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Radio & Electronics World

The communications and electronics magazine

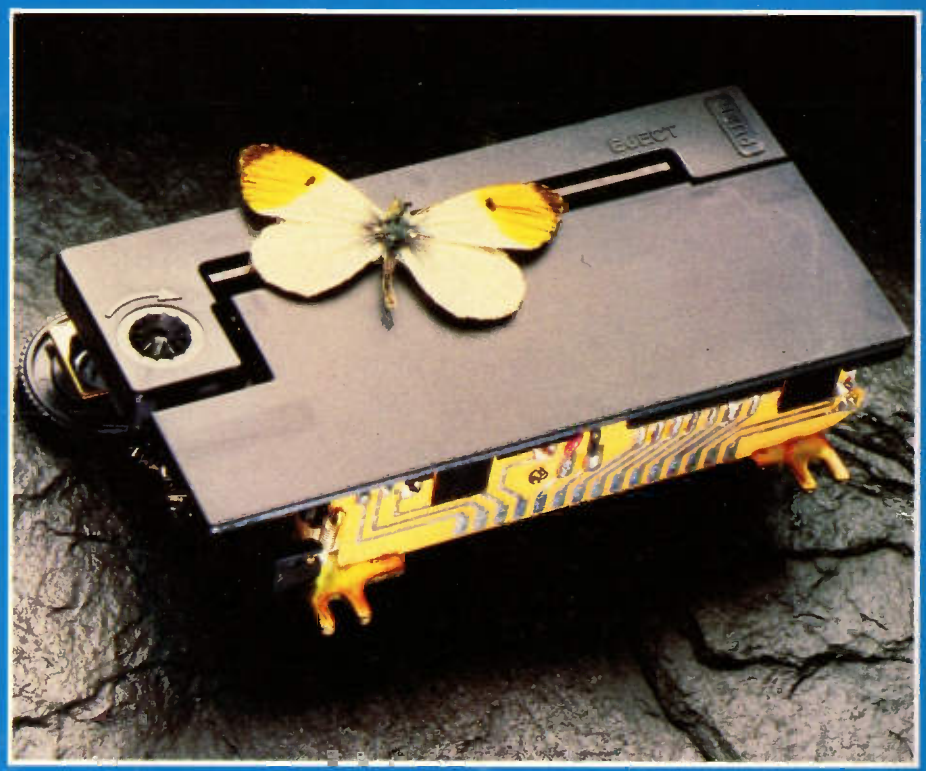
PCB DESIGN:
DRAUGHTING ON THE AMSTRAD CPC

STEREO TV:
IS 3D TV JUST AROUND THE CORNER

THE ST800:
A SCOTT-TAGGART CLASSIC UPDATED

TEST EQPT:
A SPECTRUM ANALYSER OUTLINED

DATA COMS:
FM SIDEBANDS AND CARRIER SHIFT DATA



SPECTRUM WATCH:
SHETLAND ISLANDS RADIO

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ICOM YAESU

THE TECHNICALLY ORIENTATED RADIO COMMUNICATIONS SPECIALISTS.

...STOP...PRESS...

RWC Ltd have now been appointed distributors for the new Bearcat-Uniden range of shortwave and VHF-UHF scanning receivers. Please contact us for further information.

Please add £2.50 p&p for accessories, £3 for psu's, £5 for transceivers, Send £1.00 for Raycom catalogue (refundable) or send a large S.A.E. for latest used list and information.

YAESU — Full Range Stocked

		RWC Price
FAS1-4R	Remote ant switch (FC757AT)	79.50
FBA5	Empty battery pack	7.80
FC700	ATU/power meter/dummy l'd	129.00
FC757AT	Auto ATU inc WARC bands	299.00
FIF65	Comp. I/face for Apple II	54.50
FL2100Z	HF 1.2KW linear 1.8-30 MHZ	749.00
FNB2	10.8V nicad pk for FT208 708	24.50
FNB3	Nicad for FT203/703/9R/RH	36.50
FNB4	Nicad pack for FT209RH etc.	43.50
FP700	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	P.O.A.
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**	**P.O.A.**
FT2700R	VHF 25W transceiver	339.00
FT270RH	**45W 2mtr transceiver**	**P.O.A.**
FT290R	**2mtr multimode**	**349.00**
FT690R	6mtr multimode transceiver	P.O.A.
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-FNB5	70cm H/H 1.8W	235.00
FT709R-FNB3	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 bkt/mt 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

PRICE RISE IMMINENT

ICOM — Full Range Stocked

		RWC Price
AH7000	25-1300 MHz TX base ant. 50-144-432-129	79.00
BC35E	Desk-top charger for all nicads	69.50
BP3	Standard Nicad pack 8.4V	28.50
BP4	Empty battery box for cells 6X	8.95
BP5	High capacity quick charge 10.8V nicad	59.50
DC1	12V mobile regulator pack (2E)	16.95
EX243	Curtis keyer unit for IC735/745	55.50
EX257	FM unit for ICR71	39.50
EX310	Speech synthesizer unit for 271/7000/E	41.50
FL63	250Hz RTTY/CW filter	49.00
HP1	Mono headphones	34.50
HS10	Headset and boom mic for use with HS10	20.50
HS10SB	Switch box assy for HS10 boom mic	19.50
IC-2KLPS	Power unit for IC2KL	399.00
IC-AH1	3.5-30 MHZ mobile antenna	189.00
IC-AH2A	Mobile HF ant tuner	499.00
IC-AH2B	Mobile whip and mount for AH2	179.00
IC-AT100	100W auto ATU	329.00
IC-AT150	Matching automatic ATU for IC735	349.00
IC-AT500	500W automatic ATU	499.00
IC-CP1	Mobile charging lead c/lighter	6.50
IC-HM9	Speaker mic assy.	20.50
IC-PS30	Power supply unit 25A continuous	339.00
IC-UT 16	Voice synthesizer for IC27 series	28.50
IC02E	2 mtr LCD keyboard 2W transceiver	289.00
IC120	1W 1296 MHZ mobile (40MHZ cov)	575.00
IC271E	2 mtr all mode 25W base station	829.00
IC271H	High power 100W version of IC271E	999.00
IC27E	25W 2 mtr FM mobile 9 memories	379.00
IC27H	45W version of IC27E	419.00
IC28E	25W 138-174MHz (144-146 TX) mobile TR	349.00
IC28H	45W mobile version of 28E	379.00
IC290D	25W version of IC290E	539.00
IC2E	2 mtr handheld thumbwheel 2W	185.00
IC2KL	1KW PEP linear auto band switching	1250.00
IC3200E	Dual band 25W transceiver	545.00
IC471E	UHF multimode base station 32 mem.	915.00
IC471H	75W version of IC471E	1099.00
IC4E	70cm thumbwheel Handheld 2W	279.00
IC505	3.10W 50MHZ SSB(FM) transceiver	449.00
IC735	New all mode all band transceiver	925.00
IC745E	All band SSB AM/CW gen cov TX-RX 16 mem.	799.00
IC751E	All band all mode transceiver 32 mem.	1450.00
IC04E	70cm LCD keyboard entry handheld 2W	285.00
ICR7000E	25-1300MHz all mode scanning receiver	925.00
ICR71	All band short wave receiver 32 mem.	799.00
LC11-14	Leatherette case assy for IC02/4E	8.99
LC1/2/3	Leatherette case for IC2/4/E	6.50
PS15	External power supply 20A	145.00
PS20	External PSU with loudspeaker 20A	199.00
PS25	Internal PSU for IC271E	99.00
PS35	IC751/IC271H 20A switch mode PSU	185.00
PS55	Matching power supply unit for IC735	179.00
SM6	Desk top microphone	42.50
SM8	Dual impedence 2-way base mic	79.00

CARRIAGE/POST FREE OVER £500.00

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 c/w ant.	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
CRITON	LS88B	6 OHM replacement ext. loudspeaker	6.60
DAIWA	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.	12.50
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	16.65
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 × 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 isolation	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 RANGE OF JAYBEAM + TONNA ANTENNAS IN STOCK

			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 for FT290R	39.00
MuTek	TVVF50c	High performance 2M-6M transverter	189.90
RAYCOM	**Series II**	**12A PSU**	**49.00**
RAYCOM	7.1MHZ TRAP	7.1 MHZ traps. c/w instructions	8.95
RCA	6146B	PA valve	12.85
REVCO	2044/5	Nest of dipoles w/band ant 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	14.50
SUN-ANT	SO239/ CGM	Cast/chrome SO239/gutter mount assy. c/w cable	9.75

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		As above but kit of parts only	17.50
Raycom	LCL/DNT MOD (inc. post)	LCL/DNT 10FM mod kit	14.95
NEW STORNO COM 713 55 Channel Mod Kit to 2M inc RPTR Shift, xtals + circuit instructions			29.00
NEW 2m 30W linear amp kit – parts only			29.50
Complete kit with case, heatsink, etc			39.50

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 25	145MHZ 1/4 wave PL259 fitting	2.99
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	Switvel base mag-base c/w cable PL259	9.25
Raycom	Trap-dipole	7.1MHZ trap dipole com. kit	29.95

RAYCOM POWER SUPPLIES

13.8V 12A (8A continuous)	52.50
13.8V 8A (6A continuous)	49.50

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 i/pt	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

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 (early model)	199.00
REGENCY MX8000/AOR2002	429.00
REGENCY HX2000 VHF/UHF Handheld	259.00
NEW BEARCAT DX1000 10KHz-30MHz SW RECEIVER. 10 MEMORIES, ALL MODE INC FM. ALSO SCANNING	**£329.00**
NEW BEARCAT 100XL H/H SCANNER. 66-88MHz, 118-136MHz (AIR BAND), 136-174MHz, 406-512MHz. C/W NICADS, CHARGER + LEATHERETTE CASE	**£219**
NEW BEARCAT 175XL DESK TOP SCANNING RECEIVER. 16 MEMORIES. SAME COVERAGE AS 100XL C/W AC ADAPTER	**£209**

Please call in or 'phone for latest Bearcat information.

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

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	**ALR206E**	**25W mobile**	**249.00**
ICS	**AMT2**	**AMTOR/RTTY CW Terminal**	**169.00**

Tel: 021 421 8201 (24hr answerphone)

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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.

Cover Photographs

Top: So what on Earth have butterflies got to do with printers? (p11)

Bottom: Going panel potty (p10)

SPECIAL FEATURES

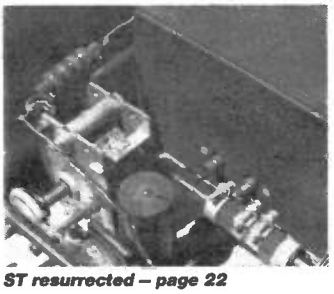
REGULARS

READER SERVICES

NEXT MONTH

☐ **Next Issue**
Cover date January 1987 on sale Thursday, 11 December

☐ **Publication Date**
Second Thursday of the month preceding cover date



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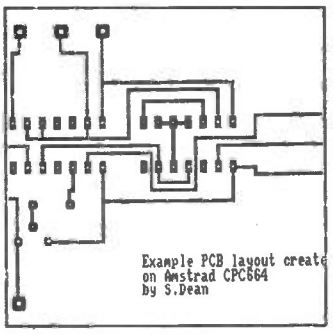
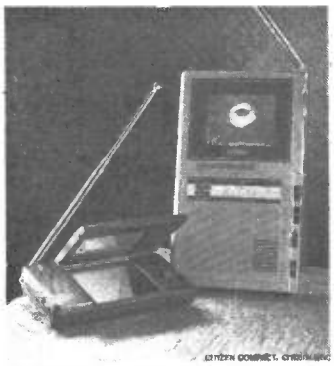


Low cost CAD – page 38



Walkman beware – page 21

Name this face! – page 15

PRODUCT NEWS

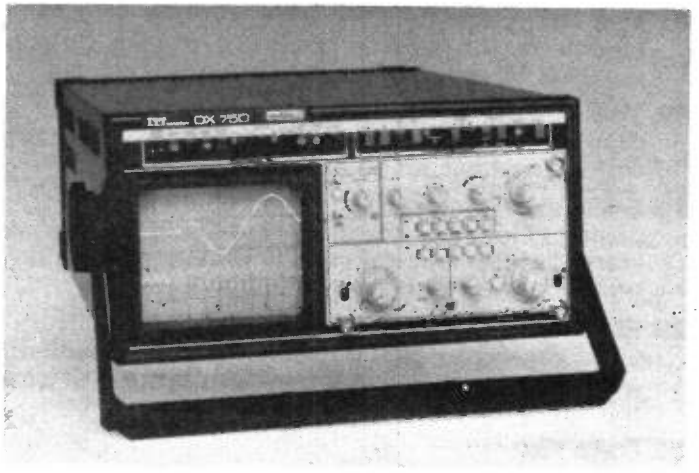
Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries

COMPACT DSO

ITT Instruments has introduced a new compact digital storage oscilloscope, the OX750, which combines a digital performance based on two 2MHz analogue/digital converters with the analogue performance of a 20MHz dual-trace oscilloscope.

The two 2MHz converters are based on a monolithic circuit which gives a resolution of 7.2 data bits at 200kHz. Each channel has a 2048-word memory, with 2000 points displayable on the screen and the remaining 48 used to provide a stored signal reference level.

The OX750 features a built-in 8085 microprocessor which not only controls all the instrument's digital functions but also provides indication and audible warning of incompatible functions.



The instrument can be used in single-shot, roll and refresh modes, with pre-triggering available in all modes. As well as the facility for comparing an incoming signal with the stored reference signal, the OX750 provides a range of signal analysis functions.

The oscilloscope can be connected to a 16-speed analogue X/Y recorder to produce an accurate hard copy of the displayed signal, and a battery-backed memory facility is incorporated for storing the mode and function settings as well as the captured signal in the event of power failure.

ITT Instruments,
346 Edinburgh Avenue,
Slough,
Berkshire SL1 4TU.
Tel: (0753) 824131.

POCKET DMM

Two new pocket-sized digital multimeters, the Soar 3000 and 3010, are now available from Advance Bryans. These auto-ranging instruments measure 56 × 108 × 10mm and weigh 80g including batteries and case, and are available with an accuracy of 1.3% (model 3000) and 2% (model 3010).

Both versions have a 3½-digit liquid-crystal display with a maximum reading of 1999. There are four dc/ac voltage ranges from 2000mV to 400V, five resistance ranges from 200 ohms to 2000k, and a continuity check which indicates resistance up to 200 ohms.

The only controls are an on/off switch and a range selector button. As well as auto-ranging, the pocket multimeter offers automatic polarity indication and a 'battery low' display. It operates from two LR-44 (1.55V) batteries.

The 3000/3010 multimeters will be available via authorised dealers at a price of £27.95 for the model 3000 and £23.95 for the model 3010.

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

IEEE-488 SCOPE

New from Thurlby Electronics is the Hitachi VC-6020 digital storage oscilloscope, which apparently is the only oscilloscope in its class to have a built-in GP-IB IEEE-488 interface as standard.

The interface allows waveform data to be sent to a host computer or to any other GP-IB instrument. Data can also be sent back to the VC-6020 from the computer, enabling many waveforms to be stored on disc and then redisplayed on the oscilloscope for comparison purposes.

The VC-6020 is a dual-channel instrument which can operate as a conventional 20MHz real-time oscilloscope. In digital storage mode it uses two separate analogue-to-digital converters operating at up to 1MHz and storing data in two separate 1,024 word memories. The vertical resolution is 8 bits and the horizontal resolution is 100 words per division; this can be magnified by 10 when required.

A hold function allows one memory to be maintained as a reference whilst the other memory is updated, thus providing a convenient means of making waveform comparisons.

A roll mode is provided which causes the screen to act similarly to a chart recorder, with slow signals being drawn continuously onto the screen.

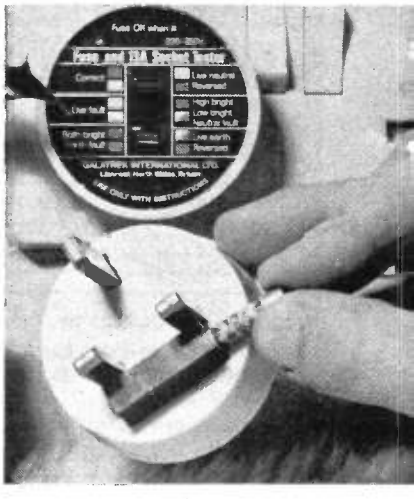
Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs PE17 4BG.
Tel: (0480) 63570.

FUSE TESTER

The Galatrek FAST (fuse and socket tester) is a 13 amp socket testing device shaped like an ordinary 13 amp plug. It will test 6 fault conditions on 13 amp wall mains sockets by simply plugging it in. The FAST also has a simple to use safe receptacle for testing any plug fuse.

The FAST costs £14.95 including postage, packing, transit insurance and VAT. Delivery is 7 to 21 days.

Galatrek International,
Scotland Street,
Llanrwst,
Gwynedd LL26 0AL.
Tel: (0492) 640311.



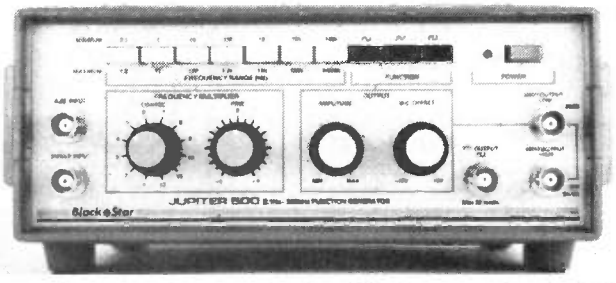
FUNCTION GENERATOR

The Jupiter 500 is a new low cost function generator from Black Star designed to satisfy wide ranging needs for a versatile waveform source offering quality, reliability and exceptional value for money. It provides high quality sine, triangular and square waveforms with a guaranteed range from 0.1Hz to over 500kHz, in seven switched overlapping decades. Coarse and fine calibrated controls give accurate adjustment within each band.

A special feature is the high output amplitude, which can be varied up to a hefty 30V peak-to-peak from 600Ω with an independently adjusted dc offset facility from −15V to +15V. A separate low level output gives a signal 20dB down for applications requiring more sensitivity. For logic, microprocessor and clock source applications a square wave TTL output capable of driving 30 standard loads is provided.

The Jupiter 500 can also be remotely voltage controlled, with 0 to 100% control of output amplitude from control signals of dc to 200kHz. Voltage controlled frequency sweep up to 1000:1 range is available, allowing its use in audio and servo testing.

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



CONTROL ON PCS

Burr-Brown International have announced a new system for data logging, graphics display, alarm annunciation and digital control on IBM PC/XT/ATs and compatibles.

Known as PCI ControLOGraph, the fully integrated system is based on menu-driven software developed by Burr-Brown. In addition, the system includes all the necessary hardware to interface a PC to the user's sensing and control devices. The system is simple to set up and use and can be run by inexperienced operators.

The user simply selects from the menu options in order to acquire analogue, digital and counter data; to linearise or translate data into engineering units; to set limits for, and enable, alarms; and to actuate digital outputs for control purposes.

Data input choices include 21 analogue signals, 24 digital bits, and three frequency/event counting channels. Four ranges of input voltage, as well as J, K or T thermocouples, can be menu-selected. Analogue, digital and frequency/event data are all acquired on each scan by the system, and the user can either display data in real-time or specify a 'trigger' condition in which information is stored in such a way that both pre and post-data is available for display/analysis.

Burr-Brown International,
Cassiobury House,
Station Road,
Watford,
Herts WD1 1EA.
Tel: (0923) 33837.

LCR DATABRIDGE

The latest addition to the range of products offered by Levell Electronics is the Aim LCR Databridge 401.

This instrument, which is auto-ranging, gives fast and accurate readings of L, C, R and Q. Auto-selection of the function and the auto-ranging are managed by a microprocessor. This gives a reading within 1 second of connecting the component, with updates twice a second.

The basic accuracy is ±0.25% of reading ±1 digit and the ultimate resolution is 0.001 ohm, 0.1μH, 0.1pF and Q of 0.001. Components may be measured at frequencies of 100Hz or 1kHz and their values are indicated on a four-digit, 11mm high, seven segment LED display. The price of the 401 is £549 + VAT.

A limits comparator, the 402, is available for connection to the Databridge 401, with pass, high fail and low fail indication. The limits may be set as absolute values or percentage tolerances with indication on red or green LEDs.

Levell Electronics Ltd,
Moxon Street,
Barnet,
Herts EN5 5SD.
Tel: (01) 449 5028.

DATA LOGGER

A new card and software package is available from Data Harvest to allow their highly successful Vela data logger to connect directly to an IBM PC or compatible.

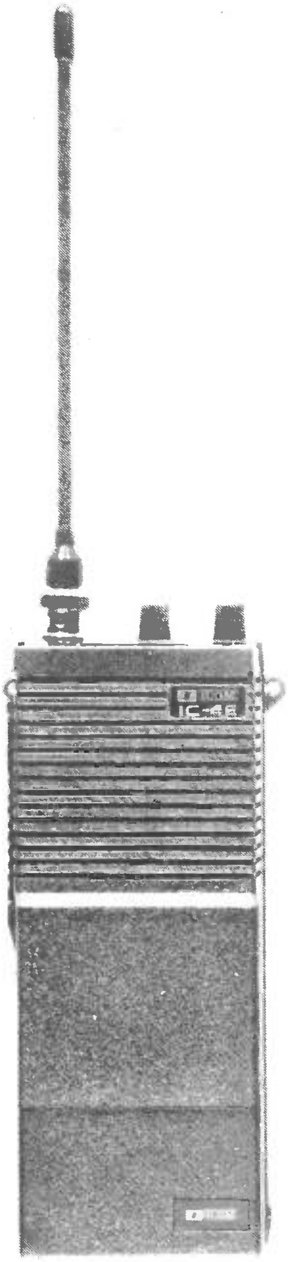
The software, called Velanalysis II, will allow Vela to load data on the IBM and manipulate and display the results in tabular or graphical form. If the data has been collected using Vela sensors then the displays are automatically in engineering units.

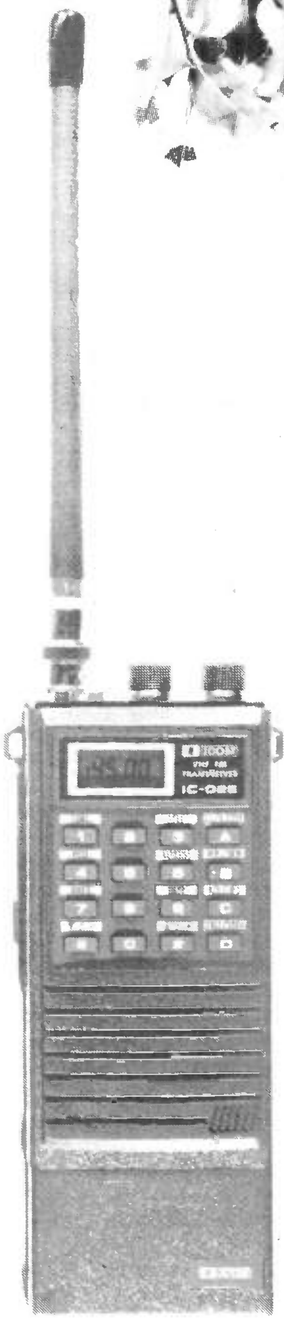
Vela is a powerful multi-purpose instrument which apart from being a 4-channel data logger is a DVM, counter/timer, transient recorder and function generator. It is equipped with 16 standard programs in EPROM with a further 60 available as an option.

Data Harvest Group Ltd,
28 Lake Street,
Leighton Buzzard,
Bedfordshire LU7 8RX.
Tel: (0525) 373666

ICOM

VHF/UHF FM Handportables.





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 tranceivers. 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 possible with IC-BP5A batte: 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.)

IC-12E 23cm Keypad Handportable. The IC-12E has a 16 button Keypad allowing direct access to frequencies, scanning and memories. Ten memory channels store operating frequency as well as simplex/duplex and duplex offset. A priority function allows another frequency such as a repeater or calling frequency to be monitored. The IC-12E is equipped with a 1750Hz tone generator for repeater access. Frequency coverage 1260-1299·9875MHz with 5 frequency step rates. An internal power module provides 1 watt or low 100mW as standard.

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.

British TELECOM Approved Dealer for Mobile Phone Division

Cellnet

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Than

Seasons Greetings to ICOM users the world over

NEW! IC-MICRO TWO, Mini-handportable.

This is the smallest handportable transceiver from ICOM. The MICRO-TWO, 2 metre FM measures only 148 x 61 x 31mm. with BP22 battery pack (not shown here). The MICRO-TWO is a hand-size transceiver which will equally fit most pockets.

On the top panel a clear LCD readout gives frequency and memory channel number. Tuning is made easy using up/down toggle switches to select 1MHz, 100kHz or 12.5kHz steps as well as the 10 memory channels. Full repeater and reverse duplex operation facilities are featured including repeater access tone. An automatic power saving function reduces battery power consumption when in receive mode. Output power is 1 watt or 100 milliwatts (low) with the BP22 nicad pack.

The ICOM MICRO-TWO is the ultimate in 2 metre miniature handheld transceivers, yet despite it's small size the receiver sensitivity and performance has not been compromised. This handy transceiver comes complete with the BP22 nicad pack (not shown here), A.C. wall charger, helical antenna. Most existing ICOM accessories can also be used.

An optional extra, the BC50 desk charger will rapidly charge the BP22 battery in just one hour. Other options include the BP23 long-life, low-power and BP24 medium-life, high-power nicad battery packs. Contact us or your local ICOM dealer for more details on this exciting new product.

Actual Size Photograph.
This shows the non-standard low capacity battery pack. N.B. Standard battery pack is normally the higher capacity BP22 as mentioned in text.

ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet

Thanet Electronics
Sea Street, Herne Bay, Kent CT6 8LD
Tel: (0227) 363859.
Dept. REW

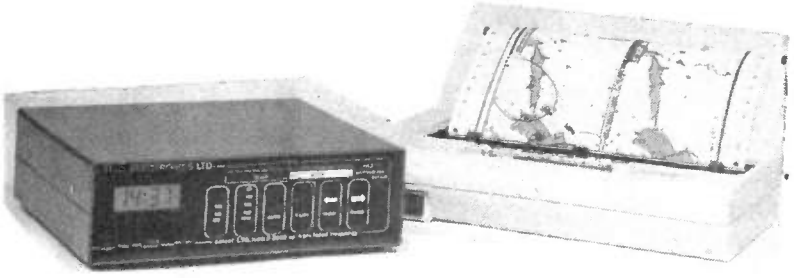
5-MODE TERMINAL

ICS Electronics have announced the availability of the PK-232 intelligent terminal unit. This new terminal unit is manufactured by AEA Inc of Seattle, USA, and combines packet, AMTOR, RTTY, CW and ASCII transceive capability into one package. It will operate with any computer having a serial RS-232 interface and suitable ASCII terminal emulation software.

Full status indication is provided on the front panel of the unit and mode control is exercised from the computer keyboard itself. HF and VHF modems are incorporated, and the correct modem characteristics are automatically selected for the mode in use. A built-in multi-LED tuning indicator is provided.

In order that it can be simply connected to both an HF and a VHF rig at the same time two cables are provided, the rigs being selectable via a front panel switch.

Specialised programs for many computers should soon be available to drive the PK-232, the price of which is £263.00 including VAT, plus £3.50 p&p and insurance.



Also new from ICS is the FAX-1 facsimile receive terminal unit. Using this, weather maps, press photographs and satellite cloud cover photographs may be copied from around the world.

The microprocessor-based system takes the audio output from an HF receiver and converts it into the necessary signals to drive an Epson FX-80 or compatible printer. Picture definition is substantially better than home computer screen-based systems, and all common IOC and rpm combinations are copied automatically.

A built-in LCD timer can turn on the system at a preset time. Additionally, a 15-LED tuning display can be used to precisely tune the received signal. Front panel mode displays and buttons allow the automatic operation of the unit to be Boverridden to give manual operation.

The power requirement is 12 volts dc at 400mA, and for portable and marine operation a compatible battery powered ink-jet printer is available. A mobile mounting bracket is provided.

The price of the FAX-1 is £269.95 including VAT, plus £3.50 p&p and insurance. For further details of these new units from ICS send an sae to the address below.

ICS Electronics Ltd,
PO Box 2, Arundel,
West Sussex BN18 0NX.
Tel: (024 365) 590.

POWER LIMITER

Sage Audio have developed a new type of fully electronic mains power protection device called a Power Limiter.

Unlike an RCCB, the Power Limiter continually monitors the normal running current of a device. It simultaneously computes the electrical state of the load by multiplying the current by the load impedance and subtracts this from the instantaneous mains voltage, the result being zero for a correct load. A faulty load will produce an error voltage, which will cause the power regulator circuitry to instantly reduce the power supplied to near zero.

Since the unit does not use thyristor type control it can switch off the power at any moment within a mains cycle. The speed with which it reacts is remarkable; a short circuit placed between live/neutral or earth under full mains supply conditions will result in neither a spark nor a blown fuse. Normal power returns on removing the fault.

The Power Limiter was originally developed for use with electric blankets as a fire prevention device, and a version for video recorders is now also available. Coming shortly is a surge current suppressor for computer appliances which use switch mode power supplies.

Prices for the currently available Power Limiters are around £16-£18.

Sage Audio,
Construction House,
Whitley Street, Bingley,
West Yorkshire BD16 4JH.
Tel: (0274) 568647.

MULTIPROM

Ground Control have introduced a new EPROM programmer for the BBC micro, the Multiprom, which they have developed from their successful Uviprom range. It will program 2732, 2764, 27128, 27256, 27512, 27513 and 27011 devices, including 'A' versions. Programming of types from 27256 upwards is carried out in 16K blocks to ensure Multiprom compatibility with all models of BBC.

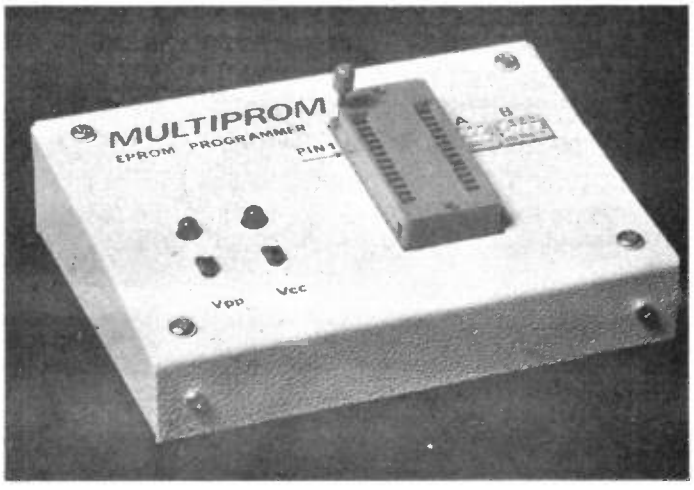
The UVP1.1 software allows an EPROM to be programmed from any file on disc, which means that a disc drive and DFS will be necessary.

The Multiprom plugs into the user port on the BBC, taking power from the computer. An on-board switch mode power supply provides 21 or 12.5V for programming.

Switches are provided for powering down the Multiprom to insert or remove an EPROM and for V_{pp} on/off. There are DIP switches to configure the instrument for different devices. EPROMS are mounted in a Textool ZIF socket.

The Multiprom costs £44.95, with the UVP1.1 software on ROM available for £5. Prices include VAT and p&p.

Ground Control,
4 Alfreda Avenue,
Hullbridge, Hockley,
Essex SS5 6LT.
Tel: (0702) 230324.



UOSAT PIX

Those who were interested in Neill Taylor's UoSAT telemetry decoding software for the Spectrum, Sudd, will welcome news of a companion program, Spix. This decodes the images from UoSAT-1's on-board CCD camera.

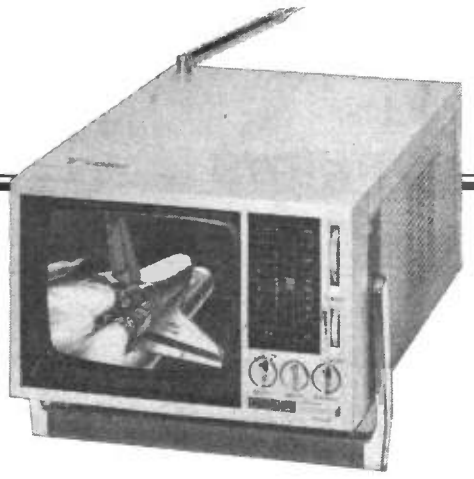
The audio signal from a VHF receiver or cassette recorder is fed directly to the computer's 'ear' socket, and Spix stores the image in a 32K buffer.

The image is displayed on the screen in 'preview' format (no grey scale) with adjustable black/white level, and this can be dumped on a printer. The program will also print a full resolution image with a full grey scale.

The decoded image may be saved on tape or microdrive.

Spix is supplied on tape with a 6-page instruction booklet and costs £4.50 including p&p in the UK and Eire. A further £1 will cover postage anywhere else (cheques etc payable to N P Taylor).

Neill Taylor G4HLX,
87 Hunters Field,
Stanford in the Vale,
Faringdon,
Oxon SN7 8ND.



MULTI-BAND TV

Now available from Aerial Techniques is the Yoko F1 multi-band 5-inch black and white TV. This set will cover 40-70MHz (Band I), 170-230MHz (Band III) and 470-860MHz (UHF band), and features automatic 5.5/6MHz sound switching with a squelch facility. LEDs indicate the band in use.

An external aerial input jack feeds a low noise tuner via an internal amplifier for optimum gain and signal to noise ratio. The receiver is claimed to be very sensitive and ideal for DXing or caravanning use. Power can be from 220V/50Hz mains, 12V car battery or dry batteries.

The Yoko F1 costs £89.95 including VAT, with carriage and insurance a further £4.95.

Aerial Techniques,
11 Kent Road,
Parkstone,
Poole,
Dorset BH12 2EH.
Tel: (0202) 738232.

PRINTER

The MCT-32 stand-alone printer from DED has a low cost compact rugged design enabling it to be used in busy industrial or office areas where space is at a premium.

It prints up to 32 characters per line on thermal paper, enclosed under a clear lid which minimizes dust problems. The size is 210×150×80mm. Data entry is RS232C at 600 baud, which interfaces to most systems using simple Basic commands. As well as a 96 ASCII character set the MCT-32 has 16 block graphic characters and can print in double width mode.

A novel feature of the MCT-32 is that each character is printed as it is received rather than waiting for complete lines as with most small printers. This greatly facilitates keyboard entry.

DED,
Mill Road,
Lydd,
Kent TN29 9EJ.
Tel: (0679) 20636.

DISC DRIVE

ASD Peripherals have launched a 10 megabyte hard disk upgrade unit for the PCW8256 and 8512. The unit, which is external and simple to install, gives some 60 times more information storage than the standard configuration, enough to store 3000 A4 pages of information without the need to exchange discs.

The unit retails at £449+VAT, and a 20 megabyte version will be available at £599.

ASD Peripherals,
Europa House,
Europa Trading Estate,
Fraser Road,
Erith,
Kent DA8 1QL.
Tel: (03224) 49235.

QUARTZ CLOCK

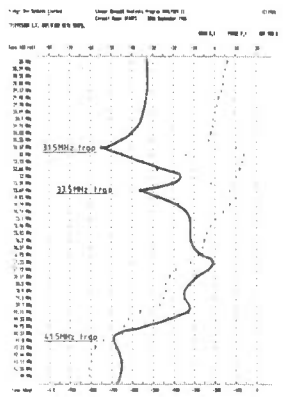
Now available from Video Electronics is the Texet World Time Clock, which gives an indication of the time in 49 different cities around the world.

Local time is read off a dual 12-hour outer ring (1-12 and 13-24hrs). An inner ring rotates with the hour hand to allow the time world-wide to be read from the markings on it.

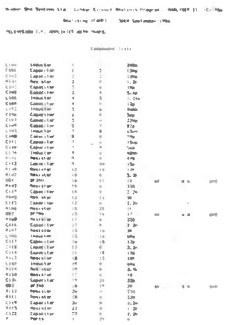
The clock can be wall-mounted or stood on a flat surface using the removable stand. It is powered by a single 'AA' sized battery, and will tolerate temperatures from -10°C to +50°C.

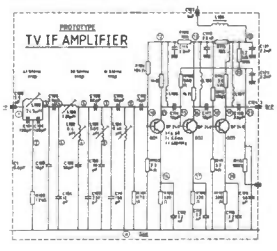
The World Time Clock is available for £15 inc VAT and p&p (UK and N Ireland).

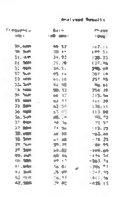
Video Electronics,
141 Lancaster Road,
Morecambe,
Lancashire LA4 5QJ.
Tel: (0524) 418873.



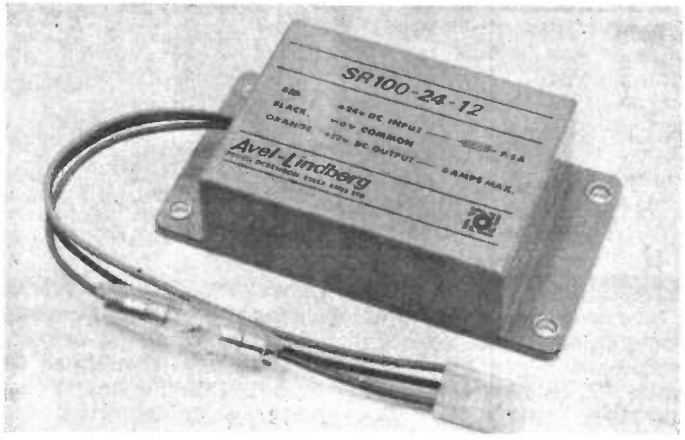
These are examples of Analyser II, an improved version of the Analyser circuit design aid for the IBM PC from Number One Systems. Prices are £65 and £195 for the two versions. For more details telephone (0480) 61778







PRODUCT NEWS



24V/12V REGULATOR

A new 100W high efficiency switching regulator from Avel-Lindberg can provide an interface between a 24V battery and the 12V power input required by an increasing range of electronic equipment fitted to the sort of vehicle which carries such batteries.

The input voltage range is 18 to 30V dc and the output voltage is stabilised at 12V or 13.8V dc. The continuous output current is 8A maximum and the output power is 100W. The efficiency is 80 to 90%, and this efficient voltage conversion is achieved by using high frequency (100kHz) switching techniques. The high frequency enables a compact, rugged and totally protected unit to be constructed, and the SR100-24/12 is only 140 × 76 × 38mm. It has four-point mounting and is totally protected against moisture and shock.

The load equipment is protected by output over-voltage (typically 15V) and current limiting circuitry (typically 130%). RFI is negligible and the connections are made via a simple non-reversible plug with input, output and common negative line, with a cable 7.5A fuse in the positive input line. The input ripple is less than 50mV and the output ripple is less than 20mV. The output regulation (line + load) is less than 1% from no load to full load.

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

AMSTRAD I/O

Amstrad CPC664/464 computer users can now benefit from the I/O expansion capabilities of the Velleman interfacing system. This system consists of a series of kits or ready-built units based on a four-slot motherboard. The motherboard connects to the computer's disc drive port and provides an additional drive connector to allow simultaneous use of the I/O system, an external disc drive and other peripherals.

The range of plug-in interface cards now available includes an eight-channel analogue input multiplexer, A/D and D/A conversion, Centronics printer port, eight-channel logic input, real-time clock and a general purpose output card with a choice of relay and triac outputs.

A 'breadboard' plug-in allows users to develop their own I/O projects.

The K2640 Amstrad motherboard kit is offered by ECW at a mail order price of £42.20, including p & p and VAT.

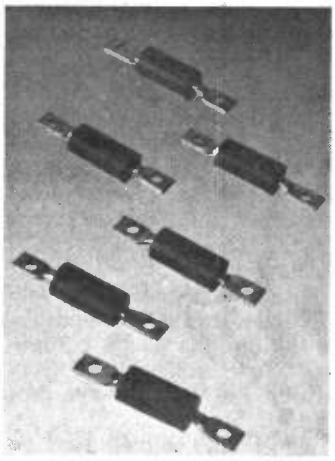
Electronic & Computer Workshop Ltd,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.

PANEL MOUNTING POT

RR Electronics can now supply from stock the model 148 and 149 single-turn panel mounting potentiometers from Spectrol.

These ½ inch square compact devices are available with either ⅛ or ¼ inch shaft diameter, single or double sections. Power rating figures are 0.5W at 70°C for the 148 and 1.0W at 85°C for the 149. The model 148 has a conductive plastic element, while the 149 has a cermet element.

RR Electronics Ltd,
St Martin's Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.



POWER RESISTORS

The high-quality PM series of precision power resistors from CGS is a silicone moulded fully insulated range designed for long-term stability. Construction is suited to high-volume manufacture, enabling close-tolerance resistors to be produced at a very economical price.

