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Radio & Electronics World

The communications and electronics magazine

THE R-2000: TAKING A LOOK AT A NEW RECEIVER

RTTY: DATA TRANSMISSION FOR THE SPECTRUM

IC240 MOD: MORE CHANNELS & REMOTE CONTROL

FM AERIALS: CHEAP AND SIMPLE HOME CONSTRUCTION

PHOTOGRAPHY: TAKING PICS OF DISPLAYS, VDUs ETC

DATA FILE: VMOS POWER FETS

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Editor
Duncan Leslie

Editorial Assistants
Jane Berry
Angela Hall

Advertisement Manager
Marian Vidler

Publisher
Peter Williams

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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 – All trim and proper – new trimmers from Citec (p10)

Bottom – Spectrum software from G1FTU (p8)

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REGULARS

READER SERVICES

NEXT MONTH

☐ **Next Issue**
Cover date March 1986 on sale Thursday, 13 February

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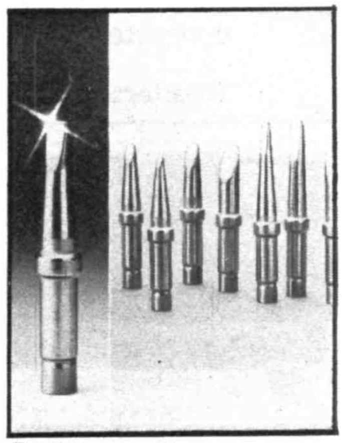
Second Thursday of the month preceding cover date



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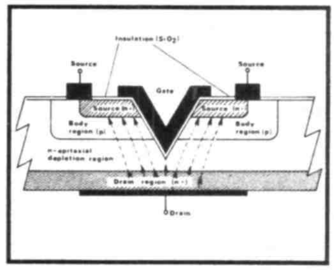


Anatomy of a VFET – page 33

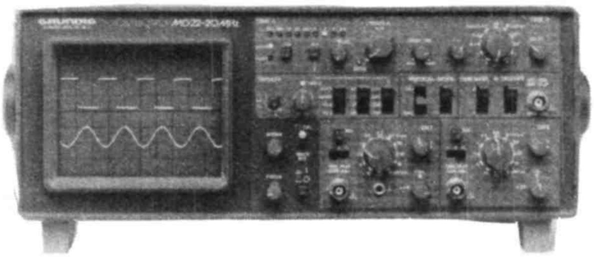
Bad news for bad boys – page 12

Ah so! R-2000 – page 21

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



DIG THAT GRUNDIG

Now available exclusively in the UK from Electronic Brokers, the Grundig MO-22 dual-channel 20MHz oscilloscope is the world's first general-purpose low cost oscilloscope to feature signal-controlled automatic timebase selection, so that the correct timebase is always selected for the incoming test frequency.

The instrument, which also features a separately triggerable second timebase for error-free amplification of selected portions of traces, incorporates several other features which are designed to make it easy to use in a variety of applications.

The MO-22 features a continuous rotary potentiometer control in place of the conventional stepping switch for manual timebase selection. In conjunction with built-in processing circuitry which provides automatic switching of the timebase from one range to the next, this provides soft-tuning of the timebase range, backed up by an unambiguous reading of the range selected on the row of LEDs.

The use of a separately triggered second timebase means that additional features such as trigger delay are unnecessary, while an automatic peak-value trigger facility means that triggering will always occur in the correct time range without any need for readjustment – even where frequency and amplitude changes occur.

Unlike many low-cost oscilloscopes, the MO-22 does not suffer from automatic blocking of the Y-channel because of the X-deflection signals, so that a dual-channel display can easily be obtained in the X/Y mode for the comparison of traces and results.

Electronic Brokers Limited,
140-146 Camden Street,
London NW1 9PB.
Tel: (01) 267 7070.

LCR METER

New from Advance House of Instruments is the Soar Model 5700 digital LCR meter, which provides a wide selection of measurements including contact resistance on switches and relays, internal resistance of batteries and junction capacitance in semiconductors.

The Model 5700 features auto-ranging and a measurement mode which automatically selects the optimum range in measuring unknown component values. Two 3½-digit light-emitting diode (LED) displays, each with a maximum reading of 1999, are provided for indication.

The LCR meter also has a dc voltage output for driving analogue recorders and comparators. Other features include a measurement frequency of 1kHz ±5%, a measurement time of 1s, a sampling time of approximately 10 times/s, and an external bias of 0-50V dc.

Advance House of Instruments,
Raynham Road,
Bishop's Stortford,
Herts CM23 5PF.
Tel: (0279) 55155.

CARRYPACK

A new low cost portable digital display meter from Royston Electronic Systems Ltd measures and generates voltages between 0 and 199.99mV with an accuracy of ±30μV. The unit also measures ambient temperatures between 0 and 50°C with an accuracy of ±0.1°C. This additional facility is particularly useful for temperature compensation when the unit is used for calibrating thermocouples. The 4½-digit display incorporates 'over-range' and 'battery-low' indicators.

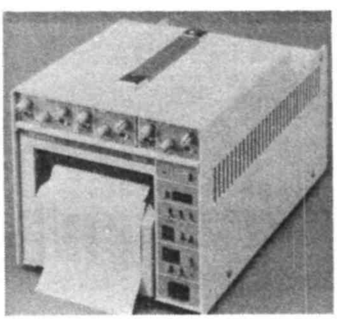
The unit has widespread applications, including laboratory calibration of transmitters and recorders. It measures only 180mm × 100mm × 44mm and has a rugged ABS plastic case with a built-in tilt stand for bench operation.

Royston Electronic Systems Ltd,
48A Kneesworth Street,
Royston,
Herts SG8 5AH.
Tel: (0763) 47709.

THERMAL RECORDER

New from Gould Electronics Ltd is the TA550 thermal recorder, designed to provide Y/t and X/Y recording for industrial, laboratory and biophysical applications.

The TA550 utilises an



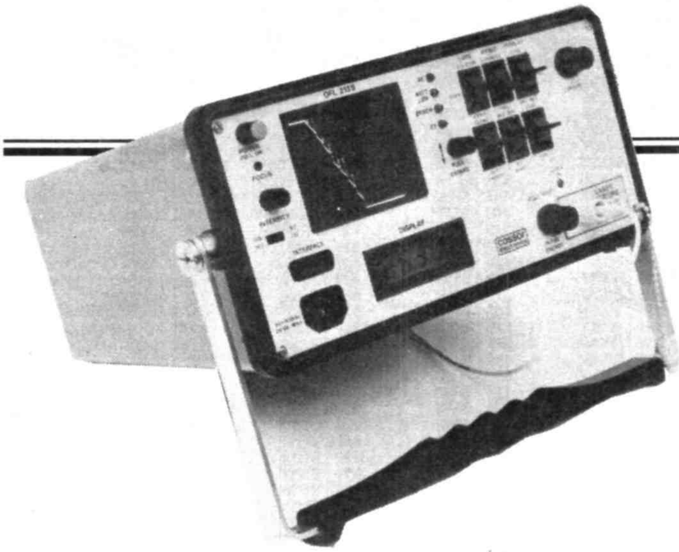
innovative writing system which has a special linear thermal array head, with in-line heating elements placed at a rate of 6 dots/mm across the 4-inch chart width. A microprocessor-based drive system determines which elements will respond to the multiple inputs appropriate to each line.

Providing up to three channels of information, the recorder also offers on-chart annotation of states such as channel identification, scale, elapsed recording time and event marker line.

With a 1 millisecond sampling rate, the TA550 has a frequency response of 50Hz and a peak capture rating of 2ms to ensure capture and recording of even highly-variable signals. Pre and post-event triggering are also provided to enable recording of only the required signals, thereby saving chart paper.

Available options include IEEE-488 and RS-232C interfaces, an expanded 64Kbyte buffer memory and channel limit switches.

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



OPTICAL FAULT LOCATOR

A new model in the Cossor optical fault locator range which has been specifically designed to handle single mode fibres at 1300nm wavelength up to distances of 40km is now on sale.

The model, the 213S, is a further development of Cossor's existing 213 model which handles fault location in multi-mode fibres. As with the 213, the new model is extremely portable, weighing only 8kg, and is designed for use in the field. It measures 290×290×150mm and its rechargeable batteries provide a minimum of three hours continuous use. Both equipments now have automatic splice or connector loss measurement, a feature which was only available manually before.

Multi-mode fibres have so far been used mainly for low bit rate applications, but as the need to replace long distance conventional cabling becomes more urgent, single mode fibres, with their greater dynamic range and capacity, will be more frequently used. This is particularly so in telecommunications. Cossor therefore are confident that their new 213S model will meet a growing demand to fault locate over greater distances of fibre optic cable.

Cossor's 213 range of OFLs accurately detect and locate long range faults, splices and connector loss. The OFL213 has a dynamic range of 25dB and the OFL213S has a dynamic range of 20dB. Attenuation can be measured to better than 0.1dB accuracy by positioning the dual cursors on the integral CRT display.

The 213S model comes with a choice of connector, a biconic and an FC, both single mode connectors, designed to meet the varying demands of the international market. It has an ergonomic, easy to use front panel control, combined with a bright CRT screen and LCD display which is easy to read in most field conditions.

Cossor Electronics Ltd,
The Pinnacles,
Elizabeth Way,
Harlow,
Essex CM19 5BB.
Tel: (0279) 26862.

FREQUENCY STANDARD

Completely new circuitry in the Quartzlock Model 2A frequency standard is contained on a CAD PCB. The latest design operates using current and 1988 BBC transmissions. Outputs of 1MHz and 10MHz are accurate to 2 parts in 10^{11} long term, and medium term to 1 part in 10^{10} with no additional drift, ageing or temperature coefficient.

Uses include the calibration, audit and certification of frequency meters, counters, timers, signal sources and generators, and radio telephone test equipment. The new model 2A uses a ferrite antenna, but external input is provided.

The CAD PCB can be retrofitted on earlier Gould Advance OFS2B and Quartzlock Model 2 receivers.

Dartington Frequency Standards manufacture the Model 2A under licence to Quartzlock Defence Systems.

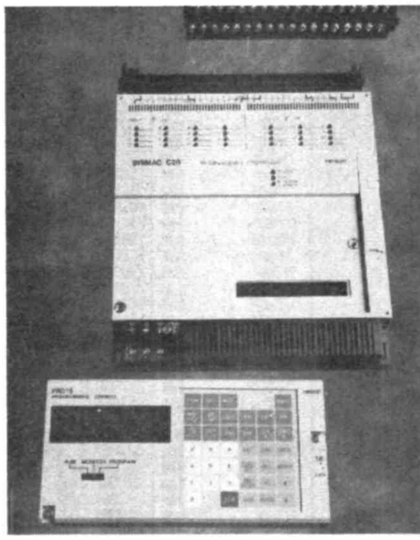
Dartington Frequency Standards,
Moor Road,
Staverton,
Devon TQ9 6PB.
Tel: (080 426) 282.

I/O CONTROLLER

IMO have announced the launch of a new programmable controller (PC), the C-20.

With a capacity of 140 inputs and outputs, the C-20 with its P1192 instructions is ideal for controlling single machines or processes.

It is recommended as a first time user PC because it has many features such as a 484 digit counter, maths capability, 1K memory etc which are very easy to use and normally only available on PCs with larger I/O capacities and larger price tags.

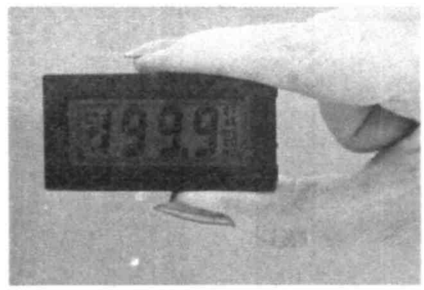


As part of the new C-series range the C-20 is fully compatible with all the other C-series central processors and peripherals, and can also utilise the advanced fibre optic communications of the range, allowing full data transfer within and beyond the system. Hence the C-20 can be used as a stand-alone unit or be integrated into a C-series based control system of virtually infinite size.

IMO Precision Controls Ltd,
1000 North Circular Road,
Staples Corner,
London NW2 7JP.
Tel: (01) 452 6444.

MINIATURE DPMs

A new range of miniature LCD DPMs, designed and manufactured in the UK, has been introduced by Lascar Electronics. All types utilise surface mount techniques to vastly reduce the overall size. The DIL format is claimed to make the meters particularly easy to use by low or high volume users. Each meter is also supplied with a 'snap-in' bezel for fast fitting.



Standard features include auto-zero, auto-polarity, 200mV fsd, programmable decimal points and low battery indication. A range of useful engineering symbols is incorporated on the LCD. Three different versions are available with character heights of 15mm, 12.5mm and 10mm. The DPM400 with its 10mm (0.4in) character height is the world's smallest off the shelf DPM. It retails at £16.95.

Lascar Electronics Ltd,
Module House,
Whiteparish, Salisbury,
Wiltshire SP5 2SJ.
Tel: (07948) 567.

LINEAR ACTUATOR

Portescap UK have combined the low power features of a precision miniature dc motor with an ovoid rotary gearbox to produce a powerful linear motor drive.

The linear output is derived from an M5-threaded shaft passing through an internally threaded gear nut which forms the final stage in the gear train driven by the motor. Because of the very high reduction ratio, the linear thrust force developed by the shaft is 400N at 20mm per minute.

Measuring 63 × 40.2 × 16.5mm, the motor gearbox assembly can be fitted to suitable M5 lead-screws of any length to provide powerful linear motion and holding torque.

Portescap (UK) Ltd,
204 Elgar Road,
Reading RG2 0DD.
Tel: (0734) 861485.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

HA1338	7.50
HA1339	2.33
HA1342	2.65
HA1350	3.27
HA1366	4.02
HA1366WR	1.86
HA1367	4.32
HA1368	1.90
HA1368R	2.45
HA1370	3.71
HA1374	8.80
HA1374A	8.80
HA1377	3.96
HA1389	2.39
HA1389R	2.05
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HA17723	5.94
HBF4030AF	2.48
HD38750A53	8.71
HD4480	17.16
HD44801A05	17.49
HEF4001P	0.67
HEF4001BP	0.67
HEF4011	0.29
HEF4528	0.00
HM6231	9.81
HM6232	8.89
HM9102	3.22
HM9104	3.24
HM9105	3.24
HT4207	17.16
ITT2003	0.22
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L129V	0.25
L200CV	1.69
LA1111AP	0.88
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.54
LA1357N	11.07
LA1363	6.21
LA1364	3.02
LA1365J	3.44
LA1378	6.52
LA1385	1.94
LA1387	7.60
LA3155	1.25
LA3300	1.54
LA3301	1.41
LA3350	1.43
LA3361	1.23
LA4030P	4.20
LA4031P	3.20
LA4032P	2.35
LA4050P	1.57
LA4051P	1.79
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	4.83
LA4125	2.25
LA4138	3.38
LA4140	1.15
LA4192	3.65
LA4220	1.62
LA4400	2.25
LA4420	1.72
LA4422	1.72
LA4430	1.47
LA4460	2.32
LA4461	2.95
LA4520	2.15
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7800	2.65
LA7801	4.15
LB1274	3.08
LC4011B	1.24
LD3120	1.13
LM1011N	3.46
LM1017N	3.41
LM1111	4.29
LM1303P/N	1.65
LM1310P/N	1.38
LM1877	10.92
LM3065N	0.85
LM317CKC	1.38
LM339N	0.80
LM3407	1.42
LM340T5	0.83
LM340T12	0.64
LM340T5	0.83
LM342N	0.62
LM342P 12V	1.62
LM342P 15V	1.62
LM342P 5V	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.43
LM748	1.82
LM8360	3.22
LM8361	2.97
LM8361	3.57
M1024	2.81
M1025	5.17
M1124	2.80

M1130	5.35
M191	6.32
M193	18.55
M51102L	6.35
M5115P	5.24
M51231P	3.04
M5124P	4.82
M5134-9341	4.13
M51394P	11.97
M5142P	5.49
M5143P	7.33
M5144P	3.77
M51513L	2.55
M51515BL	3.23
M51516L	3.95
M51517L	3.71
M5152L	2.88
M51522	5.39
M5191P	4.94
M5192	2.20
M5194AP	5.74
M53273P	1.02
M53274P	1.33
MA06	1.07
MA8001	0.82
MB3705	1.81
MB3712	1.85
MB3713	1.69
MB3730	3.25
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MC1303P	2.16
MC1307P	1.92
MC1310P	1.30
MC1327P	1.33
MC1330P	1.69
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MC1350P	1.21
MC1351P	1.33
MC1352P	1.12
MC1357P	2.15
MC1358P	1.30
MC14001	2.40
MC14013	0.41
MC14016CP	0.84
MC14011	0.26
MC14025	0.60
MC14049UBC	0.58
MC1438R	1.05
MC14493P	2.82
MC14556BCP	3.47
MC1712	3.88
MC7724CP	3.49
MC7818C	2.18
MC7824CP	4.68
MC78M12	0.83
MC78M24	0.94
MCR100	0.38
MCR101	0.67
MCR106/5	1.57
MCR220/7	2.28
ME0402	0.17
ME0404	0.26
ME0404/2	0.47
ME0411	0.28
ME0412	0.24
ME4102	0.50
ME545B	10.02
ME6002	0.26
ME6102	0.28
ME8001	0.29
MED411	0.75
MJ2501	3.30
MJ2955	0.99
MJ3000	2.37
MJ3001	1.69
MJ3028	2.65
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	2.15
ML237B	2.51
ML238	5.77
ML741CS	0.59
ML923	3.30
ML0926	3.58
MM5314N	4.02
MM5316N	3.96
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	16.20
MM5841N	6.49
MP8112	1.49
MP8113	1.49
MP8512	1.57
MPF256C	0.60
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MPSA42	0.65
MPSA56	0.27
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU55	0.99
MPSU56	0.60
MPSU60	1.33
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OC36	1.28
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OC45*	0.18
OC75	0.44
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ON236	1.06
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OT121	1.32
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PT6042	1.79
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2001B	1.33
R2029	1.33
R2030	1.33
R2257	2.38
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R2305	1.18
R2306	1.36
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R2354B	2.01
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R2477	1.02
R2501	1.28
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RCA16335	1.36
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RCA16802	1.08
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S0280	2.14
S0281	2.14
S1299	4.74
S175	31.48
S2062D	2.07
S2800	7.73
S2800D	5.54
S2802	3.47
S3702S	5.21
S3703F	5.21
S3707	4.32
S40W	10.89
S551	4.54
S552	4.54
S6080B	8.80
S6087AR	4.90
SAA1020	4.76
SAA1021	4.76
SAA1024	2.81
SAA1025	4.40
SAA1050	4.16
SAA1051	5.83
SAA1061	3.61
SAA1075	4.86
SAA1082	8.85
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SAA1124	3.25
SAA1130	4.99
SAA1174	7.77
SAA1250	3.96
SAA1251	4.98
SAA5000	4.02
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SAA5030	8.25
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SAF1039	3.35
SAS5010	8.39

SAS560	1.85
SAS560S	1.65
SAS560T	5.42
SAS570	1.78
SAS570S	2.61
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SAS660	2.97
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SAS660S	1.33
SAS6610	1.33
SAS670	3.96
SAS6700	1.33
SAS670S	1.33
SAS6710	1.33
SAS6800	2.53
SAS6810	1.43
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SBA750	1.61
SC9488P	2.09
SC9503	1.65
SC9504P	1.95
SC9511P	2.09
SCR957	1.33
SG264A	5.26
SG608	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI-1125HD	13.86
SI1125H	7.50
SKE2F 1/04	1.39
SKE2G 2/04	0.95
SKE2G 3/04	0.99
SKE4F 1/02	1.39
SKE4F 1/06	0.73
SKE4F 2/06	0.85
SKE4F 2/08	0.86
SKE4F 2/10	1.24
SKE4G 2/02	0.96
SKE5F 3/10	1.60
SL1310	3.14
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SL1432	2.25
SL414	3.69
SL432A	3.44
SL437	7.43
SL439	2.48
SL480	3.14
SL490	2.37
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SN29773	2.51
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SN76110N	0.90
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SN76131	1.92
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SN76322	2.77
SN76360	2.17
SN76390	3.08
SN76396	2.90
SN76510N	1.05
SN76532N	0.91
SN76533N	2.47
SN76530P	1.57
SN76546N	3.47
SN76540N	1.98
SN76540N	1.98
SN76544	2.89
SN76546	1.65
SN76549	2.59
SN76550	0.37
SN76551	1.49
SN76570	3.08
SN76600	1.21
SN76660N	0.00
SN76611	2.59

SN76620	2.59
SN76622	1.65
SN76623	0.69
SN76630	2.55
SN76640	4.24
SN76651	1.49
SN76660N	2.48
SN76665N	1.49
SN76666N	1.41
SN76705N	1.34
SN76707N	4.39
SN76709	5.12
SN76709N	5.45
SN76730	5.36
SN76810N	0.60
SN76920N	2.90
SN94041	5.54
SN94042	4.35
SP8385	0.55
STA441C	2.75
STK0029	5.54
STK0039	5.35
STK0050	7.67
STK0059	7.13
STK0080	9.16
STK011	3.96
STK013	9.25
STK014	8.84
STK015	7.75
STK016	6.91
STK022	5.25
STK025	12.50
STK040	8.70
STK043	10.48
STK054	7.13
STK070	22.31
STK077	7.67
STK078	8.52
STK082	11.86
STK086	13.59
STK2101	6.32
STK2110	7.33
STK2230	7.70
STK415	7.70
STK433	4.95
STK435	5.94
STK436	7.21
STK437	7.90
STK439	8.31
STK441	11.28
STK443	10.29
STK459	9.40
STK460	10.75
STK461	9.68
STK463	11.53
STK465	10.31
STK466	11.77
STR441	9.45
STR453	8.16
STR6020	8.31
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T6007	0.62
T6016	0.40
T6017	0.72
T6018V	0.72
T6021	0.40
T6022V	3.92
T6026	0.98
T6027	0.81
T6028V	0.39
T6029V	4.86
T6032V	0.98
T6033V	0.60
T6035V	0.73
T6036	0.67
T6037	2.11
T6041V	0.73
T6044V	0.95
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	0.59
T6059	1.16
T8001V	1.20
T9003V	0.95
T9005V	2.38
T9010V	0.62
T9011V	0.49
T9013V	7.96
T9014V	1.68
T9016	1.02
T9034V	1.38
T9035V	1.39
T9038V	9.42
T9051	4.29
T9053V	1.40
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T9057V	0.70
T9063V	3.24
TA5814	1.49
TA7020P	4.80
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.68
TA7071	3.69
TA7072P	2.57
TA7073P	5.86
TA7074P	1.98
TA7076P	7.50
TA7089M	1.56
TA7089P	1.50
TA7092P	6.84
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61

TA7109	3.71
TA7120P	0.64
TA7122B/P	0.92
TA7124P	2.34
TA7130P	1.27
TA7136AP	1.27
TA7137P	0.98
TA7141AP	3.87
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7161P	5.45
TA7162P	2.59
TA7169	9.54
TA7171P	2.79
TA7172P	1.41
TA7176P	2.48
TA7193AP	6.67
TA7193P	7.26
TA7201P	2.71
TA7202P	2.47
TA7203P	2.18
TA7204P	2.16
TA7205	1.38
TA7206P	6.25
TA7207P	3.34
TA7208P	2.15
TA7210P	3.58
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.37
TA7222	1.95
TA7227P	2.81
TA7229P	4.45
TA7233P	3.67
TA7240AP	7.83
TA7245P	7.50
TA7314	5.94
TA7325P	1.15
TA7609	3.17
TA7676P	2.81
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TAA570	1.74
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TAA621AX1	2.00
TAA640	4.24
TAA661B	1.00
TAA700	2.59
TAA840	2.50
TAA930	4.87
TAA970	2.83
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TAG626-600	1.06
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TBA120A	1.05
TBA120AS	1.24
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TBA120SB	1.05
TBA120T	0.95
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TBA1441	1.62
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TBA530Q	1.30
TBA540	1.15
TBA540Q	1.15
TBA550	4.50
TBA550Q	4.50
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TBA570Q	1.35
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TBA651	1.76
TBA673	2.45
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TBA720	2.50
TBA730	2.14
TBA750Q	2.90
TBA760	1.71
TBA780	1.65
TBA800	1.08
TBA810AS	1.00
TBA810S	1.61
TBA820M	0.82
TBA890	1.61
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TBA920Q	2.31
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TBA970Q	3.28
TBA990	1.82
TBA990Q	1.68
TBA231	2.57

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TCA270Q	1.71
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TCA640	10.26
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TCA730	3.81
TCA740	2.48
TCA750	2.25
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TCA900	2.04
TCA910	1.65
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TCE527	1.86
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TCE84	1.08
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TCEP100	9.61
TD190	0.95
TD3F700H	6.60
TD3F800H	4.86
TD3F800R	3.66
TD3F900H	4.16
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TDA1028	2.45
TDA1029	4.89
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TDA1037	2.95
TDA1037D	3.25
TDA1041	2.16
TDA1044	2.62
TDA1047	4.10
TDA1054M	1.21
TDA1059B	0.80
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TDA1082	3.06
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TDA9513	5.44
TE527	1.38
TE538	0.40
TE626	1.49
TEA1002	3.47
TEA1009	1.86
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TEA1087	0.51
TIC106C	0.61
TIC106M	0.77
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TIP29C	0.40
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TIP30C	0.40
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TIS90	0.28
TIS91	0.29
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TMS4116	2.06
TV106	1.76
TY6010B	2.97
U05G	1.14
U143M	3.08
U37003	0.49
UA723CA	5.53
UA758PC	5.29
UA783P3C	3.38
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UAA180	2.36
ULN2165	1.49
ULN2204	7.70
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UPC1350C	1.07
UPC1355C	2.13
UPC1362	7.75
UPC1365	7.10
UPC1366	7.14
UPC1360C	4.51
UPC1458	8.66
UPC2022	1.48
UPC30C	2.51
UPC32C	4.94
UPC41C	4.10
UPC554C	1.85
UPC558C	4.04
UPC566H	2.95
UPC572	3.87
UPC575C2	2.40
UPC576H	2.58
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UPC587C2	1.34
UPC592H	1.13
UPD1514C	8.32
UPX27C	2.18
X0022CE	4.04
X0035TA	5.11
X0056CE	5.11
X0062CE	6.52
X0065CE	4.78
X0096CE	4.29
X0109CE	9.90
X1074AF	7.00
XC9494P	1.33
Y730	0.05
Y969	0.82

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PRODUCT NEWS

NEW FROM NEVADA

Telecomms of Portsmouth have announced that they now have in stock two new low cost 934MHz personal radio band mobile antennas manufactured by Nevada. Costing £25 each, these low profile antennas offer 3.5dB gain with wide angle coverage which is useful at this frequency.

