	Deluxe straight key	49.95
Hi-mound	MK703	Squeeze key c/w base	28.95
Hi-mound	MK705	Squeeze key	25.65
Hi-mound	MK706	Squeeze key	23.50
Hi-Q	Hi-Q coil	2X coil formers/insulators (pat-pend)	7.50
HOXIN	70N2DX	Dual band 6/8 + 3X 5/8 mobile	25.90
HOXIN	70N2M	144/432 dual band 1/2W + 2 x 5/8 mobile	22.85
HOXIN	70N2V	Dual b/base ant. 3/6" long	39.00
HOXIN	HS-358	430MHz tripple 5/8 6.3dB	33.78
HOXIN	HS-770	144/432 duplexer 50W 30dB isolator	19.55
HOXIN	HS-78F	2 mtr 7/8 fold over 4.5dB	16.95
HOXIN	HS-88F	2 mtr 8/8 fold over 5.2dB	16.95
HOXIN	SMC15SE	15 mtr 130W PEP mobile ant. 1.72M long	21.50
ICS	AMT-2	AMTOR/RTTY/CW/ASCII terminal unit	245.00
ICS	RM-1	L-cost AMTOR/RTTY/CW/ASCII modem	69.00
Jaybeam	8XY-2M	2 mtr 8E crossed ant.	41.50
Jaybeam	LR1-2M	2 mtr omni-directional colinear	39.00
Jaybeam	LW10-2M	2mtr 10 element YAGI	27.25
Jaybeam	MBM48	70cm 48E antenna	40.75
Jaybeam	Q4-2M	2 mtr 4 element quad	33.95

Full Jaybeam range in stock.

Model	Description	RWC Price	
MuTek	BBBA 500u	20-500MHz low noise wide band preamp	34.90
MuTek	SLNA 144s	2 mtr low noise RF switched preamp	33.95
MuTek	SLNA 145sb	Optimised preamplifier for FT290R	39.00
MuTek	TVVF50c	High performance 2M-6M transverter	189.90
RAYCOM	Series II 12A PSU	7.1 MHz traps c/w instructions	49.00
RAYCOM	TRAP	PA valve	8.95
RCA	6146B	Nest of dipoles w/band ant	12.85
REVCO	2044/5	26-500 MHz	69.00
REVCO	Revcone	Wide band discone ant 30-500MHz	29.95
SUN-ANT	KG208 SE10	10 mtr loaded 1/4W tilt over	12.50
SUN-ANT	KG309 SE2	5/8 mtr tilt-over ant	13.50
SUN-ANT	SO239/CGM	Cast/chrome SO239/gutter mount assy	4.75

RAYCOM MOD KITS

Raycom	757	FT757GX fast tuning mod kit improves VFO tuning	29.50
Raycom	FBX-RWC MOD	LC7136-7 10 mtr FM mod kit kit c/w ins. (Built & Tested).	23.50
Raycom	LCL/DNT MOD (inc post)	As above but kit of parts only	17.50
Raycom	LCL/DNT MOD (inc post)	LCL/DNT 10FM mod kit	14.95
NEW STORNO	QCM 713 55	Channel Mod Kit to 2M inc. RPTR Shift	29.00

RAYCOM ANTENNAS

Raycom	1/1 G5RV	Full size G5RV m/band ant	14.95
Raycom	1/2 G5RV	1/2 size G5RV m/band ant	13.95
Raycom	1/4 wave	145MHz 1/4 wave PL259	2.99
Raycom	25 fitting		
Raycom	GP900	3db 800-1000MHz colinear c/w BNC	19.50
Raycom	HBD	Highband dipole assembly	8.50
Raycom	2M HB9CV Inc. Post		9.98
Raycom	70cm HB9CV Inc. Post		7.98
Raycom	5/8 whip	145MHz 5/8 spring type s/steel whip	3.75
Raycom	SO239-MAG	Magnetic mount SO239 c/w cable PL259	9.50
Raycom	Swivel-mag	Swivel base mag-base c/w cable PL259	9.25
Raycom	Trap-dipole	7.1MHz trap dipole com. kit	29.95

RAYCOM RF POWER AMPS

Raycom	V15L-145	2mtr 15W linear amp. 1-3W input	49.50
Raycom	V25F-145	2mtr 15W linear amp. 1-3W/pl	48.50
Raycom	V35L-145	2mtr 35W linear amp. 1-3W input	59.50
Raycom	V45F-145	2mtr 45W FM amp. 1-3W input	62.50

SPECIAL OFFERS

ARM-ANT	Multi P-6	Multi-polarization P/ant 140-800MHz complete	36.00
Kopek	AR1002	50g loading 3 core auto-rotator	38.50
Raycom	discone	60-600MHz	27.50
DNT	M40FM	modified 10FM	49.50
DNT	M40FM	unmodified CB27/81	29.50
ALINCO	ALR20GE	25W mobile	249.00
ICS	AMT2	AMTOR/RTTY CW Terminal	169.00

SCANNING RECEIVERS

YAESU FRG-9600 MKII very latest mod. gives improved 'S METER' on RX and extended coverage up to 950MHz. FRG9600/MK2-RW 60-950 All mode scanning RX 469.00
BEARGAT 100 VHF/UHF Handheld 259.00
REGENCY MX8000/AOR2002 429.00
REGENCY HX2000 VHF/UHF Handheld 259.00
NEW BEARGAT DX1000 10KHZ-30MHz SW RECEIVER. 10 MEMORIES, ALL MODE INC FM. ALSO SCANNING £329.00

TONNA — Full Range in Stock

TONNA	20089N	144MHz 9 element port. antenna 'N'	27.95
TONNA	20199	144/435 9+ 19 element Oscar ant	36.50
TONNA	20419	432MHz 19 element	36.50
TONNA	20422	435MHz 21 element ATV	31.25
TONNA	20624	1296 23 element ant.	27.95
TONNA	20809N	144MHz 9 ele. fixed ant. 'N'	25.65
TONNA	20813N	144MHz 13 ele. port. ant.	39.50
TONNA	20817N	144MHz 17 ele. fixed ant. 'N'	47.83
TONNA	20818N	144MHz 9 ele. crossed antenna 'N'	41.50

Tel: 021 421 8201 (24hr answerphone)

Telex: 334303 G TXAGWM



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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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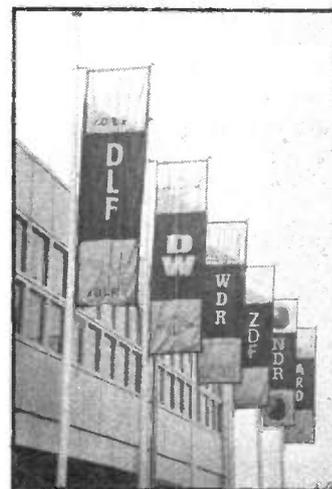
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Publication Date

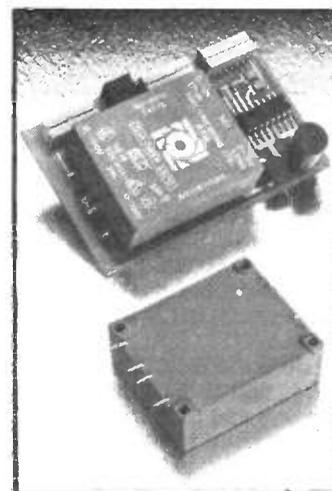
Second Thursday of the month preceding cover date



Flying the flag - page 16



What a horrible picture!



'Flat packed' - page 10

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



FREQUENCY COUNTER

The Meteor 600 frequency counter, available ex-stock from Thurlby Electronics, features an input sensitivity of better than 5mV up to 100MHz, better than 10mV up to 50MHz, and better than 25mV up to 600MHz.

It has a full 8-digit display, two levels of prescaling and three gate times between 100ms and 10s. Using the longest gate time, a resolution of 0.1Hz can be obtained. The standard crystal reference oscillator has a typical temperature stability of better than 2.5ppm from 10°C to 40°C and an ageing rate below 5ppm per year. An optional temperature compensated crystal oscillator is also available, which provides a stability of typically 0.5ppm over 0°C

to 40°C and an ageing rate below 1ppm per year.

The Meteor 600 has dual inputs with impedances of 1M Ω and 50 Ω respectively. A switchable low-pass filter is incorporated for the removal of unwanted high frequency noise when measuring low frequency signals, and a variable threshold trigger level control is also provided.

The Meteor 600 can be operated from an ac line or from rechargeable batteries. Its dimensions are 220 x 240 x 100mm and it weighs 1kg. The UK price is £99 + VAT.

*Thurlby Electronics,
New Road,
St Ives,
Huntingdon,
Cambs PE17 4BG.
Tel: (0480) 63570.*

PROBE OPTIONS

Electronic and Computer Workshop Ltd has announced the availability of high voltage probes for the Crotech range of oscilloscopes. The universal design also allows the probes to be used with many other instruments that utilise a standard BNC input connector.

The P100 is a light-weight probe that gives x100 voltage sensing and permits voltages of up to 1kV to be measured easily.

This is well suited to many equipment testing applications where HT supplies are

present.

For voltages of up to 40kV, such as those present in TV receivers and other UHV rails, the HV40 provides a x2000 voltage multiplication ratio.

The probes are available from ECW at all-in prices of £28.18 for the P100 and £34.93 for the HV40.

Prices include VAT and post/packaging.

*Electronic & Computer
Workshop,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.*

MEMORY SCOPE

Available exclusively in the UK from Advance Bryans Instruments is the Trio MS-1660, a dual channel digital memory scope designed for sophisticated waveform analysis.

Suitable for observing sporadic, transient or repetitive events, the MS-1660 digitally converts all incoming signals and stores them in the memory so that the event can be reproduced on a CRT screen or recorded as hard copy using a printer/plotter.

Features of the instrument include two independent memories, each of 8-bits x 2048 words, and a maximum write speed of 1 μ s per word.

Two independent sampling clocks are provided, thereby enabling simultaneous storage of two unrelated signals. Continuously variable cursors indicate a delay set point and a minus delay set point.

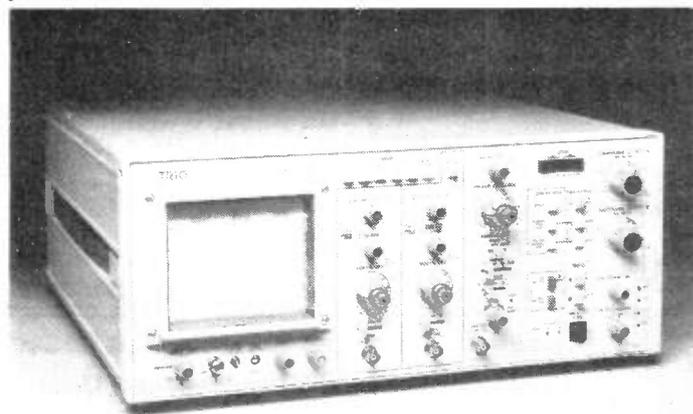
The MS-1660 has two selectable storage modes – refresh and pre-trigger. The refresh

mode initiates writing with a trigger signal, whilst in the pre-trigger mode writing is stopped by a trigger signal. In either mode the waveform following the cursor point can be viewed in magnified or contracted form in the sub-channel.

Also provided is a free-run function for automatic repetition of read/write operations. Each repetitive cycle consists of storing a written signal in a readable state for up to 20s, followed by transition to a writable state.

Other features include a built-in GPIB interface, a memory back-up facility when the instrument is switched off, and a line synchronisation feature which facilitates the observation and storage of signals that are triggered with line frequency.

*Advance Bryans Instruments,
14-16 Wates Way,
Mitcham,
Surrey CR4 4HR.
Tel: (01) 640 5624.*



LOW COST DSO

Hameg Limited have launched "the world's lowest cost" dual channel digital storage oscilloscope, the HM205, which costs £448.00 plus VAT (including probes).

This 20MHz real-time oscilloscope permits storage and display of slow-occurring signals and events (from 50s to 0.1ms). None of the usual problems associated with

long-persistence screens, such as trace flicker, streaking and relatively short view time (max 10s in single-shot mode) due to unavoidable loss of brightness are present in the HM205.

With a maximum sampling rate of 100kHz, the resolution of 1024 x 256 points for the X and Y axes is great enough to register and display even the most minute waveform

details. In the 'refresh' mode waveform, amplitude and frequency changes are visible immediately. Signals recorded in the 'single-shot' mode can be stored until the instrument is switched off, even if it is operated in any of its real-time modes.

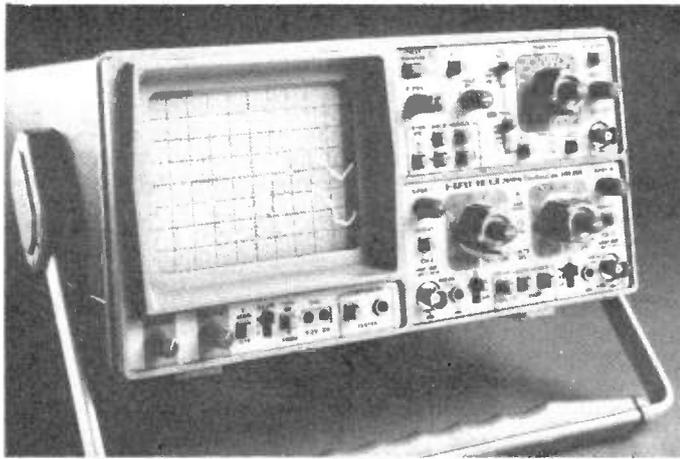
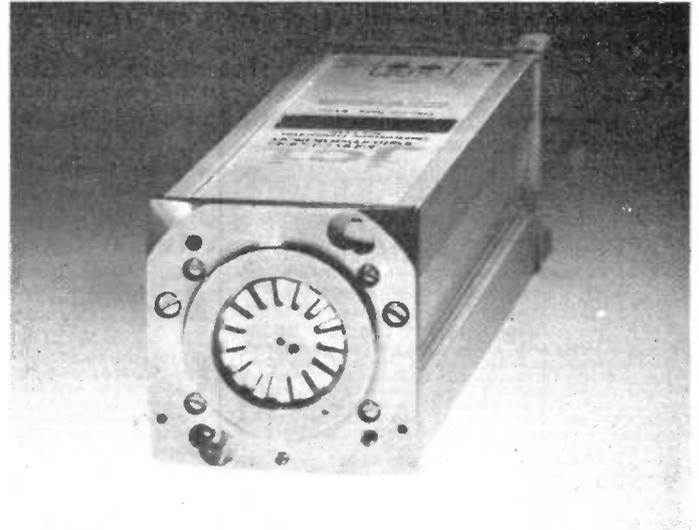
With an optional add-on, the memory contents can be retrieved as hard copy using a chart or X-Y recorder. In many applications, when slow phenomena below 10kHz are involved, the HM205 can perform the functions of much more expensive digital storage scopes.

The HM205 also offers ease of operation in the real-time

or analogue mode. It features a component tester which operates at the push of a single button, and a specially designed active video trigger that permits stable triggering of distorted TV signals.

There are three rear panel BNC sockets for vertical signal out, sweep out, and Z modulation input. The instrument also features 2-level graticule illumination and a switch-selectable 1kHz/1MHz calibrator.

*Hameg Oscilloscopes Ltd,
74-78 Collingdon Street,
Luton,
Bedfordshire LU1 1RX.
Tel: (0582) 413174.*



LOGIC ANALYSER

New from Gould Electronics Ltd is the K20 logic analyser, a low cost, easily portable instrument that offers up to twenty-four channels of logic analysis, with both state and timing mode capabilities.

Features include a memory depth of 2K samples/channel, a maximum clock rate of 100MHz, and a glitch capture mode. Hex and binary formats can be displayed simultaneously, and the K20 also incorporates a triggering facility whereby three user-defined patterns may be used sequentially or in combination.

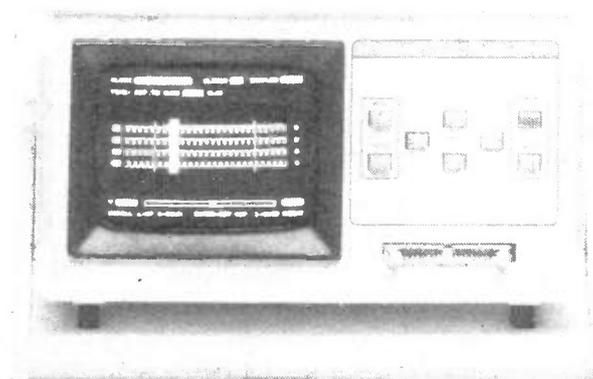
The instrument has an internal clock with a 25Hz-100MHz frequency. Set-up is assisted by on-screen messages which can be accessed by pressing the Help key.

Weighing only 4.1kg and with dimensions of 135 x 254 x 254mm, the K20 is easily

portable and ideal for a wide range of service applications. The instrument has input voltages of 110/120V ac 60Hz and 220/240V ac 50Hz, and is supplied with a state probe, timing probe, test lead set, and user manual. Available as an optional extra is a nylon

carrying case.

*Gould Electronics Ltd,
Instrument Systems,
Roebuck Road,
Hainault,
Ilford,
Essex IG6 3UE.
Tel: (01) 500 1000.*



FIELDMETER

John Chubb instrumentation has developed a fast response electrostatic fieldmeter, the JCI 111F, for measuring both truly static as well as rapidly varying electric fields. The fast response capability enables rapidly changing electrostatic conditions to be followed in manufacturing operations – such as, for example, in production handling of components sliding in contact with insulating surfaces. 50 and 60kHz electric fields can also be reliably monitored.

The JCI 111F sensitivity ranges are 2, 20, 200 and 2000 kV/m f.s.d. with both manual and automatic range selection. Static and slowly varying electric field observations are displayed in a 3½-digit liquid crystal display. This provides a resolution of a few volts per metre and the ability to measure surface potentials to a volt at 90mm separation.

Fast changing electric fields are monitored via the analogue signal output with a response time within 3ms. The instrument includes both battery and mains power supply operation and has integral battery charging facilities.

The fast response capability of the JCI 111F can be combined with options for a user-settable alarm circuit or an RS423 communications interface.

A bayonet pin arrangement is provided around the sensing aperture for mounting units which expand the range of application of the instrument. Charge may be measured using the JCI 151 Faraday Pail, and the JCI 156 and 158 voltmeter adaptors enable the fieldmeter to be used as a sensitive and stable electrostatic voltmeter. With the JCI 155 charge relaxation test unit it will be possible to study fast static charge dissipation effects.

*John Chubb Instrumentation,
Unit 30,
Landsdown Industrial Estate,
Gloucester Road,
Cheltenham,
Glos GL51 8PL.
Tel: (0242) 573347.*

COMPUTER WAREHOUSE

1000's OF BARGAINS FOR CALLERS

THE "ALLADINS' CAVE OF COMPUTER AND ELECTRONIC EQUIPMENT

HOT LINE DATA BASE



The ORIGINAL FREE OF CHARGE dial up data base. Buy, browse or place YOUR OWN AD for goods or services to sell. 1000's of stock items, spares and one off bargains. Updated daily. ON LINE NOW. CCITT, 8 bit word, no parity. For 300 baud modems call 01-679 1888 For 1200-75 baud modems call 01-679 6183

FREE Your monitor from its computer! For only £24.95 it becomes a SUPERB HIGH QUALITY * COLOUR * TV SET

The fabulous TELEBOX, an INVALUABLE MUST for the owner of ANY video monitor with a composite input, colour or monochrome. Made by a major UK Co as a TOP QUALITY, stand alone UHF tuner and costing OVER £75 to manufacture, this opportunity to give your monitor a DUAL FUNCTION must not be missed! The TELEBOX consists of a compact, stylish two tone charcoal moulded case, containing ALL electronics tuner, power supply etc to simply plug in and convert your previously dedicated computer monitor into a HIGH QUALITY COLOUR TV SET, giving a real benefit to ALL the family! Don't worry if your monitor doesn't have sound - THE TELEBOX even has an integral 4 watt audio amplifier for driving an external speaker, PLUS an auxiliary output for superb quality television sound via your headphones or HI FI system etc. Other features include: Compact dimensions of only 15.75" w x 7.5" d x 3.5" h, latest technology, BRITISH manufacture, fully tuneable 7 channel push button tuner, Auto AGC circuit, SAW filter, LED status indicator, 240V AC power supply for total safety, Mains ON-OFF switch etc. Many other uses.

LIMITED QUANTITY - DON'T MISS THIS OFFER!! ONLY £24.95 OR £19.95 if purchased with ANY of our video monitors. Supplied BRAND NEW with full instructions and 2 YEAR warranty. Post and packing £3.50 *When used with colour crt.

COLOUR & MONOCHROME MONITOR SPECIALS

'SYSTEM ALPHA' 14" COLOUR MULTI INPUT MONITOR
Made by the famous REDIFFUSION Co. for their own professional computer system this monitor has all the features to suit your immediate and future requirements. Two video inputs, RGB and PAL Composite Video, allow direct connection to BBC/IBM and most other makes of micro computers or VCR, including our very own TELEBOX. An internal speaker and audio amp may be connected to computer or VCR for superior sound quality. Many other features: PIL tube, Matching BBC case colour, Major controls on front panel. Separate Contrast and Brightness - even in RGB mode. Separate Colour and audio controls for Composite Video input, BNC plug for composite input, 15 way 'D' plug for RGB input, modular construction etc.

This Must Be ONE OF THE YEAR'S BEST BUYS. PC USER Supplied BRAND NEW and BOXED, complete with DATA and 90 day guarantee. ONLY £149.00 as above OR IBM PC Version £165.00 15 Day 'D' sct £1.00. BNC sct 75p BBC interface cable £5.50

DECCA 80 16" COLOUR monitor, RGB input.
Little or hardly used manufacturer's surplus enables us to offer this special converted DECCA RGB Colour Video TV Monitor at a super low price of only £99.00, a price for a colour monitor as yet unheard of! Our own interface, safety modification and special 16" high definition PIL tube, coupled with the DECCA 80 series TV chassis give 80 column definition and quality found only on monitors costing 3 TIMES OUR PRICE. The quality for the price has to be seen to be believed! Supplied complete and ready to plug direct to a BBC MICRO computer or any other system with a TTL RGB output. Other features are: internal speaker, modular construction, auto degaussing circuit, attractive TEAK CASE, compact dimensions only 52cm W x 34 H x 24 D, 90 day guarantee. Although used, units are supplied in EXCELLENT condition. ONLY £99.00 + Carriage.

DECCA 80, 18" COLOUR monitor. Composite video input. Same as above model but fitted with Composite Video input and audio amp for COMPUTER, VCR or AUDIO VISUAL use. ONLY £99.00 + Carr.

REDIFFUSION MARK 3, 20" COLOUR monitor. Fitted with standard 75 ohm composite video input and sound amp. This large screen colour display is ideal for SCHOOLS, SHOWS, DISCOS, CLUBS and other AUDIO VISUAL applications. Supplied in AS NEW or little used condition. ONLY £145.00 + Carr.

BUDGET RANGE EX EQUIPMENT MONOCHROME video monitors.
All units are fully cased and set for 240v standard working with composite video inputs. Units are pre tested and set up for up to 80 column use. Even when MINOR screen burns exist - normal data displays are unaffected 30 day guarantee.

12" KGM 320-1 B/W bandwidth input, will display up to 132 x 25 lines. £32.95
12" GREEN SCREEN version of KGM 320-1. Only £39.95
9" KGM 324 GREEN SCREEN fully cased very compact unit. Only £49.00

Carriage and insurance on all monitors £10.00

DC POWER SUPPLY SPECIALS

GOULD OF443 enclosed, compact switch mode supply with DC regulated outputs of +5v @ 5.5a, +12v @ 0.5a, -12v @ 0.1a and -23v @ 0.02a. Dim 18 x 11 x 6 cm. 110 or 240v input. BRAND NEW only £16.95
GOULD G6-40A 5v 40 amp switch mode supply NEW £130.00
AC-DC Linear PSU for DISK drive and SYSTEM applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of +5v @ 3 amps, -5v @ 0.6 amps and +24v @ 5 amps. Short circuit and overvoltage protected 100 or 240v AC input. Dim 28 x 12.5 x 7 cm NEW £49.94
Carriage on all PSUs £3.00

KEYBOARDS

Manufacturer's BRAND NEW surplus.
DEC LA34 Uncoded keyboard with 67 quality gold plated switches on X-Y matrix - ideal micro conversions etc. £24.95
AMKEY MPNK-114 Superb word processor chassis keyboard on single PCB with 116 keys. Many features such as On board Micro, Single 5v rail, full ASCII coded character set with 31 function keys, numeric keypad, cursor pad and 9600 baud SERIAL TTL ASCII OUTPUT! Less than half price. Only £89.00 with data. Carriage on Keyboards £3.50



DON'T MISS THE CPM Deal OF THE CENTURY

The FABULOUS CPM TATUNG PC2000 Professional Business System

A cancelled export order and months of negotiation enables us to offer this professional PC, CPM system, recently on sale at OVER £1400, at a SCOOP price just over the cost of the two internal disk drives! Or less than the price of a dumb terminal!!

Not a toy, the BIG BROTHER of the EINSTEIN computer, the DUAL PROCESSOR PC2000 comprises a modern stylish three piece system with ALL the necessities for the SMALL BUSINESS, INDUSTRIAL, EDUCATIONAL or HOBBYIST USER. Used with the THOUSANDS of proven, tested and available CPM software packages such as WORDSTAR, FAST, DBASE2 etc. the PC2000 specification, at our prices, CANNOT BE BEATEN!!

The central processor plinth contains the 64K, Z80A processor, DUAL TEAC 55F 5 1/4" CENTRONICS and system expansion ports, and if that's not enough a ready to plug into STANDARD 8" DRIVE port for up to FOUR 8" disk drives, either in double density or IBM format. The ultra slim 92 key, detachable keyboard features 32 user definable keys, numeric keypad and text editing keys, even its own integral microprocessor which allows the main Z80A to devote ALL its time to USER programs, eliminating "lost character" problems found on other machines. The attractive, detachable 12" monitor combines a green, anti-glare etched screen, with full swivel and tilt movement for maximum user comfort. Supplied BRAND NEW with CPM 2.2, user manuals and full 90 day guarantee. Full data sheet and info on request.

PC2000 System with CPM etc. COST OVER £1400

PC2000 Business System with CPM and 'Ready to Run' FAST Sales and Purchase ledger, supports up to 9000 Accounts, VAT etc. COST OVER £1700

PC2000 Wordprocessor System with CPM and TEC FP25 daisywheel printer

NOW only £399

NOW only £499 Carriage & Insurance £12.00

NOW only £799

MODEMS

Join the communications revolution with our super range of DATA MODEMS, prices and specifications to suit all applications and budgets.

- BRAND NEW State of the art products
- DACOM DSL2123 Multi standard 300-300, 1200-75 Auto answer etc. £268.00
- DACOM DSL2123AQ Auto dial, smart modem with multi standard AUTO SPEED detect, and data buffer with flow control etc. £365.00
- DACOM DSL2123GT THE CREAM of the intelligent modems auto dial, auto call, index, buffer etc etc. £498.00
- SINBACK SB1212 V22 1200 baud FULL DUPLEX, sync or async, optional auto dial. £465.00
- TRANSDATA 307A Acoustic coupler 300 baud full duplex, originate only, RS232 interface. £49.00

Ex BRITISH TELECOM full spec, CCITT, ruggedised, bargain offers. Sold TESTED with data. Will work on any MODEM or system with RS232 interface.
MODEM 13A 300 baud unit, only 2" high fits under phone, CALL mode only. £45.00
MODEM 20-1, 75-1200 baud. Compact unit for use as subscriber end to PRESTEL, TELECOM GOLD, MICRONET etc. £39.95 +pp £6.50
MODEM 20-2 1200-75 baud. Same as 20-1 but for computer end. £35.00 +pp £6.50
DATL 2412, Made by SE Labs for BT this two part unit is for synchronous data links at 1200 or 2400 baud using 2780/3780 protocol etc. Many features include 2 or 4 wire working, self test, auto answer etc. COST OVER £800. Our price ONLY £199 +pp £8.00
DATL 4800, RACAL MPS4800 baud mode, EX BT good working order, ONLY £295.00 +pp £8.00

SPECIAL OFFER

MODEM TG2393, EX BT, up to 1200 baud, full duplex 4 wire or half duplex over 2 wire line. ONLY £85.00 PER PAIR +pp £10.00

MATRIX PRINTERS

For more information contact our Sales Office.
SPECIAL BULK PURCHASE of these compact, high speed matrix printers. Built in Japan for the Hazeltine Corporation this unit features quality construction giving 100cps, bidirectional, full pin addressable graphics, 6 type fonts up to 95 single sheet or tractor paper handling, RS232 and CENTRONICS parallel interface. Many other features. BRAND NEW and BOXED COST £420. Our price ONLY £199.00

RECHARGEABLE BATTERIES

Dry Fit MAINTENANCE FREE by Sonnenschein & Yuasa.
A300 07191315 12v 3Ah NEW £13.95
A300 07191312 6v 3Ah NEW £9.95
A300 07191202 6-0-6v 1.8Ah TESTED Ex Equip £5.99

VDU TERMINALS

Standard VDU data entry terminals at give away prices!!
QUME QVT108, Current product, state of the art terminal with detachable keyboard, 12" Green screen, 2 page RAM, TVI 925, Hazeltine, ADMSA emulations, software setup, 25 x 80, Clock, Swivel and tilt base. Printer port, Function keys etc. BRAND NEW and BOXED AT ALMOST HALF PRICE ONLY £425.00
AJ510 - EX RENTAL, Z80 controlled, 15" green screen 24 x 80 display, graphics, cursor addressing, printer port etc. Very good condition TESTED complete with manual only £225.00
ADDS 520 - Dumb terminal, used, 12" b/w screen RS232 interface and printer port. TESTED. ONLY £125.00. Carriage on terminals £10.00
100's of other terminals in stock, CALL for more details.

SURPLUS SPECIALS ON PRESTEL - VIEWDATA - TELEX

PLESSEY VUTL, ultra compact unit, slightly larger than a telephone features A STANDARD DTMF TELEPHONE (tone dial) with 5 CRT monitor and integral modem etc. for direct connection to PRESTEL, VIEWDATA etc. Designed to sell to the EXECUTIVE at over £600! Our price BRAND NEW AND BOXED at only £99.00

DECCAFAX VP1 complete Professional PRESTEL system in slimline desk top unit containing Modem, Numeric keypad, CPU, PSU etc. Connects direct to standard RGB colour monitor. Many other features include: Printer output, Full keyboard input, Cassette port etc. BRAND NEW with DATA. A FRACTION OF COST only £55.00

ALPHANTANEL, Very compact unit with integral FULL ALPHA NUMERIC keyboard. Just add a domestic TV receiver and you have a superb PRESTEL system and via PRESTEL the cheapest TELEX service to be found! Many features: CENTRONICS Printer output, Memory dialling etc. Supplied complete with data and DIY mod for RGB or Composite video outputs. AS NEW only £125.00

Post and packing on all PRESTEL units £8.50

EX-STOCK INTEGRATED CIRCUITS

- 4164 200 ns D RAMS 9 for £11 4116 ns £1.50 2112 £10.00 2114 £2.50 2102 £2.00 6116 £2.50 EPROMS 2716 £4.50 2732 £3.00 2764 £4.95 2712B £5.50 6800 £2.50 6821 £1.68A09 £8 68B09 £10 8085A £5.50 8086 £15 8088 £8 NEC765 £8 WD2793 £28 8202A £22 8251 £7 8748 £15 WD280A DART £6.50 Z80A CPU £2.00. Thousands of IC's EX STOCK send SAE for list.

DISK DRIVES

Japanese 5 1/4" half height, 80 track double sided disk drives by TEAC, CANON, TOSHIBA etc. Sold as NEW with 90 day guarantee ONLY £85.00
TEC FB-503 Double sided 5H 40 TRK NEW £75.00
SUGART SA400 SS FH 35 TRK £55.00
SIEMENS FDD100 SS FH 40 TRK £65.00
Carriage on 5 1/4" drives £5.50

Carriage on NEW metal 5 1/4" DISK CASES with internal PSU.
DSK1 for 2 HH or 1 FH drive £29.95 +pp £4.00
DSK2 for 1 HH drive £22.95 +pp £3.50
DKSC 3 As DSK1 LESS PSU £12.95 +pp £2.50
DSK4 As DSK2 LESS PSU £10.95 +pp £2.00

8" IBM format TESTED EX EQUIPMENT.
SHUGART 800/801 SS £175.00 +pp £8.50
SHUGART 851 DS £255.00 +pp £8.50
TWIN SHUGART 851's 2 Mb total capacity in smart case, complete with PSU etc. £595.00
MITSUBISHI M2894-63 8" DS 1 Mb equiv. to SHUGART SABS50R. BRAND NEW at £275.00 +pp £8.50
DYSAN 8" Alignment disk £29.00 +pp £1.00

Various disk drive PSUs in Ex Stock SEE PSU section.
HARD DISK DRIVES
DRE/DIABLO Series 30 2.5 Mb front load £525.00
Exchangeable version £295.00, ME3029 PSU £95.00
DIABLO 44/DR4000A, B 5+5 Mb from £750.00
CDC HAWK 5+5 Mb £795.00, CDC 9782 80 Mb RMO3 etc. £2500.00
PERTEC D3422 5+5 Mb £495.00

RODDIE 5 1/4" Winchester's ex-stock from £150 CALL Clearance Items - Sold as seen - No guarantee
ICL 2314 BRAND NEW 14" Mb Removable pack hard disk drive, cost over £2000 with data. ONLY £99.00
BASF 8172 8" 23Mb Winchester's £199.00

Unless stated all drives are refurbished with 90 day guarantee. Many other drives and spares in stock - call sales office for details.

All prices quoted are for U.K. Mainland, paid cash with order in Pounds Sterling PLUS VAT. Minimum order value £2.00. Minimum Credit Card order £10.00. Minimum BONA FIDE account orders from Government Depts., Schools, Universities and established companies £20.00. Where post and packing not indicated please ADD £1.00 + VAT. Warehouse open Mon-Fri 9.30-5.30. Sat 10.30-5.30. We reserve the right to change prices and specifications without notice. Trade, Bulk and Export

32 Biggin Way, Upper Norwood, London SE19 3XF
Telephone 01-679 4414 Telex 894502 Data 01-679 1888

ERS — PRINTERS — PRINTERS — PRINTERS

SUPER DEAL? NO — SUPER STEAL THE FABULOUS 25 CPS "TEC STARWRITER"

Made to the very highest spec the **TEC STARWRITER** FP1500-25 features a very heavy duty die cast chassis and **DIABLO** type print mechanism giving superb registration and print quality. Micro-processor electronics offer full

DIABLO/QUME command compatibility and full control via **CPM WORDSTAR ETC.** Many other features include bi-directional printing, switchable 10 or 12 pitch, full width 381mm paper handling with up to 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard **RS232** serial interface with handshake. Supplied absolutely **BRAND NEW** with 90 day guarantee and **FREE** daisy wheel and dust cover. Order **NOW** or contact sales office for more information. Optional extras **RS232** data cable **£10.00** Tech manual **£7.50**. **Tractor Feed £140.00** Spare daisy wheel **£3.50**. Carriage & Ins. (UK Mainland) **£10.00**.



SUMMER OFFER ONLY £399.99!!

DIY PRINTER MECH

Brand New surplus of this professional printer chassis gives an outstanding opportunity for the **Student, Hobbyist or Robotics** constructor to build a **printer — plotter — digitiser** etc, entirely to their own specification. The printer mechanism is supplied ready built, aligned and pre tested but **WITHOUT** electronics. Many features include all metal chassis, phosphor bronze bearings, **132** character optical shaft position encoder, **NINE** needle head, 2 x two phase 12V stepper motors for carriage and paper control, 9.5" Paper platen etc. etc. Even a manufacturer's print sample to show the unit's capabilities!! Overall dimensions 40 cm x 12 cm x 21 cm.

Sold **BRAND NEW** at a **FRACTION** of cost **ONLY £49.50** + pp £4.50.

TELETYPE ASR33 DATA I/O TERMINALS

Industry standard, combined ASCII 110 baud printer, keyboard and 8 hole paper tape punch and reader. Standard **RS232** serial interface. Ideal as cheap hard copy unit or tape prep. for CNC and NC machines. **TESTED** and in good condition. Only **£235.00** floor stand **£10.00**. Carr & Ins. **£15.00**.

EX NEWS SERVICE PRINTERS

Compact ultra reliable quality built unit made by the **USA EXTEL Corporation**. Often seen in major Hotels printing up to the minute News and Financial information, the unit operates on **5 UNIT BAUDOT CODE** from a Current loop, **RS232** or **TTL** serial interface. May be connected to your micro as a low cost printer or via a simple interface and filter to any communications receiver to enable printing of worldwide **NEWS, TELEX and RTTY** services.

Supplied **TESTED** in second hand condition complete with **DATA, 50 and 75** baud xtals and large paper roll.

TYPE AE11	
50 Column	ONLY £49.95
Spare paper roll for AE11	£4.50
TYPE AF11R 72 Col.	
+ Ribbon	£65.00
TYPE AH11R 80 Col.	
ASCII/BAUDOT	£185.00
Carriage and Insurance	£7.50

GE TERMIPRINTER



A massive purchase of these desk top printer terminals enables us to offer you these quality **30 or 120 cps** printers at a **SUPER LOW PRICE** against their original cost of over **£1000**. Unit comprises of full **QWERTY**, electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width — up to **13.5"** 120 column paper, upper — lower case, standard **RS232** serial interface, internal vertical and horizontal tab settings, standard ribbon, adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working **GE30 £130.00**. **GE1200 120 cps £175.00**. Untested **GE30 £65.00** Optional floor stand **£12.50**. Carr & Ins. **£10.00**.

SEMICONDUCTOR 'GRAB BAGS'

Mixed Semis amazing value contents include transistors, digital, linear, IC's, triacs, diodes, bridge recs, etc. etc. All devices guaranteed brand new full spec with manufacturer's markings, fully guaranteed.

50+ £2.95 100+ £5.15
TTL 74 Series. A gigantic purchase of an "across the board" range of **74 TTL** series IC's enables us to offer **100+** mixed "mostly TTL" grab bags at a price which two or three chips in the bag would normally cost to buy. Fully guaranteed all IC's full spec. **100+ £6.90**, **200+ £12.30**, **300+ £19.50**

CENTRONICS 710 PRINTERS

EX **RENTAL** Heavy duty full width carriage printer up to **132** columns on 17" fan fold sprocket fed paper. 60 cps print speed with standard **RS232** or 20 mA loop interface. Supplied in **TESTED** used condition with data. **ONLY £85.00** carriage and insurance **£10.00**.

MAINS FILTERS

CURE those unnerving hang ups and data glitches caused by mains interference with professional quality filters **SD5A** match box size up to **1000 watt 240 V** Load **ONLY £5.95**. **L12127** compact completely cased unit with 3 pin fitted socket up to **750 watts ONLY £9.99**.

EPROM COPIERS

The amazing **SOFTY 2** The "Complete Toolkit" for copying, writing, modifying and listing **EPROMS** of the **2516, 2716, 2532, 2732** range. Many other functions include integral keyboard, cassette interface, serial and parallel i/o UHF modulator ZIF socket etc. **ONLY £195.00** + pp £2.50.

"**GANG OF EIGHT**" intelligent **Z80** controlled 8 gang programmer for ALL single 5v rail **EPROMS** up to **27128**. Will copy 8 27128 in **ONLY 3 MINUTES**. Internal **LCD** display and checking routines for **IDiot PROOF** operation. Only **£395.00** + pp £3.00.

"**GANG OF EIGHT PLUS**" Same spec. as above but with additional **RS232** serial interface for down line loading data from computer etc. **ONLY £445.00** + pp **£3.00**

Data sheets on request

20,000 FEET OF ELECTRONIC AND COMPUTER GOODIES ENGLAND'S LARGEST SURPLUS STORE — SEEING IS BELIEVING!!

DEC CORNER

PDP 1140 System comprising of CPU, 124k memory & MMU 15 line **RS232** interface. **RP02** 40 MB hard disk drive.
TU10 9 track 800 BPI Mag tape drive, dual track system. **VT52** VDU, etc. etc. Tested and running **£3,750.00**
BA11-MB 3.5" Box, PSU, LTC **£395.00**
DH11-AD 16" x **RS232** DMA interface **£1,900.00**
DLV11-J4 x EIA interface **£350.00**
DLV11-E Serial. Modem support **£190.00**
DUP11 Synchron. Serial data i/o **£650.00**
DQ200 Dialog — multi RK controller **£495.00**
DZ11-B 8 line **RS232** mux board **£650.00**
KDF11-B M8189 PDP 1123 PLUS **£1,100.00**
LA30 Printer and Keyboard **£80.00**
LA36 Decwriter EIA or 20 mA loop **£270.00**
MS11-JP Unibus 32kb Ram **£80.00**
MS11-LB Unibus 128kb Ram **£450.00**
MS11-LD Unibus 256kb Ram **£850.00**
PDP11/05 Cpu Ram, i/o etc **£450.00**
PDP11/40 Cpu, 124k MMU **£1,850.00**
RT11 ver 3B documentation kit **£70.00**
RK05-J 2.5 Mb disk drives **£650.00**
KL8 JA PDP 8 async i/o **£175.00**
M18E PDP 8 Bootstrap option **£75.00**
VT50 VDU and Keyboard ~20 mA **£175.00**
VT52 VDU and **RS232** interface **£250.00**

Give your **VT100** a Birthday!!
 Brand New **VT100** Keyboards only **£85.00**

1000's of **EX STOCK** spares for **DEC PDP8, PDP8A, PDP11** systems & peripherals. Call for details. All types of computer equipment and spares wanted for **PROMPT CASH PAYMENT**.

1000's of other **EX STOCK** items including **POWER SUPPLIES, RACKS, RELAYS, TRANSFORMERS, TEST EQUIPMENT, CABLE, CONNECTORS, HARDWARE, MODEMS, TELEPHONES, VARIACS, VDUs, PRINTERS, POWER SUPPLIES, OPTICS, KEYBOARDS** etc. etc. Give us a call for your spare part requirements. Stock changes almost daily.

Don't forget, **ALL TYPES** and **QUANTITIES** of electronic surplus purchased for **CASH**

MAG TAPE DRIVES

Many **EX STOCK** computer tape drives and spares by **PERTEC, CIPHER, WANGO, DIGIDATA, KENNEDY** etc. Special offer this month on **DEI** Cartridge tape drives **ONLY £450.00** each.

CALL FOR DETAILS

COMPUTER/SYSTEM CABINET & PSU

All in one quality computer cabinet with integral switched mode **PSU**, mains filtering, and twin fan cooling. Originally made for the famous **DEC PDP8** computer system costing thousands of pounds. Made to run 24 hours per day the **psu** is fully screened and will deliver a massive **+5v DC** at 17 amps, **+15v DC** at 1 amp and **-15v DC** at 5 amps. The complete unit is fully enclosed with removable top lid, filtering, trip switch, power and run leds mounted on all front panel, rear cable entries, etc. etc. Units are in good but used condition — supplied for 240v operation complete with full circuit and tech. man. Give your system that professional finish for only **£49.95** + carr. 19" wide 16" deep 10.5" high. Useable area 16" w 10.5" h 11.5" d.

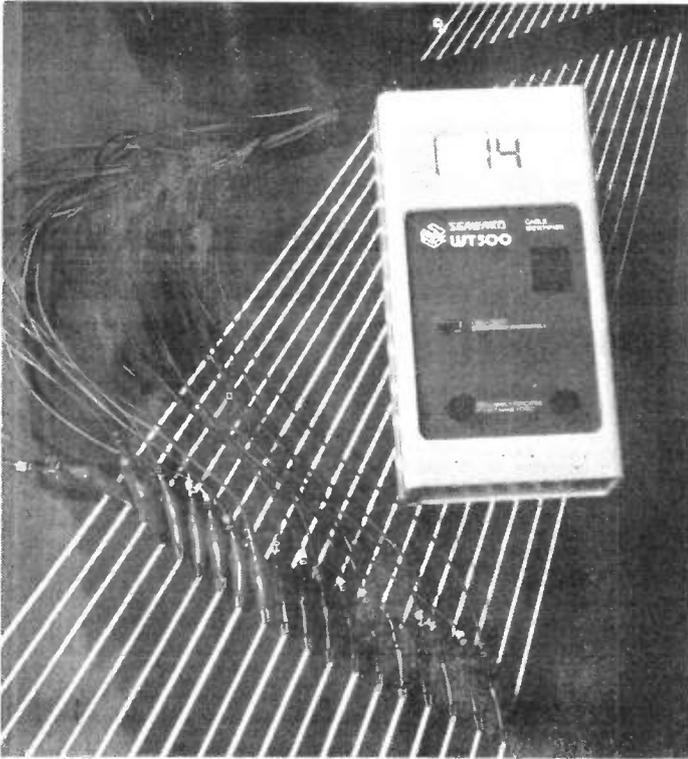
Also available less **psu**, with fans etc. Internal dim. 19" w, 16" d, 10.5" h. **£19.95**. Carriage **£8.75**

66% DISCOUNT ON ELECTRONIC COMPONENTS EQUIPMENT

Due to our massive bulk purchasing programme, which enables us to bring you the best possible bargains, we have thousands of IC's, Transistors, Relays, Caps, PCBs, Sub-assemblies, Switches etc. etc. surplus to OUR requirements. Because we don't have sufficient stocks of any one item to include in our ads we are packing all these items into the **BARGAIN OF A LIFETIME**. Thousands of components at giveaway prices. Guaranteed to be worth at least 3 times what you pay. Unbeatable value and perhaps one of the most consistently useful items you will every buy!! Sold by weight.

2.5kls **£5.25** + pp **£1.25**
 10kls **£11.25** + pp **£2.25**

5 kls **£6.90** + **£1.80**
 20kls **£19.50** + pp **£4.75**



CABLE TRACER

The WT500 is the latest cable tracer from Seaward, and is being marketed in a test kit including a sender unit for identifying up to 19 cable pairs, a high quality hard case and full operating instructions.