Ranges are available with dissipation ratings of 3.5, 5.5, 8, 10 and 11W. Ohmic values range from R051 to 10, 27, 68, 100 and 100k, with limiting element voltages 100, 160, 200, 500 and 750V respectively. Standard value tolerances are ±5, 2 and 1%, with ±0.5% also available.

Stability at nominal dissipation is 3%/1000hr. Temperature coefficient is better than 50ppm/°C.

These resistors can also be supplied non-inductively wound over a restricted range of ohmic values.

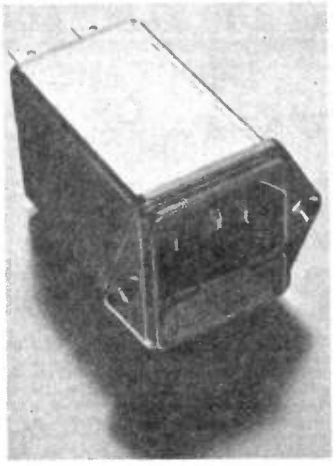
CGS Resistance Co Ltd,
Marsh Lane,
Lymington,
Hants SO41 9YQ.
Tel: (0590) 75255.

POWER LINE FILTERS

New RFI power line filters for Class I appliances from Rendar are 20% shorter than previous versions while retaining the same cut-out dimensions for easy interchangeability.

Designed to protect sensitive electronic equipment from supply-borne interference, the filters provide high symmetrical and asymmetrical attenuation over a wide frequency range. They are manufactured by Feller of Switzerland to replace a range of general purpose units as well as low leakage current types for medical appliances.

They incorporate a 3-pin applicance plug connector so that the filter is located immediately adjacent to the supply input to eliminate coupling of interference to the appliance. Since the design also includes a fuse holder, a single cut-out is required for filter, connector and fuse.



Voltage rating is 250V, current rating 1, 2, 4 or 6A. Two versions for medical appliances are available, with leakage currents of 5μA and 80μA.

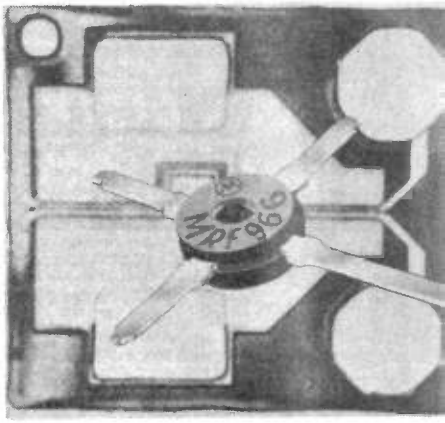
Rendar Ltd,
Durban Road,
South Bersted,
Bognor Regis,
West Sussex PO22 9RL.
Tel: (0243) 825811.

CHEAP GAASFETS

Motorola has re-entered the GaAs low noise market with the introduction of a low cost field effect transistor. The new MRF966 dual-gate FET uses improved manufacturing processes to provide lower gate leakage (1μA typical), higher g_m and higher gain than bipolar (17dB typical at 1GHz), and low noise (1.2dB typical at 1GHz).

The new FET offers superior stability over time and temperature with a mean time to failure of 10^6 hours at 125°C. A new gold-germanium back metallization suitable for bonding at 400°C has been added to allow eutectic die bonding of chips where desired.

The MRF966 was designed for use in low noise applications such as high frequency amplifiers and mixers. It is aimed primarily at receiver front ends in the 500 to 1000MHz UHF frequency range.



The MRF966 costs $1.95 in 100-up quantities, and less than $1.00 in volume quantities. Samples and small quantity orders are available from stock.

Motorola Semiconductor Products Inc,
PO Box 52073,
Phoenix,
Arizona 85072.
Tel: (602) 244 3818.

MAC DECODER

ITT has announced a single-chip decoder for use in DBS standard D2-MAC/Packet receivers. The device, called the DMA 2270, meets all the requirements of the basic D2-MAC specification.

D2-MAC is a subset of the C-MAC standard. This standard is based on time division multiplex transmission of the video signal in component form (YUV), and the digitally encoded sound and data signals, which are organised in packets and coded in duo-binary form. The standard provides a much improved performance for satellite television broadcasting, featuring no cross-colour and no cross-luminance, improved chrominance noise performance, and transmission of sound and data services.

Due to the baseband configuration of the D2-MAC signal it is possible to receive satellite transmissions and CATV with the same decoder IC. Control of the IC is achieved through the three-line serial IM bus.The highest efficiency is achieved by combining the DMA 2270 decoder IC with ITT's Digit 2000 digital TV system, but it may also be used with other TV systems.

The decoder is able to treat different sound services automatically by decoding the address field of the packet header. There are up to eight different sound channels available for each television service. The sound processor section converts all types of sound packets into a sequence of 14-bit samples. Medium quality channels are up-sampled to the 32kHz sampling frequency of the high quality channels so that all following stages deal with one data format. The storage capacity for buffering the sound packages during processing is provided by an external 64K DRAM.

One packet address is reserved for service and network identification data. This information is protected by a CRC code and by repetition. Up to 720 bits of packet-0 data can be buffered within the IC and can be read for processing by an external controller through the IM bus.

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

MINI PRINTER

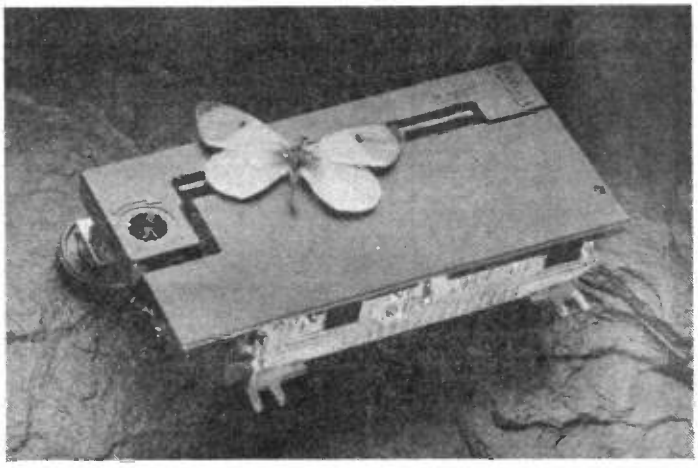
In response to customer demands for a high speed version of the popular M150 mini printer, Epson's OEM Division have launched the M185.

The M185 now uses 5 solenoids instead of the 4 in the M150 and can print 18 characters or 108 dots per line on 44.5mm paper. It has a considerably higher speed of 1.7 lines per second and a fast paper feed function of 4 lines per second. Reliability is 700,000 lines between failure, and the 5V operation makes it suitable for battery use. The size is 91 × 25 × 7mm.

Also available is the new BA180 control board, which enables any of the M180 series printers to be connected to a CPU. It accepts serial or 8-bit parallel data input and contains an on-board character generator. Its size is 80 × 80mm.

Associated products include the LA180 control chip and the M180 long life ribbon offering 1 million character print life.

Epson (UK) Ltd,
Dorland House,
388 High Road, Wembley,
Middlesex HA9 6UH.
Tel: (01) 902 8892.



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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 £29.95** 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, fully isolated 240v AC power supply for total safety, Mains ON-OFF switch etc. Many other uses.

LIMITED QUANTITY– DON'T MISS THIS OFFER!!!

ONLY £29.95 OR £24.95 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's**, 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 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' skt **£1.00**, **BNC** skt **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, 16" 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, SHOPDS, DISCO'S, 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 PSU's £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 £69.00 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 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 **EINSTIEN** 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 5¼"** Double sided **40/80** track disk drives (1Mb per drive), **PSU, 4K** of memory mapped screen **RAM**, disk controller, **RS232, 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
NOW only £399

PC2000 Business System with CPM and 'Ready to Run' FAST Sales and Purchase ledger, supports up to 9000 Accounts, VAT etc. COST OVER £1700
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PC2000 Wordprocessor System with CPM and TEC FP25 daisywheel printer
NOW only £799

SURPLUS SPECIALS ON PRESTEL – VIEWDATA – TELEX

PLESSEY VUTEL, 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**
ALPHATANTEL. 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 **27128** £5.50 **6800** £2.50 **6821** £1 **68A09** £8 **6BB09** £10 **8085A** £5.50 **8086** £15 **8088** £8 **NEC765** £8 **WD2793** £28 **8202A** £22 **8251** £7 **8748** £15 **Z80A** DART £6.50 **Z80A** CPU £2.00. Thousands of IC's **EX STOCK** send SAE for list.

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Japanese 5¼" 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 HH 40 TRK **NEW £75.00**
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Brand NEW metal 5¼" **DISK CASES** with internal **PSU.**
DSKC1 for 2 HH or 1 FH drive **£29.95** +pp £4.00
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DKSC 3 As DSK1 LESS PSU **£12.95** +pp £2.50
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8" **IBM** format **TESTED EX EQUIPMENT.**
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TWIN **SHUGART 851's** 2 Mb total capacity in smart case, complete with PSU etc. **£595.00**
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DRE/DIABLO Series 30 2.5 Mb front load. **£525.00**
Exchangeable version **£295.00. ME3029** PSU **£95.00**
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CDC HAWK 5+5 Mb £795.00. CDC 9762 80 Mb RMO3 etc. **£2500.00.**
PERTEC D3422 5+5 Mb **£495.00**
RODIME 5¼" Winchesters 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 6172 8" 23Mb Winchesters **£199.00**
Unless stated all drives are refurbished with 90 day guarantee. Many other drives and spares in stock – call sales office for details.

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BRAND NEW State of the art products.
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Ex **BRITISH TELECOM** full spec, CCITT, ruggedised, bargain offers. Sold TESTED with data. Will work on any MICRO or system with RS232 interface.
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DATEL 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
DATEL 4800, RACAL MPS4800 baud modem, 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

For more information **contact our Sales Office.**

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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 9.5" 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**

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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**
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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.

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

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Telephone 01-679 4414 Telex 894502 Data 01-679 1888

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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 compatability 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 platten 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**

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**
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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**.

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 ali 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 ICs, 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** — **5 kls £6.90** + **£1.80**
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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

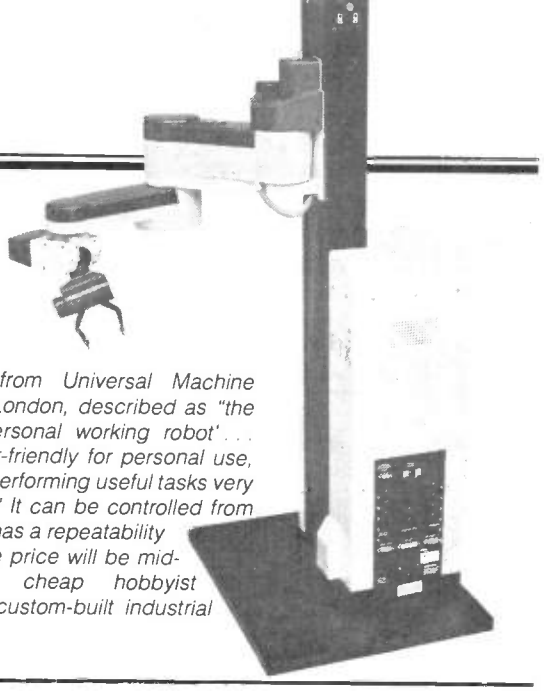
CENTRONICS 710 PRINTERS

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.**

1000's of other EX STOCK items including POWER SUPPLIES, RACKS, RELAYS, TRANSFORMERS, TEST EQUIPMENT, CABLE, CONNECTORS, HARDWARE, MODEMS, TELEPHONES, VARIACS, VDU'S, 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

NEWS DESK



This is RTX from Universal Machine Intelligence of London, described as "the world's first 'personal working robot' . . . cheap and user-friendly for personal use, but capable of performing useful tasks very cost-effectively." It can be controlled from an IBM PC and has a repeatability of ±0.5mm. The price will be midway between cheap hobbyist machines and custom-built industrial robots

Transmitter adjustments

The BBC and IBA were due to change the vision to sound power ratio at all their television stations during a nine week period starting on 13th October. This adjustment is being made to improve transmitter efficiency and to save electrical power, but it is also a necessary step in preparing the television tranmsitter network for the introduction of a digital stereo sound service at some future date.

Currently the vision to sound power ratio is 5:1. Extensive tests have shown that reception is not affected by changing the ratio to 10:1. This power ratio has been used for the last two years on the BBC-1 and BBC-2 transmitters at Crystal Palace, and has been employed for many years over much of Europe.

The dates on which individual main transmitters are to be changed will be shown on Ceefax page 195 and Oracle page 597.

Stereo TV sound

The introduction of digital stereo sound with television moved a step closer following the Government's approval of the joint BBC/IBA specification for a new transmission standard. The system, developed by BBC engineers, is currently undergoing experimental tests from the BBC-2 transmitter at Crystal Palace in London. The stereo signals are transmitted via a digitally modulated carrier at 6.552MHz above the vision carrier.

Although the BBC has no immediate plans to introduce a full stereo service, the experimental tests at Crystal Palace will be extended during the next few months to include both BBC-1 and BBC-2 transmissions.

These tests will enable manufactuers to develop prototype receivers and will allow BBC staff to gain operational experience.

Vipera siliconis

Ferranti Electronics has delivered the first samples of what is claimed to be the world's first microprocessor with guaranteed error free design to the Royal Signals and Radar Establishment (RSRE) at Malvern.

Known at VIPER (verifiable integrated processor for enhanced reliability), the new device is a 32-bit microprocessor designed by RSRE for applications requiring high operational integrity such as aircraft autopilot systems, missile systems, and nuclear power plants.

The design of VIPER is such that the operation can be formally specified and verified using mathematical techniques to ensure that a completely predictable system can be implemented for safety-critical applications. This 'provably' correct operation has not been possible with previous microprocessor systems.

Last November Ferranti Electronics was one of two companies selected to manufacture the first VIPER chips, now delivered to RSRE for evaluation. Although the device is designed to operate in a military environment and is resistant to high radiation levels, it is expected to have many civil applications, and Ferranti will be marketing the microprocessor commercially as the VIP1, which is expected to meet a 0.8MIPS minimum specification when operated with a clock of 10MHz.

Satellite comms course

The Department of Electrical and Electronic Engineering at Doncaster Metropolitan Institute of Higher Education will be offering a 12 week evening course entitled *Satellite Communications* starting in January.

The course, to be held on Tuesday evenings, will cover satellite television (history, technology, orbit calculations, launch tehniques, link budgets, reception techniques and DBS) and weather satellites (transmission format, orbit calculations/predictions, reception and display techniques). A large element of practical work will be included using the receiving equipment installed at the college.

Also on offer is an introductory course in fibre-optic technology and applications, arranged as an evening course over the same period as the satellite communications course.

For more info contact the college at Waterdale, Doncaster DN1 3EX, telephone (0302) 22122.

CAE seminar

Rapid Silicon are to hold a series of one-day seminars designed to provide an in-depth overview of the benefits, advantages and applications of computer aided engineering (CAE).

Speakers at the seminars will define the basic concepts of CAE in detail and will explain its benefits, including how a CAE system can increase productivity and reduce overheads.

The seminar is priced at £15 (£17.25 including VAT) per attendee, which includes a comprehensive literature pack, coffee, lunch and tea. The seminars commenced on 21st October at the Crest Hotel, Wycombe, and will end on 6th February 1987 at the Crest Hotel in Bristol. Further information on dates and locations is available from Rapid Silicon on (0494) 26271.

The key to progress?

Inspec, the information division of the Institution of Electrical Engineers, has announced a new and revised range of *Key Abstracts* to be published from January 1987.

Following an extensive market survey into customer requirements, four completely new *Key Abstracts* will be created: Advanced Materials, Computer Communications & Storage, Computing in Electronics & Power, and Software Engineering.

Six of the established *Key Abstracts* will be substantially revised to give improved literature coverage of the latgest developments: Artificial Intelligence, Electronic Circuits, Electronic Instrumentation, Measurements in Physics, Power Systems & Applications, and Robotics & Control.

Four new titles replace two present ones in rapidly expanding areas of technology: Antennas & Propagation, Opto-electronics, Semiconductor Devices, and Telecommunications.

Selection procedures for the whole series have been completely revised to allow more flexibility in the size of each monthly issue to cope with fluctuations in the receipt of source journals and conference proceedings. Special subscription rates apply to all 14 titles when purchased as a set.

For further details contact: Inspec Marketing Department, The Institution of Electrical Engineers, Station House, Nightingale Road, Hitchin, Herts SG5 1RJ. Tel: (0462) 53331.

Telecoms conference

The seventh annual Financial Times World Telecommunciations conference will be held at the Hotel Inter-Continental, London on 1st and 2nd December 1986. Key areas to be debated include "the confusing challenges and uncertainties facing the telecommunications industry and the changing conditions in international markets."

The speakers will include Morris Tanenbaum, Vice Chairman of the Board, AT & T, Bert Halprin, Common Carrier Bureau chief at the Federal Communications Commission in America, Sir George Jefferson, Chairman of BT, Cor Wit, Director General of Netherlands Postal & Telecommunications Services, and Masashi Kojima, Senior Executive Vice President of Nippon Telegraph and Telephone Corporation.

The opening address will be given by Geoffrey Pattie, Minister of State for Industry and Information Technology.

Further details are available from The Financial Times Conference Organisation, Minster House, Arthur Street, London EC4R 9AX. Telephone: (01) 621 1355. Telex: 27347 FTCONF G. Fax: (01) 623 8814.

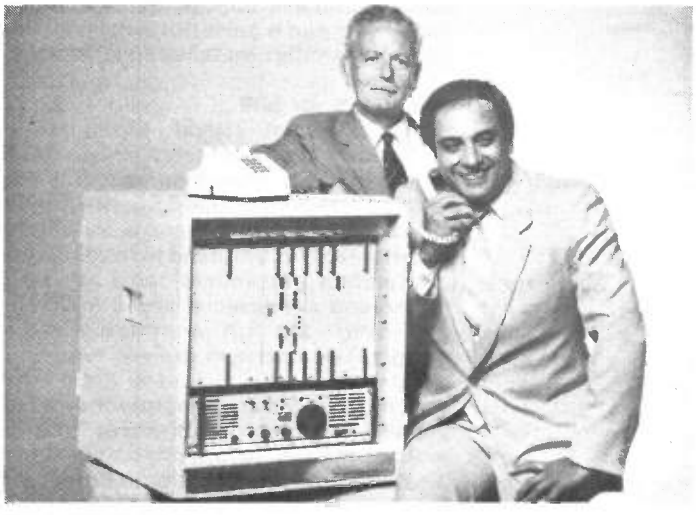
Conductive windows

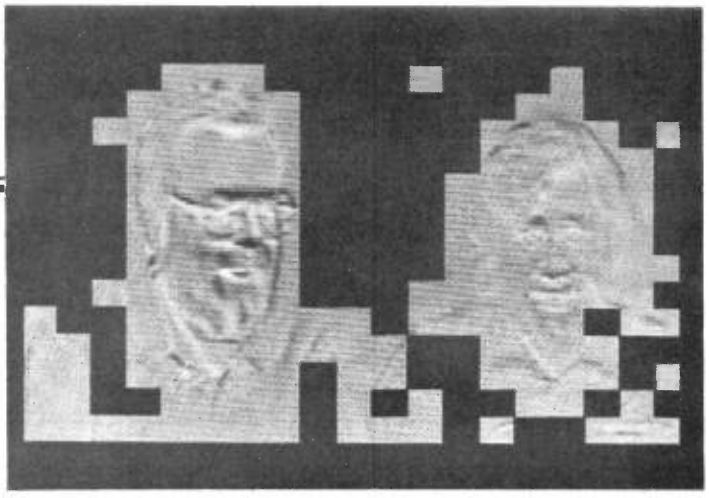
Recent tests at ERA Technology have shown that very thin metal coatings on glass can provide an effective electromagnetic screen to radio frequency interference. Glass panels coated with a very thin layer of conducting material have potential application in the reduction of emissions from computing devices and in providing protection from incoming high intensity radiation from radar transmitters.

The results of ERA's high frequency tests, which were carried out as part of a general, industry-sponsored research programme on electromagnetic compatibility, agree reasonably well with calculated values based on accepted screen theory, and some simple expressions have been derived to allow designers to obtain a rapid assessment of screening performance from the sheet resistance value.

A report covering this work, *The Electromagnetic Screening Effectiveness of Coated Glass Panels*, is available from Publication Sales, ERA Technology Ltd, Cleeve Road, Leatherhead, Surrey KT22 7SA, telephone (0372) 374151. For further information on this subject and on the research programme, contact A J Maddocks on extension 268.

The box contains microprocessor-controlled PABX equipment and an HF SSB transceiver. Called RACE, it was developed by the Department of Communications of the Canadian government to provide sophisticated communications for third world countries. It is being marketed by RACE Technologies, a division of Spilsbury Communications, Canada's largest producer of commercial HF products





TV transmission at 2Mbit/s: part of the image information transmitted when two people move their heads. The background is not transmitted

TV picture transmission

A new technique has been developed at Siemens' research laboratories that allows TV images to be transmitted at only 2Mbit/s without any noticeable impairment of quality. This data rate, which is seventy times slower than normal TV transmission rates, has particular application in ISDN networks and video conferencing. Further work is currently in progress to achieve slower transmission rates of 384 and 64kbit/s. With normal coding, a data rate of about 140Mbit/s is needed to transmit a digital television image.

It is often the case that in a sequence of TV images only a small part of the image content changes between one image and the next. The most obvious way of reducing the data rate, namely to transmit only the changes, is inadequate because the attainable reduction factor of between 5 and 10 would be too low. A factor of 70 is needed for a 2Mbit/s transmission, and one as high as 2200 for a 64kbit/s transmission.

A new technique has, therefore, been developed by Siemens with the support of the Federal German Ministry for Research & Technology. The entire TV image is initially split into blocks of 16 × 16 pixels. Each block is then assigned a coefficient by a mathematical procedure dubbed discrete cosine transformation (DCT), a technique that provides an exact symbolic description of the image content. Owing to their probability distribution, these coefficients allow more effective data reduction than is possible from the intensity of single pixels.

The next step is to check the coefficients for changes compared with the preceding image and to determine the intensity of these changes. If the analysis shows that the overall changes are minimal, then all the differences are transmitted. If the differences are considerable, such as those associated with a sudden movement, only the most significant differences are transmitted immediately, to the degree that the data rate permits. The finer details then follow in the next change of image.

The resulting image build-up is hardly noticeable; on careful scrutiny, however, a slight lack of definition for a short time after major image change can be discerned.

This technique allows the data rate required for transmitting TV images to be dramatically reduced. Siemens claims very good results at 2Mbit/s, even with a rapidly changing image content. Work is currently in progress to achieve a further reduction to 384kbit/s. The final goal is to transmit acceptable TV pictures at 64kbit/s.

With such very slow data rates the images can no longer be transmitted with full resolution. Both the number of pixels per image and the number of images transmitted per second are reduced. Thus a resolution of 360 × 288 pixels is obtained instead of the usual 540 × 575 pixels, and only 8.33 images are transmitted every second as compared with 25 at the higher speed.

To ensure that the movements do not appear jerky a computer generates the images missing from the transmitted images by interpolation and inserts them for the viewer. Initial trials at 384kbit/s show that this technique provides acceptable results.

SPECTRUM WATCH

NIGEL CAWTHORNE G3TXF

The Peacock report into the financing of the BBC, published during the summer, concluded with eighteen recommendations. The committee's principal task was to look into alternative ways for financing the BBC other than through the present licence fee (£58 colour) system.

A key recommendation was that BBC TV should not be obliged to accept advertising but instead that the licence fee should be linked to the retail price index (RPI).

In his opening address at the Royal Television Society's 'Peacock Debate', held just a few weeks after publication of the report, the BBC's Director General Alasdair Milne welcomed the fact that "advertising was being taken off the agenda" for the BBC.

But in referring to the proposed indexation of the licence fee, Milne said that a licence fee linked to the RPI is "not adequate . . . If the RPI had been used for indexing the licence fee over the past ten years, today's budget for the BBC would be one-fifth less than it is". However, during the debate several speakers wondered why the BBC's costs should be allowed to grow faster than costs in general.

A long way down the list of recommendations (in fact the 18th and last) comes a proposal that in the 1990s the transmission responsibilities of both the BBC and the IBA should be removed to a separate authority, the Broadcasting Transmission Authority (BTA).

UHF site sharing

Site sharing between the BBC and IBA, particularly on UHF TV transmitter stations, is already common practice. In a typical UHF TV transmitter station you will find four transmitters working alongside one another providing the two BBC and the two IBA channels (ITV and Channel Four/S4C) from the same building. Although each transmitter building belongs to one or other of the broadcasters, facilities are shared.

Bringing the transmission responsibilities of the UK's TV broadcasters under one roof, now that coverage is almost complete on both networks, does make sense. During the UHF TV transmitter network implementation programmes of the late '60s and early '70s it was arguably a good idea to have separate transmitter groups for each broadcaster so that there was an element of competition at the transmitter planning and service implementation level on UHF.

A common TV transmission authority has been adopted in several European countries. For instance, in France TDF is responsible for transmission of the main TV networks. In Switzerland it is the PTT that provides the broadcast transmitters for the public networks.

The only other 'technical' recommendation of the Peacock committee was that all new TV sets sold or rented in the UK from the beginning of 1988 should have a special socket to interface with a decoder to deal with encrypted signals. This is the 'peritel' socket which has been common on French TV sets for some years now.

Shetland Islands radio

One of the casualties of the recent community radio fiasco (see *Spectrum Watch* September '86) was the proposed local commercial radio service for the Shetland Islands.

UHF TV transmitter main stations (source BBC Engineering Information Dept)

There have been many attempts to provide a local commercial broadcast station in Shetland but so far all have failed. The latest attempt has floundered along with the UK community radio project, which has been sent back to the drawing board by the Cabinet.

Unlike many parts of the UK, which are served by two tiers of radio broadcasting, ie the four BBC radio programmes as well as the BBC and ILR local radio services, Shetland has only a first tier, the BBC's national programmes.

There are no medium wave broadcast transmitters in the Shetland Islands. Shetland's nearest medium/long wave stations are some 200 miles away at Burghead on the mainland. The BBC's 20kW Radios 1 and 3 and 50kW Radio 2 medium wave transmitters at Burghead do not provide an adequate service to the UK's outermost island group.

As for Radio 4 on 200kHz long wave, according to Ian Anderson of the Shetland Islands Broadcasting Company (SIBC), "you can just forget it!". The BBC long wave transmissions received in Shetland are subject to strong interference from both Poland and Leningrad, which share the same channel. Because Shetland lies so far north, during the winter 'night-time' radio propagation conditions last all day.

As well as co-channel interference problems, long wave reception of Radio 4 in Shetland at times also suffers interference effects caused by signals coming in from the BBC's different mainland long wave transmitter sites at Burghead, Westerglen and even Droitwich.

On VHF, Shetland is served by one BBC transmitter site which carries three programmes: Radios 1 and 2 (combined), Radio 3 and Radio Scotland. There are two-hour Shetland opt-outs on Radio Scotland for which the BBC produces programme material locally.

The present BBC mono FM installation uses six Eddystone 2kW transmitters into a nine-panel Marconi FM antenna, which gives a combined ERP of about 50kW. The geography of Shetland makes full coverage on VHF impossible. To achieve such coverage a powerful local medium wave transmitter installation is needed.

SIBC goes for MW

The Shetland Island Broadcasting Company's Ian Anderson told *Spectrum Watch* that it has been accepted by the main bodies concerned, BBC, IBA, Home Office and DTI, that there is a definite requirement for Shetland to have its own 'home-spun' commercial radio service.

Shetland commercial radio was 'tagged onto' the UK community radio project. The Shetland project, however, differs in many respects from the concept of community radio in the rest of the UK. Anderson emphasised that in most of the UK community radio would be a low powered third tier of broadcas-

ting, whereas Shetland's requirement was still for second tier broadcasting that would provide an adequate local commercial service for the whole island group. Covering Shetland is like trying to cover an area from Cambridge to Brighton.

In order to achieve good coverage of the islands' 23,000 population, Anderson has calculated that eventually an ERP of 7.5kW will be required, which corresponds to a 10kW AM transmitter feeding into a short mast radiator. A 10kW transmitter would provide the minimum 3mV/m signal strength required both throughout Shetland and across the Orkney island group.

Considerable engineering planning work has already gone into the project. The SIBC's recent engineering proposal for the aborted Home Office project was based on using two 1kW Eddystone AM transmitters into a Marconi R5071 'folded umbrella' vertical antenna. Because of the high winds on Shetland it is only economically practical to have a relatively short vertical radiator. The SIBC's transmitting antenna would be 0.1λ high, which at the proposed operating channel at the low frequency end of the medium wave corresponds to a mast height of 50m.

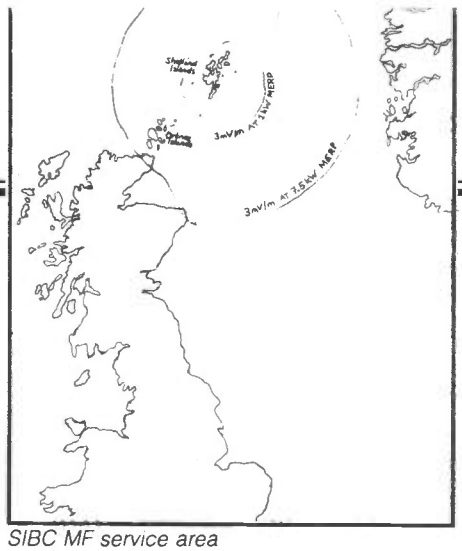
Pirate ahoy!

A possible frequency proposed was 558kHz, which at one time was used by the North Sea pirate Radio Laser (and now by the long established pirate Radio Caroline) but which in Shetland is a quiet interference-free channel. Anderson points out that if permitted they could eventually go to higher powers on this frequency without fear of causing interference to neighbouring countries. The nearest user of 558kHz is East Germany, which has two 20kW transmitter stations.

In anticipation of the project going ahead the SIBC built a studio complex, just down the road from the BBC's own installations. Anderson told *Spectrum Watch* that now the project has again gone into limbo the SIBC were having to sell off the building. However, they are still confident that the local commercial radio project for Shetland will eventually go through, with or without community radio, possibly by direct licensing. There is already a precedent for the direct licensing of a broadcast station in the UK: Manx Radio.

Manx Radio

The Isle of Man station is directly licensed by the Home Office and operates a three-transmitter network. Manx Radio has a 20kW transmitter at Foxdale on 219m for MW coverage of the island and two VHF FM stereo transmitters. A VHF 10kW transmitter at Richmond Hill and a 50W repeater on Snaefell, the island's mountain peak, provide the FM stereo coverage.



SIBC MF service area

Shetland sunk with CR

The Home Office community radio project documents published last year included a proposed 1kW MW experimental licence for Shetland. This was a higher power than was being considered for other licences. Unfortunately, in the short term at least, the Shetland Island commercial radio project seems to have been hit and sunk by the same torpedo as the CR ship. Despite the present set-backs, the SIBC still see the future as bright.

Ian Anderson says that relationships with all parties are still excellent and that they are confident that one day, sooner or later, Shetland will have its own commercial radio station.

USA: good news for mobile radio

The FCC in the US has announced the allocation of 32MHz of reserve radio spectrum remaining in the bands 821-941MHz.

In the US, the '800MHz' band was made available for 'mobile services', including the US cellular services (which currently operate at 825-845MHz and 870-890MHz) after UHF TV transmitters were moved out. But following the FCC's July announcement, cellular operators in the US are picking up a further 10MHz of spectrum. A 1MHz slice (824-825MHz and 869-870MHz) is being added at the low end of each of the existing cellular bands and a 4MHz slice (845-849MHz and 890-894MHz) at the top end.

Cellular radio in the US will then have 50MHz of spectrum. This compares with the 30MHz currently available to national UK cellular operators. However, the cellular bands in the London area (only) are being expanded as was reported in the July '86 *Spectrum Watch.*

The FCC announcement also included 27MHz in the bands 1545-1559MHz and 1646-1660.5MHz allocated to a new mobile satellite service on a shared basis with the Aeronautical Mobile Satellite Service (AMSS).

Significantly, the FCC have declined to allocate 800MHz spectrum to a mobile satellite service, believing instead that an L-band (1600MHz) allocation was preferable given the extreme needs for additional spectrum by domestic terrestial users.

VOA hits snags

One of the sites for the VOA's massive $1 billion short wave transmitting station project is in the Negev desert region of Israel. The transmitting station will carry both Voice of America and Radio Free Europe programmes to the USSR. The Israeli site will have up to sixteen 500kW short wave transmitters.

However, there is a continuing dispute between the US and Israeli authorities over the project. The Israelis argue that they should be compensated in the form of contracts for local companies for the political risk they would be taking in allowing an overtly anti-Soviet propaganda station (Radio Free Europe) on its soil. The US says that because the project is being financed by the US government, contracts must be equally open to US or Israeli companies.

The first round of 500kW SW transmitter tenders were expected to be issued in mid-November. The tender will call for the supply of short wave transmitters of 500kW or more for installation in Morocco, Sri Lanka, Botswana, Israel, Thailand and Puerto Rico. REW

The projected first phase of the VOA's re-equipment programme

Location	Target Area	First Phase Purchases
Botswana	Southern, Eastern and Central Africa	4 x 500kW SW 2 x 500kW MW
Israel	Eastern and Central Europe, the Southern USSR, East Africa and Southwest Africa	16 x 500kW SW
Morocco	Eastern Europe, North Africa and West Africa	10 x 500kW SW
Puerto Rico	South America	9 x 500kW SW
Sri Lanka	Central Asia, South Asia, East Africa and the Far East	7 x 500kW SW
Thailand	South and Southeast Asia	5 x 500kW SW 1 x 250kW SW

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

It is always good to see amateur radio appearing in the media, even if it does turn up in a somewhat bizarre manner with little regard to the true nature of our interest. Surprise, surprise, it turned up recently in that popular Sunday evening TV serial *Howard's Way*. Amateur radio managed to contact Lynn on the yacht *Barracuda* when all else had failed.

An artistic licence?

No doubt the powers that be would have forgiven the amateur who answered her call on 20 metres when all the other navigational and communication aids – including satellites – had failed! Nice to think that the story-teller responsible for *Howard's Way* thought amateur radio was the right system to call on in the circumstances of his drama, even if it was all a bit fanciful!

Multiple-choice and the RAE

Last month we offered some advice on how to become a radio amateur. The Radio Amateur's Examination is of course the peg around which becoming a radio amateur revolves. Much discussion is common these days as to whether the 'new form' of examination is preferable to the old style one.

The method of testing candidates for the RAE these days is by what is termed 'multiple-choice' question examinations. This method first came into use in about 1968 and has since become commonplace at all levels of school and technical exams.

The Radio Amateur's Examination came into being in 1947, when a written test was introduced. This was changed over to the multiple-choice type in 1979. The written examination was much criticised as being unfair in that only a small number of questions which could only cover a small part of the syllabus could be covered in the time allotted. The element of 'luck' played a big part in the success or otherwise of the candidate, depending on whether he had 'genned up' on the particular topic which came up in the exam paper. Also, of course, it was very much a matter of one's ability to express one's knowledge in writing, a skill which does not come all that easily to everyone.

The multiple-choice exam, as its name suggests, consists of a series of questions, each of which lists a number of plausible answers. The candidate must indicate which one he considers correct by filling in on the answer sheet one of a number of small spaces. The completed answer form is then read by a computerised reading machine, which can sense the marks on the answer form.

As with most changes, this type of examination, going from a written paper to what was described as a 'tick on a form', did not meet with everyone's approval. However, once one gets to know the background to this system it will be apparent that it really is a great improvement over the old written type of exam.

A selection of all possible questions was put to a large group of 'guinea-pig' students distributed throughout the country. The answers they produced were then subjected to statistical analysis, from which the suitability of the questions was assessed. For instance, if, say, 75% answered a question correctly, it was an 'easy' question. If 75% got it wrong it was too difficult.

Sometimes a question was set which caught the good candidates out; that is, it was answered incorrectly by otherwise good candidates. This type of question is not one which gives a good indication of the general level of the candidate's knowledge. It was therefore removed from the list of questions which would be included in subsequent exam papers.

In this way a 'bank' of questions was built up, from which, by random choice, a paper of almost uniform standard could be drawn up for future examinations.

Consistent marking

A further advantage of the multiple-choice question is in the marking procedure. With written exams, what one examiner may regard as a good answer may not appear so to a different examiner. The examiner may have 'good' and 'bad' days, like most of us, and it's unfortunate for you if your paper is judged by an examiner not in the best of moods! Again, the written answer may be 'partly' correct and the examiner may then have to use his own preferences for marking.

Even so, the multiple-choice type of exam has its own complexities in marking. To try to level things out so that candidates can be 'fairly' judged, and to check that all the questions asked are fair, after the first couple of hundred answer sheets have been marked an analysis of each question and answer is made to check whether the answers are coming out as expected. If any question is producing unexpected results it is disregarded. A sample of the automatic computer-marked papers is also checked manually.

So, those of you who may be taking your RAE can rest assured that the 'new' multiple-choice method will certainly give you a fairer result than the old written paper method.

Packet radio

In the coastal strip between Portsmouth and Bournemouth there are about 40 Amateur Radio and Computer Club (AMRAC) members active in the field of packet radio. Construction of a 2 metre packet repeater for the area – GB3HP – is complete, and it should be in operation by the time you read this.

The Amateur Radio and Computer Club was founded in April 1985 with the aim of encouraging the use of computer technology in amateur radio. Since that time the club has grown rapidly, and now has members throughout the UK as well as in Europe and the Middle East.

AMRAC produces a professionally printed bi-monthly newsletter of some 40 pages, as well as a hot-news sheet in intervening months. The newsletter covers all aspects of computer communications including packet radio, ASCII, AMTOR and RTTY. All the popular makes of computer are covered. In addition the club has arranged special members' discounts with selected companies, as well as importing packet radio TNCs at advantageous prices.

Membership is just £5 per annum and further details may be obtained from the secretary: Phil Bridges G6DLJ, 9 Hollydene Villas, Southampton Road, Hythe, Hants SO4 5HU. Tel: (0703) 847754. Prestel Mailbox 703847754.

RTTY Journal changes hands

The *RTTY Journal*, published for many years by Dee Crumpton N6ELP from Cardiff-by-the-Sea, California, was one of the earliest journals to be devoted solely to the interests of the RTTY enthusiast. The first publisher was Merrill Swan W6AEE, a pioneer of amateur RTTY in the USA. Many RTTY

enthusiasts got their first inspiration to try this mode from his writings – including your scribe. Most tragically he was killed in a motor accident, RTTY thereby losing one of its most active participants.

His wife Dee decided after his death to keep the journal going as a memorial to him, and with the help of friends and loyal supporters she succeeded in doing this.

Now, with the passage of time, she has had to give up and has sold out to Dale Sinner W6IWO, who becomes its owner/editor/publisher. As Dale writes in his first issue, July/August 1986:

> "I have been a subscriber to the *RTTY Journal* for many years and still have all my copies on file. I have enjoyed reading this publication all these years, never thinking I would some day be the owner and publisher. To me the *RTTY Journal* is not just a magazine, it is an institution. I shall endeavour to do my very best to continue its traditions, giving our readers the best and latest information I can get my hands on . . . The *RTTY Journal* is now in its 34th year of continuous publication and I hope to keep it going for many more years".

We wish you every success Dale.

Subscription rates are $10 per year surface mail overseas and $15 airmail, US currency only: *RTTY Journal*, 9085 La Casita Avenue, Fountain Valley, California 92708, USA.

NASA space station

Following the successful operation of amateur radio from the Shuttle mission, a proposal is being made that the NASA space station, at present in the planning stage, should have a built-in amateur radio station, not one put in at a later stage as an 'add-on' piece of equipment.

The proposal was initiated at a meeting held at the ARRL National Convention recently held in San Diego. Representatives of NASA, AMSAT and the ARRL met to discuss ideas put forward by Dr Tony England W0ORE, one of the first astronauts to use amateur radio from a spacecraft, for what he called the SSAR Project – Space Station Amateur Radio. This program will be one of the longest projects so far undertaken by radio amateurs for the space program, as the space station is not scheduled to fly until 1995.

Looking to the future

A working group was established to develop a plan which would be presented formally to NASA in 1987. One of the main objects of the project is to encourage young people to develop an interest in engineering, mathematics and the sciences, in much the same way that previous projects such as the SAREX (Shuttle Amateur Radio Experiment) and the UoSAT projects have done.

The satellites

The Russian satellites RS 5 and RS 7 went into eclipse at the end of September and have accordingly been restricted in their operational times. RS 7 is on from 0500 to 0900 UTC. RS 5 is on from 0900 to 1300 UTC. They come out of eclipse on 8th December, at which time they will return to full operational service.

The efforts that seemed to show some degree of success in getting Oscar 10 back into full working order now seem to be proving unsuccessful, and it is feared we must consider this satellite very near the end of its useful service life.