Each antenna measures 335mm and is supplied complete with 4.8 metres of cable.

The G900A is fully adjustable with an inox steel whip while the G900R is finished in black. Both have an 'SL' UHF low loss base connector, and other features include an impedance of 50 ohms, a VSWR of 1.2:1 and maximum power handling of 50 watts.

Telecomms,
189 London Road,
North End, Portsmouth,
Hants PO2 9AE.
Tel: (0705) 698113.

AHOY THERE!

The forthcoming London Boat Show 1986 will be the venue for the launch of a new VHF radiotelephone from Shipmate Marine Electronics, the Sealine 3.

The new unit offers as standard all 55 international channels, the UK marina channel, private channel capability (up to 8) and all 55 USA channels. There are dual watch and loud hailer facilities and a memory for up to 10 user-programmable channels, as well as multi-channel scanning.

Optional extras include a selcall module, an intercom facility and a telephone handset and cradle. The Sealine 3 will retail for £280 + VAT, and will be available in March.

Meanwhile the previous rig, the Sealine II, is having its price reduced by £20 to £220 + VAT.

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

ANOTHER MIRACLE

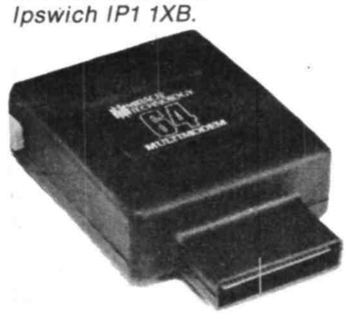
A new modem, the 64 Multimodem from Miracle Technology, gives access not only to Prestel, Micronet, Microlink and viewdata services, but also to databases, bulletin boards, electronic mail, telex and user-user communications.

64 Multimodem, for Commodore 64 and 128 owners, is a complete datacomms solution, having autoanswer, autodial, and all software onboard in ROM. Menu-driven and multi-speed, it supports CCITT V21/23 and Bell 103 standards, handling baud rates of 300/300, 1200/75 and 75/1200. Functions include save and print frame, automailbox with edit and save, and telesoftware downloading.

The modem is simple to use, fitting the computer's cartridge port and having only one external connection – the telephone lead.

At £116.15 including VAT and UK delivery, it puts inexpensive, user-friendly and comprehensive datacomms within the reach of 64 and 128 owners. BABT approval is expected shortly.

Miracle Technology (UK) Ltd,
St Peter's Street,
Ipswich IP1 1XB.



VIDEO PRODUCTS

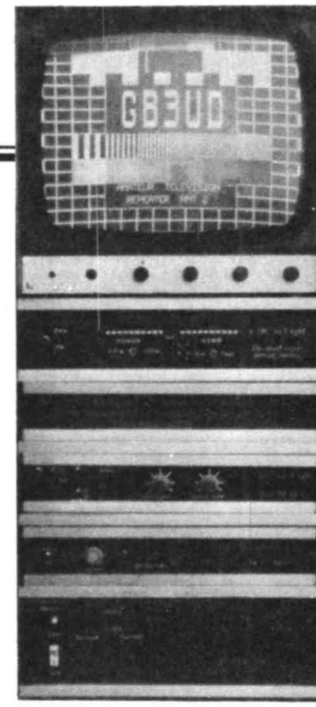
DC to Light, a new company specialising in video products for the amateur (see last month's *News Desk)*, have introduced a new 23/24cm ATV transmitter.

The DC 1G3 FM transmitter is based on a crystal referenced PLL synthesiser running at signal frequency, and will cover the whole of the 23/24cm band in 500kHz steps (it comes supplied with 4 channels of the customer's choice).

CCIR pre-emphasis is incorporated, switchable on the front panel. Sound is 6MHz FM subcarrier, with other frequencies available on request. Audio gain and video carrier deviation can both be controlled using pots on the front panel.

Two models are available, offering either 2.5 or 10W output.

An accessory available from the company allows the stacking of up to 7 units produced by the company (much like a hi-fi stacking system). The DC Stack is made from PVC laminated steel and is available in a choice of 4 colours or a teak woodgrain effect.



DC to Light,
15 Bursley Way,
Bradwell,
Stoke on Trent ST5 8JQ.
Tel: (0782) 639 406.

MORSE PROGRAM

Following the success of their G1FTU RTTY program, Pearsons Computing are now introducing G1FTU CW for the 48K Spectrum and Spectrum Plus.

The program enables the computer to both generate and decode Morse audio directly. The software filtering system devised for the receive side and the generated tones on the transmit side may be adjusted to the optimum for any given transceiver.

G1FTU CW features selectable full or split-screen operation with type-ahead capability in both transmit and receive modes. There are 9 user memories of up to 255 characters each, which may be saved on cassette, and a special memory for your contact's callsign which may be edited 'live' during reception.

The receive mode has tunable software filtering and auto-tracking of the incoming speed. The tracking rate is switchable – FAST, SLOW and LOCK modes are available – and the perceived speed (1-99wpm) is displayed continuously.

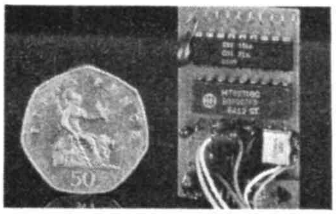
The transmit mode is fully adjustable for tone (400-1500Hz) and speed (1-99wpm), including an automatic reply speed option. For training, extended word spacing may be selected and the contents of the receive buffer may be replayed (retransmitted) at any desired speed.

For the manual key addicts, the program may be connected to a straight, bug or iambic Morse key (with normally open contacts) via a standard joystick interface. The computer then acts as variable speed/tone Morse keyer with self-completing dots and dashes. If you don't have an interface then quite reasonable iambic-type operation may be achieved by use of two of the keyboard keys directly.

G1FTU CW costs £10 inclusive (£11 Europe) and orders from licensed amateurs should be accompanied by a callsign, as each copy of the program is made individually.

Pearsons Computing,
42 Chesterfield Road,
Barlborough, Chesterfield,
Derbyshire S43 4TT.
Tel: (0246) 810652.

MINI SELCALL



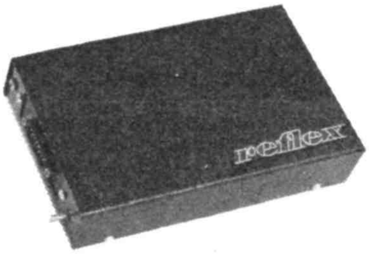
Following its successful mobile radio selective calling system, Selcall, IQD has now developed a miniaturised version for hand-held radios, known as Mini Selcall.

With Mini Selcall the hand-held radio remains mute until it is either called or used. Calls can be made to individual sets, or to selected groups, using a two-digit or a four-digit tone code, thus allowing up to 10,000 contacts. On receipt of its tone code, Mini Selcall automatically demutes the set and triggers an LED signal to indicate that a call is waiting.

Other products from IQD include Phonecontrol, an electronic remote control unit, Phonethru, a telephone switchboard bypass, and Smartpatch, a mobile radio to telephone interface.

IQD Ltd,
North Street, Crewkerne,
Somerset TA18 7AR.
Tel: (0460) 74433.

VIDEO INTERFACE



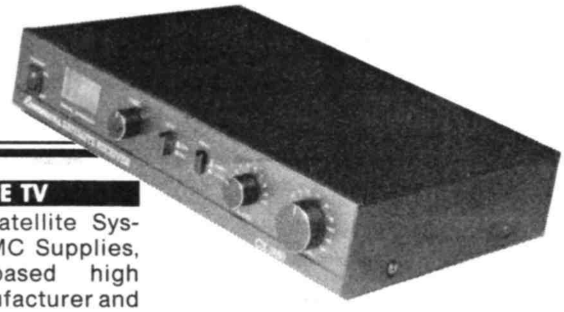
Reflex Limited have introduced a new video interface which can be used with a variety of computer systems.

Known as the GP (General Purpose) interface, this device accepts horizontal and vertical synchronisation and video signals from systems such as Apricot, IBM and Macintosh and converts them into a standard volt peak-to-peak video signal with negative sync for driving a monitor or video projector.

Reflex also offer other interfaces which allow various computers to be linked to video data projectors, including the BBC Model B, DEC Rainbow, DEC VT100/102 and HP150.

Reflex Ltd,
Wellington Industrial Estate,
Basingstoke Road,
Spencers Wood,
Reading RG7 1AW.
Tel: (0734) 884611.

SATELLITE TV



Connexions Satellite Systems, part of SMC Supplies, the Barnet based high technology manufacturer and distributor, has launched a low cost range of domestic satellite TV systems.

The Connexions satellite systems are a high quality, low cost range of TVRO (Television Receive Only) Earth terminals. A complete system consists of a dish antenna, low noise block (LNB) converter and a satellite receiver. Alternatively, each component of a complete TVRO may be purchased individually.

Dishes available are from 1.2 metres up to 2.3 metres and a top of the range system would incorporate a full band multi-satellite system with remote control.

A host of programmes can be picked up from two satellites beaming signals to the UK, namely Intelsat V and Eutelsat F1. Programming includes Premiere, Music Box, Mirrorvision, Screensport, The Children's Channel, Cable News Network, Europa TV, Filmnet, RAI.

Connexions Satellite
Systems Ltd,
125 East Barnet Road,
New Barnet,
Herts EN4 8RF.
Tel: (01) 441 1282.

AMPROM

CTP Software have announced the release of their new amateur radio communications ROM for the BBC micro, AMPROM.

AMPROM utilises the cassette port of the BBC to generate and monitor audio tones to and from a radio transceiver. Thus the BBC micro becomes a radio data communications terminal, without needing any special interface.

An AMPROM user can send and receive data over the air in teletype mode and copy files across a radio link with full error protection and correction of data. This provides an easy means of transferring (non-copyright!) programs, text, or other data from one station to another.

AMPROM is easy to use, but at the same time offers unique and advanced functionality. The manufacturer claims that its use becomes instinctive in a short space of time due to the attention paid to developing efficient keyboard use. Brief reminder prompts are also displayed, making frequent reference to the manual unnecessary.

For the advanced programmer AMPROM also provides operating system extensions for use in programs. For instance, the "★RX" command could be used to write a Basic program that constantly monitors the radio, and alerts the operator (with an alarm) if a particular callsign is heard.

The manual includes interfacing and operating instructions, along with such useful information as AMPROM memory usage.

CTP Software,
107A Shacklewell Lane,
Shacklewell,
London E8 2EB.

WHAT A CAD!

Number One Systems have launched an ac linear circuit analysis program for the IBM PC/XT and compatibles.

Using Analyser I, input impedance, output impedance, gain (magnitude and phase) and group delay can be analysed for circuits with up to 150 components and 40 connection nodes over a wide range of frequencies from less than 0.01Hz to over 1GHz.

Resistors, capacitors, inductors, transformers, operatonal amplifiers and both bipolar and field-effect transistors can be simulated by the program, and the ac performance of circuits containing these components evaluated without the need for laborious bread-boarding and bench testing. During a simulation components can be added or deleted or parameters altered, enabling the designer to quickly assess the effects of modifications or the circuit's sensitivity to component tolerance, stray capacitances, etc.

The program is particularly useful for frequency response analysis of active and passive filter circuits, loudspeaker crossover networks, IF amplifier and trap circuits, audio amplifiers, wideband amplifiers, tuned RF amplifiers, antenna and inter-stage matching networks, linear integrated circuits etc. It is expected to find application in research and development departments, colleges and universities.

The introductory price of the software in the UK is £65.00 plus VAT.

Number One Systems Ltd,
9A Crown Street,
St Ives, Huntingdon,
Cambs PE17 4EB.
Tel: (0480) 61778.

SIMPLY DASHING

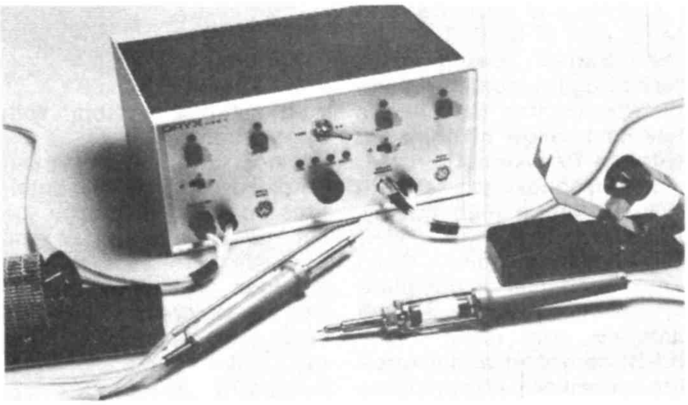
Microsystem Services (MSS), authorised distributors for FutureNet Corporation, have just announced DASH-3C – a full colour version of the popular DASH PC-based electronic engineering CAE workstation.

The system allows full colour schematics to be produced on the IBM PC, XT or AT. It captures design data, net lists, lists of materials and design check reports automatically.

DASH-3C features a large parts library that can be easily added to by the user. Included in the library are the most widely used schematic symbols with pinouts and pin functions for discrete components, microprocessors and support chips.

Microsystem Services,
PO Box 37,
Lincoln Road,
Cressex Industrial Estate,
High Wycombe,
Bucks HP12 3XJ.
Tel: (0494) 41661.

REWORK STATION



A self-contained unit for reworking assembled printed circuit boards is now being offered by Oryx. The rework station, HSR-1, is especially efficient for the removal of components from through-hole plated boards.

An integral soldering iron and an outlet for 12V dc hand-held tools provide the capabilities for fast and complete PC board correction and repair.

The self-contained HSR-1 station plugs into a standard 115V ac 3-wire outlet and requires no exterior air or vacuum supply.

The hand-tool provides proper tip temperature for quick solder melting. A large capacity electric vacuum pump quickly removes the molten solder through the HSR hand-piece. The tip automatically maintains temperature. Tip temperature is dial-set for various board materials at the control panel. This feature is especially important for working boards which are easily damaged by high heat.

Within the hand-piece is a clear glass tube for collecting solder. Replacement filter material or the complete collector are both available. Three different size tips accommodate all common conditions. A push-button switch on the hand-piece activates the vacuum pump, which can also be controlled by a separate foot-switch.

The HSR-1 can also be efficiently used in board repair, as the integral soldering iron with fume extractor enables new joints to be made and the 12V dc outlet can serve to power a hand-held drill for clearing holes or making minor modifications.

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

RF FETs

A new range of broadband RF FETs, developed by Teledyne Crystalonics, is now available from MeTL.

The range comprises three distinct families of devices. The CP640, CP664, CP665 and CP666 FETs are for high dynamic range HF and VHF amplifiers. Housed in TO-5 packages, they are for use in common gate configurations. Usable to over 300MHz, they offer drain-to-source and drain-to-gate voltage ratings from 20 to 50V and low noise figures (2.2dB typ at 50MHz).

The CP643, in a TO-46 package, is for high dynamic range RF amplifiers.Usable up to 500MHz, it has drain-to-source and drain-to-gate voltage ratings of 30V and a low noise figure when used direct from a 50Ω line (the noise figure is improved at the cost of gain when used in a 75Ω line with a 2:1 output winding ratio, or in a 50Ω line with an input step-up transformer). A dual version, the CD643, is available matched for pinch-off voltage (V_{PO}) and transconductance (g_m).

The CP650 and CP651 FETs are in TO-5 packages and feature low gate-to-drain capacitance (20pF typical) high drain current (0.5A typical), and high transconductance (150,000μmhos typical).

MeTL Limited, Unit 2,
Gt Haseley Trading Estate,
Great Haseley,
Oxfordshire OX9 7PF.
Tel: (08446) 8781.

CERMET TRIMMERS

Bosledge Limited, the Manchester-based electronic component distributor, can now supply the new series 405 and 406 trimming potentiometers from Citec.

Model 405 is a high quality miniature potentiometer in a very small package. It is dust and splash proof, with a resistance range of 100 ohms to 1 megohm. At present, it is offered with top adjustment only.

The 406 model, with a resistance range of 50 ohms to 2 megohms, has a choice of top, bottom or side adjustment. Like the 405 it is dust proof and is suitable for applications where a robust trimmer is required.

Bosledge Limited,
27-29 Church Street,
Manchester M4 1PE.
Tel: (061) 834 7339.

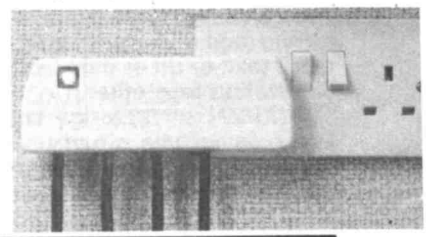
SOCKET TO 'EM

A four-in-one 13 amp plug has been introduced by Duraplug Electricals Limited. Called the MultiLine plug, it enables up to four appliances to be connected to a single socket outlet without the need for additional plugs and adaptors.

The new plug has been designed for those situations in the home where there are concentrations of stationary electrical equipment. It is suitable for lighting, hi-fi units, video and television. By wiring the equipment directly into the MultiLine plug, accessory cables can be safely and neatly routed.

The MultiLine plug is simple to wire and features a useful 'mains-on' indicator light. The unit is available in black or white and is fused at 5 amps.

Duraplug Electricals Ltd,
Westwood Works,
Margate Road,
Broadstairs,
Kent CT10 2QL.
Tel: (0843) 68771.



BETTER TIPS

The Cobonic 3S-Tip range of long-life solder tips has recently been improved. These tips, specially made as an alternative for the Weller TCP and ECP temperature controlled soldering irons, now undergo a new additional surface treatment of the areas wetted by the solder.

A variety of tip designs are available, at prices said to be extremely competitive. Further information and a price list are available from the company.

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

CMOS Z80 FAMILY

A new family of CMOS versions of the popular SGS Z80 microprocessor is now available from VSI Electronics.

Designated Z84COO, the family comprises CPU, PIO and CTC which are all fully plug-in compatible with their standard counterparts while offering greatly reduced power consumption without loss of speed. Two versions of the CPU, allowing operation at clock speeds of 2.5MHz or 4.0MHz, are designated Z84COO and Z84COOA and require only 9mA and 15mA respectively.

The Z84COOA PIO consumes only 2mA and the Z84COOA CTC only 3mA. All three devices operate from a single-rail 5 volt supply.

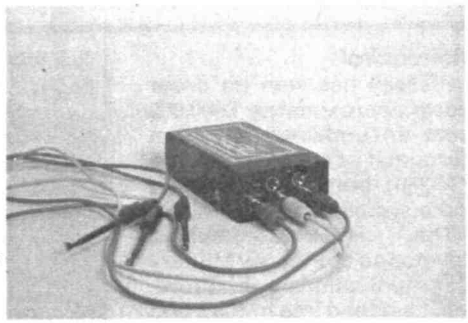
The CPU supports all the familiar features of the industry standard Z80 series devices. Both Z80 and 8080A software compatibility are therefore maintained.

Four package configurations are available: 40-level plastic and ceramic DIPs and 44-leaded and leadless plastic chip carriers.

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

REPRO-ELECTRONIC-SYSTEMS

Are pleased to announce the new TT/9OO3 transistor tester, a unique development in pocket test equipment. This instrument will test transistors *in circuit* as well as out of circuit. Operation involves merely connecting three probes and pushing the button. No wonder the TT/9OO3 has already aroused immense interest throughout Europe.



MAIN DEALERS

MIDLAND RADIO CENTRE: 133 Flaxley Rd, Birmingham. 021-784-4928

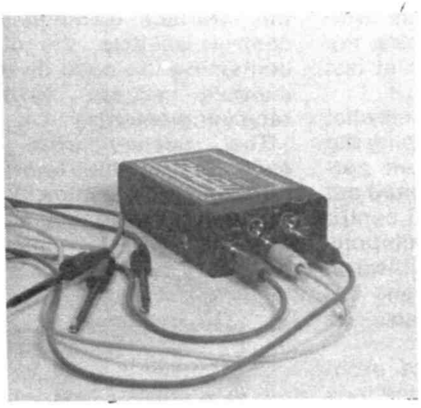
P M COMPONENTS LTD: Springhead Ent Park, Springhead Rd, Gravesend, Kent. 0474-60521

WESTMOUNT COMMUNICATIONS LTD: 251a High Street, Eltham, London SE9. 01-859-5017.

TRADE ENQUIRIES TELE: 0474 332101

MIDLAND RADIO CENTRE

Model TT/9003 Automatic In Circuit Transistor Tester.



The Repro Automatic Transistor is an Invaluable aid to the technician, and hobbyist alike. The TT/9003 is unique in that, without the faulty circuit board being powered up, both PNP and NPN transistors can be tested whilst they are still in circuit, without the use of any other ancillary equipment. Until now it has been neccessary to remove the component for testing at the work bench, a time consuming and repetitive chore. Comprising a compact unit measuring only 12 x 7 x 3cms and operated by a standard 9 volt battery, the TT/9003 can be used by anyone with an elementary knowledge of electronics. £38.85

Model LA/2502 Linear Amplifier.

A 25 watt switchable Linear Amplifier with 'supply on' and 'Power on' LED indicators. 26-30MHz. Complete with instructions. Made in UK.

£22.95

NOW AVAILABLE FROM:-

MIDLAND RADIO CENTRE,
133 FLAXLEY ROAD,
STECHFORD,
BIRMINGHAM
Tel: 021 784 4928

Mail Orders Welcome sent by return.
Cheques Please allow 7 days.

NAME...

ADDRESS ....

....

NEWS DESK

Riot control

Plessey has won an order worth approximately £500,000 from an unnamed Northern European country for the PTR5401 personal hand-held radio system.

The PVS5400 series, developed by Plessey Military Communications at Ilford, was launched late in 1984, and offers a wider range of facilities than would normally be expected on a radio of its size. These facilities include a three-key control pad (from which all operator selectable facilities, such as speech privacy, channel selection, squelch and volume control, may be selected) with associated LCD display.

The PTR5401 operates in the 68 to 77.975MHz bandwidth, offering a possible 400 FM channels. Power is 1 watt.

The PVS5158 vehicle communications harness is also now available. This integrated radio/talkback communications system is designed for use by emergency services and can be fitted to an armoured car or riot control vehicles.

The vehicle is provided with full external VHF or UHF communications (Clansman compatible), coupled to a three position intercom and public address system under the control of the vehicle commander. The rugged construction makes the PVS5158 suitable for many additional paramilitary roles, including emergency services.

Sunday afternoon motoring, Chilean style?

Bulletin board

Following the success of his terminal programs for the ZX Spectrum, Stephen Adams has announced an international bulletin board for Sinclair users which uses the Sinclair 32 column format.

This unique board will allow Spectrum, ZX81 and QL users access to fellow users in the fields of business (for commercial users of databases), education (for teachers rather than pupils) and first time users (for all the general info you are assumed to know already).

The service will operate 24 hours a day at both 1200/75 and 300 baud in an ASCII format (ie Prestel software will not work on the board) on (01) 249 3238.

The board is free to general users, although it is hoped to obtain advertising to be placed on the menus to support this. Certain sections may be available on a nominal subscription basis. The board includes a news section, allowing users to add their own reports, information, hints and tips.

The bulletin board is run on a Superbrain QDII CPM computer with 720K of on-line disc storage giving over 300K for messages, programs etc.

Although suggestions for improvements will be welcomed, the policy of the operator is not to support hacking of other computers, and any such messages will be deleted.

Details of the bulletin board, Specnet, or Specterm are available on (01) 254 1869.

Exclusive franchise

Electronic Brokers has been appointed the exclusive UK distributor for the range of test and measuring instruments manufactured by Grundig Electronic. Products covered by the new agreement include general purpose oscilloscopes, video pattern generators and an automatic field-strength meter.

The Grundig instruments are well established in West Germany and other European countries but have not previously been marketed directly in the UK.

Electronic Brokers is carrying an in-depth stocking profile of the Grundig instruments, and is supporting the products in the UK with full warranties and after-sales service.

Roving radios

The Communications and Electronics Museum, based on the collections of Douglas Byrne and Dr Graham Winbolt, is fast approaching the point at which it can at last take to the road.

If this seems a somewhat strange way of describing the operation of a museum, perhaps it should be pointed out that this museum will centre on travelling exhibitions rather than a static display. Eventually research and library facilities will also be available.

If the considerable problems involved in getting tons of equipment mobile can be surmounted, wheels should soon be turning.

Although Douglas Byrne's collection of civilian equipment and Dr Winbolt's almost legendary volume of military radios are both very impressive, the museum is always looking for interesting equipment, documents and photographs, so get rummaging in your attic. The only trouble here is, of course, that a great deal of old equipment is still giving good service.