The sender unit is connected to the cable cores using numbered and shrouded crocodile clips. The test probe is then attached to each core in turn at the other end of the cable and the LCD indicates the cable number.

The instrument incorporates a neon indicator to warn of live cables, and can withstand 240V at its terminals without damage. It is powered by a single 9V PP3 battery.

*Seaward Electronic Ltd,
Bracken Hill,
South West Industrial Estate,
Peterlee,
Co Durham SR8 2JJ.
Tel: (0783) 863511.*

COMMUNICATION TESTERS

Thorn EMI Instruments has announced a new range of Megger instruments for testing fibre optic communication networks, comprising three new instruments to complement their existing range of 850nm test and inspection equipment.

The two power meters in the range, the OTP610 and OTP620, are capable of measuring light output at 850nm, 1300nm and 1550nm, giving the instruments the ability to test the complete range of fibre networks in use today. The use of a processor to compute the output on the clear liquid crystal display allows for the automatic compensation of thermal errors.

In this application the power meters are complemented by a new 1300nm light source, the OLS610. This exhibits the same features of selectable output power and output stability shown on earlier Megger light sources.

*Thorn EMI Instruments Ltd,
Archcliffe Road,
Dover,
Kent CT17 9EN.
Tel: (0304) 202620.*

VOLTAGE MEASUREMENT

A precision voltage measurement module (DMM 204) is now available with CIL's new Jay series of measurement instrumentation. The Jay range allows different modules to be inserted into the front of the units to perform many measurement tasks, eg temperature, DMM, strain, calibration and simulation.

The Jay basically consists of a Z80-based microcomputer circuit with RS232 option, housed in a bench-mounted case. The front panel has a 2 x 16 dot matrix LCD display, switches for control functions and access for the modules.

The microprocessor program is stored in PROM within

the module. Each module therefore has a different program to perform its particular task. This means that after the instrument is purchased for, say, temperature measurement, other modules can be purchased to perform almost all measurement tasks.

The third module released by CIL, the DMM 204, is specifically designed for precision low level dc measurement. Basic accuracy is $\pm 0.01\%$ of reading with sensitivity 100 nanovolts.

*CIL Electronics Ltd,
Decoy Road,
Worthing,
Sussex BN14 8ND.
Tel: (0903) 204646.*

PATTERN GENERATOR

A low cost, rugged, mains operated bench instrument, the Orion TV and Video PAL Pattern Generator, has been developed by Black Star.

Features include separate RF and composite video outputs with level control, tunable RF carrier, internal or external sound modulation, switchable sound carriers (5.5, 6.0, 6.5MHz), and positive or negative video modulation. A front panel source of frame and line sync pulses is provided for scope triggering.

The Orion Pattern Generator, covering VHF and UHF channels, is compatible with PAL systems B, D, G, H, I and K and provides a full range of colour and monochrome test patterns including colour bars, focus and grating.

Additionally the Orion offers comprehensive rear panel outputs of RGB and sync signals with switchable signal levels and sync conditioning to ensure compatibility with the majority of video and computer monitors.

*Black Star Limited,
4 Stephenson Road,
St Ives,
Huntingdon,
Cambs PE17 4WJ.
Tel: (0480) 62440.*

MULTIMETER

A built-in signal generator allows the high performance PAN3000 multimeter many new possible applications including radio and TV circuit testing.

Available from Electronic and Computer Workshop Ltd, the PAN3000 has 58 measurement ranges, all of which are protected against misconnection and most other faults by a patented triac system and quick-blow fuse.

Sensitivity is 20k Ω /V dc and ac. The parameters that can be measured include dc voltages from 0.15 to 1500V, ac voltages from 5 to 1500V, dc current from 50 μ A to 5A, ac current from 5mA to 5A and resistance down to 0.5 ohms.

The PAN3000 costs £66.70, including VAT, post/packing, and a shock-proof case.

*Electronic and Computer
Workshop Ltd,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.*



SENSOR MODULE

PEP Modular Computers has introduced a position velocity sensor module in single-height Eurocard format to extend the line of products which interface to the VMEbus.

It has been designed for measuring current operating parameters of digitally controlled machines, eg robotics. Using the THCP 2000 chip it has four basic operating modes:

- direction discriminator
 - frequency measurements
 - pulse width measurements
 - up/down counting
- where are jumper selectable.

The module features 6 independent channels with 16 bits resolution each. All channels may be cascaded to achieve more resolution (32, 48, 64 or 96 bits). Synchronisation of different channels is possible as well.

Each channel has two optically isolated input ports for initiator signals. Each pair of inputs provides the capability to perform direction determination through a comparison of two signals.

*PEP GmbH,
Am Klosterwald 4,
8950 Kaufbeuren/Allgäu,
West Germany.
Tel: (08341) 89 74.*

TEMP/VOLTAGE CONVERTER

A temperature/voltage converter which, used with a multimeter, allows temperatures from -60°C to +950°C to be measured quickly and accurately has been introduced by Beckman Industrial. Designated the TP850 it has three interchangeable probes, each fitted with K type thermocouples: an immersion probe, a surface probe and a thermocouple wire. The price is £46.

A self-zeroing amplifier ensures excellent stability of measurements, both with time and with variations of environment temperature. The circuit provides cold junction compensation and linearisation of the signal transmitted by the thermocouple probe.

The instrument is powered by an ordinary 9V battery, the state of charge of the battery being indicated by a red LED.

The instrument will turn itself off automatically after three minutes in order to save battery life.

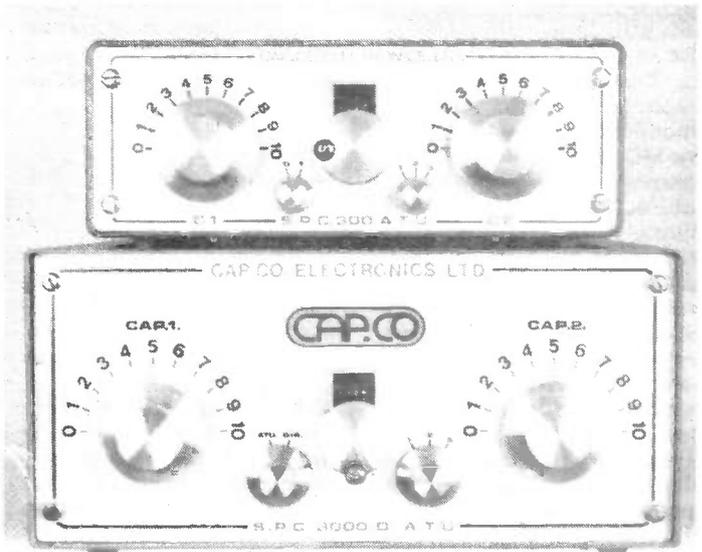
*Beckman Industrial Ltd,
Temple House,
43/48 New Street,
Birmingham B2 4LJ.
Tel: (021) 643 8899.*

ATUs UK

Cap Co Electronics have announced two new products to add to their range of high quality aerial tuning units and associated equipment.

The SPC-300D and SPC-3000D feature a safety device for protection against lightning strikes (although not against a direct strike). Switching via relays and control switches means that when the supply is turned off all antennas connected to the ATU are automatically grounded, obviating the need to uncouple all the aerials upon leaving the shack.

The new units also have provision for connecting



three aerials, a 'direct' and 'through' switch and a 1kW balun for balanced or unbalanced operation.

The established Cap Co range includes the SPC-300C, 4 to 1 and 1 to 1 kW baluns and the G4OGP quick-fit aerial kit, all using 'good old-

fashioned low loss British engineering.'

*Cap Co Electronics Ltd,
63 Hallcroft,
Birch Green,
Skelmersdale,
Lancs WN8 6QB.
Tel: (0695) 27948.*

SHACK PROTECTION

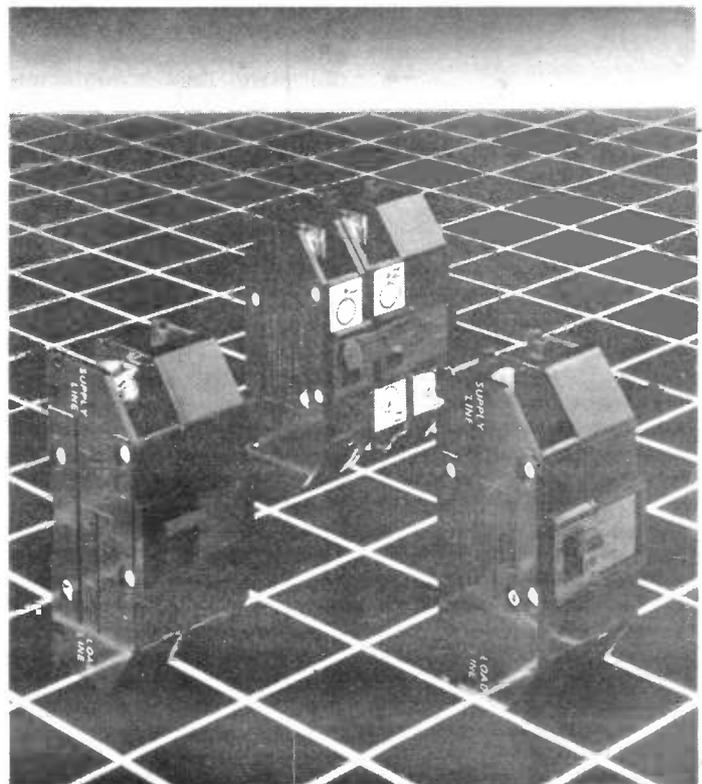
The probability of shock or earth leakage currents having a dc content is particularly high in the radio shack and this could be dangerous, say Dorman Smith Switchgear Limited.

Electronic circuitry may modify the ac voltage waveform, resulting in a complex ac/dc or pure dc leakage current, and the need for the close shock protection afforded by rcds is widely appreciated.

However, many people are not aware that the majority of rcds are incapable of sensing shock currents with a dc content; nor is it generally appreciated that many rcds will become less sensitive, slow, or even fail to operate completely if not periodically exercised using their test button.

To overcome the shortcomings of traditional rcds, Dorman Smith Switchgear have recently introduced their Safeline range of miniature circuit breakers/rcds and isolator/rcds.

Capable of sensing ac, dc or complex ac/dc shock or leakage currents and, in the case



of the mcb/rcd, additionally detecting overload currents, Safeline will probably be of interest to safety conscious operators.

*Dorman Smith
Switchgear Ltd,
Blackpool Road,
Preston PR2 2DQ.
Tel: (0772) 728271.*

PRODUCT NEWS

MARINE HAND-HELD

As an addition to the range of Sealine VHF radio-telephones Shipmate has announced the launch of its new MC-56 hand-held, which incorporates the following features: all 55 international channels fully synthesised; UK marine channel as standard; dual watch facility; channel 16 quick access button; switchable 3W/1W output power; 220V ac charger unit; the ability to add Coastguard channel 00 for authorised users.

Channel selection is by a rotary switch and channel position is viewed through a magnifier prism. All components are contained and protected within a tough plastic case which incorporates a metal belt clip, nylon wrist strap and a convenient slide-on nicad battery pack which can be recharged overnight. Optional accessories include a carrying case and a fist microphone/speaker unit.

Available from most marine electronics dealers and good chandlers, the MC-56 has an rrp of £250.00 + VAT.

*Shipmate Marine
Electronics Ltd,
Unit 5,
Elm Court,
Crystal Drive,
Smethwick,
West Midlands B66 1RB.
Tel: (021) 552 1718.*

LOW PROFILE PSU

A new low profile 120W switched mode power supply, the model 19B, has been introduced by Greendale Power.

Just 45mm tall, the model 19B is designed for use in microprocessor-based systems such as personal computers, peripherals such as Winchester and floppy disc drives, ATE systems and scientific instruments.

This new PSU achieves its diminutive size by virtue of a comparatively high switching frequency – 70kHz – and has a considerably lower profile than directly competing units. Dimensions are 220 × 100 × 45mm in the open frame (Eurocard rack mountable) version and 223 × 103 × 50mm in the optional cased version.

Five dc outputs are provided, two of which ($\pm 5V$ and $\pm 24V$) are fully floating. Standard output voltage combinations are: +5V at 12A (main output), with auxiliary outputs of either +12V/2A, -12V/2A, 5V/2A and 24V/2A or +15V/1.6A, -15V/1.6A, 5V/2A and 24V/2A. Other output voltage combinations are available to special order.

All outputs are regulated to $\pm 0.5\%$ for a 195 – 264V ac line swing when operating at 100% rated load and all outputs remain within specification for a minimum of 20ms after loss of ac power. The auxiliary outputs are short circuit protected, while the main output has current limiting protection against overload and continuous short circuits.

The ac voltage input ranges are 98/132V and 195/264V and efficiency is a minimum of 70%. In-rush surge current at switch-on is limited by special soft-start circuitry; over-voltage protection on the main +5V dc output is set between



RF PROTECTION

Roxburgh Suppressor's FL110/110M filters have been developed to protect industrial and consumer electronic products from radio interference.

The FL110 range is divided into five basic models with rated currents from 3-30A, developed to protect against differential and common mode interference. The FL110M units have linear inductance on the load side which results in an increase

in the output impedance, making them particularly suitable for use where there are low impedance loads – in brush dc motors, for instance.

Both versions are in metal cases and wire lead, faston or screw terminals are fitted, depending on the model.

*Roxburgh Suppressors Ltd,
Haywood Way,
Ivyhouse Lane,
Hastings,
E Sussex TN35 4PL.
Tel: (0424) 442160.*

5.5V and 6.5V. The model 19B is also protected against ac under-voltage operation.

Standard features of the 19B include common mode input filtering and logic inhibit (logic high, TTL compatible); all units are supplied 100% burned-in. A power failure signal output is optional. The operating temperature range is 0°C to +50°C at full rated load.

*Greendale Power Ltd,
Unit 1,
Cobnar Wood Close,
Chesterfield Trading Estate,
Sheepbridge,
Chesterfield S41 9RQ.
Tel: (0246) 455417.*

SM TRANSFORMERS

Avel-Lindberg have now added what they believe to be the first surface mounted power supply transformers to the ever growing choice of SMDs. The Avel type OB/SM flat-pack transformers span a range from 1.8 to 24VA (1.8, 3.5, 5, 8, 9, 12, 15, 19, 24VA). These small, rectangular, flat trans-

formers are tested with a one minute 5000V ac hipot test.

Dual 50/60Hz primary windings can be series or parallel connected for 120V or 240V operation, and dual secondary windings give 5, 6, 8, 9, 12, 15 and 18V rms in parallel and 10, 12, 16, 18, 24, 30 and 36V rms when series connected. The non-concentric twin primary and secondary windings are wound on separate bobbins to give maximum isolation and low inter-winding capacitance. The core construction and winding configuration achieves a near toroidal characteristic with low radiated noise, high efficiency and low temperature rise.

Although the eight soldered points provide a secure mounting for OB/SM transformers, the mechanical fixing can be supplemented by four holes moulded into the corners of the case.

*Avel-Lindberg Ltd,
South Ockendon,
Essex RM15 5TD.
Tel: (0708) 853444.*



VIDEO CONTROLLER

ITT Semiconductors has announced a one-chip video memory controller which adds several attractive features to a digital TV set. These include a flicker-free picture, still picture, multi picture-in-picture, zoom, and background storage for a teletext processor.

Flicker-free television is possible by doubling the vertical deflection frequency. The VMC 2260 video memory controller does this with a memory which is able to store one field and can handle the very high transfer rate requirements of single-speed input data and simultaneous double-speed output.

The controller accesses five standard 256K DRAMs, data being transferred between the VMC and RAMs via a bidirectional 20-bit data bus with a speed of 11.8

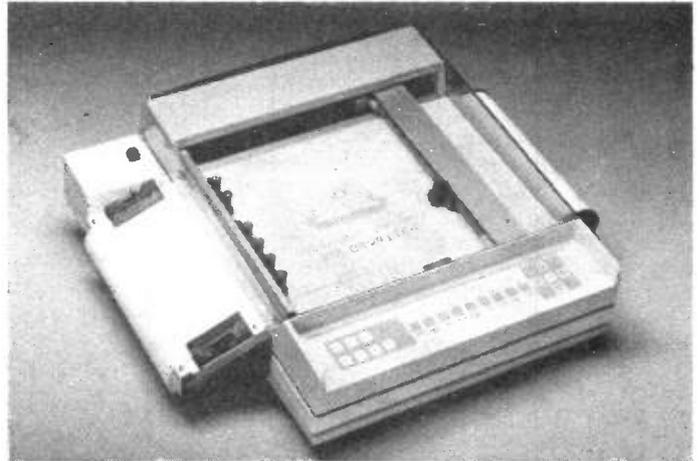
megawords per second.

The additional TV features are realised by exploiting the read and write facility of the RAMs. Still picture, for example, simply results from inhibiting writing.

For the multi picture-in-picture mode, the television screen is divided into nine small pictures of equal size, each displaying either a section of a large picture or a complete (but compressed) picture.

Snapshots of up to nine different input signals can be displayed simultaneously. Zooming is achieved by displaying only part of the RAM content: enlargement factors of two and three times are possible.

*ITT Semiconductors,
145-147 Ewell Road,
Surbiton,
Surrey KT6 6AW.*



PEN PLOTTER

Advance Bryans Instruments has announced the 6300 series Colorwriter, a new high-performance digital plotting system.

The 6300 Colorwriter combines functional design with multi-colour plotting, 7 and 10-pen models being available with a variety of pen colours and of pen types and thicknesses, as well as adaptors for liquid ink drafting or Pentel pens.

Offering graphics resolution of 0.025mm (0.001 inches), the 6300 series can be used for plotting on A4 (model 6310) or A3 (model 6320) charts in a variety of media including coated or bonded papers, or transparencies. Other functions include an optional roll chart advance capability and easily used multi-function front panel controls, giving a wide range of features such as self-test, scaling for changing plot dimensions or orientations and a pause control.

The system is compatible with most presentation, analytic and drafting programs, such as Lotus 1-2-3, Symphony, Chartmaster and SuperCalc, and its built-in intelligence includes over 65 commands. The writing speed is programmable in 1cm steps to a maximum of 40cm/s to accommodate different writing media.

Using a standard RS232C or IEEE-488 interface, the 6300 series can communicate with external computer systems for fully automated on-command digital plotting. High speed transfer of complex plots can be achieved using the system's 16K memory.

The Colorwriter's digitising sight allows it to digitise and feed back to a computer, co-ordinate from maps, diagrams and other plots for storage or precisely position and replot stored shapes.

*Advance Bryans
Instruments Ltd,
14-16 Wates Way,
Mitcham,
Surrey CR4 4HR.
Tel: (01) 640 5624.*

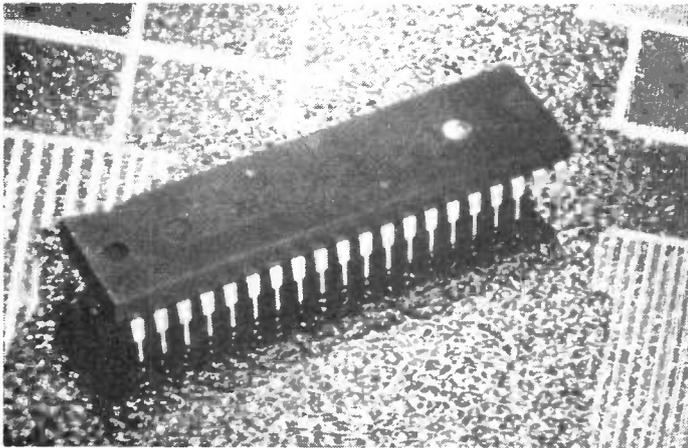
LAN CHIP-SETS

A new chip set resulting from a joint development programme between Texas Instruments and IBM is now available from VSI Electronics.

Designated TMS 380, the set provides standardised interfaces for connecting external equipment to the recently announced IBM Token-Ring network.

The set comprises five integrated circuits containing local area network (LAN) management services. Providing a data rate of 4Mbits/s using existing telephone twisted-pair, shielded twisted-pair and fibre optics, the set is designed for LAN connection to personal computers, advanced technology PCs and 32-bit professional workstations. The internal system architecture is also designed for easy upgrading, as higher speed standards are developed.

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



GRAPHICS KIT

Texas Instruments' new low cost graphics design kit, a complete package which brings simple and comprehensive full colour bit-mapped graphics to the designers' fingertips, is now available from VSI.

Operating with any 8, 16 or 32-bit CPU, this video graphics kit will support systems with screen resolutions from 256 x 256 to 4096 x 4096 pixels and any number of colours.

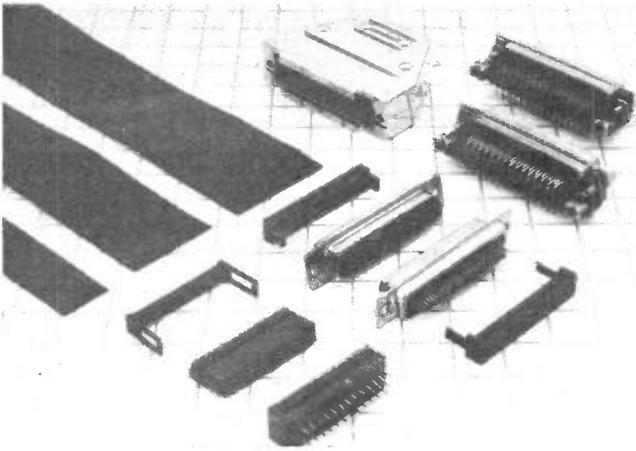
A new concept with integrated circuits to match has reduced the active device count to six. A video system controller (TMS 34061) for video RAMs eliminates separate text and graphics sub-

systems, a versatile video palette provides all the circuitry normally contained in a substantial PCB, and two multi-port video RAMs not only provide virtually unlimited memory bandwidth but also eliminate the usual problems between display, refresh and update.

The complete design kit comprises six chips, one 68-pin socket and a package of supporting literature which includes six separate publications. It costs £99 + VAT.

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

PRODUCT NEWS



CONNECTOR SYSTEM

New from Amphenol is a 0.025 inch pitch cable and connector system designed to meet the ever growing demand for interconnect miniaturisation.

Up to 50% savings on size and weight over conventional 0.05 inch pitch can be realised with this cost-effective solu-

tion, which is based on Allied Amphenol's Spectra Strip IDC flat cable.

The 0.025 inch pitch cable features IDC termination and UL recognition, using PVC dielectric and 30awg solid copper core. Five cable widths accommodate from 26 to 80 conductors. The cable is 0.025 inches thick and is

double-contoured for precise location into connectors.

The range of connectors now available includes D-type connectors, offering 16 to 74-way contact configurations for PCB and cable mounting. Connector shells are steel, yellow chromated over zinc. Nickel-plated contacts are selectively gold-plated in contact and termination areas. D-type connectors can be supplied with metalised hoods.

Also available are transition connectors for PCB-to-cable interconnection, offering from 10 to 64 contacts arranged in four staggered rows, and sockets and PCB headers, either right-angled or straight, featuring polarity keying in 10 to 80-way sizes.

*Amphenol Ltd,
Thanet Way,
Whitstable,
Kent CT5 3JF.
Tel: (0227) 264411.*

advantage of the new device.

The Palettemate is supplied complete with a package of ROM-based utilities software to enhance its use and provide special effects. It costs £127.50 + VAT.

*Wild Vision,
Mari House,
20-22 Jesmond Road,
Newcastle upon Tyne
NE2 4PQ.
Tel: (091) 281 8481.*

ANTI-SLIP MATS

Cobonic Limited seems to have the answer to all those slippery problems that can occur in the workshop, lab, office and home. It's a mat called StopSlip.

Due to its inherent tackiness, any item placed upon its surface will stick there as if glued without leaving any traces either on the table or on the object. Stop-Slip is available in various sizes with thicknesses of either 2 or 3mm. It can also be cut to required sizes with scissors.

*Cobonic Ltd,
32 Ludlow Road,
Guildford,
Surrey GU2 5NW.
Tel: (0483) 505 260.*

ORYX PSU

The range of Oryx Micro soldering irons now has a universal power supply unit suitable for all the Micro range. This PSU can be supplied wired for 6, 12 or 24V and is capable of providing 25W.

Working direct from a 240V supply, the double insulated transformer offers maximum safety to the operator using a low voltage iron.

Output voltage is designated when ordering,

although the internal circuits are still intact and can be changed if necessary.

The 13 light-weight Micro irons available for this unit, with the choice of some 23 tip styles, make this product very useful for micro-miniature work such as surface mount devices.

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

PALETTEMATE

A new colour graphics card which greatly enhances the display capabilities of the BBC microcomputer has just been unveiled by Wild Vision. The Palettemate allows 16 different colours to be selected from a palette of 4096 to be displayed simultaneously on an RGB monitor in mode 2.

The Palettemate is intended for anyone wishing to exploit the graphics capability of the BBC micro. Uses include producing dramatic effects for games programs, adding a professional finish to video presentations, and many other applications such as CAD packages or colour coding data from scientific experiments.

The card plugs inside the BBC with no soldering required, and the output to an RGB colour monitor is taken from the normal RGB socket at the rear of the computer so that no extra sockets are required.

The displayed colours are set up using separate palettes for red, green and blue which can be individually programmed using the VDU 19 statement. This way existing programs can be readily amended to take

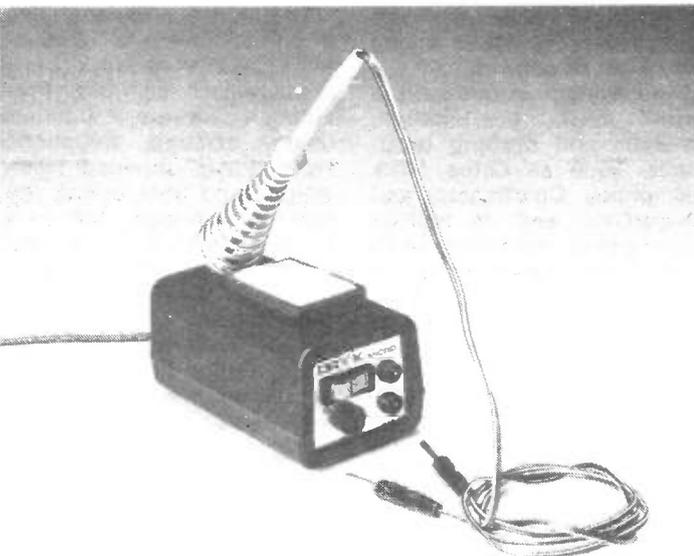
TVRO EXTRA

In last month's article, *TVRO Receiver*, we forgot to mention that when ordering the kit from Comex Systems Ltd it is necessary to add £2.50 P&P. We apologise for any inconvenience caused by this omission.

Readers are asked to note that the two Astec modules featured in the article are *not* included in the kit.

To recap, prices are as follows: TVRO receiver - motherboard and kit - £35.00; board only - £11.75; AT-1020 tuner module - £35.10; AT-3010 IF/demodulator - £54.65; F type plug for AT-1020 - 50p; Mitsubishi heterodyne 10GHz receiver - £47.00; scalar horn - £42.00; 60-1700MHz wideband low-noise preamp kit - £35.00.

*Comex Systems Ltd,
Comet House,
Unit 4,
Bath Lane,
Leicester.
Tel: (0533) 25084.*



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- ★ Broadband operation
- ★ Stainless steel hardware
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HERE'S WHAT THE CUSTOMERS SAY!

1 VK7NOW "I have recently installed a DX33 beam and I would like to advise you that I am extremely satisfied with it. It certainly outperforms the TH3JNR which I previously used and also the VSWR is lower"

2 G3AAE "This letter is to tell you how pleased I am with the DX 33 antenna. On unpacking the DX 334 was immediately impressed with the quality of the hardware and in operation it is just as impressive. I have used it on all three bands and have been obtaining excellent reports from DX stations all over the world. I have conducted tests with other stations and these show the electrical figures included in the DX 33 specification are fully met in practice. Congratulations on a very fine product"

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1075 DX-7/2	7MHz 2 ele Yagi Gamma matched 20 boom.....	£402.50
1076 DX-7/3	7MHz 2 ele Yagi Gamma matched 40 boom.....	£546.25
1077 DX-51	Rotary dipole for 282421 18 & 14MHz.....	£126.50
1080 DX-6V	10 80m Multi and Vertical plus 30m.....	£118.00
1081 DX-31	Dipole 10 15 20m 2kw p&p.....	£97.75
1082 DX-32	2 elements 10 15 20m 2kw p&p.....	£161.00
1083 DX-33	3 element 10 15 20m 2kw p&p.....	£224.25
1084 DX-34	4 element 10 15 20m 2kw p&p.....	£310.50
1085 DX-31/32	Conversion kit.....	£69.00
1086 DX-32/33	Conversion kit.....	£80.50
1087 DX-33/34	Conversion kit.....	£92.00
1089 DX-103	3 element 10m Yagi.....	£97.75
1090 DX-105	5 element 10m Yagi.....	143.75
1093 DX-4k	Converts DX 31/23/4 to 40m dipole.....	£103.50
1094 DX-27/1	Rotary dipole for 22mhz CB.....	£23.00
1095 DX-27/3	3 ele B for 27MHz Gamma matched.....	£66.00
1096 DX 24/Q	2 ele quad 2 10 15 & 20m.....	£230.00
1097 DX 26/Q	2 ele quad 2 10 15 18 20m.....	£281.75
1099 DX-7/14-2/6	2 ele 40m. 6 ele on 20m. 50' boom.....	£805.00

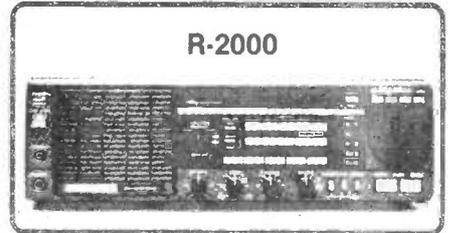
R-200

The R-200 provides outstanding performance through use of microprocessor controlled operating functions, allowing maximum flexibility and ease of operation throughout its operating range. And all mode receiver, it covers 150 kHz - 30 MHz in 30 bands, on SSB, CW, AM and FM. Key features include digital VFO's ten memories that store frequency, band and mode information, memory scan, programmable band scan, digital display with 24 hour dual clock plus timer and a host of other features to enhance the excitement of listening stations around the world. PRICE £480.

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R-2000

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139 Highview,
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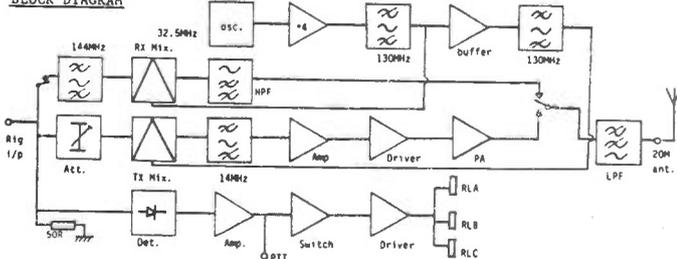
Enjoy the pleasures of 'home brew' equipment with a project from C M HOWES COMMUNICATIONS. All our kits have clear instructions, a fibre-glass circuit board that has the parts locations screen printed on it for easy, accurate assembly, plus all board mounted components. Whether you are an experienced operator planning to build a transverter or QRP transceiver, or a newcomer looking for a first receiver, we have interesting designs to suit. With our kits, you don't have to be an 'old hand' at construction to enjoy the satisfaction of using home built equipment.

Have you considered building yourself a small rig for portable and holiday use this summer?

HC220 and HC280 TRANSVERTERS - use your 2M rig on 20 and 80M!
The HOWES HC220 and HC280 offer an excellent alternative to an HF transceiver. At the present point in the sun spot cycle, is there any sense in spending a small fortune on a 9 band HF rig? The two most active HF bands can be worked using your existing 2M SSB/CW rig and our transverters - and at a considerable saving in cost too.

An exciting possibility offered by these new HOWES transverters is HF mobile operation. This becomes much more practical with the combination of a compact 2M rig, and a neat little transverter tucked out of the way.

BLOCK DIAGRAM



Both the HC220 and HC280 offer a good 10W RF output from mismatch proof transistors. The 2M drive level required is adjustable between .5 and 5W, but it can be easily modified to accept 10W or so. The use of a high proportion of fixed value filter components keeps alignment simple, and the output spectrum clean. No fancy test equipment is needed to align your kit.

On receive, the balanced mixer offers both sensitivity, and a good dynamic range. The 10 element bandpass filtering which is used ahead of the mixer requires no alignment at all - simply wind the right number of turns on the torroids! If you are competent with a soldering iron, you should be able to build a HOWES transverter. The full, clear documentation and the component locations printed on the double sided, solder masked PCB make construction a pleasure.

HC220 2M in, 20M out transverter kit: £48.90.
HC280 2M in, 80M out transverter kit: £48.90.

Assembled PCB: £79.90.
Assembled PCB: £79.90.

TRF3 SHORTWAVE BROADCAST RECEIVER.

Listen to the news, sport, music, political comment from around the world on the new HOWES TRF3 shortwave receiver. The design features switchable input impedance so that it can be used with long or short antennas, and there is an input attenuator for strong signal conditions. Up to 2W of audio output are available, but the low quiescent current consumption means that it can easily be battery powered, if you wish. Frequency coverage is 5.7 to 12.8 MHz in three bands using a 50pF tuning capacitor (available at £1.50). This simple TRF design may be firmly rooted in the silicon age, but the old thrill of far away stations heard on a home built set is still strong! Great fun to build and use - educational too!

HOWES TRF3 kit: £13.90.

Assembled PCB module: £16.90.

DeRx Direct Conversion Communications Receiver.

This simple, but very effective, single band receiver is available for 20, 30, 40, 80 & 160M. Up to 1W audio output, stable FET VFO, and amazingly good performance for a simple set. How about using one with an MTX20 or CTX transmitter for a QRP holiday and portable station? Suitable tuning capacitors for all but the 160M version are £1.50 each - you need two per receiver.

DeRx kit: £14.90. (Please state band required)

Assembled PCB module £19.90

MTX20 20M CW TRANSMITTER.

The HOWES MTX20 is a 20M CW transmitter giving up to 10W RF output, but this is adjustable, so you can turn it down to take part in the G-QRP Club's activities and awards. The design pays very careful attention to the quality of the output signal. Full key click and RF output filtering are provided.

The HOWES MTX20 is crystal controlled (one crystal provided), but you can wire up a tuning capacitor to VXO the frequency a few kHz, which is very useful. A matching VFO should be available soon. The MTX20, like its smaller cousins the CTX40 and CXT80, has the output transistor's heatsink mounted on the board, and it requires very little alignment. A super, new transmitter, and one that we feel will become very popular indeed.

MTX20 kit: £19.95.

Assembled PCB module: £26.95.

- XM1 Crystal Calibrator with 8 o/p. KN: £16.80. Assembled PCB Module: £21.30
- CTX40 (40M) or CTX80 (80M) QRP CW TX KN: £12.95. Assembled PCB Module: £18.95
- CVF40 or CVF80 VFOs for CTX KN: £9.30. Assembled PCB Module: £14.90
- ST2 Side-tone/Practice oscillator KN: £7.30. Assembled PCB Module: £10.80
- AP3 Automatic Speech Processor KN: £15.90. Assembled PCB Module: £21.40
- CM2 Quality Mic with 'VOGAD' KN: £10.25. Assembled PCB Module: £13.75



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73 from Dave G4KQH Technical Manager.

Delivery normally within 7 days.

NEWS

DESK

Let's get together

European co-operation is definitely all the rage these days, and quite rightly so. Lately, every other press release to land on my desk seems to come from the Commission of the European Community about the RACE, ESPRIT, EUREKA, DELTA "initiatives" etc, or from various European companies getting together to develop more shiny toys to benefit mankind – it almost makes you forget what their real motive is (profit, of course, although I wouldn't want you to get the impression I'm knocking it).

Anyway, some of the latest such info comes from Renault. For the last few years they've been working on Project ATLAS with Télédiffusion de France (TDF) and SAGEM (the Société d'Applications Générales D'Electricité et de Mécanique). ATLAS stands for Acquisition through Telediffusion of Automobile Logistics for Services, and whoever contrived that particular acronym ought to be forced to sit through every session of the European Parliament for the next ten years.

The project's aim is to present a car driver with

useful information through the medium of a touch-sensitive screen. This will include details of the car's mechanical condition, pre-recorded information such as extracts from the car's handbook, and external info on traffic and weather, etc (which is where TDF comes in).

Renault subsequently "put in hand a dossier within the framework of the EUREKA project" (bloody Eurospeak!), which was christened MINERVE (Media Intelligent pour l'Environnement Routier du Véhicule Européen – as acronyms go, pretty sensible).

Meanwhile, over in windmill land, Philips were working on CARIN (Car Information and Navigation), a project to develop an "electronic co-driver" to give route information, the vehicle's position, and details of the weather or the destination, all centred on the use of a compact disc (Philips pioneered the development of CD, after all).

Sounds a little bit like ATLAS, eh? Well, SAGEM, who control the MINERVE project, approached Philips with a view to working on a pan-European scale. The outcome? Yet another acronym (ho hum, this is getting

tedious), with efforts and experience all pooled in a common project, CARMINAT. Since both the ATLAS and CARIN projects have produced working demonstration vehicles, I don't suppose it'll be long before our cars are not only telling us how to get there, but where we ought to be going.

As an aside, you might be amused by another co-operative effort of Renault's, this time with Daimler-Benz. It goes under the name of PROMETHEUS, which stands for Programme for a European traffic with Highest Efficiency and Unprecedented Safety (I kid you not). If anyone can come up with a better (worse?) acronym for an actual project/organisation, I'm sure we can sort out a suitable prize...

Let's get together – part 2

With their sights firmly fixed on cutting a slice of the projected \$500 million due to be spent on VLSI (Very Large Scale Integration) ICs for ISDN interfacing by 1990, Philips and Siemens have standardised an ISDN-orientated modular architecture (IOM) for these ICs. Such chips will be used to connect the voice, data and video communication services of 10 million subscribers to the integrated services digital network.

The modularity of the IOM architecture, it is claimed, minimises the number of different VLSI circuits required and reduces their individual complexity.

A partnership between Philips and Siemens is certainly nothing to be sniffed at. According to the European Electronics Companies File 1985/6, recently published by Benn Electronics Publications, these two rank second and third respectively in European electronics sales. First was IBM (surprise, surprise) with sales of \$11,741 million. After Siemens came Thomson, GEC, ITT and a host of other big names.

If a report on such weighty matters sounds to you like good bed-time reading, give BEP a ring on (0582) 421981. It'll cost a mere £170/\$425 (well, it's a drop in the ocean to IBM).

Let's not get together!

The Small Business Bureau deserves a prize for this year's most alarmist and over the top press release so far. I quote: "If GEC takes over Plessey, 66 small or medium size high technology firms would fail or be seriously at risk, another 116 would be in difficulties, and up to 24,000 jobs could ultimately be in jeopardy".

These figures are described as minimum estimates, and came from a report prepared by Tidek Management Consultants. They form one more blow in the stroke/counterstroke battle between GEC and Plessey, with Plessey trying to stave off a take-over bid. It will probably be old news by the time you read this, but I'd put money on Plessey winning (if only because that's where my sympathies lie).

Ground probing radar

ERA Technology, the British research and development company, has taken a leading role in the development of ground probing radar for the detection of buried plastic discs and pipes.

Antenna design and signal processing technologies are now at the stage where hidden objects can be located and identified quickly and reliably despite the clutter of other, much stronger signals from unwanted 'targets'.

The ERA Technology ground probing system uses a carrierless pulsed radar to illuminate the ground through novel 'dispersionless' antenna elements. A detection 'map' can be produced, showing the position in a searched area of the targets both in plan view and in cross-section if depth information is needed. Further characteristics of the targets may be used for recognition, typically using a visual interpretation of the radar image, or identification of electrical parameters relating to the target, such as target body resonances.

This technology can be applied to a variety of civil and military tasks.

Govt communications

Fieldtech Heathrow Ltd was recently awarded a govern-

Renault Atlas system in operation

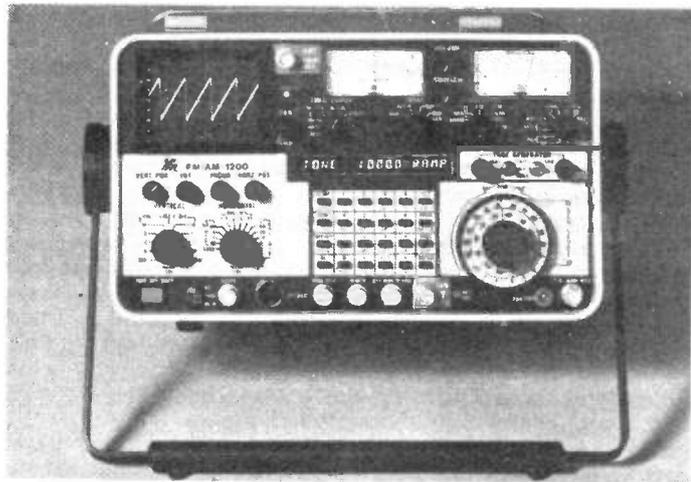


ment contract for the supply of fifty FM/AM-1200 communication service monitors and ten FM/AM-1500 communication service monitors. The contract value is approximately £500,000.

Both the FM/AM-1200 and FM/AM-1500 monitors were

first super high frequency aircraft satellite communications terminal.

The terminal, designated MASTER (an acronym for Military Aircraft Satcoms Terminal), will operate in the 7/8GHz SHF military band and will be employed to demon-



IFR FM/AM 1200 communication service monitor

designed and manufactured by the American company IFR Inc. The FM/AM-1500 integrates the functions of several different test instruments, such as FM/AM signal generators; duplex offset generator; and an audio scope spectrum analyser. The instrument features a keyboard entry system and menu functions, an LCD display for programmed frequency readout, processor-controlled memory functions and a CRT capable of alphanumeric or waveform displays.

The FM/AM-1200 features: 1-1000MHz spectrum analyser with 10 selectable dispersions from 10MHz to 10kHz; audio frequency function generator; duplex generator, off-set selectable in 10kHz steps to 49.99MHz; average and peak RF power measurement from 100mW to 150W; analogue and digital display of all received and generated parameters; vacuum fluorescent display; RS232 interface as standard; RF generator output variable to +10dBm.

Marconi aim high

Marconi Defence Systems Ltd have secured a contract from the UK Ministry of Defence to build Europe's

trate secure communications links via the UK's Skynet 4 military communications satellite.

Marconi believe that the contract offers the prospect of swift, reliable, fully-secure and jam-resistant communications for long range aircraft. The MASTER terminal will harness the potential of space communications to establish a significant advance in performance and availability over the high frequency radio links on which fixed and rotary wing aircraft currently depend for their beyond-line-of-sight contact.

Business via satellite

Marconi Defence Systems Limited of Stanmore, Middlesex, has announced a £3 million deal with the European Space Agency to supply three advanced transportable earth stations. These stations, designated TDS-6, will operate in the new 30/20GHz communications band and will be employed to test and demonstrate teleconference links and other business services available via the ESA's Olympus communications satellite. Olympus is being developed as the forerunner for the commercial satellites of the 1990s.

The Marconi design for

TDS-6 employs a land/air transportable radio cabin and trailer-mounted 2.5m diameter offset feed antenna which is capable of satisfying the most stringent CCIR side-lobe requirements. The two 30GHz uplink channels to Olympus are powered by 300W travelling wave tube amplifiers, while the 20GHz receiver employs solid-state low noise amplifiers.

Examples of Marconi's other work in the area of Kaband satellite communications equipment include filters for the ESA Eureka recoverable spacecraft inter-orbital communications payload, manufacture of a 45GHz receiver for the Skynet 4 military communications satellite, and studies of inter-satellite links for the future European Columbus space programme and data relay satellites.

Large-screen monitor

Mitsubishi Electric Corporation, following the introduction of its 35-inch colour TV in September of last year, has now developed a 40-inch direct view picture tube (the world's largest) and a 40-inch colour monitor/receiver for business use.

The monitor/receiver is equipped with the newly developed deflection frequency automatic synchronizing circuit and various signal input terminals. It can clearly display 2,000 characters owing to its square picture tube and fine pitch fluorescent screen.

Unlike existing commercial display devices, the deflection frequency automatic synchronizing circuit installed in the new display unit enables it to automatically tune the frequency horizontally and vertically when connected with business machines (personal computers and word processors).

Multi-media CD

Philips and Sony have published the provisional CD-Interactive Media System (CD-I) specifications, also known as the provisional 'Green Book', providing a complete format for the interactive use of CD ROM. The two companies were due to review the CD-I specifica-

tions with their licensees in Tokyo on 23 June and in New York on 26 June. The final specification is expected by the end of this year.

In 1980 Philips and Sony jointly developed the compact disc digital audio system and subsequently marketed compact disc digital audio products in 1982. Since that time consumer acceptance of compact audio discs and players has grown dramatically.

The two companies reached agreements for CD ROM (read only memory) applications in 1983. In May 1985 they announced the 'Yellow Book' or physical format specification for CD ROM, which laid the groundwork for storing character and graphic information on optical discs.

With the 'Yellow Book' specification, a CD ROM drive can act as a computer peripheral for business use. Information stored on the CD ROM disc can be retrieved with the use of a personal computer. The CD-I system does not require the support of a floppy disc, and the CD-I player, which contains its own intelligence, will be a stand-alone unit suitable for audio and video as well as text and data applications.

CD-I specifies how various types of information on a compact disc are identified, how each type of information is encoded, and how tracks, files, and records are laid out on the disc.

To generate a clear understanding and avoid confusion in the marketplace caused by non-compatible systems, Philips and Sony participated in the High Sierra Group with 12 other corporations active in CD ROM development. The purpose of this participation was to agree on a logical format standard which allows applications to access data from a CD ROM system independent of the particular hardware and operating system.

In harmonising the file system of CD ROM and CD-I, Philips and Sony have completed a CD-I specification which incorporates the joint efforts of the High Sierra Group and the CD-I Group to ensure that a CD ROM disc will be playable on a CD-I player.