JAS-1 or Fuji or FO-12 as it is variously called is working well but is difficult to access. Its beacon is well received, however, and all seems to be going to plan. At the time of writing it is switched off on Mondays and Fridays every week for battery charging. REW

THE COMPACT TV

The Japanese company Citizen recently launched what is bound to be a popular present this Christmas, in the shape of a truly pocket sized television set. Citizen are more widely known as a watch movement manufacturer (the world's largest, in fact), but are now diversifying into factory and office automation equipment and, of course, miniature TVs.

Citizen mini TVs, while new to the UK, have been available in the USA and Japan for some time. The new Compact 06TA uses the compactness of modern display technology and microelectronics to great effect, achieving a size of only 118 × 69 × 21mm and a weight of around 200g.

The display is rather interesting. A hinged 'lid' houses an LCD of 53 × 50mm, and this opens to an angle of 50°. The image is actually viewed in a mirror below the display, mounted in the main body of the set (not exactly a novel technique, as it was used in the early days of TV when it wasn't possible to produce 'short' CRTs. These early sets were, however, considerably larger than the 06TA!).

As you may have deduced, the display is illuminated by light passing right through it to be reflected off the mirror. This means that when using the set in bright sunshine the picture is highly visible, unlike a CRT.

The LCD is of the twisted nematic variety and gives a 130 × 160 pixel display. It employs crystals sandwiched between two polarising filters, and these are mounted with their directions of polarisation at 90° to one another – if the crystals were not present no light would pass through.

However, the crystals have a 90° twist in them. After the light has passed through the first filter its polarity is 'turned' through 90° so that it will pass through the second filter.

When a voltage is applied to a crystal it 'straightens out'. The light travelling through it will therefore be blocked, and a dark dot will appear at this crystal's location. The picture is made up of 20,800 such dots.

Obviously the 06TA will not appear very bright at night. However, one of the extras available is an electro-luminescent back-light which clips over the LCD. This takes its power from the set via a pair of contacts in the spring-loaded retaining catch.

The quoted battery life is up to 12 hours continuous use using alkaline batteries without the back-light (it takes 4 AAA cells, incidentally). With the back-light, battery life is 5 hours.

The set has a 6V dc input socket, to which one may connect a suitable ac adaptor or Citizen's 12V car battery adaptor.

Tuning is by a rotary knob on the side, which although small is easy enough to use. The UK version is UHF only, while the Japanese and American sets have a VHF/UHF band switch. A similar knob next to the tuning thumbwheel controls the volume, sound being reproduced either on a built-in speaker or through the earphone supplied. Another such knob on the front controls the screen's brightness.

The set seems more than adequately sensitive, and the picture is quite remarkable considering its size. Problems will arise when trying to read subtitles (basically, you can't), but otherwise it's more than satisfactory.

Reception proved tricky in some places (very embarrassing when I showed it off in my local boozer – nice pics of snow), but these tended to be places of generally poor reception anyway. A colleague reported excellent reception inside his car, but for heaven's sake don't drive with the TV on! It's bad enough these days having to suffer idiots screaming down the motorway with a car phone glued to their ear.

I must confess to rarely watching TV (I'd claim that pressure of work keeps me away from it, although if I was honest I'd have to say that they don't have TVs in the pubs I frequent).

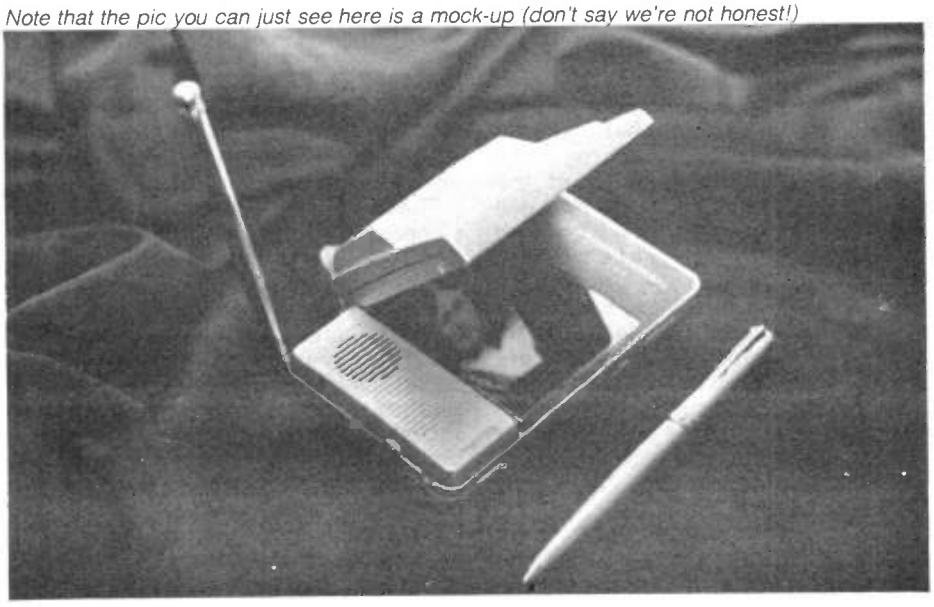
However, even I was infected by the excitement this set generated whenever I showed it to anyone. It proved its worth one dismal night at the local station when I had an eternity to wait for a train. It beats a Walkman any day!

So, how much will this miracle of modern technology cost? The 06TA has a retail price of £99.95 complete with earphone, batteries and soft carrying case (although a certain well-known electronics mag is offering them at a £10 discount). The car battery adaptor, which plugs into a cigar lighter, and the back-light unit cost £9.95 each.

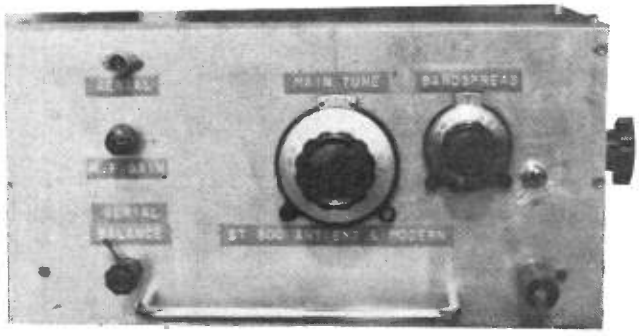
Being a bit of a cheapskate I tend to regard £100+ as a little much to pay for a Christmas present. As usual I represent a minority of one around here, for the almost universal response in this locale was "is that all?"

Anyway, I'm going to wait for the colour version. This is already in production for the Japanese market judging by Citizen's brochures, so it's only a matter of time before it reaches us . . . REW

Note that the pic you can just see here is a mock-up (don't say we're not honest!)



THE ST800



ANTIENT & MODERN

A good design never dies, it just becomes outdated. Osborne Postle G3EFZ updates a classic

To the initiated home constructor the above title will revive memories of a well-known series of pre-war receivers by a famous designer. To the uninitiated, that is those on the low side of forty, it should be explained that the letters ST are the initials of John Scott-Taggart, and the 800 indicates the penultimate of a series of straight-circuit receivers described by him in *Popular Wireless* during the 1930s.

ST800 – 'antient'

In essence the ST800 was an all-wave home constructed set using a four-band switched coil pack mounted on a single piece of 'metaplex' (sprayed metallic-faced plywood) sold by Peto Scott. All components were fixed to this metaplex 'chassis', the front of which housed the controls and a large white plastic dial on which were printed station names. An equally large tuning dial pointer enabled listeners to log exact spots on the dial scale corresponding to the stations tuned in, and ST always emphasised the large number of stations that could be received with his sets.

Battery and mains versions of the receiver were described, and in those days the appearance of a new ST design was among the highlights of a wireless enthusiast's year. I was only a schoolboy in those days, and the £5 or so needed for the ST800 coil pack and the few extra pounds for the remaining parts were carefully considered before purchasing what became the family set. It served throughout the war years and indeed for a lengthy period afterwards.

ST800 – 'modern'

The receiver presented here is an adaptation of the original design incorporating some up-to-date components and making use of established short wave receiver practice. Of the original components, only the Polar HF tuning condenser and the BTS (British Television Supplies) coil pack have been retained. The metaplex plywood has been replaced by a 35 × 23 × 7cm aluminium chassis, the valves by transistors, and the two-stage audio section cut down to provide only headphone reception.

All ham bands except 160 metres are covered, and the full range extends from the bottom of the long wave band right up to the high frequency side of the 10 metre band. A single PP7 9 volt battery has supplied current to the set for over ten years, and only an external aerial is needed to complete the outfit for serious listening.

Design development

Credit for elements of the present circuit is due to the late F G Rayer G3OGR for his FET receiver described in *Practical Wireless* some time around 1970 (the exact date eludes me). This was a 0-V-2 line-up using an MPF102 FET and two LF transistors.

The design immediately appealed, and I copied it using a 2N3819 FET and an OC71 output transistor. With these I used the detector coils of the original ST800 coil pack, and the 'lash-up' worked just as Rayer described: "quite sensitive and selective giving good reception of a large number of stations." Indeed, the performance was encouraging enough for me to try to extend the line-up to include the RF portion of the coil pack and tidy up the layout of the reaction portion of the FET detector.

First attempts at using another 2N3819 as a signal amplifier were, as might be expected, a complete failure, for as soon as the two tuning condensers were brought to common resonance the whole set went into continuous oscillation. This could be stopped only by detuning the RF section. The problem was no doubt the lack of isolation between the input and output circuits of the RF FET.

However, thanks to an article by T Bailey in *Practical Wireless*, September 1974 (page 407 *Figure 11*), in which a circuit was drawn for two FETs in cascode as an RF amplifier, the unstable front end was immediately tamed and the receiver could be extended to a 1-V-1 line-up. Thus the circuit using the whole coil pack reverted to its original function, but now using very different means of RF amplification and detection.

The complete receiver

Figure 1 shows the full circuit diagram of the receiver and the table lists the values of the components used. Long experience of short wave reception with straight receivers has shown that success with such designs depends entirely upon having precise control of the detector's onset of feedback oscillation. The ability to slide into and out of oscillation with hair-breadth accuracy is vital. With this receiver this point overrides all other considerations.

A full size, slow motion driven, high quality air spaced and ceramic insulated condenser is used at the end of a 10cm extension control shaft. This particular component is placed as close as possible to the reaction coil terminal, only 4cm of wire away in fact, and rigidly fixed to the chassis base. Likewise, the main tuning condenser and associated band-spread condenser have 10cm long extension drive shafts coupled to slow motion dials on the front panel. Such a measure ensures freedom from hand capacity even on the highest frequency covered by the receiver.

Eagle-eyed readers may spot the use of a twin-gang tuning condenser. Only one section is used, and the reason for the selection of this component was its very small physical size, ceramic insulation and very low minimum capacity. The original condenser specified by ST was 7cm long, while the present one is only 4cm across and is placed so close to the tuning coil and grid condenser that a 3.5cm flexible coupler could not be used because it fouled the side of the coil pack case, hence the use of the home-made rubber coupler with small laboratory type clips.

Two RF chokes are used in series in the detector drain circuit. The first, adjacent to the coil pack terminal, is an Eddystone catalogue No.1022, and the other is an old Wearite long and medium wave model, to ensure smooth reaction control on all four wave bands.

Adequate stability and freedom from pulling of the RF section is ensured by housing all its components below the

chassis deck: even the 'hot' end of the tuning coil is brought through directly to the tuning condenser via a small hole drilled in the deck rather than using the terminal post provided on the coil pack, which, of course, is situated above deck.

The original Polar tuning condenser, always favoured for RF tuning by ST, is retained because of its built-in slow motion drive, and it proves handy as an auxiliary reaction control, particularly on short wave. Actually it controls the very, very slight RF stage oscillation at resonance with the detector stage, something which ST liked and which in his later ST900 receiver was deliberately introduced and called 'X' reaction.

In the single audio stage following the detector a surplus step-down transformer is used to give good low impedance matching to the OC71. I have not found any need to use a second LF stage as used in Rayer's FET receiver, the line-up shown in *Figure 1* giving ample headphone signals.

While on the subject of signal strength it may be appropriate to mention the use of the potentiometer attenuator (RV1) used in the aerial circuit. This follows the example of R A Penfold as used in his short wave regenerative receiver, *Radio and Electronics Constructor,* May 1974 (page 594). It solves the night-time front end overloading problem encountered with sensitive receivers, as described in *World Radio TV Handbook*, 1980, volume 34 (page 541), to which the ST800 is no exception.

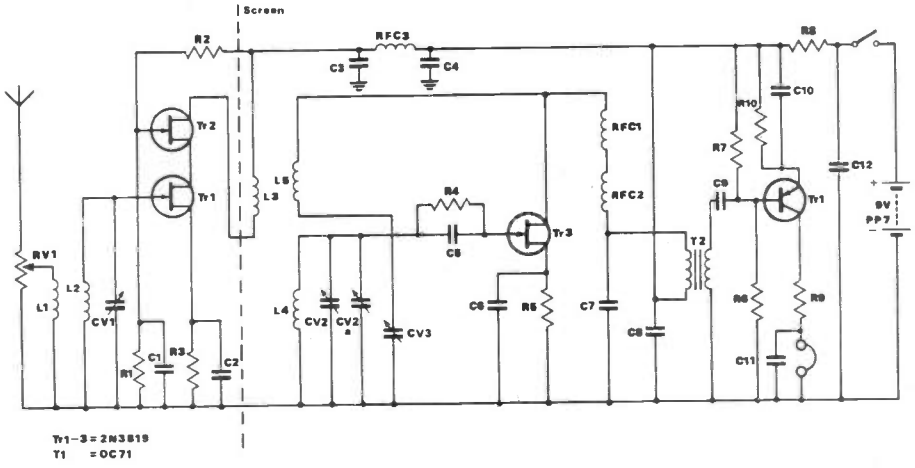


Fig 1 *ST800 'Modern' circuit diagram*

Practical points

An 18 × 36cm aluminium front panel is bolted to the chassis in conventional fashion as shown in the photograph. All components are rigidly fixed and stiff wire is used directly between connection points. The main tuning dial is the larger of the two, and the reaction control is brought out on the right-hand side of the set whilst the waveband change switch is placed on the left-hand side. All transistors are soldered into the wiring using pliers as a heat sink during the operation. The shortest possible wiring routes are used for the detector stage and the reaction stage components, no attempt being made towards a tidy arrangement of the wire connections.

Observers of modern printed circuit methods of construction may smile at the method advocated by ST for wiring up his sets. In his day soldering was little used: each component had connection terminals, and the technique for joining was to measure off suitable lengths of systoflex (flexible small-bore insulation tubing) and insert slightly longer lengths of tinned copper wire through these tubes. The wire ends were then shaped into neat loops for fixing under the terminal screws.

Lucky possessors of the Polar tuning condenser used for RF tuning (ST called it aerial balancing) will find the built-in pointer useful for roughly aligning this stage with that of the detector stage. After such rough alignment always use the minimum amount of reaction condenser capacity to produce the verge of oscillation.

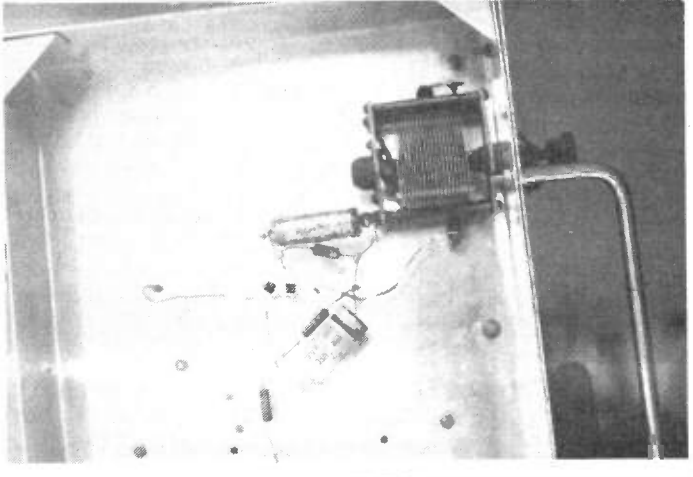
Stout three-ply sides are fixed to the front panel and chassis to stiffen the structure and provide positive location for the reaction control and waveband change switch shafts. Extra rigidity can also be gained by the use of a strong top to the receiver. In my case ¼ inch perspex has been used.

Ordinarily no earth connection is used, but if you have a particular interest in weak long wave reception extra signal strength will ensue if one is used. Evidence of this can be had by touching the metalwork whilst listening on that band.

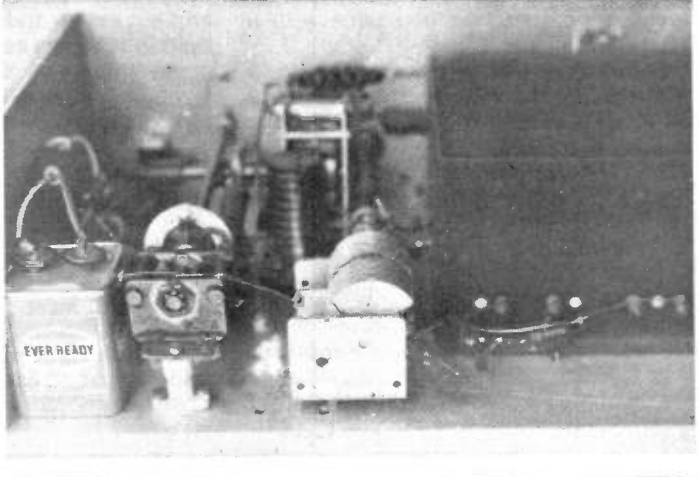
Performance

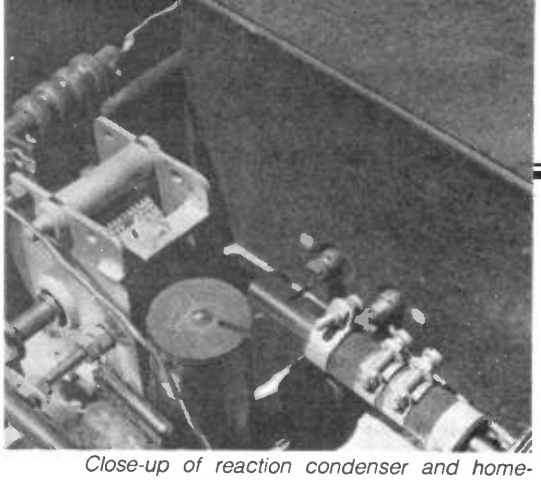
Although the original receiver was born in the days of W2XAF/XAD, VK2ME, VQ7LO, 2RO etc, and lived through the Spanish, Ethiopian and European wars, nowadays RSA, VOA, HCJB, WYFR, Radio Canada International and UAE, Dubai etc have become familiar spots on the dial. On the amateur side, too, PA0AA (PI4AA), G4RS Catterick and G3GNS provide a source of interest in the form of code proficiency reception exercises on 80 metres, whilst QSL cards from PA0GG and PY2AMI testify to the receiver's ability to receive amateur QRP beacon stations. Amateur SSB signals prove to be the most difficult stations to resolve, but in this connection the 'clarifier'

Under-chassis view of the cascode FETs and RF tuning



Rear view of tuning condensers and detector FET





Close-up of reaction condenser and home-made flexible main tuning coupling

effect of the RF tuning control in altering the pitch of the signal helps in no small way.

Naturally there is no problem with normal broadcast band signals, nor with the powerful frequency standard stations throughout the short wave frequency ranges, but for me the receiver is most at home when receiving amateur CW signals. Perhaps it is long experience of listening to crowded bands that gives the impression that this little receiver can cope with all but the most congested situations – but maybe I have developed a built-in selectoject in my head over the years!

With a straight receiver one has no ganging problem – hence maximum sensitiviy, no second channel interference – and signals appear only once and in the correct place on the dial, with no self-generated heterodynes and whistles, and with headphones one does not inflict whatever 'the wild waves are saying' on the rest of the family.

The graphs show the calibration of the receiver on the various bands, whilst the table gives the component values used in the receiver. The coils numbered L1 to L5 are contained with their respective switches in the BTS coil pack, but for prospective constructors three alternative suggestions are listed below.

Footnote

It is unlikely that readers will be able to procure the original coil pack, so the following suggestions may prove helpful for those who would like to try out the straight cascode circuit:

☐ The old Lissen Skyscraper receiver had a good switched coil pack with a short wave range.

☐ Denco Blue and Green series plug-in coils numbered 1 to 5 could be used provided a screen is placed across the chassis to separate the coil fields.

☐ The BTS range of plug-in coils specified by ST for his ST900 receiver could also be used. These were 'one-shot' coils on a six-pin base with an octal type spigot for location. Again the separating screen would be necessary.

☐ Home-made coils on standard 1½ inch diameter formers could be wound to cover the short wave range using 22swg enamelled wire (see table).

COMPONENTS

Resistors

R1,2	47k
R3	5k
R4	2M2
R5	2k7
R6	100k
R7	22k
R8	500R
R9	10k
R10	1k5
RV1	100k wire-wound pot

Capacitors

C1	4nF
C2	20nF
C3, 4, 6	10nF
C5	100pF
C7	500pF
C8	1nF
C9	8μF
C10, 11, 12	100μF
CV1, 2, 3	500pF
CV2a	35pF

Miscellaneous

RFC1	Eddystone catalogue No. 1022
RFC2	Wearite long/medium wave type
RFC3	Eddystone catalogue No. 1010
T2	Surplus step-down type, primary 2kΩ, secondary 8Ω

2 × 'Eagle Radio' slow motion dials

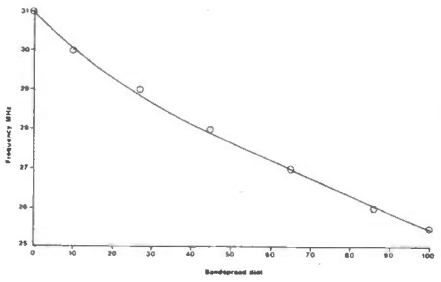
High impedance headphones (2kΩ per earpiece)

Conclusion

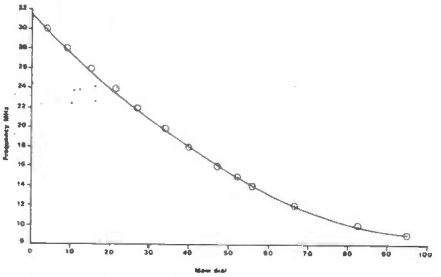
This article is entitled *ST800 – Antient and Modern*. The 'antient' portion certainly belongs to the days of yesteryear – those Golden Days of Radio – but even the 'modern' portion is getting somewhat ancient too by today's standards. It was built in 1974, has been in almost daily use since then and certainly would have remained 'incognito' but for the Editor's request to write it up. REW

Primary	Grid	Reaction
1¼	3	4
3	4	3
4	7	5
6	10	7
8	25	10

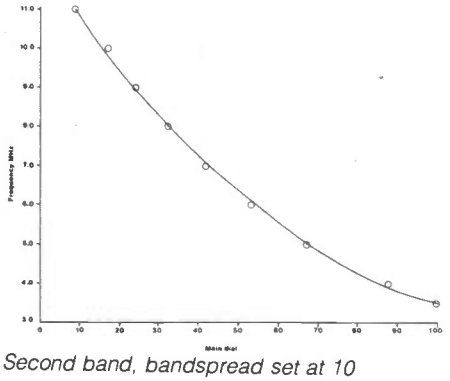
If only 4-pin formers are to hand then it will be necessary to resort to choke-capacity coupling between the RF and detector stage and use a series condenser in the aerial lead rather than the potentiometer attenuator shown in *Figure 1*



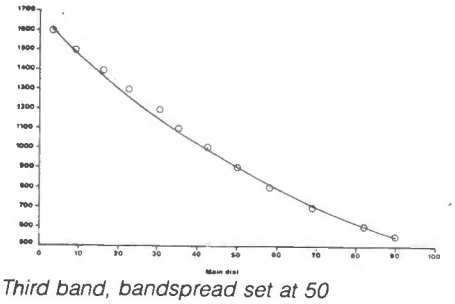
First band bandspread, main dial set at 0°



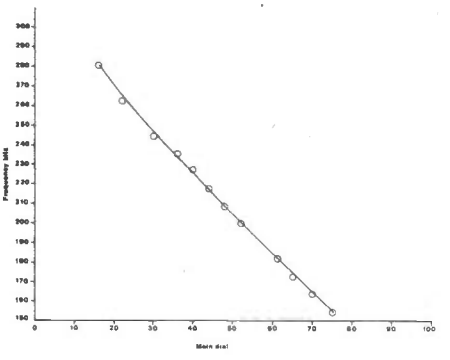
First band, main dial, bandspread set at 10



Second band, bandspread set at 10



Third band, bandspread set at 50



Fourth band, bandspread set at 50

3-D TV

James Fletcher takes a look at the prospects for stereoscopic television

Hidden away in the back rooms of the world's broadcasting organisations, teams of research engineers are constantly on the look-out for new developments that will increase the magic of the television service, so as to keep viewers interested in spending even more hours watching the box. We have recently been hearing a lot about the introduction of stereo TV, but this turns out to be merely the long-awaited addition of stereo sound to our existing pictures, and even so it will still be many years before all our programmes are accompanied by glorious stereo sound.

True stereo television, that is stereoscopic or 3-D TV, has been a gleam in the eye of researchers for many a long year, and experiments have been carried out in various parts of the world with various different systems. TVS, the ITV company that serves the south of England, actually carried live test transmissions as part of one of its popular science programmes last year, and free spectacles with different coloured lenses were given away in the *TV Times* to allow viewers to participate. Many of the effects were very good, providing a true sense of depth and perspective, but some viewers felt that many of the pictures were out of focus, and viewers who were not wearing glasses just saw a blurred-looking mess of red and green.

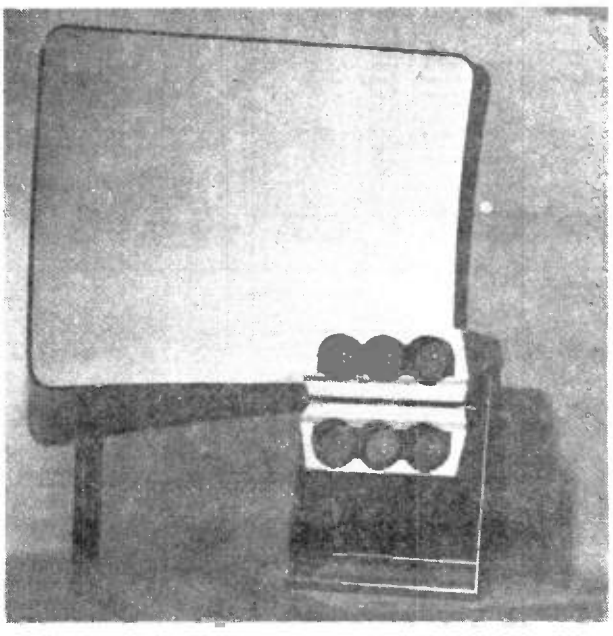
Although many specialist members of the European Broadcasting Union are currently studying the topic, perhaps the keenest of the European broadcasting institutions as far as 3-D TV is concerned is IRT, the West German institute for research into technical developments in radio and television. IRT has been researching 3-D TV for over 17 years, and as long ago as 1982 broadcast a series of stereoscopic programmes using the two-coloured anaglyphic technology and the accompanying two-coloured glasses that had been made famous by the cinema decades earlier.

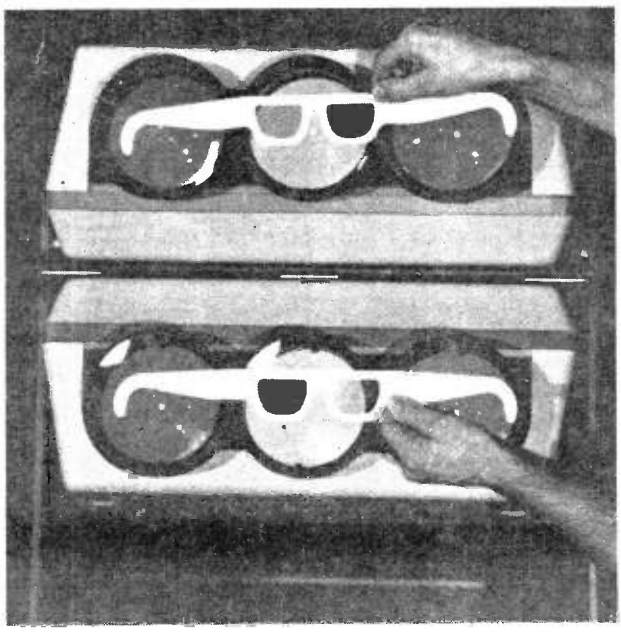
These IRT experimental broadcasts elicited a tremendous response from the public, but other work has shown that viewers are not prepared to accept a reduction in picture quality as the price for 3-D television.

The old techniques of using two colours for transmission and providing viewers with two-colour glasses have been shown to have significant disadvantages for television, and the method that IRT has found to give most satisfactory results is known as the polarisation-plane method. To obtain relief effects it is necessary to put polarising filters in front of the display tubes, with corresponding filters in the spectacles worn by the viewer. The glass in the spectacles is a neutral grey colour, so does not disturb normal vision any more than wearing a pair of sunglasses would. It has been found that by far the most convincing 3-D effects are obtained from projection televisions, where the larger image seems to add to the stereoscopic effect.

IRT's most recent demonstrations have made use of the equipment shown in the photograph, which consists of two Barco projectors mounted vertically one above the other, as closely as possible. Polarising filters in front of the lenses and corresponding filters in the spectacles allow the left eye to see only the beam produced by the upper projector and the right eye to see the lower beam. The polarisation used gives discrimination in the vertical direction, but the researchers claim that it should eventually be possible to use bi-circular polarisation, which would permit more freedom of head movement. The red, green and blue tubes are reversed on the two projectors, so that the left-right colour shading that is commonly found on single projection displays can be eliminated.

The demonstrations showed that three-dimensional television can be made to work with conventional studio equipment, and some viewers report that 3-D viewing gives a subjective feeling of enhanced picture quality as well as the sensation of depth, although the reasons for this have not yet been explained. Practical problems of receiver production at a reasonable cost still need to be overcome, however, and even the most optimistic of the German television engineers thinks that regular broadcasts are still several years away. REW





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EM4 9.00
EM80 0.70
EM81 0.70
EM84 1.65
EM85 3.95
EM87 2.50
EN32 16.50
EN91 1.95
EN92 4.50
ESU150 14.95
ESU872 25.00
EY51 0.80
EY81 2.35
EY83 1.50
EY84 5.95
EY86/87 0.50
EY88 0.55
EY91 5.50
EY500A 1.50
EY802 0.70
EZ35 0.75
EZ40 2.75
EZ41 2.15
EZ80 0.75
EZ81 0.75
EZ90 1.50
F6064 2.95
FW4/800 2.95
G55/1K 9.00
G180/2M 6.95
G232 Mullard 3.95
G240/2D 9.00
GC10B 17.50
GC10D 17.50
GC10/4B 17.50
GC10/4E 17.50
GC12/4B 17.50
GD86W 6.00
GDT120M 5.00
GN4 6.00
GN10 15.00
GR10G 4.00
GS10C 16.50
GS10H 12.00
GS12D 12.00
GT1C 14.00
GT1C S/S 13.00
GTE175M 8.00
GTR150W 1.00
GU20 35.00
GXU1 13.50
GXU3 24.00
GXU50SS 14.50
GY501 1.50
GY802 1.50
GZ30 1.50
GZ31 1.50
GZ32 1.50
GZ33 4.50
GZ34 2.15
GZ37 4.50
HAA91 1.00
HABC80 0.90
HBC90 0.75
HBC91 0.80
HF93 0.75
HF94 1.50
HK90 1.06
HL2K 4.95
HL23DD 4.00
HL90 0.70
HL92 1.50
H133/DD 3.50
HR2 4.00
HY90 1.00
HVR2 3.00
K3118 86.00
KR6/3 45.00
KT8C 7.00
KT33C 3.50
KT36 2.00
KT44 4.00
KT45 4.00
KT61 5.00
KT63 2.00
KT66/CV1075 special yellow ssss pot 19.50
KT66 USA 9.95
KT77 Gold Lion 10.95
KT81 7.00
KT88 USA 10.95
KT88 Gold Lion 18.95
KTW61 2.50
KTW62 2.50
KTW63 2.00
KTZ63 2.50
L102/2K 6.95
L120/2K 12.00
LB7-20 95.00
LS9B 6.95
M502A 60.00
M537A 60.00
M5143 155.00
M8079 6.00
M8082 7.50
M8083 3.25
M8091 7.50
M8096 3.00
M8098 5.50
M8099 5.00
M8100 5.50
M8136 7.00
M8137 7.95
M8161 6.50
M8162 5.50

M8163 5.50
M8190 4.50
M8195 6.50
M8196 5.50
M8204 5.50
M8223 4.50
M8224 2.00
M8225 3.50
ME1401 29.50
ME1402 29.50
ME1501 14.00
MH4 3.50
MHLD6 4.00
ML4 4.50
MS4B 5.50
MU14 3.50
N37 12.50
N78 9.85
OA2 0.85
OA2WA 2.50
OA3 2.50
OB2 0.85
OB2WA 2.50
OC2 2.50
OC3 1.50
OD3 1.70
OM4 1.00
OM5B 3.00
OM6 1.75
ORP43 2.50
ORP50 3.95
P61 2.50
P41 2.50
PABC80 0.50
PC86 0.75
PC88 0.75
PC92 3.50
PC97 1.10
PC800 1.10
PC900 1.25
PCC84 0.40
PCC85 0.54
PCC88 0.70
PCC89 0.70
PCC189 0.70
PCC805 0.70
PCC806 0.80
PCE82 0.80
PCF80 0.65
PCF82 0.60
PCF84 0.65
PCF86 1.20
PCF87 0.40
PCF200 1.80
PCF201 1.80
PCF800 0.40
PCF801 1.35
PCF802 0.60
PCF805 1.25
PCF806 1.00
PCF808 1.25
PCH200 1.50
PCL82 0.85
PCL83 2.50
PCL84 0.75
PCL85 0.80
PCL86 0.85
PCL800 0.80
PCL805 0.90
PD500 3.50
PD510 3.65
PEN25 2.00
PEN40DD 2.50
PEN45 3.00
PEN45DD 3.00
PEN46 2.00
PEO5-25 39.50
PEO5-40N 42.50
PFL200 0.95
PL21 2.50
PL36 0.95
PL38 1.50
PL81 0.72
PL81A 0.72
PL82 0.60
PL83 0.52
PL84 0.78
PL88 1.00
PL95 1.75
PL302 1.00
PL345 12.50
PL500 0.95
PL500 1.10
PL504 1.15
PL508 1.75
PL509 4.85
PL519 4.95
PL802T 3.50
PL820 2.95
PL5557 29.50
PL5727 2.50
PY32 0.60
PY33 0.50
PY81 0.70
PY82 0.70
PY83 0.70
PY88 0.66
PY500A 1.95
PY800 0.79
PY801 0.79
QB3-300 54.95
QB5-1750 139.50
QBL5-3500 495.00
QEO3-10 4.95
QE08-200 £145.00
QF40 65.00
QP25 1.00
QQEO2/5 19.50
QQEO3-12 7.95
QQEO3-20 35.00
QQEO6/40 45.00
QQVQ2-6 19.50
QQVO3-10 Mullard 15.00
QQV03-10 5.50

QQVO3-20A 25.00
QQVO3-20B 32.00
QQVO6-40A 27.50
QQVO7-50 63.50
QQZO3-20 42.50
QS75/20 1.50
QS75/40 3.00
QS92/1D 6.00
QS95/10 4.85
QS108/45 4.00
QS150/15 6.95
QS150/30 1.15
QS150/45 7.00
QS1200 3.95
QS1202 3.95
QS1203 4.15
QS1205 3.95
QS1206 3.95
QS1206 1.05
QS1207 0.90
QS1208 0.90
QS1209 3.15
QS1210 1.50
QS1211 1.50
QS1212 3.20
QS1213 5.00
QS1215 2.10
QS1218 5.00
QU37 9.50
QU37 11.50
QVO3-12 4.95
QVO5-25 1.75
QVO6-20 29.50
QV2-250C 45.00
QVO8-100 145.00
QY3-125 65.00
QY4-250 70.00
QY4-400 76.00
R10 4.00
R16 12.00
R17 1.50
R18 2.50
R19 2.50
R20 1.20
R1169 55.00
RG1-125 4.95
RG1-240A 14.50
RG3-250A 3.50
RG3-1250A 35.00
RK2K25 62.50
RK-20A 12.00
RL16 1.50
RPL16 12.00
RPY13 2.50
RPY43 2.50
RPY82 2.50
RR3-250 15.00
RR3-1250 35.00
RS613 45.00
RS685 54.95
RS688 52.15
S6F17 5.95
S6F33 29.95
S11E12 38.00
S30/2K 12.00
S104/1K 10.00
S109/1K 15.00
S130 5.95
S130/P 5.95
SC1/800 5.00
SC1/1100 6.00
SC1/1200 5.00
SC1/1300 6.00
SC1/2000 9.00
SD6000M 45.00
SP4B 4.95
SP41 5.00
SP42 3.00
SS501 35.00
ST11 1.50
STV280/40 11.95
STV280/80 19.95
SU42 4.95
TB2 5/300 85.00
TB2-300 45.00
TB3/2000 395.00
TBL-2-300 275.00
TBL2-500 395.00
TD03 10E 40.00
TD03 10 35.00
TD03 10D 40.00
TD03 10F 40.00
TD1-100A 25.00
TD3-12 4.00
TP25 1.50
TSP4 7.00
TT11 1.50
TT21 45.00
TT22 45.00
TT100 57.00
TTR-31MR 65.00
TY2-125A 85.00
TY4-400 85.00
TY8-600W 365.00
TYS2/250 375.00
U18-20 2.75
U19 11.95
U24 2.00
U25 0.90
U26 0.90
U37 9.00
U41 6.95

U50 2.00
U82 3.00
U191 0.70
U192 1.00
U193 0.65
U251 1.00
U801 0.75
UABC80 0.65
UAF42 1.00
UBF80 0.60
UBC41 2.25
UBC81 1.50
UBF89 1.00
UBL21 1.75
UC92 1.20
UCC84 0.70
UCC85 0.60
UCF80 1.00
UCH21 1.20
UCH41 2.50
UCH42 2.50
UCH81 1.00
UCL82 1.75
UCL83 2.50
UF85 1.20
UF41 1.15
UF42 1.15
UF80 0.80
UF89 2.00
UL84 1.50
UL44 3.50
UL84 0.85
UU5 3.50
UU7 8.00
UU8 9.00
UY41 3.50
V235A/1K 250.00
V240C/2K 225.00
V241C/1K 195.00
V246A/2K 315.00
V339 3.50
VLS631 10.95
VP133 2.00
VR75/30 3.00
VR101 2.00
VR105/30 1.50
VR150/30 1.15
VT52 2.50
VU29 4.50
VU39 1.50
W77 5.00
W729 1.00
W739 1.50
X24 1.00
X66/X65 4.95
X76M 1.95
XC24 1.50
XC25 0.50
XFW47 1.50
XFW50 1.50
XG5-500 22.50
XL 1-5V 1.50
XL628FT 7.50
XNP12 2.50
XR1-1600A 49.50
XR1-3200A 79.50
XR1-6400A 115.00
Y65 6.95
Y503 25.00
Y602 12.00
Y4070 130.00
YD1100 75.00
YJ1060 265.00
YL1000 9.50
YL1020 29.00
YL1030 59.50
YL1060 95.00
YL1070 195.00
YL1071 195.00
YL1290 59.50
Z77 1.20
Z303C 9.00
Z359 9.00
Z505S 15.00
Z520M 4.00
Z521M 8.00
Z700U 3.00
Z749 0.60
Z759 19.95
Z800U 3.00
Z803U 18.95
Z900T 9.50
ZA1000 12.50
ZA1001 1.50
ZA1002 1.50
ZC1040 8.00
ZM1005 8.00
ZM1020 8.95
ZM1021 8.00
ZM1023 7.95
ZM1041 14.00
ZM1082 9.00
ZM1084 10.00
ZM1177 9.00
ZM1202 65.00
ZM1263 4.00
ZM1612 3.00
1A3 4.50
1AC6 1.20
1B3GT 1.95
1B22 10.00
1B27 55.00
1B35A 45.00
1C5GT 2.50
1FD1 2.50
1G3GT 2.50
1K3GT 2.50
1N1 4.50
1N2 4.50
1P28 25.00
1N5GT 2.50
1P28 25.00
1S2 0.55
1S5 0.70
1T4 1.00
1U5 1.00
1X2B 1.40
1Z2 8.95
2AS15A 11.50
2B22 69.50