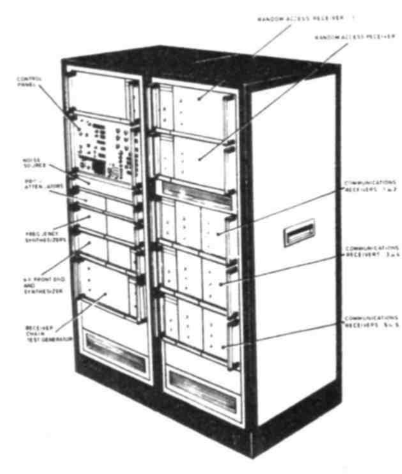
Satellite contract

Cossor Electronics, of Harlow, Essex, has won a £950,000 order to develop and build a satellite receiver subsystem for the European Space Research and Technology Centre (ESTEC). The system will be used in the PROSAT programme, which is being designed to provide a mobile communications system for land, sea and air using a satellite link.

In essence the subsystem will comprise: two dual random access receivers to provide overlapped message detection and a high and low band frequency capability; six communications receivers; and a receiver chain test generator, consisting of two channels which will provide multipath messages for test purposes. A microprocessor based keyboard/display control unit is also provided, offering greater flexibility and ease of use for the receiver subsystem.

All the equipment, apart from the VDU/keyboard, will be housed in two standard IEC144 racks, one containing the interface elements and control facilities, the other containing the code division multiple access (CDMA) receiver elements.

The receiver (with the exception of the interface front end) will employ digital signal processing techniques which will minimise



implementation losses and provide a design with repeatable characteristics. This latter aspect is an important factor in minimising the time scale of the project, since a large part of the system will consist of multiple receiver channels which will be essentially identical.

Cossor Electronics is scheduled to deliver the receiver early in 1987. It will then be integrated with the other subsystems for test and evaluation.

Six metre band

Terms for allocating the 50-50.500MHz band to the amateur radio service have been finalised by the Department of Trade and Industry and become effective from 1 February 1986.

The conditions are as follows:

The allocation shall be primary within the United Kingdom.

Initially, only Class A licensees will be permitted access to the band.

The maximum power at all times shall be: carrier, 14dBW ERP; PEP, 20dBW ERP.

Maximum transmitting antenna height to be 20 metres above ground level.

Antennas shall be horizontally polarised.

No mobile, portable or temporary premises operation will be allowed.

There will be no restriction on the modes or hours of operation.

No repeaters will be allowed in the band.

Existing permits will be withdrawn.

Usage by radio amateurs is on the basis of 'non interference' with the permitted services in Europe. The operating restrictions have been drawn up to minimise any risk of the amateur radio service interfering with established European services.

The DTI has agreed with the RSGB that use of the band will be reviewed after a year to see if the operating conditions can be revised.

Ants in your pants

Ant Products, former manufacturers of the now well established Tiger and Silver 70 antenna ranges, inform us that they have established a licence agreement with Telecommunications Antenna Systems Limited, trading as Tiger Antenna, for them to manufacture the range of Tiger and Silver 70 antenna products and accessories at their Scunthorpe premises.

Tiger Antenna will also handle the supply and distribution of these products to their numerous dealers across the country.

New products in the pipeline from Ant Products include HF and microwave antennas. A catalogue containing details of the product range can be obtained from Tiger Antenna, 60 Hebden Road, Scunthorpe, or direct from Ant Products at All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire WF8 2HA (please enclose 50p in stamps to cover costs, refundable against purchase by presenting the front cover of the catalogue).

Please note that the new telephone number for Ant Products is (0977) 85274.

Soft-Talker

A major problem in aiding the speech of deaf and hard of hearing people has been to find a method of letting them know when they are speaking too loudly.

A new development (funded by the Wolfson Foundation) has just been announced by the Speech and Language Group at the University of Cambridge School of Clinical Medicine. Mr John Walker, electronics engineer, has developed a volume monitoring and indicating system – the Soft-Talker – which is not only efficient but discreet.

Basically the device comprises a small and unobtrusive microphone and amplifier, together with a small motor vibrator mounted in a wrist watch case. The microphone picks up the user's speech and, if the volume rises above a preset level, a signal is generated to operate the motor vibrator in the wrist watch. The user then reduces his volume until the vibration stops and he knows he is talking at a socially acceptable level.

In the initial stage a low cost toy motor was tried but the batteries soon faded and the motors were less than reliable. Instead, a motor already being used in aids for the disabled – Portescap UK's 712 micromotor – is now used. This is ideal for such an application because of its compact size, reliability and low battery consumption.

The system is now in small scale production and is available from the Speech and Language Group, Addenbrooke's Hospital, Trumpington Street, Cambridge CB2 1QE, at a cost of £59.95.

Marconi's BBC order

Marconi Communication Systems Ltd has received an order from the British Broadcasting Corporation for equipment for a new transmitter station in the Seychelles. When completed in 1988 the station will improve the audibility of BBC World Service programmes in the African and Indian Ocean regions.

The order is for two Marconi B6131 250kW short wave transmitters incorporating advanced pulsam modulation. The transmitters are designed for high overall efficiency and will be capable of remote control.

Optical fibre record

A new world record for optical fibre transmission set by British Telecom promises to help contain the cost of expanding a network. A team of engineers have succeeded in transmitting data over 32km of single mode fibre at a rate of 2.4Gbit/s, the fastest rate yet achieved over an installed cable.

The record was set on a cable linking Birmingham with Tamworth and was achieved by a team from the British Telecom Research Laboratories, National Networks and the Central Midlands District.

Unlike previous laboratory demonstrations this feat was achieved over an existing cable. It illustrates the feasibility of upgrading existing optical systems without the need to replace cables. BT believe that considerable sums could be saved in the future by providing only new terminal electronics to expand the capacity of cables rather than replacing complete systems.

The data rate achieved, 2,400 million bits of information per second, represents a 16-fold capacity increase over the existing 140Mbit/s systems. It is equivalent to passing 30,720 separate speech channels, or 32 full bandwidth colour television pictures, down the same single optical fibre.

The key factor in the trial was the use of a ridge-waveguide distributed feedback (DFB) laser, made in British Telecom's Martlesham research laboratories. It gives an absolutely pure single wavelength output at 1.52 microns, which is necessary to avoid the distortion which would occur with less pure, multi-wavelength signal sources in this application. The wavelength, longer than that used by current fibre systems (1.3 microns), is chosen because of the significantly lower losses (and hence further transmission) at this frequency.

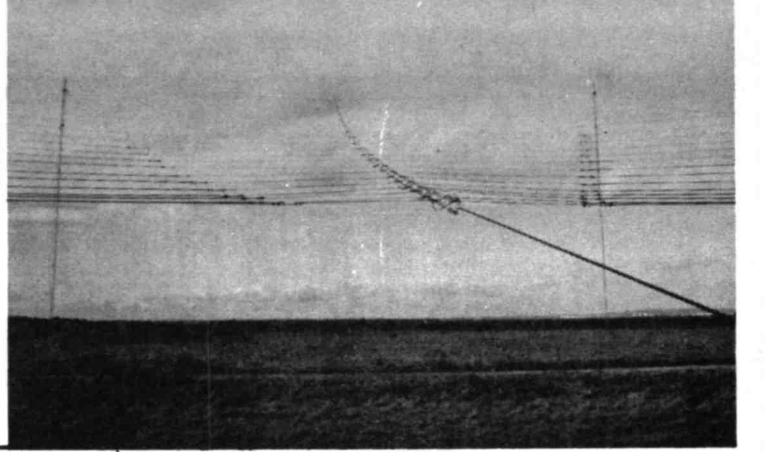
Telecentre face-lift

Fidelity telecentres, the AVS1650 and 2000 (with 16in and 20in screens respectively), were designed as one unit to contain a complete home entertainment package: television, cassette recorder, record deck, and stereo radio.

Demand for these units has apparently remained high and for 1986 the AVS2000GL is to have a face-lift. In response to consumer trends, the cabinet has a darker, natural wood look, and is enhanced with a pale grey control panel.

The remote handset controls all the functions of the telecentre, and the cassette will record off all the components.

SPECTRUM WATCH



A horizontal log-periodic communications antenna head-on (photo: TCI)

NIGEL CAWTHORNE G3TXF

We are now only months away from a new era in broadcasting, with France and Germany's direct broadcasting satellites (DBS) both due to be launched later this year. The French TDF-1 is due to be launched by Ariane from Kourou in July 1986. However, if schedules are maintained it will be Germany's TV-SAT that will be the first DBS satellite in orbit. TV-SAT is due for launch in May.

TV-SAT

TV-SAT has capacity for three TV channels and 16 stereo sound programmes. The transmitted power will be about 200W per channel. This is significantly higher than the transmitted powers of the transponders that are being used to transmit programmes (Sky Channel, Music Box etc) to cable head-ends from the communications satellites Eutelsat and Intelsat. The higher the power of the transponder, the smaller becomes the diameter of the dish antenna needed to receive the signals at adequate strength.

TV-SAT will be receivable on 60cm diameter dishes in both East and West Germany, as well as in much of Switzerland, Austria, Holland and Belgium.

Both the French TDF-1 and the German TV-SAT will be positioned at 19° west. An Italian DBS satellite, Olympus, is also under construction and will be occupying the same orbital position in 1987/88. The Olympus DBS satellite will carry multinational programming. In accordance with the 1977 WARC plan, there are fourteen countries that each have five DBS channels allocated from the same orbital position of 19° west.

Lifting a cellular base-station cabin onto a mountain site (photo: Austrian PTT)

DBS programmes

Even at this relatively late stage it has not yet been finally decided what each of the available transponders on the French and German DBS birds will be used for.

TDF-1 is expected to carry France's new private TV channel as well as an English language DBS programme run by the publishing magnate Robert Maxwell. It is ironic that Europe's first English language DBS programme channel will be carried on a French satellite.

The main footprint of the French satellite covers much of the southern part of England, and reception should be possible in other parts with slightly larger dishes.

The UK's own Unisat DBS project collapsed last year. Further studies are being undertaken by the IBA to take another look at the UK's DBS needs. While the UK continues to study, our European neighbours, helped by their governments, are getting on with DBS for real.

This time last year, the UK had just said goodbye to its terrestrial Bands I and III 405-line VHF TV transmitter networks, which marked the end of an era in television broadcasting. It was an era in which the UK had played the leading role. Just one year later we are on the threshold of the new DBS era in broadcasting. This time, far from playing the leading role, the UK is not yet even on the bottom rung of the DBS ladder.

BBC China service

The BBC is building a new high-power short wave transmitter station at Tsang Tsue in the New Territories of Hong Kong. The station will consist of two Marconi B.6131 advanced Pulsam 250kW SW transmitters and an array of four Marconi four-band curtain antennas. The East Asia Relay Station (EARS) will bring a louder World Service signal to the Chinese mainland and the surrounding area.

The BBC's Hong Kong antenna array has been specially designed to feed a strong signal into the required target areas. The table shows the configuration of each antenna as well as the direction of their main beams.

Because Hong Kong is in a typhoon zone, the design of antenna installations presents major problems. The Marconi antennas are being designed to withstand windspeeds of up to 61 metres/second (220km/hour). The BBC will be using the 'hydraulic tensioner' technique, which is designed to protect antenna arrays during a typhoon and which the BBC already has in service at other sites.

During a typhoon, as the windspeed increases, the hydraulic guy tensioners are released so that the antenna wires become less taut. As the tension in the antenna slackens beyond a certain point programme transmissions have to cease, but by using the hydraulic tensioning technique the antenna array itself can be saved in what otherwise could be the disastrous loss of a curtain antenna installation.

Large co-ax

For the first time the BBC will be departing from its traditional method of using 300 ohm balanced feeder to feed antenna arrays on high-power SW transmitter stations. For the East Asia relay, the outputs of the 250kW transmitters are being fed into 9-inch diameter Kabelmetal coaxial cable. The switching matrix which is used to connect the appropriate antenna through to the correct transmitter is made up of 9-inch coaxial switches.

The extreme climatic conditions encountered in Hong Kong require that feeder line components be extremely conservatively rated, hence the use of this large diameter coaxial cable.

Modern high-powered broadcast stations are usually designed to operate with a minimum of site staff. The BBC's designs department have designed a processor-controlled automatic transmitter station control system for Hong Kong.

Control systems at short wave broadcast stations supervise the routing of signals through from the programme input feeds out to the antennas in accordance with the programme transmission schedule. Automatic control operations include the connection of the appropriate programme line to the required transmitter as well as the management of the high-power transmitter's own automatic frequency change facilities. The selection of the correct antenna through the antenna switch matrix is also controlled automatically. Antenna selection includes the selection of the appropriate slewing angle.

Slewing is the technique which allows a seemingly fixed array to fire at an angle other than in the direction of the main beam. This is achieved by altering the feeder lengths to different portions of the antenna array. The Marconi antennas used in Hong Kong are designed for slewing angles of up to ±20°.

Satellite feed

The programme feed for the BBC's new China voice will come via satellite through Cable and Wireless' Hong Kong satellite Earth terminal station. In addition to main and stand-by satellite programme feeds, there will also be a cable feed from the BBC's relay station in Singapore. This ensures continuity of programme feed to the new East Asia Relay even in case of a serious outage at the satellite Earth station, which could possibly occur during a major typhoon.

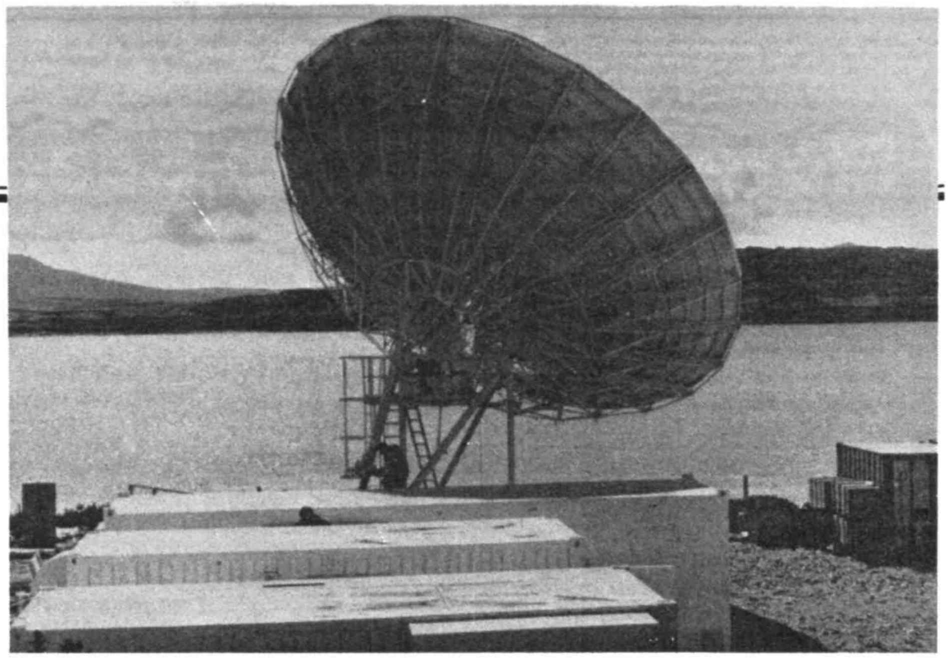
The Hong Kong relay is being built on a 'green-field' waterfront site. The immediate 'take-off' in front of the antennas is over water, and this will help to enhance the signal. The BBC Hong Kong relay is due to come on air in the autumn of 1987. About one year after Hong Kong comes on-air the BBC plan to inaugurate another new relay station, the Indian Ocean Relay Station (IORS) on the Seychelles.

BBC Seychelles relay

Site-clearance work on the BBC's new Seychelles transmitter site commenced in late 1985. It is expected that the new station will be fully operational with two Marconi 250kW transmitters and an array of six antennas during 1988. This Seychelles site, which is less cramped than the one in Hong Kong, is being designed to house a total of four transmitters. In the first instance only two are being purchased.

The table shows the intended main lobe directions for the six new antennas on the Seychelles. Their targets will be eastern, central and southern Africa, and a more complex slewing arrangement will be in use than at Hong Kong.

The new relays at Hong Kong and the Seychelles will be joining the BBC's world-wide network of relay stations which includes Antigua, Ascension Island, Berlin, Cyprus, Lesotho, Masirah Island (Oman) and Singapore. On a reciprocal basis the BBC also uses facilities provided at the Canadian Broadcasting Corporation's transmitter station at Sackville and at the VOA's facilities at Greenville on the east coast of the USA.



The Falkland Islands satellite station carries vital communications

BBC East Asia Relay Station (EARS): Hong Kong

Antenna	Configuration*	Range (MHz)	Bearing
A1	HRS 4/4/0.5	5.85-12.1	6° and 50°
A2	HRS 4/2/0.5	5.85-12.1	6° and 50°
A3	HRS 4/4/0.5	11.65-21.85	6° and 50°
A4	HRS 4/2/0.5	9.405-18.085	6° and 50°

The Hong Kong antennas can also be used as 'half arrays' (HR 2/2/0.5) with beam headings of 8° and 25°

BBC Indian Ocean Relay Station (IORS): Seychelles

Antenna	Configuration*	Range (MHz)	Bearing
A1	HRS 2/2/0.5	5.85-12.1	265°, 280° and 295°
A2	HRS 2/2/0.5	9.405-18.085	265°, 280° and 295°
A3	HRS 2/2/0.6/0.7	11.65-21.85	240°, 255° and 270°
A4	HRS 4/2/0.6/0.7	5.85-12.1	230°, 240°, 255°, 270° and 280°
A5	HRS 4/2/0.6/0.7	5.85-12.1	240°, 255°, 270°, 285° and 300°
A6	HRS 2/2/0.6/0.7	11.65-21.85	255°, 270° and 285°

The Seychelles antennas A4 and A5 can be used as 'half arrays' (HRS 2/2/0.6/0.7) with corresponding beam headings of 240°, 255° and 270° (antenna 4) and 255°, 270° and 285° (antenna 5)

* Short wave broadcasting curtain arrays are described according to the following shorthand convention: HRS w/v/h

where H = horizontal polarisation
R = reflector used
S = array can be slewed

w = width in half-wavelengths
v = number of dipoles stacked vertically ($\lambda/2$ spacing)
h = height in wavelengths of the lowest dipole element

Cellular radio goes digital

The IEE's October colloquium on 'Digital Mobile Radio' brought together the best academic brains in Britain on the subject of future generations of digital mobile radio. The panel of speakers included no less than seven university professors. Even though (as one would expect on such an occasion) some papers rapidly degenerated into a jumble of mathematical symbols, equations and heavy theory, there was nevertheless plenty to remind the audience that digital mobile radio is the key to the coming personal communications revolution.

David Cheeseman of BT's research laboratories set the scene with a paper entitled *Digital Cellular Radiophone – the Challenge and the Promise.* Today there are already some 300,000 users world-wide of first generation analogue cellular systems. These first generation systems, although they vary in detail from country to country, can generally be characterised as using FM, having channel spacings of 20, 25 or 30kHz, and using frequency division multiple access (FDMA is the classy way of saying that a system has frequency 'channels'!).

Cellular radio, said Cheeseman, is the 'highest form' of mobile radio, but the first generation systems are already experiencing congestion problems. The speed of development of modern technology is such that the useful life of a given technology rarely exceeds ten or fifteen years. Cellular radio is no exception! Plans for a second generation digital cellular network are well under way in Europe for operation in the 1990s. Cheeseman reminded his engineering audience that many of them would still be in practice when the third generation cellular systems come into service around the year 2000! REW

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8. Write your own routines using the interface board.

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PLEASE NOTE. The SS99H requires an external 5V logic compatible terminal unit, such as the MPTU-1 (See previous adverts).

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CC = Common Cathode
CA = Common Anode
RDP = Right Hand Decimal Point
LDP = Left Hand Decimal Point

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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Technical developments in amateur radio seem to come along at such a rate these days that it is pretty difficult to keep up with them. The latest to come to the fore is packet radio. Listen on the amateur bands almost any time nowadays and sooner or later you will hear it being discussed, and you will soon gather that it is still very much of a mystery to many people! So just what is packet radio?

Packet radio is a radio communication system in which a single radio channel is used to provide reliable transmission between several pairs of stations. Digitally encoded data is usually used, computers being the basis of the system. It allows messages to be transmitted at high speeds with very low error rates and it also allows the radio channel to be shared between several independent QSOs at the same time.

This is very different from conventional radio data systems such as RTTY or CW, where transmission rates are low, error rates are comparatively high and where one channel can support only one QSO at a time.

To achieve a low error rate, packet radio breaks the messages down into blocks, or 'packets', and transmits only one packet at a time. When received it is checked for accuracy, and if it has been received without error the receiving station acknowledges it as such and then another packet is sent and so on. If, however, the packet has not been received in its entirety the receiving station requests a repeat.

Packet type communications have been in existence for quite a while, years in fact, in the military and commercial spheres, but have only recently been introduced to the amateur radio scene, no doubt due to the popularity of home computers. It is a complicated system needing quite a lot of know-how, and even those who have made an in-depth study of its principles and practice have to admit that there is always something more to add to their knowledge. It is, in fact, ideal for the really dedicated experimentally orientated amateur.

Mic shy

It is surprising how often one meets a newly licensed radio amateur who for some reason does not get on the air, even though he has gone to the expense of equipping himself with all the gear necessary to get him going straight away. It is interesting to note too that quite a number of these 'non-starters' are retired and have decided that amateur radio would make an excellent pastime for their retirement.

Over the years, talking to some of these folk who seem so reluctant to get on the air, the writer has come to the conclusion that they don't get going because they are 'mic shy'. It seems that collecting their thoughts together and speaking them into a microphone is beyond their capacity. They get confused at the co-ordination required and lack confidence in their ability to do so.

However, all is not lost. One can think of possible ways of helping such folk gain confidence. Perhaps the most obvious is to invite them into one's shack, set up a phone QSO and once it's going push the microphone into their hands and say: 'Now get on with it'!

With some such encouragement and help, they'll soon overcome their mic shyness and be able to make their own QSOs. Radio clubs could help by giving instruction in 'microphone technique' and the help of an elocutionist might be sought. Many whose job or interests require them to make public speeches into a microphone find this of help. Writing out a prepared QSO and then reading it can also be tried. And a few sessions on a pair of VHF FM 'handhelds' in separate rooms may help to break the ice. If you know a sufferer don't let him give up – we all found it strange and difficult at first!

Satellite up-date

Recent information is to hand regarding Russian satellite developments.

RS 9 and 10 may well be launched by the time you read this. Their launch date was scheduled for January or February. RS 9 is to be similar to previous satellites in the RS series. It will carry a Mode A transponder with uplink frequencies between 145.860 and 145.900MHz and downlink frequencies between 29.360 and 29.400MHz. Its CW telemetry beacon will transmit on 29.402MHz.

There is a robot similar to that on RS 5 and RS 7. Its uplink is on 145.820 and the downlink is on 29.320MHz. There is also a beacon on 435.395MHz, with 2 watts output into a groundplane antenna. The telemetry system of RS 9 is similar to that used for the RS 3 to RS 8 series.

RS 10 will have several transponders. The Mode A transponder will have its uplink frequencies between 145.960 and 146.000MHz and its downlink frequencies between 29.460 and 29.500MHz. There will be two beacons on the downlink, one on 29.457 and the other on 29.503MHz. These beacons will have 250mW and 1W output.

Innovation

There is to be a '21MHz' transponder on RS 10, which will be an innovation. This Mode K transponder will have an uplink frequency of between 21.260 and 21.300MHz and a downlink frequency between 29.460 and 29.500MHz. There will be two beacons on frequencies in this range too. There will also be a new experimental Mode T transponder, with uplink frequencies between 21.260 and 21.300MHz and downlink frequencies between 145.960 and 145.995MHz. Mode T beacon frequencies are planned for 145.957 and 145.997MHz.

RS 10 will also carry a robot with an uplink frequency of 21.140MHz and downlink frequencies of 29.457 and 29.503MHz, which will make use of the two 10 metre beacon transmitters. The telemetry system will differ slightly from the RS 9 system. Finally, RS 10 will have two code stores with a capacity of 250 characters each. So it is going to be quite a sophisticated satellite.

Both RS 9 and RS 10 are planned to be launched into circular orbits with an altitude of about 1800km, a period of around 120 minutes and an inclination of between 82 and 83 degrees.

Students and technicians at the Moscow Aviation Institute are preparing a new experimental amateur satellite of the Iskra class. This will be Iskra 4. It is hoped to launch it early in 1986. In addition to a CW telemetry beacon there may be a Mode A transponder as well. It is proposed to launch it from the manned space station Salyut 7, to which it will be carried on board a Progress spacecraft. This is an unmanned automatic 'spacefreighter' which is sent to Salyut 7 on a regular basis to deliver the food and materials required by the astronauts aboard. Our thanks to Nico PA0DLO for the information from which this outline was prepared.

The Eye Emergency Net

Amateur Radio is an activity which impinges on many facets of community service. One of the lesser known such activities is the Eye Emergency Net. The writer must confess that until he read about it recently he was quite unaware of its existence. In last November's issue of the ARRL's journal *QST* there is an account of this service, provided within the USA by a group of very dedicated radio amateurs. The author of the article, John Lenman WA8MHO, begins his account by saying:

'Most amateurs have at least heard references to the Eye Emergency Net, or Eye Bank as it used to be called, and know it is one of our long-standing valuable public services. Yet many do not know its history, purpose or details of operation.'

Apparently, in the USA the Eye Emergency Net started in December 1962, through the efforts of Dr Braley W0GET, an eye surgeon in Iowa, and Ted Hunter W0NTI, an electronics engineer at Iowa State University. Their idea was to provide rapid, no-cost and effective communication once a day to make known to participating Eye Banks any emergency requirements for eye tissue, and to make known the location of any such material available. Medical information and shipping arrangements were discussed and arrangements made over the public telephone, once the tissue had been located on the net.