SPECTRUM WATCH

NIGEL CAWTHORNE G3TXF

The UK's Joint Radio Committee (JRC) of the electricity, gas and coal supply industries is undertaking a VHF ACSB pilot study in the Bristol area. The JRC will be using Amplitude Companded SSB techniques on channels in the new JRC frequency band (138/149MHz). ACSB with 5kHz channel spacing is claimed to be spectrally more efficient than FM. The trials, which are scheduled to commence in the late summer, are planned to last about a year.

The communications engineering department at Bristol University, under Professor Joe McGeehan, will be making engineering assessments during the trials. Bristol is also currently undertaking a study on behalf of the DTI to look into channel protection ratios for ACSB on VHF. The JRC ACSB trials will be followed with interest by the mobile industry.

Radio telemetry deregulation

Nearly two years ago the DTI published a Green Paper (consultative document) with proposals for the exemption from licensing of different types of low power radio devices. The proposal was to exempt low power telemetry operating either inductively in the bands 0-185kHz and 240-315kHz or free radiating at 173.2-173.35MHz (1mW) and 458.5-458.8MHz (500mW ERP).

It was also planned to exempt telemetry and telecontrol devices operating in the band 26.96-27.28MHz (other than model control equipment,

which was already exempt) with a power of up to 1mW.

Although the original consultative document was published two years ago, there have not been any announcements of final decisions on deregulation in these areas.

The latest word is that the DTI's finalized proposals are being prepared for presentation to Parliament and that deregulation in this area may possibly come into effect 'before the end of the year'.

International broadcast shows

There are four major international professional broadcast equipment exhibitions. In the US there is the annual NAB show, which attracts some 40,000 visitors from all over the world to see the latest (predominantly NTSC) products.

Far away in Japan there is the annual InterBEE show, which draws many broadcast visitors from Asia and the Pacific rim countries.

Here in Europe there are two major broadcasting exhibitions. In the UK there is the International Broadcast Convention (IBC), which will be held next month (September) in Brighton and which is a biannual event, held in 'even' years.

Over in Montreux, Switzerland, there is the International TV Symposium, which also takes place every other year, but in 'opposite' years to the IBC. The Montreux technical show should not be confused with the Montreux programme

festival. The two Montreux shows (technical and programme) have common origins but are now separate events.

Thus, up until this year at least, every year in Europe there has been just one major broadcasting show.

Newcomer: Broadcast '86

This year a newcomer to the European broadcast show scene made its debut. Broadcast '86 was held in Frankfurt in June. The organisers of 'Broadcast' made no bones about it: they want their show to become the NAB of Europe (ie the largest and most significant European broadcast show, in direct competition with the existing IBC and Montreux shows).

The first Broadcast show was a feeble affair. Many of the big names in broadcast equipment (Ampex, Bosch, Grass Valley, Marconi, Philips, Sony, Thomson) were conspicuous by their absence. The show organisers said that they had announced the show too late for these major companies to include it in their exhibition budgets.

Broadcast '86 was more a German show dealing with German broadcasting themes than a major international broadcasting event. However, the Broadcast show organisers are already planning the 1988 event. By then the major broadcast manufacturers may have been persuaded by the excellent exhibition facilities that the Frankfurt trade fair operation has to offer to take part in Europe's newest broadcast show.

Private radio Germany

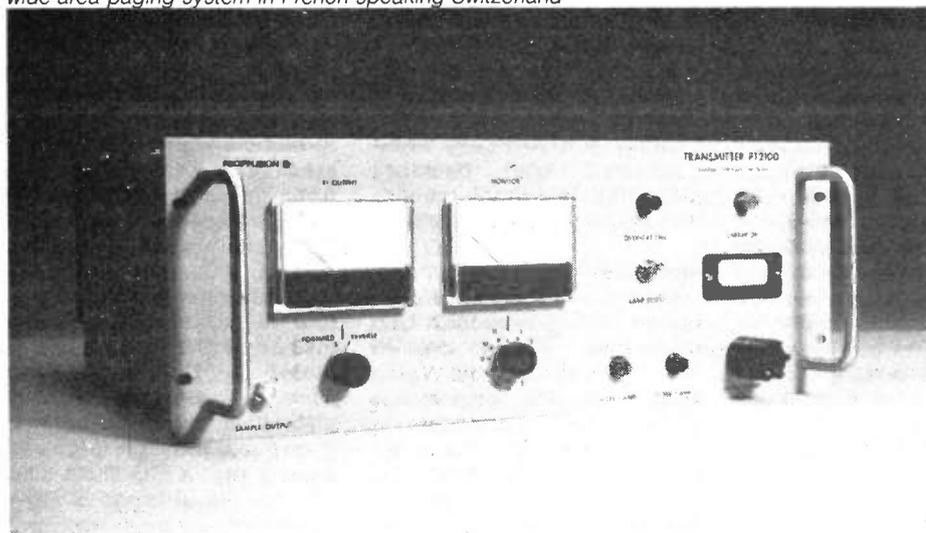
The advent of private commercial radio broadcasting is a topic of intense debate within Germany. Germany is a federation of states, each of which makes its own decisions in media matters.

Each of the eleven German states is going in a different direction when it comes to commercial broadcasting. Bayern, a southern farming state, has recently announced plans for 92 FM channels which will be spread across the state in groups of 1, 3 or 5 for local commercial radio. Bayern's major city already has a number of local radio stations including Radio Gong, Radio 92.4 and Radio Eins.

Private commercial broadcasting started in the state of Rheinland-Pfalz on 30 April 1986 at 103.6MHz with 5kW. Four companies operate the same station on a time-share basis. Rheinland-Pfalz, unlike Bayern where there will be numerous independent stations, has opted for a single private commercial station that will operate across the entire state. As there are four owners the station has been called Radio 4.

A curious feature of the limited amount of private local broadcasting that exists so far in Germany is that the transmitters and antenna facilities are provided directly by the German Post Office

UK built Rediffusion PT2100 transmitters are being used at the heart of the recently opened VHF wide-area paging system in French-speaking Switzerland



(DBP). The station organisers have nothing to do at all with the transmission side. The programme originators feed their programme down a telephone line to the DBP's transmitter station and that is the last they see of it.

This is a similar arrangement to that used by the IBA for the ILR network in the UK. It is totally different from the RF free-for-all that marked the early days of private commercial broadcasting in France, Italy and, to a lesser extent, Spain.

UK Community Radio shelved

The UK government is being severely criticised for shelving plans for a network of experimental community radio stations. It was in mid-1985 that the government invited applications from groups wishing to establish community radio stations. The original intention was to licence, on an experimental basis, a mix of low power 'community of interest' and 'neighbourhood' stations. Nearly 280 interested groups submitted tenders to the Home Office in the belief that a first round of licences would be issued before the end of the year.

Nine months later the government has announced that it is abandoning these plans, pending a complete review of the future of radio broadcasting in the UK.

The government department concerned with administering the new stations, the Home Office, had reportedly recommended that the broadcasting experiment should go ahead, but they were overruled in early July by Cabinet colleagues apparently worried about 'unregulated' stations broadcasting material critical of the government in the run-up to the next election.

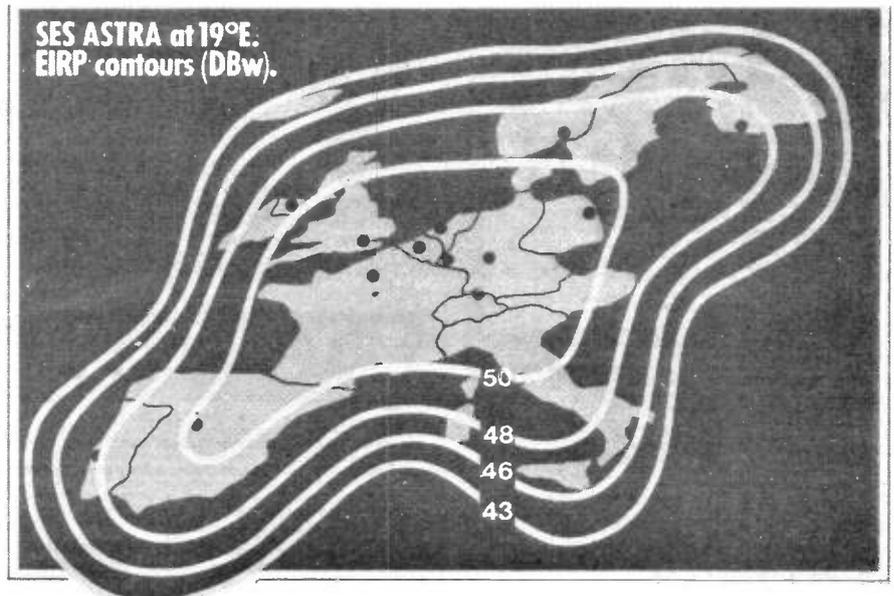
As a result of the government turnaround and the anger this has caused among applicants who had invested time and money in preparing detailed business and engineering plans for their applications, there is now a danger of a rapid rise in the number of pirate radio stations, many of which went off the air to bid for an experimental community radio licence.

New UHF Tx's for IBA

The IBA placed a £7.5 million order in June with Marconi for the supply of fourteen pairs of UHF TV transmitters, marking the beginning of the replacement programme for the first generation of IBA UHF TV transmitters that were installed in the late '60s and early '70s.

The new Marconi UHF klystron transmitters will commence operation in 1988 at the rate of six per year. The high power 15kW, 25kW and 40kW transmitters will replace transmitters in fourteen of the IBA's main UHF transmitter sites.

The IBA's UHF TV transmitter re-engineering programme will cost some £40 million at today's prices and is expected to take ten years to complete.



Transmitters being supplied in the first phase will cover the major centres of population. London's Crystal Palace transmitter alone serves over 12 million people.

The new external cavity klystron transmitters will be capable of broadcasting in stereo sound. The IBA currently maintains 1,396 TV transmitters and transposers for both ITV and Channel 4 networks. The IBA is also responsible for the radio transmitter network used by the Independent Local Radio (ILR) stations. The IBA-run radio transmitters (a mix of MW and VHF-FM) now total 125.

New European satellite: ASTRA

The Luxembourg based organisation SES has placed an order for a 16-channel DBS RCA satellite which it plans to launch on Ariane Flight 26 in May next year (Ariane flight launch dates are still only tentative following the recent Ariane launch failure - a revised launch schedule has yet to be announced).

SES say that \$200M has been invested

in the multinational satellite project. This includes the purchase of the satellite, launch fees, insurance and the construction of an Earth station in Luxembourg. The chateau of Betzdorf, once the residence of Luxembourg's Grand Duke, is being converted into the ASTRA control station and uplink point.

SES are now busy looking for customers for their 16 programme channels (and if a second satellite is launched as a working spare there will be 32 programme channels on offer). The first firm client is a Scandinavian consortium, Scansat, which will be making full use of the multi-channel sound facilities by broadcasting in several Scandinavian languages at the same time.

ASTRA's footprint will cover most of Europe, and using 45W transponders will be receivable with 85cm dishes. The 50dBW contour will cover an area containing 92% of European consumer purchasing power. However, differences between SES and Eutelsat, the European satellite communications organisation, still have to be ironed out.

The fourteen IBA stations that will be equipped with UK UHF transmitters

Station	Transmitter power	ITV channel	UHF colour service began
Crystal Palace, London	2 x 40kW	23	November 1969
Mendip, Avon	2 x 15kW	61	May 1970
Wenvoe, near Cardiff	2 x 15kW	41	April 1970
Winter Hill, Bolton	2 x 15kW	59	November 1969
Pontop Pike, Newcastle	2 x 10kW	61	July 1970
Emley Moor, Huddersfield	2 x 10kW	47	November 1969
Durris, near Aberdeen	2 x 10kW	47	July 1971
Sutton Coldfield, Birmingham	2 x 10kW	43	November 1969
Black Hill, Glasgow	2 x 10kW	43	December 1969
Divis, Belfast	2 x 10kW	24	September 1970
Bilsdale, North Yorkshire	2 x 10kW	29	March 1971
Caradon Hill	2 x 10kW	25	May 1971
Caldbeck, near Carlisle	2 x 10kW	28	September 1971
Sandy Heath, near Bedford	2 x 10kW	24	January 1971



£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
- 4 5- surface mounting switches suitably insulated for mains voltage
- 5 - electrical switches intermediate type, will also replace 1 or 2 way switches, white flush mounting
- 7 4 - in flex line switches with noons
- 9 2 - mains transformers with 6V 1A secondaries
- 10 2 - mains transformers with 12V 1/2A secondaries
- 11 - extension speaker cabinet for 6 1/2" speaker
- 13 12 - glass reed switches
- 17 2 - ultra transformers and 2 receivers with circuit
- 19 2 - light dependent resistors
- 25 4 - wafar switches - 6p 2 way, 4p 3 way, 2p 5 way, 1p 12 way small one hold foing and good length 1/2 spindle your choice
- 28 1 - 8 digit counter mains voltage
- 30 1 - Nicad battery charger
- 31 1 - lay switch with key
- 32 2 - aerosol cans of ICI Dry Lubricant
- 34 96 - 1 metre lengths colour-coded connecting wire
- 39 1 - long and medium wave tuner kit
- 41 1 - rocker switch 10 amp mains SPST
- 45 1 - 24 hour time switch mains operated (s.h.)
- 48 2 - 6V operated reed switch relays
- 49 10 - neon valves - make good night lights
- 50 2 - 12V DC 24V AC, 3 DO relays
- 51 1 - 12V 2 CD miniature relay very sensitive
- 52 1 - 12V 4 CO miniature relay
- 53 2 - mains operated relays 3 x 8 amp changeover (s.h.)
- 54 10 - rows of 32 gold plated IC sockets (total 320 sockets)
- 55 1 - locking mechanism with 2 keys
- 56 1 - miniature unselector with circuit for electric jigsaw puzzle
- 60 5 - ferrite rods 4" x 5/16" diameter aerials
- 61 4 - ferrite slab aerials with L & M wave coils
- 63 1 - Mullard thyristor trigger module
- 64 10 - assorted knobs 1/2 spindle
- 65 1 - different thermistors, mainly bi-metal types
- 66 1 - magnetic brake - stops rotation instantly
- 67 1 - low pressure 3 level switch can be mouth operated
- 69 2 - 25 watt pots 8 ohm
- 70 2 - 25 watt pots 1000 ohm
- 74 4 - wire wound pots 18, 33, 50 and 100 ohm your choice
- 77 1 - 1250 watt dimmer Ultra ref SE20
- 78 1 - time remainder adjustable 1-80 mins clockwork
- 81 2 - 30A panel mounting thyristor kits
- 85 1 - mains shaded pole motor 3" stack 1/2 shaft
- 86 1 - mains motor with gear box 1 rev per 24 hours
- 91 2 - mains motors with gear box 18 rpm
- 92 1 - thermostat for fridge
- 96 1 - motorised stud switch (s.h.)
- 101 1 - 2 1/2 hours delay switch
- 103 1 - mains power supply unit - 6V DC
- 104 1 - mains power supply unit - 4.5V DC
- 105 1 - 5 pin flex plug and panel socket
- 107 1 - 5" speaker size radio cabinet with handle
- 110 10 - slider type volume controls
- 111 2 - musical boxes (less keys)
- 112 1 - heating pad 200 watts mains
- 113 1 - FM front and with tuning condenser and data
- 114 1 - 1W amplifier Mullard 1172
- 115 1 - wall mounting thermostat 24V
- 118 1 - leak effect antenna for 5" speaker cabinet
- 120 2 - p.c. boards with 2 amp full wave and 17 other reas
- 121 4 - push push switches for table lamps etc
- 122 10 - mitra twin screened fan blower p.v.c. outer
- 123 100 - staples for thin flex
- 124 25 - clear plastic lenses 1/2 diameter
- 127 4 - pilot bulb lamp metal clip on type
- 128 10 - very fine drills for pcbs etc
- 129 4 - extra thin screw drivers for instruments
- 132 1 - plastic boxes with windows, ideal for interrupted beam switch
- 134 10 - metal anemometer fans no on/off switch, just spin to start
- 138 2 - car radio speakers 5" round 4 ohm made for Radiomobile
- 137 1 - 6 1/2" 4 ohm 10 watt speaker and 3" tweeter
- 142 10 - 4 BA spanners 1 and open, other and closed
- 145 2 - 4 reed relay kits 3V coil normally open or c/o if magnets added
- 148 20 - pilot bulbs 5.5V 30mA
- 147 1 - secret switch kit with data
- 149 4 - socket covers (protect inquisitive little fingers) for twin 13A
- 152 1 - air or gas shut off valve - clockwork operated
- 153 1 - air or gas shut off valve - thermostat operated
- 154 1 - 12V drip proof relay - ideal for car jobs
- 155 3 - varicap push button tuners with knobs
- 158 5 - 12 way connector blocks 2A 250V
- 159 3 - 12 way connector blocks 25A 250V
- 162 1 - 13A fuseal and switched spur for surface mounting or can be removed from box for flush mounting
- 163 3 - 13A sockets good British make but brown
- 169 4 - short wave air spaced trimmers 2-30f
- 171 1 - shocking coil kit with data - have fun with this
- 172 10 - 12V 6W bulbs Philips m.a.s
- 178 3 - oblong amber indicators with litupits 12V
- 180 6 - round amber indicators with noons 240V
- 181 100 - p.v.c. grommets 1/2 hole size
- 182 1 - short wave tuning condenser 50 pf with 1/2" spindle
- 184 1 - three gang tuning condenser each section 500 pf with trimmers and good length 1/2" spindle
- 188 1 - plastic box sloping metal front, 16 x 95mm average depth 45mm
- 192 6 - double pole 20 amp 250V flush mounting switch - white
- 193 6 - B.C. lamp holder adaptors white
- 195 6 - 5 amp 3 pin flush sockets brown
- 196 5 - B.C. lampholders brown bakelite threaded entry
- 198 - in flex solderless for electric blanket soldering iron etc
- 197 2 - thermistors, spindle setting - adjustable, range for ovens etc
- 199 1 - 10 digit operated solenoid with plunger 1" travel
- 200 1 - 10 digit switch pad for telephones etc
- 201 8 - computer keyboard switches with litupits 12V
- 206 20 - nitrite 80 ohm, standard type co-axial white
- 211 1 - electric clock mains driven, always right time - not cased
- 218 1 - stereo pre-amp Mullard EP9001
- 222 2 - 12V solenoids, small with plunger
- 236 1 - mains transformer 5V 1/2 amp secondary C core construction
- 241 1 - car door speaker (very flat) 6 1/2" 15 ohm made for Radiomobile
- 242 2 - speakers 6" x 4" 4 ohm 5 watt made for Radiomobile
- 243 2 - speakers 6" x 4" 16 ohm 5 watt made for Radiomobile
- 244 1 - mains motor with gear-box very small, toothed output 1 rpm
- 245 4 - standard size pots, 1/2 mag with dip switch
- 249 1 - 13A switched socket on double plate with fused spur for water heater
- 266 2 - mains transformers 5V 1/2A secondary split primary so ok also for 115V
- 267 1 - mains transformers 15V 1A secondary p.c.b. mounting
- 289 30 3.5V torch bulbs
- 290 3 7" nail to nail tape spoats
- 292 1 tan turns 3 watt pot 1/2 spindle 100 ohm
- 295 2 two plate brown bakelite coating roses
- 293 50 silicon diodes mixed unmarked
- 294 50 Germanium transistors mixed and unmarked
- 295 10 round pointer knobs 1/2" spindle
- 296 3 car cigar lighter socket plugs
- 297 1 cover for 24hr time switch ref BD45
- 298 2 15 amp round pin plugs brown bakelite
- 300 1 mains solenoid with plunger compact type
- 301 10 ceramic magnets Mullard 1/2" x 3/8" x 5/16"
- 303 12 pole 3 way ceramic wave charge switch
- 304 1 stereo amp 1 watt per channel
- 305 1 tubular dynamic microphone with desk rest
- 306 1 module, speaker & battery to make musical card
- 307 5 thermal fuses 15 amp seconds melt
- 308 1 T.V. turret tuner (black & white T.V.)
- 309 12 adaptable legended knobs 1/2" spindle
- 310 2 oven thermostats
- 311 1 Clare Elliot sealed relay 12V
- 312 1 pressure pad switch 24 x 18 (Trigger Met)
- 313 10 sub miniature micro switches
- 314 1 12" 8 watt min fluorescent tube white
- 315 1 6" 4 watt min fluorescent tube white
- 316 1 round pin kettle plug with moulded on lead

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 (EP9003) all for £8.00 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 £16.50 or without case £15.00 post paid.

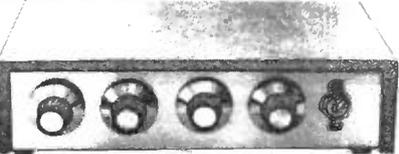


Ex-Electricity Board. Guaranteed 12 months.

VENNER TIME SWITCH

Mains operated with 20 amp 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.

SOUND TO LIGHT UNIT



Complete kit of parts of 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 1/2" 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.

12 volt MOTOR 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 1/2" spindle - 1/10 hp £3.45 1/8 hp £5.75 1/6 hp £7.50

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Learn in your sleep. Have radio playing and kettle boiling as you wake - switch on lights to ward off intruders - have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. A beautiful unit at £2.80

THE AMSTRAD STEREO TUNER

This ready assembled unit is the ideal tuner for a music centre or an amplifier, it can also be quickly made into a personal stereo radio - easy to carry about and which will give you superb reception. Other uses are a "get you to sleep radio", you could even take it with you to use in the lounge when the rest of the family want to view programmes in which you are not interested. You can listen to some music instead. Some of the features are: long wave band 115 - 170KHz, medium wave band 525 - 1650KHz, FM band 87 - 108 MHz, mono, stereo & AFC switchable, fully assembled and fully aligned. Full wiring up data showing you how to connect to amplifier or headphones and details of suitable FM aerial (note ferrite rod aerial is included for medium and long wave bands). All made up of very compact board. Offered at a fraction of its cost only £4.95

GOODS ARE ON APPROVAL

These notes are often hastily written and technical information sheets are seldom available about the items we have to describe, also advertisements sometimes go to press without our having a chance to correct any mistakes, however, everything we sell is supplied on the understanding that if it is not suitable for your project you may return it within 7 days for credit. If there was a definite error of description in our copy then we will pay postage. If not, then you pay the postage. Note this offer applies to kits, but only if construction is not started.

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Dual adaptors (2 from one socket)..... £3.95
Cord terminating with B.T. plug 3 metres..... £2.95
Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets..... £11.50

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- 2P4 -24 volt psu with separate channels for stereo made for Mullard UNILEX
- 2P6 -100V mains to 115V auto-transformer with voltage tappings
- 2P7 -Mini key, 18 button membrane keyboard, list price over £12
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- 2P70 -1 E.M.I. time motor two speed and reversible
- 2P71 -1 PAPT 240 5 hz motor
- 2P72 -1 115v Muffin fan 4" x 4" approx.
- 2P75 -1 2 hour timer, plugs into 13A socket
- 2P76 -1 auxdar tweeter partner to 5P26 speaker
- 2P77 -1 instrument box with key size 12" x 4 1/2" wide 8" deep
- 2P81 -ORACLE VE100 instrument panel, is a MODERN with extras, it is the heart of many visualita systems including the Prastal unit we recently stocked. It uses 25 I.C.s, 2 crystals, u.h.f. modifier Artax UM1233 etc. You receive this, new, unused and complete except for 7 of the plug in I.C.s.
- 2P82 -9v-0-9v 2 amp mains transformer
- 2P83 -25m 75 twin flat flex for mains appliances
- 2P84 -Modem board with press keys for telephone radiotele
- 2P85 -20v-0-20v 1/2 A Mains transformer
- 2P88 -Sangamo 24 hr time switch 20 amp S.H.
- 2P89 -120 min. time switch with knob
- 2P90 -90 min. time switch with edgewise engraved controller
- 2P91 -Panel meter size 2 1/2" x 2" scaled power factor
- 2P92 -Bailey & Mackay pressure switch 50 p.s.i.

£5 POUNDERS*

- 1 12 volt submersible pump complete with a tap which when brought over the basin switches on the pump and when pushed back switches off, an ideal caravan unit.
- 2 Sound to light kit complete in case suitable for up to 750 watts.
- 3 Silent sensor ultra sonic transmitter and receive kit, complete.
- 4 Dial indicator, measures accurately down to .01mm. "John Bull" or equally first-class make, a must for toolmaker or lathe worker.
- 5 250 watt isolating transformer to make your service bench safe, has voltage adj. taps, also as it has a 115V tapping it can be used to safely operate American or other 115V equipment which is often only insulated to 115V. Please add £3 postage if you can't collect as this is a heavy item.
- 6 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order and guaranteed.
- 7 Tape punch and matching tape reader, not new but believed in perfect working order if not so we would repair or replace within 12 months. Please add £2.50 postage.
- 8 Sensitive voltmeter relay, this consists of a 4 1/2" dia moving coil meter with electronics (we will supply oct. dig.) over £120 each, they are new and still in maker's boxes.
- 9 Box of 25 fluorescent tubes 40 watt daylight or warm white ideal window pelmets, signs, etc. Please collect or add £2 postage.
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- 12 Equipment cooling fan - mini snail type mains operated.
- 13 Ping pong ball blower - or for any job that requires a powerful stream of air - ex computer. Collect or add £21 post.
- 14 Unisector 360 degrees rotation, 5 poles, 50 ways, 50V coil.
- 15 Washing machine water pump, main motor driven so suitable for many applications.
- 16 Control panel case, conventional design with hinged front and finished metallic silver, easily arranged as lockable size approx. 15" x 10" x 5 1/2", wall mounting.
- 17 Two kits: matchbox size surveillance transmitter and 2 FM receivers.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

The AMSAT-UK/Satellite Colloquium, held at the University of Surrey over the weekend July 5/6, was an outstanding success. This event brought together over 160 amateur space enthusiasts from 14 countries. The staff of the university's electronics department, under the leadership of Dr Martin Sweeting, produced a series of lectures varying from future plans for new amateur radio satellites to considerations of the future of AMSAT-UK and its position vis-à-vis the various other organisations now entering this field.

The University of Surrey is an attractive establishment located in a most pleasant part of Surrey. The accommodation provided, the weather and the company all helped to make the event most enjoyable, with requests from those present for a similar event in the not too distant future.

The planned lectures covered such subjects as the UoSAT on-board computers, the telemetry and experimental data formats, the digital communications experiment, the radiation detectors, particle wave experiment and the CCD camera, satellite tracking and orbits, Oscar 10 and Phase 3C satellites and much more. Informal meetings added considerably to the variety of topics discussed. There were also some interesting trade stands and demonstrations on view. The new UoSAT Control Centre was available for inspection and the occasion was honoured by the presence of the RSGB's Mrs Joan Heathershaw.

Oscar 10 – still in trouble

The orbit of Oscar 10 takes it out into space as far as some of the highly charged areas of the outer atmosphere such as the Van Allan Belt. Electrically charged particles in this area are thought to be responsible for the problems recently experienced in the control of this satellite, which have necessitated a shut-down of its transponders.

High energy particles are thought to be responsible for faults which have occurred in the memory system. These faults are not so much due to damage sustained by the actual hardware as to static discharges interfering with the software programs which have been loaded into the memory systems. An attempt was made to erase the existing

program in the satellite and reprogram it – not an easy task. In the mean time the battery is being discharged, as controls for its recharging are not being received correctly, and word was passed around to all possible Oscar 10 users not to use the satellite even though at times they might find the transponders working apparently normally. Hopes are high that if the battery can be kept up to a sufficiently high voltage to enable control of the satellite to be maintained, it should be possible in time to bring it back into full operational use.

Special event stations

This time of year sees a proliferation of what are termed 'special event stations' operating on the various bands. They are specially licensed stations operating temporarily from the site of some fete or similar celebration, staged to demonstrate amateur radio to the attending public. The call sign issued by the Licensing Authority has the prefix GB followed by the usual figure and letters.

These special event stations are popular both with the public attending the event, as it gives them a practical demonstration of a real live amateur radio station, and with the radio amateur fraternity, as it gives them something challenging to do in setting up the station and offers the chance of operating with an unusual call sign.

An interesting 'licensing peculiarity' turned up over the question of using the

new 50MHz band for special event station events. Apparently the terms of the licence under which 50MHz operates at the moment preclude this.

A remarkable old-timer

Ken Aiford G2DX died earlier this year. In a personal tribute to him another remarkable old-timer, Dud Charman G6CJ, in the *May Radio Communication*, gave some details of his life.

Born in 1893, he grew up in Kendal and showed an early interest in 'things scientific'. In 1912 he obtained an experimental transmitting licence, with the call TXK. He purchased a 'wireless station' from the famous London store Gamage, which cost all of £5.00! It consisted of a spark transmitter and a crystal detector.

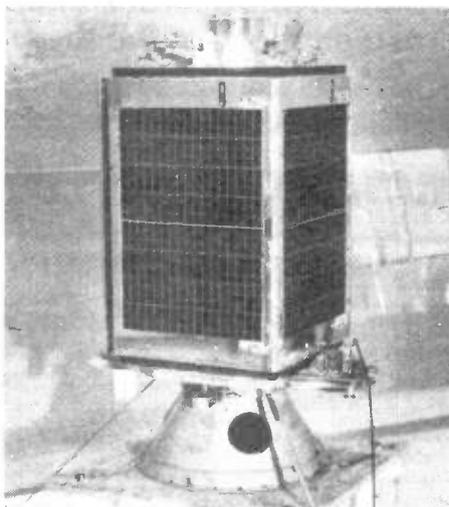
With a friend who had an aeroplane – a pretty rare possession in those days – they flew the wireless station over Lake Windermere and its signals were received on the ground.

Mr Gamage, the owner of the store, was very keen on the new 'wireless', and he provided a room in his store where those also interested in this new science could meet to discuss their results and experiments. Ken had met Leslie McMichael, another wireless pioneer, and they went to these meetings at Gamage. They formed the Wireless Society of London, which later became the Radio Society of Great Britain.

Ken's first job was as a draughtsman at Vickers in Barrow, where he designed the tail-fin of an early airship. From there he went as an aerodynamicist to the Royal Aircraft Factory at Farnborough. There he learnt a lot more about wireless and during the First World War he designed the Army No 2 Wireless Set.

From 1921-3 he was active in the transatlantic tests carried out to see if wireless communication could be established from this country to America. He learnt about the superhet receiver whilst engaged in these tests and was foremost in establishing their use among the amateur radio fraternity in this country. He spent many years on the council of the RSGB and leaves behind him a great quantity of records and material which will be preserved for posterity.

Dud Charman G6CJ is himself a famous old-timer. He acquired a reputation as an 'aerial wizard', design-



A UoSAT satellite on terra firma

AMATEUR RADIO WORLD

ing aerial systems for commercial use as well as for amateurs. He was famous for the working model used to test his aerial designs and demonstrate their characteristics.

This model consisted of a baseboard several feet square and covered with copper sheet. He constructed miniature versions of his aerials exactly to scale and mounted them on this 'earth', feeding them with RF around 3000MHz in frequency. A 'pick-up loop' fed a receiver where the signals were demodulated into a sound signal, and he could then move the loop around the aerials giving an audio signal of varying strength.

Dud used to demonstrate this model to radio clubs many years ago, a demonstration which was very popular. Advancing years have curtailed his activity in this direction, but he was persuaded to resurrect the equipment again for 'just one more demonstration' at the recent AMSAT-UK Colloquium, referred to previously. Those present who saw this demonstration were as fascinated with it as his earlier audiences years ago!

Honour for Japanese amateur

From the current issue of the IARU Region 1 *Region News*, we read that Mr Shozo Hara JA1AN, a very well-known

Japanese radio amateur, has been awarded a 'Ranjuhoshō', – the Japanese 'Blue Ribbon Medal' – in recognition of his distinguished service in the telecommunications world, particularly for his promotion of amateur radio in Japan during the past three decades. In Japan, a Blue Ribbon Medal is awarded by the State for distinguished social work, scientific achievement or invention, or some other meritorious service or achievement. There are not many such awards made, and to receive one is the highest honour for a private citizen. Those medal winners in the Japanese telecommunication world have been mostly presidents or high-ranking executives of public telecommunication corporations such as NTT, KDD and NHK, or of commercial broadcasters or major electronics enterprises.

Shozo Hara's interest in amateur radio goes back to 1939 and has continued unabated ever since. After the Second World War he was the prime promoter of the re-establishment of amateur radio in Japan, which he secured in 1952. At the same time his best efforts were dedicated to reorganising the national amateur radio society in Japan, JARL, not only so that the organisation ran profitably but that it should fulfil the

needs of its members. Thanks to his efforts, JARL succeeded in readjusting to these requirements and received government approval in 1959.

He has been President of JARL without a break since 1970, and has worked steadily for attaining their goals both domestically and internationally.

RSGB's next president

Mrs Joan Heathershaw is to be the RSGB's president again next year. A very popular president when she filled the position a year or so ago, she was unanimously elected to fill the post again during 1987. This will be a particularly busy year for the RSGB, as it is the society's 75th anniversary in 1988, so preparations for celebrating the occasion will be necessary.

Computer congress

For the first time, a congress on the state-of-the-art of computer use by the radio amateur is being organised. The congress is to be held in Florence in November. Applications must be submitted by August 31st. Entitled 'Hambit '86', it is being hosted by the Italian Amateur Radio Association (ARI). Details from Carlo L Ciapetti I5CLC, Via Trieste, 36-50139 Florence, Italy. 



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- PACK 26 4 CR106-4A THYRISTORS
- PACK 29 20 ASSORTED ICs. CMOS, TTL, linear, all sorts. Don't miss this one!
- PACK 31 20 RECTIFIERS. High current, IN100 series, top Hat, etc.

MISCELLANEOUS

- PACK 43 100 MYSTERY PACK of at least 100 components. The most popular pack of all!

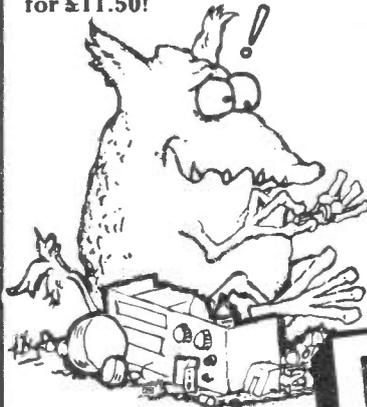
All components are new, marked, tested and guaranteed to full manufacturers specifications.



JUNK

Components, boards, panels, sometimes almost complete pieces of equipment. Transformers, capacitors, resistors, ICs, Ferraris (spot the deliberate mistake); in short - JUNK. Switches, pots, relays (is he never going to stop?), fuses... one of our legendary JUNK parcels can be yours for as little more than the price for posting it. If you're feeling particularly reckless, have two. IT'S CRUNCHY!

SUPER ECONOMY FAMILY JUNK PARCEL, 10kg (approx. 22lbs) for £11.50!



CMOS AND TTL MONSTER PACK

Delightfully logical 4000-series CMOS and 7400 series TTL. This is their song: Clock, toggle and pulse; Clock, toggle and pulse; Clockin', togglin', puls'n' all night long Yeah!

I can thoroughly recommend these chaps - they deal with their signals in a brisk and efficient way, and, unlike others, they often sing in tune. Where are my little green tablets? Aaaaaaah... that's better.

What I meant to say was that I can quite safely guarantee that you'll be paying less than a third of the usual price from magazine advertisements - a more realistic estimate is that you would pay about five times as much if you bought the ICs individually. What more could you ask?

PACK OF 50 ASSORTED CMOS AND TTL ICs ONLY £6.00!

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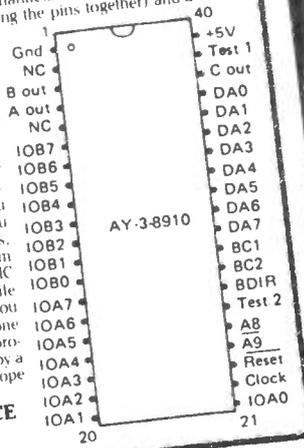


IC OF THE MONTH AY-3-8910 PROGRAMMABLE SOUND GENERATOR

You can have great fun experimenting with this IC, which will interface with any microprocessor or home computer (details and circuits in the data leaflet) and will produce an astonishing variety of sounds. There are three output channels which can be used separately or mixed (just by connecting the pins together) and a noise source which can be added to any of the channels. Control of pitch, duration and envelope shape allows all kinds of effects - explosions, gun shots, police sirens, helicopter noises and even music!

The data leaflet explains how to connect and program the IC and has a number of demonstration programs to get you started. After that, it's up to you to work out your own sounds, or just program it at random and see what comes out! The IC is less than half price while stocks last, so what are you waiting for? If you don't buy one at once, I must ask you to provide a good excuse, signed by a responsible person (the Pope will do).

**THIS MONTH'S PRICE ONLY £2.50!
DATA LEAFLET 50p**



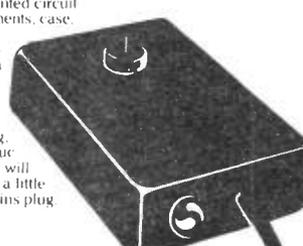
POWERFUL AIR IONISER KIT

Ions have been described as 'vitamins of the air' by the health magazines, and have been credited with everything from curing hay fever and asthma and reducing high blood pressure, to improving concentration, increasing vitality, curing insomnia, and even speeding up the healing of burns! Although some of the benefits may be exaggerated, there is no doubt the ionised air is much cleaner and purer and seems much more invigorating than 'dead' air.

One of the tangible results of using an ioniser is that dirt, dust, pollen and smoke particles become charged and are precipitated to the ground, where they will be swept up during normal household cleaning. You can test this for yourself by inverting a smoke-filled jar over the ioniser - the smoke disappears in seconds. Just what you need if you share an office with smokers (or if you are a smoker with unsympathetic colleagues!) The action of precipitating particles from the air is of immediate benefit to asthma and hay fever sufferers, of course, no matter how beneficial the ions themselves may be.

The kit can be assembled in three to four hours, and includes a roller-timed printed circuit board, 66 components, case, mains lead, components for a tester so that you can be sure the

ioniser is working, and full instructions. All you will need to supply is a little Araldite and a mains plug.



IONISER KIT, with case, ONLY £9.50!

ORDERING

Please send your order to the address above. There is no VAT to be added, but please include a 60p contribution towards postage and packing.

DIGITAL FILTERS

Bringing the computer closer to the analogue world

by Mary Dick

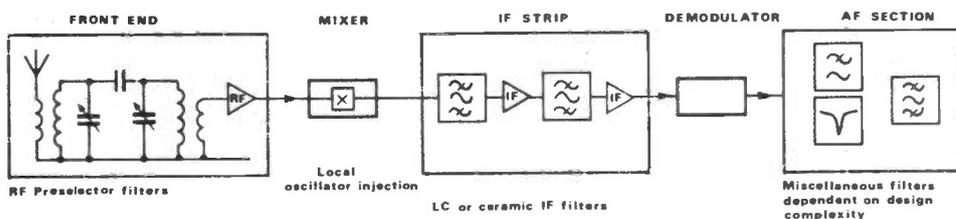


Fig 1 Filtering in a superheterodyne receiver

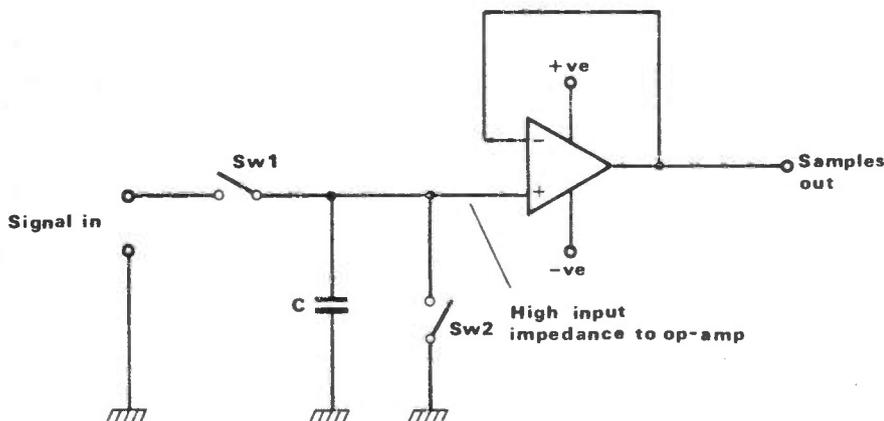


Fig 2 Sample and hold circuit

Filtering is an everyday part of amateur radio. Indeed, picking out a particular signal from all those unwanted signals that surround it in today's crowded HF bands is essential for successful communication. As the available spectrum becomes increasingly used, the filtering requirement becomes more stringent.

Traditionally, filters for a whole range of applications have been constructed from inductors, capacitors, and resistors. Figure 1 shows a schematic of a superheterodyne receiver - this is an excellent example of filtering at work. The front-end and IF filters are constructed from carefully designed inductors and tunable capacitors; the audio section filters, to enhance speech or the keyed tone of a morse signal, use

RC filters or op-amps to simulate inductors of large value.

Technology has changed though. Crystal filters, ceramic resonators and surface acoustic wave (SAW) devices are common items in many catalogues - they have improved the sharpness of filter passbands and make the passband characteristics more invariant to the manufacturing process. The computer has helped, too. Sophisticated circuit analysis programs allow designers to optimise their design long before it is built. But the computer and its digital techniques have made advances into filter technology and enable filtering operations to be performed that would have been nearly impossible with analogue designs. Digital filters are becoming

one of the day-to-day workhorses of modern electronics. Let us take an introductory tour of this important field and try our hand at a simple design.

Enter the computer

Why is the introduction of the computer such an important step? What are the advantages to be gained?

Perhaps the most obvious advantage is one of long term stability. Traditional filters suffer from drifting of their characteristics owing to circuit warm-up and the changing of component values as the device ages. Because a digital filter uses numbers stored in a read only memory (ROM), the characteristics are much more stable; the effects of vibration, shock and temperature change also disappear.

The cost of volume production is less with the digital system - ROMs can be produced much more easily than precision inductors, for instance. Size, too, tends to be smaller.

However, the adaptability of digital filters is probably their strongest point: a few simple changes to the computer's program and the filter characteristics can be changed. This adaptability can even be made to alter the filter's characteristics according to the nature of the input signal - giving a sort of intelligence to the filter.

Preparing analogue signals

The first problem encountered when using a computer is the preparation of the analogue signal so that it may be read by the computer. This is done by an analogue-to-digital converter. Before the converter digitises the input voltage, the voltage is sampled. Figure 2 shows a very simple sampler. The sequence of operation is as follows: with S₁ open, S₂ closes and discharges C₁; S₂ opens and S₁ closes; the input voltage then appears on C₁, and when S₁ opens at the end of the sample is available as a stable voltage at the output of the voltage follower.

The two main assumptions are that the high impedance of the follower (perhaps a MOSFET device) will not discharge C₁ significantly between successive samples and that the sample time (when S₁ is closed) is sufficiently short that the input voltage does not vary during it. The action of the sampler is shown in Figure 3. Note how the holding function of the sampler works.

Although there are several techniques for analogue-to-digital conversion (ADC), only one is described here to illustrate the ADC step in the digital filtering process. Single-slope conversion is one of the oldest methods; it is simple in concept and easy to understand. Figure 4 shows the circuit of a single-slope ADC. In its reset state, S₁ has discharged C₁, the flip-flop output (Q) is zero and the counter is zeroed.

To begin the conversion S_1 is opened and a pulse is sent to the set input of the flip-flop. Because the flip-flop output is high, pulses from an oscillator are clocked into the counter. With S_1 open, the constant-current source charges C_1 and the non-inverting input of the comparator sees a linear, rising ramp of voltage.

When the voltage on C_1 rises above that of the input (V_{in}) the comparator output goes high, resetting the flip-flop and so stopping the counter. As the value of the counter is directly proportional to the input voltage, the computer may read the (digital) counter and scale the value to obtain a reading of the true (analogue) input voltage.

Digitisation process

The digitisation process is not without its problems, however. The ADC tends to have errors caused by manufacturing tolerances and temperature drifts; the first may be cured by tighter quality control, but this raises the price. The resolution of the ADC, while not an error, does limit its ability to see small voltage variations. For example, an 8-bit ADC has 256 discrete levels between its two reference voltages. If the total range is 1 volt, then the ADC will be blind to changes of less than around 2mV and the most accurate that ADC answers can be quoted to is 4mV. For many purposes this sort of resolution will be quite adequate; the actual accuracy of the device depends on the accuracy of the voltage reference and, in the above example, the stability of the oscillator.

A much more fundamental problem occurs within the sampling process and is not a fault. Sampling any waveform will, unless preventative steps are taken, introduce 'aliasing'. The result of this is that a signal of one frequency will appear as another after sampling - and disrupt any attempt at filtering.

Figure 5a shows a signal being sampled ten times during one cycle. Figure 5b shows the result of applying the same sampling to a signal of much higher frequency - it can be seen that, after sampling, the signal appears at a quite low frequency. If care is not taken, aliasing like this could cause a high frequency signal to creep through a low-pass filter, for example.

'Anti-alias'

Unfortunately, there is no 'magic-wand' cure for aliasing; a conventional, analogue low-pass filter has to be used before the sampler to ensure that the alias-causing signals are blocked out. Such a filter is known as an 'anti-alias' filter and is designed to start attenuating frequencies at about one third of the sampling frequency.