2C39A 29.50
2C39BA 29.50
2C40 37.00
2C42 29.50
2C51 0.75
2CY5 1.50
2B7 1.50
2D21 1.95
2D21W 2.50
2E22GY 45.00
2E26 7.95
2J42 93.00
2K25 35.00
2K25 Ray 75.00
2K26 95.00
2K29 250.00
2K56 250.00
3A108A 9.00
3A/107B 12.00
3A/109B 11.00
3A/110B 12.00
3A/141K 11.50
3A/147J 7.50
3A/167M 10.00
3A2 3.95
3A3A 3.95
3A4 1.10
3AL5 0.95
3AT2 3.35
3AU6 0.85
3B2 3.00
3B4 7.00
3B7 4.50
3B24 10.00
3B26 24.00
3B28 12.00
3BZ6 1.50
3C4 2.50
3C45 24.00
3CB6 1.50
3CN3A 2.50
3CS6 0.95
3CY5 1.50
3CX3 2.50
3D6 4.50
3D21A 29.50
3E22 49.50
3EH7 1.95
3EJ7 1.95
3W4GT 2.50
4B32 35.00
4B551B 115.00
4BQ7A 1.75
4BZ6 1.95
4-65A 59.00
4-125A 72.50
4-250A 79.50
4-400A 87.50
4C27 25.00
4C28 25.00
4CB6 1.95
4CX250B 49.00
4CX250B EIMAC £59.50
4CX250BM 75.00
4CX250K EIMAC 95.00
4CX350A 95.00
4CX350F 79.50
4CX1500B 398.50
4GS7 2.25
4GV7 2.25
4JC6A 2.95
4J52 75.00
4KT6 1.50
4X150A 35.00
5A/102D 9.50
5A152M 9.00
5A163K 10.00
5A170K 6.25
5A-206K 10.00
5A-180M 9.00
4AM8 4.15
5AM8 2.15
5AN8 1.20
5AR4 2.00
5AU4 1.50
5B.110M 10.00
5B-254M 14.50
5B-255M 19.50
5B255M 19.50
5B/256M 9.00
5B-257M 9.00
5B-258M 14.50
5C22 125.00
5R4GB 3.50
5R4GY 3.50
5T4 5.95
5U4G 2.95
5U4GB 3.50
5V4G 1.25
5Y3GT 1.95
5Z4GT 0.85
6/30L2 0.70
6A/203K 9.00
6A7 4.95
6A8G 1.50
6AC7 2.00
6AF4A 2.50
6AG5 1.50
6AG7 1.95
6AH6 2.50
6AJ4 2.00
6AJ7 2.00
6AK5 1.95

6AK6 2.50
6AL5 0.60
6AM4 3.25
6AM5 6.00
6AM6 1.95
6AN5 4.50
6AN8A 3.50
6AQ5 2.15
6AQ8 0.85
6AR5 5.95
6AR8 3.95
6AS5 1.50
6AS6 2.50
6AS7G 4.50
6AT6 0.75
6AT8 1.75
6AU4 2.00
6AU6 0.95
6AV6 0.75
6AW8A 2.50
6AZ8 4.50
6B7 2.80
6B8G 1.50
6BA6 0.95
6BA7 4.50
6BA8A 3.50
6BC8 1.00
6BE6 0.95
6BG6G 3.00
6BH6 1.95
6BH8 1.50
6BJ6 1.50
6BK4 4.00
6BK7A 1.95
6BL8 1.15
6BM8 0.58
6BN4 1.65
6BN6 1.65
6BN7 4.50
6BN8 3.95
6BQ5 0.75
6BQ7A 0.72
6BL7GTA 3.95
6BL8 1.15
6BR5 0.70
6BR7 4.95
6BR8 2.15
6BR8A 2.15
6BS7 5.50
6BW4 1.50
6BW6 5.35
6BW7 1.50
6BW8 4.00
6BX6 0.48
6BX7GT 3.50
6BZ6 2.50
6BZ7 2.95
6C4 1.25
6C5 1.95
6C6 2.50
6C8G 1.50
6C11 2.50
6C18 2.50
6CA4 4.95
6CA7 3.50
6CB5 3.95
6CB6 1.95
6CD6GA 4.50
6CF6 1.50
6CG7 2.25
6CH6 6.95
6CL3 3.95
6CL6 3.25
6CL8A 2.00
6CM5 1.60
6CM7 2.95
6CS6 0.75
6CS7 0.95
6CW4 6.50
6CY5 1.00
6CY7 2.95
6D6 2.50
6DC6 2.95
6DJ8 0.95
6DK6 1.50
6DQ5 5.95
6DQ6B 2.50
6DW4 2.15
6EA4 4.95
6EA7 2.50
6EA8 2.50
6EB8 1.75
6EM5 2.50
6EM7 2.50
6EU7 £1.95
6EU8 1.75
6EV7 2.95
6EW7 4.50
6EW6 1.50
6F1 2.00
6F5 4.95
6F7 5.50
6F6G 2.00
6F12 1.50
6F13 3.00
6F14 1.00
6F17 2.75
6F21 2.50
6F23 0.60
6F24 1.25
6F25 1.25
6F28 1.25
6F32 1.25
6F33 17.00
6FH8 12.50
6G6G 5.50
6GH8A 0.80

6GK5 1.50
6GK6 1.95
6GM6 0.95
6GS7 2.15
6GV7 2.50
6GW8 0.80
6H1 9.50
6H3N 2.50
6H6 1.95
6H6GT 1.95
6HB7 0.95
6HF5 5.50
6HF8 2.50
6HS6 4.95
6HS8 1.95
6HZ6 2.65
6J4 2.15
6J4WA 3.15
6J5 2.50
6J6 2.05
6JB6A 3.95
6JE6C 5.50
6JM6 3.95
6JS6C 4.95
6JU8 2.50
6J7 2.50
6K7G 2.00
6K8Y/G 3.00
6KD6 6.50
6KM8 2.50
6KT8 2.95
6KZ8 1.95
6L1 2.50
6L19 3.95
6L6GC 2.95
6L6GC (GE) 4.95
6L6GT 1.95
6LD20 1.15
6LF6 7.50
6LJ8 2.50
6LQ6 5.50
6L15 3.15
6MJ6 4.95
6N7 2.50
6N7GT 2.50
6P15 1.50
6P25 4.00
6P26 4.00
6P28 2.00
6Q7 1.75
6Q7GT 1.20
6R7G 3.15
6S4A 1.50
6SA7GT 1.35
6SC7 1.50
6SG7 2.50
6SH7 1.35
6SJ7GT 1.35
6SK7 1.35
6SK7GT 1.35
6SL7GT 0.85
6SN7GT 1.35
6SQ7 1.35
6SS7 1.95
6U4GT 1.75
6U8 1.15
6U8A 1.50
6V6GT 1.50
6X2N 1.00
6X4 1.50
6X5GT 1.00
6X5GTY 1.00
6X8A 2.25
7A6 4.50
7A7 2.00
7AD7 1.75
7AU7 1.50
7B6 3.50
7B7 2.50
7C6 2.50
7E7 2.50
7J7 5.50
7V7 4.15
7Y4 2.50
8B10 2.50
8BQ5 1.95
8D8 2.50
8EQ7 1.95
8298A 8.50
85A8 1.50
10D2 1.25
10DE7 2.50
10F1 0.75
10GK6 1.95
10P14 2.50
10P18 0.70
10LD12 0.65
11E3 55.00
12A6 3.95
12AD6 1.50
12AG8 1.50
12AL5 1.00
12AT6 1.25
12AT7 1.15
12AT7WA 2.50
12AU6 1.95
12AU7 0.65
12AV6 1.95
12AX4GT 1.00
12AX7 0.65
12AX7WA 2.50
12AY7 3.95
12AZ7A 1.95
12B4A 4.50
12BA6 1.50
12BE6 1.95

12BH7A 2.50
12BL6 1.75
12BY7A 2.75
12CA5 1.95
12CX6 1.20
12DQ6B 3.50
12DW4A 3.50
12DW7 2.50
12E1 17.95
12E14 38.00
12GN7 4.50
12HG7A 4.50
12J7GT 3.50
12K5 1.95
12K7GT 1.50
12K8 1.95
12SA7GT 1.95
12SG7 4.75
12SH7 1.95
12SK7 1.95
12SJ7 1.50
12SN7GT 1.85
12SQ7GT 1.95
12SR7 2.50
13D3 3.20
13D7 3.20
13D7 2.50
13D9 3.20
13DR7 2.95
13E1 145.00
13EM7 3.50
14S7 1.95
7BR3 3.95
17EW8 0.95
17DW4 2.50
17DW4A 2.95
17JZ8 4.50
18D3 6.00
19AQ5 3.50
19AU4GT 2.50
19G3 17.00
19H5 33.50
19Q6 9.00
20A2 10.50
30D1 0.70
20LF6 3.50
20L1 0.95
20P1 0.55
20P3 0.60
20P4 1.95
20P5 1.15
21JZ6 3.15
21LU8 2.50
24B1 39.50
24B9 39.50
25L6GT 1.75
25BQ6 1.75
29C1 19.50
29KQ6 6.50
30C17 0.40
30C18 1.48
30F5 0.95
30FL1 1.00
30FL2 1.35
30FL12 0.95
30FL13 1.10
30FL14 1.25
30L1 0.45
30L15 0.60
30L17 0.80
30P4MR 1.00
30P12 1.00
30P18 0.60
30P19 1.00
30PL1 2.50
30PL13 0.60
30PL14 1.75
31JS6A 5.50
33A 158M 19.50
35A5 4.50
35L8GT 2.00
35W4 0.70
35Z3 1.85
38HE7 4.50
40KD6 5.50
42 6.95
47 6.00
50A5 1.50
50C5 0.95
50CD6G 1.15
50EH5 1.50
52KU 2.00
53CG 15.00
60B5 1.00
60JY6 2.96
61SPT 4.50
75B1 3.50
75C1 2.50
83 8.50
83A1 9.00
84 3.00
85A1 6.50
85A2 1.95
90AV 15.00
92AG 19.50
92AV 15.00
95A1 6.50
108C1 1.50
150B2 6.50
150C2 2.50
150C4 2.15
185T 1.50
274A 15.00
307 5.00
328A 15.00
388A 17.50

404A 10.95
425A5 8.00
431U 4.50
572B 55.00
5636 1.50
6146A 7.50
6158 3.20
6386 14.50
6883B 9.95
6973 5.95
705A 8.00
706A 8.00
715C 45.00
725A 275.00
7527 89.50
7703 395.00
803 14.95
805 39.00
807 1.95
810 85.00
811A 15.00
813 23.50
829B 14.50
832A 14.50
833A 95.00
866A 6.50
872A 20.00
873 60.00
884 5.50
927 15.00
930 9.95
931A 17.50
954 1.00
958A 1.00
1299A 0.60
1619 2.50
1625 3.00
1626 3.00
1927 25.00
2050 5.50
2050W 6.95
3545 4.00
4313C 4.00
4328D 9.00
5642 9.50
5651 2.50
5654 1.95
5663 1.95
5670 3.25
5672 4.50
5687 4.50
5692 3.50
5696 3.50
5704 3.50
5718 6.15
5725 2.50
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5751 2.95
5763 4.95
5814A 3.25
5829WA 6.50
5840 3.50
5842 11.00
5847 10.95
5879 5.00
5886 13.95
5894 39.50
5899 4.50
5963 2.00
5965 2.25
6005 1.85
6012 16.00
6021 3.65
8057 3.75
8058 3.95
6060 2.25
6062 4.50
6063 2.00
6064 2.95
6067 7.00
6072 4.20
6080 7.95
6132 10.00
6146B 9.50
6688 6.50
6887 9.50
6080 7.95
6080WA 9.50
6096 5.50
6132 10.00
6136 2.50
6146B 9.95
6157 2.50
6201 6.45
6211 2.50
6267 2.25
6350 3.50
6688 6.50
6870 11.50
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FM SIDEBANDS AND CARRIER SHIFT DATA

Bob Redding G3VMR, our regular columnist on data transmission, outlines some elegantly simple ideas for amateurs to experiment with

This is meant to be a simple recap of modulation theory in order to point out the apparent advantages of a simple way of sending data on radio, namely direct carrier shift.

The history of radio progressed through spark, then morse, before amplitude modulation became established, until a certain Major Armstrong spent about 20 years trying to convince people that frequency modulation had advantages. His uncomfortable passage ended when he jumped from a window in New York before his ideas were properly recognised, so I am aware of the risk I am taking.

However, I have enjoyed amateur radio for 50 years and believe that most of the advances in radio communication have originated from amateurs, and so here is my chance to plough back a little bit of novelty in an area which seems wide open for the amateurs to show professionals what can be done.

Modulation is the way in which we convey information on a radio wave and the simplest form is amplitude modulation, in which we mix a carrier with the audio signal. Everybody knows that this produces two sidebands, and the width of the signal is twice the maximum audio frequency. AM is inefficient, hence the move to 'single sideband', and Major Armstrong's 'nightmare child'.

Frequency modulation is more complex and much less easily understood. Basically we move the carrier frequency 'sideways' by the audio signal, but few of the textbooks are clear about how we control both the frequency and the volume for a complex sound waveform. Too often we just give something a name, like 'deviation' and 'modulation index', which might make a few diagrams and formulae look simpler, but do not fully explain what is happening.

Speech or music is a very complex blend of frequencies at different phase and volume levels. It is very difficult to show these in diagrams, and a single frequency aspect can be over-simplified. In the simplest terms, the frequencies of the sound are conveyed as the rate of variation in the carrier frequency, and the power level of each frequency determines the magnitude of the deviation and the number of sidebands in the transmitted signals.

The target to achieve is 100% modulation, at which state all the energy is in the sidebands and the carrier looks like a hole in the middle! The situation for frequency modulation is much more complex than for amplitude modulation because the modulation index (ie the ratio of the deviation to the frequency producing it) determines how many sidebands we have.

To approximate 100% modulation and improve the efficiency for speech, we need to tailor the audio response by emphasis and de-emphasis. In practice the conventions for narrow-band VHF working limit the speech range to a value numerically similar to the deviation, and we usually tailor the higher frequencies, with a cut-off at about 3500Hz.

Data transmission

The reason for recalling the above is that data is now being transmitted on VHF and UHF FM channels both as packet and as plain ASCII text, and this introduces an interesting situation. Data is normally sent on telephone lines as two different frequencies, separated by a few hundred cycles, by what is known as a modem. The reason for the development of the modem is that a telephone line is non-linear and so some frequencies are much more attenuated than others, so that the sharp transitions of digital data are distorted. These transitions are more easily seen as a frequency shift, hence the use of a modem.

When one uses a radio channel instead of a telephone line, then the modem is an easy way to send data. This was discussed in an article in *R&EW* in October 1984. The reason modems work better than on a telephone line is probably that a radio channel is more linear!

A better method of working on VHF radio is by shifting the carrier frequency directly by the data. Not only is this much simpler and cheaper to do, but the inherent performance and capability seems better. This is probably best explained in diagramatic form.

Figure 1 shows in outline the audio input circuit of a VHF FM transmitter. The microphone input is amplified and clipped, and applied to a varactor (or voltage-variable capacitor) to alter the frequency of a crystal oscillator. After suitable multiplication and amplification it becomes the transmitted frequency. The speech or tones from a modem represent a series of frequencies that result in a band of output frequencies, these being the carrier and the sidebands.

Simplifying transmission

Data consists of only 'marks' and 'spaces' and is usually available as two voltage levels, eg below ½V and above 3V (TTL levels). If we apply this voltage to the varactor instead of the sound signal, then we would shift the carrier frequency from one value to another, that is a deviation of, say, 3kHz.

These are two simple frequencies and though we may get a click at the transition from one to the other, there need be no appreciable amount of energy in sidebands. The clicks represent the transitions from '1' to '0', and theoretically we could resolve them by triggering a 'flip-flop'. A better way is to look at the frequency and see whether it is the upper or lower value. A phase-locked loop does this and restores the data to its '1' and '0' voltage levels.

This is about all we need for receiving data. The easiest place to connect the phase-locked loop is in parallel with the audio output circuit since, of course, this will not respond above the audio range of, say, 3500Hz. We can therefore tap off at the last IF, eg 455kHz, and test whether the instantaneous frequency is 455 or 458. We could of course make it easier still by coming down to a lower IF, so that the percentage difference is greater.

The interesting thing is that the faster our data rate, the higher the rate of the clicks but the less they intrude on adjacent channels. If, for example, we go above 5kHz then the audio circuit of receivers will not respond.

If we have done our carrier shift (or, if you like, 'modulated continuous wave') carefully and paid attention to detail, I think the channel it occupies can be quite narrow, as shown by FM theory. A modulation index of 0.2 means only 1% of energy in the sidebands, and we don't use them. This suggests that we should make the deviation one fifth of the data baud rate, which seems practicable for

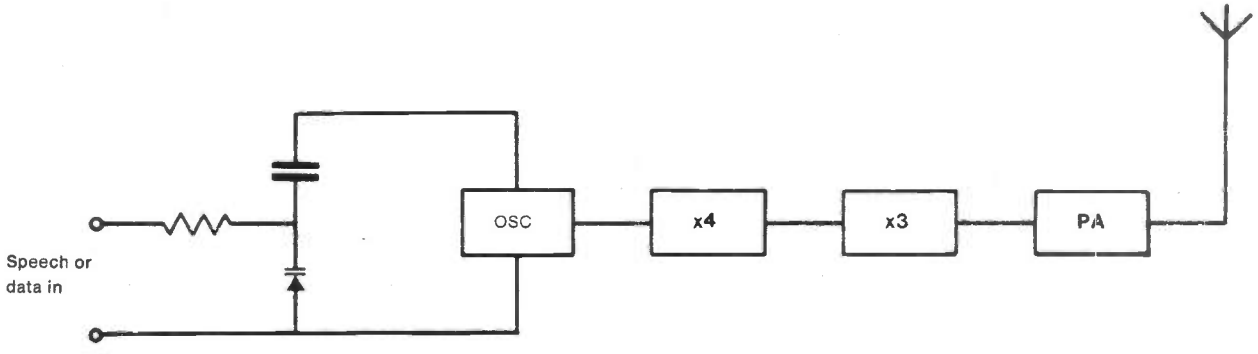


Fig 1 *Block diagram of an FM transmitter showing an outline of the audio input circuitry*

the highest we presently use (1200 baud) and upwards.

Simple trials

The best way to get the feel for this is to apply it to existing gear, and any synthesized transceiver in which the last digit switches 1 or 5kHz presents an easy way. Many small hand-helds, eg the AR240 and the IC, have a switch for setting the last 5kHz. If one brings out two leads and switches them with data signals, then the carrier will shift by nominally 5kHz.

An easy method of connection is to use an opto-isolator so that the data from the computer drives the LED, giving an isolated make/break as a transistor junction. If you put a voltmeter across the switch the polarity can be noted and the transistor connected accordingly.

Such shifting of the FM carrier provides a signal which looks like a two-tone single sideband one, and can in fact be resolved as such. If you listen to the signal on an FM rig you will probably also hear any sound in the background unless you disconnect the microphone – but it doesn't necessarily corrupt the data!

Such a 5kHz shift tends to be wide and difficult to resolve as SSB, and about 1kHz is more appropriate. Details for the FT290R and CB rigs modified for 29MHz will be given in later articles.

Comparison with RTTY

Such experiments will make some RTTY experts say "We do this already", and in a sense they are right, but the route is tortuous. If we put the RTTY or modem audio tones into a single sideband transmitter, then theoretically what we get out is two specific frequencies, offset from the nominal carrier. However, so far it has been usual practice to use an SSB receiver to insert the carrier and restore the audio tones

Fig 2 *Speech or modem tones will produce a complex output of carrier and sideband frequencies*

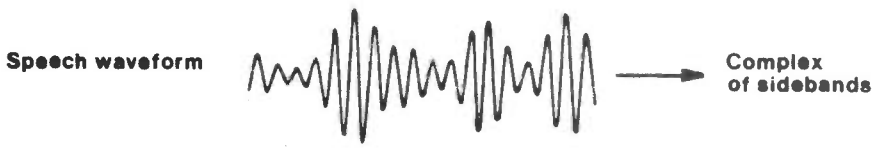


Fig 3 *Applying data at TTL levels to the varactor produces a steady output at either, say, 144.675 or 144. 678MHz depending upon whether a mark or space is being sent*

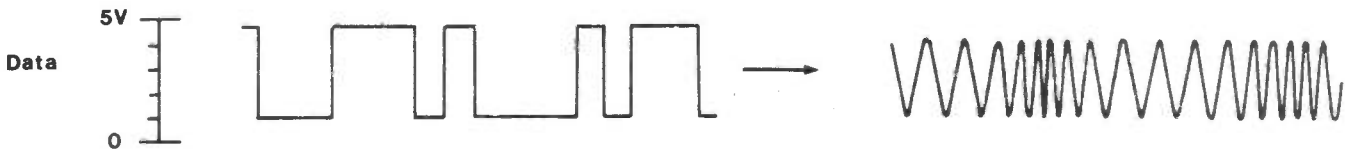
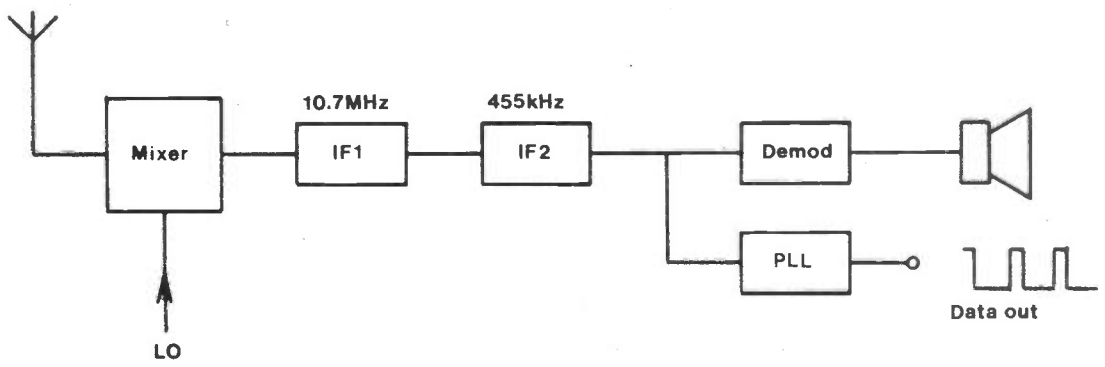


Fig 4 *A phase-locked loop is used after the second IF to sample the instantaneous frequency and provide suitable output levels for the data*



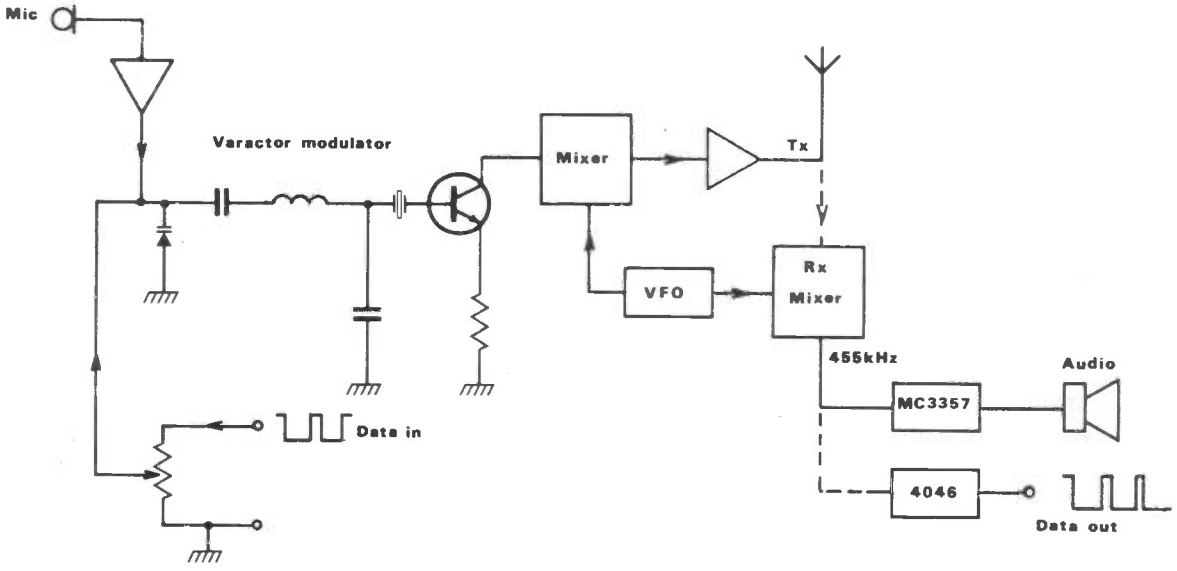


Fig 5 *The additions necessary to an FM transceiver for carrier shift data*

and detect the shift of 170Hz between them. Like the telephone, the limitation lies in the permissible audio bandwidth.

I am suggesting that we do not need a single sideband receiver, for an added PLL circuit would suffice. Further, the sideband technique represents transmitting only part of the radio spectrum it generates. Carrier shift can be achieved simply by modifying the drive to any crystal-controlled circuit, and produces a steady power level; the frequency shifts at the time and to the extent that we command, but the power level remains constant in all stages of the equipment.

Contrast this with the transmission of two separate tones and you will see where the advantage lies. Because we are making the shift elegantly with the minimum of disturbance, we minimise interference and spurious generation, rather than pumping energy in and out of reactive circuits, and this is where the scope for better operation lies. Sometimes I wonder whether what we call sidebands are merely the products of the artefacts we use.

Don't be reactionary

It pays to keep an open mind, because our conventional theory grew up around currents surging in and out of large inductors, and capacitors consisting of many yards of wire strung above an earth plane. When we change anything, the stored energy has to go somewhere!

Such origins are a far cry from solid-state micro-components which react in picoseconds, and where, even at the speed of light, the length of the path determines what performance is possible. Anyone versed in VHF or home computer circuitry will know that it is no good putting all the smoothing across the power supply; decoupling capacitors have to be fitted at each element of the load, and so they are no longer mystified by 0.01μF capacitors in parallel with a 10μF one a few inches away!

Implementing carrier shift

The experiments described above mean that the carrier shift is made via the synthesizer; this circuitry will modify the data and hence the results may be dubious and vary according to the equipment.

However, once confidence is gained, it is quite simple to make 'carrier shift' an addition to almost any rig, including a CW transmitter! The simplest and most economical candidate is the modified CB or 10 metre FM rig, which has plenty of room for the additional components. The big attraction of 29MHz FM is that when the band opens we should be able to work considerable distances, even via repeaters in the USA.

The diagram gives an outline of the modifications, which work as follows. The mark and space data, as two voltage levels, goes straight to the varactor and shifts the frequency between, say, 29.400 and 29.402. Thus, computer output data goes to a potentiometer where we pick off the right amount of voltage to give the chosen shift, and that is all that is required for transmission. If the transmitter is only CW, or has no FM varactor, then a small capacitor switched in parallel with the crystal will achieve the same purpose, and this is simpler for some rigs. The actual switching is best achieved by an opto-isolator as described earlier.

For receiving the data we need to add a phase-locked loop in parallel with the audio demodulator chain in order to work at the higher frequencies. To get the simple mark/space output signal needs little more than the well-known 4046 phase-locked loop, which was described in detail in the May 1984 issue of *R&EW*. This article did not go into demodulation but the operation is quite simple and is shown in the diagram.

The incoming signal at pin 14 goes to an amplifier and then to a comparator. The VCO is set to move between two frequencies, eg 460 and 450, by resistors and a capacitor. The output of the VCO is compared with the received signal and any difference feeds back to the VCO to correct its voltage, and this voltage change provides the output signal. So when the signal on pin 14 moves the VCO has to follow, and so the voltage at output pin 10 goes up and down. This voltage goes to an amplifier in order to provide the TTL level output.

Testing the demodulator

It happens that there is readily available to the amateur a frequency shift signal which is ideal for showing the operation of such a circuit and understanding the general operation. This is provided by the beacon service, which invariably uses frequency shift keying in morse for identity purposes, and sometimes with RTTY as well. In the case of GB3VHF the shift is 850Hz for morse and 170Hz for RTTY, according to Brian Bower G3COJ.

One can see the shift with a good frequency meter. Obtain a signal from a good receiver at the 455 IF stage. The frequency meter will show a variation as the tuning is varied, but whatever the figure when the morse signal appears it will show as a shift in the frequency of about 1kHz. On changing over to RTTY the shift is clearly much smaller, of the order of 200Hz, but is, in any case, usually too rapid to be read with accuracy except on special equipment.

It is quite easy to see this shift as data if we add the PLL as illustrated. The output at pin 10 will be a dc voltage with a certain amount of noise on it, which moves up

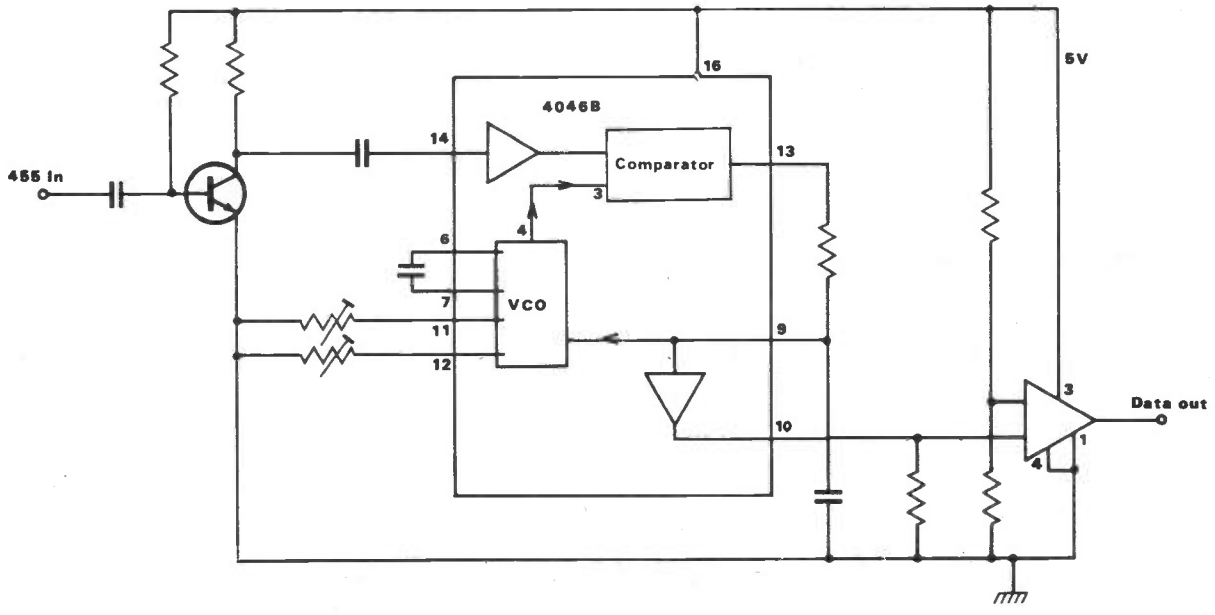


Fig 6 *The 4046B phase-locked loop used for demodulation of data*

and down with the frequency shift and will be clearly seen on a scope. Tuning the receiver across the signal to see and hear the sidebands is very illuminating.

The circuit seems to work over a number of decades and therefore can work from morse up to very fast data. It will be seen later that this much simplifies the operation of data protocols, and it is hoped that we can avoid many of the conventions that bedevil telephone line practice such as parity and the number of bits of data, and perhaps develop 'error-obvious coding' and use synchronous operation. REW

COMMERCIAL APPLICATION OF DATA TRANSMISSION: the uses of data over radio are indicated by the press release and letter reproduced here. If you'd suggested such possibilities to anyone a few years ago, who'd have believed you?

IBA

NEWS RELEASE
INDEPENDENT BROADCASTING AUTHORITY
70 Brompton Road London SW3 Tel 01-584 7011 Telex 24346
October 2, 1986

APPLICATIONS FOR THE TWO LONDON RADIO TELETEXT FRANCHISES

Five applications for the two Radio Teletext franchises for the London area hed been received by the IBA by the deadline of noon today (October 2, 1986). Submissions have been received from the following:-

Air Call Teletext Ltd.,
176-184 Vauxhall Bridge Road,
London, SW1.
(Contact Richard Brooke, 01-434 3121)

Independent Radio Features Ltd.,
Gough Square,
London, EC4P 4LP.
(Contact Bill Coppen-Gardner, 01-353 1010)

Radio Teletext London Ltd. (RTL),
24 Old Bond Street,
London, W1X 3DA.
(Contact Brenda Bakalla, 01-491 4809 or Peter Faure, 01-223 2840)

Reuters Ltd.,
85 Fleet Street,
London, EC4P 4AJ.
(Contact Ms. A. Visscher, 01-324 7528)

Telemat UK Ltd.,
c/o CASE Group PLC,
Caxton Way,
Watford,
Herts.
(Contact Frederick G. Parsons, (0923) 58000)

The IBA advertised on August 5 for contractors to provide a subscription service whereby data, transmitted on Independent Local Radio frequencies, would be received in visual readout form on portable or desk-top receivers.

The two services will operate on the VHF/FM frequencies - 95.8 Mhz and 97.3 Mhz - used by Capital Radio and LBC respectively. The new data services will use what is effectively spare capacity wichin the bandwidth of each frequency and will not be audible on normal radio programme reception.

-2-

The term of each of the new franchises will correspond to that of the ILR contractor on whose frequency the radio teletext service will operate. Capital's present contract runs until October 1992, LBC's until October 1991. Each ILR service has a potential audience of about 8½ million people.

After detailed assessment of each application, the IBA hopes to be able to award the contract around the turn of the year. Which of the two frequencies is allocated to the successful applicants will be determined by the IBA.

Radio teletext services have operated in North America for a number of years; many have concentrated on the provision of financial data. For example, subscribers could have international stock and share price changes in near real time, or receive currency market information from world sources at virtually any time of the day. The IBA, however, has left applicants free to make whatever proposals for services they wish to provide, subject to the provisions of the Broadcasting Act 1981 and the Cable and Broadcasting Act 1984.

Copies of the full applications will be available, by appointment, for public scrutiny in the IBA's library at its headquarters at 70 Brompton Road, London, SW3, from October 6.

In due course subscriber radio teletext services could be advertised for transmission on IBA transmitters in other areas of the United Kingdom.

Note to Editors

This new radio teletext service is entirely different from the proposed European radio data service (RDS), although both will be transmitted on spare bandwidth within VHF/FM channels. RDS will provide automatic tuning, station identification and an accurate clock among other auxiliary information. The IBA intends to begin to introduce RDS on ILR transmitters from the summer of 1987 onwards.

Atlanta Gas Light Company/P.O. Box 4569/Atlanta, Georgia 30302/Phone 404-584-4000

August 6, 1986

Dear Customer:

Atlanta Gas Light Company has selected your gas meter as one of several in your area to help test a new system for reading meters remotely. This system uses a new technology to read meters accurately, faster and at a lower cost.

How will it work? Gas Company personnel will install a small remote index on your gas meter. The index, which contains a battery powered radio transmitter, will replace the one presently on your meter. The change will not affect your equipment and there will be no cost to you. You don't even have to be home for this to be accomplished.

During the test period we will periodically drive by your home in a specially equipped mini van to electronically read your meter. We will occasionally do on-site visits to compare the reading on your meter with our electronic reading.

These test readings will not be used to calculate your monthly bills. Your gas bill will be based on readings obtained by our meter readers on their regularly scheduled dates.

Atlanta Gas Light Company is always looking for ways to improve service to its customers. This test is just another way to show that "We are working to serve you better".

We sincerely appreciate your cooperation in this test, which will last approximately six months. We value you as a customer and are glad natural gas is meeting an important part of your energy needs.

Sincerely,

James G. Brown
Manager Buckhead Office

DATA FILE . . .

Ray Marston presents a variety of relay-output circuits

In last month's edition of *Data File* we took a fairly detailed look at the basic operating principles and 'usage' rules of the four best-known types of electro-mechanical and electronic relay device, ie the electromagnetic relay, the reed relay, the opto-coupler and the CMOS bilateral switch. In this edition of 'The File' we continue the relay theme by presenting a variety of useful relay-output circuits that can be used with either electromagnetic or reed-type relays.

High Z relay switches

Electromagnetic and reed-type relays are basically low impedance devices, with typical coil impedances of only a few tens or hundreds of ohms. Their effective input impedances can easily be increased, however (so that they act as high impedance or 'high Z' relay switches), by simply interposing a transistor or IC 'driver' stage between the relay coil and the input drive signal. *Figures 1* to *4* show variations of this theme.

In *Figure 1*, Tr1 is wired as a simple common-emitter amplifier and increases the effective relay coil-current sensitivity by a factor of about ×100 (= the current gain of Tr1) and also increases the voltage sensitivity to a few volts. R1 limits the Tr1 input current to a safe value and also dictates the effective input impedance of the circuit (= R1 plus roughly 1k). D1 and D2 damp the coil back-emfs, as described last month. Relay contacts RLA/1 can be used to control external circuitry.

The *Figure 1* circuit gives a non-latching relay action, in which the relay is off when the input voltage is less than 600mV and on when the input exceeds a few volts. The circuit can be made to give a self-latching action by modifying it as shown in *Figure 2*.

Here, n.o contacts RLA/2 (plus n.c switch S1) are effectively wired in parallel with Tr1, and thus bypass Tr1 and self-latch the relay once it has been initially activated. Once it has self-latched the relay can only be turned off again by either opening S1 or breaking the supply-line connections.

The *Figure 1* and *2* circuits have input impedances of only a few thousand ohms. If desired, the input impedance can be raised to 10M or more by driving Tr1 via a CMOS 'buffer' stage, as shown in *Figures 3* and *4*. In these circuits the CMOS buffer is made from one or more 'gate' stages of a 4001B quad 2-input NOR gate, the gate being wired in the inverter mode by shorting its two input terminals together.

In *Figure 3* only a single CMOS inverter stage is used. Consequently, to ensure that the relay turns off when the input voltage is low, the Tr1 transistor 'driver' must be a pnp device. In *Figure 4* two CMOS inverter stages are wired in series to give zero overall signal inversion, and Tr1 can thus be an npn device.

Note in both the above circuits that the input impedance actually equals the R1 value, and that the relay actually turns on (or off) when the input signal goes above (or falls below) the half-supply (approximately) 'transition' voltage value of the CMOS input gate, at which value the gate operates in the linear mode. C1 is used to inhibit any high frequency or transient instability that may occur in the gate when it is in this linear mode.