Originally only six cities were involved, but the net has since grown to cover many more cities, some outside the USA. Some 10,500 transfers of tissue have so far been carried out.

Co-operation

The net does not have any offices, business meetings or formal organisation. Membership is determined by the individual Eye Banks' desire to use amateur radio as a channel of communication. If a particular Eye Bank wishes to use the amateur radio net for supplementing their normal channels of communication, then mutual arrangements are made with any co-operating local radio amateur.

The USA Eye Emergency Net operates on 80 and 40 metres, with morning and evening net sessions. Many operators in the net faithfully check in day after day for months without ever getting any traffic. This does lead to frustration and disappointment for an operator who is keen to be of real service. Hence, participation often ceases and it becomes difficult to keep the nets intact. The article concluded by expressing the hope that with more support from the amateur radio fraternity they expect to be around for at least another twenty years!

Something like an antenna system!

What must be quite the largest two metre antenna system in existence has recently been built by Dave Blaschke W5UN. Built for two metre 'moonbounce' activity, it replaces a small sixteen element yagi he previously used. The new system consists of thirty-two commercially available KLM 17 LBX yagi antennas, each on a boom thirty-one feet long. The main 'H' frame is a boom ninety-seven feet long. There are eight cross-arms made from forty foot lengths of three inch diameter aluminium tubing. The horizontal boom is supported on two vertical towers.

Azimuth rotation is accomplished by driving one of the towers in a hundred foot radius around the other tower, which acts as a pivot for the system. The movable tower is supported on a stripped down 1947 Ford pick-up chassis driven by an electric motor. It takes about one acre of land to rotate the array through the full 360 degrees.

THE TRIO R-2000

Ken Michaelson G3RDG casts an eye over Trio's latest box of tricks

Already possessing the Trio R-1000 communications receiver, and finding it an excellent piece of equipment, it was with interest and pleasure that I had the opportunity to use the latest model of the line, the R-2000.

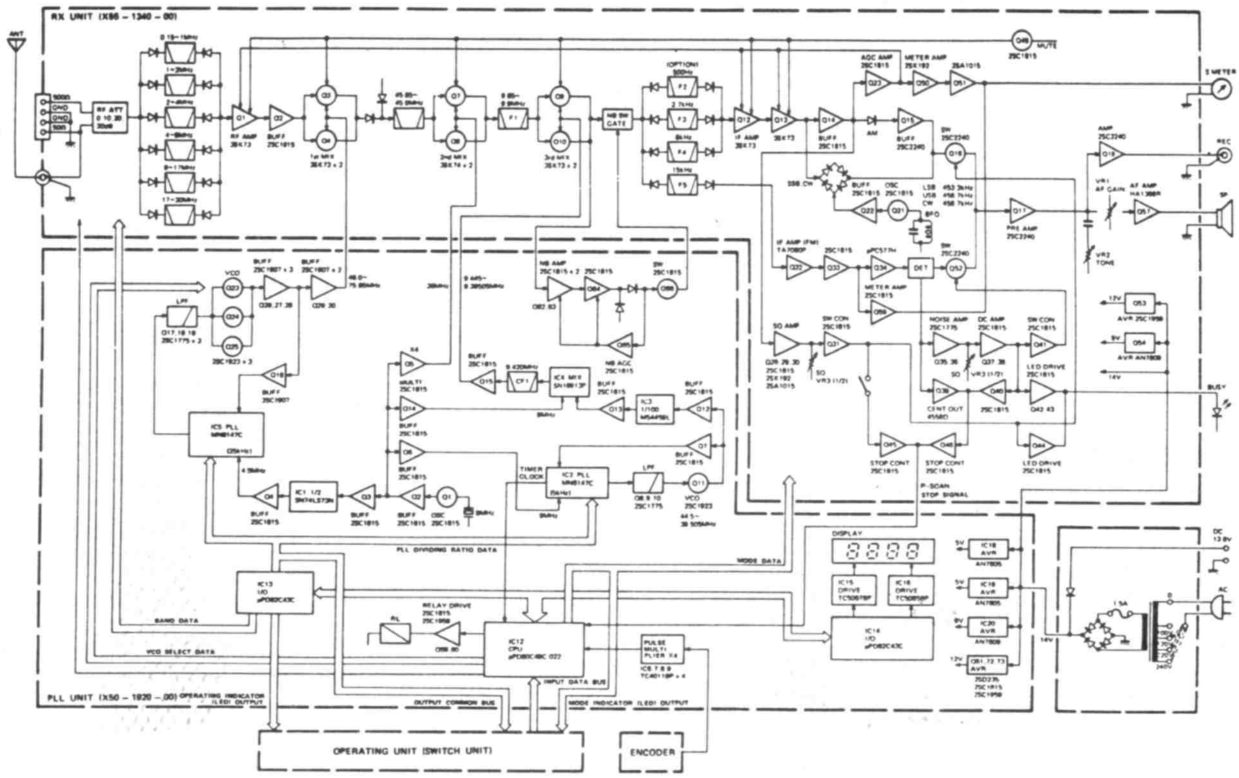
The receiver is physically larger than the R-1000, being 375mm (14.8ins) wide × 115mm (4.5ins) high × 210mm (8.3ins) deep, and weighs 5.5kg (12.1lbs). There are four modes of reception, AM, FM, SSB (USB/LSB) and CW; one more than the R-1000, which has no FM mode. The sensitivity is of a high order, being less than 0.4μV between 2MHz and 30MHz for SSB and CW, which are the more popular modes. I found the selectivity, too, to be entirely satisfactory, being given as 2.7kHz at the −6dB point for SSB and CW. An extra crystal filter is available from Trio (YG-455C) which gives a 500Hz position for CW. There is also a VHF converter covering 118 - 174MHz (VC-10) available, which is intended to be plugged into a socket at the rear of the unit. Neither of these accessories was supplied for the review, so I cannot comment on them. The unit operates from a 12 volt supply.

The frequency stability of the receiver is stated to be within ±50Hz during any 30 minute period after a one hour warm-up, and although I did not use any instruments to check this figure, when receiving RTTY commercial stations I found I could leave everything running for long periods and return to find that perfect copy was still being received. There is no analogue dial as with the R-1000, but I did not consider that a disadvantage. The digital readout is provided with a dimmer switch, although I could not see the point of it, never having had occasion to use this facility on my R-1000.

This digital display is also used to show two different clocks. Both are in the 24 hour format, clock 1 being employed to operate a timer which will switch the receiver on/off at predetermined times, and clock 2 for local time or UTC as desired. With this facility it is possible to record an item which might be broadcast when one is otherwise engaged. The timer will switch on the receiver and also (by means of the 'remote' terminal at the rear of the receiver) switch on a cassette recorder. It will then switch both units off at the appropriate time.

At the right-hand side of the receiver is the tuning knob, with a comfortable rubber ring round the outside giving a very pleasant 'feel' to the control. Above the tuning knob are the 'tuning speed' switches. Since this is a synthesised receiver, the three switches select the steps for tuning. The 'slow' switch moves the frequency at the rate of 50Hz per step, the 'mid' at 500Hz and the 'fast' at 5kHz per step. Personally, I never altered it from the 'slow' position when using the receiver; I found the other two rates far too fast. There is also a 'lock' facility so that one does not accidentally shift the tuning knob during reception.

Below the tuning knob are two pads, slightly larger than the tuning rate switches, which control the band switching in 1MHz steps. Press the right-hand one and the receiver is switched to a lower band. The left-hand one does the opposite. Each time a band is changed, a 'beep' is heard from the speaker. There is an adjustment of the level of the beep by means of a small screwdriver from the under-side of the receiver. If the pad is kept pressed, the band changes without



a stop until the end of the range.

To the right of the main front panel are the mode switches (AM, FM, USB, LSB and CW). The one in use at any time is indicated by a green LED to the left of it.

Many advantages

In the middle of the panel are the memory keys (1-0). It is vital that the owner reads the manual in order to understand the memory keys, otherwise full use cannot be made of the receiver's many advantages. One can program ten different frequencies, together with their modes, ie AM, USB, FM etc, by tuning in the frequency desired and pressing the 'M.IN' key. The receiver gives a beep and the frequency is recorded. This can be recalled by pressing the same key again. The insertion of these frequencies is retained by a back-up lithium battery with an estimated life of five years, so that there will be no trouble about recalling the inputs even when the receiver is switched off or disconnected from the mains supply.

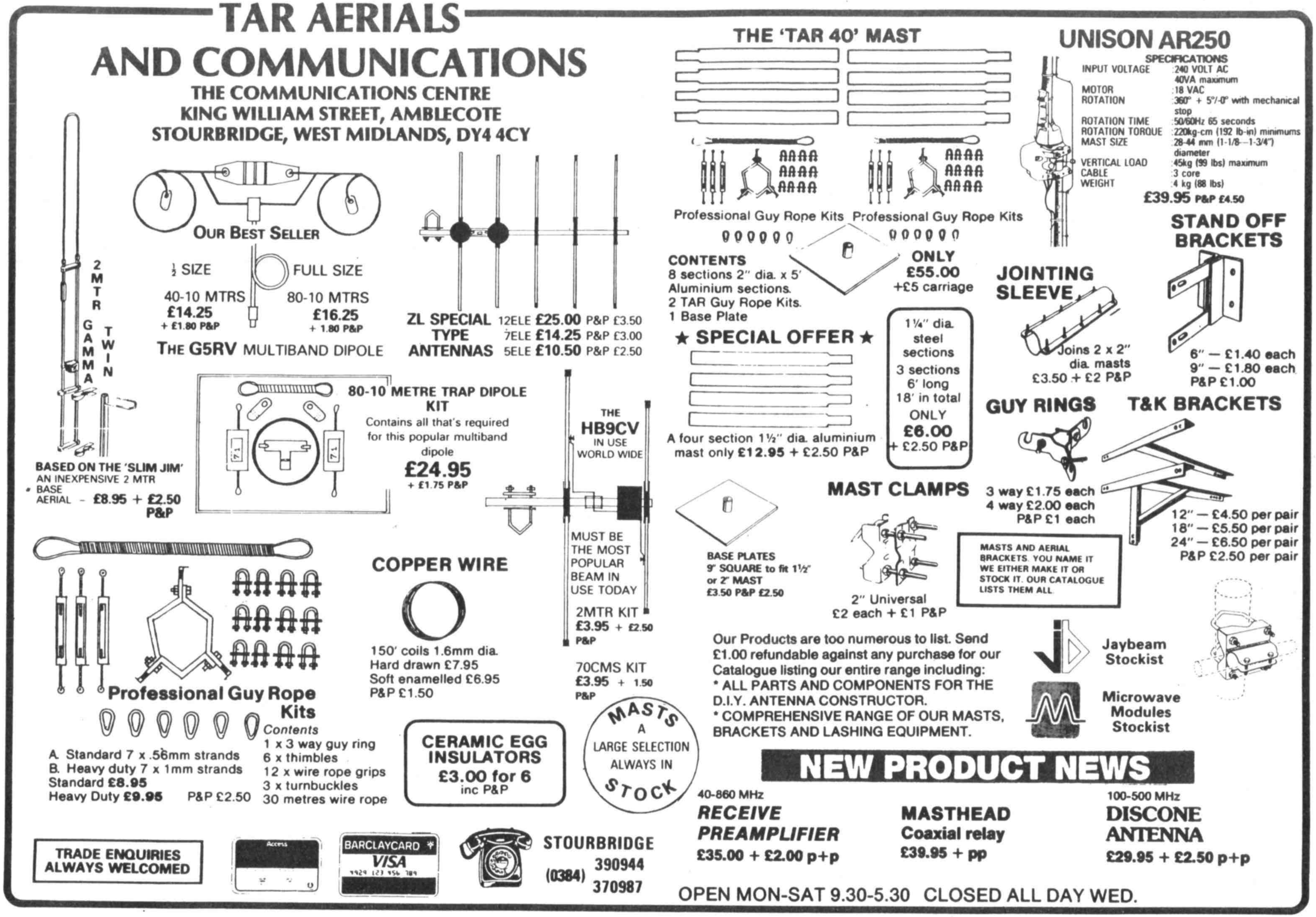
If the 'Auto.M' key is depressed, all the information as to the tuning and mode is automatically retained, and can be recalled in the same manner as above. Having recalled a frequency (the number of the key being shown on the panel), the tuning knob may be turned either way without disturbing the pre-recorded frequency, and when a more desirable station is heard all that it is necessary to do is to press 'M.IN' again to replace the previous frequency with a new one.

There is also a 'memory scan' facility, and if 'M.Scan' is pressed scanning will start from channel 1 and proceed through the range to channel 0 at 1.5 second intervals. In order to stop the scanning one presses 'M.Scan' again. As mentioned above, the receiver has the FM mode available, but since I did not have the VHF converter I could not try this mode. The squelch circuit, however, works on all modes and was useful for leaving the receiver on stand-by on a calling channel. It is possible to arrange that the receiver stops at a signal when scanning (in AM, SSB or CW modes) by changing a jumper on the receiver PCB from the 'S1' position to the 'S2' position, but when operating in this manner the scanning does not stop at the centre tuning point, so one has to press the 'hold' key and finally tune in manually.

I thoroughly enjoyed the R-2000's facilities, particularly the memories which were available. It was a great help to tune in calling frequencies and put them into memory, to be recalled each day or whatever without any dial and waveband twiddling. The scanning facility, too, was an advantage to use, as I could monitor several frequencies at completely different parts of the spectrum very quickly. In fact, I connected up my Trio TS820S in conjunction with the R-2000 using the 'remote connector' and used the receiver instead of the receive section of the TS820S. It worked beautifully, and made an interesting change from the normal transceive operation. It is hardly necessary to comment about Trio workmanship and the overall finish of the unit: it was excellent throughout.

Good investment

All in all, I found the receiver gave an excellent account of itself over the whole range available, and I consider it to be a good investment at £479.47, including VAT but with carriage at £7.00 to be added. The VC-10 VHF converter is priced at £128.36 including VAT + £2.50 carriage, and the YG-455C crystal filter is £89.98 including VAT + £1.00 carriage. Thanks are due to Lowe Electronics Ltd of Chesterfield Road, Matlock, Derbyshire DE4 5LE for the loan of the receiver for this review. REW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MOTOR :18 VAC
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ROTATION TIME :50/60Hz 65 seconds
ROTATION TORQUE :220kg-cm (192 lb-in) minimums
MAST SIZE :28-44 mm (1-1/8—1-3/4") diameter
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A variety of options include IC-PS25 internal AC power supply, IC-EX310 voice synthesizer, the TV-1200 TV transceiver adaptor and the IC-EX309 computer interface. The IC-1271E is the most compact and lightest all-mode 1200 MHz transceiver currently available.

IC-R7000 VHF/UHF scanning receiver

Causing quite a stir at the moment is the ICOM IC-R7000. This new receiver is able to give high frequency coverage up to 1.3MHz without sacrificing SSB stability which is maintained throughout the IC-R7000's entire frequency range. For simplified operation and quick tuning, the IC-R7000 feature direct keyboard entry. Precise frequencies can be selected by pushing the digit keys in sequence of the frequency or by turning the main tuning knob. FM/AM/SSB modes, frequency coverage 25-1000 MHz and 1025 – 2000MHz (25 – 1000MHz and 1260 – 1300MHz guaranteed specification). The IC-R7000 has 99 memories available to store your favourite frequencies including the operation mode. Memory channels may be called up by simply pressing the memory switch, then rotating the memory channel knob or by direct keyboard entry. A sophisticated scanning system provides instant access to most used frequencies. By depressing the Auto-M switch. The IC-R7000 automatically memorises frequencies in use, while the unit is in the scan mode. This allows you to recall frequencies that were in use. Scanning systems include memory selected frequency ranges or priority channels, scanning speed is adjustable. Narrow/wide filter selection. Five tuning speeds: 10Hz, 100Hz, 1.0KHz, 10KHz and 25KHz. All functions including memory channel readout are clearly shown on dual-colour fluorescent display with dimmer switch. The IC-R7000 has dial-lock, noise blanker, S-meter and attentuator. Options include RC-12 infra-red remote controller and a voice synthesizer.
For a more detailed specification of the competitively priced IC-R7000 contact your authorised ICOM dealer or telephone us direct on 0800 521145, our FREE Linkline service for Amateurs and SWL's.

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IC735 compact HF Transceiver

As predicted the ICOM IC-735 has rapidly gained the reputation it deserves. When compared with similar 'top names' transceivers the IC-735 towers above them (despite its smaller size). The IC-735 has a larger number of programmable channels, but notably most important is the superb sensitivity in all modes SSB, CW, AM and FM. This superior sensitivity is due to the excellent front end performance. All amateur frequencies from 1.8MHz to 30MHz are available including the three new bands 10, 18 and 24MHz. RF output is approximately 100 Watts. Tuning ranges from 100KHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY operation is also possible. Dynamic range is 105dB with a 70.451MHz first IF circuit. Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Preamp is 10dB and attenuator 20dB. Computer remote control is possible via the RS-232C jack. Options include: the AT-150 automatic antenna tuner, the PS55 AC power supply and the SM-6 and SM-8 desk mics. Why not find out more about the IC-735 by ringing us or your local ICOM dealer.

Thanet Electronics are proud to offer their continued complete service for all Amateur radio requirements – no matter what your problem may be regarding the smooth operation of your shack Thanet have the answers, and technical 'know-how'.
If you require a demonstration of any ICOM equipment telephone our retail premises on Herne Bay (0227) 369464 where we will be pleased to hear from you.

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WANT TO LEARN MORE?

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This is strictly a helpline for obtaining information about or ordering ICOM equipment. We regret this service cannot be used by dealers or for repair enquiries and parts orders. Thank you.

ICOM authorised dealers in the U.K.

Alyntronics, Newcastle, 0632-761002.
Amateur Radio Exchange, London (Ealing), 01-992 5765.
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A.R.E. Comms, Earlestown, Merseyside, 09252-29881.
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Dressler (UK) Ltd., London (Leyton), 01-558 0854.
D.W. Electronics, Widnes, Cheshire, 051-420 2559.
Hobbytronics, Knutsford, Cheshire, 0565-4040. Until 10pm daily.
Poole Logic, Poole, Dorset, 0202 683093.
Photo Acoustics Ltd., Buckinghamshire, 0908-610625.
Radcomm Electronics, Co. Cork, Ireland, 01035321-632725.
Radio Shack Ltd., London NW6, 01-624 7174.
R.A.S. Nottingham, 0602-280267.
Ray Withers Comms, Warley, West Midlands, 021-421 8201.
Scotcomms, Edinburgh, 031-657 2430.
Tyrone Amateur Electronics, Co. Tyrone, N. Ireland, 0662-42043.
Reg Ward & Co. Ltd., S.W. England, 0279-34918.
Waters & Stanton Electronics, Hockley, Essex, 0702-206835.

Listed here are just some of the authorised dealers who can demonstrate ICOM equipment all year round. This list covers most areas of the U.K. but if you have difficulty finding a dealer near you, contact Thanet Electronics and we will be able to help you.

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MODIFYING THE ICOM IC240

48 channels and remote control from P J Cooper G3CXI

Although the Icom 240 is now no longer in production there are very many of these transceivers in general use. They are basically 23-channel 10 watt FM transceivers, and give a very good account of themselves on the band.

The channel selection is by diode matrix such that one can choose 14 simplex channels, while 9 channels are committed for repeater operation. Obviously a few extra channels would be very useful.

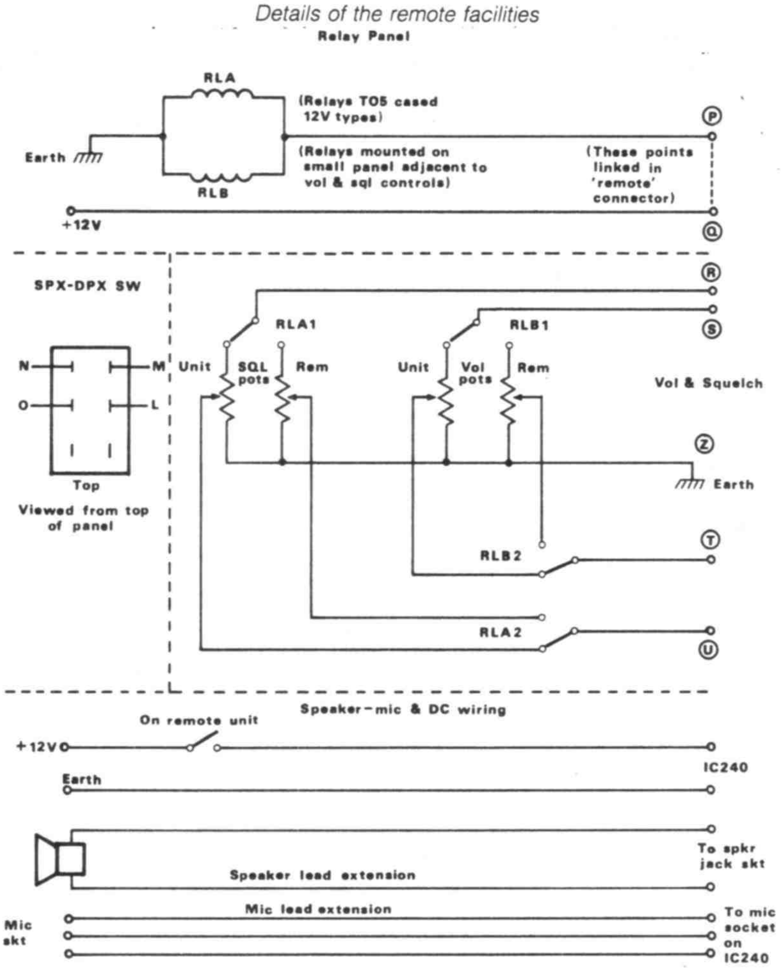
I was faced with a problem: having acquired a different vehicle, where would I fit the IC240? There was certainly no place on or around the fascia panel, and indeed nowhere inside the car itself, but many ideal places in the car boot. An investigation then commenced into redesigning the circuit to allow for remote control, as a small place had been found on the lower part of the instrument console where a remote control panel would blend in with the normal instrumentation. The design criteria were:

1. 48 switch-selected channels.
2. Toneburst blanking on simplex.
3. Automatic repeater shift.
4. Safe mobile operating.

An investigation of the simplex/duplex switching showed that three voltage supplies were available:

1. General supply on at all times.
2. Receive only voltage, on only during receive.
3. Transmit only voltage, on only during transmit.

Details of the remote facilities



This pointed the way to the simplex/duplex remote switching solution, which was achieved by exclusive-OR gates in the remote control panel.

Channel switching is by means of two wafer switches – a 12-way and a 4-way. This allows for all channels from 144.6MHz to 145.575MHz and 145.8MHz to 145.975MHz, the gap in the middle being repeater output channels and therefore mainly unusable.

Once again switching is done where necessary by using exclusive-OR gates and diodes. The diode marked with an asterisk is important: this diode replaces the signal which comes from the SPX/DPX switch which on transmit is no longer there, and omitting this diode will cause possible transmission outside the band. The other diodes on the gates of IC2a and IC2b are for tone blanking on simplex channels.

Indication of duplex or simplex channel operation is shown by red and green LED indicators.

Controls

All controls, ie two switches, volume, squelch and on/off toggle, are fitted on a small control panel behind which is a small chassis carrying the diodes and OR-gates etc. The 12 volt supply is switched through to the main unit from the panel and an LED indicator shows when it's switched on.

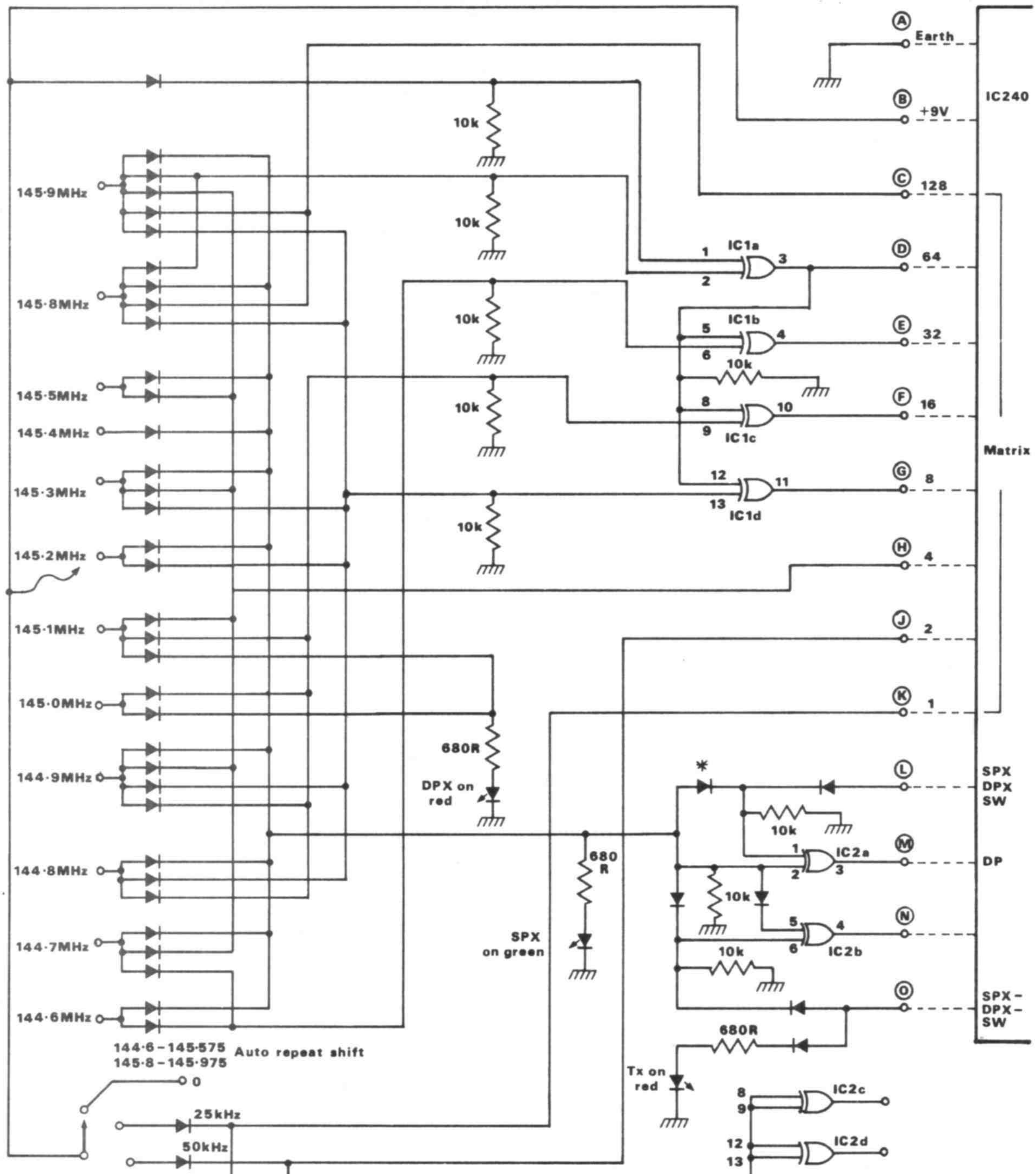
The volume and squelch controls are operated by a small relay panel carrying two TO-5 cased 12 volt relays which are activated when the remote control is plugged in. The circuit shows how this is wired. When the unit is removed from the car it reverts back to standard 23 channel operation.