Now that the signal has been digitised the computer can read it in from the ADC, which is normally handled as a 'memory-

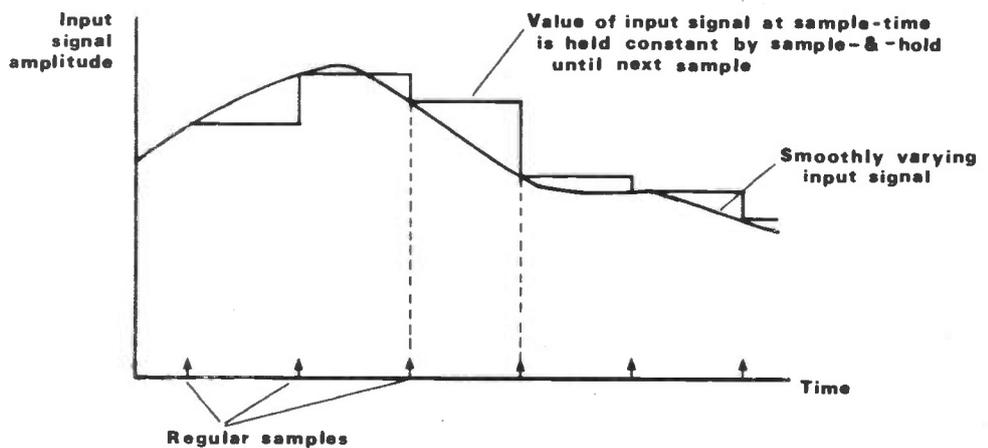


Fig 3 Effect of sampling on an input signal

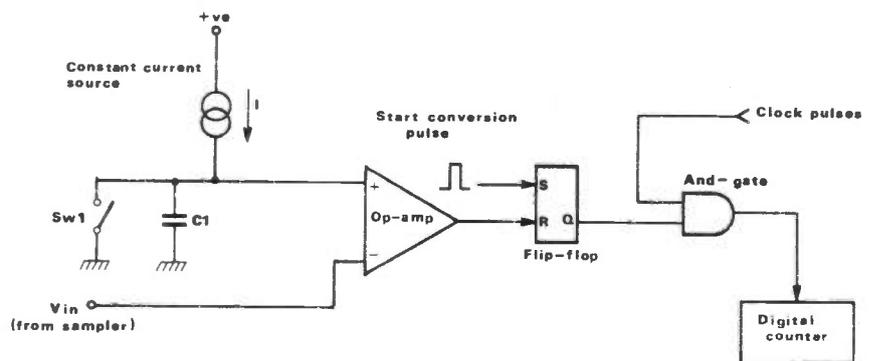


Fig 4 Single-slope analogue to digital converter

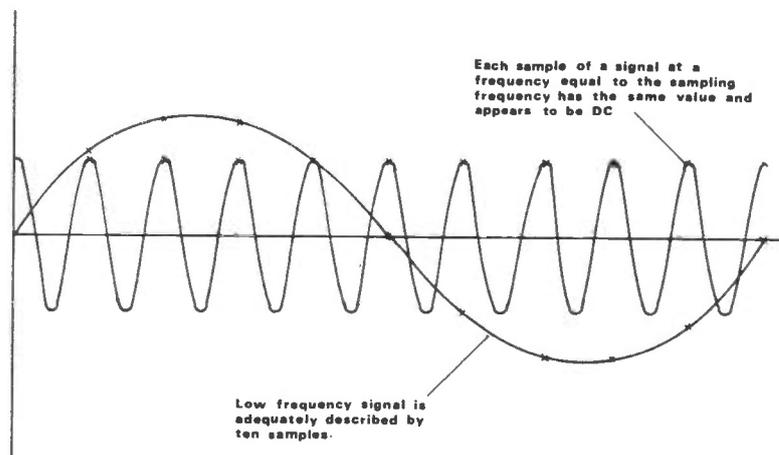


Fig 5 An example of 'aliasing'

mapped' peripheral. Once the signal is in memory there are a few simple manipulations which can be done, and these are briefly described below.

Two signals can be added (audio mixer) or subtracted (differential amplifier) by simple addition or subtraction operations; multiplication and division can also be done. The signal can be clipped: if its (digitised) value exceeds

the clipping threshold, the signal's value is set equal to the threshold's value. A variation on this would be soft-clipping where, perhaps, a signal in excess of the threshold might be clipped to:

$$V_{out} = \sqrt{(V_{in} - V_{threshold})^2 + V_{threshold}^2}$$

In order to treat two signals like this, their sampling rates and the range of the ADC used must have been the same.

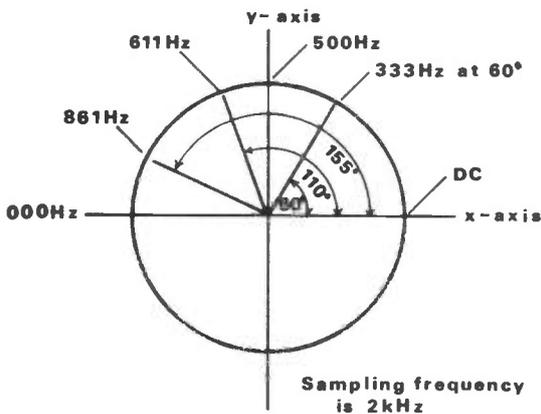


Fig 6 Plot of signal frequency as related to angle around circle

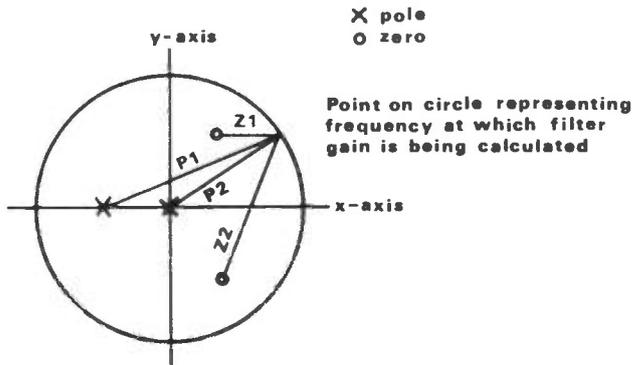


Fig 8 Two poles and two zeros on the Z-plane

Filtering – the digital way

Analogue filters are so common in communications circuits that little thought is given to them by the user. When confronted with the design of a filter – perhaps for a homebrew transceiver – a previously designed version is usually to be found in the literature. Changing its centre frequency or pass-band characteristics may be accomplished by scaling the values of a few components.

This apparently rule-of-thumb system works very well, but actually hides a vast amount of complex mathematics which 'governs' filter design and characteristics. To describe these mathematics here would be the next logical step in considering the transition from analogue to digital filters, but if a certain amount can be taken in trust by the reader, it is much simpler to try a short, non-mathematical treatment. Those who understand the mathematical techniques might gain even more of an insight into the problem; certainly the author did.

Before starting, it is as well to remember that not all signals are being considered: the anti-alias filter has only

left those with a frequency range from dc to (approximately) one third of the sampling frequency.

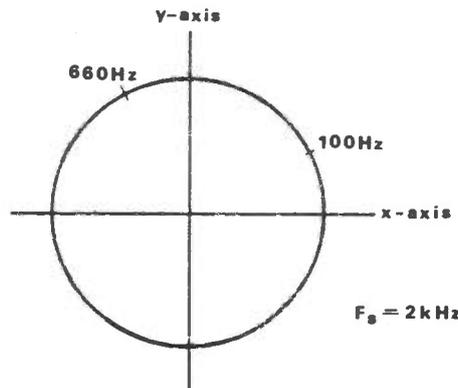
If we wanted to represent the frequencies coming into the filter, we might decide to draw them on some kind of graph. Without worrying too much about why, let us plot them on a circle – rather like a polar diagram. Figure 6 shows such a plot: dc levels are 'placed' at the intersection of the circle with the positive x-axis and, as we move round the circle anti-clockwise, signals of increasing frequency are represented until we return to our start point at a frequency equal to the sampling frequency.

Sampling frequencies

Since the frequency at any given point on the circle is linearly proportional to the angle traced through from the start point, a frequency of half the sampling frequency is represented by the point at the intersection of the negative x-axis and the circle. If we were sampling 2,000 times per second, the circle would have the corresponding frequencies as marked in Figure 6.

Different sampling rates would cause the frequencies to be linearly scaled as

Fig 7 100 and 660Hz signals on the circle (Z-plane)



the sampling is to 2,000. While there is a mathematical reason for drawing such a graph, the reader should not feel that it is an unreasonable way of representing signals. Figure 7 shows the same graph with two signals plotted, one a 660Hz morse code signal and the other a 100Hz 'unwanted' noise signal that might come from mains interference.

The design of a suitable digital filter to remove the unwanted signal is our next step. If we leave our two signals in their graphical form we could design a mask to fit over Figure 7. In doing so, we shall multiply the mask with the original signals – so a simple mask might consist of a value of 1 everywhere except at the position of the unwanted signal, where it should have a value of zero.

Signal amplification

If we wanted a particular signal to be amplified, a value exceeding 1 might be used in the mask. Now, at this point, the mathematics which have been put to one side force us to limit what is available for the mask. The zero value is allowed and this is mathematically described as a 'zero'. The other component that may be used is infinity; we can place an infinity (known as a 'pole') in our mask. Zeros and poles are allowed to be placed anywhere in the mask – but some care is needed if the result of multiplying the mask and the signals is to produce a meaningful result. After all, if we place a pole on a signal the computer will suffer from an arithmetic overflow and probably crash.

How is the effect of the mask on the signals present calculated? This is a fairly simple operation and is vital if we are to be able to predict the action of our filter. If we first consider a point on the circle, the effect of the mask on the amplitude of a signal with a frequency corresponding to that point is the quotient of the product of the point-to-zero distances and the product of the point-to-pole distances.

Figure 8 shows an arbitrary point, two poles and two zeros. The amplitude of the resulting output will be:

$$A(\text{out}) = A(\text{in}) \frac{Z_1 Z_2}{P_1 P_2}$$

To determine the characteristics of the filter over the filter's range (from dc to $f_s/2$) this calculation is performed all round the top semicircle with as many points being chosen as are necessary to specify the characteristic with the desired accuracy. Because this is fairly difficult to visualise several examples are included to show the effect of different pole-zero configurations.

Figure 9 shows a simple zero located at the dc point on the circle, and the associated filter characteristic. Note how there is a smooth roll-off towards dc just as though a dc-blocking capacitor had been placed in an analogue circuit. The frequency scale is not fixed in value

– the graph goes from dc to $f_s/2$; if f_s is varied then the upper limit and the roll-off breakpoint, f_{R1} , also change. Using the equation given above, the response becomes:

$$A(\text{out}) = A(\text{in})Z_1$$

At the dc point, Z_1 is zero but rises to $\sqrt{2}$ at $f_s/4$ and to 2 at $f_s/2$.

The smooth roll-off is not always what is wanted – a steeper rejection slope which allows more low frequencies to pass might be more applicable in many cases. If we think about this requirement, it is obvious that we need to keep the zero at the dc point because that is where the rejection is required. However, a short distance round the circle from the dc point the filter is required to have a unity response, ie it passes frequencies unattenuated.

Because the above equation is only governed by Z_1 a change will need to be implemented. If a pole is added near the dc point, say at $(y=0, x=0.9)$, then the characteristic becomes:

$$A(\text{out}) = A(\text{in}) \frac{Z_1}{P_1}$$

Near the dc point the distance Z_1 is very small, and so dominates the response. However, as we move anti-clockwise round the circle Z_1 and P_1 become nearly equal and the input and output amplitudes become equal. The effect on the filter's characteristic is quite pronounced: the -3dB point has moved from $f_s/4$ to $f_s/500$. Hence, if f_s is 1 kilohertz, the filter's roll-off has gone from 250Hz to around 20Hz.

By moving the pole closer to the zero this could be improved, although, as noted later, there are problems encountered (see *Figure 10*).

A simple bandpass filter

The last example in this section is that of a simple bandpass filter designed to amplify signals around $f_s/4$ while totally rejecting both dc and $f_s/2$ signals. Here, two zeros are required and are placed at the intersections of the unit-radius circle and the x-axis, as shown in *Figure 11*. Since we want $A(\text{out})$ to be much larger than $A(\text{in})$ at $f_s/4$, we include a pole near the $f_s/4$ point; another pole is also placed near the $3f_s/4$ point for mathematical symmetry and a 'real' implementation. Now, if we calculate the distances Z_1, Z_2 , and P_2 and then use our simple rule:

$$A(\text{out}) = A(\text{in}) \frac{Z_1 Z_2}{P_1 P_2}$$

we can see that $A(\text{out})$ is zero where wanted and will be $2\sqrt{2}/P_2 P_1$ at the $f_s/4$ point. Choosing P_1 and P_2 to be 0.8 of a radius from the centre gives a gain at the centre frequency of 5.6. *Figure 11* also shows the frequency response – a rather mediocre bandpass filter.

While no mathematics have been used, the reader should be able to have an intuitive feel for the relationship

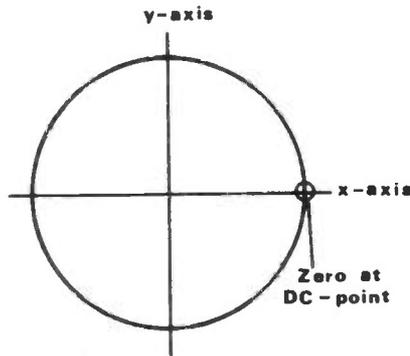


Fig 9 Single zero diagram and frequency response

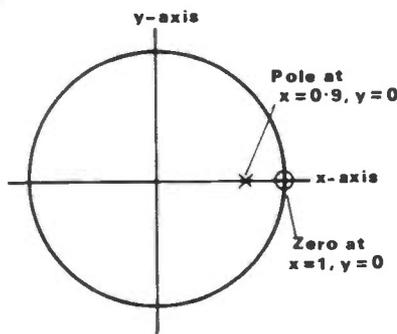
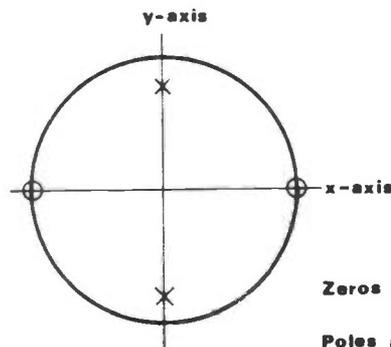


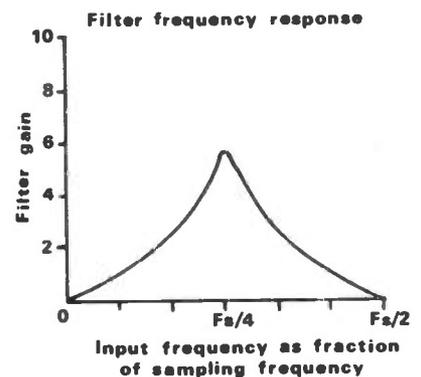
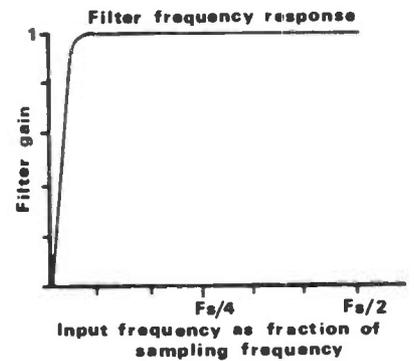
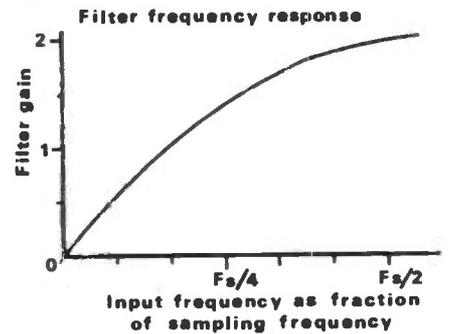
Fig 10 Improved dc blocking filter



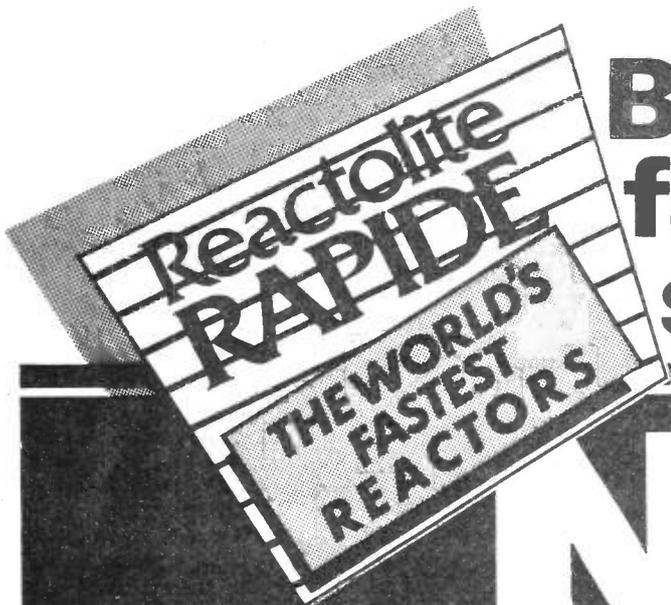
Zeros at $\begin{cases} x=+1, y=0 \\ x=-1, y=0 \end{cases}$
Poles at $\begin{cases} x=0, y=+0.8 \\ x=0, y=-0.8 \end{cases}$

Fig 11 Simple bandpass filter

between the position of zeros and poles and the frequency response. Of course, these illustrations have been simple – most digital filters have a large number of coefficients and can have very complicated characteristics. In such cases computer programs aid the filter designer. REV



NEXT MONTH . . .
The concluding part of *Digital Filters* covers IIR and FIR devices and actually implementing a filter



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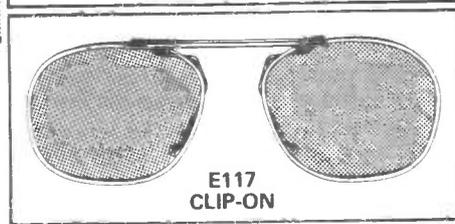
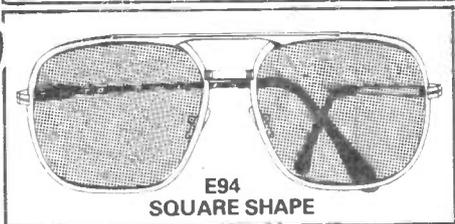
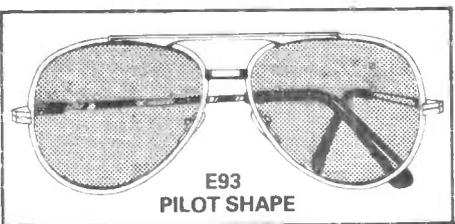
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0986

AN 18 TO 28MHz PREAMPLIFIER

A simple construction project for a real performer

Ken Williams

The performance of many older, and some not so old receivers tends to tail off above 14MHz, and this was brought home to me only a few days ago when I heard a local station working DX on 21MHz which did not even appear above the noise level of the shack receiver.

Thoughts of modifications to the rig immediately came to mind, but after consideration it was decided to construct a preamplifier which could be used in conjunction with any HF equipment in the shack.

Designing a preamp

When designing a preamplifier for VHF high sensitivity is paramount, but on HF the atmospheric noise level limits the usable sensitivity. However, the extremely strong broadcast signals to be found right across the HF spectrum make good cross modulation characteristics essential.

With these parameters in mind, some thought was given to the actual circuit.

Firstly, there would be little difficulty in obtaining the necessary sensitivity, for almost any reasonable HF or VHF RF transistor would produce the desired performance.

Secondly, to give improved protection against cross modulation a band-pass input circuit should be employed.

Thirdly, as the preamplifier would be feeding into a low impedance receiver input, matching in the form of an emitter follower output stage should be included.

Fourthly, in order to avoid overloading the receiver, an attenuator should be incorporated in the output circuit.

The next move was to the workshop in order to investigate the contents of the components store (ie junk box).

Removing a kilo of fluff, dozens of open circuit resistors and a tatty, ten year old copy of *Playboy* revealed a BF180, sundry

small unmarked transistors, a two-gang 50pF variable capacitor, an Eddystone diecast box and various pieces of single sided copper-clad board.

From the latter a piece 7 × 4.5cm was cut, and following my normal practice the pattern in the PCB was cut using a dental burr in a miniature electric drill.

The circuit was wired as indicated, with the exception that for initial testing the band-pass input was replaced by a single tuned circuit.

The only component which the reader may have difficulty in obtaining is the RF choke in the collector circuit of the BF180. This had been removed from a defunct Pye Ranger VHF RT equipment. Should a similar component not be available, it is probable that a 1000 ohm resistor would form a viable substitute with little detriment to the performance of the unit.

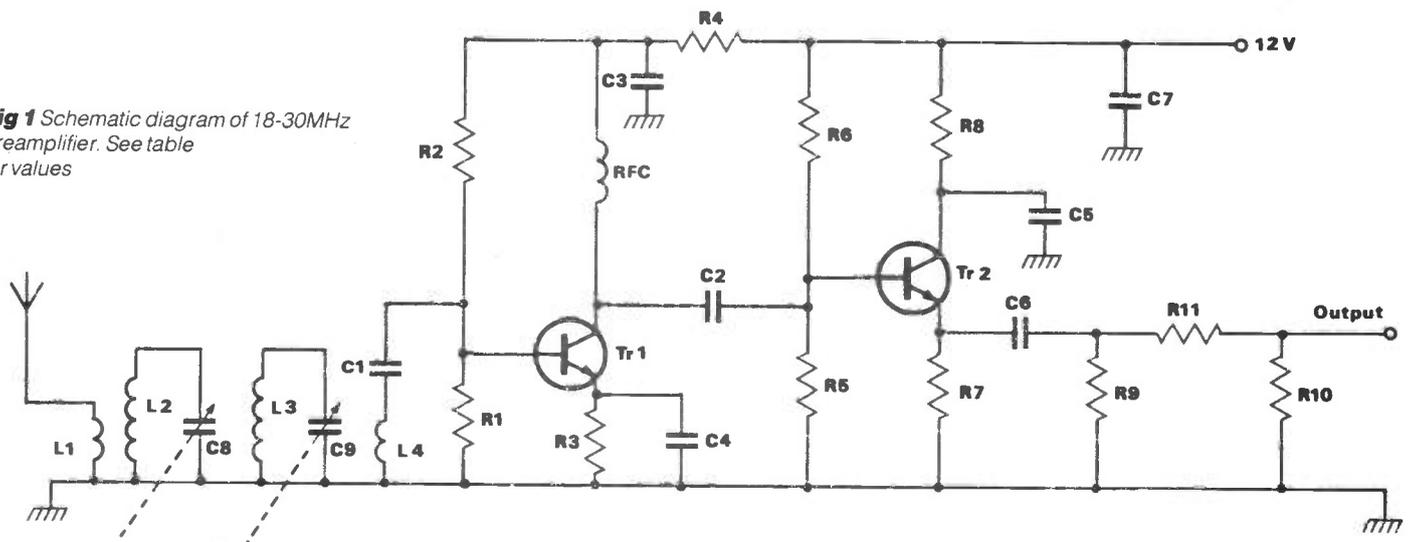
Component values

The component values used are not, in general, critical, and if those quoted are not available the preferred value above or below will probably make little difference to the final performance. Some care should be taken in the bias arrangements for the BF180, R1 being selected to give the device a standing current of about 1mA. Should a BF180 not be available, a 2N706 or similar would probably make an adequate substitute.

The emitter follower stage uses an unmarked npn JFET which other evidence suggests may be a 2N706. The circuit values used allow almost any small signal transistor to be used in this position.

An attenuator (R8, R10, R11) is located between the emitter follower and the output. This is intended to reduce the overall gain of the preamplifier so that the first stage of the succeeding receiver will not be overloaded by strong signals, and also to provide a measure of impedance matching between preampli-

Fig 1 Schematic diagram of 18-30MHz preamplifier. See table for values



18-28MHz PREAMP

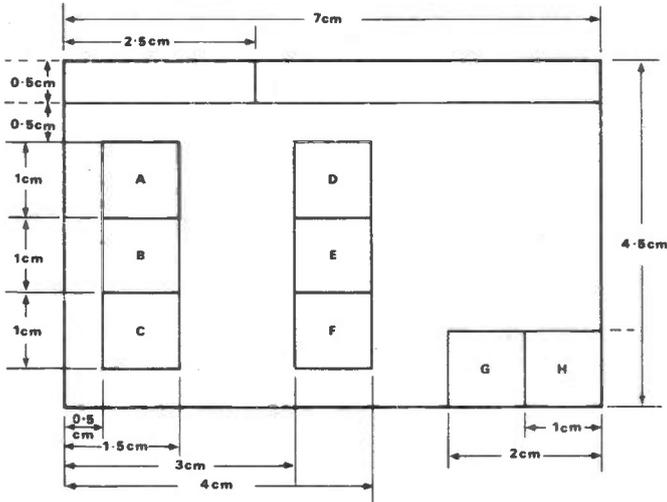


Fig 2 PCB layout. Pattern should be cut on single-sided board

fier and receiver. For initial testing, however, attenuation was not really required and the value indicated for R11 was temporarily inserted.

When the wiring of the PCB was complete, rather than immediately mount it in the box it was decided to carry out the preliminary performance tests. These were carried out using a single input tuned circuit.

Using the preamplifier in conjunction with a Drake 2B switched to 2.1kHz bandwidth, a system noise figure of better than 3dB was obtained on 21MHz. A gain figure of about 22dB was measured by comparing the input necessary to provide a selected S meter reading on the receiver with and without the preamplifier in circuit.

When, however, the input of the preamplifier was connected to a non-resonant aerial, severe cross modulation was evident.

The band-pass input circuit was then constructed, with the inductors wired directly between the stator plates and frame of the capacitor. This enabled their relative position to be easily adjusted for optimum performance. By trial and error, and balancing overall gain against cross modulation performance, a spacing of 1 inch centre to centre was finally chosen.

Performance figures

Finally, the preamplifier was mounted in the Eddystone box and the final performance figures determined.

Compared with the earlier tests with a single input circuit the sensitivity was somewhat degraded, with an indicated noise figure of 4dB on 28MHz and about 1dB worse on 21MHz. The gain also was slightly less at about 20dB. This reduction in performance caused no concern, for it still remained far better than required.

At this point it was considered that the preamplifier met the requirement, and it

only remained to increase the value of R11 to reduce the gain to a level whereby the addition of the amplifier to the input of the receiver caused only a slight increase in background noise. The final value selected will therefore vary in each individual case.

Thumbs up

I make no claim that this preamplifier is the ultimate, it certainly is not. But it will give a considerable improvement in performance to older or less sensitive receivers. Furthermore it is simple to construct and has only one component (the $2 \times 50\text{pF}$ ganged capacitor) which may be difficult to obtain.

If only one band is required the ganged capacitor could be replaced by preset trimmers, although if that band required is at the lower end of the range it may be desirable to add a turn or two on the inductors.

At one point in the development of this preamplifier trimmer capacitors were added across the inductors, but after a little experimentation it was decided that they were not necessary.

REW

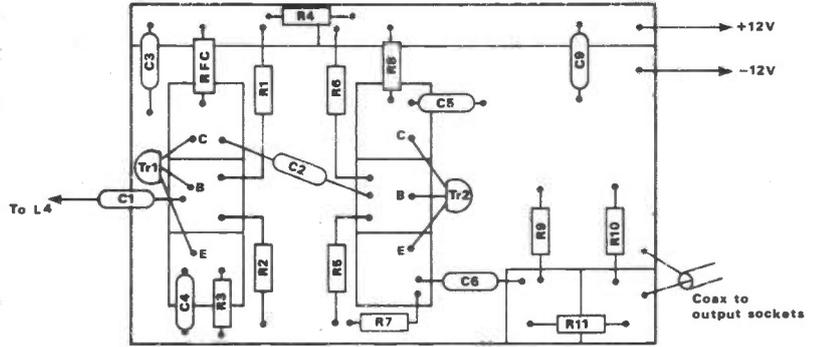


Fig 3 Component layout on PCB

COMPONENT LIST

Resistors

R1	6k8
R2,6	33k
R3	470R
R4	680R
R5	15k
R7,8	1k
R9,10	68R
R11	68R initially, then adjust (see text)

Capacitors

C1,2	25pF
C3,4,5,6,7	10nF
C8,9	$2 \times 50\text{pF}$ ganged variable

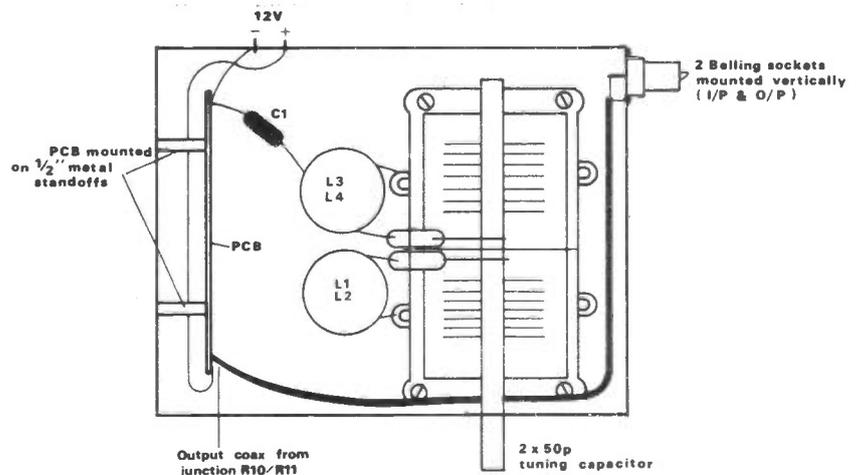
Inductors

(all wound on $\frac{1}{2}$ inch former)	
L1	3 turns over 'cold' end of L2
L2	$15\frac{1}{2}$ turns close-wound 22g enamelled wire
L3	As L2
L4	5 turns over 'cold' end of L3
RFC	choke from Pye Ranger (see text)

Semiconductors

Tr1	BF180 or similar
Tr2	2N706 or similar (see text)

Fig 4 Preamplifier in box sockets can be moved to rear



RTTY

ON THE SPECTRUM

by S Dean

Readers who have used the test program published with the Spectrum RTTY terminal (Feb-Mar '86) will by now have realised its limitations for 'on air' use.

This is not surprising, since the program's main use was simply to set up the terminal and confirm operation. The program described below, however, possesses all the facilities which have come to be expected of any self respecting RTTY terminal, such as:

- Five 255 character memories, to store commonly used messages such as station details etc.
- A 1023 character keyboard buffer to allow messages to be compiled while receiving.
- Fast machine code routines allowing the proposed higher baud rates to be handled easily.

■ Control of the transmitter push-to-talk switch.

Note that this new program does not provide the filter calibration tones and the baud rate check facility, since these are not normally required once the unit has been set up. It is therefore advisable to keep a copy of the original test program in case recalibration is necessary (unless of course test equipment is available).

Program description

The main portion of the program is written in machine code for speed reasons: Program II is the assembly listing. The first part of the program performs initialisation (lines 460-620). This includes zeroing the keyboard buffer length SILOLL + SILOLH, setting both cursors to the left-hand side, clearing the keyboard byte KBD, clearing the screen and setting the terminal in receive mode.

Whilst in the receive mode, the UART status, the keyboard, and the mode control byte are polled continuously. If a character is received by the UART, its code is used as an offset pointer in the look-up table to convert the 5-bit ASCII to 7-bit ASCII which the computer requires to print.

The Spectrum keyboard is scanned every 20 milliseconds by the operating system, and if a key is pressed its code is placed into location KBD (23560). Lines 640-1170 check if this key is one of the controlling characters, in the following order: figure shift, lines 700-750; letter shift, lines 760-800; return to menu, lines 810-830; transmit mode, lines 840-940; receive mode, 950-1040; send RYs, lines 1050-1170.

Lines 1180-1270 check the keypress against the look-up table entries to see if it is sendable: if so it is placed on the 'top' of the keyboard buffer (unless the buffer is full, in which case the character is ignored).

If the character is not sendable, lines 1620-1910 check if it is a request to load the contents of one of the memories into the keyboard buffer. Since the memory can be up to 255 characters long, the receiver register is sampled after each memory character transfer so as not to miss any received characters.

The current mode (receive, transmit, or send RYs) is held in the MODE byte, which will contain 0, 1 or 2 respectively. Lines 1930-2020 jump to the appropriate routine, depending on the current mode, then loop back to the beginning of the keyboard routine.

In transmit mode, if the UART is ready to send, the bottom-most character of the keyboard buffer (SILOBT) is read out and the whole buffer contents moved down by one character (lines 3470-3670). If the buffer is empty the program returns to the keyboard routine to wait for a keypress.

Lines 3680-3710 check if the character read out is sendable, and if so its shift state is checked against the current state (lines 3760-3900). If a change of shift is detected the appropriate shift code is transmitted before sending the character itself. The character is printed in the top window by line 3730.

A continuous stream of RYs is sent by lines 4020-4060, which will continue until the mode is changed. These characters are not printed in the window.

The two text windows each have their own print routines (PR1 and PR2), enabling them to work independently. Each window prints on a fixed line, and a scroll is forced when the cursor reaches the RHS of the screen or if a line feed character is received by the print routine. The scroll itself is simply a Z80 block move instruction applied to the relevant screen address area.

The easy way

Channel 2 is opened before each printing operation to ensure that the main screen is used. RST16 is the easy way to the Spectrum 'print character routine'. Apart from printing characters on the screen, this routine allows the cursor to be positioned in a way similar to the PRINT AT n, m in Basic. Extensive use is made of this to control the position of both cursors.

Program I is the Basic program, which is used to load the machine code initially, and to display and set the five memories. Note that the machine code loader is at the end of the program, which means that if the program is stopped and re-run, it is not necessary to reload the code (damn clever!).

Line 20 sets caps lock on, because lower case letters are not included in the 5-bit ASCII table. Note that if caps lock key (caps shift 2) is pressed while not in the machine code part of the program, caps lock is turned off and must be returned to the on state, or the keys a-z will not be recognized by the keyboard routine (unless shift is used).

The memory contents are displayed and changed by lines 100-430. Each memory is allocated 255 bytes irrespective of whether they are all used or not. This is done to simplify accessing the

Program I - Basic program

```

10 PAPER 7: INK 0: BORDER 0
20 POKE 23658,8
30 CLS
40 PRINT AT 3,12:"MENU" AT 5,8
:PRINT AT 5,11:"(1) AT 5,8:SET
:MEMORIES(2) AT 7,8:"SAVE MEMOR
IES(3)
50 PRINT AT 10,8:"WHICH ?" PR
USE 0: LET I=CODE (INKEYS)
60 IF I=49 THEN LET K=USR 2900
0
70 IF I=50 THEN GO SUB 100
80 IF I=51 THEN GO SUB 450
90 GO TO 30
100 CLS: SET MEMORIES
110 CLS: PRINT "WHICH MEMORY
(1-5)?"
120 PRINT: PRINT "(ENTER) FOR
MENU"
130 PAUSE 0: LET I=CODE (INKEYS)
140 IF I=35 THEN RETURN
140 IF I<1 OR I>5 THEN GO TO 10
0
150 LET L=31313+I: LET ST=31319
+255*(I-1)
160 CLS: PRINT "MEMORY ",I,""
170 PRINT
180 FOR C=0 TO PEEK (L)-1
190 IF PEEK (ST+C)>10 THEN GO T
O 0
200 PRINT CHR$ (PEEK (ST+C))
210 NEXT C
220 PRINT: PRINT "LENGTH=",PEE
K L
K: PRINT: PRINT "ALTER (Y/N)?"
0
230 PAUSE 0: LET I=INKEYS
240 IF I=>8 THEN RETURN
250 PRINT: PRINT "ENTER NEW ME
SSAGE -# ENDS"
260 LET C=0
270 PAUSE 0: LET I=INKEYS
280 BEEP 34,35
290 IF CODE I=35 THEN POKE L,C
: RETURN
300 IF CODE I=>8 THEN GO TO 34
0
310 IF C=0 THEN GO TO 270
320 LET C=C+1
330 PRINT "/";CHR$ (PEEK (ST+C))
: GO TO 270
340 IF CODE I=>9 THEN GO TO 37
0
350 IF C=PEEK L THEN GO TO 270
360 PRINT CHR$ (PEEK (ST+C))
LET C=C+1: GO TO 270
370 IF C=245 THEN BEEP 2,10
380 IF C=245 THEN GO TO 270
390 POKE ST+C,CODE I
400 PRINT I:
410 LET C=C+1
420 IF CODE I=13 THEN POKE ST+
C,10: LET C=C+1: GO TO 270
430 GO TO 270
440 POKE 31313+I,C
450 RETURN
460 SAVE "SUPER RTTY" LINE 490
470 SAVE "RTTY.obj" CODE 29000,3
600
480 RETURN
490 CLEAR 29399
500 LOAD "RTTY.obj" CODE
510 GO TO 10

```

RITY ON THE SPECTRUM

memories. The actual lengths of the five memories are stored in a further block of 5 bytes (addresses 31314-31318). Line 150 calculates the location at which the length of the selected memory is stored and also the start address of that memory.

The memories start at the end of the

machine code, and are saved as one with the code (line 470) after first re-saving the Basic part. This makes life simpler, since you don't have to find the beginning of the code on tape to save - just rewind to the start and it saves the lot.

Simple, isn't it! Well don't worry if it all

seems a bit complicated, you don't need to understand how the thing works to type the program in and use it, just follow the simple instructions below.

Writing the program

First type in Program 1 and save it using SAVE "RITY" LINE 490. If an assembler is

Program 11 - Assembler listing

```

PROG USES KEYS: -
CAP SH 1 LOAD MEM1 3 4
          2 1 2 3 4
          5 6 7 8 9 10
          11 12 13 14 15
          16 17 18 19 20
          21 22 23 24 25
          26 27 28 29 30
          31 32 33 34 35
          36 37 38 39 40
          41 42 43 44 45
          46 47 48 49 50
          51 52 53 54 55
          56 57 58 59 60
          61 62 63 64 65
          66 67 68 69 70
          71 72 73 74 75
          76 77 78 79 80
          81 82 83 84 85
          86 87 88 89 90
          91 92 93 94 95
          96 97 98 99 100
          101 102 103 104 105
          106 107 108 109 110
          111 112 113 114 115
          116 117 118 119 120
          121 122 123 124 125
          126 127 128 129 130
          131 132 133 134 135
          136 137 138 139 140
          141 142 143 144 145
          146 147 148 149 150
          151 152 153 154 155
          156 157 158 159 160
          161 162 163 164 165
          166 167 168 169 170
          171 172 173 174 175
          176 177 178 179 180
          181 182 183 184 185
          186 187 188 189 190
          191 192 193 194 195
          196 197 198 199 200
          201 202 203 204 205
          206 207 208 209 210
          211 212 213 214 215
          216 217 218 219 220
          221 222 223 224 225
          226 227 228 229 230
          231 232 233 234 235
          236 237 238 239 240
          241 242 243 244 245
          246 247 248 249 250
          251 252 253 254 255
          256 257 258 259 260
          261 262 263 264 265
          266 267 268 269 270
          271 272 273 274 275
          276 277 278 279 280
          281 282 283 284 285
          286 287 288 289 290
          291 292 293 294 295
          296 297 298 299 300
          301 302 303 304 305
          306 307 308 309 310
          311 312 313 314 315
          316 317 318 319 320
          321 322 323 324 325
          326 327 328 329 330
          331 332 333 334 335
          336 337 338 339 340
          341 342 343 344 345
          346 347 348 349 350
          351 352 353 354 355
          356 357 358 359 360
          361 362 363 364 365
          366 367 368 369 370
          371 372 373 374 375
          376 377 378 379 380
          381 382 383 384 385
          386 387 388 389 390
          391 392 393 394 395
          396 397 398 399 400
          401 402 403 404 405
          406 407 408 409 410
          411 412 413 414 415
          416 417 418 419 420
          421 422 423 424 425
          426 427 428 429 430
          431 432 433 434 435
          436 437 438 439 440
          441 442 443 444 445
          446 447 448 449 450
          451 452 453 454 455
          456 457 458 459 460
          461 462 463 464 465
          466 467 468 469 470
          471 472 473 474 475
          476 477 478 479 480
          481 482 483 484 485
          486 487 488 489 490
          491 492 493 494 495
          496 497 498 499 500
          501 502 503 504 505
          506 507 508 509 510
          511 512 513 514 515
          516 517 518 519 520
          521 522 523 524 525
          526 527 528 529 530
          531 532 533 534 535
          536 537 538 539 540
          541 542 543 544 545
          546 547 548 549 550
          551 552 553 554 555
          556 557 558 559 560
          561 562 563 564 565
          566 567 568 569 570
          571 572 573 574 575
          576 577 578 579 580
          581 582 583 584 585
          586 587 588 589 590
          591 592 593 594 595
          596 597 598 599 600
          601 602 603 604 605
          606 607 608 609 610
          611 612 613 614 615
          616 617 618 619 620
          621 622 623 624 625
          626 627 628 629 630
          631 632 633 634 635
          636 637 638 639 640
          641 642 643 644 645
          646 647 648 649 650
          651 652 653 654 655
          656 657 658 659 660
          661 662 663 664 665
          666 667 668 669 670
          671 672 673 674 675
          676 677 678 679 680
          681 682 683 684 685
          686 687 688 689 690
          691 692 693 694 695
          696 697 698 699 700
          701 702 703 704 705
          706 707 708 709 710
          711 712 713 714 715
          716 717 718 719 720
          721 722 723 724 725
          726 727 728 729 730
          731 732 733 734 735
          736 737 738 739 740
          741 742 743 744 745
          746 747 748 749 750
          751 752 753 754 755
          756 757 758 759 760
          761 762 763 764 765
          766 767 768 769 770
          771 772 773 774 775
          776 777 778 779 780
          781 782 783 784 785
          786 787 788 789 790
          791 792 793 794 795
          796 797 798 799 800
          801 802 803 804 805
          806 807 808 809 810
          811 812 813 814 815
          816 817 818 819 820
          821 822 823 824 825
          826 827 828 829 830
          831 832 833 834 835
          836 837 838 839 840
          841 842 843 844 845
          846 847 848 849 850
          851 852 853 854 855
          856 857 858 859 860
          861 862 863 864 865
          866 867 868 869 870
          871 872 873 874 875
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          881 882 883 884 885
          886 887 888 889 890
          891 892 893 894 895
          896 897 898 899 900
          901 902 903 904 905
          906 907 908 909 910
          911 912 913 914 915
          916 917 918 919 920
          921 922 923 924 925
          926 927 928 929 930
          931 932 933 934 935
          936 937 938 939 940
          941 942 943 944 945
          946 947 948 949 950
          951 952 953 954 955
          956 957 958 959 960
          961 962 963 964 965
          966 967 968 969 970
          971 972 973 974 975
          976 977 978 979 980
          981 982 983 984 985
          986 987 988 989 990
          991 992 993 994 995
          996 997 998 999 1000
          1001 1002 1003 1004 1005
          1006 1007 1008 1009 1010
          1011 1012 1013 1014 1015
          1016 1017 1018 1019 1020
          1021 1022 1023 1024 1025
          1026 1027 1028 1029 1030
          1031 1032 1033 1034 1035
          1036 1037 1038 1039 1040
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          1101 1102 1103 1104 1105
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          1111 1112 1113 1114 1115
          1116 1117 1118 1119 1120
          1121 1122 1123 1124 1125
          1126 1127 1128 1129 1130
          1131 1132 1133 1134 1135
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          1146 1147 1148 1149 1150
          1151 1152 1153 1154 1155
          1156 1157 1158 1159 1160
          1161 1162 1163 1164 1165
          1166 1167 1168 1169 1170
          1171 1172 1173 1174 1175
          1176 1177 1178 1179 1180
          1181 1182 1183 1184 1185
          1186 1187 1188 1189 1190
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          1376 1377 1378 1379 1380
          1381 1382 1383 1384 1385
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          1861 1862 1863 1864 1865
          1866 1867 1868 1869 1870
          1871 1872 1873 1874 1875
          1876 1877 1878 1879 1880
          1881 1882 1883 1884 1885
          1886 1887 1888 1889 1890
          1891 1892 1893 1894 1895
          1896 1897 1898 1899 1900
          1901 1902 1903 1904 1905
          1906 1907 1908 1909 1910
          1911 1912 1913 1914 1915
          1916 1917 1918 1919 1920
          1921 1922 1923 1924 1925
          1926 1927 1928 1929 1930
          1931 1932 1933 1934 1935
          1936 1937 1938 1939 1940
          1941 1942 1943 1944 1945
          1946 1947 1948 1949 1950
          1951 1952 1953 1954 1955
          1956 1957 1958 1959 1960
          1961 1962 1963 1964 1965
          1966 1967 1968 1969 1970
          1971 1972 1973 1974 1975
          1976 1977 1978 1979 1980
          1981 1982 1983 1984 1985
          1986 1987 1988 1989 1990
          1991 1992 1993 1994 1995
          1996 1997 1998 1999 2000
          2001 2002 2003 2004 2005
          2006 2007 2008 2009 2010
          2011 2012 2013 2014 2015
          2016 2017 2018 2019 2020
          2021 2022 2023 2024 2025
          2026 2027 2028 2029 2030
          2031 2032 2033 2034 2035
          2036 2037 2038 2039 2040
          2041 2042 2043 2044 2045
          2046 2047 2048 2049 2050
          2051 2052 2053 2054 2055
          2056 2057 2058 2059 2060
          2061 2062 2063 2064 2065
          2066 2067 2068 2069 2070
          2071 2072 2073 2074 2075
          2076 2077 2078 2079 2080
          2081 2082 2083 2084 2085
          2086 2087 2088 2089 2090
          2091 2092 2093 2094 2095
          2096 2097 2098 2099 2100
          2101 2102 2103 2104 2105
          2106 2107 2108 2109 2110
          2111 2112 2113 2114 2115
          2116 2117 2118 2119 2120
          2121 2122 2123 2124 2125
          2126 2127 2128 2129 2130
          2131 2132 2133 2134 2135
          2136 2137 2138 2139 2140
          2141 2142 2143 2144 2145
          2146 2147 2148 2149 2150
          2151 2152 2153 2154 2155
          2156 2157 2158 2159 2160
          2161 2162 2163 2164 2165
          2166 2167 2168 2169 2170
          2171 2172 2173 2174 2175
          2176 2177 2178 2179 2180
          2181 2182 2183 2184 2185
          2186 2187 2188 2189 2190
          2191 2192 2193 2194 2195
          2196 2197 2198 2199 2200
          2201 2202 2203 2204 2205
          2206 2207 2208 2209 2210
          2211 2212 2213 2214 2215
          2216 2217 2218 2219 2220
          2221 2222 2223 2224 2225
          2226 2227 2228 2229 2230
          2231 2232 2233 2234 2235
          2236 2237 2238 2239 2240
          2241 2242 2243 2244 2245
          2246 2247 2248 2249 2250
          2251 2252 2253 2254 2255
          2256 2257 2258 2259 2260
          2261 2262 2263 2264 2265
          2266 2267 2268 2269 2270
          2271 2272 2273 2274 2275
          2276 2277 2278 2279 2280
          2281 2282 2283 2284 2285
          2286 2287 2288 2289 2290
          2291 2292 2293 2294 2295
          2296 2297 2298 2299 2300
          2301 2302 2303 2304 2305
          2306 2307 2308 2309 2310
          2311 2312 2313 2314 2315
          2316 2317 2318 2319 2320
          2321 2322 2323 2324 2325
          2326 2327 2328 2329 2330
          2331 2332 2333 2334 2335
          2336 2337 2338 2339 2340
          2341 2342 2343 2344 2345
          2346 2347 2348 2349 2350
          2351 2352 2353 2354 2355
          2356 2357 2358 2359 2360
          2361 2362 2363 2364 2365
          2366 2367 2368 2369 2370
          2371 2372 2373 2374 2375
          2376 2377 2378 2379 2380
          2381 2382 2383 2384 2385
```