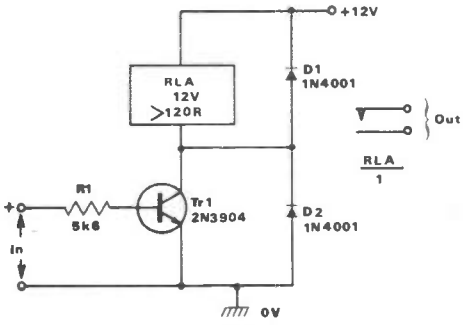


Fig 1 *Non-latching transistor driven relay switch*

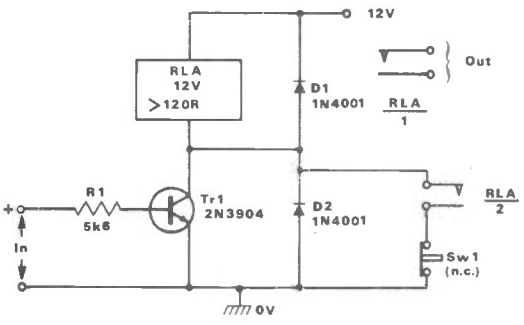


Fig 2 *Self-latching transistor driven relay switch*

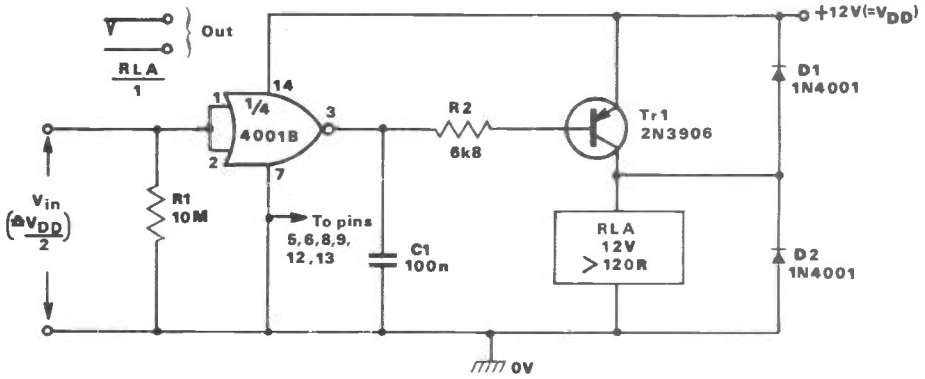


Fig 3 *Simple high impedance relay switch*

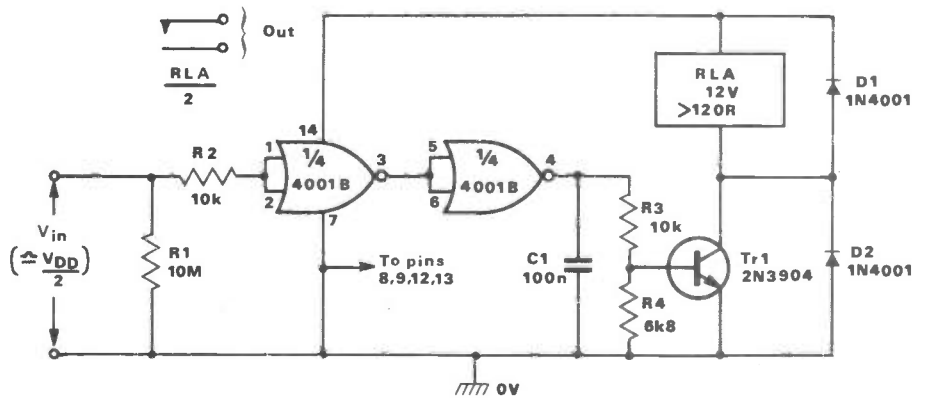


Fig 4 *Modified high impedance relay switch*

Bistable circuits

A relay can be made to give a bistable action, in which it turns on and self-latches when a 'set' push-button switch is operated and can subsequently be turned off again only by operating a 'reset' push-button switch, by using the connections shown in *Figure 5*. Here, two

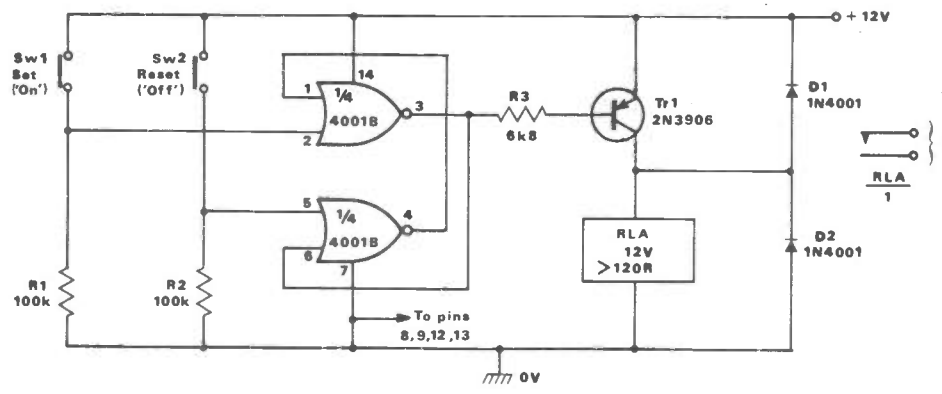


Fig 5 *Simple bistable relay switch*

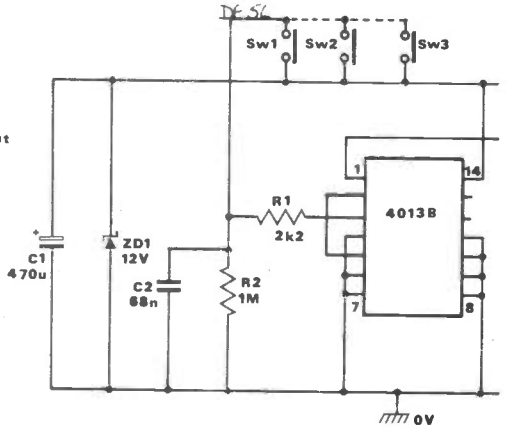


Fig 8 *Multi-input mains p*

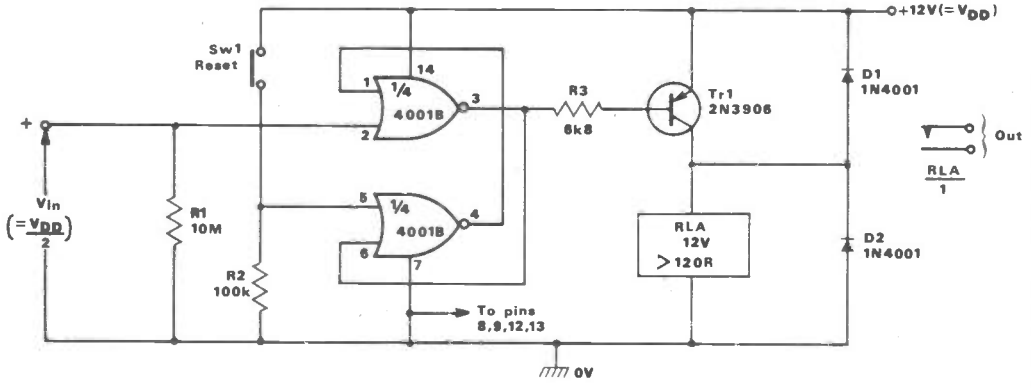


Fig 6 *Self-latching high impedance relay switch*

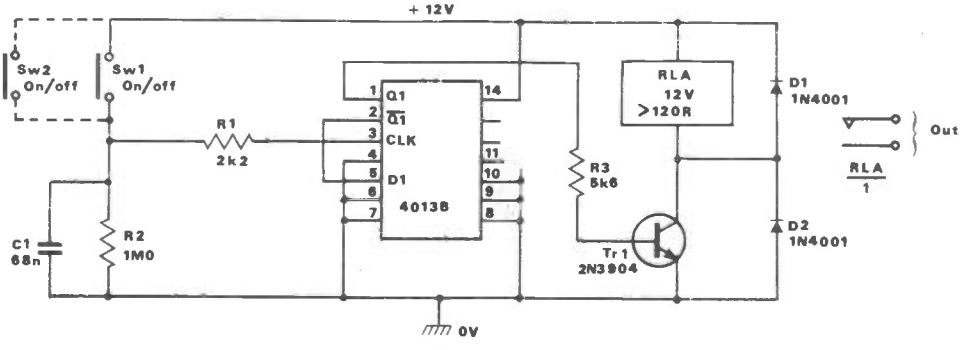


Fig 7 *Push-button operated 'binary' relay switch*

NOR gates (taken from a 4001B CMOS IC) are wired as a simple manually-activated bistable multivibrator that has one of its outputs taken to the relay coil via the Tr1 common-emitter buffer stage.

The *Figure 5* circuit actually changes state as its set or reset input signal rises through the half-supply transition voltage value of the CMOS gate. This fact allows the circuit to be easily modified so that it acts as a self-latching high impedance relay switch, as shown in *Figure 6*. Here, the relay turns on and self-latches when the input voltage rises above the transition value; the relay can then be turned off only by removing (or reducing) the input voltage and pressing the reset switch. This circuit has an input impedance of 10M.

Figure 7 shows another useful type of push-button operated relay switch. In this case the circuit can use a single control switch to turn the relay on and off, but any number of such switches can be wired in parallel if desired, to allow the relay to be remotely controlled from any number of input points. The circuit action is such that the relay changes state each time an input switch is operated (pressed and released): thus if the relay is initially on it will turn off when any switch is next operated, and on again when any switch is operated after that, and so on. The circuit thus gives a 'binary' relay switching action.

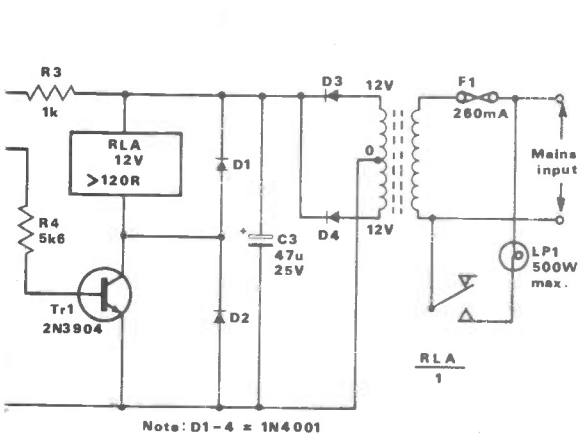
The *Figure 7* circuit is designed around a 4013B CMOS dual D-type flip-flop IC, which has one flip-flop stage disabled by taking its input pins to ground and has the other configured as a divide-by-two circuit (by shorting its not-Q and D1 pins together). The input 'clock' pulses to this divide-by-two stage must have rise times less than 15μs, and these are obtained by operating one or other of the push-button switches.

Each time a button is closed C1 charges rapidly via the switch, thus providing the fast rise time clock pulse; C1 discharges slowly via R2 when the switch is reopened, thus eliminating false triggering via switch-bounce effects etc. Tr1 and the relay thus reliably change state each time a push-button switch is operated.

Circuits of the *Figure 7* type are of particular value in enabling hall, landing, or corridor lights to be controlled from several different 'switching' points. In this case the push-button control switches can easily be connected to the main unit via very thin twin cable that can easily be hidden from sight. In this application the unit should (naturally) be powered from the ac mains, and *Figure 8* shows how the circuit can be modified for this type of operation. Mains transformer T1 must provide a 12-0-12V output at 100mA or greater.

Timer circuits

Relays can be usefully employed in a wide variety of 'timer' or time-delayed switching applications, giving delays varying from a fraction of a second up to tens of hours. *Figures 9* to *15* show some practical examples of such circuits.



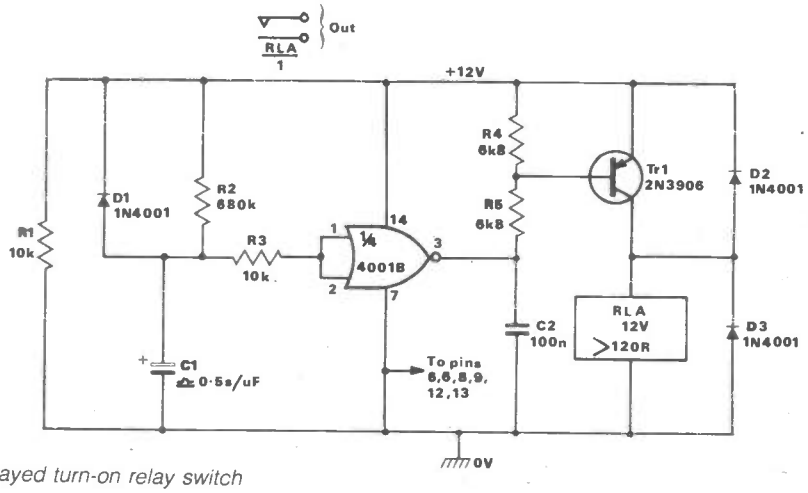


Fig 9 Delayed turn-on relay switch

owered 'binary' lamp driver

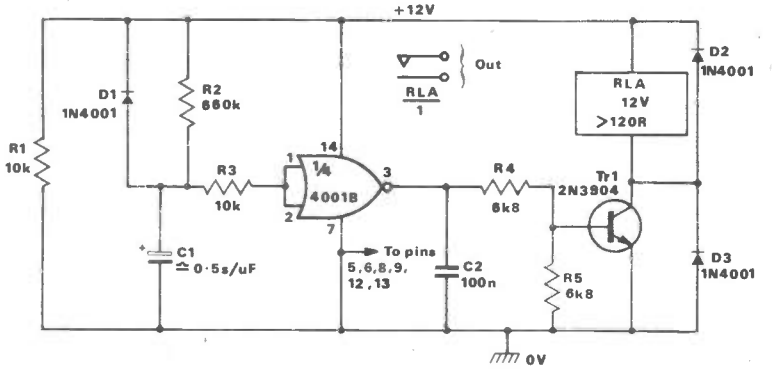


Fig 10 Auto turn-off relay switch

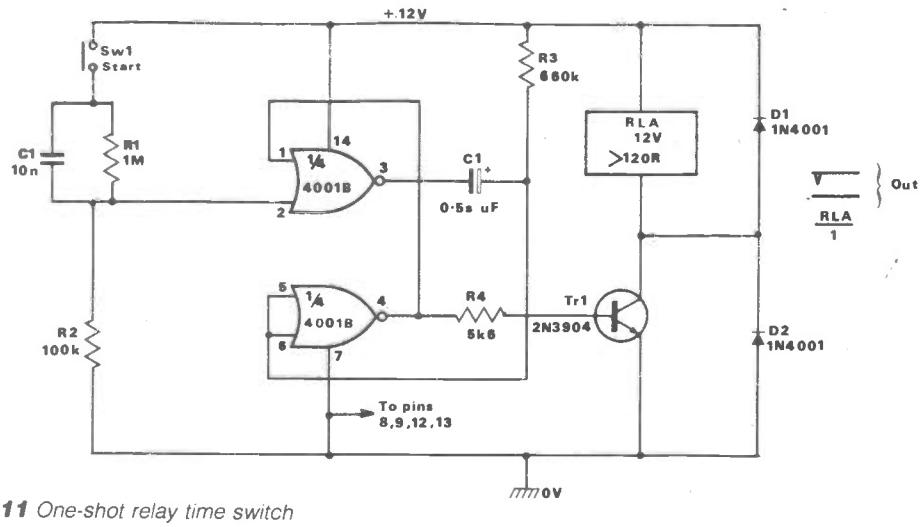


Fig 11 One-shot relay time switch

Figures 9 to *11* show how the inexpensive 4001B CMOS IC can be used to implement medium-accuracy time delays of up to several minutes. The *Figure 9* design gives a delayed turn-on relay switching action, and operates as follows.

The CMOS gate is wired as a simple digital inverter, with its output feeding the relay coil via pnp transistor Tr1 and with its input taken from the junction of the time-controlled potential divider formed by R2 and C1. When power is first applied to the circuit C1 is fully discharged. The inverter input is thus grounded and its output is at full positive-rail potential; Tr1 and the relay are thus both off under this condition.

As soon as power is applied to the circuit C1 starts to charge up via R2, and a rising exponential voltage is applied to the input of the inverter. After a delay determined by the C1-R2 values this voltage rises to the threshold value of the CMOS inverter stage, and its output swings towards the zero-volt rail and drives Tr1 and the relay on. The relay then remains on until power is removed from the circuit, at which point C1 discharges rapidly via D1 and R1; the operating sequence is then complete.

Reverse operation

Figure 10 shows how the operation of the above circuit can be reversed, so that the relay turns on as soon as power is applied but then turns off again automatically after a preset delay. This action is obtained by simply modifying the relay-driving stage for npn transistor operation.

Note that the *Figure 9* and *10* circuits each have a time delay of about 0.5 secs/μF of C1 value, thus enabling delays of up to several minutes to be obtained. If required, the delay periods can be made variable by replacing R2 with a fixed and a variable resistor in series.

Figure 11 shows how a pair of CMOS gates can be used to make a push-button activated medium-accuracy one-shot relay switch that gives time delays of up to several minutes. The action is such that the relay turns on as soon as 'start' switch S1 is momentarily closed, but turns off again automatically after a preset delay that is roughly equal to 0.5secs/μF of C1 value. As can be seen, the two CMOS gates are simply wired as a manually-triggered monostable multivibrator that has its output fed to the relay via R4 and Tr1.

The *Figure 9* to *11* circuits are all based on simple CMOS elements, and are intended for use in medium-accuracy timer applications only. Far greater timing acuracy can be obtained by using a 555 timer IC as the basic circuit timing elment, and *Figures 12* to *15* show four practical high-accuracy timer circuits that are designed around this IC.

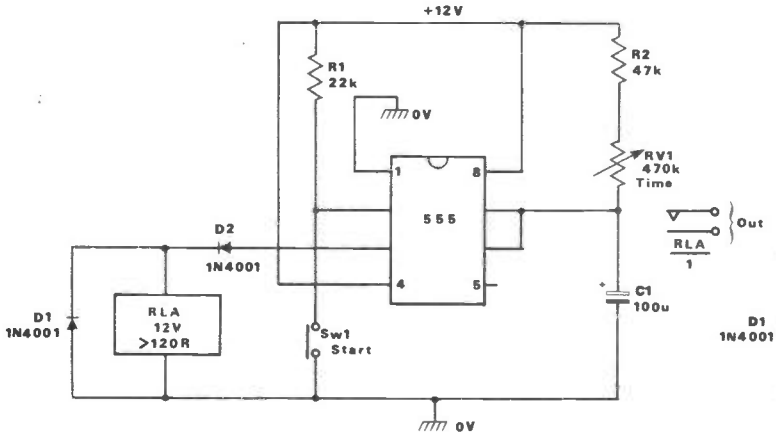


Fig 12 *Simple 6 to 60 second timer*

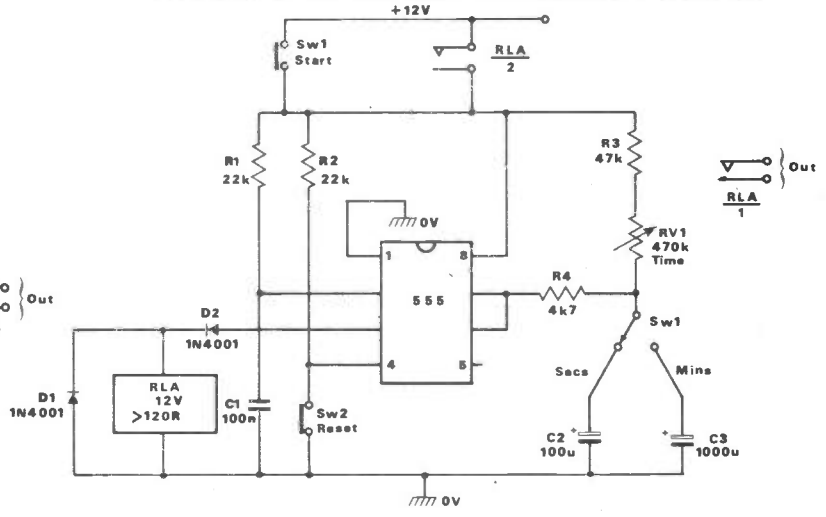


Fig 13 *Two-range 6-60 second and 1-10 minute timer*

Figure 12 shows the circuit of a simple 6 second to 60 second timer in which the 555 IC is wired in the monostable or one-shot mode. Here, the circuit starts a timing cycle when 'start' switch S1 is briefly closed; relay RLA immediately turns on and C1 starts to charge towards the positive rail via R2 and RV1 until eventually, after a delay determined by the RV1 setting, C1 rises to two-thirds of the supply rail voltage, at which point the IC changes state and the relay turns off. The timing cycle is then complete.

Correcting a defect

A weakness of the above circuit is that it continually draws current from the supply rail, even when the relay is off. *Figure 13* shows a 2-range timer circuit that does not suffer from this defect, and which covers the timing range 6 seconds to 10 minutes.

The circuit operates as follows. When 'start' switch S1 is briefly closed a start pulse is fed to pin 2 of the IC via R1 and C1, and the relay turns on. Contacts RLA/2 then change over and maintain the power connections to the circuit when S1 is released.

The circuit runs through a timing cycle similar to that described above, but with the period determined by either C2 or C3, until eventually the relay turns off, at which point contacts RLA/2 reopen and break the supply connections to the circuit. The timing cycle is then complete. Note that this circuit can be turned off part-way through its timing cycle by operating 'reset' switch S2.

Conventional electrolytic capacitors have very wide tolerance values (typically −50% to +100%), and suffer from relatively large and unpredictable leakage currents. Consequently simple circuits of the types shown in *Figures 12* and *13* cannot be relied on to give precise timing periods or to give periods that exceed fifteen minutes or so. *Figures 14* and *15* show two high-accuracy long-period timer circuits that do not rely on the use of electrolytics for their timing operations.

In the *Figure 14* and *15* circuits IC1 is wired as a free-running astable multivibrator. In the *Figure 14* design the astable frequency is divided down by IC2, a 14-stage binary counter, so that the relay turns on as soon as S1 is closed, and turns off again on the arrival of the 8192nd astable pulse, thereby giving total timing periods in the range 1 to 100 minutes.

The *Figure 15* circuit is basically similar to that of *Figure 14*, except that an additional decade-divider stage is used in position 3 of SW1, thus giving a maximum division ratio of 81,920 and making maximum timing periods of up to 20 hours available from the unit. This circuit is of particular value in giving time-controlled turn-off of battery chargers, etc.

A further selection of relay-output circuits will be presented in next month's edition of 'The File'. REW

Fig 14 *Two-range 1-10 and 10-100 minute timer*

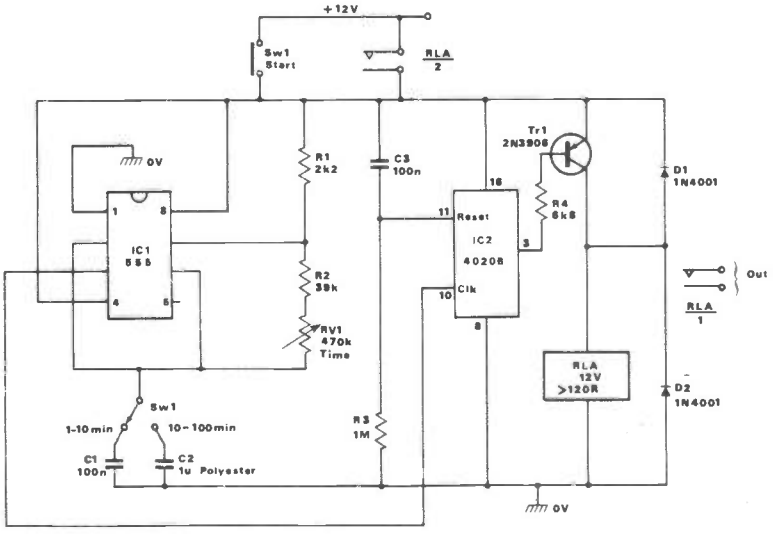
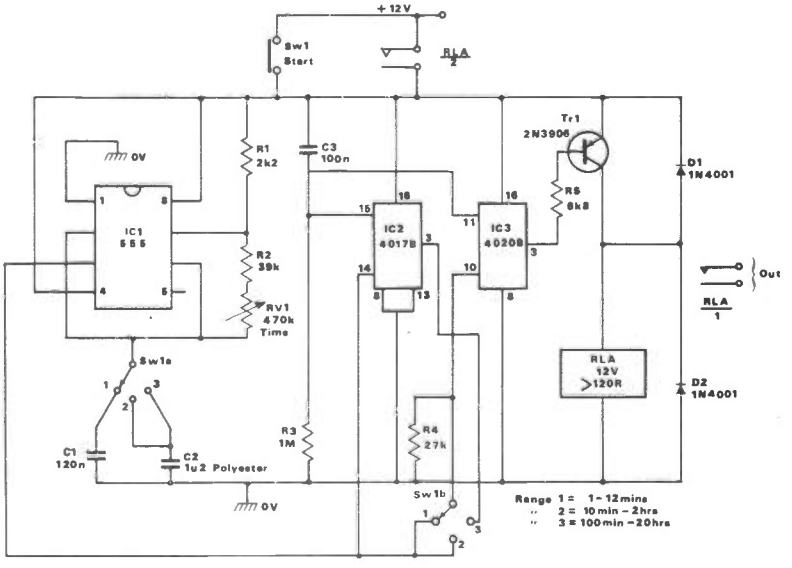


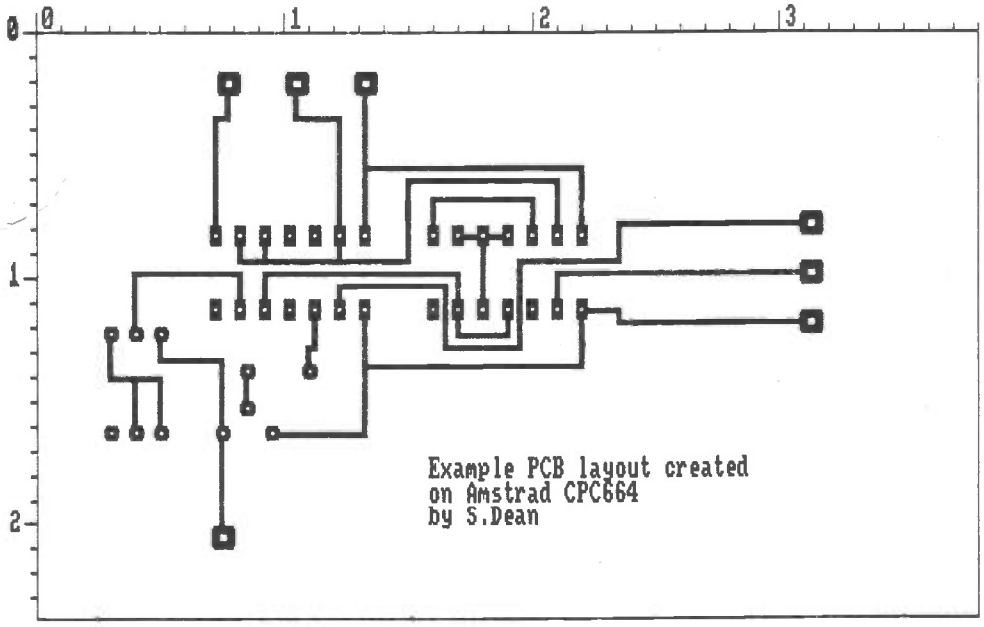
Fig 15 *Wide-range timer spanning 1 minute to 20 hours*



PCB DESIGNER

By S Dean

An on-screen draughting program for the Amstrad CPC range of computers



This simple Basic program will allow the user to design printed circuit board layouts on the Amstrad 464/664/6128 computers, and although facilities such as auto-routing are not included, the program is extremely simple to use and produces high quality artworks. The program is purely an on-screen design aid, and as such has certain limitations which are discussed later. It works to a scale of approximately 2:1, the precise scale being irrelevant since a scale ruler is provided on the print-out.

Program requirements

To use the program successfully the user will need an Epson compatible printer such as the Amstrad DMP2000, Epson FX80 etc. If the operator is unsure of printer compatibility, then he should check that it is able to produce a 72 dots/inch (horizontal) print-out in the bit image mode, and that to enter this mode the sequence ESC ★ 5 is required. To date the author has found that the Amstrad DMP1 and the Epson MX82 will *not* work without modification to the program (details available on request).

Apart from a printer, it is assumed that the user has access to the sort of photographic equipment needed by all CAD programs.

Brief specification

The program produces artwork for boards of dimensions 3.8 × 2.4 inches, to which a surprisingly large amount of circuitry may be added! Larger boards and double-sided boards can also be produced – the techniques for this are discussed later.

The nominal track width is 0.025 inches, which is narrow enough to fit comfortably between two adjacent DIL pads. Wider track can be built up if required. Six commonly used DIL arrangements can be selected using the function keypad, and these may be either horizontal or vertical in orientation. Any DIL size and pitch can be created using the editing features.

Text may be added to the artwork (a feature frequently omitted from extremely expensive CAD systems!) and layouts can be stored or recalled from disc/tape. Selectable multi-pass printing is provided to allow draft or final copies.

Entering the program

The complete listing for the PCB design utility is reproduced here, and as can be seen it is all Basic, any machine code routines being 'poked in'.

As usual, care must be taken when typing in the listing in order to enter the data in lines 2660-3020 correctly, otherwise the program could crash or hang. For this reason you are advised to save the program before attempting to run it. Take note also that semicolons and colons mean more to the computer than to you or I!

Using the program

Moving the cursor. The cursor keys move the cursor around the PCB in 0.025 inch steps. The cursor is 0.025 inches square.

Drawing track. The beginning of the track is marked at the current cursor position by pressing the Enter key. If the cursor is then placed at the end of the track and the Enter key pressed once again, the track will be drawn.

NOTE: It is not possible to draw a track if both X and Y co-ordinates have been changed after the track beginning marker has been placed. This is to prevent the 'ragged' appearance of diagonal lines. If this is attempted a warning beep will be issued and the command ignored. The beginning of the track still remains fixed.

Deleting. Any part of (or the whole) board may be erased by the following procedure. First, mark any corner of the rectangular area to be erased by pressing Enter as above. Next, move the cursor to the diagonally opposite corner of the rectangle and press the DEL key.

DIL pads. These may be added to the board by using the numeric keypad as follows:

Key 0 – 8-pin
Key 1 – 16-pin
Key 2 – 20-pin
Key 3 – 24-pin
Key 5 – 50-pin PCB edge connector (for Amstrad expansion!)

All the above keys print the pads horizontally. To print vertically press CTRL at the same time as the required key.

Single pads. These are available on the numeric keypad:

Key 9 – small (ideal for discrete components)
Key 6 – large (for PCB pins etc)

Text may be added at the current cursor position using the keyboard, and this may include UPPER/lower case letters and numbers plus a few other odds and sods.

CTRL-L will allow a board layout to be loaded from disc/tape. An automatic 'catalogue' is issued if the computer has a disc drive.

NOTE: Incorrect filenames will bring

the program to a depressing halt, since disc errors are not trapped by the program. If this happens, any work already on the drawing board can be saved using SAVE FILENAME, B,&6000,&4000 before re-running the program.

CTRL-S will save the current PCB layout to disc/tape. The filename may be up to 8 characters in length. Since the layout is saved as a screen image, 16K (17K on disc) is required for each layout. Make sure that there is enough free space!

CTRL-P will print out the PCB layout after asking 'how many passes?'. For your own time's sake, and for the sake of the printer ribbon, use a single pass for draft copies. Passes of up to 4 times may be required for the finished product, depending upon, amongst other things, ribbon condition.

CTRL-G puts a 0.1 inch graticule on the board for alignment purposes. The graticule is removed automatically before saving, printing, and just before a pad or track is set down.

CTRL-R can be used to produce a mirror image of the board if required, which may prove useful if the user prefers to design the layout as if looking through the board from the component side. In this case it will be necessary to reverse the layout to produce the 'print side' prior to printing (text should be added after reversing). This is especially useful on double-sided layouts, where both sides may be designed in the same manner without mental mirror imaging, a feat that the author finds mind boggling!

Designing larger boards

By now you may have realised that a board 3.8 × 2.4 inches isn't large enough to accommodate your latest project, and that some means of creating larger artworks is required.

The simplest method of doing this is to consider the board in parts which will fit on a single screen, taking note of the positions of interconnecting tracks. When each piece has been printed they can be assembled and stuck in the correct position ready for photographing (remember that this piecing together is necessary on all CAD systems using standard printers). By far the hardest job is to remember the positions of interconnections from another board, although this is made easier by using the ruler.

It is unlikely that the user of this program will consider designing double-sided printed circuits, mostly because of the problems associated with the accuracy in both photographing and alignment of the two transparencies. If a double-sided board *is* required, it is best to position all the ICs and other component pads which will need to be on both sides, and then save a copy of this before adding any track. Work on the board may then continue, and, after saving the completed side A, the previously saved layout may be reloaded and be treated as side B of the board. Note that both sides of the board cannot be shown on the screen at once.

Conclusions

The author has used the program to design several PCBs with very good results, and the quality of the final product is almost purely dependent upon the care taken during the photographic stages. If the photographic equipment is less than ideal it is best to avoid running track between the pads of DILs, since any loss of focus could result in shorts between the track and the adjacent pad(s). REW

```
10 REM PCB DESIGNER BY S.DEAN
20 MEMORY &4FFF
30 INK 1,24
40 MODE 1
50 MOVE 0,0:DRAW 639,0:DRAW 639,399:DRAW 0,399:DRAW 0,0
60 LOCATE 6,5
70 PRINT"Printed Circuit Drafting Aid"
80 LOCATE 8,15:PRINT"      By    S.Dean"
90 LOCATE 6,24:PRINT "Generating Code...Please Wait!"
100 GOSUB 2510
110 LOCATE 6,24:PRINT"Ready...Press any key
120 SOUND 1,100,40,7
130 WHILE INKEY$="":WEND
140 MODE 2
150 GOSUB 1550:REM show help page
160 ON ERROR GOTO 190
170 !DISC
180 D=1:GOTO 210
190 IF ERR=28 THEN D=0
200 RESUME 210
210 F$="NONAME"
220 A$=CHR$(23)+CHR$(1):REM XOR GRAPHICS MODE
230 B$=CHR$(23)+CHR$(3):REM OR GRAPHICS MODE
240 MODE 2
250 PRINT B$;
260 TAG
270 ORIGIN 0,0
280 MOVE 18,0:DRAW 626,0,1:DRAW 626,382:DRAW 18,382:DRAW 18,0
290 N=0
300 FOR X=18 TO 626 STEP 16
310 MOVE X,382:DRAWR 0,4,1
320 IF N/10=INT(N/10) THEN DRAWR 0,8,1:MOVER -4,5:PRINT INT(N/10);
330 N=N+1
340 NEXT
350 N=0
360 FOR Y=382 TO 0 STEP -16
370 MOVE 18,Y:DRAWR -4,0
380 IF N/10=INT(N/10) THEN DRAWR -4,0:MOVER -18,8:PRINT INT(N/10);
390 N=N+1
400 NEXT
410 TAGOFF
420 SYMBOL 240,255,255,255,231,255,255,255,0
430 SYMBOL 242,127,255,255,252,252,255,255,127
440 SYMBOL 243,254,255,255,63,63,255,255,254
450 SYMBOL 244,0,240,248,120,248,240,0,0
460 SYMBOL 241,0,15,31,30,31,15,0,0
470 SYMBOL 245,0,127,127,126,127,0,0,0
480 SYMBOL 246,0,254,254,126,254,0,0,0
490 PRINT A$;
500 x=32:y=364
510 GOSUB 1030
520 I$=INKEY$:IF I$="" THEN 520
530 IF INKEY(1)>-1 AND X<620 THEN GOSUB 1030:X=X+4:GOTO 510
540 IF INKEY(8)>-1 AND X>22 THEN GOSUB 1030:X=X-4:GOTO 510
550 IF INKEY(0)>-1 AND Y<374 THEN GOSUB 1030:Y=Y+4:GOTO 510
560 IF INKEY(2)>-1 AND Y>4 THEN GOSUB 1030:Y=Y-4:GOTO 510
570 IF INKEY(18)>-1 AND STATUS=0 THEN GOSUB 750:GOTO 510
580 IF INKEY(18)>-1 AND STATUS=1 THEN GOSUB 840:GOTO 520
590 IF INKEY(15)>-1 THEN N=8:SP=3:GOSUB 1060:GOTO 520
600 IF INKEY(13)>-1 THEN N=14:SP=3:GOSUB 1060:GOTO 520
610 IF INKEY(14)>-1 THEN N=16:SP=3:GOSUB 1060:GOTO 520
620 IF INKEY(5)>-1 THEN N=20:SP=3:GOSUB 1060:GOTO 520
630 IF INKEY(20)>-1 THEN N=24:SP=4:GOSUB 1060:GOTO 520
640 IF INKEY(12)>-1 THEN N=50:SP=2:GOSUB 1060:GOTO 520
650 IF INKEY(11)=0 THEN GOSUB 2110:GOTO 510
660 IF INKEY(3)=0 THEN GOSUB 1780:GOTO 510
670 IF INKEY(36)=128 THEN GOSUB 1880:GOTO 510
680 IF INKEY(50)=128 THEN GOSUB 2350:REM REVERSE SCREEN
690 IF INKEY(44)=128 THEN GOSUB 1550:REM HELP
700 IF INKEY(27)=128 THEN GOSUB 2210:GOTO 520
710 IF INKEY(60)=128 THEN GOSUB 2000:GOTO 520
720 IF INKEY(79)=128 AND STATUS=1 THEN GOSUB 1440
730 IF ASC(I$)>31 AND ASC(I$)<123 THEN TAG:PRINT I$;:TAGOFF:GOSUB 1030:X=X+8:GOSUB 1030
740 GOTO 520
750 REM FIX CO-ORDS OF LINE
760 XB=X:YB=Y
770 IF G=1 THEN GOSUB 1380:TG=1
780 PRINT B$;
790 GOSUB 1030
800 PRINT A$;
810 STATUS=1
820 IF TG=1 THEN GOSUB 1380:TG=0
830 RETURN
840 REM END OF LINE
850 IF X<>XB AND Y<>YB THEN SOUND 1,200,10,7:RETURN
860 IF G=1 THEN TG=1: GOSUB 1380
870 PRINT B$;
880 IF XB=X THEN 940
890 IF X>XB THEN F=3 ELSE F=0
900 MOVE XB,Y:DRAW X+F,Y,1:MOVE XB,Y+2:DRAW X+F,Y+2
910 PRINT A$;
920 GOTO 990
930 STATUS=0:RETURN
940 IF Y>=YB THEN F=2 ELSE F=0
950 FOR A=0 TO 3
960 MOVE X+A,YB:DRAW X+A,Y+F,1
970 NEXT
980 PRINT A$;
990 STATUS=0
1000 GOSUB 1030
1010 IF TG=1 THEN GOSUB 1380:TG=0
1020 RETURN
1030 MOVE X,Y:DRAW X+3,Y,1
1040 MOVE X,Y+2:DRAW X+3,Y+2
1050 RETURN
1060 REM DIL PADS HORIZONTAL
1070 IF INKEY(23)=128 THEN 1220
1080 IF X+N$8>631 THEN SOUND 1,200,10,7:E=1:RETURN:ELSE E=0
```

```
1090 IF G=1 THEN GOSUB 1380:TG=1
1100 GOSUB 1030
1110 PRINT B$;
1120 TAG
1130 FOR A=0 TO N/2-1
1140 MOVE X+A*16-2,Y+8:PRINT CHR$(240);
1150 MOVER -8,-SP*16:PRINT CHR$(240);
1160 NEXT
1170 TAGOFF
1180 PRINT A$;
1190 GOSUB 1030
1200 IF TG=1 THEN GOSUB 1380:TG=0
1210 RETURN
1220 REM DILS VERTICAL
1230 IF Y-N*8<-6 THEN SOUND 1,200,10,7:E=2:RETURN:ELSE E=0
1240 IF G=1 THEN GOSUB 1380:TG=1
1250 GOSUB 1030
1260 PRINT B$;
1270 TAG
1280 FOR A=0 TO N/2-1
1290 MOVE X-6,Y-A*16+6:PRINT CHR$(245)CHR$(246);
1300 MOVER SP*16-14,0:PRINT CHR$(245)CHR$(246);
1310 NEXT
1320 TAGOFF
1330 PRINT A$;
1340 GOSUB 1030
1350 IF TG=1 THEN GOSUB 1370:TG=0
1360 RETURN
1370 REM GRATS
1380 IF G=0 THEN G=1 ELSE G=0
1390 PRINT A$;
1400 FOR XG=34 TO 626 STEP 16:MOVE XG,0:DRAW XG,382,1:NEXT
1410 FOR YG=366 TO 0 STEP -16:MOVE 18,YG:DRAW 626,YG:NEXT
1420 MOVE X,Y
1430 RETURN
1440 REM ERASE
1450 IF G=1 THEN GOSUB 1370:TG=1
1460 GOSUB 1030
1470 PRINT CHR$(23)CHR$(0);
1480 FOR A=MIN(X,XB) TO MAX(X,XB)+3
1490 MOVE A,MIN(Y,YB):DRAW A,MAX(Y,YB)+2,0
1500 NEXT
1510 PRINT A$;
1520 GOSUB 1030
1530 IF TG=1 THEN GOSUB 1370:TG=0
1540 STATUS=0:RETURN
1550 REM HELP
1560 GOSUB 2450
1570 CLS:PRINT"CONTROL KEYS:-"
1580 PRINT:PRINT"CTRL-G ... TURN ON 0.1 INCH GRATICULE"
1590 PRINT"CTRL-H ... HELP MENU"
1600 PRINT"CTRL-L ... LOAD PCB FROM DISK/TAPE"
1610 PRINT"CTRL-P ... PRINT  BOARD (ANY KEY ABORTS PRINTING!)"
1620 PRINT"CTRL-R ... REVERSE BOARD LAYOUT"
1630 PRINT"CTRL-S ... SAVE PCB TO DISK/TAPE"
1640 PRINT:PRINT"DRAWING KEYS:-"
1650 PRINT:PRINT "KEYPAD 0 ... 8 PIN DIL"
1660 PRINT TAB(8);"1 ... 14 PIN DIL"
1670 PRINT TAB(8);"2 ... 16 PIN DIL"
1680 PRINT TAB(8);"3 ... 20 PIN DIL"
1690 PRINT TAB(8);"4 ... 24 PIN DIL"
1700 PRINT TAB(8);"5 ... 50 PIN PCB EDGE CONNECTOR"
1710 PRINT TAB(8);"8 ... SMALL PAD"
1720 PRINT TAB(8);"9 ... LARGE PAD"
1730 PRINT TAB(8);"CTRL KEY WITH ABOVE TO PRINT VERTICALLY"
1740 LOCATE 15,24
1750 INPUT "PRESS 'ENTER' TO RETURN TO DRAWING BOARD";Q$
1760 GOSUB 2470
1770 RETURN
1780 REM ROUND PADS
1790 IF G=1 THEN GOSUB 1370:TG=1
1800 GOSUB 1030
1810 PRINT B$;
1820 MOVER -8,6
1830 TAG:PRINT CHR$(242)CHR$(243);
1840 TAGOFF
1850 PRINT A$;
1860 IF TG=1 THEN GOSUB 1370:TG=0
1870 RETURN
1880 REM LOAD PIC
1890 GOSUB 2450
1900 CLS
1910 IF D=1 THEN CAT
1920 PRINT"NAME OF ARTWORK TO LOAD":PRINT
1930 INPUT F1$
1940 MODE 2:IF F1$="" THEN GOSUB 2470:GOSUB 1030:RETURN
1950 F1$=LEFT$(UPPER$(F1$),8)
1960 IF ASC(F1$)<65 OR ASC(F1$)>90 THEN PRINT CHR$(7);:GOTO 1920
1970 F$=F1$
1980 CLS:LOAD "!"+F$,&C000
1990 RETURN
2000 REM SAVE PIC
2010 IF G=1 THEN GOSUB 1370:REM REMOVE GRATS
2020 GOSUB 1030
2030 GOSUB 2450
2040 CLS:PRINT"SAVE AS:- "F$
2050 PRINT"Y/N?"
2060 I$=INKEY$:IF I$="" THEN 2060
2070 I$=UPPER$(I$):IF I$="Y" THEN 2090
2080 INPUT "NEW FILENAME:-";F$
2090 CALL &BB09:CALL &BB09:SAVE F$,B,&6000,&4000:GOSUB 2470
2100 GOSUB 1030:RETURN
2110 REM SMALL PAD
2120 IF G=1 THEN GOSUB 1370:TG=1
2130 GOSUB 1030
2140 PRINT B$;
2150 MOVER -8,7
2160 TAG:PRINT CHR$(241)CHR$(244);
2170 TAGOFF
2180 PRINT A$;
2190 IF TG=1 THEN GOSUB 1370:TG=0
2200 RETURN
2210 REM PRINT
2220 IF G=1 THEN GOSUB 1380:TG=1
2230 GOSUB 1030
2240 GOSUB 2450
2250 CLS:PRINT"NUMBER OF PASSES (1 TO 4)"
2260 INPUT P$:P=VAL(P$):IF P<1 THEN P=1
2270 IF P>4 THEN P=4
2280 POKE &5200,P
2290 GOSUB 2470:REM RESTORE PIC
2300 CALL &5000
2310 SOUND 1,200,10,7
2320 GOSUB 1030
2330 IF TG=1 THEN GOSUB 1380:TG=0
2340 RETURN
2350 REM REVERSE
2360 GOSUB 1030
2370 IF G=1 THEN GOSUB 1370:TG=1
2380 PRINT CHR$(23)CHR$(0);
2390 CALL &50F0
2400 SOUND 1,200,10,7
2410 PRINT A$;
2420 GOSUB 1030
2430 IF TG=1 THEN GOSUB 1370:TG=0
2440 RETURN
2450 REM SAVE SCREEN
2460 CALL &5180 : RETURN
2470 REM RESTORE PIC
2480 CALL &518C:RETURN
2490 REM POKE IN M/C CODE
2500 SUM=0:RESTORE 2660
2510 FOR a=&5000 TO &50D7
2520 READ d:POKE a,d:sum=sum+d
2530 NEXT
2540 IF SUM<>22787 THEN PRINT"DATA ERROR IN BLOCK 1":STOP
2550 sum=0:RESTORE 2880
2560 FOR a=&50F0 TO &5160
2570 READ d:POKE a,d:sum=sum+d
2580 NEXT
2590 IF SUM<>14481 THEN PRINT"DATA ERROR IN BLOCK 2":STOP
2600 sum=0:RESTORE 3000
2610 FOR a=&5180 TO &5197
2620 READ D:POKE A,D:SUM=SUM+D
2630 NEXT
2640 IF SUM<>2034 THEN PRINT"DATA ERROR IN BLOCK 4":STOP
2650 RETURN
2660 DATA  205, 6, 185, 62, 13, 205, 208, 80, 62, 10
2670 DATA  205, 208, 80, 62, 27, 205, 208, 80, 62, 65
2680 DATA  205, 208, 80, 62, 7, 205, 208, 80, 33, 0
2690 DATA  0, 17, 0, 0, 58, 0, 82, 230, 7, 50
2700 DATA  1, 82, 24, 90, 213, 1, 0, 7, 229, 213
2710 DATA  197, 205, 223, 189, 193, 209, 225, 167, 40, 2
2720 DATA  203, 193, 203, 1, 19, 16, 237, 203, 9, 121
2730 DATA  205, 208, 80, 35, 124, 254, 1, 32, 5, 125
2740 DATA  254, 144, 40, 3, 209, 24, 213, 6, 56, 175
2750 DATA  205, 208, 80, 16, 251, 58, 1, 82, 61, 50
2760 DATA  1, 82, 40, 11, 62, 13, 205, 208, 80, 209
2770 DATA  33, 0, 0, 24, 19, 58, 0, 82, 50, 1
2780 DATA  82, 62, 10, 205, 208, 80, 205, 27, 187, 48
2790 DATA  37, 209, 24, 55, 62, 27, 205, 208, 80, 62
2800 DATA  42, 205, 208, 80, 62, 5, 205, 208, 80, 175
2810 DATA  205, 208, 80, 62, 2, 205, 208, 80, 6, 56
2820 DATA  175, 205, 208, 80, 16, 251, 24, 132, 33, 0
2830 DATA  0, 209, 19, 19, 19, 19, 19, 19, 19, 122
2840 DATA  254, 2, 56, 206, 123, 254, 129, 56, 201, 62
2850 DATA  27, 205, 208, 80, 62, 50, 205, 208, 80, 62
2860 DATA  13, 205, 208, 80, 205, 208, 80, 201, 79, 205
2870 DATA  43, 189, 121, 48, 250, 201
2880 DATA  205, 6, 185, 221, 33, 6, 82, 33, 124, 1
2890 DATA  17, 18, 0, 237, 83, 2, 82, 17, 113, 2
2900 DATA  237, 83, 4, 82, 237, 91, 2, 82, 19, 237
2910 DATA  83, 2, 82, 229, 205, 223, 189, 225, 221, 119
2920 DATA  0, 237, 91, 4, 82, 27, 237, 83, 4, 82
2930 DATA  229, 213, 205, 223, 189, 209, 225, 221, 190, 0
2940 DATA  40, 29, 237, 91, 2, 82, 229, 205, 222, 187
2950 DATA  205, 220, 189, 225, 221, 126, 0, 237, 91, 4
2960 DATA  82, 229, 213, 205, 222, 187, 205, 220, 189, 209
2970 DATA  225, 122, 254, 1, 32, 184, 123, 254, 66, 32
2980 DATA  179, 43, 43, 124, 167, 32, 159, 125, 254, 2
2990 DATA  32, 154, 201
3000 DATA  33, 0, 192, 17, 0, 96, 1, 0, 64, 237
3010 DATA  176, 201, 33, 0, 96, 17, 0, 192, 1, 0
3020 DATA  64, 237, 176, 201
```