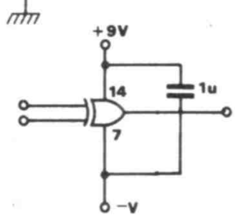
Simple modifications are necessary to the main IC240. The 9-way connector is removed and minor surgery performed to fit a slightly larger connector to take the remote cable. In my case I used a miniature 25-way flat ribbon cable, and of course on the remote unit any connectors available can be used as space is not so important here.

The relays controlling the volume and squelch are made up on a small Veroboard and glued to the edge of the panel adjacent to the present controls in the IC240, the controls then being rewired via the relays. Wires are run from the matrix board points, the relay panel and the SPX/DPX switch to the new the connector on the IC240 and hence via the control cable to the remote unit.

The speaker is plugged into the socket on the IC240 and taken through into a convenient place within the car. Similarly the microphone is extended into the inside of the car; in my case I have fitted a small microphone connector in an armrest locker between the seats, and the microphone sits in there out of sight until required.

When the IC240 is installed in the car





Switching arrangements for 48 channels

boot, don't forget to switch it on to high-power, put the SPX/DPX switch to SPX and select a blank (star) position on the channel selector. Control is now passed to the remote unit from which all selection of channels etc takes place.

Operation is simple, with two switches to select 100kHz and 25kHz steps. A few trips around the switches will show how easy it is to move from one channel to another. Repeater channels are automatically switched for repeater shift. The panel identification is to individual choice, either channel numbers or frequency. I prefer frequency, but others with prime channel requirements may choose to identify them in some special way.

Finally, it is a comforting thought to know that the expensive bit is locked away at all times in the boot and could even be concealed there – my own equipment is not obvious even with the boot open. I hope that this modification will give your Icom 240 a new lease of life and many more channels on which to enjoy the hobby of amateur radio. REW

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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
PL802	5.95
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	84.95
QB5-1750	139.50
QBL5-3500	495.00
QE03-10	4.95
QE08-200	£145.00
QF40	65.00
QP25	1.00
QQE02/5	19.50
QQE03-12	7.95
QQE03-20	35.00
QQE06/40	45.00
QQV02-6	19.50
QQV03-10 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
TD1-100A	28.00
TD3-12	4.00
TP25	1.50
TSP4	7.00
TT11	1.50
TT21	45.00
TT22	46.00
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	2.95
UBC81	1.50
UBF89	0.60
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	0.65
UCL82	1.75
UCL83	2.50
UF85	1.20
UF41	1.15
UF42	1.15
UF80	0.80
UF89	2.50
UL44	3.50
UL84	0.85
UU5	3.50
UU7	8.00
UU8	9.00
UY41	3.50
UY85	0.70
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	99.50
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	29.50
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	0.70
1U5	1.00
1X2B	1.40
1Z2	8.95

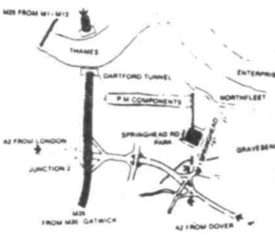
2AS15A	11.50
2B22	69.50
2C39A	32.50
2C39BA	39.50
2C40	37.00
2C42	29.50
2C51	0.75
2C53	32.00
2CY5	1.50
2B7	1.50
2D21	1.50
2D21W	2.50
2E22GY	45.00
2E26	7.95
2J42	93.00
2K25	27.50
2K25 Ray	75.00
2K26	95.00
2K29	250.00
2K56	250.00
3A108A	9.00
3A/107B	12.00
3A/109B	11.00
3A/110B	12.00
3A/141K	11.50
3A/147J	7.50
3A/167M	10.00
3A2	3.95
3A3A	3.95
3A4	1.10
3AL5	0.95
3AT2	3.35
3AU6	0.65
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	3.50
5U4GB	2.50
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	1.50
6AK6	2.50
6AL5	0.60
6AM4	3.25
6AM5	6.00
6AM6	1.50
6AN5	2.65
6AN8A	2.65
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	5.95
6B7	2.50
6B8G	1.50
6BA6	0.95
6BA7	4.50
6BA8A	3.50
6BC8	1.00
6BE6	0.72
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.20
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
f116BX6	0.48
6BX7GT	3.50
6BZ6	2.50
6BZ7	2.95
6C4	1.10
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	1.15
6DQ5	6.95
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	1.10
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	4.95
6JM6	3.95
6JS6C	4.95
6JU8	2.50
6J7	2.50
6K7G	2.00
6K8Y/G	3.00
6KD6	5.50
6KM8	2.50
6KT8	2.95
6KZ8	1.95
6L1	2.50
6L19	3.95
6L6GC	2.95
6L6GC (GE)	4.50
6L6GT	1.95
6LD20	1.15
6LF6	7.50
6LJ8	2.50
6LQ6	4.95
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	0.95
12AT7	1.15
12AT7WA	2.50
12AU6	1.95
12AU7	0.85
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
13EI	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	2.95
61SPT	4.50
75B1	3.50
75C1	2.50
83	8.50
83AI	9.00
84	3.00
85A1	6.50
85A2	1.50
90AV	10.00
92AG	19.50
92AV	12.50
95A1	6.50
108C1	1.50

150B2	6.95
150C2	1.50
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	65.00
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	65.00
811A	15.00
813	23.50
829B	14.50
832A	14.50
833A	95.00
866A	4.50
872A	25.00
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	3.95
2050W	4.50
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
5726	1.50
5727	1.95
5749	2.50
5750	1.85
5751	2.95
5763	4.95
5814A	3.25
5829WA	6.50
5840	3.50
5842	11.00
5847	10.95
5879	8.50
5886	13.95
5894	39.50
5899	4.50
5963	2.00
5965	2.25
6005	1.85
6012	16.00
6021	3.65
6057	2.50
6058	3.95
6060	2.25
6062	4.50
6063	2.00
6064	2.95
6067	1.95
6072	4.20
6080	7.95
6132	10.00
6146B	9.50
6688	6.50
6887	9.50
6080	8.50
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
6887	9.50
6873	4.50
7189	3.50
7199	6.15
7239	17.50
7247	2.95



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FOIL AERIALS

It's amazing what can be done with the simplest and cheapest of materials. Ivor Nathan demonstrates a true kitchen table experimenter approach to aerials . . .

Aluminium foil, especially in the form of baking foil, is an excellent material for the construction of aerials because of its high electrical conductivity, and because it can easily be cut to size and shape. Used in conjunction with adhesive masking tape it can readily be used to make different types of aerial, either for temporary experimentation or for permanent use. The masking tape reinforces and protects the aluminium foil and it can also be used to hold the aerial in place after construction.

The simplest VHF aerial that can be made from foil is the half-wave dipole. For Band II frequencies, each arm of the dipole should be cut to a length of 2½ feet. Accordingly, from a roll of baking foil about 17½ inches wide, cut off a piece that is 2½ feet long. Cut this piece along its length to form two pieces 2½ feet long, each about 8¾ inches wide. Fold each piece in half along its length and then twice again in the same way so that two pieces which are each 2½ feet long and about 1 inch wide are formed. This multiple folding provides additional physical strength and also presents a greater metallic surface to incoming signals, enhancing the capture effect of the resultant aerial.

Each arm of the dipole should then be attached to the adhesive side of a length of masking tape which has been cut to a size about ½ inch larger in every direction than the dipole arm (see *Figure 1*). Two inch wide masking tape is ideal; the combination of multiple-folded aluminium foil and masking tape is surprisingly strong but flexible.

At one end of each dipole arm (the 75 ohm feed point) punch a small hole through the foil and masking tape so that stranded wire can be inserted and secured after sufficient insulation has been removed from the wire. Carefully twist the end of the wire around after ensuring that there is sufficient bare wire in contact with the aluminium foil; then, fold back the excess masking tape to completely seal the connection, ensuring positive contact. The two connecting wires can then be taken to a plastic terminal-block, the other end of which secures the 75 ohm coaxial feeder cable (see *Figure 2*).

Fig 1 *One half of the dipole*

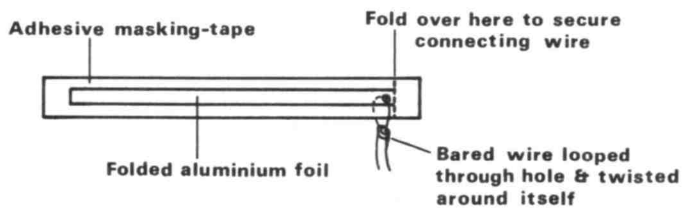
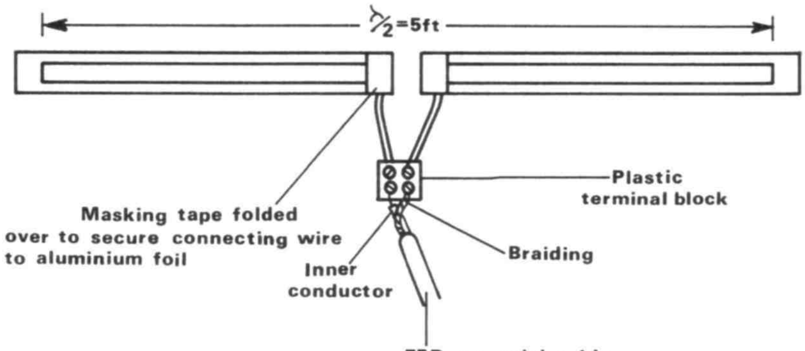


Fig 2 *The complete dipole*



For extra support, one continuous length (approximately 5 feet 2 inches) of adhesive masking tape can then be stuck along the other side of the outstretched aluminium foil to form a sandwich; ensure that there remains an insulating gap of about 1 inch between the two arms of the dipole, at the feed point. Alternatively, there is no need to fit this second piece of masking tape if the dipole is to be stuck to an inside wall or wooden window-frame by the sticky surface of the existing tape which is not covered completely by aluminium foil.

In this form, the dipole was compared with an upstairs indoor 'V' dipole made of aluminium tubing, already in use with a stereo tuner, and was found to be almost identical in performance.

Here in North London, close to the Hertfordshire border, several stations now operating above 100MHz and located south of London (including the new IBA station, Radio Mercury) were receivable in mono, as they were on the original aerial. Below 100MHz, all the local transmissions were received on either aerial in stereo and with negligible background hiss.

Tape it up

The dipole which has just been described can also be used in another form by modifying it after construction. Where insufficient space is available to suspend it either horizontally or vertically (or at 45° for mixed polarisation) each half of the dipole can be tightly rolled up, as shown in *Figure 3*, and the entire assembly can be taped together to form a compact package which can then be housed in a plastic container measuring about 2½ inches by 2 inches by 1½ inches; a hole would need to be drilled in the container to accommodate the coaxial feeder cable.

In its rolled-up form, successive turns of aluminium foil are insulated from each other by the masking tape. In this configuration, the aerial was found to be less responsive to distant signals but still provided stereo reception of all local signals.

Its main advantage was that it was receptive to signals arriving in any plane; polarisation characteristics of incoming signals could be ignored. Because of its omnidirectional properties, distant signals could be received by placing the compressed aerial, in its weatherproof plastic container, unobtrusively on the outside wall of the house and in a higher position.

This compressed version of the aerial is also ideal for use with a car-borne VHF/FM stereo receiver because its plastic container can be mounted on the outside of a car and is less likely to be damaged either by vandals or in the car-wash than a conventional aerial. Alternatively, it can be mounted inside one of the windows, rather than making use of

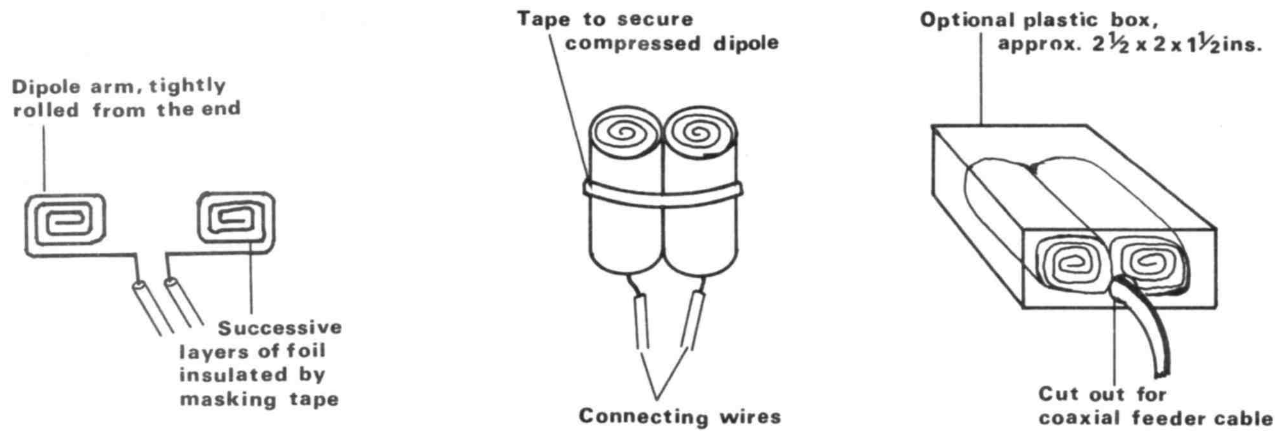


Fig 3 *Optional compressed configuration*

the rear windscreen de-mister that is sometimes capacitance-coupled for use as a (very directional and random-length) car aerial. Again, the omni-directional properties of this compressed dipole are ideal for use with a car because of the latter's frequently changing direction when mobile.

More ambitious

A more ambitious type of aerial that can be constructed from aluminium foil is the quad, which when used with a reflector gives approximately +8dB gain over a simple dipole. The method of construction is very similar to that already described for the open dipole, except that the foil does need to be sandwiched between two layers of adhesive masking tape because of the sheer size of a Band II quad (31½ inches square). It is easier to make the quad from five separate pieces of foil (five because of the gap for the centre-fed coaxial-cable connection) rather than from one piece. Because of this, it is essential to ensure that there is sufficient overlap between each piece at the four corners of the complete assembly, so that continuous electrical conductivity occurs throughout its entirety except for the centre-feed gap.

As with the dipole described previously, multiple folding of each strip before sandwiching between the masking tape provides physical strength and enhanced capture effect. The same method of connection, using two pieces of stranded wire and a plastic terminal-block, is used as before to terminate the aerial into 75 ohm coaxial feeder cable (see *Figure 4*).

If used in the shack or den, the quad aerial can be either taped to the inside of a wooden window-frame or secured to a sheet of hardboard or wood. If the latter method is used, the aerial can be conveniently turned and tilted to enable its very directional properties to be fully exploited. Should the aerial not be used in the shack or den, it can be taped out of sight behind either a picture-frame or a large item of furniture.

The quad aerial described was compared, without adding a reflector, to the same indoor 'V' dipole as before. It was found to give superior results to the original dipole and to all aerials tried so far; in particular, Radio Kent was received at a much higher signal strength than before, although still in mono at this extreme range.

The same type of quad aerial could be secured to a sheet of hardboard or wood, as could the plastic terminal-block and coaxial feeder cable, mounted in a loft roof-space and fitted with a 33 inch square reflector made in the same way as the aerial itself and positioned 23½ inches (0.2λ) behind it (see *Figure 5*). The complete assembly would then give approximately +8dB gain over a single dipole.

For good results . . .

All aerials described in this article have a nominal impedance of 75 ohms; for use with receivers with a 300 ohm input impedance the appropriate matching transformer will be required for optimum results. REW

Fig 4 *Quad aerial for Band II*

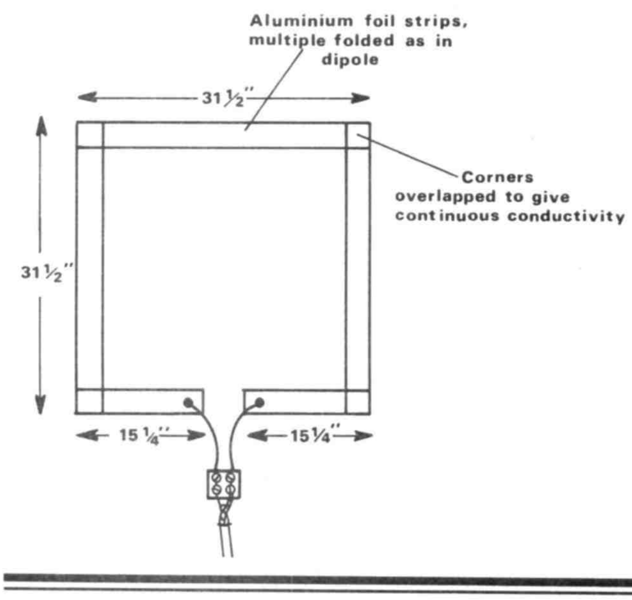
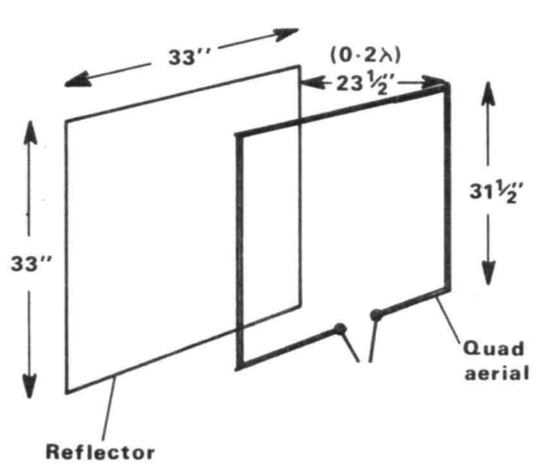
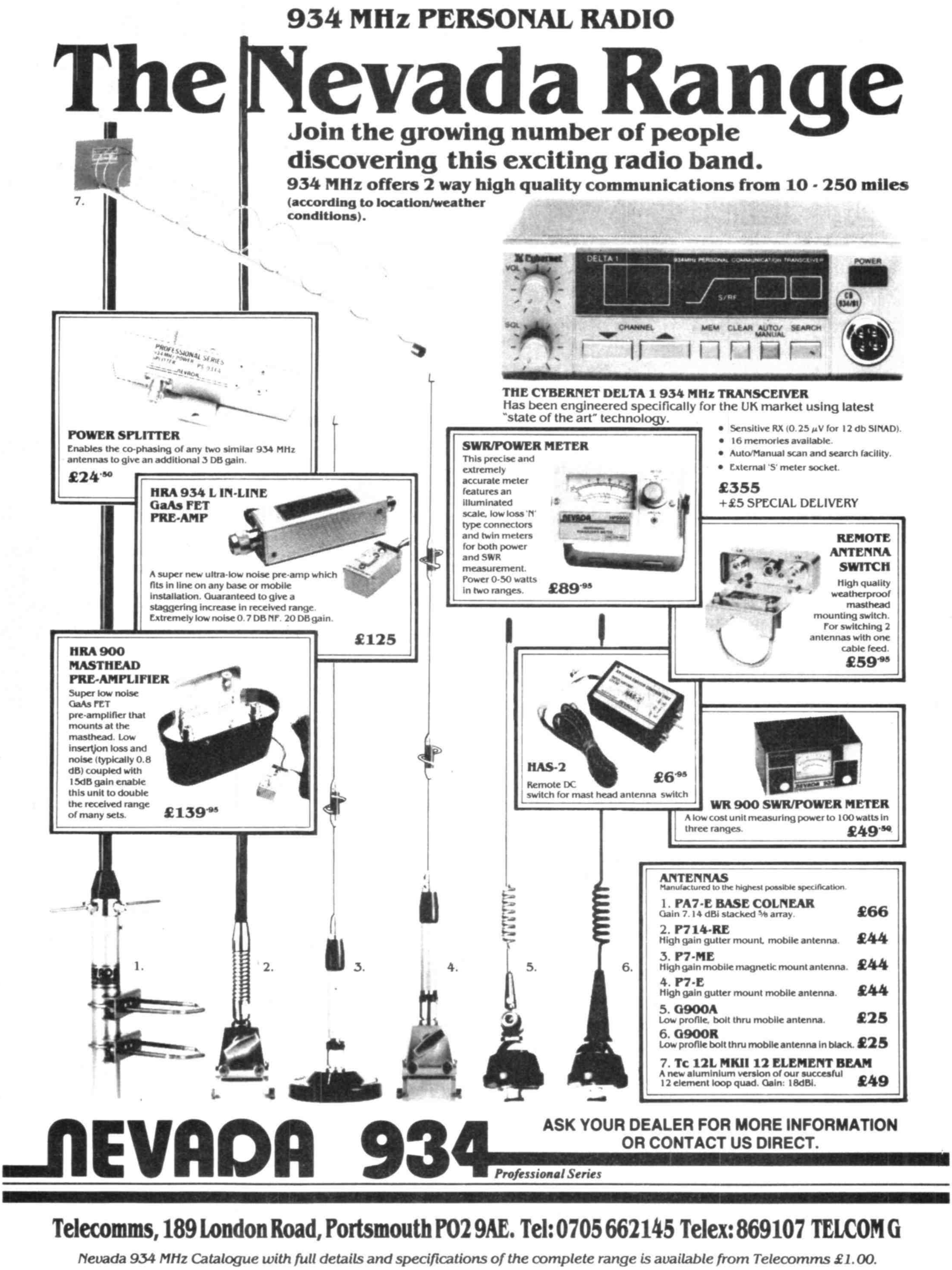


Fig 5 *Adding a reflector*

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DATA FILE . . .

Ray Marston looks at VMOS power-FET principles and applications

In the last three editions of *Data File* we have discussed the basic principles of the field-effect transistor (FET), given introductory explanations of devices such as the JFET, the IGFET/MOSFET, and the VFET, and taken in-depth looks at practical applications of both the JFET and the MOSFET. In the present edition of 'The File' we conclude this FET mini-series by first taking a brief look at the general family of power FETs known as 'VFETs', and then taking an in-depth look at applications of a specific member of that family, the VN66AF VMOS power FET.

VFET basics

A VFET can, for most practical purposes, be simply regarded as a high-power version of a conventional enhancement mode MOSFET, even though the VFET in fact uses a different form of construction and a slightly different operating principle than the low-power MOSFET.

The 'V' in the 'VFET' title actually indicates that the device uses a vertically-structured (multi-layer) form of construction, in which the main terminal currents flow vertically through the semiconductor materials, rather than being (as in the case of a normal MOSFET) a single-layer device in which the main terminal currents flow horizontally through the surface layer of the semiconductor material. These points are illustrated in *Figures 1* and *2*.

Figure 1 shows the basic construction of an n-channel enhancement mode MOSFET, which comprises a single thin layer of p-type semiconductor material with n-type source and drain material infused into the main layer. The gate is electrically insulated from the semiconductor material, but electrostatically controls the width of a drain-to-source conduction channel at the surface of the semiconductor material. The channel is fully closed when zero gate bias is applied, but opens as the gate is positively biased.

Horizontal flow

Note in *Figure 1* that the MOSFET drain-to-source signal current flows 'horizontally' through the conductive channel of the device, and that because the semiconductor layer is very thin the maximum allowable drain-to-source currents are very limited (typically to maximum values in the range 2 to 40mA).

Figure 2 shows the basic construction of an n-channel enhancement mode VFET device, which uses a 'vertically-structured' form of construction using several layers of semiconductor material, one above the other. The gate bias again electrostatically controls the width of a drain-to-source conduction channel, but in this case the drain-to-source current flows vertically through the semiconductor layers: the maximum allowable operating current of the VFET is thus not restricted by the 'thinness' of the individual semiconductor layers, and many practical VFET devices can handle main-terminal currents of up to several amps.