Program III - Basic loader

```

10 REM BASIC LOADER
20 REM BY S. DEAN
30 LET S=0
40 FOR A=29000 TO 29865
50 READ D
60 LET S=S+D
70 POKE A,D
80 NEXT A
90 IF S<>91721 THEN PRINT "ERROR IN DATA PLEASE RE-CHECK":STOP
100 LET S=0
110 FOR A=31232 TO 31295
120 READ D
130 LET S=S+D
140 POKE A,D
150 NEXT A
160 IF S<>3432 THEN PRINT "ERROR IN DATA PLEASE RE-CHECK":STOP
170 PRINT"DATA READ O.K. NOW SAVE THE CODE":STOP
180 DATA 175,50,77,122,50,78,122,50,81,122,50,76,122,50,74,122,50,75,122,50
190 DATA 8,92,33,120,105,34,79,122,205,103,115,205,107,13,205,103,115,17,136,116
200 DATA 1,32,0,205,60,32,205,88,116,58,8,92,167,202,158,114,245,175,50,8
210 DATA 92,241,254,11,32,8,62,32,50,76,122,195,158,114,254,10,32,7,175,50
220 DATA 76,122,195,158,114,254,14,32,1,201,254,12,32,24,58,81,122,254,1,202
230 DATA 158,114,62,1,50,81,122,211,95,205,78,116,205,156,115,195,158,114,254,9
240 DATA 32,20,58,81,122,254,0,202,158,114,175,50,81,122,211,95,205,88,116,195
250 DATA 158,114,254,15,32,29,58,81,122,254,2,202,158,114,62,2,50,81,122,205
260 DATA 78,116,62,1,211,95,205,78,116,205,156,115,195,158,114,33,0,122,1,64
270 DATA 0,237,177,32,72,205,41,114,254,13,32,5,62,10,205,41,114,195,158,114
280 DATA 175,185,200,126,197,229,205,41,114,58,81,122,254,0,32,3,205,27,116,225
290 DATA 193,35,11,24,231,237,91,77,122,245,62,3,186,48,2,241,201,42,79,122
300 DATA 241,119,19,237,83,77,122,35,34,79,122,245,205,16,115,241,201,254,7,32
310 DATA 15,33,87,122,237,75,82,122,205,16,114,195,158,114,254,6,32,13,33,87
320 DATA 123,237,75,83,122,205,16,114,195,158,114,254,4,32,13,33,87,124,237,75
330 DATA 84,122,205,16,114,195,158,114,254,5,32,13,33,87,125,237,75,85,122,205
340 DATA 16,114,195,158,114,254,8,32,13,33,87,126,237,75,86,122,205,16,114,195
350 DATA 158,114,58,81,122,254,0,204,27,116,58,81,122,254,1,204,169,115,58,81
360 DATA 122,254,2,204,16,116,195,121,113,254,5,216,254,13,32,10,62,32,205,2
370 DATA 115,175,50,74,122,201,245,205,103,115,254,10,32,13,33,0,64,205,111,115
380 DATA 62,143,205,2,115,241,201,62,22,215,62,7,215,58,74,122,215,241,215,58
390 DATA 74,122,60,254,32,56,6,33,0,64,205,111,115,50,74,122,62,143,205,2
400 DATA 115,201,245,62,22,215,62,7,215,58,74,122,215,241,215,201,254,5,216,254
410 DATA 13,32,10,62,32,205,89,115,175,50,75,122,201,245,205,103,115,254,10,32
420 DATA 13,33,160,72,205,111,115,62,143,205,89,115,241,201,62,22,215,62,20,215
430 DATA 58,75,122,215,241,215,58,75,122,60,254,32,56,6,33,160,72,205,111,115
440 DATA 50,75,122,62,143,205,89,115,201,245,62,22,215,62,20,215,58,75,122,215
450 DATA 241,215,201,245,62,2,205,1,22,241,201,1,32,7,197,229,84,93,197,30
460 DATA 32,0,68,25,125,254,32,48,4,124,198,7,103,229,237,176,209,195,16,254
470 DATA 65,175,18,19,16,252,225,193,36,124,230,7,32,216,175,201,6,3,33,255
480 DATA 255,43,124,167,32,251,16,246,201,219,63,203,79,200,237,75,77,122,175,185
490 DATA 32,2,184,200,17,120,105,26,107,98,35,237,176,257,75,77,122,11,257,67
500 DATA 77,122,237,75,79,122,11,237,67,79,122,33,0,122,1,64,0,237,177,192
510 DATA 229,205,185,114,225,43,58,76,122,173,205,111,40,22,125,230,32,50,76,122
520 DATA 254,0,32,7,62,31,205,5,116,24,5,62,27,205,5,116,125,205,5,116
530 DATA 201,245,219,63,203,79,40,250,241,211,63,201,62,10,205,5,116,62,21,205
540 DATA 5,116,201,219,63,203,71,200,33,0,122,58,76,122,111,219,31,211,31,254
550 DATA 27,32,6,62,32,50,76,122,201,254,31,32,6,62,0,50,76,122,201,181
560 DATA 111,126,229,205,185,114,225,125,230,32,50,76,122,201,17,98,116,1,19,0
570 DATA 205,60,32,201,17,117,116,1,19,0,205,60,32,201,22,10,1,17,2,16
580 DATA 7,84,82,65,78,83,77,73,89,17,7,16,0,22,10,1,17,4,16,7
590 DATA 82,69,67,69,73,86,69,32,17,7,16,0,22,10,14,82,84,84,89,32
600 DATA 127,32,83,46,68,69,65,78,17,0,22,8,0,23,31,0,32,22,12,60
610 DATA 23,31,0,32,17,7
620 DATA 0,69,10,65,32,83,73,85
630 DATA 13,68,82,74,78,70,67,75,84,90,76,87,72,89,80,81,79,66,71,0
640 DATA 77,88,86,0,0,51,10,45,32,33,56,55,13,32,52,32,44,37,58,40
650 DATA 53,43,41,50,96,54,48,49,57,63,64,0,46,47,61,0

```

available the machine code can be entered from Program II, otherwise the loader (Program III) can be used. This program pokes the machine code in from the data statements and verifies that the data is correct by adding all the numbers and checking the total against the checksum value obtained from the prototype program.

If an error is detected by the program, the numbers in the DATA lines should be checked carefully. This is almost certainly the hardest part of typing in the program, but the data must be exactly as listed. Incidentally, don't delete the checksum lines in the hope that it might just work. Take it from me - it won't.

Once the code has been generated successfully (shown by DATA READ O.K.), save it with SAVE "rtty.obj" CODE 29000,3600, after the Basic which was saved earlier.

Testing the program

With the terminal connected (turn off the supply first!), load and run the program in the normal manner using LOAD". If all is well the menu will appear, and operation can be confirmed.

Operating instructions

When running, the following options are available from the menu (note: don't use the 'Enter' key when selecting from the menu).

Set Memories: This option allows the operator to examine and change the contents of the five memories. The operator is asked which of the memories to alter, and the contents of the selected memory are displayed along with its length and the 'alter Y/N' prompt.

To change the contents, answer Y then type in the new contents. If most of the original contents are correct, or if text needs to be added at the end of a

memory, the cursor right key (caps shift 8) will copy characters from the old contents to the new up to the desired position. To correct typing errors, use the cursor left key (caps shift 5) to delete the text one character at a time.

For example, to correct the omission of i in details, press left arrow twice to delete the s and l, then continue typing ils to complete the word.

To terminate a memory entry, use the 'E' key (symbol shift 3). This is used rather than the more usual Enter to allow the latter to be employed to insert carriage return/line feeds into the memory as required. The program will issue a warning beep when the memory is almost full (more than 245 characters), and any text entered after the 255th will be ignored.

Run Program: This option starts the terminal in the receive mode with the received text appearing in the top window. Text to be transmitted may then be compiled in the bottom window (the terminal may be immediately switched to transmit if required).

Memories may be added to the buffer by using caps shift 1-5. Each keypress is checked to see if it is a valid 5-bit ASCII character, invalid keys being ignored.

To transmit the compiled message press caps shift 0: each character will appear as it is sent, in the top window. Text may still be added while sending, even to the point when the keyboard buffer is empty. A short delay is provided when switching to transmit to allow any relays in the transmitter to operate.

A continuous stream of RYs may be sent by pressing caps shift 9. This will continue until another mode is selected. Note that the RYs are not displayed in the window.

To return to the menu, press caps shift and symbol shift.

Caps shift 1	Put memory 1 into transmit buffer
Caps shift 2	Put memory 2 into transmit buffer
Caps shift 3	Put memory 3 into transmit buffer
Caps shift 4	Put memory 4 into transmit buffer
Caps shift 5	Put memory 5 into transmit buffer
Caps shift 6	Letter shift (receive only)
Caps shift 7	Figure shift (receive only)
Caps shift 8	Receive mode
Caps shift 9	Send RYs
Caps shift 0	Transmit mode

Caps shift + symbol shift Return to menu

Enter Issue a carriage return/line feed

Save Memories: This option need only be used if the contents of a memory have been altered, and a permanent record is required. Before saving memories, rewind the tape to the beginning and follow the usual prompts.

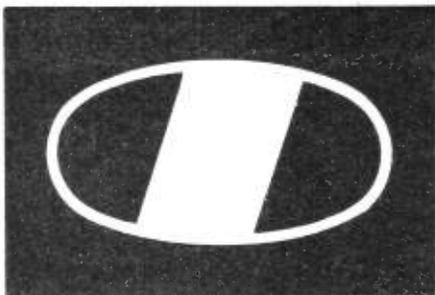
Well that's about it, except to remind the more idle of readers that a tape containing the program can be obtained from the author for a mere £4.50 including postage (make cheques payable to S Dean and send them to the editorial offices).

READER OFFER

For those of you interested in building a RTTY terminal unit for the Spectrum, *Radio and Electronics World* now has a stock of PCBs for the unit designed by S Dean, as published in the February issue of the magazine.

The board measures 14.5 x 11cms and costs £9.20 including postage and packing.

To order your board please send a cheque or postal order made payable to *Radio and Electronics World* to: *Radio and Electronics World Magazine*, Sovereign House, Brentwood, Essex CM14 4SE. Allow 28 days for delivery.



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If you want a handheld with exceptional features, quality built to last and a wide variety of interchangeable accessories, take a look at the ICOM range of FM transceivers. All ICOM handhelds come with an IC-BP3 nicad battery pack, flexible antenna, AC wall charger, belt clip, wrist strap and personal earpiece as standard.

IC-2E/4E, 2 metre and 70cm thumbwheel handportable.

These popular handhelds from ICOM are still available. For those Amateurs who require a simple but effective FM transceiver the IC-2E and 4E take some beating. Frequency selection is by means of thumbwheel switches (with 5kHz up-switch) and duplex or simplex facility. Power output is 1.5 watts or 150 milliwatts (2.5 watts is possible with IC-BP5A battery pack).

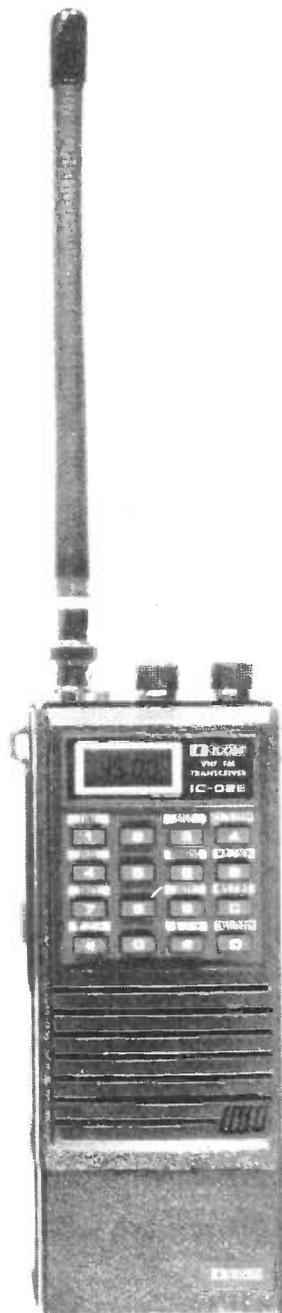
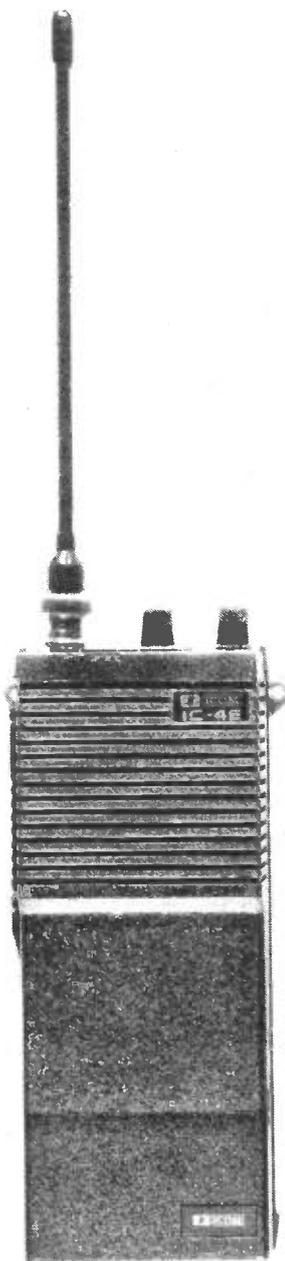
IC-02E/04E 2 metre and 70cm keypad handportable.

These direct-entry CPU controlled handhelds utilize a 16-button keypad allowing easy access to frequencies, memories and scanning. Ten memories store frequency and offset. Three scanning systems, priority, memory and programmable band scan, (the IC-02E now with an improved CPU retains duplex offset). These handhelds have an LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions. Power output is 3 watts or 0.5 watt in low power position for the IC-02E and 2.5 watts or 0.5 watt for the IC-04E. (5 watts is possible with the IC-BP7 battery pack or external 13.8V.DC.)

STOP PRESS. New handheld available. Just released is the **IC-12E** 23cm keypad handportable, this new transceiver has direct keypad entry for frequency, memories and scanning systems. Ten memories store operating frequency simplex or duplex. An internal power module provides 1 watt or 100 milliwatts of RF power. Five tuning speeds including 12.5kHz and 25k $\frac{1}{2}$.

Also available for ICOM handhelds are a large range of optional extras including a variety of rechargeable nicad power packs, dry-cell battery pack, desk charger, headset and boom mic, speaker mic, leatherette cases and mobile mounting brackets.

For more information on these handportables and other ICOM Amateur equipment contact your local authorised ICOM dealer or Thanet Electronics Ltd.



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JANUARY 1986

Features - Power Supplies, the final instalment; Calculating Inductance, use your computer to make it easy; Volmet, airport weather forecasts; Active Audio Bandpass Filter, an original and novel design; Data File, IGFET and MOSFET devices; Antenna Tuning Unit, a useful and straightforward project; Radio Data Systems, data transmissions alongside entertainment broadcasts; Traps, making traps using miniature coaxial cable.



FEBRUARY 1986

Features - Trio R-2000, an interesting communications receiver; Modifying the Icom IC240, a mod to give 48 channels and remote control; Foil Aerials, cheap and cheerful antennas; Data File, VMOS power FETs; RTTY using the Spectrum, part 1 of a project to build a terminal unit for data transmission; Photographing Displays, how to take photos of display media, from LCDs to CRTs.



MARCH 1986

Features - Variable ac Power Supply, a useful construction project; Dragon 32/64 Morse Tutor, a program to help you tackle the dreaded code; Satellite TV, TV reception via satellite; Data File, bipolar transistor principles; RTTY Decoding using the Spectrum, part 2.



APRIL 1986

Features - Icom IC-2 Modification, a listen-on-input mod; The Icom IC-R71E, a user review; Computing - Low-Pass Filters, a design program; Data File, the common-collector transistor amplifier; Nicad Discharger, how to construct a unit to protect your 12V batteries; Vectors and Rotating Waveforms, an explanation; Long Wave Loop Antenna, a construction project for the much neglected LW band.



MAY 1986

Features - VPS Video Timers, an efficient video recorder timing system; Computing - Transformers, a program to calculate transformer capabilities; Small Fires in Jam Jars, part 1 of an explanation of valves; Data File, voltage amplifying transistor circuits; Can You 'ear Me Moother? A cheap 5-element quad for 2m; Damp Detector, a useful device for the bathroom.



JUNE 1986

Features - Spotlight on PRS, "people's radio" at 900MHz? Shunting Panel Meters, avoiding low resistor values; Voltage Regulators, the basics of using IC regulators; Small Fires in Jam Jars, part 2; Data File, a look at oscillators; Spectrum Morse, hardware and software; Noise Limiter, an easy listening add-on for your receiver.



JULY 1986

Features - ASTRID, some UoSAT reception hardware; The Starphone on 70, an interesting modification; CAD for the ZX Spectrum, a program for designing common emitter amps and active filters; Data File, generating square waves, sawtooths and white noise waveforms; 13.8 Volt 20 Amp Power Supply, a low cost, well-regulated PSU; Network 934, upmarket CB.



AUGUST 1986

Features - Icom IC-735, an amateur radio rig incorporating computer technology; Silver Sensor, a high performance set-top aerial; Computers, Receivers and Interference, an explanation and some solutions; TVRO Receiver Project, a low cost alternative to buying off-the-shelf; Data File, transistor audio preamps; Lighting ATV, shedding some light on a neglected subject.

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C P I

THE TRIODE VALVE

As you probably know from the earlier article on valves (*R&EW* May and June '86), the ability of the diode valve to pass current flow in one direction was demonstrated by J A Fleming in 1904 and is the fundamental property of the electronic valve.

Experiments were subsequently carried out in an attempt to externally control the flow rate of electrons from cathode to anode. It was not until 1908 that it could be successfully demonstrated that the introduction of a mesh of wire positioned between the cathode and anode would influence the flow of electrons, the influence exerted depending upon the potential difference between this grid of wire and the cathode.

Principles

The space charge surrounding the cathode plays an important part in the movement of electrons. The potential of the space charge will determine whether electrons travel on to the anode or return to the cathode.

If a grid of wire is positioned so that it encloses the cathode in the space charge region, its potential with respect to the cathode will influence the flow of electrons. This mesh of wire is known as the control grid (abbreviated to grid), and is of open mesh or spiral construction so as not to impede electron flow.

It is apparent that the potential applied to the grid will have a much greater relative influence on the space charge than the anode will have for the same applied potential, since the grid is much closer. The control grid therefore provides a very effective way of regulating the electron flow from cathode to anode. For a given cathode temperature, the electron flow or anode current I_a will now depend not only upon the anode potential V_a , but also upon the grid potential V_g .

PART ONE

by Roger Alban GW3SPA

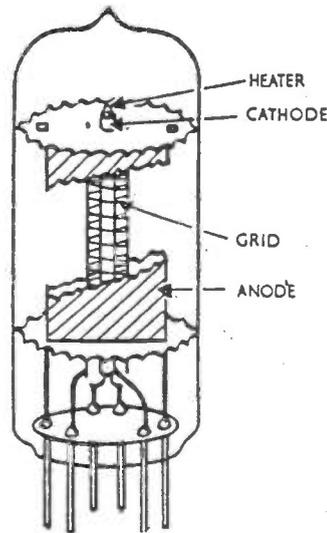


Fig 1 Construction of triode valve

Construction

In the construction of a typical small triode valve, the cathode is a tube of circular or rectangular cross section, the anode is a cylindrical or rectangular box of thin sheet metal surrounding the cathode, and the grid is a helical winding of thin wire supported between anode and cathode.

Figure 1 shows the construction of a typical triode valve. The grid does not necessarily prevent electrons leaving the cathode from reaching the anode: they pass between the wires of the grid.

Valve parameters

As mentioned earlier, the anode current I_a can be influenced by three possible variables: filament temperature, anode voltage V_a , and grid voltage V_g . In practice the valve must be designed to give sufficient emission of electrons for the particular purpose for which it is intended. The cathode is arranged to be operated at a fixed temperature which will provide the required electron emission and ensure long life.

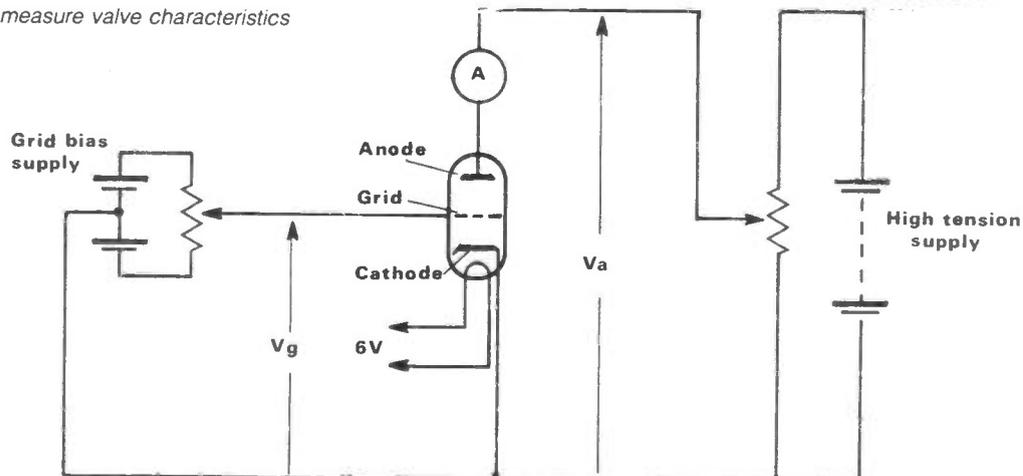
When the characteristic performance of the triode valve is measured, the cathode is heated under a specified fixed condition, and either the anode voltage or the voltage applied to the grid is varied while the resulting anode current is recorded. These variations may also affect the flow of grid current.

Test circuit

A test circuit suitable for measuring the static valve characteristics is shown in Figure 2. The filament is connected to a constant voltage source of 6V, which heats the cathode to the required temperature. In the anode circuit a potentiometer is connected across the high tension anode battery supply to permit the anode voltage to be finely adjusted. The anode current is read by the ammeter inserted in the anode supply circuit. A voltmeter is connected across the triode between anode and cathode to measure anode voltage. The battery in the grid circuit is centre-tapped and shunted by a potentiometer.

By using this circuit configuration the voltage applied to the grid can be continuously varied over a wide range of positive and negative values, recorded on a voltmeter connected between the grid and cathode. These measurements will give the 'static' characteristics of the triode valve, since they are measured

Fig 2 Test circuit to measure valve characteristics



THE TRIODE VALUE

Fig 3 Anode characteristics of triode valve

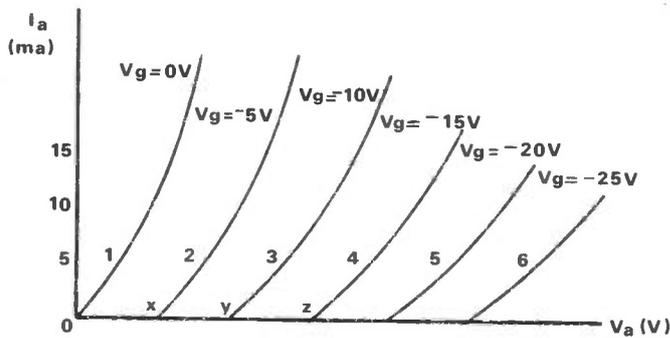


Fig 4 Mutual characteristics of small triode valve

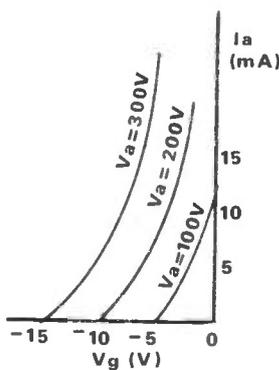


Fig 5 Anode slope resistance

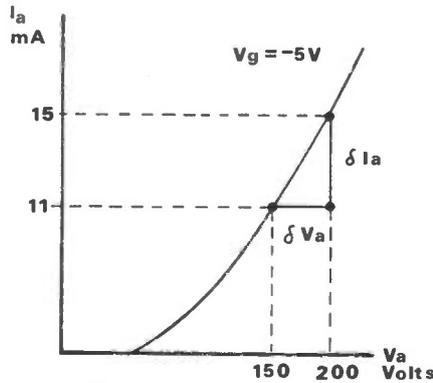


Fig 6 Obtaining anode slope resistance from mutual characteristics

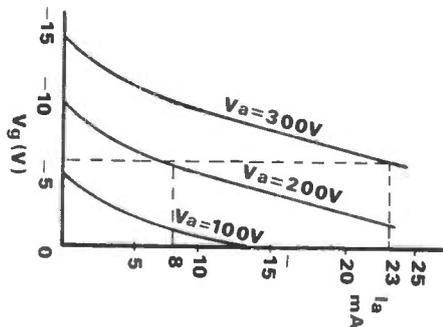
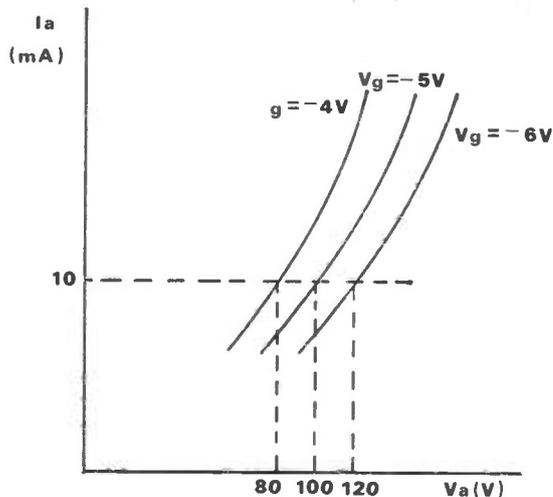


Fig 7 Using the anode characteristics to obtain the amplification factor



with fixed values of voltage applied to the various electrodes and not with the varying or dynamic potentials of normal operation.

It is not possible to represent the behaviour of a triode by a single characteristic curve, as could be done for the diode. This is because the anode current is controlled by both the anode and grid voltages. It is therefore necessary to devise graphs to show the effect of both voltages at once.

The usual practice is to present two sets of characteristic curves, with one set showing anode current against anode voltage for various fixed values of grid voltage. Another characteristic curve is plotted showing anode current against grid voltage for various fixed values of anode voltage.

If we plot anode current against anode voltage for various fixed values of grid voltage we obtain the characteristic curve shown in *Figure 3*. As there is no fundamental difference in principle of operation between a diode and a triode we can consider initially what happens if the grid is connected directly to the cathode, ie if the grid voltage V_g is zero. Under this condition the triode behaves in much the same way as a diode, and its characteristic curve is like curve 1 in *Figure 3*.

To observe the effect of varying the value of V_g the test circuit shown in *Figure 2* is used and the potentiometer in the grid bias supply varied to obtain various fixed values of grid voltage. For each grid voltage individual curves of anode voltage against anode current are plotted.

For example, suppose the grid is made $-5V$. If the anode voltage V_a is zero, the electrostatic field surrounding the grid will prevent any electrons from passing through the grid and thus I_a will be zero. Anode current will only flow if the anode is made sufficiently positive to overcome the effect of the negative charge on the grid. This occurs at point X on the graph shown in *Figure 3* at the foot of curve 2.

For values of V_a less than this the anode current will remain cut off, while for values greater than this the current rises when V_a is increased, giving a characteristic resembling that of a diode.

Curve 2 in *Figure 3* shows a similar graph shape to that of curve 1, but is displaced to the right of the diagram. Curves 3, 4, 5, and 6 are again similar in shape. Every increase in negative grid bias causes a further displacement to the right requiring higher values of V_a to encourage anode current to flow.

This set of curves is called the static anode characteristics. Any convenient value of V_g can be chosen for the individual curves, but V_g must be held constant for any one curve. It can be seen that the distance between the curves is almost equal, showing that for this

particular valve every 5V increase in negative grid bias requires about 100V increase in positive anode voltage to counteract the influence of the grid.

Mutal conductance

Another set of characteristic curves can be plotted when the anode voltage is held constant and the grid voltage is varied, with the anode current being measured. The resulting graphs are shown in *Figure 4*.

It will be observed that these graphs have a considerable linear portion which for the three curves plotted are parallel and equally spaced. It can be seen from *Figure 4* that the anode current decreases as the grid bias is increased, until eventually the cut-off point is reached. The higher the value of V_a the greater the bias required to achieve cut-off.

The slope of the straight portion of the graph is the ratio of current to voltage, or conductance. The values of current and voltage are obtained from separate circuits comprising the anode and grid. Therefore the slope of the graph is known as the control grid to anode transconductance, more usually known as the mutual conductance. This is a measure of the control exercised by the grid over the anode current and is defined as the ratio of small change in anode current to the change in grid voltage which causes it. Mutual conductance is denoted by the symbol g_m and is measured not in mhos but in milliamps per volt.

It is customary for valve manufacturers to provide both the anode characteristics and the mutual conductance characteristics, although it is possible to obtain one from the other. Sometimes the third possible set is also given, showing V_a plotted against negative V_g , each curve being plotted for a fixed value of I_a .

Triode coefficients

Having obtained the anode and mutual conductance characteristics for the triode it is now possible to predict how it will behave when used in a circuit. However, it is possible to simplify the design work required by considering only the part of the characteristics where the curves are roughly straight and parallel. The three quantities I_a , V_a , and V_g are then taken two at a time, and for each pair the change in one quantity caused by a small change in the other is found.

Valve resistance

With the grid potential held at a constant value, the anode characteristic curve is obtained for various fixed values of grid voltage. The linear portion of these curves for various fixed values of grid voltage measures the ratio of anode current to anode voltage, and is called the internal conductance of the valve.

The reciprocal of this is the voltage to current ratio, which is known as the ac resistance or the internal impedance, or alternatively the slope resistance for the triode. This is defined as the ratio of a small change in anode potential to the change in anode current which results, the grid potential remaining constant. It is measured in ohms and is denoted by the symbol r_a .

Over the linear portion of the curve for the grid voltage held at 5 volts, *Figure 5*, if I_a is the small change in anode current resulting from a small change V_a in anode voltage, then:

$$r_a = \frac{V_a}{I_a}$$

In the graph shown in *Figure 5*, the ac resistance is:

$$r_a = \frac{200 - 150}{(15 - 11) \times 10^{-3}} = \frac{50 \times 10^3}{4}$$

$$= 12,500 \text{ ohms}$$

The ac resistance may also be determined from a pair of graphs showing the mutual characteristic. If we extend the mutual characteristic graph shown in *Figure 4* to obtain the graph shown in *Figure 6*, we can see that if we hold the grid voltage constant at -6V and draw a dotted vertical line which will cut the linear portion of the curves for V_a at 200V and V_a at 300V, the change in anode voltage will produce a rise in anode current from 8mA up to 23mA. Therefore the ac resistance is:

$$r_a = \frac{300 - 200}{(23 - 8) \times 10^{-3}} = \frac{100 \times 10^3}{15}$$

$$= 6,700 \text{ ohms}$$

Amplification factor

When the grid voltage is varied it results in a change of anode current. The amplification factor of the triode is the ratio of the change in V_a to the change in V_g , with I_a being held constant. Therefore if we are to obtain the amplification factor we must hold I_a constant after V_g has been varied. It will be necessary to readjust the value of V_a to obtain the original value of I_a .

A set of characteristic curves can be plotted to obtain the ratio, or it can be obtained from the anode characteristic curve as shown in *Figure 7*. If I_a is held constant at, say, 10mA, then a change in grid voltage will result in a change in anode voltage. As both V_a and V_g are measured in volts, μ has no units and is merely a number, typical values ranging from 10 to 100.

In the example shown in *Figure 7*, the value of the amplification factor will be:

$$\mu = \frac{V_a}{V_g} = \frac{120 - 80}{6 - 4} = \frac{40}{2} = 20$$

This procedure can be applied to any triode by measuring the horizontal distance between the chosen curves for V_g to obtain the change in V_a along the horizontal axis of the graph. It is wise whenever possible to take a measurement of the rate of change either side of the proposed operating point of the valve to obtain the average value.

Mutual conductance

The third coefficient required is the mutual conductance, which has already been calculated from the mutual characteristic curve shown in *Figure 4*.

The mutual conductance of the triode can be calculated by holding the anode voltage constant at, say, 200V and determining the change in I_a when V_g is varied. Thus:

$$g_m = \frac{I_a}{V_a} = \frac{15 - 5}{7 - 4} = \frac{10}{3}$$

$$= 3.3\text{mA/V}$$

Typical values range from 1 to 10mA/V. A knowledge of the valve parameters enables the most suitable type of triode to be selected for a particular purpose from the wide range of valves available.

A simple relationship exists between the various parameters. As previously derived, the amplification factor $\mu = V_a / V_g$. If we now multiply numerator and denominator by I_a and rearrange the equation we obtain:

$$\mu = \frac{V_a}{I_a} \times \frac{I_a}{V_g}$$

which can be rewritten as:

$$\mu = r_a \times g_m$$

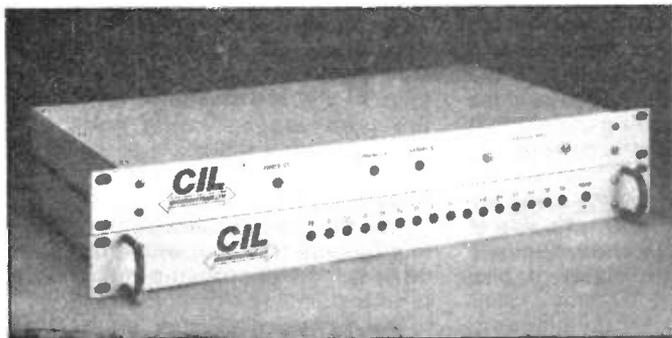
This equation is always true provided the three coefficients are always measured near the same operating point.

Under certain conditions grid current will flow: if the grid is positive with respect to the cathode, some of the electrons on their way to the anode will be attracted towards the grid.

Up to a certain limit this grid current is practically independent of the voltage applied to the anode. If the anode voltage is high, the electron velocity will also be high. Electrons will then collide with the grid with such force as to knock off other electrons, which will then be attracted to the anode. This is a form of secondary emission and will result in the grid current being reduced.

If air has found its way into the valve glass envelope and the valve has become 'soft', some of the positive ions formed by collision between electrons and gas molecules will be attracted to the grid, even when the grid voltage is negative with respect to the cathode. This will be equivalent to a negative grid current and is sometimes referred to as 'backlash' or reversed grid current. Absence of reversed grid current is an indication that the valve vacuum has not been contaminated with air.

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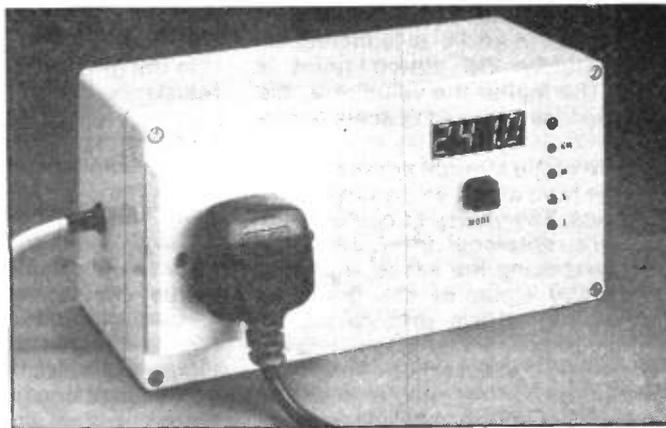
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Ray Marston looks at audio power amplifier principles

In recent editions of *Data File* we have taken a look at the operating principles and applications of the discrete bipolar transistor, including practical low power amplifier circuits and different types of multivibrator and oscillator design. Last month we concentrated on audio preamplifier and tone control circuits, etc. In the present edition of 'The File' we continue the audio theme by looking at the operating principles of low frequency power amplifier circuits.

Power amplifier basics

Basically, a transistor audio power amplifier's job is that of converting the medium level, medium impedance ac output voltage of a preamplifier stage (described last month) into a high level power-amplified state suitable for driving a low impedance device such as a loudspeaker or pair of headphones etc, and to do so with the minimum of signal distortion.

This action can be achieved by operating the transistor(s) in either of two basic modes, known as 'class A' or 'class B'. Figures 1 and 2 outline the basic principles of these two operating modes.

A basic class A amplifier normally consists of a single transistor wired in the common emitter mode with the speaker acting as its collector load, as shown in Figure 1a. The essential feature of this type of amplifier is that its input (base) is biased so that the collector current takes up a quiescent value roughly half-way between the desired maximum and minimum swings of output current, as shown in Figure 1b, so that maximal undistorted output signal swings can be obtained. From this description it can be seen that if the ac and dc impedances of the speaker load are the same, the transistor collector voltage takes up a quiescent value of roughly half-supply volts.

Excellent signals

The class A amplifier is simple and produces excellent low distortion audio signals. Its major disadvantages are that it consumes a high quiescent current and is relatively inefficient. Amplifier 'efficiency' can be regarded as the ratio of ac power feeding into the load to the dc power consumed by the circuit. At maximum output power the efficiency of the class A amplifier is typically about 40% (the theoretical maximum is 50%), falling to about 4% at one tenth of maximum output and to near-zero at very low output power levels.

A basic class B amplifier normally consists of a pair of transistors driven in anti-phase but driving a common output load, as shown in Figure 2a. In this particular design the two transistors are wired in the common emitter mode and drive the speaker via push-pull transformer T2, and the anti-phase input drive is obtained via phase-splitting transformer

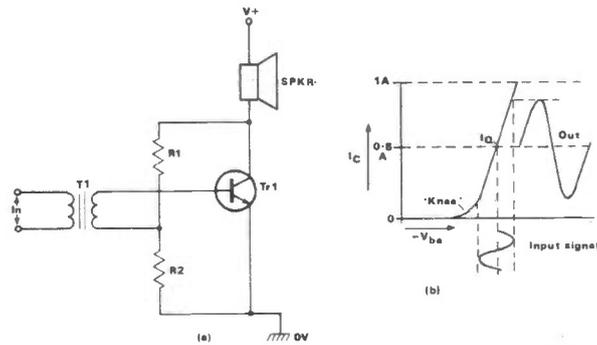


Fig 1 Basic circuit (a) and transfer characteristics (b) of class A amplifier

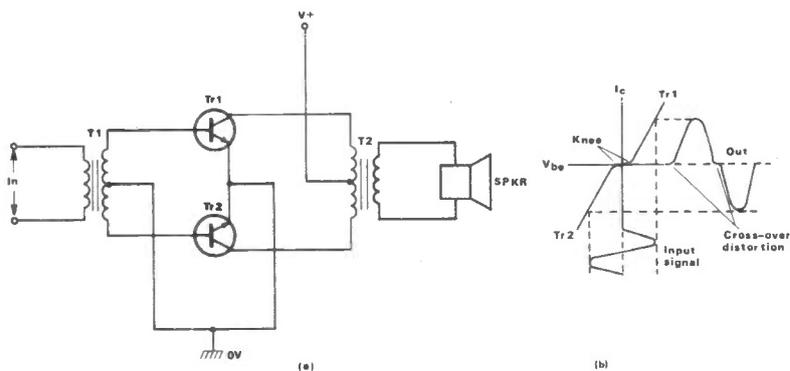


Fig 2 Basic circuit (a) and transfer characteristics (b) of class B amplifier

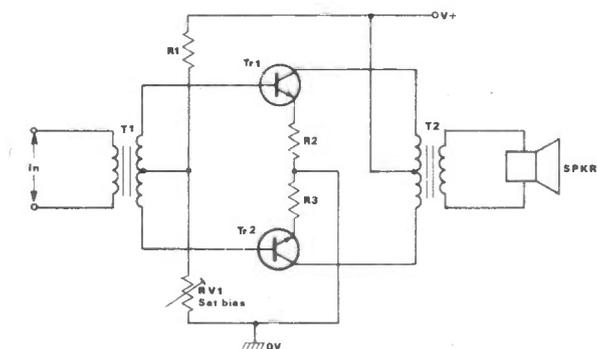


Fig 3 Basic circuit of class AB amplifier

T1. The essential features of this type of amplifier, however, are that neither transistor is biased on under quiescent conditions and that one transistor is driven on when the other is driven off, and vice versa.

The major advantages of the class B amplifier are that it consumes near-zero quiescent current and has a very high efficiency (theoretically up to 78.5%) under all operating conditions. Its major disadvantage is that it produces high levels of signal distortion, as is made clear by the graph of Figure 2b.

The basic action of the Figure 2a circuit is such that both transistors are cut off under quiescent conditions, since both transistors are operated with zero base

bias. Consequently neither transistor conducts until the input drive signal exceeds the base-emitter 'knee' voltage (about 600mV) of the transistor. This factor results in severe cross-over distortion in the output signal of the amplifier, as shown in Figure 2b.

Cross-over distortion is highly objectionable to the audio listener, so in practice the basic class B circuit must be modified if it is to be used as a practical audio power amplifier. The modified circuit is known as a 'class AB' amplifier.

The major advantage of the class B amplifier is that it consumes very little quiescent current. Its major disadvantage is that it generates severe cross-over distortion. In practice the cross-

over distortion can be virtually eliminated by applying slight forward bias to the base of each transistor, as shown in *Figure 3*, so that each transistor passes a modest amount of quiescent current. Such a circuit is known as a class AB amplifier.

The basic class AB amplifier circuit of *Figure 3* was widely used in many early transistor power amplifier systems, but can now be regarded as obsolete. One of its main disadvantages is that it requires the use of transformers for input phase splitting and output speaker driving. Another disadvantage is that its two transistors must have closely matched electrical characteristics; if they do not, they will give unequal values of signal amplification and a good low distortion performance will not be obtained.

Figure 4 shows the basic circuit of a class AB amplifier that suffers from none of the snags mentioned above. It uses a complementary pair of transistors (one pnp and one npn) wired in the emitter follower mode, and uses a split (dual) power supply. The two emitter followers are biased (via R1-R2) so that their outputs are at zero volts, and zero current flows in the speaker load under quiescent conditions, but they have slight forward bias applied (via RV1) so that they pass modest quiescent currents and thus do not suffer from cross-over distortion problems. Identical input signals are applied (via C1 and C2) to the bases of the emitter followers, which do not require the use of a 'split-phase' drive system.

The circuit operates as follows. When an input signal is applied to the *Figure 4* circuit, the positive parts drive Tr2 off and drive Tr1 on. Tr1 is an npn transistor, and acts as a current source with a very low output (emitter) impedance: it feeds a faithful unity-voltage-gain copy of the signal directly to the speaker under this condition, almost irrespective of the actual parameter values of Tr1. Similarly, the negative parts of the input signal drive Tr1 off and Tr2 on. Tr2 is a pnp

device, and acts as a current sink with a very low input (emitter) impedance: it draws a faithful unity-voltage-gain copy of the signal from the speaker under this condition, almost irrespective of the actual parameters of Tr2.

Thus the basic *Figure 4* circuit does not require the use of transistors with closely matched electrical characteristics, and does not call for the use of input or output transformers. The design can be modified for use with a single-ended power supply by simply connecting one end of the speaker to either the zero or the positive supply rail and connecting the other end to the amplifier output via a high value blocking capacitor, as shown in *Figure 5*.

The basic *Figure 4/5* circuit forms the basis of virtually all modern hi-fi audio power amplifier designs, including those in integrated circuit form. Let's look at some of the many modifications that can be made to the basic circuit.

Circuit variations

The basic *Figure 4* circuit gives zero overall voltage gain, so the most obvious circuit modification is to provide it with a voltage-amplifying driver stage, as shown in *Figure 6*. Here, Tr1 is wired as a common emitter amplifier and drives the

two emitter followers via collector load resistor R1. Note that Tr1 base bias is derived from the circuit's output via R2-R3, thus providing dc feedback to stabilise the circuit's operating points and ac feedback to minimise signal distortion.

Figure 6 also shows how a form of auto-bias can be applied to Tr2 and Tr3 via silicon diodes D1 and D2. If simple potential-divider biasing is applied to the circuit as in *Figure 4* it will be found that the circuit's quiescent current will increase when the ambient temperature rises (because of the thermal characteristics of the transistor base-emitter junctions) and decrease as the temperature falls. In *Figure 6* the biasing is derived from the forward voltage drop of the D1-D2 silicon diodes, which inevitably have thermal characteristics that are almost identical to those of the Tr2-Tr3 base-emitter junctions, thus giving the circuit near-perfect thermal compensation.

In practice a small preset pot is usually wired in series with D1-D2 to allow the bias voltage to be adjusted over a limited range, and low value resistors R4 and R5 are wired in series with Tr2 and Tr3 emitters to provide a degree of dc negative feedback.