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66. 1 – magnetic brake – stops rotation instantly
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70. 2 – 25 watt pots 1000 ohm
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181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
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188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
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199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
206. 20 – mtres 80 ohm, standard type co-ax off whte
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 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, ½ meg with dp switch
249. 1 – 13A switched socket on double plate with fused spur for water heater
266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 car cigar lighter socket plugs
298. 2 15 amp round pin plugs brown bakelite
300. 1 mains solenoid with plunger compact type
301. 10 ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 12 pole 3 way ceramic wave charge switch
304. 1 stereo amp 1 watt per channel
305. 1 tubular dynamic microphone with desk rest
308. 1 T.V. turret tuner (black & white T.V.)
310. 2 oven thermostats
311. 1 Clare Elliot sealed relay 12V
312. 1 pressure pad switch 24 × 18 (Trigger Mat)
313. 5 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
453. 2 – 2½in. 80ohm loudspeakers
454. 2 – 2¼in. 80ohm loudspeakers

MULLARD UNILEX AMPLIFIERS

We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules – i.e. Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for £6.00 plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

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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.

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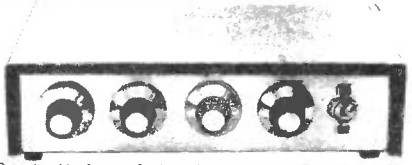
Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95 without case, metal case – £2.95, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs 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 ¼" 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

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1/10 hp £3.45
1/8 hp £5.75. 1/6 hp £7.50

25A ELECTRICAL PROGRAMMER

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 £2.50

THIS MONTH'S SNIP

4 High quality 7-segment l.e.d. displays, high brightness, high contrast, yours for only £2—Ideal for LIGHT RIDER (Oct '86) projects. Our reference 2P121.

MAKING SUNBEDS?

CHOKE AND STARTER for 6' 100uva tube £2, post £1 for 1 or 50p each in quantity.
TUBE HOLDERS. Canopy type spring loaded, 4 pairs for £1, 100 pairs £20, 1,000 pairs £150, post paid.

TANGENTIAL HEATERS?

We again have very good stocks of these quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1·2kw, 2kw, 2·5kw, and 3kw. Prices are £5 each for the first 3, and £6.95 for the 3k. Add post £1.50 per heater if not collecting.
CONTROL SWITCH enabling full heat, half heat or cold blow, with connection diagram, 50p for 2kw, 75p for 3kw.

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Woods extractors
5" £5 + £1.25 post. 6" £6 + £1.50 post.
4" × 4" Muffin equipment cooling fan 115V £2.00
4" × 4" Muffin equipment cooling fan 230/240V £5.95
5" Plannair extractor £5.50
9" Extractor or blower 115V supplied with 230 to 115V adaptor £9.50 + £2 post.
All above are ex computers but guaranteed 12 months.
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on p.c.b. size 4" × 2" (app.) Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each, or 13 for £12.00

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2P4 – 24 volt psu with separate channels for stereo made for Mullard UNILEX
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2P8 – Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
2P9 – Time and set switch. Boxed, glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters
2P10 – 12 volt 5 amp mains transformer – low volt winding on separate bobbin and easy to remove to convert to lower voltages for higher currents
2P12 – Disk or Tape precision motor – has balanced rotor and is reversible 230v mains operated 1500 rpm
2P14 – Mug Stop kit – when thrown emits piercing squawk
2P15 – Interrupted Beam kit for burglar alarms, counters, etc.
2P17 – 2 rev pr minute mains driven motor with gear box, ideal to operate mirror ball
2P18 – Liquid/gas shut off valve mains solenoid operated
2P19 – Disco switch-motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
2P20 – 20 metres extension lead, 2 core – ideal most Black and Decker garden tools etc
2P21 – 10 watt amplifier, Mullard module reference 1173
2P22 – Motor driven switch 20 secs on or off after push
2P26 – Counter resettable mains operated 3 digit
2P27 – Goodmans Speaker 6 inch round 8ohm 12 watt
2P28 – Drill Pump – always useful couples to any make portable drill
2P31 – 4 metres 98 way interconnecting wire easy to strip
2P32 – Hot Wire amp meter – 4½ round surface mounting 0–10A – old but working and definitely a bit of history
2P34 – Solenoid Air Valve mains operated
2P35 – Battery charger kit comprising mains transformer, full wave rectifier and meter, suitable for charging 6v or 12v
2P38 – 200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc.
2P43 – Small type blower or extractor fan, motor inset so very compact, 230V
2P46 – Our famous drill control kit complete and with prepared case.
2P49 – Fire Alarm break glass switch in heavy cast case
2P51 – Stereo Headphone amplifier, with pre-amp
2P55 – Mains motor, extra powerful has 1¼" stack and good length of spindle
2P62 – 1 pair Goodmans 15 ohm speakers for Unilox
2P64 – 1 five bladed fan 6½" with mains motor
2P66 – 1 2Kw tangential heater 115v easily convertible for 230V
2P67 – 1 12v–0–12v 2 amp mains transformer
2P68 – 1 15v–0–15v 2 amp mains transformer
2P69 – 1 250v–0–250v 60 mA & 86.3v 5A mains transformer + 50p post
2P70 – 1 E.M.I. tape motor two speed and reversible
2P72 – 1 115v Muffin fan 4" × 4" approx. (s.h.)
2P75 – 1 2 hour timer, plugs into 13A socket
2P82 – 9v–0–9v 2 amp mains transformer
2P84 – Modem board with press keys for telephone redialler
2P85 – 20v–0–20v ½A 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
2P94 – Telephone handset for EE home telephone circuit
2P95 – 13A socket on satin chrome plate
2P97 – mains transformer 24V 2A upright mounting
2P98 – 20m 4 core telephone cable, white outer
2P99 – 500 hardened pin type staples for telephone cable
2P101 – 15V mains transformer 4A upright mounting
2P105 – capillary type thermostat for air temperature with c/o switch
2P107 – membrane keyboard, telephone type
2P108 – mains motor with gear box giving 110rpm
2P109 – 5" wide black adhesive pvc tape 33m, add £1 post if not collecting

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5P23 – miniature (appr. 2½" wide) tangential blow heater, 1·2kw
5P24 – ¼hp motor, ex computer, 230V, mains operation 1450rpm. If not collect add £3 post
5P25 – special effects lighting switch. Up to 6 channels of lamps can be on or off for varying time periods
5P26 – Audax woofer 8" 8ohm 35 watt
5P27 – cartridge player 12V, has high quality stereo amplifier
5P28 – gear pump, mains motor driven with inlet and outlet pipe connectors
5P32 – large mains operated push or pull solenoid. Heavy so add £1.50 post
5P34 – 24V 5A toroidal mains transformer
5P35 – modern board from telephone auto dialler, complete with keypad and all ICs
5P37 – 24 hour time switch, 2 on/offs and clockwork reserve, ex Elec. Board loading up to 50A. Add £1 post
5P41 – 5" extractor fan, very quiet runner (s.h.), gntd 12 mths
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5P51 – 200W auto transformer 230V to 115V torroidal
5P52 – mains transformer 26V 10A upright mounting, add £2 post
5P54 – mains motor with gear box, final speed 5rpm
5P58 – Amstrad stereo tuner FM and LM and S. AM
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THE POOR MAN'S SPECTRUM ANALYSER REVISITED

The design in *R&EW* for an oscilloscope add-on suffered a few problems, not least the difficulty in obtaining components. Richard Hosking offers some thoughts on improving a basically fine idea

I was intrigued by the article in *R&EW*, November '83, describing a low cost spectrum analyser. However, a number of problems arose on building the circuit: the VCO was difficult to get going satisfactorily over a wide enough frequency range, and building the helical filter used a lot of PC board and solder!

Fig 1 *Spectrum analyser block diagram*

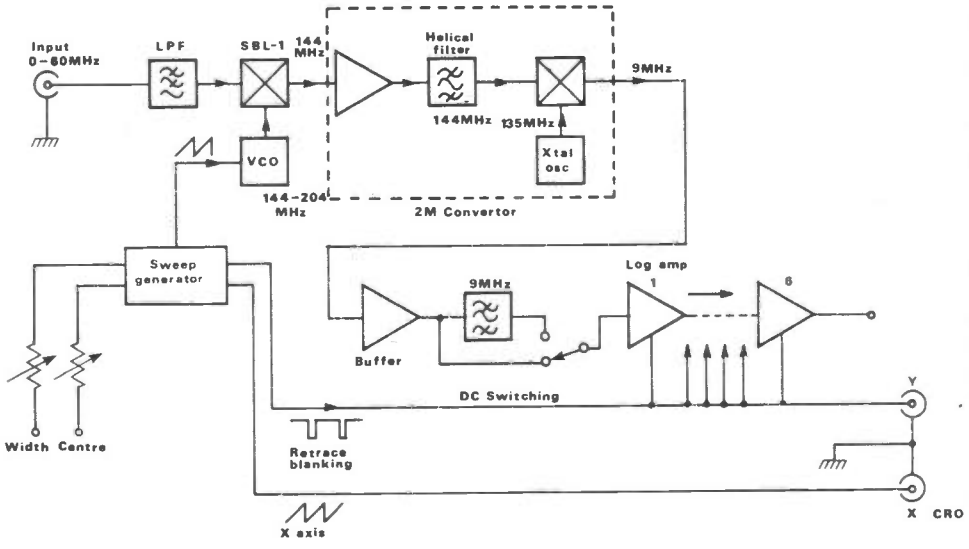
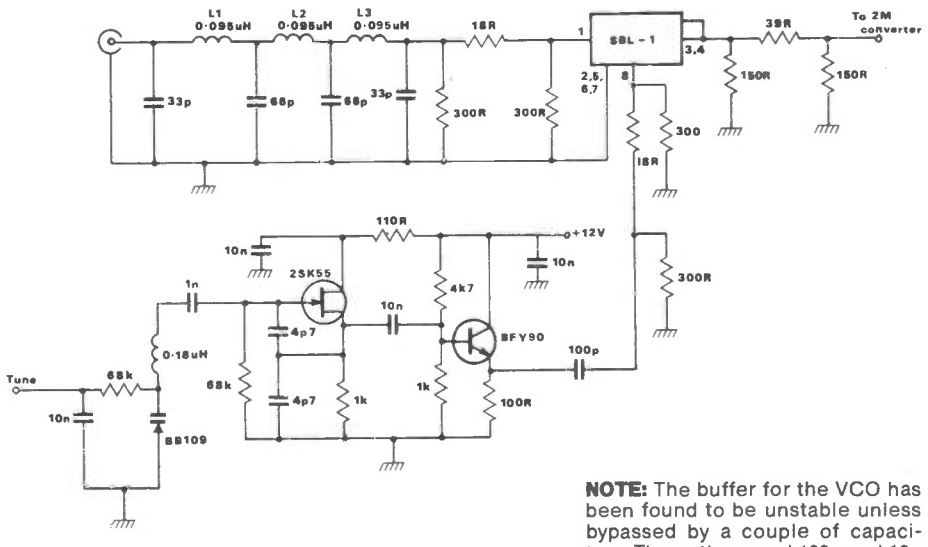


Fig 2 *VCO and 1st mixer circuit*



NOTE: The buffer for the VCO has been found to be unstable unless bypassed by a couple of capacitors. The author used 100n and 10n ceramic

I thought the device would be more useful if the filter was narrow enough to look at sidebands, eg for setting up SSB generators etc. Normally an expensive commercial unit would be required to do this. To obtain this sort of selectivity (in the order of 500Hz) a crystal filter is required, and as these are only practical at frequencies less than about 30MHz a dual conversion approach is used.

A block diagram of the current design is shown in *Figure 1*. At the input is a low-pass filter with a cut-off of 100MHz. This feeds the SBL-1 1st mixer as in the previous design. A voltage controlled oscillator (VCO) sweeping from 144-204MHz gives a first IF of 144MHz for an input of 0-60MHz.

The 1st IF/2nd mixer is a 144MHz converter, the design slightly modified from the Ambit 2m converter. This uses a helical filter and gives an image rejection of about 50dB. A second IF of 9MHz is used, as narrow crystal filters are available at this frequency.

A 6-stage IF/log amplifier follows, the circuit being basically unchanged except that the two buffer stages are omitted. I also made some modifications to the original sweep generator to allow a narrow sweep range.

VCO

Various designs were tried here. A series-tuned Clapp circuit using a 2SK55 FET gave good results, being stable and having a low noise output. The varicap diode is a BB109, which gives a sweep of 60MHz. I have not tried the original device specified, which would probably give a wider sweep range. The oscillator is buffered by a BFY90 as an emitter follower.

The sweep voltage should not be less than about 0.5V, otherwise the VCO may behave unpredictably. This is because the combined RF and dc voltage biases the varicap into conduction.

The VCO uses an S18-style inductor supplied by Ambit (0.18μH, No. 35-10403). Ambit are now trading as Cirkit, of course. Ordinary ceramic capacitors were used with good results in the tuned circuits.

Low-pass filter/1st mixer

The low-pass filter remains a 7-pole design with the component values changed to give a cut-off of 100MHz. S18 inductors are used here (0.098μH, Ambit No. 35-00503). The first mixer uses the SBL-1 ring-diode mixer.

Resistive networks at all ports give an approximate impedance match to all mixer products, image frequencies as well as those required. If these are not matched the mixer tends to perform poorly. The conversion loss is about 10dB, but this is not critical for this application.

This device has excellent strong signal handling, given an adequate local oscillator drive. The analyser limits at about 10mV input and can distinguish a signal of about 10μV. Hence the overall dynamic range is 60dB.

The circuit of the VCO and mixer stages is shown in *Figure 2.*

First IF/2nd mixer

A 144MHz converter provides a convenient way of realising this stage. The Ambit design uses a helical filter to give excellent image rejection. To give a 90MHz 2nd IF an oscillator frequency of 135MHz is used. Overtone crystals can be obtained for this frequency from specialist crystal manufacturers.

Oscillator circuits at this frequency are quite critical. The capacative reactance of the crystal is tuned out by a parallel inductor, which may have to be varied for individual crystals. In this circuit another S18 device was used (0.18μH, Ambit No. 35-10403).

The converter uses 3SK88 FETs as RF amplifier and mixer, with a 144MHz helical filter providing selectivity. A 9MHz IF transformer is used at the output of the mixer (Ambit No. KACSK3893A). The converter has to be shielded to reduce spurious responses.

2nd IF/log amplifier

The log amp remains essentially the same as in the previous design, although with the two preamplifier stages omitted. In this circuit a Yaesu crystal filter was used (No. XF 8.9HCN). Any similar device with a passband of about 300Hz could be used here. A diode dc switching network bypasses the filter when sweeping over a wide range. If other filters are used, terminating resistors of the appropriate value should be substituted.

The IF strip gives a surprisingly accurate logarithmic response as tested using a commercial signal generator. The circuit is shown in *Figure 4.* The IF transformers are again supplied by Ambit. T2 (filter match) is a type No. KACSK3892A (stock No. 35-38920). T3-8 are type No. KACSK3893A

Sweep generator

I found that the gain of the ramp buffer had to be reduced to obtain a narrow enough sweep to look at carrier sidebands. The LF347 quad FET op-amp works satisfactorily in this circuit, the new configuration of which is shown in *Figure 5.*

The input resistor to the summing amplifer is switched to reduce the gain, the sweep width being variable using RV1. Tuning is accomplished with RV2, and RV3 provides fine tuning. Reduction drives or multi-turn pots are necessary on these controls in the narrow sweep mode.

Layout and shielding of leads to controls is important, particularly as concerns earth returns. A 1mV shift in VCO voltage produces a 2.5kHz frequency shift!

Hum and noise on the supply lines must be minimized – 10mV of ripple on the 12V line is sufficient to upset the VCO in narrow mode. I used a 33000μF capacitor on the 12V line, and low impedance leads are required to get the maximum ripple reduction.

The X-axis output was taken from pin 2 of the 555 via a 1μF capacitor. BC178C pnp transistors can be used for the current sources to the 555.

Power supply

This is not critical, except that the supply rails should be stable. IC voltage regulators are used to give +12, +24 and −6V. I used 78/79 series devices. The 12V regulator needs heatsinking as it has to supply about 250mA. Care should be taken with earth returns, as stated previously.

Construction

Various layouts are possible, and I have left this to individual taste. I used separate printed circuit boards for the power supply and sweep generator and shielded enclosures for the VCO/1st mixer, 2m converter and IF strip, made from PC board. If shielded enclosures are not used there is a tendency to instability and spurious responses.

Fig 3a *First IF/2nd mixer oscillator/buffer*

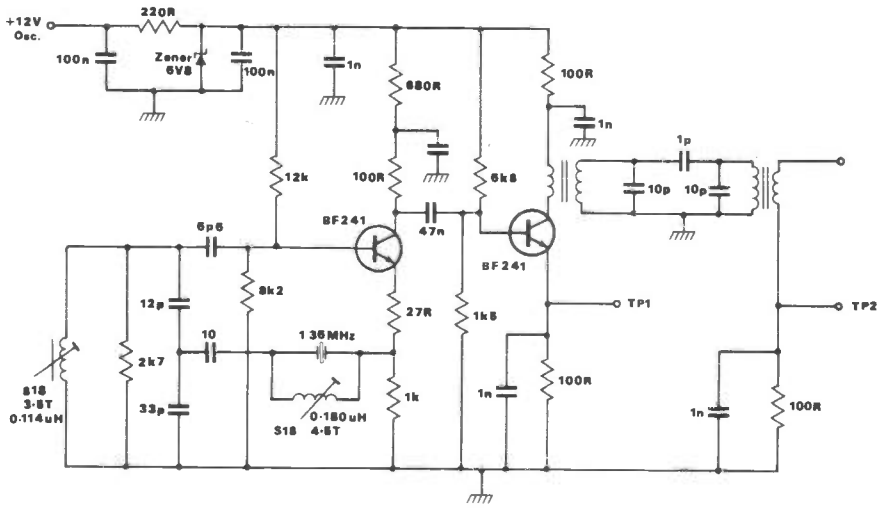
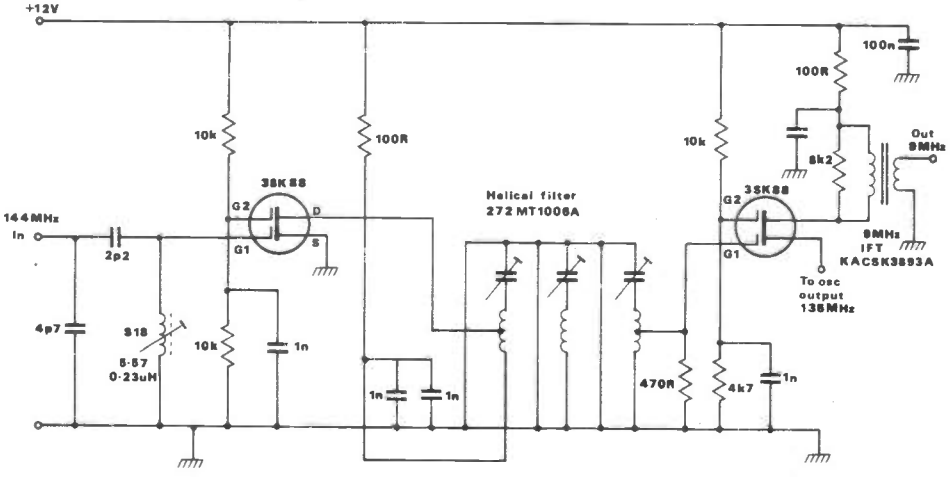


Fig 3b *RF amp/2nd mixer*



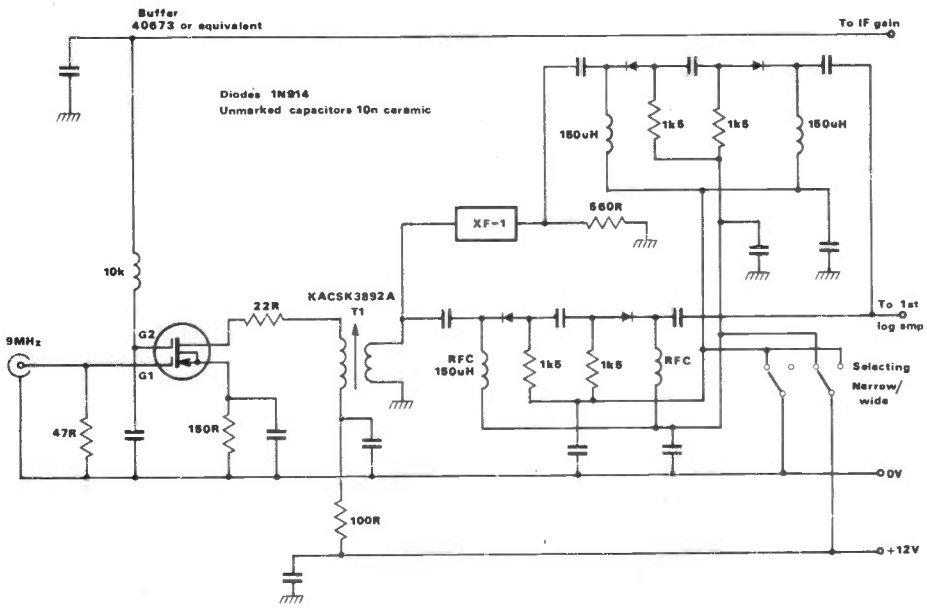


Fig 4a *IF/log amp input/filter*

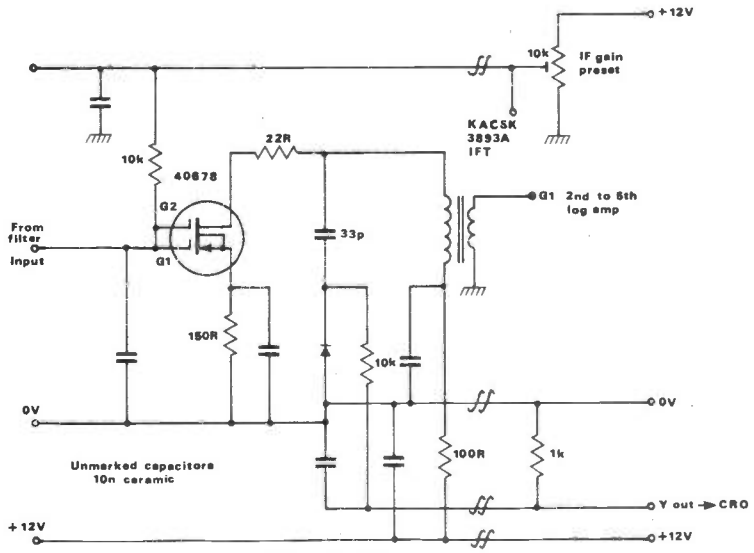


Fig 4b *IF/log amp*

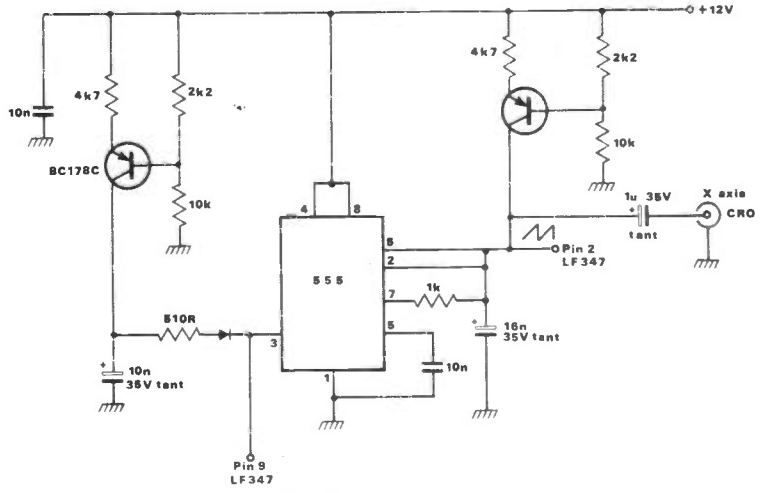


Fig 5a *Ramp generator*

Feed-through capacitors and BNC connectors were used for connections as appropriate.

Good RF construction practices should be followed, with double-sided PC board used for the RF circuitry with the top as ground-plane (this is not a project for the beginner).

Testing

The following test equipment is required: multimeter, 250MHz counter, CRO (for the display), RF signal generator, and short wave receiver.

Assuming a suitable power supply is available, first check for shorts etc. The VCO output should be checked with a counter and adjusted to 144MHz at about 0.5V. The frequency should sweep up to about 200MHz at 24V.

Next, set up the 2m converter using an SW receiver on 9MHz and a 144MHz signal generator or 'off-air' signal. Align the IF strip using a 9MHz source with the filter out of circuit. Measure the dc output voltage while tuning. The sweep generator output should be checked with a CRO, and should be a ramp from −4.5 to 23V in the full sweep mode. The amplitude and dc components of the ramp should be independently variable in the narrow sweep mode. At the lowest setting the waveform should be about 1mV p-p, with hum and noise less than about 200μV (if your CRO will measure this!).

In practice

The sweep is not exactly linear in the full sweep mode, but good enough in practice. In the narrow sweep mode there is some jitter but a very usable trace is obtained. This jitter is minimized by careful power supply filtering and shielding of leads in the sweep generator.

I found the VCO stability was quite good and there was no significant drift while taking readings. With the narrow filter in circuit there is an extra 'lobe' in the trace due to the filter ringing – this disappears at the lowest sweep settings.

The output from a 10.7MHz DSB generator is shown in *Figure 6*, and the carrier can be seen to be about 40dB below the sidebands. The audio input frequency was 1500Hz. The harmonic output from the generator is shown in *Figure 7*. A spurious response is seen at about 40MHz.

Further developments

The tracking generator promised in the last article has not yet appeared! This would be a logical next development. The range of the device could be extended by using a higher IF, eg 432MHz. It may be helpful to bring the IF gain control out to the front panel to make the gain variable for small signals. I would certainly be pleased to hear about any further ideas. REW

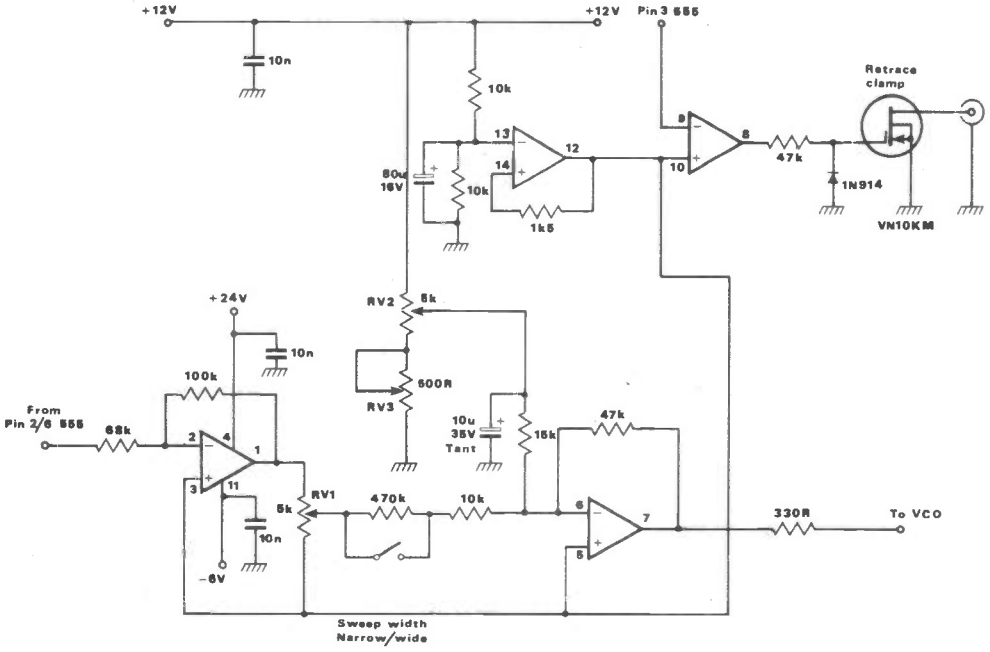


Fig 5b Sweep generator

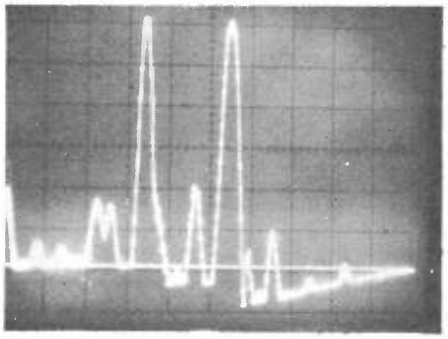


Fig 6 10.7MHz DSB output (from G4EAG SSB generator)

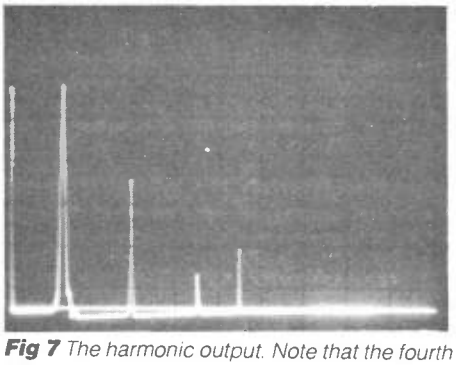


Fig 7 The harmonic output. Note that the fourth blip is spurious

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

The uninspired summer seems to have been no dampener of ATV activity; indeed, it may have been a stimulus. Either way, I have received a good batch of letters, which saves me from having to make it all up.

Microwave news

Just for a change we'll start at the top of our spectrum, so let's work our way down from 10GHz.

The 3cm band seems to be attracting more and more interest. Chas Winton GM6XW writes from Larbert in Stirlingshire about the very active ATV group in the central region, with group calls GM4OMT, GM6JWH, GM1FAI and GM6XW. GM1FAI is in Linlithgow and the others are in the Falkirk area. They hope to be operative soon on 10GHz and there is already activity on 70cm and 1.3GHz most evenings and at weekends. Most of the interest is in 1.3GHz, and a call on 144.750 will usually raise one of the group for information.

Mike G3PFR suggests that 10GHz ATV be kept to the 10.1 to 10.3 section of the band (according to the *RSGB Microwave Newsletter*). Tim G3KEU also notes that a centre frequency of 10.250GHz appears to be the accepted one for ATV and raises the question of just what deviation should be used; there appears to be no standard at present. Several stations are using Wood & Douglas equipment with an IF bandwidth of 10 to 12MHz, but Tim prefers the DBS standard of 13MHz/volt and 27MHz bandwidth, since this allows the receiver to double for satellite use. With the availability of SAW filters for DBS receivers it becomes relatively easy to construct a high quality system.

Tim has used his ATV gear during the cumulative contests with good results and is gradually extending the range. During May he worked from his home in Swindon to G3VKV/P on Cleeve Common, Gloucester, and in the June contest from Cleeve Common to G3VKV/P on the Clee Hills in Shropshire. In July the 73km path between Walbury Hill and Cleeve Common was beaten. His equipment is a 50mW transmitter and a one-metre Cassegrain-fed dish.

On 23cm Dave McQue G4NJU has a 1W transmitter in Bletchley and is working on a 10W PA. Colleagues Tony Smith G6DJI and Dave Ruck G6RFH are constructing 70cm gear, and both Daves have 'Worthing'-style broadside arrays almost ready for 1.3. They are using separate Tx and Rx antennas to avoid relay complications.

Another couple of potential 10GHz activists are Chris G4AYT (Whitstable) and Ron G6GHP (Westgate). Staying in east Kent, Roy Gilham tells me that John G8UWS is on another tour of duty in the Falklands and this time he has taken his ATV gear – that should fascinate the penguins! Roy has worked John G3OGX in Rayleigh (Essex) now, getting a P2 report over this obstructed 36km path.

Some Summerfun contest achievements now. Mike G8LES near Alton managed to reach Chris G8GLQ/P at Trowbridge, getting P5 pictures on 3 watts over the 60 mile path.

Seventy centimetres

June, July and August were good months for Roy Gilham in Thanet, managing to work as far as Trowbridge (G8GLQ/P) in the Summerfun contest on 13th July. It was not exactly a good contact: each figure had to be exchanged separately in turn, but they made it after 30 minutes! On Saturday 14th June he worked ON1AHT and FC1GIA, while F1ESA hooked up with G8UWS in Folkestone. Roy also made it to Dave G3MPS in Farnham and Lewis G6HVQ in Hampton Court. The following weekend, conditions allowed reception of G4SHC up in the Peak District of Staffordshire as well as G4CRJ (High Wycombe).

In August he worked our old friend Peter G4LXC/A, now in Maidstone, and in a minor lift on 13th August hooked up with G3MPS again, G8LES (Mike, Alton) and G6HVQ (now in High Wycombe).

On 31st August the Maidstone radio club put on a radio and ATV display at an agricultural rally on Detling Hill, using the callsign G8GRF. Nick G4ZXI brought his TV gear from Headcorn and the various operators worked most of the stations in east Kent.

Earlier in the month, on 10th August, F1ESA came up out of the blue with P5 positive modulation pictures from an old German gun emplacement in the Pas-de-Calais. Unfortunately two metres was as flat as a pancake and no contact was established.

More Summerfun news – it sounds like a popular event! The best DX for Mike G8LES in Hampshire was GW8LIR in Wrexham. Not bad for flat conditions, and probably says something about their sites. Garry G4CRJ also entered the contest but had to withdraw very rapidly as his tower collapsed! The damage has now been re-welded by G6HVQ.

South Wales revived

Good news from South Wales! Eric Edwards GW8LJJ has reformed the Gwent ATV Group and had the old callsign GW8OOJ reissued. Indeed, the Gwent and Glamorgan area is again awakening from the dead. Eric has started his trips around the radio clubs with talks and demonstrations of home-brewed ATV gear. Mike GW4JKV has been diving into the shack debris to retrieve his home-made 70cm upconverter, while Keith GW8TRO has 100mW radiating from a Pye pocketphone. Peter GW4EAI has built a 100mW 70cm transmitter to a *CQ-TV* design and is busy constructing a camera. Interest in the Caerphilly area is supplied by Ray GW8GKF, who has 24cm in mind. Photocopies of relevant information have been supplied to him . . .