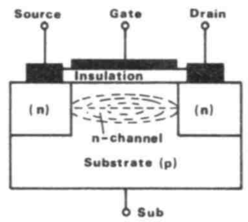


Fig 1 *n-channel enhancement mode MOSFET*

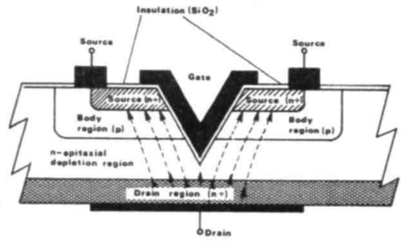


Fig 2 *Typical VFET power device*

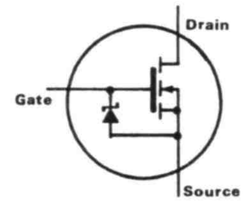


Fig 3 *Siliconix VMOS power FET*

Device type	P_{TOT} (max) W	I_D (max) A	V_{DS} (max) V	V_{DG} (max) V	V_{GS} (max) V	V_T (min-max) V	g_m (typ) mmhos	C_{IN} (max) pF	f_T (typ) MHz
VN10KM	1	0.5	60	60	5	0.3-2.5	200	48	–
VN1010	1	0.5	100	100	15	2V max	200	48	–
VN46AF	12.5	2	40	40	15	0.8-2	250	50	600
VN66AF	12.5	2	60	60	15	0.8-2	250	50	600
VN88AF	12.5	2	80	80	15	0.8-2	250	50	600

Fig 4 *Major parameters of 5 n-channel Siliconix VMOS power FETs*

Device type	P_{TOT} (max) W	I_D (max) A	V_{DS} (max) V	V_{DG} (max) V	V_{GS} (max) V	V_T (min-max) V	g_m (typ) mmhos	f_T (typ) MHz	Channel type
2SJ48	100	7	−120	−120	14	−0.8 to −1.5	1000	900	p
2SJ49	100	7	−140	−140	14	−0.8 to −1.5	1000	900	p
2SJ50	100	7	−160	−160	±14	−0.8 to −1.5	1000	900	p
2SK133	100	7	120	120	14	1 to 1.5	1000	600	n
2SK134	100	7	140	140	14	1 to 1.5	1000	600	n
2SK135	100	7	160	160	±14	1 to 1.5	1000	600	n

Fig 5 *Major parameters of 6 high power Hitachi VFETs*

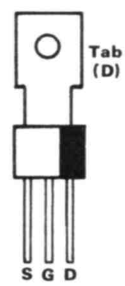


Fig 6 *TO202-cased VN66AF power FET*

STATIC	Max drain-source voltage	60V
	Max drain-gate voltage	60V
	Max continuous drain current	2A
	Max pulsed drain current	3A
	Max continuous forward gate current	2mA
	Max pulsed forward gate current	100mA
	Max continuous reverse gate current	100mA
	Max forward gate-source (Zener) voltage	15V
	Max reverse gate-source voltage	−0.3V
	Max dissipation at 25°C case temperature	15W
	Gate threshold voltage	0.8V min, 1.2V typical
	Zero-gate-voltage drain current at 25°C	10μA max
	On-state drain current at V_{GS} = 10V	1.0A min, 2.0A typical
	Temperature operating and storage range	−40 to +150°C
DYNAMIC	Forward transconductance (typical)	250 millimhos
	Input capacitance (typical)	50pF
	Reverse transfer capacitance (typical)	10pF
	Common-source output capacitance (typical)	50pF
	Typical switching times, 25V supply, 23R load, 0-10V gate drive from a 50R source: Turn-on delay	2ns
	Rise time	2ns
	Turn-off delay	2ns
	Fall time	2ns

Fig 7 *Major static and dynamic characteristics of the VN66AF*

The specific form of VFET construction shown in *Figure 2* was pioneered by Siliconix in the mid-1970s, and devices using this construction are marketed under the trade name of 'VMOS power FETs' (vertically-structured metal oxide silicon power field-effect transistors). This 'VMOS' name is normally associated with the V-shaped gate groove formed in the structure of the VMOS device.

Siliconix VMOS power FETs are probably the best known type of VFETs. These devices are presently available as n-channel devices only, and in most cases incorporate an integral Zener diode which gives the gate a high degree of protection against accidental damage. *Figure 3* shows the standard symbol used to represent such a device, and *Figure 4* lists the main characteristics of five of the best known members of the VMOS family; note in particular the very high maximum operating frequencies of these devices.

Another well-known family of VFET devices are those produced by Hitachi. These devices use a rather different form of construction than that shown in

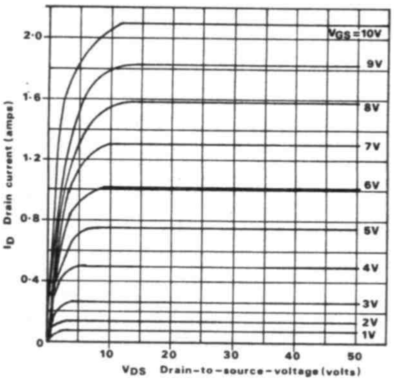


Fig 8 Output characteristics of the VN66AF

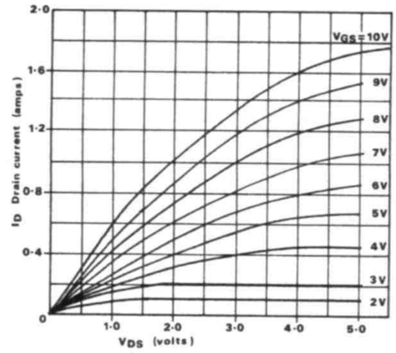


Fig 9 Saturation characteristics of the VN66AF

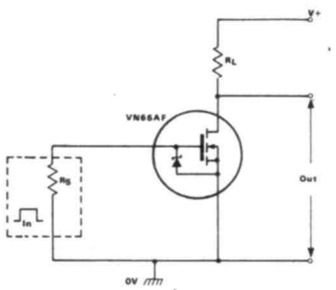


Fig 10 Basic VMOS digital switch or amp

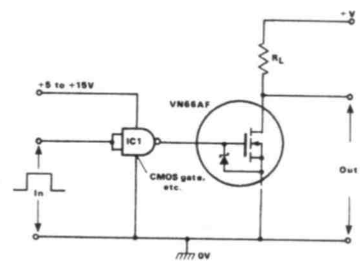


Fig 11 Method of driving VMOS from CMOS

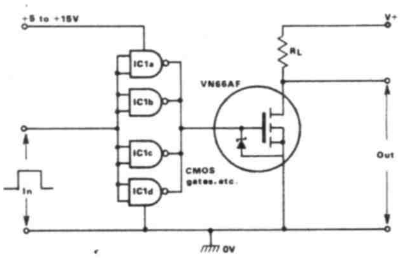


Fig 12 Rise and fall times can be reduced by driving from parallel connected gates

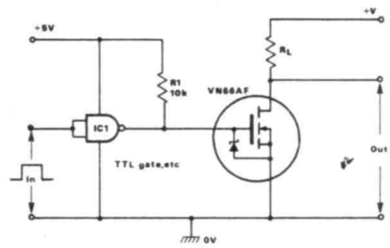


Fig 13 Method of driving VMOS from TTL

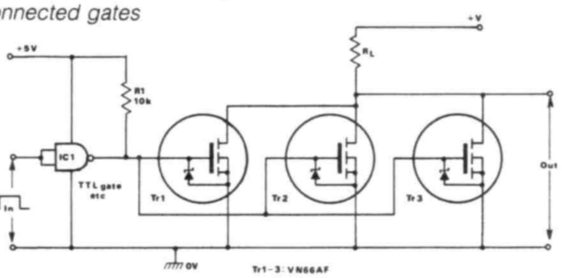


Fig 14 Boosting the output of Figure 13 by driving 3 VN66AF's in parallel

Figure 2, and are available in both n-channel and p-channel versions. This range of VFETs is well suited to complementary audio power amplifier applications, and *Figure 5* lists the main characteristics of six devices in their '7 amp, 100 watt' range.

The VN66AF

The best way to get to know VMOS is to actually 'play' with a device, and for this purpose the VN66AF is very useful and fairly readily available. It is normally housed in a TO-202 style plastic-with-metal-tab package with the outline and pin connections shown in *Figure 6.*

Figure 7 lists the major static and dynamic characteristics of the VN66AF. Points to note here are that the input (gate-to-source) signal must not be allowed to exceed the 15V Zener rating of the unit, and that the device has a typical dynamic input capacitance of only 50pF. This capacitance dictates the dynamic input impedance of the VN66AF; the static input impedance is in the order of a million megohms.

Figure 8 shows the typical output characteristics of the VN66AF, and *Figure 9* shows its saturation characteristics. Note the following specific points from these graphs:

1. The device passes negligible drain current until the gate voltage reaches a threshold value of roughly 1 volt. The drain current then increases non-linearly as the gate is varied up to about 4 volts, at which point the drain current has a value of about 400mA. The device in fact has a square-law transfer characteristic below 400mA.
2. The device has a highly linear transfer characteristic above 400mA (4V on the gate), and thus offers good potential as a low distortion class A power amplifier.
3. The drain current is controlled almost entirely by the gate voltage and is almost independent of the drain voltage so long as the device is not saturated. A point not shown in the diagrams is that for a given value of gate voltage the drain current has a negative temperature coefficient of about 0.7% per °C, so that the drain current decreases as temperature rises. This characteristic gives a fair degree of protection against thermal runaway.
4. When the device is saturated (switched fully on) the drain-to-source path acts as an almost pure resistance with a value controlled by the gate voltage. The resistance value is typically 2R with 10 volts on the gate, and 10R with 2 volts on the gate. The off resistance of the device is in the order of megohms. These characteristics make the device highly suitable for use as a low distortion high speed analogue power switch.

Digital circuits

VMOS can be used in a wide variety of practical digital and analogue applications. It is delightfully easy to use in digital switching and amplifying applications; *Figure 10* shows the basic connections. Here, the load is simply wired between the drain and the positive supply rail, and the digital input signal is fed directly to the gate terminal. Switch-off occurs when the input goes below the gate threshold value (typically about 1V2). The drain 'on' current is determined by the peak amplitude of the gate signal, as shown in *Figure 8,* unless saturation occurs. In most digital applications the 'on' current should be chosen to ensure saturation.

The static input impedance of VMOS is virtually infinite, so zero drive power is needed to maintain the VN66AF in the 'on' or 'off' state. Drive power is, however, required to switch the device from one state to the other: this power is absorbed in charging or discharging the 50pF input capacitance.

The rise and fall times of the output of the *Figure 10* circuit are (assuming zero input rise and fall times) determined by the source impedance of the input signal, by the input capacitance and forward transconductance of the VMOS device, and by the value of R_L. If R_L is large compared to R_S, the VN66AF gives rise and fall times of roughly 0.11ns per ohm of R_S value. Thus a 100R source impedance gives an 11ns rise or fall time. If R_L is not large compared to R_S, these times may be considerably changed.

A point to note when driving the VN66AF in digital applications is that its input Zener forward and reverse voltage ratings must never be exceeded. Also, because of the very high frequency response of VMOS, the device is prone to unwanted oscillations if its circuitry is poorly designed. Gate leads should be kept short, or be protected with a ferrite bead or a small resistor in series with the gate.

Rise and fall times

VMOS can easily be interfaced directly to the output of a CMOS IC, as shown in *Figure 11*. Output rise and fall times of about 60ns can be expected, due to the limited ouput currents available from a single CMOS gate, etc. Rise and fall times can be reduced by driving the VMOS from a number of CMOS gates wired in parallel, as shown in *Figure 12*, or by using a special high-current driver.

VMOS can be interfaced to the output of TTL (either standard or LS types) by using a pull-up resistor on the TTL output, as shown in *Figure 13*. The 5 volt TTL output of this circuit is sufficient to drive 600mA through a single VN66AF. Higher output currents can be obtained either by wiring a level-shifter stage between the TTL output and the VMOS input, or by wiring a number of VMOS devices in parallel, as shown in *Figure 14*.

When using VMOS in digital 'switching' applications, note that if inductive drain loads such as relays, self-interrupting bells or buzzers, or moving-coil speakers are used, 'clamping' diodes must be connected as shown in *Figure 15* to damp inductive back emfs and thus protect the VMOS device against damage.

Simple 'digital' designs

Figures 16 to *20* show a few simple but useful 'digital' applications of the VN66AF VMOS device.

The touch-activated power switch of *Figure 16* could not be simpler: when the 'contacts' are open, there is zero volts on the gate of the VN66AF, so the device passes zero current. When a resistance (zero to tens of megohms) is placed across the contacts (by contact with skin resistance), a substantial gate voltage is developed by potential divider action and the VN66AF passes a high drain current, thus activating the bell, buzzer or relay.

The *Figure 17* circuit is similar to the above, but has two sets of 'touch' contacts and gives a semi-latching relay action. When the 'on' contacts are touched, C1 charges via the skin resistance and turns the relay on. The resulting C1 charge then holds the relay on until the charge either leaks away naturally or is removed by briefly touching the 'off' contacts.

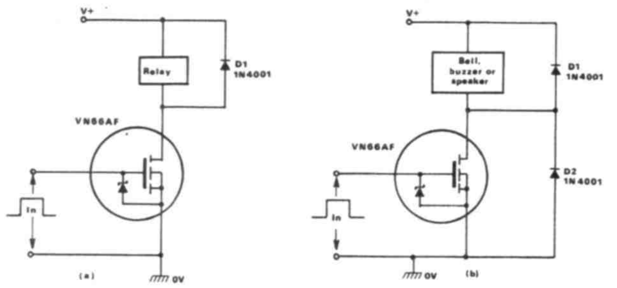


Fig 15 *If inductive loads are used in digital switching circuits protection diodes must be connected*

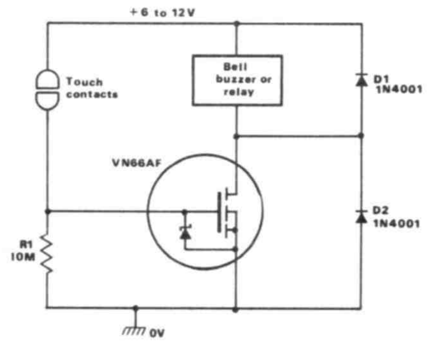


Fig 16 *Touch-activated power switch*

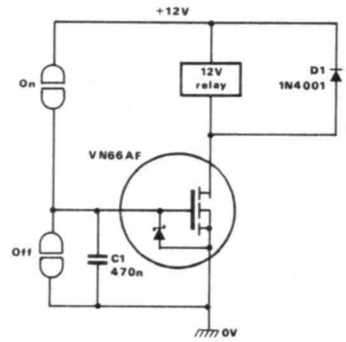


Fig 17 *Semi-latching touch-activated relay switch*

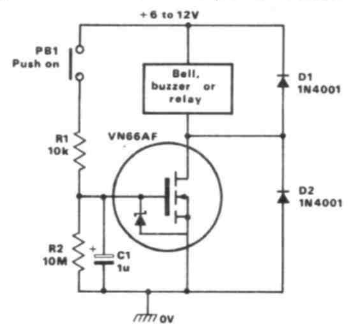


Fig 18 *Delayed turn-off power switch*

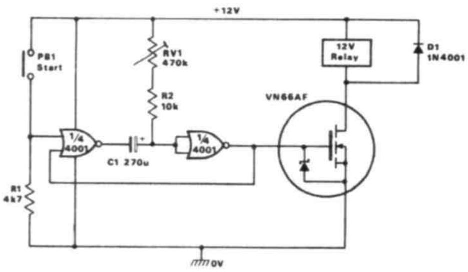


Fig 19 *Simple relay output timer circuit*

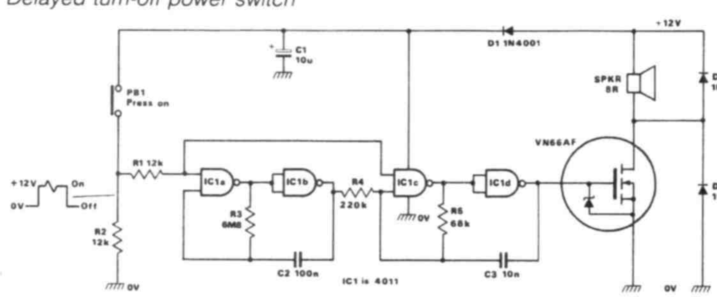


Fig 20 *Warble-tone 6W alarm*

In the manually-activated delayed turn-off circuit of *Figure 18*, C1 charges rapidly via R1 when push-button switch PB1 is closed, and discharges slowly via R2 when PB1 is open. The load thus activates as soon as PB1 is closed, but does not deactivate until some tens of seconds after PB1 is released.

In the simple relay-output timer circuit of *Figure 19*, the VMOS device is driven by the output of a standard manually-triggered monostable or 'one-shot' multivibrator designed around two gates of a 4001 CMOS IC. The relay turns on as soon as PB1 is closed, and then turns off automatically after a preset delay. The delay is variable from a few seconds to a few minutes via RV1.

Finally, *Figure 20* shows the practical circuit of an inexpensive but very impressive alarm-call generator that produces a police-like 'dee-dah' sound. The alarm can be turned on by closing PB1 or by feeding a 'high' voltage to the R1-R2 junction. The circuit uses an 8R speaker, and generates roughly 6 watts of output power.

Figures 21 to *23* show three simple but useful dc lamp controller circuits that can be used to control the brilliance of

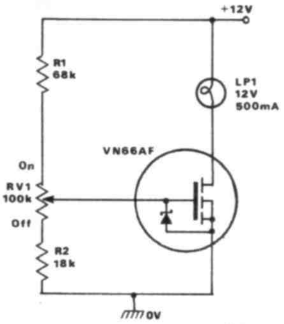


Fig 21 *Simple dc lamp dimmer*

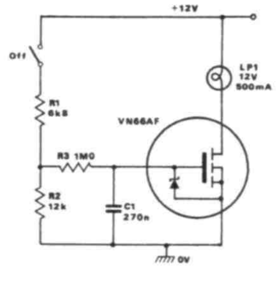


Fig 22 *'Soft-start' lamp switch*

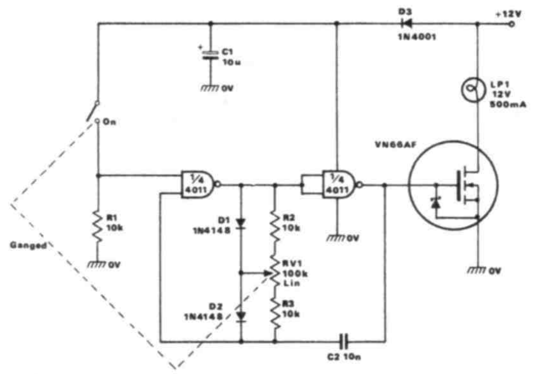


Fig 23 *High-efficiency dc lamp dimmer*

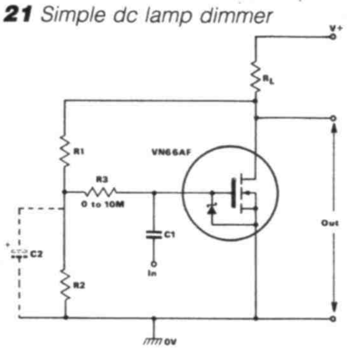


Fig 24 *Biasing techniques for linear common source mode*

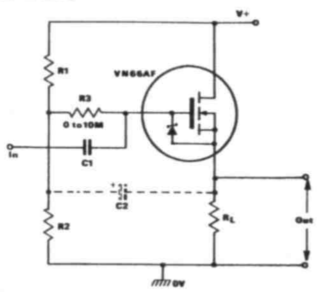


Fig 25 *Biasing techniques for linear common drain mode*

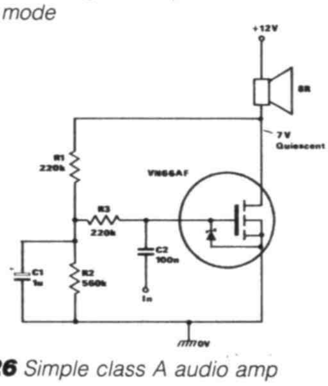


Fig 26 *Simple class A audio amp*

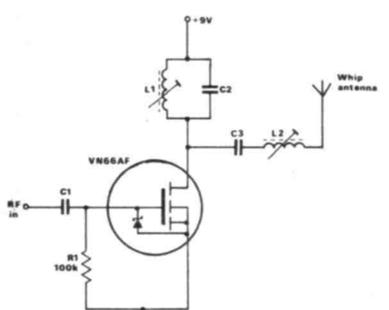


Fig 27 *600mW radio control or CW transmitter*

any 12 volt lamp with a power rating of up to 6 watts. A VMOS power FET can, for many purposes, be regarded as a voltage-controlled constant-current generator: thus in the *Figure 21* circuit the VMOS drain current (and therefore the lamp brightness) is directly controlled by the variable voltage developed on the slider of control pot RV1.

The *Figure 22* circuit is a simple modification of the above design, the action being such that the lamp turns on slowly when the switch is closed as C1 charges up via R3, and turns off slowly when the switch is opened as C1 discharges via R3.

The *Figure 23* circuit is an ultra-efficient 'digital' lamp dimmer which controls the lamp brilliance without causing significant power loss across the VMOS device. Here, the two 4011 CMOS gates are connected as an astable multivibrator that has a mark/space ratio that is fully variable from 10:1 to 1:10 via RV1, and has its output fed to the gate of the VN66AF, thereby enabling the 'mean' lamp brightness to be varied from virtually fully-off to fully-on. In this circuit the VMOS device is always switched either fully on or fully off, so power losses are negligible.

Linear circuits

VMOS power FETs can, when suitably biased, easily be used in either the common source or common drain (voltage follower) 'linear' modes. The voltage gain in the common source mode is equal to the product of R_L and the device's g_m or forward transconductance. In the case of the VN66AF the device gives a voltage gain of 0.25 per ohm of R_L value, ie a gain of ×4 with a 16R load, or a gain of ×25 with a 100R load. The voltage gain in the common drain mode is slightly less than unity.

A VMOS power FET can be biased into the linear common source mode by using the standard enhancement mode MOSFET biasing techniques shown in *Figure 24*, in which the R1-R2 potential divider is wired in the drain-to-gate ac/dc negative feedback loop and sets the quiescent drain voltage at roughly half-supply value, so that maximal signal level swings can be accommodated before clipping occurs.

In this circuit, when R3 has a value of zero ohms, the circuit exhibits an input impedance that because of the ac negative feedback effects is roughly equal to the parallel values of R1 and R2 divided by the voltage gain ($R_L \times g_m$) of the circuit. If R3 has a finite value the input impedance is slightly less than the R3 value, unless ac feedback-decoupling capacitor C2 is fitted in place, in which case the input impedance is slightly greater than the R3 value.

Common drain operation

Figure 25 shows how to bias the VMOS device for common drain (voltage follower) operation. Potential divider R1-R2 sets the VMOS gate at a quiescent value slightly greater than half-supply volts. When the R3 value is zero, the circuit input impedance is equal to the parallel values of R1 and R2. When the R3 value is finite the input impedance equals the R3 value plus the parallel R1-R2 values. The input impedance can be raised to a value many times greater than R3 by adding the C2 'bootstrap' capacitor to the circuit.

Figure 26 shows a practical example of a VMOS 'linear' application. Here the circuit is wired as a class A power amplifier which because of the excellent linearity of the VN66AF gives remarkably little distortion for so simple a design. The VN66AF must be mounted on a decent heatsink in this application. When the design is used with a purely resistive 8R load, the amplifier has a bandwidth that extends up to 10MHz.

Finally, to complete this look at VMOS power FETs, *Figure 27* shows how such a device can be used to make a simple but excellent 600mW radio control or CW transmitter output stage. the L1-C2 tank circuit and the L2-C3 antenna resonator component values must be chosen to suit the required operating frequency.

Next month

In next month's edition of *Data File* we will look at the faithful old 'bipolar' transistor, and present a stack of useful applications circuits. REW

RTTY DECODING USING THE SPECTRUM

Software-only approaches may demonstrate some elegant programming, but for reliability you can't beat a terminal unit. S Dean presents a terminal for the ubiquitous Spectrum

The use of microcomputers for the transmission and reception of RTTY signals is becoming increasingly widespread, almost totally replacing the old teletypewriter for obvious reasons. Commercial units (and kits) are available to do this on most home micros, but these tend to be expensive and give the user no insight into the way the system works.