Fig 4 Basic class AB amplifier with complementary emitter follower output and dual power supply

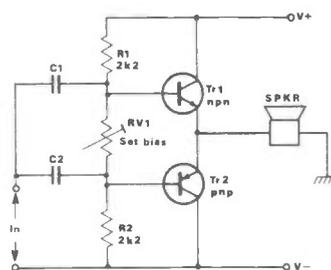


Fig 5 Alternative versions of the class AB amplifier with single-ended power supply

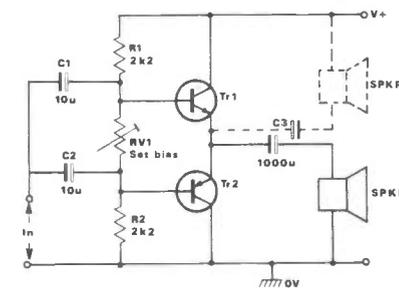


Fig 6 Complementary amplifier with driver and auto-bias

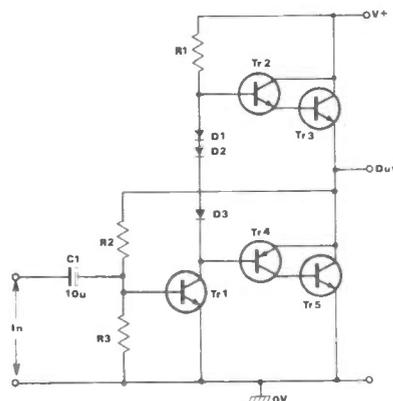


Fig 7 Amplifier with Darlington output stages

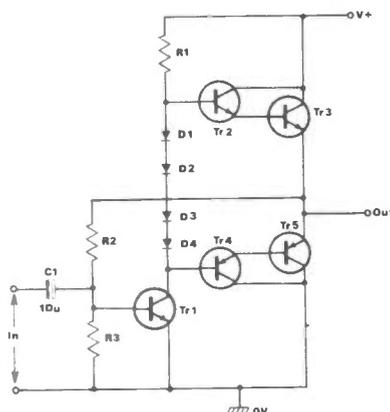
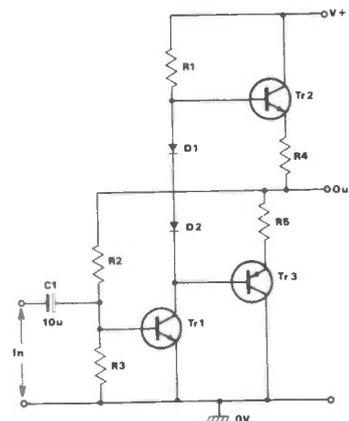


Fig 8 Amplifier with quasi-complementary output stages



The input impedance of the basic *Figure 4* circuit equals the product of the speaker load impedance and the current gain of Tr1 or Tr2. An obvious circuit improvement is to replace the individual Tr1 and Tr2 transistors with 'super-alpha' connected pairs of transistors, thereby greatly increasing the input impedance of the circuit and enabling the amplifier to be used with a driver with a large value collector load. *Figures 7 to 9* show three alternative ways of modifying the *Figure 6* circuit in this way.

In *Figure 7* Tr2-Tr3 are wired as a Darlington-connected npn pair, and Tr3-Tr4 are wired as a Darlington-connected pnp pair of transistors. Note in this circuit that four base-emitter junctions exist between Tr2 base and Tr4 base, so the output circuit must be biased via a chain of four silicon diodes.

In *Figure 8* Tr2-Tr3 are wired as a Darlington-connected npn pair of transistors, but Tr3-Tr4 are wired as a complementary pair of common emitter amplifiers that operate with 100% negative feedback and provide unity voltage gain and a very high input impedance. The *Figure 8* circuit configuration is known as a 'quasi-complementary' output stage, and is probably the most popular of all class AB amplifier con-

figurations. Note that this circuit calls for the use of three biasing diodes.

Finally, in *Figure 9* both Tr2-Tr3 and Tr4-Tr5 are wired as complementary pairs of unity-gain common emitter amplifiers with 100% negative feedback, but are virtual 'mirror images' of each other. The circuit thus has a complementary output stage. This circuit calls for the use of only two biasing diodes.

Amplified diode

The circuits of *Figures 6 to 9* all call for the use of a chain of silicon 'biasing' diodes. If desired, each of these chains can be replaced by a single transistor and two resistors wired in the 'amplified diode' configuration shown in *Figure 10*.

Looking at this diagram, it can be seen that if R1 is replaced by a short the circuit output will equal the base-emitter junction 'diode' voltage of Tr1, and will have the thermal characteristics of a single diode. If R1 equals R2 the circuit will act like two series-connected diodes, and if R1 equals 3xR2 it will act like four series-connected diodes, and so on. Thus the *Figure 10* circuit can, by adjusting the R1/R2 ratios, be made to simulate any desired whole or fractional number of series-connected diodes.

Figure 11 shows how the circuit can be modified so that it acts as a fully adjustable 'amplified diode', with an output variable from 1 to 5.7 x the base-emitter junction voltage.

Bootstrapping

In the basic complementary amplifier circuit of *Figure 6*, the main purpose of the Tr1 driver stage is to provide significant overall voltage gain to the amplifier. At any given Tr1 collector current value this voltage gain is directly proportional to the effective Tr1 collector load value, so it seems obvious that (for maximum voltage gain) R1 should be given as large a value as possible. There are, however, a couple of snags that complicate this simple theory, as follows.

The first problem is that the *effective* or ac value of R1 equals the actual R1 value shunted by the input impedance of the Tr2-Tr3 power amplifier stage. Thus if R1 has a high value, the power amplifier input impedance must be even greater. This requirement can usually be met by simply replacing Tr2 and Tr3 with high gain 'pairs' of transistors, as in the circuits of *Figures 7 to 9*. Let's assume that this is done.

The second snag is that to provide maximal output signal swings Tr1 must be biased so that its collector takes up a quiescent half-supply voltage value, as determined by the collector current of Tr1 and by the resistive value of R1. The actual value of R1 is thus predetermined by biasing requirements. To get high voltage gain, therefore, a way must be found of making the ac impedance of R1 much greater than its dc value. This can be done by using the 'bootstrapping' technique shown in *Figures 12 and 13*.

Note in *Figure 12* that Tr1 collector load comprises R1 and R2 in series, and that the circuit output signal (which also appears across the speaker) is fed back to the R1-R2 junction via C2. This output signal is a near-unity-voltage-gain copy of that appearing on Tr1 collector.

Let's assume that R1 has an actual value of 1k and that the Tr2-Tr3 stage gives a voltage gain of 0.9. It can be seen that under actual amplifying conditions 'X' signal volts appear on the low end of R2 and 0.9 'X' volts appear at the top end of R2, ie only one tenth of 'X' signal volts are developed across R2, which thus passes only one tenth of the signal current that would be expected from a 1k resistor. In other words, the ac signal impedance value of R2 is ten times greater (10k) than its dc value, and the signal voltage gain is similarly increased.

In practice, the above-mentioned bootstrapping technique enables the effective voltage gain and collector load impedance of Tr1 to be increased by a factor of about x 20. *Figure 13* shows an alternative version of the circuit which

Fig 9 Amplifier and complementary output stages

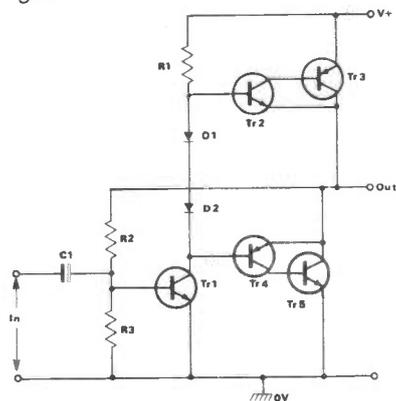


Fig 10 Fixed-gain 'amplified diode' circuit

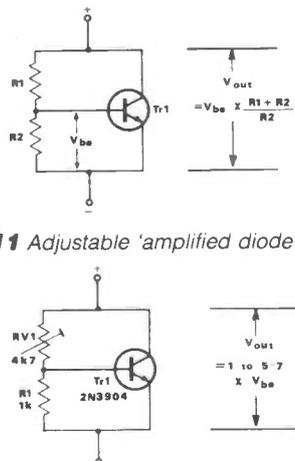


Fig 11 Adjustable 'amplified diode' circuit

Fig 12 Amplifier with bootstrapped driver stage

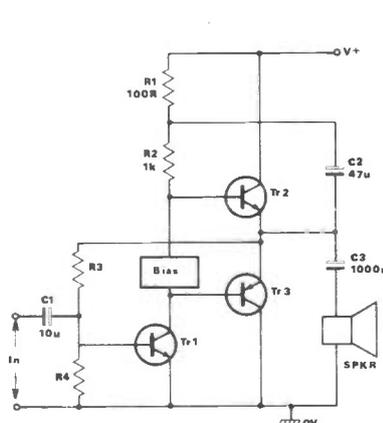
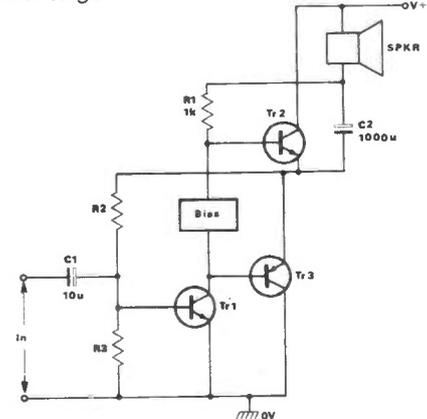


Fig 13 Alternative amplifier with bootstrapped driver stage



DATA FILE

saves two components. In this case the speaker forms part of Tr1's collector load, and is bootstrapped via C2.

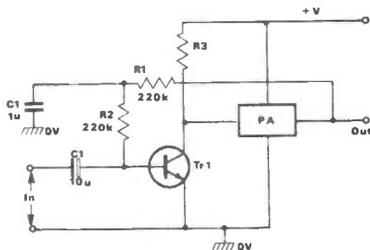
Note that an alternative to the bootstrapping technique is that of replacing the load resistor with a simple transistor constant-current generator. This technique is used in many integrated circuit (IC) types of power amplifier.

Alternative drivers

In the basic Figure 6 circuit the Tr1 driver stage uses parallel dc and ac voltage feedback via potential divider network R2-R3. This circuit is simple and stable, but suffers from fairly low gain and very low input resistance, and can be used over only a very limited range of power supply voltages.

A simple variation of this circuit is

Fig 14 Driver stage with decoupled parallel dc feedback



shown in Figure 14. It uses current feedback via series resistors R1-R2, thus enabling the circuit to be used over a wide range of supply voltages. The feedback resistors can be ac decoupled (as shown) via C2, if desired, to give increased gain and input impedance, at the expense of increased signal distortion. Tr1 can be a Darlington type if a very high input impedance is required.

Figure 15 shows an alternative configuration of driver stage. This design uses series dc and ac feedback, and gives greater gain and input impedance than the basic Figure 6 circuit, but uses two transistors of opposite polarities.

Finally, Figure 16 shows a driver circuit that is specifically intended for use in amplifiers that use dual (split) power

Fig 15 Driver stage with series dc feedback

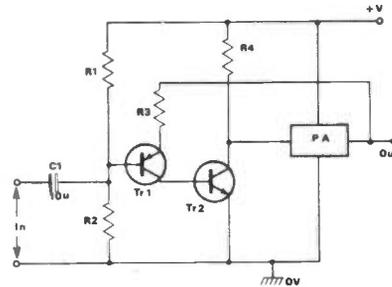


Fig 16 Driver stage with long-tailed pair input

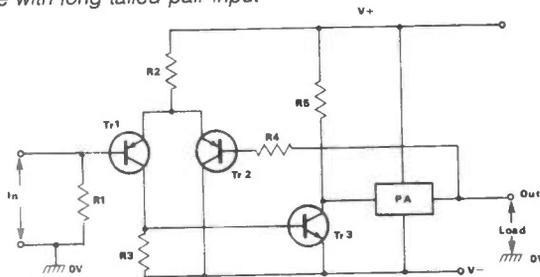
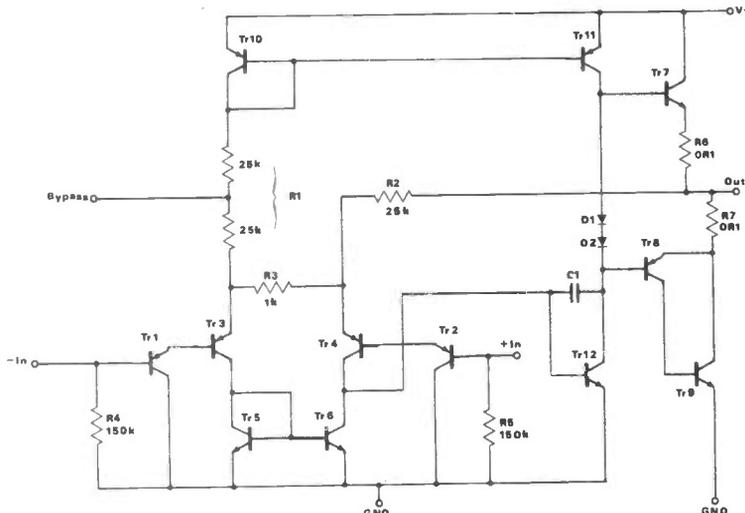


Fig 17 Basic internal circuit of LM 3-80 2-watt audio power amplifier IC



supplies and have direct-coupled ground-referenced input and output stages. It uses a long-tailed pair input stage, and the input and output will both centre on dc earth potential if R1 and R4 have equal values. The circuit can be used with a single-ended power supply by simply grounding one of its supply lines and using ac coupling of the input and the output signals. The basic Figure 16 circuit forms the basis of many practical IC power amplifier designs.

An IC power amplifier

An integrated circuit consists, in essence, of little more than a lot of transistors and resistors all formed or 'integrated' on the same slice of silicon 'chip'. The techniques used in designing the actual circuit are very similar to those used in designing an ordinary transistor circuit. This is particularly true in the case of IC power amplifier designs, and to illustrate this point Figure 17 shows (in basic form) the internal circuit of the well-known LM380 2 watt audio power amplifier IC, which can be used with single-ended power supplies.

In the LM380, Tr1 and Tr2 are wired as pnp emitter followers that drive the Tr3-Tr4 differential amplifier pair of transistors: pnp transistors are used in these stages so that input signals can be dc referenced to the ground line, thus enabling input transducers to be directly connected between the ground and input lines.

The output of the differential amplifier stage is direct coupled into the base of Tr12, which is wired as a simple common emitter amplifier with Tr11 acting as its high impedance (constant-current) collector load, and the collector signal of Tr12 is fed to the output pin of the IC via the Tr7-Tr8-Tr9 quasi-complementary emitter follower set of output transistors. The output currents of Tr7 and Tr9 are rated at 1.3A peak.

Bias-determining and gain-controlling resistor networks are built into the LM380 IC. Feedback resistor R2 is wired between the output terminal of the IC and one emitter side of the differential amplifier stage, and has half the value of R1; the action of these two resistors is such that the amplifier output automatically balances at a quiescent potential of about half supply-line voltage. The voltage gain of the IC is internally fixed at $\times 50$ (34dB) by the ratios of R2 and R3, but can easily be altered by using external feedback or decoupling networks. The LM380 is a very versatile and easy to use IC.

Next month

In next month's edition of 'The File' we will conclude this transistor mini-series by looking at a few practical power amplifier circuits, plus a variety of useful and not-so-useful gadgets and miscellaneous circuits.

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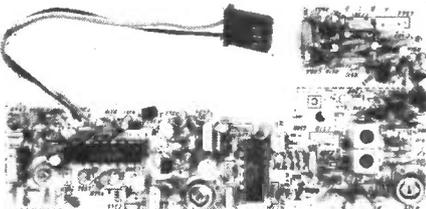
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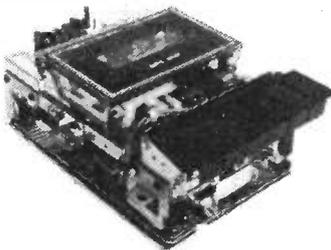
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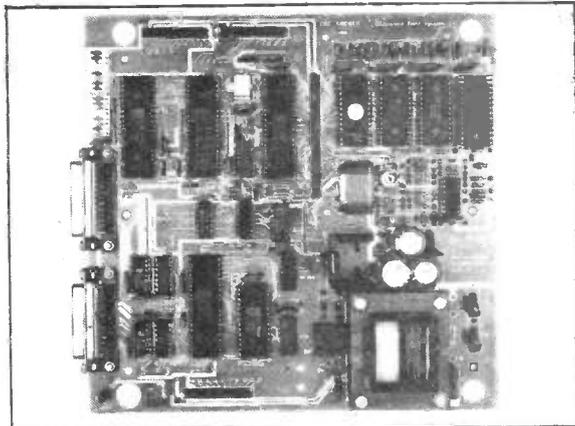
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May was an incredible month for sporadic-E openings, with practically every Band I transmitter in Europe being received. One enthusiast reported openings on all but one day during the month, which can't be bad for the start of the season. Unfortunately, exotics haven't been widely received although some reports suggest that USA or Canadian signals may have been sighted.

During an opening from the south-east, Arabic pictures were logged together with a station broadcasting in English some two hours ahead of BST. The latter is thought to have been the 5kW transmitter at Dhahran in Saudi Arabia. Much of this month's activity centres around semi-exotics and mystery signals; we hope these will ultimately be identified.

Featured fortunes

This month we are featuring William Maries' DX-TV log noted at Studley in Warwickshire. All the times are BST and reception is via sporadic-E except NOS-1 from the Netherlands and Canal Plus from France.

1/5/86: Canal Plus on test with the PM5544 on channels L5 and L8. The L8 signal was perfect except for the negative vision. Signals were received from 0800 via tropospherics; unidentified French TV on L25 with colour bars at 0910 via trop.

2/5/86: Canal Plus at 0708 with a very weak signal on L8 via trop; NOS 1 with the PM5544 on E4.

5/5/86: NOS 1 with the PM5544 on E4; CST with the EZO on R2 received via MS at 1143.

6/5/86: NOS 1 with the PM5544 on E4; NRK on test with the PM5534 and 'BREMANGER' identification via MS on E4.

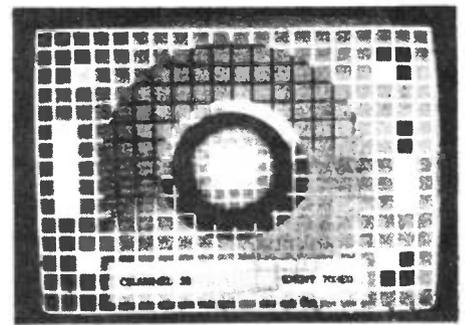
11/5/86: NOS 1 with the PM5544 on E4; RAI with programmes on IA from 1527. Received in PAL colour at times.

15/5/86: TSS with an animated programme on R1 and R2 at 1436 followed by a news programme; TVR with programme details at 1958 and then a logo and clock on R2; RAI with a sports programme on IA and IB from 1545; MTV with a clock at 2014 (white background), announcer, programmes at 2015. Received on R1.

16/5/86: RAI on IA with the PM5544 at 0800. Also seen later with programmes at 1609; TSS on R1 with the 0249 at 0815 (floating with the UEIT), R2 with the UEIT at 0831, R3 with the UEIT at 1021 (with UT0167 identification), and R4 with the UEIT at 1055. While R1 and R2 showed 'HOBCTN' at 1255, R3 radiated the UEIT; MTV on R1 with the clock (white background) at 0855 and then programmes at 0856; SVT with the PM5534 on E2, E3 and E4. Received in colour at times from 1020; DDR 1 with a film and then a hobby programme. Received on E4 and identified by the anti-pirate identification at 1015; DR with the PM5534 on E3 and E4 received from 1052; CST with the EZO seen briefly at 1117 on R1; TVP with the PM5544 on R1, R2 and R3. Received from 1135; NRK with the PM5534 on E2

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith



with 'GULEN' and 'GAMLEN' on E3. Received from 1437; TVE with horse racing from 1735 on E4.

17/5/86: YLE on test with the FuBK on E3 and E4. Programme details were shown at 1317 and programmes began at 1330; TSS with programmes on R1 at 1130. Also later with programmes on R1 and possibly with a test card floating, although it could not be identified; NRK on test with the PM5534 with 'STEIGEN' (received in colour at times) and 'MELHUS' floating on E2. Reception from 1155; RUV with the PM5544 on E4 at 1640, in colour at times.

18/5/86: RUV with the PM5544 on E4 from 1055.

21/5/86: RAI on channels IA and IB with a concert. Received at 1650; BR with a film and identified by the anti-pirate ident; ORF with the news on E2a; JRT with a programme - 'TVO'; MTV with the clock at 1828 (black background) and 'TV HIRADO' at 1830. Received on R1 and R2; French sound (unidentified) was received on R1 vision at 1912. No picture was resolved but could possibly be Canal Plus on L2.

22/5/86: TVE with a bullfight in colour.

26/5/86: RAI with programmes on IA and IB at 1633; RTS with the PM5534 and 'RT SH SHQIPTAR' identification on IC, received at 1638; MTV on R1 with the clock (black background) at 1900; ORF with a sports report on E2a at 1905; TVE with programmes at 1930; JRT with adverts at 2020 on E4.

30/5/86: TSS with the UEIT on channel R1 at 1047 and R2 at 1042. 0249 on R1 at 1050. Also seen at various times during the day with programmes; SVT with the PM5534 on E2 at 1045 and E3 at 1126. Writing was received with the E2 signal but could not be compared with the E3 signal as they were not received at the same time. The writing was not always present on E2. Received up until 1341; RAI with programmes on IA and IB at 1126. Also seen later with TG 1 at 1916; JRT with the PM5544 and clock 'JRT BGRD' identification on E3, received at 1130. Later at 1456 the 'RTV LJNA' PM5544 was received, changing to 'RTV 1 LJUBLJANA' at 1459; ORF with the PM5544 on E2a changing with the TO5 - received from 1218 until 1523. Also on E4 at 1505. Both in colour at times; TVE with teletext (sort of !) from Galicia and then programmes at 1230, received on E4. Also seen later with general programmes at 2020 on E2, E3

and E4 - adverts on E2 were different to those on E4; CST with the EZO on R1 at 1232 changing to FuBK. Programmes first seen at 1450. Received up to 1545; NRK with the PM5534 and 'MELHUS' ident. Received at 1243 on E2; RTP with adverts on E3 at 1251; TVP with the PM5544 on R1 at 1429; RUV with the PM5544 on E4 at 1433; Radio Tele Uno with their FuBK on IA at 1451; unidentified vertical bars on E2 until 1330; unidentified multi-burst on R1 at 1438.

A good start to the season

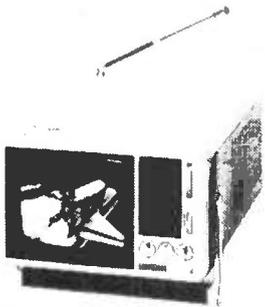
May 16th and 30th were two remarkably brilliant days for DX-TV reception, with intense activity throughout Band I and even Band II (TV). DX from virtually all points of the compass came through on the 30th. During the afternoon there were sightings of an Italian private TV test card blasting its way through over transmissions from RAI on channel IA. This station was Radio Tele Uno, which started using channel IA last year. The electronic test card resembles the FuBK but it includes an additional chequered band towards the top.

During the same opening another Italian private station was noted on IA, namely Nord Center Television (NCT). This appeared radiating a chequerboard pattern with the logo superimposed in the lower corner. A different private/pirate Italian network was logged by Ray Davies of Happisburgh, Norfolk. An 'older type' test card was seen with the identification 'CARELETTO' at the bottom.

Very high MUFs were recorded on May 16th when Russian transmissions were resolved as high as channel R4. The East German service (DDR:F1) was logged by many DXers on channel E4 from the Cottbus outlet. A film was being shown, followed by a programme about various hobbies. William Maries of Studley noticed an anti-pirate 'DDR' logo superimposed in small lettering.

Kevin Jackson of Leeds logged Finland using the FuBK test card with the identification 'YLE TV1' for most of the morning on May 17th prior to programme commencement on channels E3 and E4. At 1155 BST, sample teletext pages were shown with the identification 'YLE-TEKST-TV' at the top. It would appear that the dreaded Ceefax-style sample pages of text have caught on even in Finland! Vince Richardson of Dolgarrog

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33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35 80p

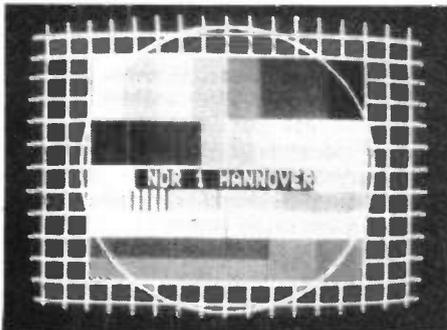
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100/1A 1N4002 4p. 1000/1A 1N4007 7p. 60/1.5A S1M1 5p. 100/1A bridge 25p
400/1A 1N4004 5p. 1250/1A BY127 10p. 30/45mA OA90 6p. 30/15A OA47 8p
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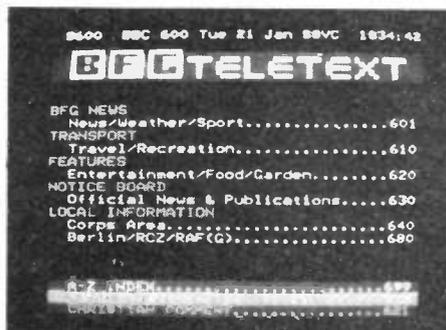
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FUBK test card radiated by NDR in West Germany



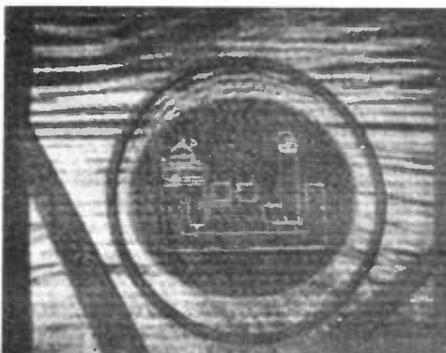
Sample teletext page by British Forces in Germany — note BBC ident



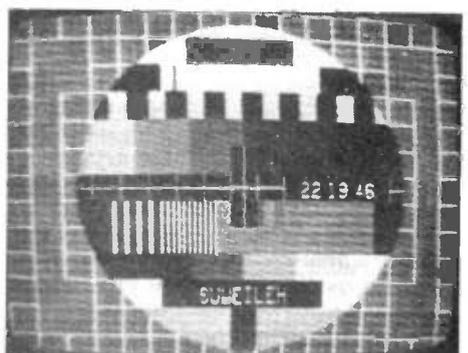
Identification used by the French Forces TV network in West Berlin



Main news programme in Arabic from the Egyptian TV service



Identification caption radiated by JTV in Jordan and received on E3



PM5534 test card transmitted from the JTV outlet at Suweileh

DX-TV RECEPTION REPORTS

in Wales even spotted the YLE test card on channel E2. YLE ceased using this channel a few years ago for their TV-1 and TV-2 transmissions, but this is the second report of its reception within a year. Chris Howles of Lichfield noted a YLE test pattern on E2 during last year's season.

Another mystery concerning a defunct transmitter cropped up on May 7th. Tony Privett of Basingstoke was surprised to find the DDR:1 clock caption present on channel E3 at 0800. The Helpterberg E3 outlet supposedly closed down a few years ago, although Andy Webster of Billinge near Wigan caught sight of the DDR:F1 electronic test card on this channel last year.

Icelandic channel E3 and E4 transmissions from RUV presented themselves on several days during the month. RUV is often regarded as an early or late evening source of reception, but recent reports indicate that morning transmissions do, in fact, take place. Iain Menzies of Aberdeen saw the 'RUV-ISLAND' PM5544 at 0200 on May 3rd with a co-channel 525-line picture (system M) during auroral-E activity. The system M signal couldn't be identified but it must have been from a Canadian or USA station.

Albania (RTS) has appeared on channel IC at least twice during the month. Simon Hamer of New Radnor in Powys saw it on the 30th with programmes while William Maries noted the PM5534 test card complete with the identification 'RTSH SHQIPTAR' on the 26th.

Reception reports

There's an abundance of Scandinavian DX in Simon Hamer's log for May. He received Finland displaying the 'YLE TV1' FuBK test card on the 6th. A caption from NRK in Norway appeared during several openings which read 'Dagsrevyen'. We assume this referred to programme schedules. The 16th was a typical day for Scandinavian DX, when SR/SVT (Sweden) came through on the colour PM5534 pattern on channels E2, E3 and E4. Test cards from Norway were also noted bearing transmitter identification including 'GREIPSTAD' on channel E2 and 'HEMNES' on E3. He also noted on E3 the 10kW Danish transmitter at Fyn.

Simon has reminded us that during the early sixties transmitter details were incorporated on the monochrome test card. It was similar to the BBC's Test Card 'C' but had an additional outer circle and was designated test card 'G'. The transmitter location and 'DANMARKS RADIO' appeared in two white segments at the top and bottom. Later versions were of the standard test card G variety in which the familiar 'letterbox' was added. At one time, Danmarks Radio also used the Philips PM5540 (NOS-type) monochrome test card. With the

introduction of colour TV the old favourites were replaced by the ubiquitous PM5544. The digital clock insert was incorporated a couple of years ago. There is only one other Danish Band I transmitter in operation and that is the 50kW channel E4 outlet at Copenhagen.

The 30th was a record day for Simon. Even Albania appeared on channel IC (82.25MHz vision) when the MUF rose well into Band II. Perhaps the highlight of the day was the reception of the recently opened Eesti TV outlet on channel R1. The identification 'EESTI TELEVISIOON' appeared on the FuBK-type test card. It is worth remembering that programmes from the USSR TV network 'TSS' are also aired over the network. This might be a little confusing since captions in both the Cyrillic and Roman alphabet may be seen at times. The news programme from Estonian TV is identified by the letters 'AK', which means 'Aktuelle Kamera'. This title is also used by the East German TV service.

The letters 'MTV' occasionally cause confusion when seen by enthusiasts on channels E3 and E4. Hungarian TV (Magyar Televizio) always springs to mind when DXers see an 'MTV' caption. However, when received on an 'E' channel it is a sure sign that signals are arriving from YLE in Finland. The caption is shown between commercials.

Despite having less time for DXing, Iain Menzies has managed to log a few unusual signals during May. Apart from the system M reception on the 3rd, he was surprised to see the West German FuBK pattern on channel E2 carrying SWF (Südwestfunk) identification. There is nothing listed for SWF on E2, but Chris Howles has a video recording made last year showing the 'GRÜNTEEN', 'SAARL RUND' and 'SWF RBG' FuBKs all floating with one another.

Mark Dent and Kevin Jackson (both of Leeds) have sent logs detailing sporadic-E openings noted during May. An Italian private station was seen on the 9th and 30th bearing the identification 'RADIO-TELE-UNO'. To round off the month, signals from TVR in Rumania were noted on channel R2 from the outlet at Bucuresti. A colour-bar pattern was resolved at 1537 before going on to the FuBK test card at 1544. Mark has commented that TVR seems to be rare this year. The station was a lucky catch on the 7th because the transmitter was only switched on to show Bucharest win the European Cup!

Allen Hawkes of Prestwick in Scotland has contacted us to describe recent DX conditions north of the border. Using a D-100 DX-TV converter fed from a 5-element wideband array, Allen noted a mystery when the letters 'RTC' appeared between commercials shown on channel E3. A number of other readers have also seen this. Can anyone help identify this station?

Service information

Denmark: A second TV network is due to come into service during 1988 via 12 main UHF transmitters. Facilities will be provided to allow regional broadcasts from each site. TV-2 will be totally independent of the existing Danmarks Radio network and revenue will be raised from advertising. With the proposed introduction of this new service, Denmark should become an interesting country from the point of view of DX-TV enthusiasts.

Due to problems with reception from the DR outlet at Sønderjylland/Rangstrup (channel E7 with 60kW ERP), a low power transmitter has been brought into service at the same site on channel E9.

Netherlands: Despite rumours to the contrary, the Dutch PTT do not have any plans to introduce a low power TV network in West Germany. It was anticipated that NOS programmes would be relayed to Dutch army personnel stationed in Germany.

The FuBK test card, with regional identification, is gradually being introduced at every main NOS transmitter. At present, however, the outlet at Smilde still radiates the old monochrome Philips PM5540 pattern prior to the regular PM5544 transmissions.

USSR: The UEIT electronic test card radiated by the Lithuanian TV service includes the identification 'LRRTPC'. This is an abbreviation for 'Lietuvos Respublikinis Radijo ir Televizijos Perdavimo Centras' which means the 'Lithuanian Republican Radio and TV Transmitting Centre'. This is located at Vilnius.

Poland: Sample pages of teletext are now transmitted from TVP-2 outlets. Unlike the BBC's crack-pot decision to replace test card transmissions with Ceefax, the Polish authorities have seen sense by broadcasting teletext for about ten minutes after close down.

At present TVP-2 shows around 25 pages of text.

France: The following transmitters are due to come into service for the TV 5 network during December: Brest/Roc Tredudon on channel 34; Cherbourg on 35; Rennes 34; Beauvais/St Just 49; Chartres 47; Reims 53; Troyes 29.

The following outlets are due to commence between September and December and will be used for the TV 6 service: Rennes on channel 31; Rouen 62; St Etienne 62; Avignon 54; Angers 53; Lorient 65; Valenciennes 37; Dunkerque 62; Caen 60; Angouleme 34; Bourg-en-Bresse 32.

TV 6 programmes are also radiated in Band I from the channel L4 outlet situated at Lille-Lambersart.

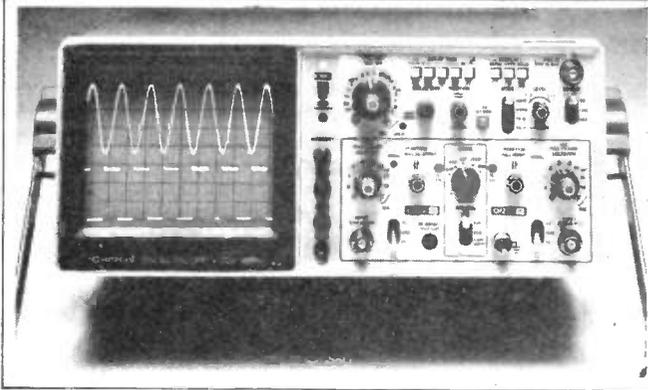
Our thanks to Gösta van der Linden and the Benelux DX Club (Netherlands) for supplying this month's service information.

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ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Anice bulging file of letters means you have been busy sending in news and photos of activity on the air – thanks! Please keep it up, too much is most certainly better than not enough. In fact the slow-scanners among you seem to have taken my past remarks to heart, because this time your news far outweighs the remainder. Excellent – but that means there's so much news I have had to split it down the middle. So, slow-scanners, your news comes next month!

70cm and all that

Down to business, and we start with a detailed letter from Steve G4DVN in Werrington, Stoke-on-Trent. He says quite a few new ATV stations have sprung up over the last couple of years and some nights are quite busy with ATV pictures flying all over the place. Stations active most nights include G6IUH, G1DDA, G1OLX, G6UKP, G1DIP, G3OGD and G8KUJ. Steve has recently got back on 70cm and runs 100 watts PSP to an 18-element parabeam. Best DX with this set-up was a P3/P4 two-way with

The G6HH/P team 'live'! Mike G1IGM (front left), chief mast erector Paul G8OXD (front right), Nick G4ZXI (back right) and Derek G4KMJ (rear left). See text for details of their (soggy) achievements



F3YX back in December 1983.

From the most northerly tip of Nottinghamshire, on the borders of Lincolnshire and Yorkshire, comes a letter from Dave Higginson G8JET. He is on the air "at last" and has a Fortop transceiver and a 48-element Multibeam. Stations worked so far include Ted G6HMS (North Hykeham), Dave G4DUB (Clowne) and Frank G3OS in Sturton-by-Stow. All these contacts were P3, over 20 miles or more.

Further afield there's José ON7TP in Liège – or Luik if you prefer. He has been involved with ATV since 1979 and in 1984 "had the bright idea of joining the BATC, giving me a lot of good material and infos." In fact showing the magazine to others in his local ATV group led to their joining up as well. They are building a number of BATC colour test cards and note that the circle is better than anything produced by a home computer.

TV down under

Another long distance letter comes from Michael ZL1ABS in Albany, Auckland, New Zealand. Alwyn ZL1TZV is (re-)building for 70cm ATV – and converting from 405 to 625 lines in the process! Nice to hear that some people can still transmit 405 lines – can anyone else?

In all there are eight new stations under construction in Auckland using the TV for Amateurs/CQ-TV122 transmitter and an EPROM-based call sign generator. PCBs are provided by ZL1TVW (TV Wayne!), a leading ATV man in New Zealand.

Ian ZL1TOQ is in charge of the appeal to fund a TV repeater in Auckland, which is now nearly paid for. Its proposed site is the Klondyke Road Tower.

Still on repeaters, the Wellington ATV repeater has just had its RF equipment renewed (all solid-state) in time for the national VHF Convention. The output, incidentally, is on 614MHz and viewers need converters since most domestic TVs are fitted only with VHF tuners. When not in use the repeater sends an electronic ident, with a seven minute teletext bulletin of ham radio, ATV and propagation news every half hour. Longer monthly bulletins also go out over the repeater, as well as on 3.9MHz LSB.

Wet funday

From St Leonards, Sussex, Tim Anderson G1JWR writes with news of the local Fun Day. Since most people were working on April 1st they postponed their activity until the following Bank Holiday Monday and used the customary contest site, Fairlight Helipad. This is 160m asl, just east of Hastings and right on the coast.

Thanks to prior publicity they had plenty of contacts, of which 22 were two-way TV (all on 70cm). Best DX was Welwyn Garden City: the French could not be raised on .750 or .170.

For a fun day the weather was appalling – torrential rain, snow, and three inches of hailstones at close of play. And then the van wouldn't start! The G6HH/P team will be at it again from the same site during the September contest, and let's hope they have more luck next time . . .

Higher things

Back up to Staffordshire, and activity on 24cm is gradually increasing thanks to GB3UD, which is in beacon mode at present. Several stations are either building or buying equipment, with activity already seen from G1DDA, G1OLX, G6UKP and G4DVN. Steve's equipment is 10W from a tripler into a Jaybeam (1296) 15/15 antenna; he intends to supplement the latter with the 1240-1280MHz version for the bottom end of the band as soon as possible.

Steve has also been busy constructing a twin 2C39 PA and is just waiting for a video QSO to prove it can pass vision. Currently it is producing 70W out for 10W in, but Steve expects to improve on this. He will then be looking for a little more DX: at the moment semi-DX regulars include G3DFL, G8MTF and G6EHJ, all around P3/P4.

The 'other Steve' G8JMJ should be installed in his new mountainside location above Malvern by the time you read this, and he looks forward to working the world from there. He – like Garry G4CRJ in High Wycombe and Jeff G3CPP in Mildenhall – is getting very interested in 10GHz FM video. Steve seeks suggestions for a good frequency to settle on – he is thinking of building a simple fixed-frequency transmitter and receiver. Drop me a line with any ideas.

Garry says it's about time we knew where all the 3cm operators are – that way they might get to work each other! I'll willingly produce a map if you write in and identify yourselves . . .

New stations

Keith Miles G1OTO is a new(ish) station in Mapperley, Nottingham, and is keen to make contacts. His equipment includes a Solent 1W transmitter, Wood & Douglas complete receive system and a 20-turn helical antenna. A 10W PA is under construction. There is not much activity locally and even GB3GV is not

NETWORK 934

Andy Emmerson G9BUP

visible. However, G6YKC and G4ROB are constructing transmitters so things are looking up.

During April he went /P at Dorkett's Head to work Richard G8BWC. This was his first 24cm TV contact and he was rewarded with P5 reports in both directions. The power was just 1.25W and G6YKC assisted, making recordings and playing them back on 70cm. Another new station is Dave McQue G4NJU in Bletchley; he is receiving the Dunstable repeater.

Participation in the May Day micro-wave contest was a little patchy, but one person who got out and about was Ivor G1IXE from Bristol. He took his 24cm gear to a high spot in the Quantocks near Minehead. Best DX was Roger G4ZQF back in Bristol, with a P4 report over the 62km path.

Repeater news now from G1JWR. The Sussex TV repeater is to be called GB3VI, as GB3SX is still in use for the Crowborough beacon. The transmitter is virtually complete, while work will shortly start on the rest, G4BGQ making the hardware and G4BCO doing the software. As soon as the licence is received they hope to have the repeater in beacon mode.

That's it for this time. Next month all the news is slow-scan, but more reports are welcome, so don't keep all the news to yourselves. Drop me a line care of the editor. REW

Our prayers were answered – well, some of them! People like me who had been complaining that they hadn't seen a decent lift for ages were rewarded throughout the second half of June with some excellent conditions for tropospheric DX. Since this was largely coupled with good weather in general, I dare say nobody had any complaints.

I say 'in general' advisedly, because some of the openings did not fit the textbook pre-conditions of a warm, bright day followed by a much cooler, still evening. I know this is oversimplifying anyway, but I suppose you could say that the good conditions were not always obvious from the weather.

Those who made the effort were rewarded with the DX, which for us in central England included north and south Wales, Kent, Tyneside, Jersey and north Yorkshire.

Effort and its rewards

Working the DX does, of course, involve a bit of effort. . . just listening to the band often gives no clue that there is any opening at all. So it is worth giving CQ calls now and again – then you may work the rare DX! You will rapidly observe that the successful DXers are not the alligators (huge mouths and tiny ears); when they call they leave plenty of gaps for people to react and possibly

turn their beams.

If you have a sensitive set-up it is worth disabling the squelch to hear any weak stations coming back to you; unfortunately some operators get out far better than they can receive (no preamp perhaps), and you end up hearing them but never working them because they don't hear you. Sometimes they are in a semi-local net with their squelch turned up, and don't even realise how far their signals are travelling. Ah, well, this is the very meat of DXing and forces you to use your skill in winking out the rarities.

Operating standards during the lifts were extremely good, with none of the 'whoosh, over the top. . .' we sometimes hear on other bands. Stations who were the centres of attention worked patiently through the pile-ups they were causing.

My only gripe – and it's not just a personal one – is about these peculiar people who ask if you QSL; you say yes, and they say that they too QSL 100%. They insist on a card direct, so you take down their details, spend a small fortune on stamps and wait for the cards in return. Ha ha ha! I think I had a 25% success rate in June and I don't believe the Post Office lost *all* those cards. So from now on I don't send a card until I have received one. . . but I do QSL 100%!

Club news

There seems to be some turnover in the club membership scene. The original 934 Club has passed the 1000 mark in membership numbers but the total of current members is closer to 750.

I gather that some members felt they only needed a PO box facility, and they could get this cheaper from a local club or dealer. This is understandable, but these folk are forgetting the representation that the club has with the Radio Regulatory Division and the negotiations which go on behind the scenes. The more members the national bodies have, the better they can claim to represent the majority of 934MHz band users.

I said bodies in the plural, since there is now an alternative 934 club. This is the Personal Radio Club of Great Britain, based in Southampton and run by James Finch. Just like the original 934 Club, it is fiercely independent of any sponsorship or commercial relationship with any dealers. Inevitably the leading lights of each club have connections with the trade, but in my opinion this does not disqualify them; in fact their knowledge of the commercial world befits them for these roles.

Anyway, you can join PRCGB by sending £5 and your name and address to 41 Twyford Avenue, Shirley, Southampton SO1 5NZ.

The first newsletter is full of useful technical background and attractively produced. The club intends to hold regional demonstrations and meetings and has had the clever idea of issuing five-digit membership numbers which could be used as call signs if Swiss-style PRS ever takes off in this country.

I have joined, and would recommend the club from first impressions. Of course I support the original 934 Club as well, but I hope we don't get any more breakaway groups, since this will diminish our credibility with the people at Waterloo Bridge House.

Out and about

Rallies exclusively for 934 enthusiasts have not taken off in a large way yet, though there have been some well-supported local meetings such as the one at Epsom Downs earlier in the year.

I shall be pleased to plug any event if you let me know in good time – write care of the Editor at least two months in advance. Do tell your friends about this magazine, too. . . it may be the only regular monthly 934 spot!

Several amateur radio mobile rallies have had 934MHz get-togethers, usually informal gatherings around the stands of enlightened dealers who have brought 934MHz gear for sale. In this way, I have had the pleasure of putting a face to several voices and names, too numerous to mention here.

Hardware news

Marksman Products from Milton Keynes have brought out a new design of delta-feed yagi, in 4 and 12-element sizes. I hope to bring you a user test report next time.

Selectronic of Canvey Island have a new colour leaflet and price list showing their range of accessories, while Telecomms of Portsmouth have added two items to their roster of useful test gear. Priced at £29.95 is a dummy load for use on all frequencies up to 3GHz (ideal for all amateur, CB and commercial use). There is also a low cost SWR and power meter aimed at the lower end of the 934MHz and cellular market: it costs £49.95 and I hope to check one out soon.