In Barry we have Jeff GW6CNS again surfacing to radiate 70cm TV with Wood & Douglas equipment, and tests have been carried out with Simon GW8NVN. Roger GW4UGI has shown interest and is busy with mods to a 1043 tuner as well as sorting out an aerial system. Also in Barry, Eric has come back to ATV after five years and has started from scratch with home-brew gear. Transmitter line-up is 100mW into a 6W transistor linear feeding a 2C39A plus 1kV. 70cm receive is a tuner stripped from a scrap VCR and another using a 1043. The latest receiver is a Philips G11 tuner/IF strip using a modified Mullard U321 tuner and provides composite video out with 12V supply. Antenna at GW8LJJ is an 88-element multibeam at 50 feet.

Work has also started on 24cm equipment: the receiver is already made and a transmitter is progressing with some difficulty. Eric says he has given up the old idea of starting construction at 3am, but he does sometimes carry on until 0130!

Give them a shout on two metres if you are in the vicinity: 144.550 and 144.750 are used in Barry, while in Blackwood they monitor 144.800.

Repeater news

GB3VI (Hastings, AM) is still awaiting its licence and hopes to assume the call GB3SX when this is released by the Crowborough 10 metre beacon. Bob G4BGQ has constructed most of the

NETWORK 934

Andy Emmerson G9BUP

transmitter section and it is reportedly very impressive. It will probably undergo soak testing from his home. The logic rack has been started and 99% of the materials required for this have been donated. Provision is being made for a fourth repeater handler module for future expansion, possibly a digipeater (whatever that is!).

GB3ZZ (Bristol, FM) has passed its second annual general meeting stage in August. A superb site has been found on a high spot in Filton, with a peppercorn rent of just £1 a year. Work is now starting on the construction of the repeater and a licence application has been made. Not many call letters remain unallocated in the GB3 series, so the distinctive GB3ZZ has been requested. This would complement Bristol's other 23cm project, GB3AA, and would give Bristol the dual honour of being first and last in the list!

Slow-scan news

None whatsoever. The SSTVers probably close down and hibernate for the summer! REW

Last month I mentioned the mechanisms which give us lifts or openings, those fantastic days when the band is wide open and 200 mile conversations are commonplace. So far this autumn we haven't been let down, either – early October saw a period of consistent high pressure with some excellent contacts made. Some Cornwall stations were working Northern Ireland, a distance of over 400 miles – does anyone wish to claim a distance record?!?

A lift tonight

How often have you heard "I think there may be a lift tonight" on the air? Sometimes it's pretty obvious and you wonder why people even bother to make such a point, when stations 100 or 200 miles distant are crashing in like locals and the whole band is in chaos. Then the only people who say this are those who have just switched on and can't believe their ears, or perhaps folk who are new to the 32cm band. At other times, though, it may be the middle of the day and the pious operator who offers this opinion may just be voicing 'a feeling in the bones'.

With practice it's quite easy to predict or spot these 'lifts' or 'openings'... if only we could conjure them up at will!

This is not going to be a technical article (the real experts will probably wince at my simplifications!), but I hope I can throw some light on this fascinating subject for those not already 'in the know'.

Tropospheric propagation

The mechanism which extends the reach of our signals is called tropospheric propagation, which occurs during the middle and end of certain weather conditions. This is the same 'mirror in the sky' effect which causes foreign interference to broadcast TV and FM radio reception, adding an extra hundred or two miles to the normal range of radio signals.

To the TV broadcaster and viewer tropo DX is normally a pain. Of course, TV DXers are rubbing their hands with glee, wondering what will turn up on their screens. Obviously any apology caption about foreign interference or the telltale signs of patterning or second picture breakthrough on the screen will send 934ers up to the shack or out in the car to the nearest mountain-top. Only if they are TV DXers as well will there be a conflict of interests!

Mirror in the sky

What causes lifts and when do they occur? And how can you spot them before they happen? Firstly, you should know that our 934MHz radio signals do not only follow the curvature of the Earth: some also shoot beyond the horizon into the sky beyond and are lost for ever in outer space! This is because they are not reflected in the same way that medium and short wave signals are.

There is, however, a layer of the atmosphere which does sometimes act as a mirror to our signals, and thus gives them much greater range than normal. Everyone can then join in, although as usual the better sited stations will do better.

This layer is known as the troposphere, and extends from the ground up to 20,000 feet. It does not normally reflect VHF and UHF radio signals, except when there is a 'temperature inversion' caused by rapid changes in the humidity and temperature in the upper air. When this occurs a reflecting layer is formed: it's a bit like the phenomemon which makes the 'puddles' we sometimes see above a hot road or the mirages in the desert.

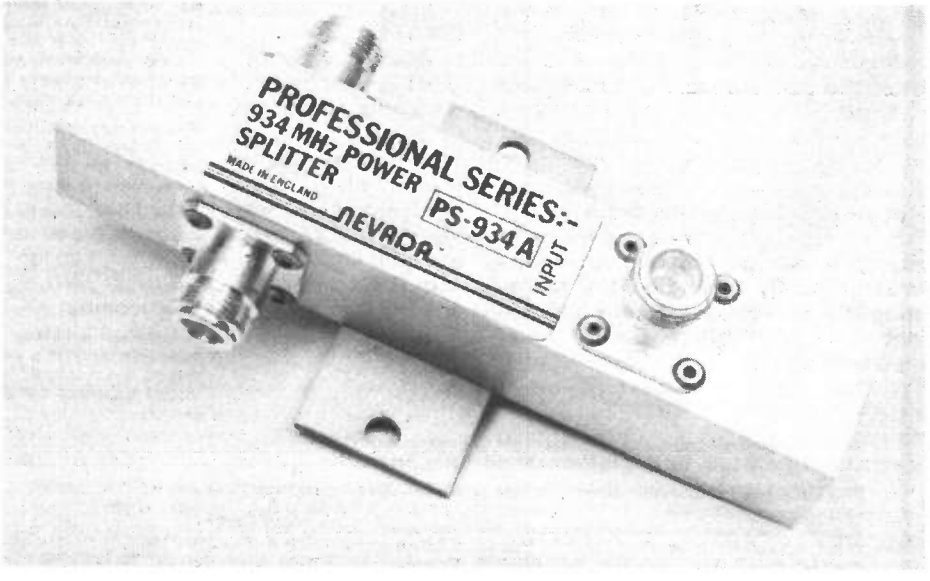
When to watch out

In practice most openings occur in the spring and autumn, when the right weather conditions are most common. More rarely you will get lifts in the middle of summer and even during bright sunny spells in the depths of winter. The critical features are warm weather during the day and a rapid drop in temperature at night. It should be cloudless and settled (no wind) and the pressure should be high.

The most spectacular lifts occur on the trailing edge of a high pressure system, ie on the last day of 'good weather' just before the pressure drops. Usually things will be slightly lively from about tea-time, getting better once the temperature has dropped outside, say 8 or 9pm. Sometimes the lift will get progressively better until about 1 or 2am, while at other times it will fade out with a bang at 11 or 12 (or perhaps all but the most devoted have gone to bed!).

It is worthwhile, therefore, to study the weather forecasts whenever you suspect that a lift may be due: heavy condensa-

If you ever wondered what a power splitter looked like, wonder no more. By adding a second beam antenna and one of these you can theoretically increase the gain of an aerial system by 3dB, ie double the power, although this is never quite achieved in practice



tion on cars and windows and fog outside are also clues.

There are degrees of lift. A weak opening will be adequate for 934MHz voice signals but may not affect TV pictures much. A real crasher will be wide open on all frequencies from two metres to 23cm and above. Despite the DX chaos, local signals are not affected.

Lifts are often directional, running parallel with the isobars (the lines linking points with equal pressure on the weather charts). If a lift persists for more than a day it may well change its orientation and favour signals from a different direction. This explains the so-called east-west and north-south ones.

Ducts and trapping

An interesting effect of some openings is ducting, when the signals are trapped between two of these conducting layers. The signals will not escape until there is some discontinuity in the lower layer. This explains why some signals go straight over the top of some stations: they can hear distant ones but none at medium distance. You may be hearing one station yet a friend only 15 miles away may be working someone completely different on the same channel and on the same beam heading, all because of ducting.

Apart from these high-level ducts you can also get low-level ducts across water. This would help across the Irish Sea and, say, from Kent to Norfolk (*are you sure about the latter – Ed*) but only if you were not too far inland and not very high above sea level.

Switzerland or bust

What are the chances for international DX on 934MHz? Not much at the moment, since the only other country with a 934MHz personal radio service is Switzerland, and that's pushing it a bit (though not impossible) for tropo DX from the UK. Most of the activity in Switzerland is using digitally selected channels and it might be difficult to break in on QSOs. However, a few UK stations are equipped with Swiss sets and are keenly waiting for that first hook-up!

Contact has already been made with France, where there are a few stations with British sets (as well as British 934MHz operators on holiday from time to time). In the near future it is expected that Austria and the Netherlands will adopt the Swiss automatic 933/4MHz system (we may do also), so more international contacts may be in sight.

Incidentally, I did take a trip to Switzerland recently but commitments meant that I did not have the opportunity to sample the Swiss 934 scene as I had hoped. It appears that there are about 2000 active operators there, using mostly Japanese rigs. Certainly the shopkeeper I met had little good to say about the Reftec rigs originally used there – he had a workshop with more than 20 defunct examples! Clearly he didn't know how to get the best out of them, since they can be a very good rig when tweaked with tender loving care.

The only rigs currently on sale are the Clarion JC-10 and the Stabo. The Reftec, Veriphon (Commtel clone), Uniden PC-1010 and Mitsubishi hand-held are no longer allowed to be sold. Beam and collinear antennas like ours are used, and I brought back a fistful of catalogues showing many fascinating accessories. Their club seems to have died, as has the national CB magazine, and circumstances meant I was unable to make any contacts on the air. Next time perhaps!

73

That's it, once again I've used up all my space. I'm still waiting to see some of your reports and QSL cards, so do take time out to drop me a line. REW

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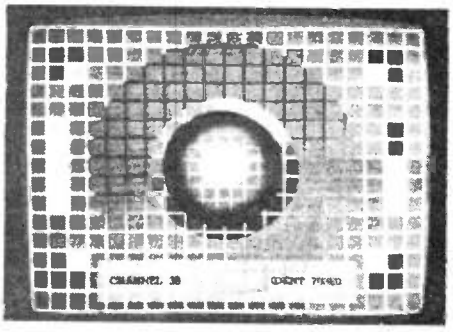
DX-TV RECEPTION REPORTS



Compiled by Keith Hamer and Garry Smith

August got off to a flying start with many days of intense sporadic-E activity. Unfortunately, from the 15th onwards conditions deteriorated dramatically and it was a struggle to receive anything in Band I. Perhaps Hurricane Charlie had something to do with it. In any event, most DX-TV enthusiasts feared a premature end to the season. However, conditions picked up again towards the end of August.

Tropospheric DX in Band III and at UHF has been practically non-existent apart from a few barely detectable signals from France, Belgium and the Netherlands lurking around from time to time.

Mysteries

At least two mysteries arose during August. The first was a Norwegian PM5534 test card carrying the station location 'NORDHUE' in the lower black rectangle. This was seen by Kevin Jackson of Leeds during the morning of the 14th on channel E4.

The odd thing about this reception is that Nordhue is a high power outlet on channel E5, often received by enhanced tropospheric conditions. The most likely explanation is that an E4 relay takes its feed from Nordhue, which is situated some 100km north of Oslo. According to the EBU's *List of Television Stations* there is a relay at Tretten which is geographically close to Nordhue. The ERP is only 9 watts. Kevin has remarked that the signal was fair and the identification was clearly visible.

The second mystery concerns yet another sighting of an Arabic transmission on channel E2. Simon Hamer at New Radnor in Powys noticed black Arabic script upon a white background shortly after 1840 on August 5th. This was during an intense opening from the south-east. There are at least four known possibilities, namely Iran, Dubai, Lebanon and Egypt. The outlets in Iran and Dubai are high power while the ERPs of the transmitters in Lebanon and Egypt are only approximately 1kW. Identification is extremely difficult with Arabic stations simply because very few enthusiasts can decipher the language!

Russian test cards

The Russian UEIT electronic colour test card has been seen on channel R2 during August with various forms of identification. In place of the familiar 'UT 0167' inscription at the top of the test pattern, regional identification from Uzhgorod has appeared (see below). A digital clock caption was featured in the lower portion of the test card.

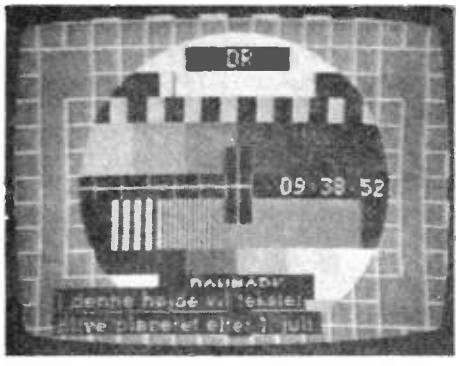
The transmitter is situated close to the border with Czechoslovakia, and although it has been around for some time this test card is rarely reported. It was logged here in Derby on the 4th and by Kevin Jackson on the 14th.

Kevin has managed to notch-up at least ten different forms of UEIT test card identifications over the past year, but only three can be tracked down to specific transmitters. These are as follows:

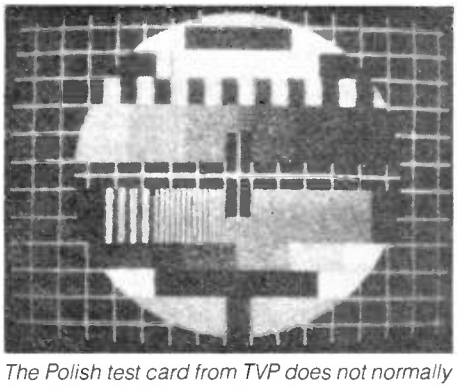
ЛЕНИНГРАД LRRTPC ЧЖГОРОД

These are respectively Leningrad on

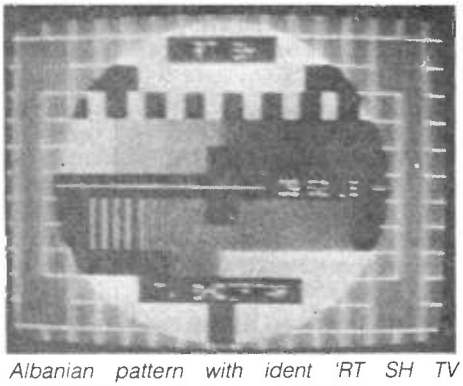
PHOTO FILE ● PHOTO FILE ● PHOTO



PM5534 test card used by Danmarks Radio

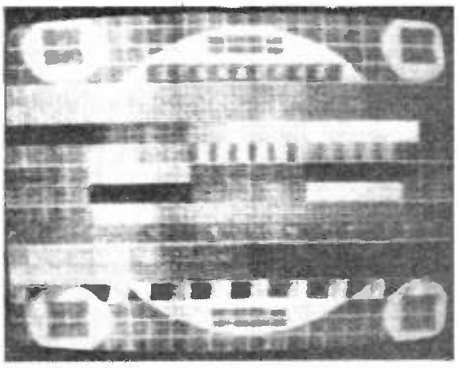


The Polish test card from TVP does not normally carry identification



Albanian pattern with ident 'RT SH TV SHQIPTAR' received on channel IC

Identification caption radiated in West Germany



Russian electronic test card from Leningrad on channel R1

Caption radiated on R1 by TSS in the USSR after close-down

Pics: Thomas Graf (W Germany) and HS Publications

channel R1, Vilnius on R2 from Lithuania, and Uzhgorod on R2.

The remaining unidentified sources are: UT 0167; 2578; 1985 (the 'year' version); UT 14 09 27 (the numbers form a digital clock); ЛПД ЧД

If anyone can supply any further information please let us know.

Log for August

This month we are featuring part of the reception noted by Kevin Jackson of Leeds. As you can see, it's quite impressive!

1/8/86: RAI (Italy) IA with 'RAI 1' PM5544 test pattern at 0839.

3/8/86: TVE (Spain) E3 (2 Txs) on progs at 1420; TVE E4 on progs at 1422; RAI IA progs at 1822; RAI IB (2 Txs) with progs at 1828.

4/8/86: CST (Czechoslovakia) R2 with 'SR1 TV BRATISLAVA' PM5544 test card at 0928; CST R1 on EZO test pattern with 'RS-KH' identification at 0929; RAI IA radiating the PM5544 at 0930; RTU (Radio-Tele-Uno) IA showing the electronic test pattern at 0931; CST R2 on 'RS-KH' EZO pattern at 0932; TVE E2 prog at 0934; RAI IA (2 Txs) with PM5544 at 0938; TVE E3 prog at 0941; JRT (Yugoslavia) E3 clock caption with 'RADIO TELEVIZJA BEOGRAD' superimposed at 0954 followed by 'JRT BGRD' PM5544 at 0956; ORF (Austria) E2a and E3 prog at 1007; JRT E3 with 'JRT RTV-LJNA' PM5544 (Ljubljana) at 1009; RAI IB on PM5544 at 1010; SRG1 (Switzerland) E2 and E3 with '+PTT SRG1' FuBK test pattern at 1014; Canal Plus (France) L3 on prog at 1038; TVE E4 prog at 1039; SSR1 (Switzerland) E4 with '+PTT SSR1' FuBK from La Dôle Tx at 1059; SVT (Sweden) E2 on 'TV1 SVERIGE' PM5534 at 1351; RAI IA prog at 1827.

5/8/86: TVE E2, 3 and 4 with progs from 1527 onwards; RTP (Portugal) E3 prog at 1602; RAI IA progs at 1607; TVE2 E2 vertical stripe test pattern at 1621 going on to the GTE colour test card at 1645 with 'tve tve2' identification; TVE E4 (2 Txs) on progs, also E3 (2 Txs) at 1646; MTV (Hungary) R1 announcer at 1728; TVR (Rumania) R2 showing colour bars at 1735 followed by the 'TVR BUCUREST!' FuBK at 1745; JRT E3 and 4 progs at 1747; MTV R2 progs at 1802; BR1 (Bayerischer Rundfunk, West Germany) E2 prog with the identification 'BR' in the top left-hand corner at 1803; RAI IB prog at 1812; JRT E3 with 'RTV LJUBLJANA' clock at 1829; RAI IA (2 Txs) on progs at 1922; TVE E2, 3 and 4 on progs at 2009 – Spanish transmissions on E2 and E4 were still present at 2200.

6/8/86: RAI IA on 'RAI 1' PM5544 at 0852; SRG1 E2 with '+PTT SRG1' FuBK at 0900; TVE E2, 3 and 4 on progs at 0900; RAI IA prog at 1557; TVE E2, 3 and 4 progs at 1628; TVE E4 (2 Txs) with progs at 1747; RTP E3 progs at 1749; RAI IA (2 Txs) with progs at 2029; Spanish signals noted on E2, 3 and 4 and also RTP E3 as late as 2215.

7/8/86: TVE E3 showing cartoon *Pepé le Phew* at 1634.

9/8/86: RAI IA on PM5544 at 0932; RAI IB with teletext pages at 1033; TVE E2, 3 and 4 noted on programmes at various times during the morning until 1412; Canal Plus L3 progs at 1415; RTP E3 prog at 1419; JRT E4 with regional programme from Zagreb at 1541; JRT E3 with Beograd prog at 1552; JRT E3 with Ljubljana prog at 1605; MTV R1 showing *Video Reklam* at 1614; MTV R2 with similar; JRT E4 with 'JRT SKPJ RTV SKOPJE' PM5544 at 1620; TVR R2 colour bars at 1628; RAI IA (2 Txs) and IB with progs at 1837; JRT E3 progs at 1841; TVE E3 progs at 2101.

10/8/86: RAI IA with PM5544 at 0755; unidentified programmes on R1 at 0844; unidentified film on E3 at 0927; TSS (Russia) R1 prog at 0957; ORF E2a showing 'ORF FS1' PM5544 at 1059; TVE E2 prog at 1018; RTP E3 prog at 1132; TVE E3 (2 Txs) with progs at 1207; SRG1 E2 on '+PTT SRG1' FuBK at 1208; TVE2 E2 prog at 1227.

11/8/86: TVE E2 and 4 on progs at 0918; TSS R2 with announcer at 1149; CST R1 radiating the 'RS-KH' EZO test pattern at 1149; TVE2 E2 with vertical stripes test pattern at 1154; NRK E2 on 'NORGE MELHUS' PM5534 at 1202; NRK E2 on 'NORGE STEIGEN' PM5534 at 1212; NRK E3 on 'NORGE HEMNES' PM5534 at 1216; ORF E2a on 'ORF FS1' PM5544 at 1218; TVP (Poland) R1 and 2 with dark background PM5544 at 1225; TSS R1 showing the 0249 monoscopic test card at 1239; TVE E3 teletext pages at 1253; TVE E4 progs at 1307; RTP E3 on FuBK test pattern with 'RTP LISB1' identification at 1341; SVT E2 using 'TV1 SVERIGE'

PM5534 at 1409; JRT E4 on progs from Zagreb.

There's a lot more, but unfortunately insufficient space to show it.

Reception reports

William Maries of Studley in Warwickshire noted an interesting opening to the north-east on the 11th. The Russian '0249' monoscopic test card was seen alternating at times with another pattern which consisted of horizontal bars, presumably from another TSS outlet. Russian programmes were also spotted simultaneously on channels R1 and R2.

Another opening on the 13th produced Finland radiating the FuBK test card on channel E3 at 1155, while later in the day the Icelandic PM5544 put in an appearance on channels E3 and E4 with the usual 'RUV ISLAND' identification. Perhaps the most exciting discovery for William occurred on August 27th when he received a PM5537 test card on channel R2 carrying the identification 'EESTI TV\ TALLIN'. Chris Howles of Lichfield also noticed this. Reception was from 1105 with a five minute break from 1115 when the test card was replaced by a blank raster which included a digital clock at the bottom.

William has advised that the Ghana Broadcasting Corporation still have transmitters operational on channels E2, E3 and E4. With luck, GBC could be received from the south under exceptional conditions. In fact, Ghana was often seen a number of years ago during the early part of sporadic-E seasons. Unfortunately there haven't been any definite sightings for the past couple of years. Due to major reorganisation at the studios GBC have reduced transmission times, and they now only broadcast between 1745 and 2100. When the work has been completed towards the end of December transmissions will be from 1630 until 2230.

John Bray of St Neots in Cambridgeshire noted an odd transmission one morning during August at 1000 on channel R1. A test pattern consisting of a plain white vertical band down the centre of the screen was resolved, only to be replaced by a multi-burst (frequency grating) pattern. Reception faded before any further clues as to its origin could be gleaned. The most likely country to be using these patterns is Hungary. MTV regularly use the multi-burst prior to the PM5544 test card, but the white bar pattern still remains a mystery.

According to reception by John early one morning, the Spanish TV service (TVE) has altered its traditional opening sequence, which consisted of animated logos and the transmission number. With the advent of breakfast TV, tradition has been swept aside. The GTE colour test card is shown for a short period and is immediately followed by the breakfast TV studio shot with an on-screen clock.

Harold Brodribb of St Leonards-on-Sea reports an active day on the 4th. Several Eastern bloc countries were resolved including test cards from Czechoslovakia (CST) and Russia (TSS). The 'RS-KH' EZO-type electronic pattern was present from CST on channel R1, while on R2 a PM5544 test card was noted with the inscription 'SR1 TV BRATISLAVA'. Harold sent a drawing of a Russian electronic test card which he received on R2 during the same opening. We can confirm that he too has had the UEIT 'Uzhgorod' version of the TSS pattern which included a digital clock in the lower half of the picture.

The Icelandic PM5544 from RUV was seen on channel E4 by both Mark Dent of Leeds and Simon Hamer of Powys on August 3rd. Mark saw it at 0446 while Simon's reception was timed at 2037.

Mark's log for August features most European countries. He too saw the UEIT test pattern from Uzhgorod in the USSR on the 4th and again on the 14th. Also on the 14th, the Russian colour blockboard test pattern (PM5537) appeared bearing the identification 'EESTI TV TALLIN'. This was during a mid-morning intense sporadic E opening.

On August 9th, Simon Hamer noted the *Telejurnal* news programme on channel R2 from TVR in Rumania. On that particular day the MUF rose sufficiently to permit the reception of RTS (Albania) and RAI (Italy), both in Band II on channel IC. The private Italian station of RTU was logged on the 11th with their distinctive electronic test card which carried the identification 'RADIO-TELE-UNO' on channel IA. This was a 'first' for Simon.

Finally, for anyone wondering what had happened to NRK programmes on August 27th, all can be revealed. According to a news item on *Sweden Calling DXers* monitored by Simon, the radio and TV networks in Norway were on strike due to a pay dispute!

AFRTS in Oman

We recently mentioned in *R&EW* that several readers had received transmissions in Kuwait from the American Forces Radio & TV Service intended for personnel in Europe. These broadcasts are apparently picked up from an American satellite and relayed in the Middle East.

Peter MacIver has written from the Sultanate of Oman giving details of his reception. He uses an NEC 14T420 SB colour set fed from a horizontally polarised multi-band VHF/UHF aerial via a National TY-BP 36 mast-head amplifier. The AFRTS broadcasts are received in monochrome on channel 68. Peter has managed to borrow a multi-standard receiver and he reports that near-perfect NTSC colour can be resolved with sound. Apparently the signal is normally scrambled but in recent months the encoding equipment has been switched off.

The best time to receive the AFRTS programmes in Oman is between 1800 and 2000 local time (1400 to 1600 GMT) while the sun is setting, although the quality is good enough during the morning for 'casual viewing'. Programmes are mainly American sports events, although the *Today* show is relayed live from the USA between 0800 and 1000 GMT.

Multi-band VCR

It has come to our attention that the Solavox 1404 VCR, currently available from Comet at £299.95, has a multi-band tuner fitted as standard. Band switching is accomplished by means of switches positioned adjacent to the appropriate tuner pre-setter. The video cassette recorder will, presumably, cater for SECAM reception, since a switch beneath the front flap is marked 'PAL or DDR'; the TV service in East Germany uses the SECAM system. The VCR covers Bands I, III, IV and V.

The recorder also features a four-event timer and infra-red remote control. We understand that a similar machine, known as the Alba 4000, is available through some high street retailers.

Free DX-TV info sheet

We have received a number of letters from newcomers to DX-TV enquiring whether there is any information available which covers the basic techniques involved in long-distance TV reception. An information sheet has been produced to cater for DX-TV enthusiasts who have little practical experience with the hobby. A free copy is available from: HS Publications, 17 Collingham Gardens, Derby DE3 4FS. A 17p stamp should be sent with requests for this information sheet to cover postage.

Service information

RUMANIA: Due to an ever increasing lack of energy (*eh?-Ed*) the Rumanian TV service (TVR) now radiates programmes on only one network. TVR-1 is broadcast on weekdays between 2000 and 2200 local time. Longer transmission hours are available at weekends. The test card is radiated from 1945 until 1955, at which time a TVR identification caption is shown, accompanied by the rather lengthy national anthem. Programmes begin five minutes later with the news bulletin *Telejurnal*.

DENMARK: Danmarks Radio have introduced a new dimension to their teletext service. A selection of pages from the Swedish and Finnish TV networks (SVT and YLE) is now included. This could be slightly confusing for DXers receiving teletext from Denmark.

This month's service information was kindly supplied by Gösta van der Linden (Netherlands) and Michael Summers Larsen (Denmark). REW

MEDIUM WAVE DXING

by Steve Whitt

This month I've taken the opportunity to bring you a report on a very interesting DXpedition that visited Anglesey in September. I've also used the examples of some of the DX heard to illustrate an item on time-keeping and the MW DXer. It's not often that DXpeditions take place, and they illustrate just about every aspect of MW DXing; especially knowing when and where to listen.

Local radio news

Following up on an item a couple of issues ago regarding BBC Essex, this station has now chosen its operating frequencies and is ready to start full programming at 0600 (local time) on 5th November. BBC Essex will have its main studio block in Chelmsford, close to the site used by Marconi for his pioneering broadcasts earlier this century. To celebrate this historic connection the Marchesa Maria Marconi has been invited as guest of honour at the station's official opening ceremony.

Over 100 hours of local programmes are planned each week, aimed at a potential audience of 1.5 million. BBC Essex has had to abandon its original MW frequency of 558kHz (occupied by R Caroline) but is now using 729kHz, 765kHz and 1530kHz to cover the county – yet another set of frequencies to succumb to all-night Radio 2 relays. In fact at night very nearly one third of all MW frequencies carry Radio 2 relays!

Report from Anglesey

For the week 13/20th September four intrepid DXers (John Faulkner, William Davies, Mark Hattam and myself) ventured to the island of Anglesey in order to convert an isolated farmhouse into a DX nerve centre.

This DXpedition had been planned some months in advance to make the most of MW DX conditions around the period of the autumn equinox. In previous years the equinoxes have often yielded some of the best DX, and on top of this autumn 1986 happens to coincide with the 'sunspot minimum'. Sunspot cycle 21 has nearly ended, with solar activity at its lowest for over a decade. The potential for excellent DX was there.

Unfortunately the day before our arrival on the island there was a significant disturbance of the ionosphere which upset reception of signals from North America.

On our arrival the first task was to get an aerial up for the first night, but it was only after several hundred metres of wire had been supported on bamboo canes that we realised that farm animals have a strange affinity for aerials! Indeed, it took a herd of vandalistic bullocks just seconds to destroy a couple of hours' work.

Having resolved this problem with the farmer and re-erected the aerial we settled down to a long night of DX. One of the best things about a DXpedition is not having to get up for work in the morning; in fact after all-night sessions we usually ended up going to sleep around 7 o'clock.

By the third day we had three Beverage aerials up, having moved one from NW to SW after we realised that Latin America was the dominant source of signals. The receivers in use were a Drake R7A, a Drake TR7/RV7, a CR100/2 and my trusty R390A/URR, and these were coupled to any of the three Beverage aerials: 400m length on 320° bearing, 250m on 280° bearing and 250m on 245°.

Useful directionality

These aerials were (as expected) very directional; indeed, it was possible to switch between the NW wire and the SW wire whilst tuned to 1026kHz and completely separate the co-channel signals from Downtown R in Northern Ireland and ABC Tramore in the Irish Republic.

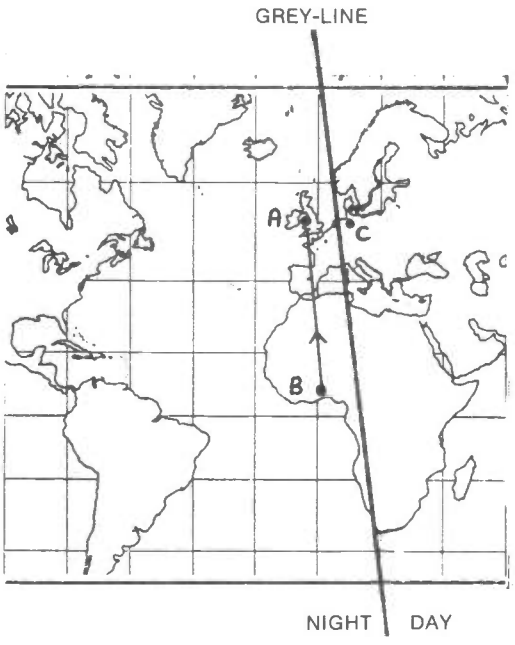
Well, what did we hear? Not a lot from North America (especially early in the week), quite a few Caribbean stations and plenty of South Americans. In addition several Africans were noted, as well as one Chinese station. Ironically, CJYQ in Newfoundland, usually one of the easiest stations to hear, was barely audible most of the time.

China calling

The first DX would come in around 2100hrs (China) followed by Brazil around 2200. By 0300-0500 stations in the prairie area of Canada and the USA were audible and during the subsequent hours, towards dawn, reception veered back to Argentina and Colombia. Even 45 minutes after local sunrise good DX signals were still being heard, since the normally interfering skywave signals from continental Europe were being absorbed in the sunlit regions of the ionosphere.

The table lists some of the most

AFRICA:	R Kwara, Nigeria 612kHz at 0500 ORTM Nouakchott, Mauritania 1349kHz at 2200
ASIA:	R Beijing, China 1521kHz at 2100
N AMERICA:	GRF, Qeqertarsauq, Greenland 650kHz CFRY, Portage la Prairie MB 920kHz CJCA, Edmonton AB 930kHz CBR, Calgary AB 1010kHz CKXL, Calgary AB 1140kHz KSL, Salt Lake City UT 1160kHz CJVR, Melfort SK 1420kHz KGA, Spokane WA 1510kHz
S AMERICA:	R Carve, Montevideo, Uruguay 850kHz R Nacional Buenos Aries, Argentina 870kHz R Rio Cuarto, Argentina 1010kHz R Tupi, Rio de Janeiro, Brazil 1280kHz R Dos Mil, Cumana, Venezuela 1500kHz R Minuto, Barranquilla, Columbia 1520kHz Also an unidentified 250W Brazilian on 1510!
CARIBBEAN:	NBS, Trinidad & Tobago 610kHz ABS, Antigua 620kHz Voice of Barbados 790kHz



A = Anglesey
B = Ilorin, Nigeria
C = West German station

Diagram showing the grey-line at 0500 UTC in mid-September

interesting stations heard, out of a total of around 65 DX stations located in 18 countries.

As an intensive exercise in DXing, there is little to beat a DXpedition. In just a few days (or rather, nights!) it is possible to observe changing propagation patterns and reception conditions; conditions which are usually overlooked when DXing is restricted to just a couple of hours at a time on occasional days.

Time-keeping

Owning the best radio in the world and the biggest aerial will not open the door to the DX world unless you know when to listen. For MW DX it is normally essential for a complete path of darkness to exist between the transmitter site and the listening site. If more than an hour of daylight exists, stations are unlikely to be heard over great distances irrespective of their power.

One intriguing aspect of DX which is not widely exploited is known as grey-line DX, which in its simplest form can be considered as an enhanced propagation path following the line formed on the Earth's surface at the boundary between day and night. This technique is little used on MW since many DXers in the UK concentrate on transatlantic stations.

As an illustration of this technique I'll take the case of our reception in Anglesey of Radio Kwara from Nigeria. This is an example of grey-line DX, but it also illustrates the significance of knowing station schedules. R Kwara is located in Ilorin, Nigeria and signs on at 0440UTC with a programme in English and Hausa. At this time during the equinox both Britain and the path to Nigeria are in darkness; in fact the path falls directly on the grey-line.

The fates conspire

R Kwara is not the sole user of 612kHz, but circumstances conspired to allow regular clear reception of this station every day we were in Anglesey. Also to be found on this frequency are powerful stations in Germany and the USSR, but by 0430 their transmitter sites are in complete daylight, ie on the wrong side of the grey-line. In addition RTE in Dublin and Medi-1 in Morocco use 612kHz, but they sign on at 0500 and 0530UTC respectively. Thus R Kwara could be heard for up to 45 minutes with excellent reception; this situation, however, would only exist for a few weeks each year as it depends on seasonal changes, and the effects of summer time on station schedules. REW

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QSO

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

Improved Spectrum RTTY (Sept '86)

In view of the problems encountered using the basic loader (program III), I decided to get to the bottom of things by typing in the listing as it appears in the magazine. Much to my horror the program did not work. The problem lies with the Basic program being so large, due to the mass of data statements; the machine code generated overwrites the end of the Basic.

I must confess at this stage that although the code that is generated by this program is perfectly correct, I did not use this program to generate my code! Anyway, to cut a long story short, may I suggest the following minor modifications, which I *have* tested.

☐ In program III, add

```
25 CLEAR 39000
```

and change lines 40 and 110 as follows:

```
40 FOR A = 39000 TO 39865
110 FOR A = 41232 TO 41295
```

☐ Run the program, which will now generate the code at a higher address, and save the code to tape using

```
SAVE "rtty.obj" CODE 39000,3600
```

☐ Reset computer and load in program I.
☐ Break into the program (in the usual Spectrum way) and change line 500 to:

```
500 LOAD "rtty.obj" CODE 29000
```

☐ Run the program and allow it to load the code produced by program III. Then use the 'save memories' option on the menu to save a nice tidy copy of the whole program.

Well that's about it except to apologise for any inconvenience caused by these errors, and to hope that when readers get the program working they will not be disappointed with its performance.

Incidentally, it struck me when modifying program III that it will probably not work at all on a 16K machine, although I am confident that if users of these create the code on a 48K machine (or buy my tape!), then it will work. However, I have no means of verifying this – does anybody still use 16K machines?

TV news

The latest *CQ-TV*, journal of the British Amateur Television Club, carries the first article in what is due to become a regular column entitled *Satellite TV News*. This one is written by Charlie Suckling G3WDG, although judging by the intro he may not be the regular correspondent, and he has also penned an article in this issue about building a satellite TV receiver.

As if that wasn't enough about satellite TV, there is also a circuit for a tunable sound demodulator by Dave Crump G8GKQ, as well as various smaller items about equipment (including an ad from a new supplier of home-brew modules, Silverstone Electronics of Northants).

Despite the wealth of satellite info, there is plenty of space devoted to other aspects of ATV (the mag runs to 88 pages, produced to the usual high standard). So if you don't want to miss out, membership application forms are available from Dave Lawton G0ANO, 'Grenehurst', Pinewood, High Wycombe, Bucks HP12 4DD. Membership costs £5 per year or £1.25 for each remaining quarter (subs fall due on 1st January).

Data transmission

On the subject of club journals, the latest issue of *Datacom* is now available. This is published by the British Amateur Radio Teleprinter Group, and has a similar format to *CQ-TV* (card cover, A5 size, 104 pages). BARTG, for those who are not too familiar with the group, promotes all aspects of amateur data communications (fax, AMTOR, packet etc) as well as teleprinting.

The latest *Datacom* includes a feature on 5-unit codes and construction details for a digital audio filter based on the MF10 chip (we'll be publishing a feature about this chip ourselves in the near future).

Membership costs £7 in the UK and Eire, £10 in Europe, £10 overseas surface mail and £16 overseas airmail. The membership secretary is Mrs Pat Beedie GW6MOJ, 'Ffynnonlas', Salem, Llandeilo, Wales SA19 7NP.

RDF to Radar

RDF to Radar is the subject of a forthcoming meeting of Chelmsford Amateur Radio Society, to be held on 2nd December at the Marconi College, Arbour Lane, Chelmsford.

The venue seems appropriate, Chelmsford being the centre of Marconi's pre-war operations. The town still has divisions of the company resident, with Marconi buildings almost everywhere one turns.

Details of CARS are available from Roy G3PMX and Ela G6HKM, 1 High Houses, Mashbury Road, Great Waltham, Essex CM3 1EL.

On the move

The Lagan Valley Amateur Radio Society has changed its address, and now meets at Harmony Hill Art Centre, 54 Harmony Hill, Lisburn, County Antrim, Northern Ireland. Meetings are on the second Monday of each month (except July and August), commencing at 7.30pm. Further information is available from Jim GI4TCS QTHR, telephone (0846) 682474.

Raynet in Worcester

Worcester and District ARC are hosting a talk on Raynet on 1st December, and offer a warm welcome to any visitors to this or any other of their meetings, which are held every two weeks on a Monday night at 8pm. The venue is The Odd Fellows Hall, New Street, Worcester.

Calling all winos

They seem to be starting their Christmas celebrations early in Bristol, with home-brew wine sampling on the list of forthcoming events for the South Bristol ARC, this meeting being scheduled for 19th November.

Along slightly more serious lines, Ken Harvey G5KT will be giving a lecture on amateur radio in the 1930s on 3rd December.

Meetings are held every Wednesday at Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. More details are available from Len Baker G4RZY, c/o 62 Court Farm Road, Whitchurch, Bristol BS14 0EG. Telephone (0272) 834282.

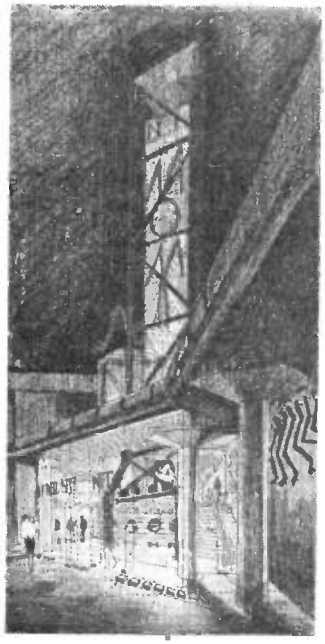
The British Vintage Wireless Society puts out an excellently produced newsletter, whose editor was present at the preview

The Baird Televisor of 1930, a 30-line vision-only mechanical disc television receiver

Ben Clapp (top) was Baird's first engineer in 1926, while William Fox, now 97, was a close friend of the inventor

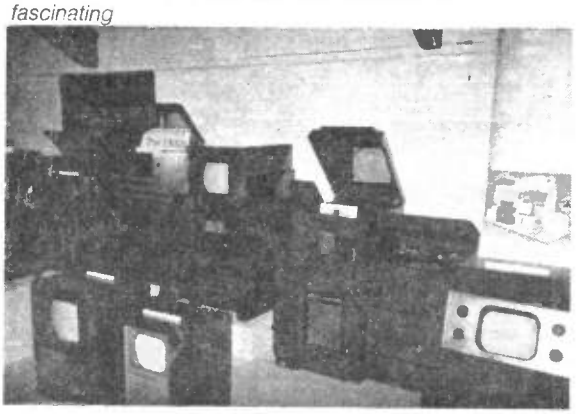
Television in the Home 1926-1986

An exhibition was mounted recently at the Royal Festival Hall to promote the Museum of the Moving Image, which is due to open next year next to the National Film Theatre on the South Bank. Despite the dubious title (they've gained 10 years or so on the history of home viewing), the preview was fascinating, due in large part to Ben Clapp and William Fox recounting their early experiences of TV with Baird.