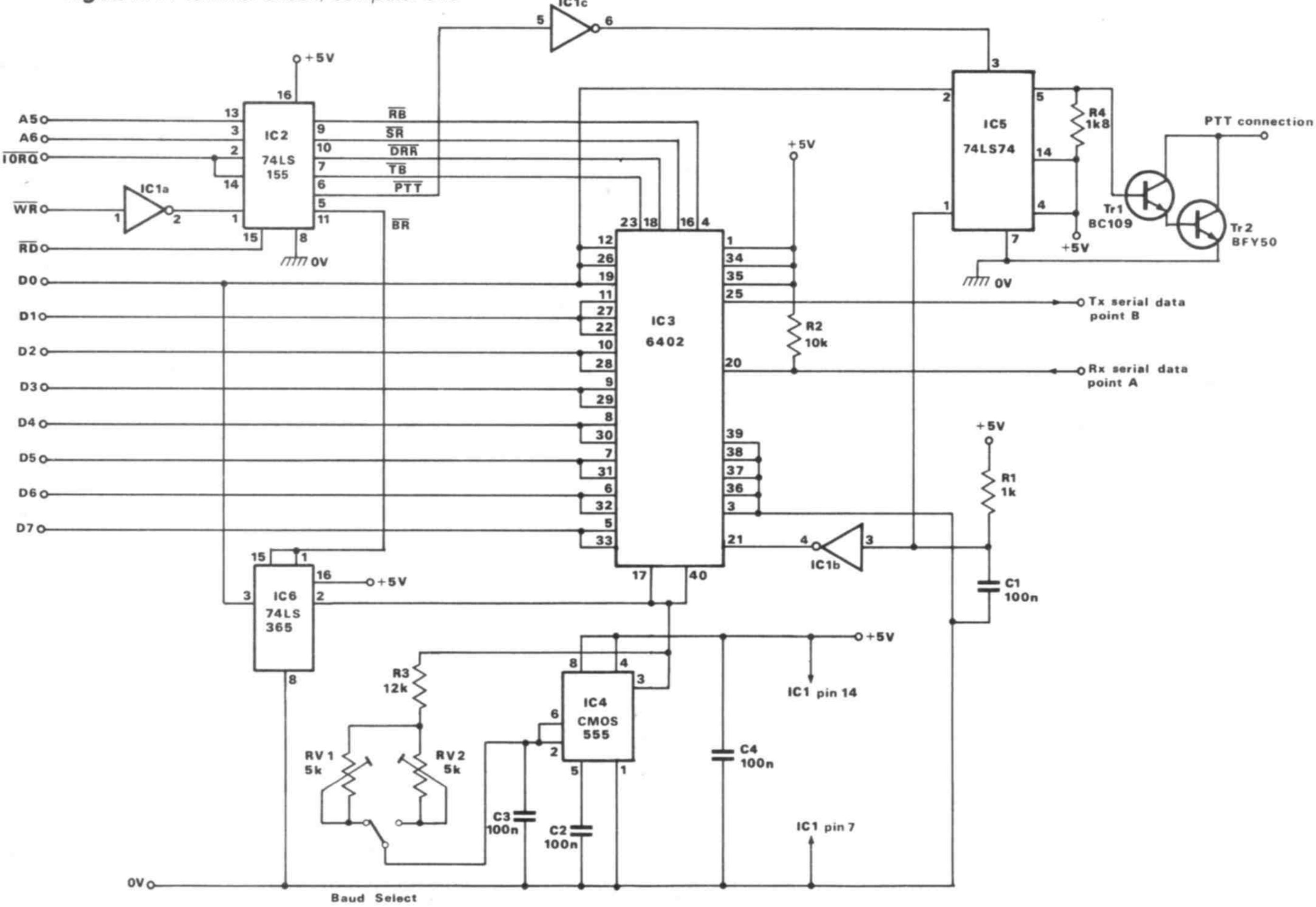
The terminal described in the following article is intended to be used with the Spectrum 16K or 48K computer. It is inexpensive to build, and every effort has been made to explain the operation of both hardware and software in sufficient detail to enable most 'hams' to get the unit operational without difficulty.

The program provided was written to allow the testing of each routine separately, and although communication is quite possible using this program, an improved version is available from the author (£4.50 including postage), which amongst other things allows the reply to be compiled whilst receiving. It is hoped that the program will be published in a later issue of this magazine.

RTTY – a brief outline

The most common of RTTY systems uses serial 5-bit ASCII (American Standard Code for Information Interchange) to represent letters, numbers, and symbols. Now, with 5 bits only 32 characters can be represented, so to allow the full alphabet as well as figures 0 to 9 and symbols to be sent, the receiving terminal is told whether the code about to be sent represents a letter or a figure/symbol by a shift character. This shift character need only be sent whenever a change from letters to numbers/symbols or vice versa is needed.

Fig 1a *RTTY terminal circuit, computer end*



For example, if the callsign G3XYZ is sent, only 2 shift characters are needed, a number shift preceeding the '3' and a letter shift preceeding the 'X'. A table of the standard codes is shown in next month's instalment

Now that we have a 5-bit code we require a means of modulating a transmitter signal to broadcast the information. The most common system is FSK (frequency shift keying), in which the ones and zeros of our serial binary code are represented by two tones of different frequency.

Over the years standards have evolved for both the rate of sending and the frequency of the tones. There is unfortunately more than one standard, and to cover most amateur and commercial RTTY broadcasts we need to be able to meet the following requirements:

Baud rates: 45.5 and 50

Tones: 1275Hz for a '0' or 'space'

1445Hz or 1700Hz for a '1' or 'mark'

The baud rate is the number of bits transmitted per second.

Circuit description

The circuit diagram of the terminal is shown in *Figure 1*, and is best considered in separate parts:

(1) Address decoding.

Because of the way that the Spectrum uses I/O addresses to communicate with its own devices, eg keyboard etc, the range of usable addresses is quite limited. Since A5 and A6 are not used internally, it makes sense to use these lines for external devices. IC2 and IC1a (*Figure 1a*) decode the 8 combinations of these lines (4 write, 4 read), although the combination of A5 and A6 both being high is unusable since the Spectrum sets these lines high whilst addressing internal devices.

(2) Serial/parallel circuit.

This circuit uses the Intersil 6402 UART (Universal Asynchronous Receiver-Transmitter), chosen because of its flexibility and low cost.

The receive data output and the status register of the UART have 'tri-state' outputs allowing them, along with the transmitter buffer register, to be connected directly to the Spectrum's data bus. The decoded address lines from IC2 determine which of the above registers has access to the bus.

A reset pulse is provided at switch-on to the UART (IC3) and the PTT bistable (IC5) by C1, R1 via the inverter IC1b. The transmit and receive clocks are generated by IC4, the actual frequency being 16 times the required baud rate. Two switchable preset rates are shown, set by RV1/RV2, although other baud rates can be catered for by adding more variable resistors as required.

The UART's character length number of stop bits etc has been set up as required for RTTY by linking the appropriate pins to 0V or Vcc.

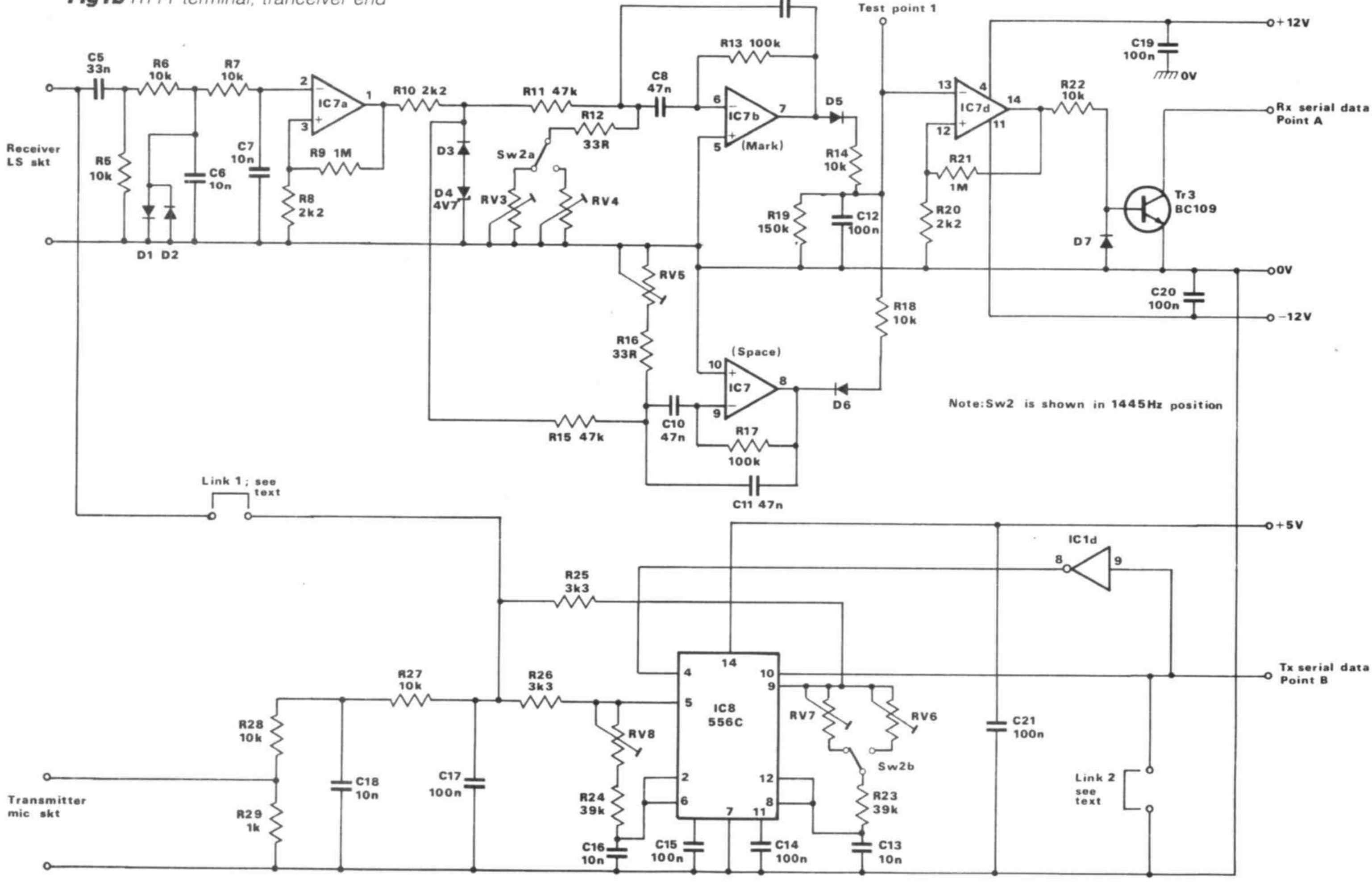
In receive mode, the 'data received' pin of the UART's status register is monitored by continuously addressing SR. When a character is received it is read into the computer by addressing RB. The 'data received' bit is then cleared by addressing DRR, allowing the UART to receive another character.

When transmitting, the UART tells the computer if it is ready to send a character by asserting 'transmitter buffer register empty' in the status register. The character to be sent is then loaded into the transmitter buffer by addressing TB.

(3) Push-to-talk circut.

The PTT bistable IC5 is intended to switch the station from receive to transmit under program control via driver stages Tr1, Tr2. The bistable is set

Fig 1b *RTTY terminal, tranceiver end*



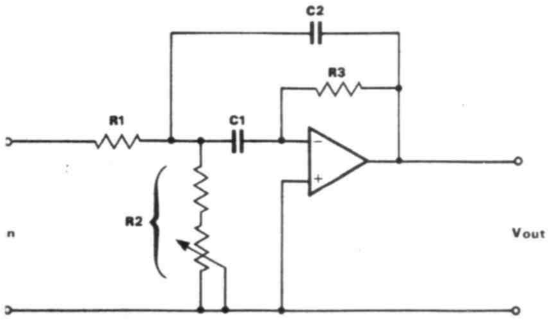


Fig 2 *The tunable bandpass filter*

(transmit mode) by writing a '1' to address PTT, and reset (receive mode) by writing a '0'.

(4) Baud rate monitor.
The baud clock is read onto data line D0 via IC6 when BR is addressed. This circuitry is optional, and IC6 may be omitted if desired.

(5) Tone decoder.
The circuit diagram of this board is shown in *Figure 1b.* IC7a amplifies and clips the audio signal taken from the receiver's loudspeaker terminals to produce a squarewave of constant amplitude, free from effects of QSB. The passive filters formed by C5, R5 and C6, C7,R6,R7 give the stage a bandpass characteristic to reduce effects of QRM. D1, D2 limit the input signal to prevent overload of the stage.

The squarewave signal (limited to ±5 volts by D3, D4) is fed to two tone filters, a 'mark' filter IC7b, and a 'space' filter IC7c. The centre frequency of IC7b is switchable to allow either 1445Hz or 1700Hz 'mark' signals. This type of filter is fairly common in RTTY circuits, since it is easily tuned using one variable resistor. The design criteria of the filter are rarely published but are worth a brief mention, since the filter may find uses elsewhere.

Figure 2 shows the circuit of the filter and its characteristics. The outputs of the filters are rectified by D5 and D6, and charge C12 either positively or negatively depending on the tone frequency. This signal is amplified and clipped by IC7d to provide serial code at logic levels, via Tr3, to the UART.

IC7a and IC7d both have a small amount of positive feedback to improve switching, and to give clearly defined thresholds of operation. If the receiver has insufficient output voltage to exceed this threshold (about 20mV), or if the circuit seems too sensitive, the value of R8 should be changed.

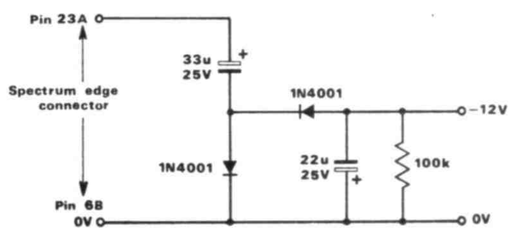
(6) Tone encoder.
Separate oscillators are used to produce the mark and space tone frequencies, their outputs being combined by R25,26 to provide the transmitter modulating signal. The serial data from the UART switches between oscillators by placing a reset on one or the other (due to the inverter IC1d). The space frequency is set to 1275Hz by RV8 and the mark frequencies to 1445Hz by RV6 and 1700Hz by RV7.

The squarewave output of IC8 is obviously unsuitable for modulating transmitters, and a passive filter R27,C18 is used to produce a reasonable approximation of a sinewave. The output level is attenuated down to microphone levels by R28,29.

(7) Power supplies.
The complete RTTY unit requires +5V and ±12V supplies. The 5V can be obtained from the Spectrum edge connector, as can the +12V, but do not be tempted to use the edge connection marked −12V as this pin is incorrectly marked and does *not* carry a −12V supply.

A simple way of providing the negative rail is to utilise the inverter circuit inside the Spectrum by adding the extra components shown in *Figure 3a.* If preferred, the unit can be run off an external supply. This will certainly relieve the already overworked Spectrum supply, especially with a 48K machine. A simple external supply is shown in *Figure 3b.*

Fig 3a *−12V supply from the Spectrum*



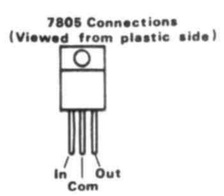
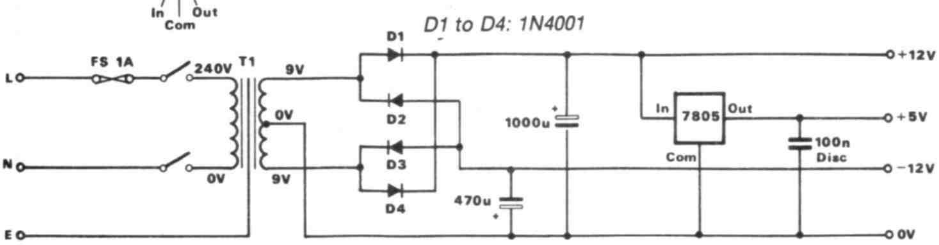


Fig 3b *External power supply*



NEXT MONTH

Yes, you've guessed it! In Part 2 we'll be covering the software involved in this project(obvious really, was'nt it?) For those whose typing is less than sparkling(and after all we are dealing with the Spectrum keyboard), this software is available on tape from the author for £4.50 including postage via the editorial offices.

Don't delay, post today!

COMPONENTS

Resistors	
R1, 29	1K
R2, 5, 6, 7, 14, 18, 22, 27, 28	10K
R3	12K
R4	1.8K
R8, 10, 20	2.2K
R9, 21	1M
R11, 15	47K
R12, 16	33R
R13, 17	100K
R19	150K
R23, 24	39K
R25, 26	3.3K
RV1, 2	2K 10 turn
RV3, 4, 5	50R 10 turn
RV6, 7, 8	20K 10 turn
Capacitors	
C1, 2, 3, 12, 14, 15, 17	0.1μF polyester
C5	33nF "
C6, 7, 13, 16, 18	10nF "
C8, 9, 10, 11	47nF "
C4, 19, 20, 21	0.1μF ceramic
Semiconductors	
IC1	74LS04
IC2	74LS155
IC3	6402
IC4	555 (CMOS)
IC5	74LS74
IC6	74LS365
IC7	TL074 or TL084
IC8	556 (CMOS)
D1, 2, 5, 6, 7,	1N4148
D3, 4	BZY88 C4V7
Tr1, 3	BC109
Tr2	BFY50
Miscellaneous	
SW1	SPDT toggle switch
SW2	DPDT toggle switch
23-way double-sided edge connector 0.1 pitch with locating peg	
Printed circuit board or Veroboard	
4 Test pins.	

Note that the components list refers to the main circuit, and does not include the power supplies

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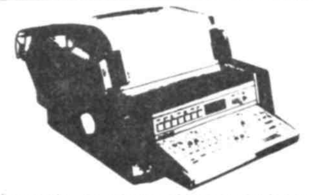

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DZ11-B 8 line RS232 mux board	**£650.00**
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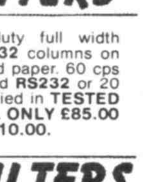

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Access

PHOTOGRAPHING DISPLAYS

Dig out your SLR and brush off your exposure meter as James Dick outlines the basics of producing a permanent record of various displays

Photography is still a mixture of science and Black Art. This seems to be especially true when a more technical type of photography is undertaken. In electronics – whether it is for professional presentations or merely for record-keeping in the lab or 'shack' – the ability to take photographs is an added bonus for many. The professional engineer wanting a photograph from a colour computer terminal and the radio amateur recording a rare DX-TV picture both share a need for display photography, but both may be discouraged by the apparent complexity of photographic technique.

This need not be so. With a minimum of equipment and previous experience, good photographs *can* be obtained. The tips given below will provide pointers, at least, to the correct path.

Prerequisites

A camera is obviously essential, as is some means of measuring exposure. While simple cameras can be used, the minimum that will provide the flexibility needed for most work is a single-lens reflex (SLR). The SLR allows the photographer to view the scene that is being shot through the lens: what is seen in the viewfinder is actually what will go onto the film when the picture is taken. This facility means that the focus of the camera's optics may be correctly adjusted and ensures compatibility of the camera body with a selection of lenses (wide-angle, zoom, etc).

With an SLR, the standard focal length lens (usually with a focal length of 50mm for 35mm cameras) will be quite adequate. Close-up photographs that require the camera to be closer to the object being photographed than the minimum focus of the lens can be achieved by two methods.

The first, and more expensive, is to buy a lens with a 'macro' ability. This means that the lens can focus down to very small distances to take close-up photographs.

The second, cheaper method involves the purchase of 'close-up' lenses. These are not true camera lenses but are thin, simple lenses that are screwed onto the front of the standard lens. At a cost of a few pounds each, close-up lenses offer a cheap and (very) simple method of taking close-up photographs.

The measure of the required exposure is best achieved with an exposure meter. Either a hand-held type or one mounted on the camera may be used. Ideally, 'through-the-lens' (ttl) metering will be available.

Apart from the camera and exposure meter, there are a few items that might also be useful. A cable-release, a tripod (to hold the camera steady) or suitable pile of books, a sheet of black cloth (for shielding lights from the object being photographed, so preventing reflections), and a pale grey cloth are commonly helpful items to have to hand.

A description of actual operation of the camera and exposure meter is not included here. Firstly, it is outside the scope of this article. Secondly, there are so many different types that it would be impossible to cover even a small fraction of these. The manufacturer's instruction booklet should be consulted whenever there is any doubt of an operational nature.

Liquid crystal displays

The first type of display to be discussed is the LCD. These are very common in digital watches, calculators and portable computers. Large area versions with the ability to be used for graphics are becoming increasingly used and will, no doubt, replace the cathode ray tube as the major display peripheral for computers. This is good news for photographers – LCD devices are, perhaps, the easiest display medium to photograph.

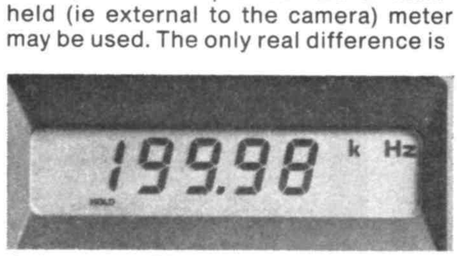
The display should be placed so that it is well lit by the ambient lighting, but note that the plane of the display should be perpendicular to the camera's line of sight. The display-to-camera distance should be such that the display will fill as much of the picture as possible. With a single-lens reflex camera this may be checked by looking through the viewfinder – other camera types may not allow optimum setting up without more careful adjustment of distance and focus. For small displays the addition of a close-up lens may be required.

Perhaps the most important aspect of photographing LCDs (and, indeed, any other subject) is to look at the picture in the same manner that the camera does – with total objectivity. The human eye tends to concentrate on the subjectively important item in a scene and sometimes ignores other features which will assume an (unwanted) importance in the reproduced photograph. Hence, check to see if there are any stray reflections from the display, distracting items in the background, or a misalignment that might cause the display to appear tilted.

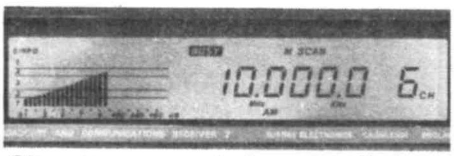
Extra care

Some of these potential hazards may be corrected in the darkroom – but if the film is to be processed commercially, extra care is required because no correction will be possible.

Having now positioned the camera and brought the display into focus, the only task that remains is to determine the exposure. While the comments that follow refer implicitly to an SLR-type ttl meter, either a top-of-camera or hand-held (ie external to the camera) meter may be used. The only real difference is



A nice simple LCD display – no problem!



Of course, some manufacturers complicate things with additional illumination

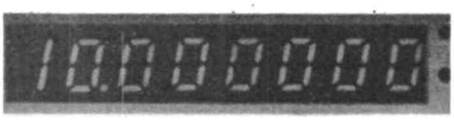
Watch out for nasty reflective bits like chrome or brushed aluminium that, with the last two, more care has to be exercised to ensure that the meter is pointing to where you think it is!

When determining the exposure, it helps to remember that the exposure meter will average the scene and give a reading which would make the picture an average of grey in black and white. This is perfectly adequate for day to day work because the average scene contains such a range of intensity that the average is truly grey. Colour photography works in just the same manner except that colour information as opposed to just intensity is present. Readers who understand the workings of a colour television will appreciate the similarity with the luminance and chrominance signals.

Not quite black and white!

What upsets – or might upset – the exposure system with display work is that the assumption that the scene to be photographed contains an even mix of black and white may be incorrect. The simplest way to avoid this problem is to substitute the display with a material which will not upset the exposure meter, or which will – but in a predictable way. A light grey card or cloth may be obtained from a good photography shop which will act as a suitable material.

As an alternative, a sheet of matt-finished white paper may be used and an adjustment made to the exposure reading obtained from the meter. With the white paper in place (so that the meter only sees white paper) determine the exposure. The adjustment required will increase the exposure by 'two stops'. For example, if the meter says to use 1/60th for a particular film speed and aperture, the actual exposure will need to be 1/15th.



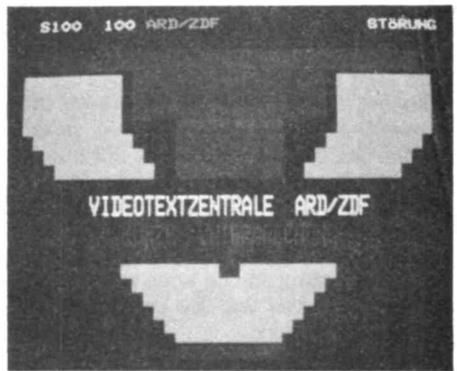
Light-emitting diode displays

LED displays are rather difficult to photograph. While many of the comments above still apply (focus, composition, and awareness of reflections etc), the determination of correct exposure is slightly more difficult. This is because the brightness of the display is often much greater than the ambient lighting – so the exposure for the equipment and that for the display are not at all similar.

The result is frequently seen even in commercially produced photographs for advertising: the equipment is correctly exposed but the displays are smudgy and over-exposed.

Because each display is different, there is no constant rule that may be applied. However, the following tip may help. First, take a photograph of the equipment with the display switched off. Then, re-expose the film (ie take a double exposure) with the room in

A typical off-screen shot of broadcast TV



Take care with videotext. These pics are from our resident experts, Keith Hamer & Garry Smith

darkness but with the display switched on. For the second exposure, the setting used should be one or two stops less than that for the equipment itself to compensate for the brighter display – beware of those displays that automatically adjust!

Cathode ray tubes

The last species of display is the omnipresent CRT. Its three main uses are in televisions, oscilloscopes, and computer-driven VDUs. Because of the different properties of the images present on the displays, each will be discussed individually.

The television display is often photographed by TV-DXers, and is also the simplest CRT display to photograph. First, the TV picture itself is adjusted. This is most easily done in a room well lit by artificial light – simply set the contrast, brightness and colour saturation (if relevant) so that the image would be suitable for normal viewing. If it is daytime, direct sunlight or strong reflections should be kept out of the room.

Set the camera in front of the TV so that as much of the picture as possible is taken up by the TV image and adjust the camera to obtain a sharp focus on the image. Check at this stage that there are no distracting reflections from the face of the CRT. Determination of the correct exposure is simple – the camera is, after all, seeing a normal image. With a through-the-lens meter, ensure that the TV image is filling the camera's viewing screen and use the meter as normal; other types of meter will need care taken with the pointing.

There is one complication, however: the TV image is refreshed every 40 milliseconds. This means that at the start of any 40 millisecond period, one part of the screen will be bright because the electron beam has just written on it, while another part will be less bright because the glow from the phosphors on that area has decreased.

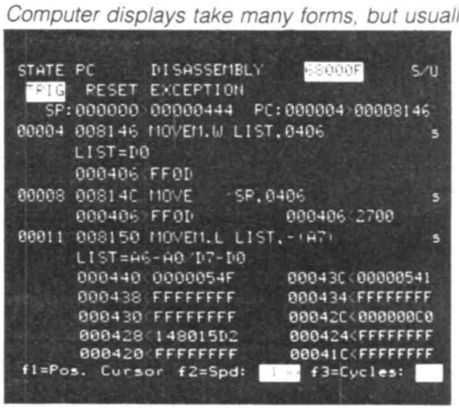
The rate of 'glow decay' is, of course, governed by the 'persistence' of the phosphor. Hence if a patchy intensity is to be avoided, the duration of the exposure has to be greater than a few refresh periods – a shutter speed of 1/8th is normally suitable, the exposure being adjusted by setting the lens aperture. A tripod/cable-release combination will be needed to prevent hand tremor from blurring the photograph.