Sign-off

That's all for this month, except to hope that the RRD may permit the use of antennas with more than 4 elements. Mike TC1 tells me there was some hesitation early on due to fears of health and safety hazards, but these may soon be overcome. If we are successful it will be because of representation, not by magic, so join a club if you haven't already done so! Stand up and be counted. . . REW

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TD440	2.20	7815	0.85	D16-160GH/98	69.00	M38-140L	65.00	V810A	11.50
TD440	2.20	7815	0.85	D16-160GH/99	69.00	M38-140L	65.00	V810A	11.50
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A2293 8.50	EBF85 0.75	EL200 1.40	M8204 5.50	QV07-50 63.50	U95 1.00	2C55 1.50	6AN5 2.65	6GK9 2.50	12CX6 1.20	5636 1.50
A2426 29.50	EBF89 0.70	EL204 1.40	M8223 4.50	QV07-50 63.50	U97 1.00	2D21 1.50	6AN8A 2.65	6GK9 2.50	12D06B 3.50	6146A 7.50
A2599 37.50	EBF93 0.95	EL209 5.25	M8224 2.00	QV07-50 63.50	U98 1.00	2D21W 2.50	6AOS 2.15	6GKT 1.95	12D4W 3.50	6158 3.20
A2792 27.50	EBL1 2.50	EL219 6.95	M8225 3.50	QV07-50 63.50	U99 1.00	2E22GY 45.00	6AR5 5.95	6GKT 1.95	12D4W 3.50	6386 14.50
A2800 11.50	EBL21 2.00	EL220 3.65	M8225 3.50	QV07-50 63.50	U99 1.00	2E26 7.95	6AR8 3.95	6GKT 1.95	12E14 38.00	6973 5.95
A3042 24.00	EC52 0.75	EL221 3.50	M8225 3.50	QV07-50 63.50	U99 1.00	2J42 93.00	6AS5 1.50	6GKT 1.95	12G7A 4.50	705A 8.00
A3283 24.00	EC52 0.75	EL222 12.95	M8225 3.50	QV07-50 63.50	U99 1.00	2K25 Ray 75.00	6AS6 2.50	6GKT 1.95	12HG7A 4.50	715C 45.00
AC/TH3 4.00	EC80 9.50	EM1 9.00	M8225 3.50	QV07-50 63.50	U99 1.00	2K26 95.00	6AS7G 4.00	6GKT 1.95	12K5 1.95	725A 275.00
ACT22 56.75	EC81 7.95	EM4 9.00	M8225 3.50	QV07-50 63.50	U99 1.00	2K29 250.00	6AT6 4.75	6GKT 1.95	12K7GT 1.50	7527 89.50
AC/S2 PEN 4.00	EC86 1.00	EM80 0.70	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AU4 2.00	6GKT 1.95	12K8 1.95	7703 15.00
AH221 8.50	EC88 1.00	EM81 0.70	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AU6 2.00	6GKT 1.95	12S4GT 1.95	803 14.95
AH238 38.00	EC91 1.10	EM85 1.85	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	805 39.00
AL60 6.00	EC92 1.95	EM87 2.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	807 1.95
AN1 14.00	EC93 1.50	EM87 2.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	810 85.00
ARF21 0.70	EC97 1.10	EN91 1.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	811A 15.00
ARF24 1.25	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	813 23.50
ARF35 0.50	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	829B 14.50
AZ11 4.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	832A 14.50
BL3 2.50	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	833A 95.00
BS450 67.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	866A 4.50
BS810 58.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	872A 2.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	873 80.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	884 5.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	927 15.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	930 9.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	931A 17.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	954 1.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	958A 1.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	1299A 0.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	1619 2.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	1625 3.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	1626 3.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	1927 1.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	2050 3.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	2050W 4.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	4313C 4.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	4328D 9.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5642 9.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5651 2.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5654 1.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5663 1.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5670 3.25
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5672 4.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5687 4.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5692 3.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5696 3.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5718 6.15
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5725 2.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5726 1.75
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5727 1.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5749 2.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5750 1.85
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5751 2.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5763 4.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5814A 3.25
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5829WA 6.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5840 3.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5842 11.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5847 10.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5879 9.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5886 13.95
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5894 39.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5899 4.50
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S7GT 1.95	5963 2.00
BS814 55.00	EC97 1.10	EN92 4.50	M8225 3.50	QV07-50 63.50	U99 1.00	2K50 250.00	6AV6 2.50	6GKT 1.95	12S	

MEDIUM WAVE



DXING

by Steve Whitt

As a result of some interesting feedback, this month's column features a selection of news items as well as some more tips for the DXer wishing to keep up with what's happening in the radio world. Having a radio and an aerial is really only half of the problem; the other half is knowing when and where to tune, and so this month I'm including details of both printed and computerised sources of information.

IBA round-up

According to the IBA, independent local radio now has the following coverage figures for the UK. The table shows the percentage of the population able to receive ILR stations at normal listening quality.

Unfortunately, despite the number of ILR stations operating, I cannot help but feel that wherever you go they tend to sound the same, with similar music formats, sound-alike commercials and jingles, and almost identical news; it is indeed rare to find a station with genuine character or style.

One exception to the rule is a new DX radio show called Red Dragon DX, being aired on Red Dragon Radio in the Newport and Cardiff area. The show is being hosted by Al Dupres, an active radio listener himself, and it can be heard on 1305 and 1359kHz at 0015 UTC every Saturday morning. It is not often that DXing gets this level of exposure in the UK, so tune in to Al and give him your support.

A couple of months ago I highlighted the activities of Festival Radio Stoke, a special event station being operated by Signal Radio throughout the summer on 1017kHz. This station may be the forerunner of others in a similar vein, since the Home Office has expressed an intention to licence a number of such stations each year.

Unfortunately, information on these stations seems to be hard to come by, and details are announced at fairly short notice. One example that came to my notice is Showground Radio, which as I write is due to be operated by Hereward Radio especially for the East of England Show from 15-17 July. This station will be operating on 1602kHz but sadly it will

have packed its bags and left by the time you read this column.

Computer corner

Information databases for home computers are widely available these days. I have, however, received information about one with a difference which is intended for the DXer (particularly for those with an interest in Irish radio!). 'Radiobase' is a computer database capable of holding records of radio stations from anywhere in the world. It has a capacity of 550 files, but to get the user started it is supplied with up to the minute information on around 220 Irish stations (MW, FM and SW).

To use Radiobase you'll need access to a 48K Sinclair ZX Spectrum or Spectrum+ computer. Naturally it offers full search and sort facilities as well as appropriate printing commands. The program, which comes on a cassette tape, is supplied with complete instructions and is available for just £5.50. For further information, or to place orders, write to Brian Buckley, 29 Coalisland Road, Lurgaboy, Dungannon, Co Tyrone, N Ireland BT71 6LA.

Computers can also be excellent sources of information, and if you are lucky enough to have access to BT's Prestel system there are a couple of areas of interest to the MW DXer. Firstly, keying *25887# will get you into Waveguide 258, which is a large section of weekly updated info on radio, TV and

amateur radio. This makes very interesting reading. Secondly, you'll occasionally find information about broadcasting and radio regulatory affairs in the section edited by the DTI; key *2040# for this one.

Community Radio

The Home Office announced in early July that all Community Radio plans had been shelved because the government, citing the example of anti-Indian propaganda aired by some Asian-run stations, felt that stations might fall into the hands of 'extremists'. There is a possibility that Community Radio may be revived as part of the predicted radio shake-up due as a result of the Green Paper to be published before the end of the year, but in the interim some disillusioned applicants are likely to sue the government over their costs whilst others will undoubtedly appear as pirate operators. Note: to keep in touch with the latest news on the London pirate scene phone the 'TX' magazine recorded message on 01-400 8282.

Spain on Medium Wave

This is the title of a new 68-page (21 x 15cm) book. It comprises three sections; the first is a record of all MW stations in frequency order, including the main details about each one; the second part contains info on station networks; and lastly there is a quick reference index. A 42 x 30cm map of Spain is also included. To order send an International Money Order for 550 pesetas or 9 IRCs to; Fransisco Martinez y Martinez, Apartado 4031, 28080 Madrid, Spain.

'Now Radio Newsletter'

This is a new fortnightly radio newsletter edited by Jay Jackson (formerly of Radio Caroline) aimed at both the broadcaster and the listener. It covers all aspects of radio in and around the UK and Eire.

A sample copy (costing £1.00) and full subscription details are available from *NOW Radio Newsletter*, PO Box 45, Kettering, Northants NN16 0NW.

DX FILE

Summer not really being the DX season, I thought I'd highlight some of last winter's DX. I recently heard from a keen Norwegian DXer, Geir Stokkeland, who wrote to report some fabulous DX heard last winter from his location near the North Cape in Norway. He reports the very first logging of Fiji (684kHz) in Europe and the first logging of New Zealand for over a decade (on 1008, 1035 and 1098kHz). He adds two Chinese stations to the list of 'firsts' as well as KIPA Hawaii. And to round things off Geir added around 150 stations from the USA to his personal log. Well, all I can do is

turn green with envy!

On the subject of last winter's DX, the Medium Wave Circle has available a publication detailing every American station heard in the UK during the 85/86 winter DX season. It covers North, Central and South America as well as the Caribbean. A copy is available (ask for Reprint no 7) from Harold Emblem at 55 Halsall Road, Southport, Merseyside PR8 3DB for 50 pence plus a stamped SAE.

That's it for another month, so until we meet again I look forward to your correspondence on any aspects of MW radio.

REW

LIGHTING ATV

PART TWO

In the first part of *Lighting ATV*, aspects of lighting techniques, illumination levels and the qualities required of the light itself were introduced. This brief introduction concludes with a look at lighting equipment and its use.

Many variations exist in lighting equipment. There are general purpose and special purpose sources, in a considerable range of powers. Some have lens systems, others do not. Some of these types are adjustable, allowing the position of the lamp to be varied in relation to either the reflector or the lens, or both. This is known as 'racking'. It adjusts the area of illumination by widening ('flooding'), or narrowing ('spotting') the beam of light emitted.

Racking can be used to adjust light levels from each source. This balancing of levels between one light and another is subjective, but in colour television the general preference is for a close ratio between 'key' and 'fill'.

Balancing levels

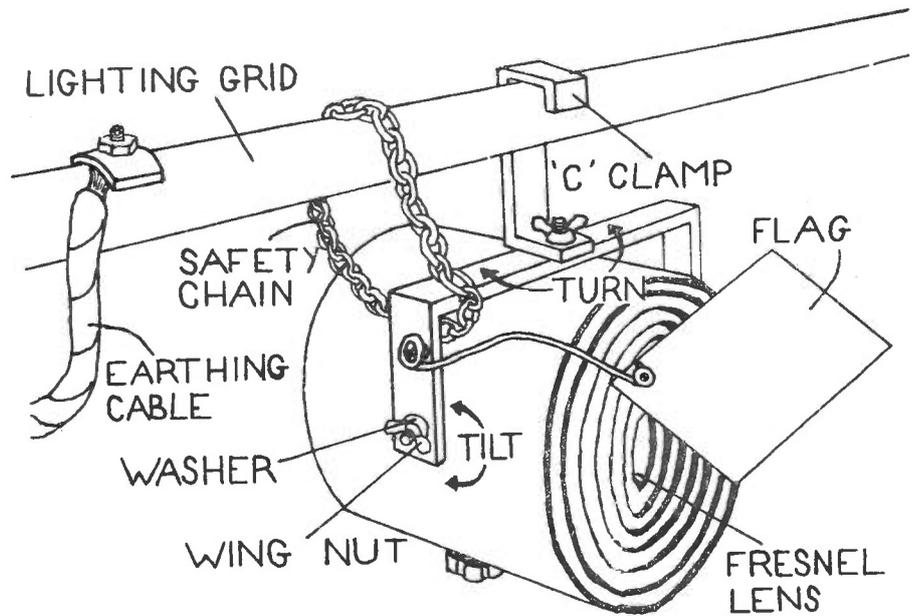
A convenient method of balancing light levels is to use spun fibreglass in front of the source. It is mounted in a frame or clipped slightly away from the lantern to avoid its heat. Spun fibreglass is a more efficient method than using 'neutral density' filters for lowering intensity, as it diffuses the light. It is cheap and easier to obtain, although it is not as good as an Opal ('frost') filter as a diffuser. Its use has the advantage of helping to even out any patchy illumination from a poor quality source.

The 'Fresnel' type of lantern is a good all-rounder to have, where racking is provided. It has a special lens of concentric prisms, which is intended to even out the 'hot spot' in the centre of the beam, making it a controllable flood. It can be used to key and fill and also light specific areas. Second-hand theatre Fresnels may be available quite cheaply and it may be possible to 'uprate' some to quartz halogen (ask the manufacturer).

Checking equipment regularly is very important for safety. These same checks are recommended on second-hand equipment before you purchase. Correctly rated heat resistant cable should always be used near the heat source. Check the terminals and the plug (if fitted). Professional equipment is often remotely fused, and it's not uncommon for wires to work loose in constant use. Check this cable inside the lantern for insulation wear.

Where racking is provided check its full travel, noting that the cable does not get trapped. Mechanical fixings must be secure and independently earthed, to protect against a lantern becoming live. A second link to the fixing for overhead lanterns is recommended, such as a safety chain looped around.

To maintain the light output, dust the lens, lamp and reflector, but do not wipe the highly polished 'front silvered' mirror type, just blow the dust off. The state of such a reflector should be checked when purchasing. Normally any used lamp with this type of reflector is of little or no



By Norman E Ash

value, although the amount of tarnish on it should give an idea of its age.

The main lighting feed should be through an accessible isolator switch. Never use any combustible material either to construct units, or in close proximity to them; always use the proper lighting filters.

There are two main drawbacks in using dimmers: there are potential RF interference problems, and the 'colour temperature' varies dramatically with level adjustment. Dimmers do, however, prolong the life expectancy of the lamps. Intensity can also be varied (without colour temperature change) by using multiple lamped sources, whose lamps are switchable in parallel to the supply.

Do it yourself

Finally, it is possible for a competent home constructor to make some of the lighting equipment, if all the normal safety rules are followed. This brief article cannot give any detailed account, but may give an idea of the possibilities and problems involved.

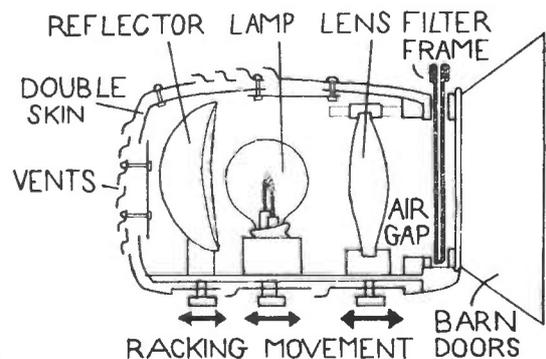
Lamps often have a very narrow working temperature range: the lamp housing should be designed to dissipate the heat at a rate which maintains this temperature.

Multiple lamped units can use less powerful lamps to overcome this problem. Fluorescent strip lighting makes an extremely good 'soft light' source for fill lighting with a diffuser filter, and spot bulbs with integral reflectors can also be easily constructed.

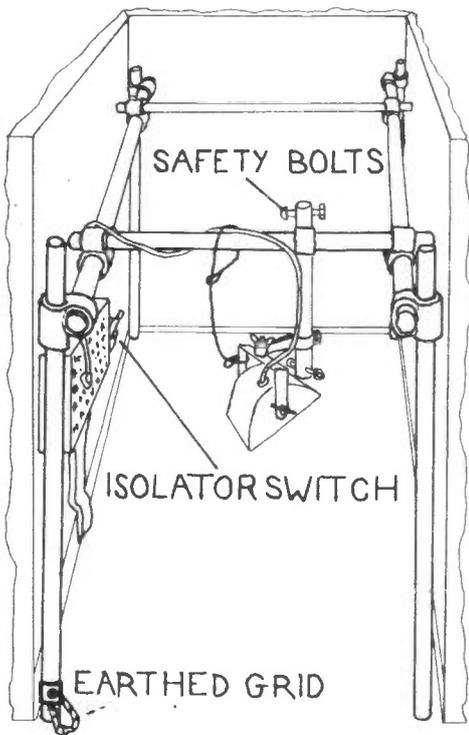
Reflector design requires a high

output with even illumination within the directional angle of beam required. Unevenness shows up (as if lighting through trees) with patchy dips in level. Cooking foil is too uncontrollable to use easily. The reflector from an old electric bar fire might provide an answer for short 'hot burning' tubes. Old car spot lights can provide other shapes for bulb type lamps. Cool burning lamps, such as the fluorescent tubes, can simply have a white laminate or paint reflector. Double skinned construction is recommended for the hotter burning lamps.

Adapting ready-made lighting is recommended for directional and controllable units. Junk shops may provide old projectors, which, with a wide angle lens, in a small studio, may make an ideal key source. Photographic flood lighting units would make convenient fill sources once adapted.



LIGHTING ATV



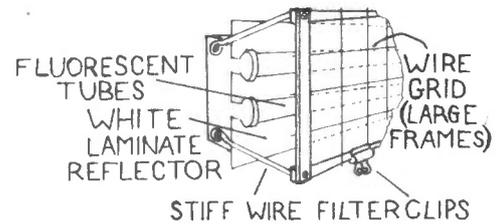
These 'lightweight' units might be suspended from a home-made 'lighting grid' made from gas pipe for a small studio and from scaffolding poles for heavy units with large spans.

If a pole is erected floor to ceiling in each corner of the studio and paired together by bars, clamped firmly, so that the room walls support these without any movement, then lateral bars can be clamped across the top in the desired position for lighting. A short bar can be clamped vertically downwards off the grid, to vary the height of the lanterns. Safety 'coach bolts' prevent the bar from dropping.

Adjustment

The lanterns need to be able to tilt and turn. A bolt through the pivot point can be clamped against the body of the unit using wing nuts and large washers, although in the turn movement this can be dangerous unless a restraining method (such as safety chains) is used.

Frames to hold filters can be made of flat metal bar. Overlapped ends can be bolted through and into a loop of stiff wire (made from an old coat hanger), the other end being attached using self-tapping screws or bolts to the body of the unit. Allow an air gap behind the frame,



and for a unit intended as a soft light diffuser a large frame 30-60mm away should work better. Use small Bulldog clips to hold the filters in position. Opal (frost) diffuser is recommended for fill lighting, where affordable.

The looped stiff wire can also be used as a metal mask plate ('flag') holder. Lanterns often have these attached ('barn doors') and they can mask off the light to illuminate specific areas. These are normally matt black, but silver finished flags can also be used as reflector panels.

Parts for constructional work, such as C clamps, should be available as spares for theatre lighting. Numerous books on lighting are available: a particular series on television includes a popular volume on lighting for TV. 

NEXT ISSUE

Radio & Electronics

The communications and electronics magazine **World**

RECEIVER REVIEWS

The Grundig Satellit 400 and 650 Rx's are under the scrutiny of Brian Kendal

KP-202 MOD

Peter Rouse irons out some quirks on this 2m hand-held

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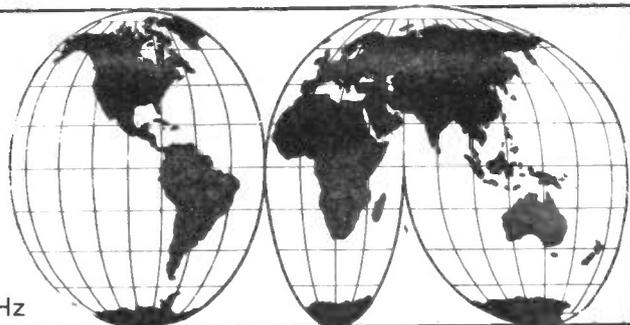
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SHORT WAVE NEWS FOR DX LISTENERS

By Frank A Baldwin

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



This month we feature just a few of the Latin American transmitters currently operating on the 90 metre band (**3200** to **3400**). A more complete review will be undertaken at a later date, including the low powered transmitters seldom heard in the UK. Our last update of some of the South American stations on the band appeared in the June 1984 issue.

Brazil

Newcomers to the hobby should note that Portuguese is the programme language used by Brazilian stations, whereas Spanish is used by most South American countries. Original native languages such as Aymara and Quechua are also sometimes heard on the band. French is radiated by RFO Cayenne (10kW) in French Guiana on **5055** variable, whilst Radio Apintie, Paramaribo, Surinam on **5005.6** at 0.35kW uses Dutch, Hindustani and Javanese.

Radio Bandeirantes, Cachoeira Paulista is on **3285** from 0900 to 0300 with a power of 2.5kW. It rarely appears in the logs of European DXers but is often heard by those nearer Brazil.

On **3325** there are two Brazilians, the first being the 2.5kW Radio Difusora Universitaria, Guarulhos working from 0800 to 0300 or sometimes 0330. It is seldom heard outside the country, probably because the 5kW Radio Liberal in Belem, working around the clock, effectively blankets their transmissions. Whatever the actual cause, the latter is regularly reported world-wide.

Radio Alvorada in Londrina is on the air from 0800 to 0300 (Sunday from 0830 to 0200) on **3335** at 5kW. Not often heard in Europe, it is frequently heard by USA DXers.

Radio Nacional, a Radiobras station, occupies **3374.5**, at which frequency it radiates

from 0800 to 0300 at 5kW. Although like many other Latin American stations it is rarely heard in Europe, that is no reason why UK broadcast band enthusiasts should not endeavour to log this or indeed any other South American transmitter notable for its absence from European logbooks. The short wave bands can often be full of surprises—there is always the likelihood of that long sought-after station being audible on channel when least expected — a last despairing effort does sometimes produce results!

Ecuador

Radio Federacion Shuar, Sucua, reactivated in August 1985 after a period off the air, is on **3210.7** reportedly closing at 0159. The power is 10kW.

Regularly logged here is HCJB in Quito on **3220**. At 10kW it programmes in Quechua from 0830 to 1430, from 2100 to 0200 and from 0200 to 0500 in Spanish. A good one for the 90 metre band newcomer to try.

La Voz de Rio Carrizal, Calceta operates from 1100 to a variable closing around 0400 on **3260.6**. At 3kW, it identifies as 'Radio Carrizal' but is rarely heard in the outside world.

La Voz de Napo, Tena programmes in Quechua and Spanish from 1000 to 1215 and from 2200 to close-down around 0230. The power is 2.5kW and the frequency is **3280**. Move nearer to Ecuador to hear this one!

Often heard and reported throughout the world is Radio Iris, Esmeraldas on **3381**. With a power of 5kW it is scheduled from 1100 (variable) to 1300 and from 2100 to 0400 varying to 0500.

Most reported of all the Ecuadoreans on the band is undoubtedly Radio Zaracay in Santo Domingo de los Colorados. At 25kW it is on the air from 1000 to 1400 and from 1900 to 0500 on a slightly

variable **3395**.

Guatemala

Radio Cultural in Guatemala City on **3300** at 10kW radiates in local languages, English and Spanish. The schedule is from 1200 (Sunday from 1100) to 0830. The English programmes are timed from 0300 to 0430 daily and on Sunday from 0030 to 0430. Regrettably it is infrequently heard in Europe.

In Coban, Radio Tezulutlan is on the air from 1000 to 1500 and from 2100 to 0230 with a power of 5kW on **3370.1**. Seldom heard on this frequency by Europeans, it's frequently noted on the parallel **4835** channel.

Peru

Radio La Voz de Oxapampa, Oxapampa on **3260** is scheduled from 1100 to 1300 and

from 2300 to around 0400 with a power of 5kW. It identifies as 'La Vox de la Selva Central', but is seldom logged outside Peru — grrrr!

None at 1kW

It will be noted that 90 metre band Latin American transmitters rated at 1kW or less have been omitted from the above. Such a low power rating does not preclude reception here in the UK: in fact some such stations are heard more frequently than many listed here. Power ratings in themselves are no guarantee of reception in Europe. Other factors such as co-channel interference, station equipment efficiency and location all contribute to the final result.

An update of low powered 90 metre band LA stations will appear in due course.

AROUND THE DIAL

We hope the following will help readers obtain similar results to those reported here.

AFRICA

Benin

Cotonou on **4870** at 2135, OM (OM = male announcer or speaker) with a talk in French. Cotonou is on the air carrying the Home Service in French and local languages — all eighteen of them — at the following times: from 0400 (Sunday from 0600) to 0800 (Saturday until 1100, Sunday until 2300) and from 1300 to 2300 with a power of 30kW. Station identification will be made easier for English speaking listeners by tuning in to the English news bulletin radiated at 2000 every Wednesday.

Chad

N'djamena on **4904** at 2202, OMs with songs in vernacular, OM with announcements in French. Radiodiffusion Nationale Tchadienne operates from 0455 to 0730 (Sunday until 0700) and from 1555

(Sunday from 1445) to 2100 (Saturday and Sunday until 2200) with a power of 100kW. The frequency is apt to vary from **4903** to **4906** on occasions. French and Arabic together with Sara and some other local languages are used in broadcasts from N'djamena.

Egypt

Cairo on **9755** at 2037, OM with recitations from the Holy Quran in a transmission for the Middle East timed daily from 0200 to 0730 and from 1100 to 2100.

Ghana

GBC (Ghana Broadcasting Corporation) Accra on **3366** at 2238, jazz music European style then some vocal 'oldies'. GBC2 features programmes in English and is scheduled from 0545 to 0800 (Sunday until 0900) and from 1530 to 2200 with a power of 10kW.

Kenya

The Voice of Kenya, Nairobi on **4915** at 0455, YL (young lady = female) with pop songs in

SHORT WAVE NEWS

Swahili, OM announcer. The National Service is entirely in Swahili and is radiated from 0300 (Sunday from 0330) to 0630 and from 1330 to 2110 with a power of 100kW. The frequency varies from that above to **4914**.

Dominating the frequency, Nairobi is co-channel with the 10kW Accra operating from 0545 to 0800 (Sunday until 2200) and from 1200 to 2200 in local vernaculars and English. To log the latter station listen after Nairobi closes.

Morocco

VOA Tangier on **5995** at 0723, OM with a programme about recent South-East Asian events during the English transmission for Europe timed from 0400 to 0800.

South Africa

RSA Johannesburg on **3230** at 1750, OM with a talk about sport in English, organ music, the RSA interval signal at 1756 then sign-off without the National Anthem at 1758. This 250kW transmitter operates an irregular special sports service in English on this frequency from 1600.

SABC Johannesburg on **3320** at 2010, jazz music on a piano then YL with announcements in Afrikaans. At 100kW, this one is on the air with the Home Service entirely in Afrikaans from 0350 (Saturday from 0353, Sunday from 0400) to 0510 and from 1635 to 2200.

Togo

Radiodiffusion TV Togolaise, Togblekope on **5047** at 0532, congregation with hymns, OM sermon in a vernacular. The Home Service in French and vernaculars is scheduled here from 0530 to 0803 and from 1703 to 0005. An easy identification of this one can be made by listening for the newscast in English, which is radiated daily at 2000. The power is 100kW.

Zambia

ZBS (Zambia Broadcasting Services) Lusaka on **4910** at 0354, OM with a news bulletin in a vernacular with several mentions of Zambia, then YLs with a programme of local songs. The Home Service in vernaculars and English is broadcast on this channel

from 0350 to 0530 and from 1530 to 2105 (Friday until 2205). There are newscasts in English at 0500 weekdays and at 1800 daily. The power is 50kW.

SOUTH AMERICA

Bolivia

Radio Nueva America, La Paz on a measured **4796.5** at 0219, OM with a harangue in Spanish interspersed by audience applause: still very forcefully speaking at 0227 retune until 0240 switch-off. Radio Nueva America is scheduled from 1000 to 1430 and from 2200 to a variable sign-off time of 0400 (Sunday from 1030 to close-down between 2245 and 2300). The power is 1kW, but because the channel is a clear one it is frequently logged in Europe. Founded in 1548, La Paz lies in a valley at a height of 12,000 feet.

Brazil

Radio Difusora do Maranhao, Sao Luis on **4755** at 0207, OM with ballads in Portuguese. RD do Maranhao operates irregularly and reportedly closes at 0530. The power is 2kW.

Radio Difusora Acreana, Rio Branco on **4880** at 0224, YL with folk songs complete with local style musical backing. The signals from Rio Branco are radiated from 0900 to 0400 and the power is 5kW.

Ecuador

HCJB (Herald Christ Jesus Blessing) Quito on **6130** at 0710, OM with a religious talk in the English transmission for Australia and New Zealand, timed from 0700 to 1130.

Honduras

La Voz Evangelica, Tegucigalpa on **4820** at 0436, OM with a talk in Spanish and OM with a hymn. LV Evangelica operates in Spanish from 1030 to 0600 but with an English transmission on Monday timed from 0300 to 0600. The power is 5kW.

Venezuela

Radio Mundial Bolivar, Ciudad Bolivar on **4770** at 0200, OM with the station identification, promos (promotions) in Spanish then suddenly off at 0304 - presumably a breakdown. At 1kW, Radio Mundial Bolivar is scheduled from 0900 to 0400.

ASIA

China

Radio Beijing on **9945** at 1320, Chinese style orchestral music during the Vietnamese programme for Asia, timed from 1100 to 1555.

Radio Beijing on **9965** at 1950, YL with announcements during the Albanian programme for Europe, scheduled from 1900 to 1955. Carrier off at 1957 then 'East is Red' on chimes at 2000, YL and OM with the station identification and the Esperanto offering to Europe, from 2000 to 2030.

SOUTH-EAST ASIA

North Korea

Pyongyang on **9977** at 1937, OMs choir with songs then OM with announcements in the Korean transmission for Europe, Near and Middle East and Africa, scheduled from 1900 to 1950.

Vietnam

Hanoi on **10040** at 1606, OM and YL alternating with news items in an English programme directed to Africa and timed from 1600 to 1630.

PACIFIC

Australia

Melbourne on **7205** at 1750, YL with announcements, YL with a pop song in an English programme for Asia scheduled from 1430 to 2040.

Guam

TWR (Trans World Radio) Agana on **9870** at 1327, OM with a religious talk and address of the organisation concerned then OM with the station identification, all in an English programme for Asia, scheduled from 1300 to 1400.

NEAR AND MIDDLE EAS

Bangladesh

Dhaka on **6240** at 1920, YL with the station identification and a newscast in Bengali with mentions of country names such as Japan etc, in the Bengali slot timed from 1900 to 1930.

India

AIR Delhi on **9945** at 1434, OM and YL with songs in Hindi then some local style music in the General Overseas Service English programme for eastern and South-East Asia, scheduled from 1330 to 1500.

Delhi on **17875** at 1000, YL with the station identification, frequencies and times of English broadcasts, then YL with a news bulletin, all in an English transmission for Australia and New Zealand scheduled from 1000 to 1100 and also logged in parallel on **17387**.

Iraq

Baghdad on **13700** at 0832, OM and YL with announcements then some Arabian music in an Arabic presentation to Europe, timed from 0400 to 1000.

Pakistan

Karachi on **15595** at 1556, OM with a harangue in Urdu with many mentions of Pakistan in the Urdu offering to the Middle East timed from 1330 to 1600. At 1600, OM with the station identification, frequencies and times of English broadcasts, OM with the news in English at slow speed to the Middle East, scheduled from 1600 to 1615.

Islamabad on **15605** at 1005, OM with the news in English until 1010, then into Urdu in the Urdu/English programme for Europe, scheduled from 0715 to 1115.

Islamabad on **17660** at 1059, YLs with songs then OM with the station identification in Urdu and English, local and UTC time-check, then news of national affairs in English at slow speed timed from 1100 to 1115, all during the Urdu/English programme for Europe scheduled from 0715 to 1115.

NOW HEAR THESE

Omdurman, Sudan on a measured **5038.5** at 2114, OM with announcements in Arabic, OM with a song complete with Arabic type musical backing in the Voice of the Sudanese Nation service on this channel from 1600 to 2200 with a power of 20kW.

ZBC Gweru on a measured **3395.7** at 1851, OM with announcements in English then OM with pops. Radio 1 in English radiates on this frequency from 0325 (Sunday from 0400) to 0615 and from 1545 to 2100 (Saturday until 2200). Relays of Radio 3 are made from 2100 to 2200, Sunday to Thursday inclusive. The power is 20/100kW. 

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

934MHz Club

Two years ago, five 934MHz enthusiasts got together to form the 934MHz Club UK. From such humble beginnings the club has flourished, and to date has some 750 paid up members. Not bad when you consider that membership was originally only expected to hit the 200 mark!

The club has gone from strength to strength, having now established what is described as a 'good' relationship with the DTI. Discussions with the department have apparently included the idea of expansion of the band and the possibility of lifting the cur-

rent antenna restrictions and setting up repeaters.

Further details can be obtained from the newsletter editor and club chairman, Vic Anthony UK.01, PO Box 424 Althorne, Chelmsford, Essex.

RSGB convention

The RSGB has once again chosen the Belfry Hotel, on the A40 near Oxford, as the venue for this year's National HF Convention.

It costs just £2 to get in and attractions include a 1.8MHz get-together, a Worked All Britain stand, RNARS QRQ CW tests, and a DX quiz, to mention but a few. There will also be a supervised con-

struction area where you're invited to build a simple direction-conversion Rx.

A provisional lecture programme starts at 10.30am with Don Field G3XTT, who writes for our sister magazine, *Amateur Radio*, discussing HF antennas for small gardens. Between 1545-1645 there will be a DX forum.

As you can see, it will be quite an eventful day - so don't miss it.

For further details contact D Field G3XTT, 105 Shiplake Bottom, Peppard Common, Henley-on-Thames RG9 5HJ, or telephone (0734) 501359.

Midlands VHF

The RSGB Midlands VHF Convention is being held on Saturday 11th October at Madeley Court Centre, Telford, Shropshire from 1900hrs.

The convention programme includes lectures on cellular radio, 10GHz amateur television and meteor scatter. The forum will be followed by an evening buffet until 2200hrs.

As well as a small trade show, bring and buy and book stall, there will be a measurements facility providing most required measurements up to 18GHz.

A 'how to get there' map and further information is available from J Burden G3UBX, 18 Langley Road, Merry Hill, Wolverhampton for an SAE.

28th Harlow rally

The twenty-eighth Harlow Amateur Radio Rally will take place on Sunday 21st September at the Harlow Sports Centre, Hammarskjold Road, Harlow, Essex. Doors open at 10.00am.

Features of the rally include a giant bring and buy, exhibits by special interest groups and morse tests (must be pre-booked with the RSGB).

Parking is free and a licensed bar will be available for the essential tittle and other refreshments. Access to the venue is via the M11 (junction 7) or the A414, but talk-in on S22 and G6UT will be available for the confused.

Further information is available from David Gould G3UEG on (0279) 22365 (day) and (0279) 27788 (evenings and weekends).

Peterborough rally

The Peterborough Radio and Electronics Society Mobile Rally will take place on Sunday 21st September at the Wirrina Sports Stadium, Bishops Road, Peterborough.

The venue is situated on the river embankment and offers free parking and delicious meals in the adjacent Tropicana Restaurant. With a little ingenuity it should be possible to appease the missus with a slap-up meal and the romantic setting, while you get down to the serious business of radio junk, etc.

Further details are available from Peter Wilson G4PNW at 221 Tyesdale, Bretton, Peterborough PE3 6XZ.

ELOHEX '86

The Hornsea Amateur Radio Club are holding a Computer and Electronics Exhibition on 19th October at the Floral Hall, Hornsea.

The exhibition will include local club and trade stands in addition to the statutory junk and bring and buy stands.

Cafe and bar facilities will be available and talk-in will be on S22 and G4EKT. Doors open from 1000 to 1700hrs.

The club meets every Wednesday at 1950 for 2000hrs at The Mill, Atwick road, Hornsea, North Humberside for a full programme of talks, videos and slides on a variety of subjects. Visitors and guests are always welcome.

Details on the exhibition and club meetings are available from Richard Guttridge G4YTV, tel: (0401) 62498.

More junk

The Aberdeen ARS plans to hold one of its frequent junk sales on 5th September, followed on the 12th by a Raynet presentation and slide show, on the 19th by Sid Will's morse keyer project, and a lecture, "Computers in amateur radio", on the 26th.

The society is currently running the WASR (Worked All Scottish Regions) Award. Full details are available from GM4BKV at 67 Greenfern Road, Mastrick, Aberdeen.

Regular society meetings are held on Fridays at 7.30pm at 35 Thistle Lane, Aberdeen and information can be obtained from Don GM4GXD on (04676) 251.



Any old iron?

Once again, the Dunstable Downs Radio Club will be holding the National Amateur Radio Car Boot Sale at the Shuttleworth Collection Old Warden Aerodrome, Nr Biggleswade, Bedfordshire, on Sunday 21st September.

There will be over 100 stalls selling equipment and components, both new and old.

Admission to the sale, which takes place from 10am until 5pm, is just 50p.

For further details contact Phil Morris G6EES, 10 Seamounts Close, Dunstable, Beds LU6 3EQ. Tel: (0582) 607623.

Speed freaks

Richard Branson may not have succeeded on his first attempt, but he and his Virgin Atlantic Challenger II grabbed the headlines recently when he finally broke the existing speed record for crossing the Atlantic.

A special event station, GB2AC, was set up to mark the occasion by the Wimbledon and District Radio Society. Members involved were G1SHV, G4SBK, G4XLM and G8NGT.

The equipment used by the society included Meteostat weather picture receivers, low speed audio recorders and amateur band SSB transmitters and receivers.

For details of the club contact TW Mansfield G3ESH, 16 Fir Grove, New Malden, Surrey KT3 6RH. Tel: 01-942 1418.

GB00LD

The Thorbury and District Amateur Radio Club will be operating the above special event station over the weekend of 13th/14th September.

The station will be operating during the open days of the Oldbury-on-Severn nuclear power station, and will be operational on HF, 2 metres and 70 centimetres.

Special QSL cards will be issued to contacts. Further information is available from Alan Jones G8AZT, c/o 9 Queen's Walk, Thornbury, Nr Bristol BS12 1SR. Tel: (0454) 416381.

Botswana independence

To celebrate Botswana's 20th anniversary of independ-

ence, Botswana amateurs have been allowed to use a special callsign facility during the independence celebrations throughout September and October.

Full licence holders will use the prefix 802 and novice licence holders will use the prefix 800.

BARS members, including SWLs and other Botswana active radio amateurs are being issued with QSL cards.

Please note that BARS does not operate a running QSL bureau and incoming cards are distributed only to BARS members.

Further information is available from the Botswana Amateur Radio Society, PO Box 1873, Gaborone, Republic of Botswana, Southern Africa.

Going, going, gone!

On 16th September the Rugby Amateur Transmitting Society is holding an auction of radio goodies.

To keep all you hungry hams happy there will also be a barbeque to provide sustenance, as well as trade and club stands.

The doors open at 7.30pm and admission is free. The venue is the Cricket Pavilion, 'B' Building Entrance, BTI Radio Station, A5 Trunk Road, Hillmorton, Rugby, Warwickshire CV23 0AS.

For more information contact Kevin Marriot G8TWH on (0788) 77986.

College quest

The London Electronics College, which celebrates its 80th anniversary this year, intends to mark the event by setting out on an international quest to find its oldest former student.

The college, formerly known as the British School of Telegraphy and founded in 1906, trained early marine radio officers using the original Marconi wireless telegraph, some 300 of its students being at sea in 1912. Harold Bride, wireless operator on the SS Titanic at the time of the tragic iceberg disaster, and Thomas Cottam on the SS Carpathia, the first ship to acknowledge the radio distress messages which saved so many lives, were both trained at the college.



Nowadays, the college specialises in professional electronics technician education, having ceased radio officer training in 1980. The nautical connection was maintained to the end as the college was amongst the sponsors of the Trans-Globe Polar Expedition, lead by Sir Ranulph TW Fiennes under the patronage of the Prince of Wales, during 1979-82. Lady Virginia Fiennes, the expedition radio operator, trained at the college during one of the last marine courses.

Since its foundation the college reckons it must have trained some 5,000 students, many of whom will still be scattered over the remote parts of the world, both on land and at sea. In honour of the college's 80th birthday, a general signal 'QSO' is being sent out to all former students asking them to get in touch again. It's just possible that some of those original 1906 Marconi wireless telegraph operators will respond to the call. Present-day staff and students look forward to welcoming such visitors on a tour of inspection - just to see how much electronics has changed in the era of microcomputers and new technology.

An apple a day . . .

The Communications and Electronics Museum was presented with an Apple computer by the Rank Xerox Information Technology Centre (Slough) on 1st July. The computer was accepted on behalf of the CEM by the Lord Mayor of Portsmouth City, Councillor Miss Marie Seaman, at a special presentation

ceremony at Fort Widley in Portsmouth where the Museum's collection of historic equipment is being recorded and restored. The Apple computer will assist with the administration and archive activity required to establish the museum.

The CEM is building upon the collection of civil and military equipment which has been gathered by Dr Graham Winbolt and Mr Douglas Byrne. In time the museum aims to establish a permanent home for the collection.

Food for thought

The latest issue of the Bury Radio Society's journal, *Feedback*, features an interesting article by Bob Hayter G4OAC about operating VHF/UHF on the routes to the West Country (guess who took his rig on holiday?).

There are many other news items and features worthy of mention, including a review of a morse tutor program by NW Webster G2DWR, which will interest prospective Class A licencees.

Two events the club has lined up are a talk by Peter Smith on ultrasonics and Doppler shift on 9th September, while on 14th October there is a construction competition.

Meetings are held every Tuesday at 8pm at the Mosses Youth and Community Centre, Cecil Street, Bury.

For further details on the club contact M Sivieri G4ZTB, 47 Ramsay Avenue, Bacup.

Spilling the beans

The British Amateur Radio Teleprinter Group (BARTG) recently released the sum-

mer issue of its quarterly journal, *Datacom*.

The fruits of the group's labour include information regarding terminals for the ST5MC de Luxe, a piece about fault finding on computers, packet radio news and an item about data communication.

For further details contact Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ. Tel: (0602) 262360.

South Bristol ARC

We recently received the latest update of the South Bristol ARC's event calendar.

Notable events include a VHF activity night on the 27th August, whilst on 10th September there will be a lecture and demonstration of cellular radio. This will be followed on the 17th by a computer bring and buy evening.

For further details contact Len Baker G4RZY, Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol, Avon BS14 OLN. Tel: (0272) 834282.

IRTS Yearbook

We have just received the 1986/87 edition of the *Irish Radio Transmitters Society's Handbook*.

As usual a useful editorial is included, as well as club reports, information on international prefixes, the 14MHz Band Plan, a news service, and call listings of EI and SWLs.

If you are interested in joining the society, application forms are available from PO Box 462, Dublin 9.

BATC journal

CQ-TV, the bimonthly magazine of the British Amateur Television Club, has the usual crop of excellent articles in the August edition, making it a must for ATV enthusiasts.

Included in this particular issue is John Wood's *TVRO Receiver Project*, which also appeared in last month's *Radio and Electronics World*. There is a report on the 1986 BATC Show which was held in May, as well as articles entitled *Yaesu FRG9600 for television*, *Frequency converter for mathematical PAL* and

Colour from a "no colour" shack.

Membership costs £5.00 per year and forms are available from Dave Lawton G0ANO, "Grenehurst", Pinewood Rd, High Wycombe, Bucks HP12 4DD, on receipt of an SAE.

Top cat

ACCumulator, - the Amateur Computer Club's newsletter, has a new editor, Bazyle Butcher.

The club caters for the more technically minded and this is reflected in the newsletter, which carries articles on the construction and use of computers and add-ons. In the latest issue, Leon Heller explains how to build a simple microprocessor controlled PLL frequency synthesizer, and there is also information on the RS232 interface and radio data systems.

To join the ACC, send £6.00 to Andy Leeder, Church Farm, Stratton St Michael, Norwich NR15 2QB.

Lough Erne AGM

On 17th September the Lough Erne Amateur Radio Club plans to hold its AGM. The venue will be the Railway Hotel, Enniskillen, Northern Ireland at 8.00pm.

Further information is available from W A Ward G14WRE on (0365) 24905.

Quick and painless?

On Thursday 11th September Steve Wight G3ZVW, of the Southgate ARC, will be discussing 'The Quick and Painless Way to Learn CW'.

It all goes down at the Holy Trinity Church Hall (Upper), Green Lanes, Winchmore Hill, London N21, at 7.45pm.

For further details contact Dave Elson G4YLL, 200 Churchgate Road, Cheshunt, Herts EN8 9EL. Tel: (0992) 30051.

Pay attention

SWLs wishing to take the RAE in May 1987 may wish to attend a course running at the Avondale Evening Centre in Stockport on Tuesdays.

Enrolment will take place on the week commencing 15th September.

For further details contact the Evening Centre Head or ring Rik Whittaker G4WAU on (061) 427 4730.

NOTES FROM THE PAST

Old Wives' Tales

Contrary to a widespread belief, *all* modern inventions are not the work of teams of professionals working for big organisations. A steady proportion are purely amateur, particularly those of everyday devices rather than abstract ideas. The safety razor was just such an invention, and Kodachrome was initiated by two amateurs. Nearer at home, Bakelite - so widely used in radio - at least started off with independent backing.

Inventors, too, appear to be born rather than made. Once a man has invented something he is eagerly snapped up for institutionalised research. Here he gets a chance to show his paces with big financial backing. Perhaps for this reason (the spreading of a wide filter for all sorts of ideas still untried) institutional research pays off dividends and is so widely thought to be responsible for the introduction of *all* new inventions.

Usually, whenever I get a lot of correspondence on a particular point, and especially when the writers seem a little hazy on a subject, I try it out on my circle of friends and acquaintances... It invariably provides a useful clue to what people popularly suppose and what they really know.

I did just this on the topic of inventions, and to my astonishment I found quite a lot who were firmly convinced that 'big businesses' buy up and suppress inventions so as not to ruin their existing market. This, of course, is just nonsense, in Britain, at any rate. If a patent is not worked for three years after the grant, any bona fide applicant can apply for the issue of a compulsory licence to do so.

Old wives' tales die hard. One or two friends I spoke to obviously still harboured a suspicion that there was a catch in it somewhere, even after I tried to disillusion them. Perhaps there is something in the romantic fiction that bright ideas are regularly bought up and 'killed' that makes them prefer to believe it's true!

South Cheshire ARC

The South Cheshire ARC has sent us details about some forthcoming events, including a talk on Operation Raleigh on 8th September.

The club's AGM on 13th October will be followed by a lecture on railway workings.

All meetings take place at the Crewe LMR Sports Club, Goddard Street, at 8pm.

For further details contact Chris G1PUV on (07816) 73185.

Happy hunting

Crawley ARC's latest newsletter features some helpful advice on antennas by G3UOV.

One event mentioned in the club's programme summary sounds particularly interesting and takes place on 27th August - a pub hunt...

For further details contact Dave Hill G4IQM, 14 The Garrones, Worth, Crawley, West Sussex RH10 4YT.