An arty-farty architect's impression of the museum

The selection of sets on display didn't include very much from the '20s, but was nevertheless fascinating



A reproduction living-room of the '50s. The TV was showing scenes of the Coronation when I took this pic

G4ULD, who is also a Group Scout Leader, supervising the electronic construction project which proved a hit for so many Scouts attending the Surbiton District Scouts JOTA station GB2BG. The project was for each Scout to assemble a multivibrator-driven flashing LED display from kits of parts provided by the Wimbledon & District Amateur Radio Society

The National Museum of Photography, Film and Television has published this booklet to celebrate 50 years of television, and it is well worth buying for the illustrations alone (£1.50 + 75p p&p from the shop at the museum, whose address is Princes View, Bradford, W Yorks BD5 0TR)

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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 tinned 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.

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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!

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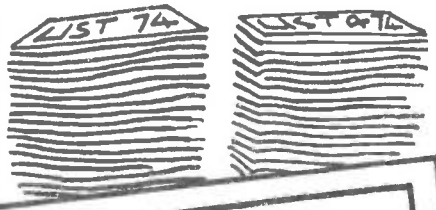

IC OF THE MONTH
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The data leaflet explains how to connect and program the IC and has a number of demonstration programs to get you started. After that, it's up to you to work out your own sounds, or just program it at random and see what comes out! 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).

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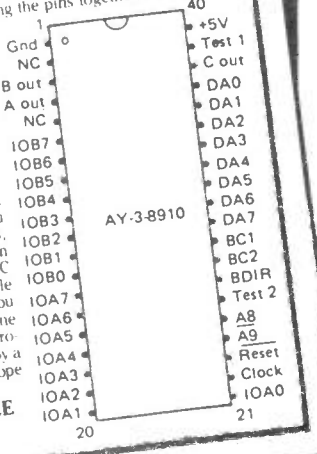
DATA LEAFLET 50p



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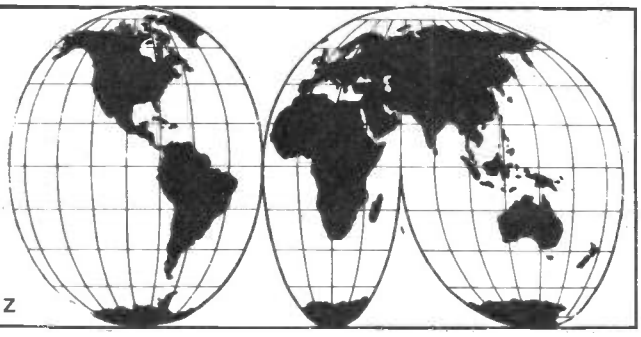
Please send your order to the address above. There is no VAT to be added, but please include a 60p contribution towards postage and packing.

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

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

The prime time for reception here in the UK of the signals from the far-flung islands of Indonesia is from mid-September through to mid-March, the main peak during October and November being followed by a secondary rise during February. The season starts with barely audible transmissions which, with the passage of time, gradually rise in signal strength until many of the transmitters are audible at reasonable signal strengths almost daily. The most favourable times to listen are from 1500 to 1700 and from around 2200 to 2400. From past experience, the former period produces the best results.

Radio Republik Indonesia

RRI stations tend to sign on around 2200 to 2300 and sign off the following day, in UK terms, from 1500 to 1700. The Indonesian stations of interest to UK DXers are those of the government owned Radio Republik Indonesia (RRI). The main transmitter is located in Jakarta, this feeding material and programmes of national interest to networks of regional and local stations.

All are required to relay the Jakarta originated Programa Nasional news bulletins *(warta berita)*, this sometimes leading to identification confusion. Upon hearing the announcement "Inilah Radio Republik Indonesia Programa Nasional, Jakarta", which precedes all news bulletins, be aware that on most occasions the transmission being logged will not be direct from Jakarta but will be a regional relay, eg that from Yogyakarta.

Sign-off is usually preceded by quotations from the Holy Quran, announcements in Indonesian (Bahasia Indonesia, developed from Malay and officially adopted as the national tongue in 1949) and finally *Rayuan Pulau Kelapa* (Love Ambon), the song of the Coconut Islands, rendered on a Hawaiian guitar.

About Indonesia

Formerly the Dutch East Indies, Indonesia is comprised of some 3000 islands in the Malay Archipelago. The capital is Jakarta in the north-west, its port, Tanjungpriok, being the largest in the country, exporting coffee, minerals, rubber and tea. The capital was renamed Jakarta in 1949, having been founded as Batavia by the Dutch in 1619.

The dominant religion is Islam, recitations from the Holy Quran often being a feature of DXers' Indonesian reception reports. The population is mainly Malayan and Papuan, the Chinese forming the largest minority.

Island groups of Indonesia are principally the Sundas Islands, which includes Borneo, Java and Sumatra, the Lesser Sundas, including Bali and part of Timor, the Moluccas, the Riouw Archipelago and West Irian.

DXing Indonesia

Although dealing here primarily with those transmitters operating on the 60 metre band (**4750** to **5060**) it will often prove convenient in the first instance to tune to the out-of-band frequency of **4719** where, if the prevailing conditions allow, one will hear signals from the 'marker' station RRI (Radio Republik Indonesia) Ujung Pandang slowly gaining in signal strength from around 1500 onward. At 50kW it is on the air with programmes for the local populace from 0855 to 1605, although the closing time, like the frequency, can vary slightly. The channel is a clear one, Ujung Pandang being commonly reported worldwide.

A 'marker' station is one whose transmissions can be used to indicate conditions on the band affecting signals from a particular area of the world.

Searching for and logging the Indonesians on the Tropical Bands is far from an easy matter where the radiated powers are less than 10kW. Even those rated at 10kW may be classed as difficult for UK DXers.

RRI Ujung Pandang appears again on **4753** where it is scheduled from 2055 to 0030 but radiates irregularly. At 20kW it is widely heard and frequently reported in the SWL press. The frequency is variable. Ujung Pandang is located in Propinsi Sulawesi Selatan, literally Province Celebes South.

Going up

Next in ascending frequency order is RRI Medan on **4764.2**. With a power of 50kW it operates from 2100 to 0300 (Sunday from 2300 to 0800), from 0500 to 0800 and from 0900 to 1600. Not often heard in the UK, it was logged by the writer at 1525 during January last. Medan is located in Propinsi Sumatera Utara (Province Sumatra North).

Frequently logged here in the UK and world-wide are the signals emanating from RRI Jakarta in Java (Jawa) on **4774.5**. Programa Nasional is scheduled on the air from 2158 to 0100 and from 1500 (but recently reported at 1330) to 1705. Programa Khusus (municipal, ie locally originated programmes) from 0100 to 0200 (Sunday from 0800 to 1500). The power is 50kW.

Then there is the rarely heard RRI Fak-Fak in West Irian (Irian Jaya) on **4788** varying to **4789** with a power of 1kW, being on the air from 2030 (variable) to 2315 and from 0730 to 1330 or sometimes 1400. I class this one as super-DX!

In the Moluccas (Maluku), RRI Ambon is on the air from 2100 to 0015, from 0330 to 0600 and from 0800 to closing at either 1500 or 1600. The frequency is **4845.3** and the power is 10kW. The 1500 sign-off time largely bars us from logging this one. From 1400 one is more likley to hear the signals from Radio Malaysia in Kuala Lumpur (50kW) if conditions are very good – the latter signs off at 1500. A late night listening session will almost certainly result in the reception of signals from the 100kW Nouakchott in Mauritania. Note, however, that RRI Ambon does sometimes close at 1600, in which event, if you happen to be on frequency and the Indonesians are coming through well, count yourself fortunate indeed.

AROUND THE DIAL

If you can hear 'em then you can log 'em! The following information will provide a means to that end.

AFRICA

Cameroon

Radiodiffusion du Nationale Cameroun, Yaounde on **4850** at 1816, YL (contraction for young lady, in the radio world signifying a female) with a talk in French in the National Service, which is in French and English. Yaounde is scheduled on the air from 0400 to 0700 and from 1630 to 2400. The programmes in English are timed from 0505 to 0600 (Sunday until 0645) and from 1705 to 1845 (Sunday from 1730). News bulletins in English are at 0530, 1800 and 2100. The power is 100kW. Yaounde was founded by Germany circa 1895, later becoming the capital of French Cameroon, and is now the capital of the Cameroon Republic.

Benin

ORTB (Office de Radiodiffusion et Television du Benin), Cotonou on **4870** at 2025, YLs with a song and chants in a local vernacular complete with African drums as a backing. The Home Service in French and

vernaculars is on this channel from 0400 (Saturday from 0545, Sunday from 0600) to 0800 (Saturday until 1100, Sunday through to 2300) and from 1300 to 2300. There is sometimes an English newscast at 2000.

Egypt

Cairo on **12050** at 1842, YL with a talk then OM (contraction for old man, a male) with the station identification in the Arabic transmission for Europe, scheduled from 0700 through to 2350.

Ghana

GBC (Ghana Broadcasting Corporation), Accra on **3366** at 2032, OM with a review of recent local events. GBC2 programmes entirely in English on this frequency, which makes station identification a relatively easy matter for newcomers to short wave listening. The schedule of this 50kW transmitter is from 0530 to 0805 (Saturday and Sunday until 0900) and from 1505 to 2305.

Ivory Coast

RTI (Radiodiffusion Television Ivoirienne), Abidjan on **6015** at 0559, choral/orchestral rendering of the National Anthem, OM with the station identification and frequencies in French at sign-on, OM with the news followed by some announcements and a programme of local pops. The timing of this French transmission is from 0600 to 1600.

Rwanda

Kigali, Rwanda on **3330** at 1803, OM with a newscast in French. The Home Service logged here is in Kinyarwanda, Swahili and French from 0300 to 0600 (Sunday until 2100), from 0900 to 1200 (Saturday until 2100) and from 1330 to 2100 with newscasts in French timed at 0430, 1115, 1600, 1800 and at 1930. The power is 5kW.

Zambia

ZBS (Zambia Broadcasting Services), Lusaka on **4910.4** at 0410, OM with a talk at the end of which the station identification was announced, all in a vernacular during a Home Service programme. In vernaculars and English on this channel, Lusaka broadcasts from 0355 to 0530 and from 1530 to 2105 (Saturday and Sunday until 2205) with a power of 50kW.

CENTRAL AMERICA

Antigua

BBC Relay on **9510** 0525, OM in Engish with a news review in the World Service transmission for North America, timed from 0430 to 0915.

Cuba

Radio Rebelde (Radio Rebel), Havana on **5025** at 0249, YL with a pop song in Spanish. This one is reportedly on the air from 2330 to a closing time varying from 0400 to 0540. The power is 50kW, Radio Rebelde being heard and reported by short wave listeners world-wide.

Nicaragua

La Voz de Nicaragua, Managua on **6015** at 0424, OM with a shouted political speech in Spanish until 0450 with many mentions of Nicaragua. At 0540 retune, YL with a talk then OM with the station identification at 0545 in the English External Service scheduled from 0430 to 0600. Signal wiped out at 0559 when Abidjan, Ivory Coast opened on schedule.

SOUTH AMERICA

Colombia

La Voz del Cinaruco, Arauca on **4865.2** at 0404, OM with a newscast in Spanish with mentions of local place names such as Barranquila. LV del Cinaruco is scheduled from 0900 through to 0400 (Sunday until 0200) with a power of 1kW in the Caracol network, and identifies as *La Voz de la Frontera* (The Voice of the Frontier).

Ecuador

HCJB Quito on **6230** at 0332, YL with a religious talk in English during a programme for North America, scheduled from 0200 to 0700.

Brazil

Radio Educacao Rural, Campo Grande on **4755** at 0422, OM with some announcements in Portuguese then into a programme of local pops. The citizens of Campo Grande can receive programmes from this station from 0800 (Sunday from 0900) to 0500 (Sunday until 0400) with a news bulletin every half hour. The power is 10kW.

Radio Nacional de Tabatinga, Benjamin Constant on **4815** at 0313, OM with a talk in Portuguese. At 10kW, this Radiobras station is on the air from 0900 to 0300 but on some weekends works around the clock.

Venezuela

Radio Mundial (Radio World-wide) Bolivar, Ciudad (Town) Bolivar on **4770** at 0347, OM with a folk ballad in Spanish after the station identification. The power is 1kW and the schedule is from around 0900 to a 0400 sign-off. When on this frequency, however, note should be taken of the fact that there is now a newcomer in the shape of Radio Andina de Arequipa, Arequipa, Peru, operating around the clock with a power of 10kW.

ASIA

Bangladesh

Dhaka on **6240** at 1917, music in the local style and YL with a song then OM with announcements in the Bengali presentation to Europe, timed from 1900 to 2000.

Taiwan

VOFC (Voice of Free China), Taipei on **15440** at 1900, OM with the station identification in Chinese, the National Anthem, OM with annoucements then YL with a newscast in the Chinese programme directed to Europe from 1900 to 2000.

SOUTH-EAST ASIA

North Korea

Pyongyang on **9345** at 2000, interval signal, OM with the station identification, then the National Anthem followed by an announcement of the times and frequencies on which the English transmissions may be heard, all in the English programme intended for Europe and scheduled from 2000 to 2100. Also heard in parallel on **6576**.

PACIFIC

Australia

Melbourne on **17715** at 0842, YL with the sporting news in English in the Asian Service, on this channel from 0100 to 0900. At 0900, YL with the station identification and sign-off, enabling reception of faint signals from an unlisted co-channel Chinese transmitter thought to be CPBS Beijing.

NEAR & MIDDLE EAST

Iraq

Baghdad on **9690** at 0507, YL with a news bulletin in an Arabic transmission for the Middle East, scheduled from 0230 to 1500 and from 1630 to 2300.

Baghdad on **13650** at 0608, OMs with songs in Arabic and musical backing in the local style. The schedule is unknown at the time of writing.

Kuwait

Radio Kuwait on **9840** at 0459, YL with songs and music in an Arabic language offering to the Middle East timed from 0230 to 1510.

Turkey

Ankara on **15220** at 1917, YL with a song together with local style music during the Turkish programme for Europe, scheduled from 0400 through to 2150.

CLANDESTINE

Radio Caiman (Radio Alligator), OM with an anti-Cuba talk in the Spanish transmission to Central America on **7470** at 0040. This one is thought to radiate from 0000 to 0400.

NOW HEAR THIS

Radio Candip, Bunia, Zaire on **5066** at 0342, OM with announcements in French followed by some music in typical African style. With a power of 10kW, Radio Candip is on the air with the Home Service in French, local vernaculars and Swahili from 0330 to 0545 (Sunday until 1915) and from 1330 (Saturday from 1030) to 1915.

NOW LOG THIS

Radio Nacionale Progreso, Loja, Ecuador on a measured **5060.6** at 0423, OMs with talks in Spanish, promos and announcements with echo effect, OM with the station identification, then the National Anthem and carrier off at 0525. At 5kW, RN Progreso is scheduled from 1000 to closing around 0500 (variable). REW

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■ Valves, all brand new and boxed. Quality manufacture; Mullard, Mazda etc, over 1,000 must be sold from 10p each. Just ring or write (sae please) for a quote on the types you require. Also approx £100 value assorted electric/electronic parts, components, motors, etc, well worth viewing. Best offer over £20 accepted. K Bailey, 30 Seymour Close, Selly Park, Birmingham B29 7SD. Tel: (021) 472 3688

■ 70cm hand-held Trio TR3500 for sale or swap for 2 metre equivalent, as new condition, realistic offers. John Lowe, 23 Hoylake Drive, Tividale, Warley, West Midlands. Tel: Dudley 58549

■ SX200 AM/FM scanning receiver, with MPU, vgc, £195. 680R Super Tester AVM, unused, still boxed, £35. Advance A/M SG62B signal generator, 150kHz-220MHz, with manual, £40. N Porter, 23 Calder Court, Britannia Road, Surbiton, Surrey KT5 8TS. Tel: (01) 390 2650

■ Radio shack clearance: communication valves, half to quarter list price, most boxed, eg QQV06-40A, QQV02-6, QV03-12, QQV03-20A, GR10M, G180/2M, G1/371K, 866A, 829, 931A, CV187, CV136, CV1076, CV1219, CV1178, A2599, A2900, A2426, DET22, 807. Valves for the T/R19, R1155, R1132, R107, R109, C12, W/S18, W/S21/22, T/R29, W/S38, R209, R210. Valves for practically all ex-WD receivers, plus all Eddystone receivers from 345 to 770. Marconi/Racal etc Rx valves also. Hill/Shaw, 86A High Street, Poole, Dorset BH15 1DB. Tel: Poole 680500 or 622051

■ Trio 20MHz oscilloscope model CS-1566A. Only had about two hours use from new, £175. Tel: (0246) 854495 (Chesterfield)

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■ Tandy Realistic DX302 digital comms receiver, 0.1-30MHz, £175. Two metre convtr, 28MHz IF, £16.50. Base stn CB, Harvard H-407, £60. ZX81 computer, new, £15. Spectrum 48K, £40. Datacrdr, £15. Games £1 each. Sony ICF2001, £75 with power supply. 2 metre 141-179MHz hand-held rcvr, £80. HF ATU, home-built, not working, £2. All plus postage. Nicad charger, four HP-7s, £2.50. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: (01) 674 0513

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■ Manual or any information on Kay DRM1 memory rhythm machine to help disabled OAP pass time when not DXing. Mr Turner, 5 Alexandra St, Thorne, Doncaster, S Yorks DN8 4EE. Tel: (0405) 813694

■ Cheap working or complete but non-working 6C6, 6D6 HRO Rx for rebuild or spares, with or without coils and power unit. Also Heathkit alignment generator model HFW-1 in full working order with manual and any correction sheets. Service sheet or manual for original metal-cased All Systems Sinclair Microvision, or how to get the metal case off without damage to insides? M J Shepherd, 66 Westerland Avenue, Canvey Island, Essex SS8 8JS

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*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Oct 86	14 Aug 86	20 Aug 86	22 Aug 86	11 Sep 86
Nov 86	11 Sep 86	17 Sep 86	19 Sep 86	9 Oct 86
Dec 86	16 Oct 86	22 Oct 86	24 Oct 86	13 Nov 86
Jan 87	13 Nov 86	19 Nov 86	21 Nov 86	11 Dec 86

CONDITIONS & INFORMATION

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

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

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

Printed — web-offset.

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

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

Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.

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

SAA5000A £1.50
SAA5012A £5.00
SAA5020 £3.50
SAA5030 £5.50
SAA5040 £3.50
SAA5040A £5.50
SAA5050 £5.50
SAF1032p £2.50
SAF1039 £2.00
SAS560 £2.00
SA5660 £1.00
SAS670 £1.00
SL901B £4.50
SL918 £4.50
SAA5052 £5.50
SAA5043 £5.50
SAA5051 £5.50
TA7122 £1.15
TAA320A 50p
TAA470 £1.50
TAA570 75p
TAA611B 50p
TAA621 £2.00
TAA661 50p
TAA641 £1.50
TA7117 50p
TA7120P 50p
TA7315AP 50p
TA7607AP 40p
TA7609P 50p
TBA120A 40p
TBA120AS 50p
TBA120SA 40p
TBA120B 40p
TBA120SB 40p
TBA120SQ £1.00
TBAS120U 75p
TBA120Q 30p
TBA120C 40p
TBA1441 £1.00
TBA231 75p
TBA395Q 50p
TBA396Q £1.00
TBA396 75p
TBA440P £1.00
TBA1440C £1.00
TBA480Q £1.00
TBA520 £2.00
TBA530 £2.00
TBA540 £1.00
TBA550Q £1.75
TBA560CQ £2.00
TBA570 £1.50
TBA625 50p
TBA641 £2.00
TBA651 £2.00
TBA673 £1.00
TBA720A £1.50
TBA750Q £1.50
TBA780 £1.50
TBA800 50p
TBA810AP 60p
TBA810S 60p
TBA820 60p
TBA890 £1.00
TBA900 £1.50
TBA920 £1.50
TBA920Q £1.50
TBA950 £1.50
TBA990Q £1.00
TMS1000NL £2.00
TMS1943 clock chip £1.00
TMS9980 £4.00
TMS9901 £1.00
TMS2716JL £1.00
TMS3529 £1.00
TMS3720ANS £3.00
TMS4014 70p
TX-012 £1.00
TMS9902 £1.20
ULN2216 75p
SN29848 50p
SN29770BN £1.00
SN29771BN £1.00
SN29772BN £1.00
SN7402N £1.00
SN7472N £1.00
SN74107 £1.00
SN74167 70p
SN7472N 20p
SN75108AN £1.00
SN76001 £1.00
SN76003 £1.00
SN76013ND £1.50
SN76018 £1.00
SN76008 £1.00
SN76023N £1.50
SN76033 £1.50

Diodes

BY127 10p
BY133 10p
BY134 10p
BY164 50p
BY176 25p
BY179 40p
BY184 25p
BY187 10p
BY190 40p
BY196 30p
BY198 10p
BY204/4 8p
BY206 8p
BY208/800 8p
BY210/400 5p
BY210/800 10p
BY223 60p
BY224/600 4.8A/ 600v bridge £1.00
BY226 15p
BY227 15p
BY228 20p
BY229/400 30p
BY237 5p
BY254 10p
BY255 30p
BY298 10p
BY299 10p
BY406 8p
BY527 20p
BY407a 10p
G11,470M/250V SP £1.00ea
Min 12volt relays 75p
R1038 40p
R1039 40p
R2009 80p
R2010b £1.00
R2029 50p
R2210 60p
R2257 60p
R2265 50p
R2305 50p
R2306 50p
R2322/2323 pair 80p
R2323 15p
R2396 50p
R2461 80p
R2030 50p
R2443=BD124 40p
R2737 40p
R2738=TIP41 30p
R2775=TIP41c 40p
R3129=TIP47 40p
S2008b 80p
2SC940 £1.00
BU 105/04 80p
BU 108 £1.00
BU 124 50p
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
BUW 84 30p
BUY 71 £1.00
TIC 106A 30p
TIC 116m 40p
TIC 116n/Y 1003 35p
TIC 126N 40p
TIC 206m 30p
TIC 225S 40p
TIC 225E 40p
TIC 226m 30p
TIC 236m 30p
TICV 106D (T092 case 2A/400V) 10p
TIP 29 20p
TIP 30 35p
TIP 30A 35p
TIP 30B 40p
TIP 30C 45p
TIP 31 30p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 50p
TIP 36C 70p
TIP 41B 40p
TIP 41D 70p
TIP 42/BRC 6109 30p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 102 30p
TIP 112 30p
TIP 115 50p
TIP 117 50p
TIP 120 35p
TIP 125 35p
TIP 130 30p
TIP 131 25p
TIP 136 30p
TIP 140 50p
TIP 640 50p
TIP 2955 35p
T6032 30p
T6036 40p
T6040 40p
T6047 40p
T6049 40p
T6051 40p
T6052 40p
T9004 40p
T9005 40p
ZTX 102c 10p
ZTX 107 10p
ZTX 108c 10p
ZTX 109k 5p
ZYX213 5p
ZTX341 10p
ZTX342 10p
ZTX384 10p
ZTX451 10p
ZTX550 10p
MJ 2253 60p
MJ 3040 60p
MJ 2209 10p
SP 8385 50p
SAB 3205 £1.00
SAB 4209 £1.00

Computer Transformer 20v/2.25A; 20v/1.5A; 17/5A; 19/5A; 28/05A £3
Mains ViewData Torroidals £3.75
240V/240/6V/4 amp/6v 500m/a in / out

BD 517 30p
BD 519 30p
BD 534 30p
BD 544 30p
BD 595 30p
BD 610 30p
BD 646 30p
BD 676 30p
BD 678 30p
BD 681 30p

Voltage Regulators

-5V/UA78P05SC 30p
-5V/LM79MO5CP 25p
-8V/79M08c 30p
+6V/78M06c 30p
+10v/78LA10 20p
LM 337 30p
LM 342/18 30p
LM 340T 5.0 50p
+12V/LM 340T12 50p
+15V/78M15 15p
+18V/MC/8M18 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 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BCW 71R 30p
BYF 1202 10p
BYF 1204 10p
BYF 3126 40p
BYF 3214 40p
BYX 10 6p
BYX 36/600 35p
BYX 38/300 25p
BYX 49/600R 75p
BYX 55/350 10p
BYX 55/6000 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BVY 95C 12p
BYZ 106 10p
BPW 41 15p
BYW 56 2/A1000v G11 8p
BZU 15/24 54p
BZY 93c75 50p
BZV 15/18 30p
BZV 15/30 30p
BZW 70c6v2 10p
BZX 79.3v 10p
BC414 10p
BC416 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
BCX32/36 pair 75p
BCX32 25p
BD116 25p
BD124 50p
BD124 (metal) 60p
BD130Y 25p
BD131 30p
BD132/238 30p
BD135 25p
BD136 30p
BD138 30p
BD176 25p
BD182 £1.00
BD183 70p
BD202 60p
BD204 60p
BD221 20p
BD222 30p
BD228 30p
BD226 20p
BD233 30p
BD235 30p
BD239 15p
BD243c 30p
BD244 50p
BD250a 30p
BD252 20p
BD253B 50p
BD331 20p
BD332 20p
BD373b 20p
BD416 25p
BD433 25p
BD437 25p
BD439 50p
BD501 30p
BF761 30p
BF858 30p
BF871 30p
BFR39 15p
BFR52 7p
BFR79 15p
BFR81 15p
BFR87 10p
BFS60 10p
BFT42 20p
BF694 10p
BF758 30p
BF760 30p
BFT34 15p
BFT43 10p
BFT84 8p
BFW11 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
BTY80 20p
BSX19 17p
BSX20 17p
FT3055 30p
TCE82 30p
2N930 5p
2N2221 8p
2N2222 8p
2N2906 10p
2N3055 40p
2N3566 10p
2N3702 10p
2N3711 10p
2N3583 50p
2N3904 15p
2N4355 10p
2N4442 £1.00
2N4444 £1.00
2N5296 40p
2N5983 30p
2N6099 40p
2N6109 40p
2N6130 50p
2N6133 20p
2N6348 20p
2N6399 10p
2X 2N6099 on heat sink 50p
2SA437 20p
2SB407 Sanyo TO3 10p
2SB474 30p
2SB566 10p
2SC381 10p
2SC458 50p
2SC515 10p
2SC732 10p
2SC733 10p
2SC1030 £1.00
2SC1172A 10p
2SC1173 10p
2SC1419 20p
2SC1546 20p
2SC1725 20p
2SC2068 20p
2SC2073 8p
2SC2122A £1.00
2SC2229 15p
2SC7350 15p
2SD180 TO3 80v/6A 15p
2A 15p
2SD200 £2.00
2SK30A 10p
3C107 10p
3C108 10p
3C109 5p
3C113 10p
3C114 10p
3C115 10p
3C116 10p
3C117 20p
3C119 20p
3C125 10p
3C126 10p
BC139 10p
BC140 30p
BC141 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
BC173 10p
BC174 10p
BC183 10p
BC184 10p
BC204 10p
BC207 10p
BC212 10p
BC213 10p
BC214 10p
BC237 10p
BC238 8p
BC239 10p
BC250 8p
BC251 10p
BC252 10p
BC262 10p
BC263b 20p
BC294 30p
BC298 10p
BC300 30p
BC301 30p
BC303 30p
BC307 7p
BC308 7p
BC309 10p
BC327 10p
BC328 10p
BC328/338 pair 15p
BC337 10p
BC338 10p
BC347 10p
BC349b 10p
BC350 20p
BC365 10p
BC384 10p
BC394 10p
BC413 10p
SN76110N £1.00
SN76115AN 50p
SN76131 50p
SN76141N £1.00
SN76226 £1.00
SN76227N 60p
SN76228N £1.00
SN76270 £1.00
SN76532N 50p
SN76544N £2.00
SN76545 £3.50
SN76546 £1.00
SN76550 30p
SN76552 30p
SN76570 £1.00
SN76620 50p
SN76650 50p
SN76660N 40p
SN76620AN 50p
SN76666 £1.00
SN76705N £1.00
SN7670N 75p
SN76708AN 75p
SN76720 £1.00
UA783P3C 40p
BT100A/02 40p
BT138/10A 70p
BT146 30p
TBA540Q £1.50
TCA270 £1.00
TCA270Q £1.00
TCA640 £1.00
TCA660 £1.00
TCA270S £1.00
TCA270SQ £1.00
TCA740 £1.00
TCA800 £4.00
TCA830 £1.00
TCEP100 £2.25
TCE120CQ £1.00
TDA440Q £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 80p
TDA2004 £2.00
TDA2010 £1.00
TDA2140 £3.50
TDA2030 £2.00
TDA2525 £1.00
TDA2640 £2.00
TDA2522 £1.00
TDA2530 £1.50
TDA2532 £1.00
TDA2540 80p
TDA2541 £1.00
TDA2575A £1.00
TDA2581 £2.50

10 Mixed TV & radio speakers £4.00
2x Hi-Fi Philips car tune up tweeter EN8320 £10.00
ITT CVC45 8 way resistor unit for v/cap £3.00
.700/10v x 10 50p
68/16 x 10 50p
150/16 x 10 50p
47/25 x 10 50p
220/25 x 10 50p
1/250 x 10 50p
8 Speaker £1.00
x48r £1.00
TDA2590 £1.00
TDA2593 £1.00
TDA2560 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 £1.50
TDA2561A £4.50
TDA9403 £3.00
TDA3651AQ £3.00
TEA1009 50p
UPC1365 £3.00
SN74LS 125AN 30p
SN174LS 248 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

Philips Cartridges

GP412 £6.00
GP412/11 £6.00
GP406 £6.00

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
AC188 15p
AC188K 15p
ACY21 25p
AD143 50p
AD149 50p
AD161/162 pair 40p
AF139 25p
AF181 £1.00
AF239 25p
AF367 25p
AL102 £1.75
BC161 30p
BD507 50p
BD509 30p
BD510 30p
BD517 30p
BD519 30p
BD534 30p
BD535 30p
BD544D 30p
BD562 30p
BD610 40p
BD646 50p
BD676A 30p
BD678 50p
BD681 25p
BD807 20p
BD826 50p
BD948 30p
BDX75 20p
BDX32 £1.25
BF115 20p
BF121 20p
BF127 20p
BF137 20p
BF157 20p
BF160 20p
BF161 20p
BF164 60p
BF179 30p
BF180 20p
BF181 20p
BF182 20p
BF184 20p
BF194 10p
BF195 10p
BF196 10p
BF197 12p
BF198 10p
BF199 10p
BF200 20p
BF222 10p
BF224 15p
BF238 20p
BF240 16p
BF244 40p
BF245b 20p
BF256 10p
BF257 20p
BF258 25p
BF262 15p
BF263p 25p
BF264 15p

PHILIP

Philips stereo headphones min £3.50
Philips solder irons 25w mains £4.00

8000/30v 50p
470/40v x 10 £1.00
22/100v x 10 £1.00
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
022/1kv 10p

Automatic Telephone GEC answering machine with new plan plug £35.00

VM6101
MULLARD TELETEX DECODER
With interface panel and data command panel
New £6 Post £2

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts **50p**

Panel Meters

2½x2¾ gray front. 300v meter and 1M/A **£2.50**

Philips headphones, stereo electrodynamic £10

8 SEG LED Display with driver I.C 50p

MODEM
Line Terminal Unit
VM6501 £4.00
Designed to work at 1200/75 or 1200/1200. Diagram and Connection Data Supplies

Indicator Tube

ITT 58705 £1.00
8 Seg Display FND500 20p
ITT Micro Phone M5 50p
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** 1.5 battery
TA/12v 2 pin battery lead **30p**

Phillips CD Headphones SBC482 £10

Various Tools and Accessories

Philips microphone SBC 466 £10.00
Philips 'The Credit Card' calculators, solar powered £6.00
Philips dual power calculator SBC 1833 £10.00
Hills MR TRRs HT520, HT420 £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 300Ω £1.50
L.C.D. clock display with alarm 75p
=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
Freeze £1.20
Foam Cleaner £1.20
Contact Cleaner £1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona All at £1.20
Push Button Mains 75p
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00
Mains timer, 13 amp – up to 2 hours, easy to use, plugs into socket £3.00
Sellotape PVC Electric Insultation 50mm x 20M 70p
Screen locking agent, large can £1.50
20 GEC Service Manuals & Rank £5.00
Red E.H.T. LAED and Anode Cap £1.00
10 x G11 Cap 470/250 £15.00
Weller solder iron 15 watt/25 watt £5.00
2 way baby alarm/intercom with long leads £5.00
Phillips universal battery tester/charger, fuse/bulb tester to clear £4.00
Hitcachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 60p
70ML Silicone Sealer (clear) £1.00
100 Coax Plugs £10.00
De-solder pump – 2 nozzels Philips £5.00
Plastic box for i.c.s. 6" x 3" x 1½" 50p
Flat Red LED 12p
500gm 60/40 solder reel £7.00
Clearweld glue pack 30p
Dual v/u meter – 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 £16.00)

100 W/W Res £1.50
BF 199 20 for £1.00
10x20 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

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 £1.50
10A £1.50
Mixed ribbon cables £1.00
25 LEB red/yellow/green £1.50
201/C Holders £1.20
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 50p
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
1,000 Diodes, Condensers, Resistors on Bandolier £2.00
Lucky Dip 600 gram £1.00
Jungle Bag 5kg £5.00
20 Knobs £1.00
40 Pots, ¼" +6mm spindles for audio/TV £3.00
20mm Fuse Holders
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
Pocket Personal Model 3000. AC-DC & resistance range 2000mv-400v – 200Ω-2000 £24.00

SENDZ COMPONENTS

63 Bishopsteignton, Shoeburyness, Essex SS3 8AF
SAME DAY SERVICE
All items subject to availability. No Accounts:
No Credit Cards, Postal Order/Cheque with order
Add, 15% VAT, then £1 Postage.
Add Postage for overseas
Callers: To shop at 212 London Rd, Southend.
Tel: 0702-332992
Open 9-1/2.30-6 GVMT + school orders accepted on official headings add 10% handling charge

TELECOMMS BUMPER CATALOGUES

CB £1
934 MHz £1
29 MHz £1

Each catalogue is packed full of info. and includes a £2 voucher.

2 MTR EQUIPMENT

2 MTR HANDHELD
CTE. CT1600

A superbly sensitive new handheld covering 142-149MHz
- Repeater shift
- High/low power 1.5/0.5 Watt
- Thumbwheel selector

£199

VHF MOBILE AMP

B110 144MHz 110 Watt W/Pre Amp	£169
B42 144MHz 40 Watt	£64.66
LA05435 144MHz 45 Watt	£69.75

934 MHz PERSONAL RADIO

CYBERNET DELTA 1 TRANSCEIVER

- Scan
- Memories

£355

£459

NPR 900 934 MHz Handheld
We are the UK's leading distributor of 934MHz equipment. Send £1 for our full catalogue containing technical info and details of this exciting New Radio Band. Catalogue includes £2 voucher.

29 MHz BASE ANTENNAS

NEVADA TC52 ½ WAVE

This top class half wave uses high grade aluminium and a low loss coil handling up to 1 KW
WIND RESISTANCE:-75 MPH
GAIN:- 2.5 dB
FREQ:- 28-30MHz

£27.82

NEVADA TC58 5/8 WAVE

Using high grade aluminium and a low loss coil complete with small radials this antenna is our most popular amongst the 29MHz fraternity.
POWER:- 1kW
GAIN:- 3.5 dB
FREQ:- 28-30MHz
LENGTH:- 6.6 MTRS

£29.75

SALIUT 3/4 WAVE

Using a unique base hoop this antenna offers exceptional ground wave coverage on 10 FM
POWER:- 2kW
GAIN:- 4.5 dB
FREQ:- 28-30MHz
LENGTH:- 9.1 MTRS

£49.72

RF AMPLIFIERS

All amplifiers except broadband models are tuned for 29.6MHz centre freq. Should you require a lower freq. i.e. 28.5MHz please state when ordering. Export models available for 26-30MHz.

MOBILE AMPLIFIERS
C.T.E. MOD 767

£49.90

76 Watts FM
INPUT:- 0.5-10 Watts
SWITCHABLE:- Class AB, Class C
SUPPLY:- 13.8 Volt
REMOTE CONTROL FACILITY

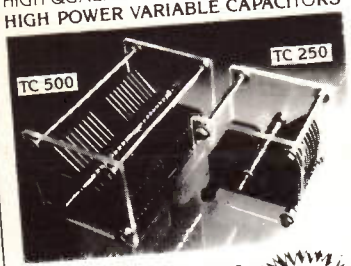
C.T.E. MOD 737 50W FM AM/SSB/CW	£44.76
C.T.E. MOD 767 80W FM AM/SSB/CW	£49.90
C.T.E. MOD 757 150W FM Broadband	£116.87
ZETAGI B35 25W FM 26-30MHz	£22.23
ZETAGI B150 70W FM 26-30MHz	£49.96
ZETAGI B300 150W FM (2-30MHz)	£136.00
NEVADA TC35 30W FM 26-30MHz	£23.75

MAINS OPERATED AMPLIFIERS

C.T.E. DC9 Solid State 150W FM (Broadband)	£198.31
ZETAGI B132 150W FM Solid State (Broadband)	£119.00

NEVADA AMATEUR PRODUCTS

HIGH QUALITY BRITISH MADE
HIGH POWER VARIABLE CAPACITORS



IDEAL FOR ATU's OR AMPLIFIERS

£27 plus £2 p&p

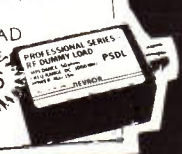
TC 500
(13-500) pF variable cap.
2mm air gap. 7.8kV B/Down voltage.

£19.95 plus £1 p&p

TC 250
(13-250) pF variable cap.
2mm air gap. 7.8kV B/Down voltage.

NEVADA PSDL
PROFESSIONAL DUMMY LOAD

£36



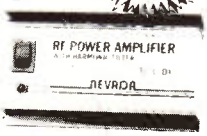
FREQ:- DC to 3,000 MHz
POWER:- 15 Watts
Made to the highest standards. This unit is a must for UHF, VHF and HF operators, offering wide Freq. coverage at an affordable price.

NEVADA

HIGH QUALITY BRITISH MADE 29MHz FM PRODUCTS

NEVADA TC35 DX
R.F. POWER AMP. WITH HARMONIC FILTER

£23.75



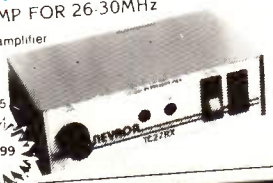
INPUT:- 1-4 Watts
OUTPUT:- 25-30 Watts
SUPPLY:- 13.8V DC
FREQ.- 26-30 MHz

Can be centred on 29.6 MHz or 28.5 MHz (state which). A new top quality amp. which now features harmonic filter to reduce harmonic O/P

NEVADA TC27 RX
RECEIVER PRE-AMP FOR 26-30MHz

A superior low noise pre-amplifier for 29MHz FM operation. Variable gain -6dB's to +16dB's suitable for use with transceivers up to 25 Watts output

£23.99



NEVADA TM27
ANTENNA MATCHER

Ideal for both home and mobile use this matcher really works allowing full coverage of the 10 MTR band and handling 100 Watts

£11.64

TC2
2 WAY ANTENNA SWITCH

A robust unit with unique double screening handling up to 200 Watts and exceptionally low insertion loss.
FREQ.- 1-100MHz

£6.81

NEVADA TC27 RXM
MOBILE PRE-AMPLIFIER FOR 29MHz FM

An F.E.T. low noise pre-amplifier with variable gain. Designed to improve reception on even the best transceiver.
GAIN:- -6 to +20dB's

£19.95

TELECOMMS

HOTLINE (24 HOURS)
0705 662145

189 LONDON ROAD, PORTSMOUTH, HANTS, PO2 9AE,
TELEX 869107 TELCOM G

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TRADE ENQUIRIES WELCOME.

WORLDWIDE DISTRIBUTORS OF AMATEUR & PERSONAL RADIO EQPT.