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FOR SALE

■ National HRO plug-in coil packs, 900kHz to 30MHz. Cover ranges 900kHz-2.05MHz/1.7MHz-4MHz/ 3.5MHz-7.3MHz/ 7.0MHz-14.4MHz/ 14MHz-30MHz, £20. Can have receiver, power supply and speaker for nothing (been modified to partly miniature valves). Would prefer swap for useful military radio, WHY. Tony Howard. Tel: (0234) 68559 (work hours, inc Sats)

■ Two TS180S HF transceivers, two PS30 20A PSUs, two AT230 tuning units, VFO180, SP180 with built-in filters. Also SM220 station monitor scope, MC50 station mic, microdot RTTY terminal (video module requires attention). All good condition. Reason for sale: changing hobby. Tel: (0788) 536626

■ Exchange complete camera processing outfits, including Olympus OM40 prog, OM30 cameras with flash, winder, lenses, filters, gadget bag etc, and colour darkroom with enlarger, p/tank, chemicals, paper, trays, plus lots more. All 2 months old in vgc, cost £820, will exchange for good HF trans, preferably with FM, but all very carefully considered, WHY? Or sell for £550. Tel: Chris. (02407) 5036

■ Trio R600, new October, original packing, as new condition, not used a lot, genuine reason for sale, £250. Tel: Deal (0304) 363687

■ Yaesu FT290R2 mtr, no mods. Realistic PRO2003 home base scanner, covers 68-512MHz. CWR600 CW/RTTY reader. MM144/100S 2 mtr 100W linear. Saisho TCR5005 port/mains TV/stereo radio cassette. Total value £1,028 new, exchange for all band HF trans, ie FT102, IC740, IC720A, FT902DM, TS430, WHY, or sell £650. Will include Ferguson 3V32 stereo 2 speed VHS video, original price £649, for FT1, FT980, TS980, TS930S, or sell total for £1,000. Tel: Chris G1BFH. (02407) 5036

■ Spectrum 48K interface one, 2 microdrives, cartridges, ZX printer plus 6 rolls paper, data-corder, joystick and interface, Spelmate back-up interface, keyboard, every issue *Crashmicro*, *Micro Adventurer*, lots of software, books, adventure maps, game hints, in fact complete computer set-up (going back to model railways), £199. Dave, Bourne End. Tel: (06285) 24529 evenings

■ Amstrad CPC6128 colour monitor, built-in disc drive, 2 months old, boxed, sell for £300, or swap for Yaesu FRG8800. Tel: Hull 651498 after 1600 hours and ask for Paul

■ 19in rack cabinets to take 10 1/2in racking. Cabinet 16in deep, £8. 140mm card frame to suit above, £2 each. Don. Tel: Hitchin 811591

■ Trio TR7200G 2 metre, FM only transceiver, £100 ono. Spectrum Plus keyboard and power supply, £60 ono. Plus 18 inch b/w TV, £20 ono. Dave Wells. Tel: Lancing 755898 after 8pm

■ Yaesu 225RD, immac cond, muTek FE-board, original packing, £325. Yaesu FL2100Z linear, new bands, mint, original packing, £270. Westtower 3/S 45ft, two years old, £210. New QTH forces sale. Tel: (0932) 780917

■ 80ft radio telephone aerial complete with guys, cost £3,500 new, offers. Thorp Wardell Services Group, Barley Castle Lane, Appleton, Near Warrington. Tel: (0925) 61356

■ Realistic DX100 and DX200, all band communications receivers, complete with operations manuals, £120 ono. RO'(G) Shiels, 3 Mess, HMS Arrow, BFPO Ships. Tel: (021) 327 6678

■ CAPCo SPC300 ATU Rx/Tx, 400W 1kW PEP; 4-1 balun, 1kW PEP; 2 open wire spacer kits, £100. Tono 777 reader/sender, RTTY, Amtor, bit-inversion, CW etc, £200. Both boxed as new with manuals. Mr Ferry. Tel: 01-570 5603

■ Yaesu FR101S comm receiver, mint cond, no mods, with manual, £200. Realistic DX200 five band comm receiver, no mods, mint cond, with manual, £75. Buyers inspect and collect. G2AFN, QTHR.

Tel: Leamington Spa (0926) 38926

■ Trio TS430S, virtually unused, hence £600, with original packing and manual. Icom tcvr IC701, 100W, solid-state, 10m to 160m (pre-WARC), complete with matching spkr/PSU IC701 PS and desk mic, SM2, no extras to buy, all original packing and manual, prefer buyer to inspect and collect or carriage extra. Would be interested in IC2001D with aircraft as p/ex. VR57 valve wanted. Tel: Hemel Hempstead (0442) 59970

■ Eddystone 770R receiver - 19 to 165MHz, in six bands, £100. KW Vespa Tx, £30. RTTY V-type tuning indicator, £10. Tel: (0608) 811102

■ Scanning receiver, Bearcat 210, coverage 32-50, 146-174, 416-512MHz, with service manual, boxed, mint, £115 ono. Realistic PRO2001 scanner, coverage 30-50, 144-174, 430-512MHz, service manual available, in good condition, £150 ono. Shogun sel call unit, new, £25. Tel: 01-582 8738

■ Yaesu FT209R trans hand-held, 10MHz coverage, good cond, boxed with speaker mike and charger, £190. Standard C7800 VHF trans, good cond, boxed, £140. G6EBN not QTHR. Tel: Waltham Cross (0992) 32114 after 7pm

■ Trio TM211E 2 metre FM transceiver, 9 months old, warranty, inst manual, boxed, 5W/25W incl dcs and dsc system used in shack, only £250. G1JUB not QTHR. Tel: Cuffley 872772

■ Realistic DX160 comm receiver, general coverage, 150kHz to 30MHz in five bands, excellent cond, good working order, ideal for beginner in short wave radio or as a standby rec. Buyer collects, £50 ovno. Tel: Goole 2235 ask for Andy

■ Leak throughline FM tuner (mono), 88-108MHz, ideal for conversion, £10. Tel: Bristol 776891 evenings or weekends

■ Ferrograph 4AN mono open reel tape recorder, speeds 3 3/4-7 1/2, complete with manual, microphone and 20 assorted tapes. Gwo, bargain, £18. Tel: Bristol 776891 evenings or weekends

■ Sony ICF2001 FM/AM/SSB/CW Rx, 150kHz to 30MHz plus 76MHz to 108MHz FM, as new and boxed with manual, £89. Ken Ballance, 18 Rambleford Way, Parkside, Stafford ST16 1TW. Tel: Stafford (0785) 44964

■ 23cm filter, 3-pole type, 70cm 1/2-wave filter, wavemeter to cover 144MHz to 2500MHz, 10GHz wavemeter in kit form. Paul Sergeant, 6 Gurney Close, Costessey, Norwich. Tel: (0603) 747782

■ FT707 transceiver, YM35 mic, 10A Coutant PSU, all vgc, £350. Trio JR500S Rx, £30. Datong code call, £10. Heathkit 'scope 10-18U, £20. Rod G3RTB. Tel: (0904) 641011, York

■ Sony ICF2001D, brand new, £300. John Atkinson, 39A The Drive, Adel, Leeds LS16 6BQ. Tel: (0532) 670476

■ Ham Jumbo HF Tx - main RF trann's and xtals removed due to visit from DTI, but can soon refit or sell in non-working cond. Only one mod: record jack on front panel for conn'tn to computer for CW decoding. Or will swap for SX200N scanner or any similar rig. Also loads of junk for home-brew fans. Phone for details. Pete, 27A Friar Street, Bridgwater, Somerset TA6 3LH. Tel: (0278) 428 633

■ Four BSR/MacDonald turntables, all in varying states of disrepair (all serviceable), £10 each or £30 for 4. 100 watt disco PA (needs attention), £30 ono. 3 channel light controller (needs attention), £20 ono. Electric lead guitar (Strat copy) plus case (box), strap and lead, £80 ono. Marshall 12 watt lead guitar amplifier, as new and under guarantee, £70. Beyer Dynamic audio microphone (as used by the BBC, etc), £20 ono. All carriage arranged to anywhere. All items must be sold. Tony D Sheach, 8 Struan Road, Portree, Isle of Skye IU51 9EG. Tel: (0478) 2548, after 7pm

■ Grandstand P2004 2 watt 4 frequency FM/UR hand-set, won in a competition, extremely good

condition and a very rare item (Serial No 000019). This set is believed to be one of very few in circulation (model never marketed). Uses FM/UR channels 2, 14, 21, 39. This rare item must be sold so highest offer accepted, circa £70+ ono. Carriage anywhere in UK or abroad. Tony D Sheach, 8 Struan Road, Portree, Isle of Skye IU51 9EG. Tel: (0478) 2548, after 7pm

■ Yaesu FT290R, immaculate, inc case, Nicads, charger, £250. Desk mic with compression, wired 290, £25. Tokyo Hy-power 30 watt linear, with GaAsFET pre-amp, £55. 6 amp PSU, £15. Save £15 buy the lot for £330. Halicrafters SX140 ham band Rx, £60. Realistic DX100L Rx, £30. Buyers to collect. Datong D70 Morse Tutor, £35. Mike G1HGD. Tel: Kenilworth (0926) 55158 evenings, 53964 day

■ Trio TH21E 2m hand-held, Trio UK spec, with Nicad, charger, flexiwhip aerial, strap and case. Excellent condition, £155 incl UK carriage. C Redwood, 45A Lutworth Avenue, Hamworthy, Poole, Dorset BH15 4DH

■ Kubota 3W generator, now costs over £700. Run for only 30 hours, £495. G6JNS QTHR. Tel: (0905) 620041, 24 hours

■ First reasonable offer for following complete HF station: HW101 with PSU, immaculate cond, 220W PEP; Hanson PEP/Voc/SWR meter (new); VR3 vertical antenna (new); 20ft x 2in mast with 10ft ext: AR2000 rotator; 8 over 8 beam; co-ax and plugs and many station accessories included. Reason for sale: emigration. Callers or written offers welcomed, must sell by July 31 1986. Chris GM0CFK, 130 Main Street, Kinglassie, Fife

■ 19 inch cabinet rack enclosure with rear door: height 59 inches, width 22 inches, breadth 26 1/2 inches. Good condition, buyer collects, £25. Tel: Southend (0702) 521966

■ Amstrad CPC6128, colour monitor, built-in disc drive, 2 months old, boxed. Sell for £300 or swap for Yaesu FRG8800. Tel: Hull 651498 after 1600 hours and ask for Paul

■ Sanyo RD222 stereo cassette deck with Dolby noise reduction and metal tape facility, dual LED VU level indicators. Sanyo TT22L tuner, LW, MW, FM. Sanyo TP22 semi-automatic turntable with cartridge. Sanyo TA222 stereo amp, 20 watts rms per channel, needs attention, no left channel. Sanyo 2-way speakers, 20 watts rms, and/or cabinet in rosewood. Cost over £250, sell for £150 - offers. Mr Loxley, 24 Burnside Avenue, Salford, Manchester M6 8WR. Tel: (061) 737 4015

■ Hard-up student with large overdraft needs to sell his FT101ZD, SSB/CW, 9 bands, fan, dc/dc converter and microphone. Crystalled up for eleven metres but still have ten metre crystals if you want to convert back, £380 ovno. Tel: (061) 766 3466 after 6.30pm

■ Mags for sale: *Wireless World*, Dec '53, Mar-Sept '54, Nov-Dec '54, Oct '55-Mar '56, May '56-Aug '57, Jan '63-June '63, Jan '64. *Short Wave Magazine*, 1962 complete, 1963 complete, 1964 complete, Jan '65, Jan '67-Aug '67, July '68, April '69-Sept '70, Feb '71-June '71. *Radio Communication*, May '69-Mar '70, Aug '68. *RSGB Bulletin*, 1964 complete, 1965 complete, 1966 complete, Jan and Mar-Aug '67. Offers please. Richard Williams, 32 The Gower, Thorpe Egham, Surrey TW20 8UD. Tel: Chertsey 60476 evenings

■ Pioneer record deck PL12D, complete with Audio Technica stylus, offers. Tel: D Head on Stevenage (0438) 62179

■ ASR 33 teletype, 110 baud ASCII serial input. In good order and complete with keyboard, stand, 8-bit paper punch and tape reader, £125. Tel: (0387) 62108

■ FDk 750xx 2m multimode transceiver, £275 ono. MM 100LS 2m linear amp with preamp, £110 ono. Both items vgc. Tel: Ashford, Kent (0233) 29685

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■ Spectrum 48K, Interface One, 2 microdrives, cartridges, ZX printer + 6 rolls paper, dattacorder, joystick + interface, Specmate back-up interface, keyboard, every issue *Crashmicro*, *Micro Adventure*, lots of software, books, adventure maps, game hints, magazines, in fact complete computer set-up (going back to model railways), £199. Tel: Dave, Bourne End 24529 evenings

■ High quality 12V dc to 24V dc 0.5A converter, £10. Miniature 24-column RS232 input printer, includes drive PCB, paper ribbons (RS301-959), £40. Various Wood & Douglas modules, 70cm, 2m. Data elect sensitive printer, BCD input, mains PSU, £45. Rustrack chart recorder, mains supply. 0-1V galvo, £50. All with data. Terry, tel: (0276) 34783 after 1800

■ Pensioner enthusiast wants HMV2818 b/w TV (Thorn 1591 chassis) cheap. I will repair (?). Polaroid roll camera 8000, with leather case, beautiful, not plastic! £35 ono. Also Rolleiflex 2 1/4 x 2 1/4, Tessar 1.35mm lenses, for roll film, well used but lenses etc perfect, £65 ono. Wanted: Lindsley Hood/Hart tape recorder-kit or complete, or who would build one (how much please?). K A Evans, Shelford Cottage, Melbury Abbas, Shaftesbury, Dorset SP7 0DB. Tel: (0747) 3515

■ Taylor valve tester, as new, £80. Electronic valves, 6CHC, new and boxed, £5. New, not boxed, £4. 6AM6, £1. EF80, £0.50. EF86, £2. EF95, £1. EF91, £1. ECC84, £0.50. ECC83, £1. ECC81, £1. EL84, £0.50. EY51, £0.50. EY86, £0.50. EZ81, £0.50. E80F, £2. 6V6G, £1. 6CH6, £4. 6AM6, £1. 6BW6, £5. 6AT6, £0.50. 6BE6, £0.50. 6BA6, £0.50. 12AU7, £0.50. 12AT7, £0.50. PCC84, £0.50. PCF 80, £0.50. EZ81, £0.50. Copies of valve data sheets and characteristics, £0.50 per copy, all plus post and packing. Tel: (0843) 587243

■ Leak through-line FM tuner, 88-108MHz, ideal conversion, £10. Tel: Bristol 776891 evenings or weekends

■ Icom IC-271E 2m multimode base stn, 12V, 25W with muTek front end, mint, £550. Diawa DR7500X rotor, med/heavy duty (would handle 3-el tribander), £80. Howes speech processor and RTTY switch box for IC-271E, £10. Altron SM30WM tilt-over mast, 30ft, winch etc, buyer collects, £180. Tel: Peterlee (0783) 863212

■ DX-TV! Waltham Ministar 6 inch mono VHF/UHF (bands 1, 3, 4 & 5) system B/G. Sharp selectivity and sensitivity. Has pulled in all western and eastern European countries, one year's use only - condition genuinely as new, £50. Tel: Porthcawl (065671) 5813 and ask for Mike

■ Wood & Douglas 70cm PA 70FM10, 500mW to 10W (kit), £30. UFM01 70cm oscillator, £18 (kit). 70LIN3LT 500mW to 3W PA, £15 (kit). 1250DC50 24cm downconverter, £54. 70cm/24cm WDV400/1200 varactor, £50. 50MHz IF processor, £31 (kit). Jaybeam 23cm D15/23 yagi (new), £46. Tokyo Hypower 2m linearr, HL82U, 80W. Phone Paul G4XHF on (0293) 515201

■ Spectra physics laser, model 120, 15mW helium/neon ion type. Exchange for a high quality 40MHz + scope or sell for £550. Klay Lund, 9 Blencow Drive, Brackley, Northants NN13 6HH. Tel: (0280) 703115

■ AVO electronic multimeter, 45-range, £25. RFU1 signal gen, 100kHz-200MHz, £15. IG-102 signal gen, 100kHz-220MHz, £15. OS2 scope, £25. IM-1B valve multimeter with RF probe, £20. All perfect order with handbooks. Western four-way antenna switch, £5. MML 144/30LS linear, as new, £40. Osker power/SWR meter, SWR200, four ranges to 2kW, covers 3MHz to 200MHz, as new, £20. Earl G3OXV, 1 Mayfield Drive, Daventry, Northants. Tel: 702265

■ Tektronix 545A scope, perfect working order, very useful instrument with manuals, £65 ono. PSUs, 5V 10A, 12V 5A self-contained, as new, £7 each (6 available). Mains trans, 110/240V, 80VA, £5 each (6 available). Mono data monitors, Philips, 9 inch 12V, some screen marks, £7.50 each (6 available). 26 inch monitor, colour, vgc, RGB/NTSC input, £15. All items collect or + carriage. K E Franklin, 50 Abingdon Street, Burnham-on-Sea, Somerset TA8 1PJ. Tel: (0278) 784205

■ H/P TDR model 1415A, old but excellent + manuals, offers to Alan on East Grinstead (0342) 312329 after 6pm

■ In-circuit transistor tester, small, PP3 powered,

LED indication, with 3 test hooks, new, £20 incl p&p. Also 7A 36V mains trans, £10 plus p&p. R Duncan, Park Cottage, 7 Park Road West, Sutton-on-Sea, Lincs LN12 2NQ. Tel: 41681

■ Two GEC mobile high band radio telephones, 4ch, xtalled for working together. Compact, modern, vgc, £75 the pair including technical details. Pye F27 base station, 6ch high band, will work on 2m, vgc, £50, remote control available. Also GEC wire recorder as used by US war correspondents during WWII, working order, £25. Walker, 23 Forest Hill, Yeovil, Somerset BA20 2PF. Tel: 25225

■ Slow-scan TV transmit and receive program for Sinclair Spectrum computer, no hardware needed. Super program, cost £15, accept £5. Also have a Prism VTX 5000 modem, cost new £99, accept £40. Paul Goodrum, 9 Ryston Close, Downham Market, Norfolk PE38 9BD. Tel: (0336) 388615

■ Yaesu FT290/FT790 optional extras: mobile mount MMB11, £22; speaker mike YM49, £12; PTT switch box SB2, £10. All as new with boxes, can deliver south-east. Also, are you fed up with thumbwheels? I want to swap my FT708 with extras for a good Icom IC-4E to match my IC-02E. Please phone (07914) 2823 evenings or weekends (QTH Brighton)

■ Hang glider, modern single surface, less than 10 minutes air time, seated harness and helmet included, value about £200. Exchange for 934 CB gear, general coverage receiver or anything interesting. EPROM blower, small lathe, WHY? Mike Barber, tel: Aylesbury (0296) 28369

■ Telefunken Opus 8 receiver, immaculate, offers. Philips B4X23A receiver, offers. Pye medium, long, five short waves. Eveready portable. Heathkit receiver in leather case. Whiteley Minor model Stentorian loudspeaker. E J Byrne, 28 Abbeyle Road, Birmingham B31 3TJ. Tel: (021) 475 1794

WANTED

■ Eddystone 888, 880 or 680. KW76, 77, 202, or Drake 2B. All letters answered. B Smith, Hirsts Cottage, Spa Lane, Latham, Ormskirk, Lancs L40 6JG. Tel: (0695) 21128

■ Vintage wireless sets: round bakelite Ekcos, also 1155 Rx, AR88 or Eddystone sets, working or not, by private collector. Other communications receivers considered. Also wanted: circuit or manual for US Army Signal Corps receiver type BC342N. Please phone Clacton 473540

■ Cheap linear amplifier for 26-30MHz AM, FM and SSB. Must be switchable 25W, 50W, 100W. David Mitchell, 'Westfield', Rillington Fields, Scagglethorpe, Malton, N Yorks YO17 8EB

■ Video recorder, any make, any condition, working or not, not concerned about mechanics/heads etc. Will collect. Tel: D Head on Stevenage (0438) 62179

■ Manual, service sheets, or any information on Russian made dual trace oscillograph type CI-16, dated 1973. Also any details or information on equivalent for Russian valve 6C1917. Simon Baines, 9 Yeats Close, Newport Pagnell, Milton Keynes MK16 8RD

■ Yaesu FRG7 receiver or Yaesu 7700 general coverage receiver, 0-30MHz, or Trio or Icom, with AM/SSB. All letters will be answered, details of price and condition please, distance no object. Mr H Richardson, 7 Grange Road, Thornaby, Cleveland TS17 6LT

■ Portable record players - late '50s, early '60s valve models, particularly Dansette Automix using UL41 amplifier and 6 1/2 inch round speaker, also Pilot with UCL83 amplifier. Other models required are Philco, EAR twin-speaker models, Pye black box, HMV. Can possibly collect. E C W Huggins, The Malt House, Laxfield, Woodbridge, Suffolk IP13 8DZ. Tel: (098) 683 660

■ Eddystone EC10 or similar comm receiver in working or repairable condition. A J Reynolds, 139 Collenswold Road, Stevenage, Herts. Tel: Stevenage 355325

■ Oric Atmos programs and instruction manual, can copy and return. EC55 valve also wanted. Write

to Howard Ketley, 1 Tewkesbury Avenue, Mansfield Woodhouse, Notts NG19 8LA. Tel: (0623) 20990 Monday to Thursday evenings after 7pm

■ Trio R1000 general cov Rx, AM + SSB, or any other gen cov Rx and VHF scanner. I will pay good price but it must be in good condition. I will pay air freight to Israel. Please write to or phone Janssen David, PO Box 129, 70600 Yavne, Israel. Tel: 08438174

■ Scanner users look! Book in the making: do you run a scanner often, anywhere in the UK? Do you collect freqs? Do you use it with a computer using RS232C port? Would you like a reward? Then spend a 12p stamp and write to me in strict confidence and tell me about your scanner. All letters answered. Also wanted: instructions for Texas TI58, service manual for AOR2001 and 2002, also Trio TH21E h/port. All costs+ returned. Ring or write to Peter, 51 Weyland Road, Winesham, Suffolk IP6 9ET. Tel: (04738) 5526 10am to 10pm

■ Icom IC-4E in good condition: I would like to swap my Yaesu FT708 with extras for an IC-4E to enable me to share extras with my new IC-02E. My rig has keyboard control, scanning, memories, priority channel etc. It is in very good condition and works well, so I would expect something similar. Tel: (07914) 2823 evenings/weekends only. Can demo south-east England

■ Hacker radio, any model considered, working or not. Tel: Reading (0734) 883799

■ Back issues of *Radio and Electronics World*. Also *Everyday Electronics and Computer Projects*. Write to Martin Burgess, 2 Beechwood Road, Rhyl, Clwyd. Tel: (0745) 825036 after 6pm

■ Any large short wave receiver, must be valved, the larger the better. Will take ex-army or ex-navy etc. Don't worry, I will pay for post and package, or possibly collect. Remember, the larger the better! C Loxley, 24 Burnside Avenue, Salford, Lancs M6 8WR. Tel: (061) 737 4015

■ Coil pack for Eddystone 940, or info on same, scrap set considered as long as coil assembly intact, or bottom range four coils. Have schematic diagram and manual. (OAP hobby revival). J L R Clayton, 36 Stoke Hills Estate, Farnham, Surrey GU9 7TF. Tel: 712054

■ Collins R-390A/URR or Racal 6217E. P Swiatek DD5GF, Bunzlaver Str 5, 5 Koeln 40, W Germany. Tel: (2234) 47976

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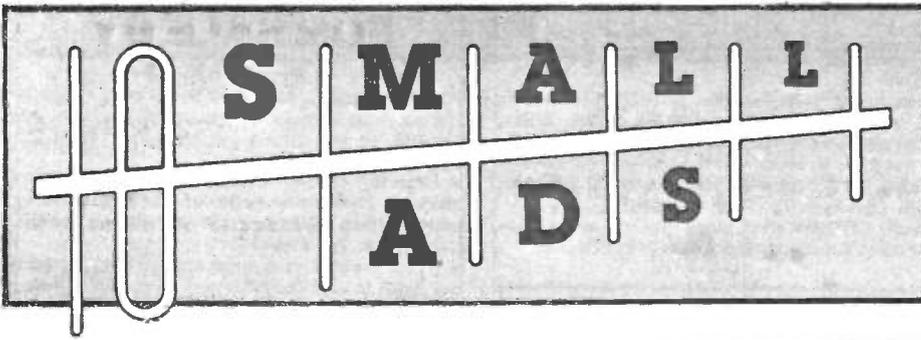
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■ Cossor ganging oscillator model 343. Manual for radar CRT reactivator model 202. *Wireless World* 1984 August to December inclusive and January 1985, for completing my volumes. Cambridge mutual inductance bridge, Marconi 1936 9-valve LW/MW radiogram or chassis model 292 or



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TMS329 £1.00 TMS3720ANS £3.00 TMS4014 £7.00 TX-012 £1.00 TM59902 £1.20 ULN2216 £7.50 SN2948 £5.00 SN29770BN £1.00 SN29771BN £1.00 SN29772BN £1.00 SN7422N £1.00 SN7427N £1.00 SN74107 £1.00 SN74167 £7.00 SN7472N £2.00 SN75108AN £1.00 SN76031 £1.00 SN76003 £1.00 SN76013ND £1.50 SN76018 £1.00 SN76008 £1.00 SN76023N £1.50 SN76033 £1.50</p> <p>Diodes BY127 10p BY133 10p BY134 10p BY164 50p BY176 25p BY179 40p BY184 25p BY187 10p BY190 40p BY196 30p BY199 10p BY200/4 5p BY206 10p BY208/800 5p BY210/400 5p BY210/800 10p BY223 80p BY224/800 4.8A/800v bridge £1.00 BY226 15p BY227 15p BY228 20p BY229/400 30p BY237 5p BY254 10p BY255 30p BY298 10p BY299 10p BY406 5p BY527 20p BY407a 10p G11 470M/250V SP £1.00ea Min 12volt relays 75p R 1038 40p R 1039 40p R 2035 50p R 2010b £1.00 R 2029 50p R 2210 50p R 2257 60p R 2265 50p R 2305 50p R 2306 50p R 2322/2323 pair 60p R 2323 15p R 2396 50p R 2461 80p R 2430 50p R 2443-BD124 40p R 2737 40p R2738-TIP41 30p</p> <p>R2775-TIP41c 40p R3129-TIP47 40p S 2008b 80p S 20940 £1.00 BU 105/04 80p BU 106 10p BU 126 80p BU 180a 65p BU 204 70p BU 205 £1.00 BU 206 £1.00 BU 207 £1.00 BU 208 80p BU 208 on heat sink 70p BU 208A £1.10 BU 208D 90p BU 222 £1.00 BU 326 £1.00 BU 407 60p BU 409 60p BU 426V 60p BU 500 £1.10 BU 508A £1.20 BU 526 75p BU 705 £1.00 BU 807 £1.00 BU 824 £1.00 BU 826 £1.00 BU 834 30p BUY 71 £1.00 TIC 106A 30p TIC 116m 40p TIC 116n/Y 1003 35p TIC 126N 40p TIC 203 30p TIC 225S 40p TIC 226E 40p TIC 226m 40p TIC 236m 30p TICV 106V (T092 case 2A/1A) 10p TIP 29 30p TIP 30 35p TIP 30A 35p TIP 30B 40p TIP 30C 45p TIP 30E 35p TIP 32 25p TIP 33B 50p TIP 33C 70p TIP 34A 50p TIP 34B 60p TIP 40 70p TIP 35B 70p TIP 35C 70p TIP 35D 80p TIP 36 50p TIP 36C 70p TIP 37 40p TIP 41 70p TIP 42/BRC 6109 30p TIP 48 40p TIP 49 30p TIP 50 30p TIP 100 30p TIP 102 30p TIP 112 30p TIP 115 50p TIP 117 30p TIP 120 35p TIP 125 35p TIP 130 30p TIP 131 25p TIP 136 30p TIP 140 50p TIP 140 50p TIP 2955 35p T6032 40p T6036 40p T6040 40p T6047 40p T6049 40p T6051 40p T6052 40p T9004 40p T9005 40p ZTX 102C 10p ZTX 107 10p ZTX 108C 5p ZTX 109K 5p ZTX 213 5p ZTX 341 10p ZTX 342 10p ZTX 451 10p ZTX 550 10p MJ 2253 60p MJ 3040 10p MJ 2209 10p SF 8985 50p SAB 3205 £1.00 SAB 4209 £1.00</p> <p>SPECIAL OFFER CVC21 Chassis complete £35 Computer Transforms 20V/2.5A, 20V/1.5A, 17V/5A, 19V/5A, 28V/0.5A £3 Mains ViewData Torroidals £3.75 240V/240V/4 amp/6v 500ma in / out</p> <p>BD517 30p BD519 30p BD534 30p BD544 30p BD584 30p BD610 30p BD646 30p BD676 30p BD678 30p BD681 30p</p> <p>Voltage Regulators +5V/UA78P05SC 30p -5V/UA78M05CP 25p -8V/79M08C 30p +6V/79M06C 30p +10V/78L10 20p LM 337 30p LM 342/18 30p LM 340T 5.0 30p +18V/78M15 30p +18V/MC78M15 20p +24V/78M24 30p MC 7724cp 40p MC 7824 40p TIS 90 10p TIS 91 20p TIS 92 20p TIS 93 20p U 19885 40p U 3845 15p U 3845 15p MR 508 10p MR 501 10p</p> <p>MR502 10p BCW 71R 30p BYF 1202 10p BYF 1204 10p BYF 3126 10p BYF 3214 40p BYX 10 6p BYX 36/600 35p BYX 38/300 25p BYX 49/600R 75p BYX 55/350 10p BYX 55/600 (Bead) 10p BYX 71/350 20p BYX 71/600 20p BYX 72/300 20p BYX 33/600 50p BYV 95B 10p BYV 95C 12p BYZ 106 12p BPW 41 15p BYW 56 2/A1000v G11 8p BZU 15/24 54p BZY 93/75 50p BZV 15/18 30p BZV 15/30 30p BZW 70c6v2 10p BZX 79 3v 10p BD414 10p BD116 10p BC440 30p BC454 10p BC455 10p BC456 10p BC460 25p BC462 10p BC463 10p BC478 10p BC527 10p BC532 10p BC546 10p BC547 10p BC548 10p BC556 10p BC557 10p BC558 10p BC559 10p BC635 10p BCX31 25p BCX32/36pair 75p BD116 25p BD124 (metal) 50p BD130Y 25p BD131 30p BD132/238 30p BD135 25p BD138 30p BD138 30p BD176 25p BD182 £1.00 BD183 70p BD202 60p BD204 60p BD221 60p BD222 30p BD223 30p BD243c 30p BD244 50p BD250a 30p BD252 20p BD253 20p BD331 30p BD332 20p BD373b 20p BD416 25p BD433 25p BD437 25p BD439 50p BD501 50p BF761 30p BF858 30p BF871 30p BFR39 7p BFR52 7p BFR79 15p BFR81 15p BFR87 10p BFR90 10p BFT42 10p BF694 10p BF758 30p BF760 30p BFT34 15p BFT43 10p BFT44 8p BF784 20p BFX29 30p BFX84 25p BFY50 15p BFY52 20p BFY90 25p BLY49 25p BPW41 25p BRC116 25p BRX43 15p BRX48X 10p BRY56 30p BSS68 10p BSY79 10p BSY95a 10p BT Y80 10p BSX19 17p BSX20 17p FT3055 30p TCE82 30p 2N930 30p 2N2221 5p 2N2222 5p 2N2906 10p 2N3055 40p 2N3566 10p 2N3702 10p 2N3711 10p 2N3593 50p 2N3904 15p 2N4355 10p 2N4442 10p 2N4444 £1.00 2N5296 40p 2N5983 30p 2N6099 40p 2N6109 40p 2N6130 50p 2N6133 20p 2N6348 10p 2N6399 20p 2X 2N6099 on heat sink 50p 2SA437 20p 2SB407 Sanyo 10p 2SB474 30p 2SB566 10p 2SC361 10p</p> <p>2SC458 90p 2SC515 10p 2SC732 10p 2SC733 10p 2SC1030 £1.00 2SC1172A 10p 2SC1173 10p 2SC1174 20p 2SC1546 20p 2SC1725 20p 2SC2068 20p 2SC2073 8p 2SC2122A £1.00 2SC2229 15p 2SC2730 15p 2SD180 TO380V/6A 15p 6A 15p 2SD200 £2.00 2SK30A 10p BC107 10p BC108 10p BC109 5p BC113 10p BC114 10p BC115 10p BC116 10p BC117 20p BC119 20p BC125 10p BC126 10p BC138 10p BC140 30p BC41 25p BC143 25p BC147 10p BC148 10p BC149 10p BC153 10p BC154 10p BC157a 10p BC158 10p BC159 10p BC160/16 25p BC171 10p BC172 10p BC174 10p BC183 10p BC184 10p BC185 10p BC207 10p BC212 10p BC213 10p BC214 10p BC237 10p BC238 8p BC239 8p BC250 8p BC251 10p BC252 10p BC262 10p BC263 10p BC294 30p BC298 10p BC300 30p BC301 30p BC303 7p BC308 7p BC309 10p BC327 10p BC328 10p BC329/338 pair 10p BC337 10p BC338 10p BC347 10p BC349b 10p BC350 20p BC356 10p BC384 10p BC394 10p BC413 10p SN761 10N £1.00 SN761 15AN 50p SN76131 10p SN76141N £1.00 SN76226 £1.00 SN76227N 60p SN76228N £1.00 SN76270 £1.00 SN7632N 50p SN76544N £2.00 SN76545 £3.50 SN76546 £1.00 SN76550 £1.00 SN76552 30p SN76570 £1.00 SN7660 10p SN7660N 50p SN76620AN 50p SN7666 10p SN7670N £1.00 SN7670N 75p SN76708AN 75p SN76720 £1.00 UA783P3C 40p UA781A102 40p BT138/10A 70p BT146 30p TBA540Q £1.50 TCA270 £1.00 TCA270Q £1.00 TCA640 £1.00 TCA650 £1.00 TCA270S £1.00 TCA270SQ £1.00 TCA740 £1.00 TCAR80 £4.00 TCA830 £1.00 TCE100 £2.25 TCE120CO £1.00 TDA1400Q £1.00 TDA1003A £1.00 TDA1010 £1.00 TDA1060A £1.50 TDA1072 £1.00 TDA1151 30p TDA1170 £1.00 TDA1190 £1.00 TDA1200 75p TDA1327A £1.00 TDA1365 £3.00 TDA1412 50p TDA2003 60p TDA2004 £2.00 TDA2010 £1.00 TDA2140 £1.00 TDA2300 £2.00 TDA2525 £1.00 TDA2640 £2.00 TDA2522 £1.00 TDA2530 £1.50 TDA2532 £1.00 TDA2540 80p TDA2541 £1.00 TDA2571AQ £2.50 TDA2575A £1.00</p> <p>10 Mixed TV & radio speakers £4.00 2x Hi-Fi Philips car tune up tweeter EN8320 £10.00 ITT CVC458 way resistor unit 400V/cap £3.00 470/10v x 10 50p 68/16 x 10 50p 150/15 x 10 50p 47/25 x 10 50p 220/25 x 10 50p 1/250 x 10 50p GB Speaker £1.00 6x4 8r £1.00 TDA2581 £2.00 TDA2590 £1.00 TDA2593 £1.00 TDA2660 50p TDA2600 £5.00 TDA2611A £1.00 TDA2611AQ £1.00 TDA2653 £1.00 TDA2002 £1.00 TDA2640 £2.00 TDA2680 £1.00 TDA2690 £1.00 TDA2593 £1.00 TDA3190 £1.00 TDA3560 £4.00 TDA3571Q £1.00 TDA9403 £3.50 TDA3651AQ £3.00 UPC1365 £3.00 SN74LS125AN 30p SN174LS248 50p SIL4516 50p SN16861NG 50p SN16862AN £1.00 SN16964AN 50p SN29764AN £1.00 UA721 40p UA7300 40p MJE3055 £1.00 MJE2801 30p MJE2955 50p MJE13005 30p</p> <p>Philips Cartridges GP412 £8.00 GP412/11 £8.00 GP406 £8.00</p> <p>Transistors A1222 15p A1223 15p AC106 15p AC121 15p AC124 15p AC128 15p AC137 15p AC151 15p AC131 15p AC138 15p AC152 15p AC153K 15p AC142K 15p AC169 15p AC176 15p AC176K 15p AC178K 15p AC179 15p AC186 15p AC187K 15p AC188 15p AC189K 25p ACY21 25p AD143 50p AD149 50p AD161/162 pair 40p AF139 25p AF181 £1.00 AF239 25p AF367 25p AL102 £1.75 BC161 30p BD307 30p BD309 30p BD510 30p BD517 30p BD519 30p BD534 30p BD535 30p BD544D 30p BD562 30p BD610 40p BD646 50p BD676A 30p BD678 50p BD681 10p BD807 20p BD826 50p BD948 30p BD975 20p BDX32 £1.25 BF115 20p BF121 20p BF127 20p BF137 20p BF157 20p BF160 20p BF161 20p BF164 60p BF179 30p JF180 20p BF181 20p BF182 20p BF184 20p BF194 20p BF195 20p BF196 10p BF197 12p BF198 10p BF199 10p BF200 20p BF222 10p BF224 15p BF238 20p BF240 16p BF244 30p BF245b 20p BF256 10p BF257 20p BF258 25p BF262 15p BF263p 25p BF264 15p</p> <p>PHILIP Philips stereo headphones min £3.50 Philips solder irons, 25w mains £4.00</p> <p>Automatic Telephone GC answering machine with new plan plug £35.00</p> <p>MODEM Line Terminal Unit VM6501 £4.00 Designed to work at 1200/75 or 1200/1200 Diagram and Connection Data Supplies</p> <p>Indicator Tube ITT 58705 £1.00 8 Seg Display FN5000 20p Mullard 125V/170 Mc/s 45 watts £4.00 Mullard Broadband R.F. power modules UHF BG Y22E £10.00 PT4236C PT8706C £3.00 ITT Micro Phone M5 with switch Sub-min Relay low voltage 50p Mains relay coil 230V 30p Philip PP3 batteries 10 for £3 12v battery holders A A 50p 15v battery TA/2V 2 pin battery lead 50p</p> <p>Various Tools and Accessories Philips microphone SBC 466 £10.00 Philips 'The Credit Card' calculators, solar powered £6.00 Dual induct power calculator SBC 1833 £10.00 Hills MR TRTs H520 £15.00, H1420 £14.00 Microphone Philips stereo SBC 469 £23.00 1000 flat LED green £20.00 or 3p each VM6103 Mullard Teletex Decoder £4.00 T/V V/Aerial 3000 £1.50 L.C. Diode display with alarm 7.5p ±4 D/P push mains switch 20p each Mains lead & two pin socket for radio cassette 35p T/V loop aerial 75p Radio Telescope Aerial £1.00 Philips Neon Lamps for TV sets 5p Foam Cleaner £1.20 Contact Cleaner £1.20 Cans of Anti Static, Degrease Cleaner and Anti Corona Push Button Mains All at £1.20 Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt 75p Mains timer, 13 amp - up to 2 hours, easy to use, plugs into socket £3.00 Sello tape PVC Electric insulation 50mm x 20M 70p Screen locking agent, large can £1.50 20 GFC Service Manuals & Rank £5.00 Red E.H.T. LAED and Anode Cap £1.00 10 x G11 Cap 470/250 £5.00 Weller solder iron 15 watt/25 watt £5.00 2 way baby alarm/intercom with long leads £5.00 Philips universal battery tester/charger, fuse/bulb tester to clear £4.00 Hitachi Silver Oxide Battery G13 UCC3571EC SR44 1.5v 60p 70ML Silicone Sealer (clear) £1.00 100 Coax Plugs £5.00 De-solder pump + 2 nozzels Philips £5.00 Plastic box for c.s. 6' x3' x1/2' 50p Flat Red LED 12p 500gm 60/40 solder reel £7.00 Clearweld glue pack 30p Dual inductor 20 + 10db £1.00 K30 thermistor 232266298009 75p GEC Mains Power Supply R.E.G. £3.00 Frapil moving iron meter, 0-5 amp/0-60v, 0-40 amps 0-250v £2.50 each (cost £18.00)</p> <p>100W/W Res £1.50 BF 199 20 for £1.00 10x2 Turn 100k pots. Rank £2.00 Thorn 9 volt power supply regulated £3.00 BF 470 20 for £2.00 20 Slider Knobs 70p 6 mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00</p> <p>Mixed Packs TO66, 12 Power Trans RCA 16182 NPN £1.00 Replacement for BD124 and Mounting Kits £1.00 50 Mixed AC series Transistor £4.50 15 Panel mount rocket switch 250V/10A £1.50 25 Panel Mount Bulbs & Neons £1.00 10A £1.00 Mixed ribbon cables £1.50 25 LEB red/yellow/green £1.20 201/C Holders £1.00 20 Large LED Red £1.00 20 Small LED Red £1.00 10x20 Turn 100K Pots £1.00 100 Transistor £2.50 20 Convergence Pots 80p 100 Sticks £1.00 10 Thermistors £1.00 20 Slider Pots £1.00 30 Presets 50p 40 glass reed switch £1.00 10 press to make switch 70p 40 Pots £1.50 10 Gun Switches 50p 5 Tube Bases £1.00 1000 Diodes, Condensers, Resistors on Bandolier £2.00 Lucky Dip 600 gram £1.00 Jungle Bag 5kg £1.00 40 Pots, 1/4" - 6mm spindles for audio/TV £3.00 20mm Fuse Holders £2.50 Chassis Mount 20 for £1.00 IN4001/6 100 mixed £2.50 EHT Diodes small 20 for £1.00 20 Mixed Switches £1.00 ITT M5 50p Microphone - ITT - Rank 30p 400V/4A Triac 10 for £1.00</p>	<p>2SC458 90p 2SC515 10p 2SC732 10p 2SC733 10p 2SC1030 £1.00 2SC1172A 10p 2SC1173 10p 2SC1174 20p 2SC1546 20p 2SC1725 20p 2SC2068 20p 2SC2073 8p 2SC2122A £1.00 2SC2229 15p 2SC2730 15p 2SD180 TO380V/6A 15p 6A 15p 2SD200 £2.00 2SK30A 10p BC107 10p BC108 10p BC109 5p BC113 10p BC114 10p BC115 10p BC116 10p BC117 20p BC119 20p BC125 10p BC126 10p BC138 10p BC140 30p BC41 25p BC143 25p BC147 10p BC148 10p BC149 10p BC153 10p BC154 10p BC157a 10p BC158 10p BC159 10p BC160/16 25p BC171 10p BC172 10p BC174 10p BC183 10p BC184 10p BC185 10p BC207 10p BC212 10p BC213 10p BC214 10p BC237 10p BC238 8p BC239 8p BC250 8p BC251 10p BC252 10p BC262 10p BC263 10p BC294 30p BC298 10p BC300 30p BC301 30p BC303 7p BC308 7p BC309 10p BC327 10p BC328 10p BC329/338 pair 10p BC337 10p BC338 10p BC347 10p BC349b 10p BC350 20p BC356 10p BC384 10p BC394 10p BC413 10p SN761 10N £1.00 SN761 15AN 50p SN76131 10p SN76141N £1.00 SN76226 £1.00 SN76227N 60p SN76228N £1.00 SN76270 £1.00 SN7632N 50p SN76544N £2.00 SN76545 £3.50 SN76546 £1.00 SN76550 £1.00 SN76552 30p SN76570 £1.00 SN7660 10p SN7660N 50p SN76620AN 50p SN7666 10p SN7670N £1.00 SN7670N 75p SN76708AN 75p SN76720 £1.00 UA783P3C 40p UA781A102 40p BT138/10A 70p BT146 30p TBA540Q £1.50 TCA270 £1.00 TCA270Q £1.00 TCA640 £1.00 TCA650 £1.00 TCA270S £1.00 TCA270SQ £1.00 TCA740 £1.00 TCAR80 £4.00 TCA830 £1.00 TCE100 £2.25 TCE120CO £1.00 TDA1400Q £1.00 TDA1003A £1.00 TDA1010 £1.00 TDA1060A £1.50 TDA1072 £1.00 TDA1151 30p TDA1170 £1.00 TDA1190 £1.00 TDA1200 75p TDA1327A £1.00 TDA1365 £3.00 TDA1412 50p TDA2003 60p TDA2004 £2.00 TDA2010 £1.00 TDA2140 £1.00 TDA2300 £2.00 TDA2525 £1.00 TDA2640 £2.00 TDA2522 £1.00 TDA2530 £1.50 TDA2532 £1.00 TDA2540 80p TDA2541 £1.00 TDA2571AQ £2.50 TDA2575A £1.00</p>	<p>Philips stereo headphones min £3.50 Philips solder irons, 25w mains £4.00</p> <p>Automatic Telephone GC answering machine with new plan plug £35.00</p> <p>MODEM Line Terminal Unit VM6501 £4.00 Designed to work at 1200/75 or 1200/1200 Diagram and Connection Data Supplies</p> <p>Indicator Tube ITT 58705 £1.00 8 Seg Display FN5000 20p Mullard 125V/170 Mc/s 45 watts £4.00 Mullard Broadband R.F. power modules UHF BG Y22E £10.00 PT4236C PT8706C £3.00 ITT Micro Phone M5 with switch Sub-min Relay low voltage 50p Mains relay coil 230V 30p Philip PP3 batteries 10 for £3 12v battery holders A A 50p 15v battery TA/2V 2 pin battery lead 50p</p> <p>Various Tools and Accessories Philips microphone SBC 466 £10.00 Philips 'The Credit Card' calculators, solar powered £6.00 Dual induct power calculator SBC 1833 £10.00 Hills MR TRTs H520 £15.00, H1420 £14.00 Microphone Philips stereo SBC 469 £23.00 1000 flat LED green £20.00 or 3p each VM6103 Mullard Teletex Decoder £4.00 T/V V/Aerial 3000 £1.50 L.C. 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