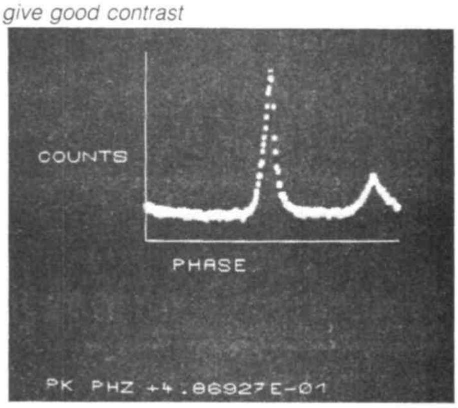
Computer displays

Computer-driven VDUs come next. Most of what has been said for TV applies to the VDU image. The main difference is that a picture suitable for judging exposure may not be present.

With a television, a test card provides a nearly ideal 'standard' image. However, if the computer is used to fill the screen with pure white, the exposure meter may be read using this white image and, when the wanted image appears, an adjustment of two stops made so that the exposure used is longer – or with a larger

Computer displays take many forms, but usually give good contrast





PHOTOGRAPHING DISPLAYS

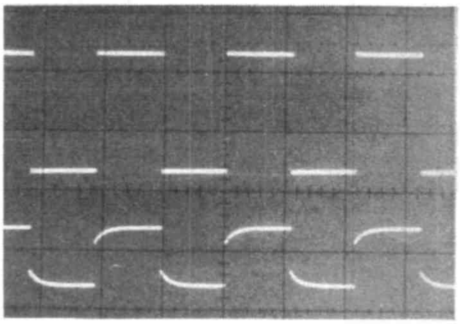
physical aperture (smaller 'f' number) – than that read from the meter for the white image.

The last display to be considered is the ever-helpful oscilloscope. Again, much of what has been said for the TV image still applies. The oscilloscope may be treated as a television with a variable refresh rate and simpler image. The exposure, however, has to be determined according to the scan rate, and a few simple rules will be described to help.

Useful accessories

Some oscilloscopes come supplied with an elongated, hollow pyramid: the camera lens is fitted in through a hole in the apex while the 'base' of the pyramid is strapped onto the (vertical) face of the oscilloscope. This cuts out all light except that coming from the tube phosphors and, if fitted, the illuminated graticule. While an illuminatd graticule is useful, many 'scopes do not have such a facility. The graticule can still be made to show up by not using a pyramidal hood – it then appears as fine black lines (rather than white) against a grey tube face. The beam display is seen as white.

The simplest case is when the display on the 'scope appears to be flicker-free.



A typical dual trace 'scope display

Flicker usually disappears at beam speeds of around 1 millisecond/cm. The camera is set up and focussed on the display; lighting is assumed to be ample but diffuse, and no reflections are present from the tube face that will be seen by the camera.

The exposure may be determined in the same manner as for LCD photographs – it helps to turn the beam intensity to zero when exposure measurement is being done. Once the exposure is set (with a shutter speed of $\frac{1}{60}$th or longer), the beam intensity may be increased to a level that would be comfortable for normal viewing – rather dimmer, perhaps, is better than slightly too bright. If a hood is used, the same exposure setting may be used. The illuminated graticule should have its intensity adjusted so that it is just visible.

At slower beam speeds, the bright spot of the beam end is discernible as a distinct feature. The phosphor persistence causes a short tail behind the spot – the longer the persistence, the longer the tail. This is more complex to photograph because it is necessary to ensure that the beam traverses the screen several times during the exposure. Hence the exposure time is set by the beam speed.

Oh no! Maths!

If the 'scope has a 10cm face width, and a beam speed of 5 milliseconds/cm, each traverse will take 50msec. Four or five traverses will take around 250msec – so $\frac{1}{4}$second would be a suitable shutter speed. The aperture size is found from the meter in the same manner as in the flicker-free case, above, with $\frac{1}{4}$ second for shutter speed. However, for the actual exposure it is reduced by one or two stops – the oscilloscope face will be reproduced rather under-exposed but the beam will not be over-exposed. This, the most difficult area of oscillography, may well need some practice. REW

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BD126 – 4 pilot bulb lamp holders bakelite batten type
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BD128 – 10 very fine drills for pcbs etc
BD129 – 4 extra thin screw drivers for instruments
BD130 – 2 centre zero panel meters 100-0-100 uA
BD131 – 1 100 uA edge wise balance meter
BD132 – 2 plastic boxes with windows, ideal interrupted beam kits
BD133 – 1 Microsonic radio case in leather case
BD134 – 10 model aircraft motors – require no on/off switch, just spin
BD135 – 10 large and 20 small Screwit porcelain connector/insulators
BD136 – 2 car radio speakers 5" round 4 ohm made for Radiomobile
BD137 – 1 5" 4 ohm speaker 5 watts & 1 matching tweeter
BD138 – 1 9" × 4" 8 ohm 5 watt speaker
BD139 – 4 600 ohm microphone/speaker inserts
BD140 – 1 waterproof metal cased plug and socket 3 pin
BD141 – 10 miniature slide switches 2 pole c/o
BD142 – 10 4 ba spanners 1 end open, other end closed
BD143 – 5 100k multi turn pots with knob
BD144 – 10 chassis mounting fuse holders for 5 mm fuses
BD145 – 2 4 reed relay kits 3v coil can be normally open or c/o
BD146 – 20 pilot bulbs 6.5v ·3a Philips
BD147 – 1 Secret switch kit with data
BD148 – 1 Printed circuit kit with data and 100 circuits
BD149 – 4 socket covers (protect inquisitive little fingers) for twin 13A
BD150 – 5 socket covers (protect inquisitive little fingers) for single 13A
BD151 – 20 4 way terminal blocks 3A 250v
BD152 – 1 Air or gas shut off valve – clockwork
BD153 – 1 Air or gas shut off valve – thermostatic
BD154 – 1 12v drip proof relay – ideal for car jobs
BD155 – 3 Varicap push button tuners with knobs
BD156 – 2 pairs Ferrite cores Neosid 56 × 18 mm
BD157 – 6 2 circuit micro switches – Licon ideal for Joystick
BD158 – 5 12 way connector blocks 2A 250v
BD159 – 3 12 way connector blocks 25A 250v
BD160 – 6 pairs 3 way connectors plug in, terminal block type
BD161 – 1 13A panel socket MK ref 735 WH1
BD162 – 1 13A fused and switched spur for surface mounting or can be removed from box for flush mounting
BD163 – 3 13A sockets good British make but brown
BD164 – 2 13A switched sockets good British make but brown
BD165 – 1 13A switched socket on base for surface mounting
BD166 – 1 30A panel mounting toggle switch
BD167 – 1 8 pin flex terminating plug and chassis mounting socket (s.h.)
BD168 – 2 50 tag component mounting strips
BD169 – 4 Short wave air spaced trimmers 2 – 30pf
BD170 – 2 Hivac numicator tubes neon type
BD171 – 1 Shocking coil kit with data – have fun
BD172 – 10 12v 6w bulbs Philips m.e.s.
BD173 – 1 6v d.c. solenoid with plunger 1" travel
BD174 – 2 end of travel c/o switches – very robust mounted on heavy metal plate 10A 250v
BD175 – 1 200 rpm motor mains operated 2 watt
BD176 – 4 heavy duty push switches – ideal for foot operation 3A 250v
BD177 – 5 Lilliput bulbs 12v
BD178 – 3 Oblong amber indicators with lilliputs 12v
BD179 – 3 Oblong amber indicators with neons 240v
BD180 – 6 round amber indicators with neons 249v
BD181 – 100 p.v.c. grommets ⅜ hole size
BD182 – 1 short wave tuning condensor 50 pf with ¼" spindle
BD183 – 1 two gang short wave tuning condenser with ¼" spindle 2 × 50 pf
BD184 – 1 three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
BD185 – 4 ferrite rod aerials 8" × ⅜" rods with long and medium wave coils
BD186 – 1 3 wafer switch: 18 pole 2 way, 12 pole 3 way, 9 pole 4 way, 6 pole 6 way, 3 pole 12 way, your choice
BD187 – 2 2 wafer switches 12 pole 2 way, 8 pole 3 way, 6 pole 4 way, 4 pole 6 way, 2 pole 12 way, any 2 your choice
BD188 – 1 plastic box sloping metal front, size 160 × 95mm average depth 45mm
BD189 – 2 double pole 20 amp 250v flush mounting switches – white

Ex-Electricity Board. Guaranteed 12 months.

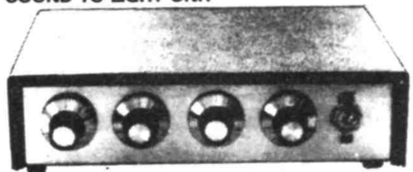
VENNER TIME SWITCH

Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95 without case, metal case – £2.95, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30.

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
1/10 hp £3.45
1/8 hp £5.75. 1/6 hp £7.50

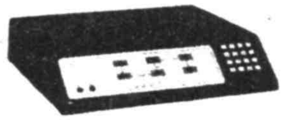
SOUND TO LIGHT UNIT



Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by 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.

PRESTEL UNITS

These are brand new and we understand tested, came with manufacturer's guarantee now void as the manufacturer no longer trades. These originally sold for over £150. We offer then complete, except for 7 plug in i.c.s and price is only £14.95 (less than the value of the modem included).



TANGENTIAL BLOW HEATER

by British Solartron, as used in best blow heaters. 3Kw £6.95 complete with 'cold' 'half' and 'full' heat switch, safety cut out and connection diagram.

Please add post £1.50 for 1 or 3 for £20 post paid
2.5 Kw KIT Still available: **£4.95 + £1.50 post** or have 3 for £16 post paid.

FROZEN PIPES

Can be avoided by winding our heating cable around them – 15 mtrs connected to mains costs only about 10p per week to run. Hundreds of other uses as it is waterproof and very flexible. Resistance 60 ohms/metre. Price 28p/metre or 15m for £3.95.

CORDLESS TELEPHONES

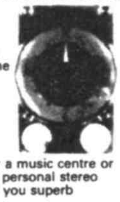
"IT'S FOR YOU-OU" even if you are in the bath, its an infinite extension any room and even in the garden – have one on approval or come and try one here. BT approved £120 not yet approved £69. plus £2 post.

SOCKETS PLUGS ETC for BT phones

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

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. Independent 60 minute memory jogger. A beautiful unit at £2.50



THE AMSTRAD STEREO TUNER

This ready assembled unit is the ideal tuner for a music centre or an amplifier, it can also be quickly made into a personal stereo radio – easy to carry about and which will give you superb reception.

Other uses are a "get you to sleep radio", you could even take it with you to use in the lounge when the rest of the family want to view programmes in which you are not interested. You can listen to some music instead.

Some of the features are: long wave band 115 – 170KHz, medium wave band 525 – 1650KHz, FM band 87 – 108 MHz, mono, stereo & AFC switchable, fully assembled and fully aligned. Full wiring up data showing you how to connect to amplifier or headphones and details of suitable FM aerial (note ferrite rod aerial is included for medium and long wave bands). All made up on very compact board.

Offered at a fraction of its cost **only £4.95**

COMPUTER DESKS

Few still available

Computer desks – size approx 4' × 2' × 2'6" high formica covered, cost over £100 each. Our price only £9.50 – you must collect – hundreds supplied to schools.

J. BULL (Electrical) Ltd.

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Established 30 YEARS

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted day or night. Haywards Heath (0444) 454563.
Bulk orders: phone for quote. Shop open 9.00 – 5.30, Mon to Fri, not Saturday.

TWO POUNDERS

Following the popularity of our BAKERS DOZEN £1 PARCELS, we are now introducing some BAKERS DOZEN £2 PARCELS. We feel that you will agree that most are exceptional bargains but you can still get a bit extra, as with the £1 parcel, if you buy 12 you get another free!

2P1 – 24 hour time switch with 2 on/offs, an ideal heating programmer
2P2 – Wall mounting thermostat, high precision with mercury switch and thermostat
2P3 – Variable and reversible 8-12v power supply, ideal for model control
2P4 – 24 volt psu with separate channels for stereo made for Mullard UNILEX Amplifiers.
2P5 – 12 volt psu 750 ma output – plastic cased
2P6 – 100 watt mains to 115 volts auto-transformer with voltage tappings
2P7 – Mini key, 16 button membrane keyboard, list price over £12, as used on PRESTEL
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, battery chargers etc
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
2P11 – Power amp module Mullard Unilex EP9000 (note stereo pre-amp module Unilex 9001 is BD216
2P12 – Disk or Tape precision motor – has balanced rotor and is reversible 230v mains operated 1500 rpm
2P13 – Sun Lamp switch stays on for ½ hr or 1 hr depending on setting of grub screw
2P14 – Mug Stop kit – when thrown emit piercing squawk
2P15 – Interupted Beam kit for burglar alarms, counters, etc
2P16 – Lockable metal box with 2 keys, ideal for your tools
2P17 – 1 rev per 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
2P21 – 10 watt amplifier, Mullard module reference 1173
2P22 – Motor driven switch 20 secs on or off after push
2P24 – Clockwork operated 12 hour switch 15A 250V with clutch
2P25 – 1000 watt flasher mains motor driven
2P26 – Counter resettable mains operated 4 digit
2P27 – Goodmans Speaker 6 inch round 8ohm 12 watt
2P28 – Drill Pump – always useful couples to any make portable drill
2P29 – 24 position Yaxley switch contacts rated 5A – ¼ spindle
2P30 – 15 metres 6 way telephone or interconnecting wire
2P31 – 4 metres 98 way interconnecting wire easy to strip to use the cores separately
2P32 – Hot Wire amp meter – 4½ round surface mounting – old but working and definitely a bit of history
2P33 – 0-30 amp meter 2" round panel mounting with shunt ex ministry equipment
2P34 – Solenoid Air Valve mains operated
2P35 – Battery charger kit comprising mains transformer, full wave rectifier and meter, suitable for charging 6v or 12v
2P36 – 20 Amp meter, with shunt unused but ex-equipment
2P37 – 0-100 micro amp meter, 2" square flush mounting good make
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.
2P39 – Gear train size approx. 6½" × 3½", 2 brass pillars for motor mounting (1.9" fixing centres), first wheel made of fibre, 3 other steel and brass wheels. 80 turns of fibre wheel give one turn of final drive shaft which is ¼" dia. rod
2P40 – 12 volt motor – can be fitted to 2P39 gearbox

IONISER KIT

Refresh your home, office, shop, work room, etc. with a negative ION generator. Makes you feel better and work harder – a complete mains operated kit, case included.
£11.95 plus £2.00 post.

MORE BAKERS DOZEN £1 PARCELS

BD189 – 2 double pole 20 amp 250v flush mounting switches – white
BD190 – 2 double pole 20 amp 250v surface mounting switches with neon indicators – brown
BD191 – 6 B.C. lamp holder adaptors white
BD192 – 3 B.C. to 2 pin lamp holder adaptors
BD193 – 6 5 amp 3 pin flush sockets brown
BD194 – 3 5 amp 3 pin switched sockets surface mounting, brown
BD195 – 5 B.C. lampholder bakelite threaded entry
BD196 – 1 in flex simmerstat for electric blanket soldering iron etc
BD197 – 2 thermostats, spindle setting – adjustable range for heaters ovens etc
BD198 – 1 rod thermostat for water heater etc 11" rod
BD199 – 1 mains operated solenoid with plunger
BD200 – 1 10 digit switch pad for telephones etc
BD201 – 8 computer keyboard switches, with knobs, pcb or vero mounting
BD202 – 1 solenoid mains operated air valve 110v coil
BD203 – 2 8 push button switch banks 6 interlocking and two independent locking less knobs or one with knobs your choice
BD204 – 1 3 push mains voltage switch with knobs
BD205 – 1 ultra small 12v relay 3A gold-plated contacts normally open
BD206 – 20 metres 80 ohm coax, off white
BD207 – 20 metres high voltage flex 14.0075
BD208 – 1 Photo multiplier tube RCA 4555
BD209 – 1 Metal box approx. 7½ × 4½ × 1½
BD210 – 4 Transistors type 2N3055
BD211 – 1 Electric clock mains driven, always right time – not cased
BD212 – 1 Double 8v ½ amp mains transformer ideal for dimming or strobing fluorescent tubes
BD213 – 2 Curly 5 core leads for mobile telephones, transmitters etc
BD214 – 3 sub-miniature toggle switches spdt
BD215 – 5 miniature slide switches dpdt with chrome dolly
BD216 – 1 Stereo preamp Mullard EP9001
BD217 – 100 push on tag connector ¼ straight
BD218 – 100 push on tag connector ¼ right angled
BD219 – 100 soldercon terminals make IC sockets any length and width
BD220 – 3 Heat sinks for flat ICs predrilled size 40 × 40 × 25mm matt black, four sided

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

New Year's resolutions ... yes, I know it's a bit late to be thinking about them, but I hope more ATV operation is high on your list – it is on mine (together with the Morse)! I could do with a few more activity report letters, too. You know where to send them: either direct to me QTHr, or care of the editor. That said, let's get on with the news for this month.

Recap from last time

I mentioned two new commercial items, Icom's IC-1271 23cm transceiver and Tandy's new multi-standard portable TV. Examples of the transceiver are starting to trickle into the country, so Thanet Electronics tell me, although so far they have only had two examples, one for the workshop and one for the showroom. Demand is expected to be high, despite the price of £939. Ten watts all modes on 23/24cm is quite a prize, and I am sure this will be engineered to Icom's usual high standards. Thanet will not be bringing in the ATV adapter, thankfully.

The little TV from Tandy is a cracker, but it does not tune 70cm direct. You can use a converter to channels 2 or 36 though, or no doubt you could tweak the existing tuner. There is plenty of room in the case, so we may expect some video in/out mods.

Repeater update

No news from the Stoke crowd, so perhaps GB3UD has not made it on the air yet. Let's hope they have success soon. GB3TV on Dunstable Downs now has 'big ears', in the form of a GaAsFET receive preamplifier. And at Markfield, GB3GV is having a complete refit. John G3YQC is rebuilding the receiver and transmitter of the Leicester 'box', which should eliminate the minor difficulties users have had up to now. A new aerial system is also planned; at present an Alford slot gives omnidirectional coverage, which is not necessarily the best use of the output power. In the future the watts will be concentrated by means of broad-beam yagis in three major directions where the main activity is.

New video computer

Most people have heard of MSX computers. The idea is excellent; standardisation at last of home computer software. All MSX computers, regardless of manufacturer, run the same Basic programs so you can go straight out and buy or swap them, without the hassle of having to convert them into, say, Sinclair or BBC Basic. To begin with the Japanese manufacturers priced their MSX machines too high, and they have not really caught on here. Sur le Continent, on the other hand, and in Japan, they are really big business. All this is by way of introduction.

For some time there have been rumours of MSX computers which could be connected direct into a home video system to give special effects and overlay captions and other graphics. At last one of these machines has hit our shores, the Pioneer PX-7. If you like this sort of thing you'll probably cream when you read the three page colour folder (get yours from Pioneer, 1-6 Field Way, Greenford, Middx UB6 8UZ).

The machine itself comprises an MSX home computer (with separate keyboard and built-in printer, data cassette and joystick ports). Optional add-ons include floppy disc drive, MSX program cartridges, MSX music keyboard and 32K expansion RAM cartridge. To the computer you can connect TV, colour monitor, RGB monitor, VCR, video camera, printer and an audio system.

The capabilities are endless, and fall into three main categories: video effects, advanced graphics, and stereo sound synthesiser. Apart from this it acts as a normal home computer.

All the standard horizontal and vertical wipes are there, plus exotic ones like dot matrix and explosion. In addition you can add computer-generated text to superimpose titles and so on. The PX-7 will lock to any video source, video cassette, disc, camera or even broadcast, and the computer graphics can be combined with these in a number of ways.

For advanced graphics capabilities an optional Video Art ROM cartridge and graphics tablet can be plugged in. You can sketch on the tablet with the stylus provided and then fill in with 16 colours. The graphics system includes automatic generation of a range of circles, squares and rectangles as well as pre-programmed one-touch wipes. The effects sequences can be saved onto tape or floppy disc for repeated use later.

The built-in stereo sound synthesiser can make a three-note harmony over eight octaves, which you can control with Basic programs to produce your own original audio-visual presentations. A number of MSX music system cartridges give an instant audio capability. You can preview your work on headphones or built-in speaker, then send to line to record. Although not stated in the literature, it looks as if you can mix the synthesised sounds with pre-recorded tapes or records.

All in all, the PX-7 sounds like an extremely creative piece of equipment, the full extent of which people will take a long time to realise. Prices are not stated, by the way, so you'll have to ask. The tone of the literature indicates that the machine is aimed at the amateur rather than professional market, so I hope it is affordable. The styling of the hardware and the features repertoire lead me to wonder, though!

Foreign tales

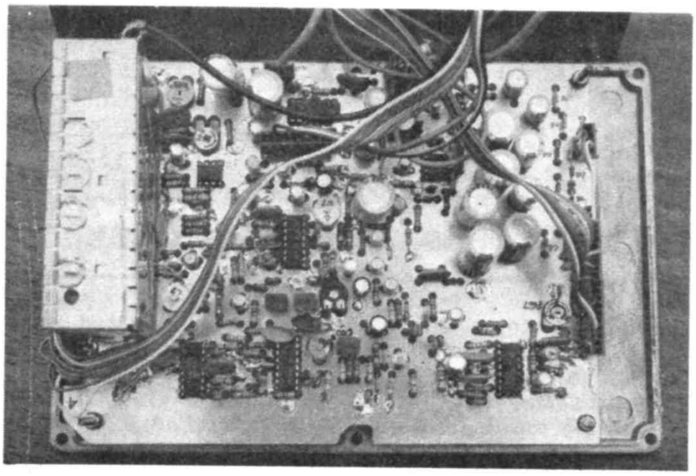
I try to avoid making this column parochial, though this is to some extent inevitable when the activity groups are concentrated in particular areas. It is up to you to write and complain if your area is not covered! Two snippets which have crossed my desk deserve mention. In West Berlin the local district of the German Amateur Radio Club (DARC) has just established a 24cm TV beacon. Apparently out of 1,600 radio amateurs in Berlin just 15 are involved in ATV. There's a moral to be drawn there, but I'm not sure what it is!

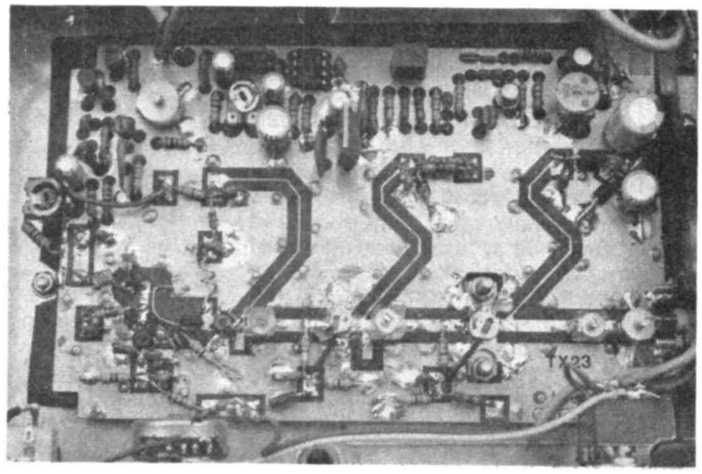
From France comes news of last year's SITRA – Salon de l'Informatique et de la Télévision Amateur. Held each autumn in Poitiers, this is where all the French amateurs interested in ATV, SSTV, TV-DX, RTTY, packet radio and satellites come together. There were 35 different displays this time, with the ATV stand led (as usual) by Marc Chamley F3YX. F1GXY was showing the new *VHF Communications* PAL colour pattern generator, which I mentioned a few issues back. Many French amateurs use PAL colour on account of its easier production and mixing.

On the slow-scan scene, Michel Pelhatre F3ZZ gave an illustrated talk on the various scanning systems used for SSTV since 1958, from long-persistence tubes to 256×256 images from the space shuttle. F1DJO and F6FJH demonstrated a satellite TV system costing less than £500 to construct.

934 news

In a recent article in *Amateur Radio,* Angus G3OSS made a throw-away remark that 934MHz would make an ideal talkback band for ATV. Well, I'm ahead of you Angus – I was already using 934 for





this last year! Seriously, if you haven't considered 934 yet I urge you to do so. Clearly there are not that many ATVers equipped for this band yet, but it would give you a speech channel that does not get as busy as two metres.

Propagation is very similar to 70 centimetres, given the higher gain aerials which can be used at 32 centimetres. I have also used 934MHz as a useful propagation indicator: 934MHz is often open when 70cm is, but with two metres no different from normal.

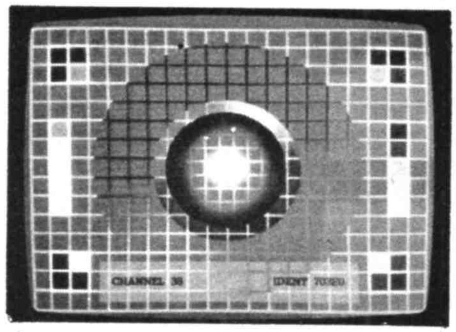
Photos and finale

Last time I had no room for pictures, but this time we have a bit more space. So here are the Solent Scientific products reviewed last time, the UHF FM receiver kit (£69.95) and the 1 watt 24cm transmitter kit (£64.95). The receiver is the picture with the TV tuner and the 'spaghetti'. It mounts conveniently in the lid of the diecast box used to house the complete converter and receiver assembly.

The transmitter is the PCB marked TX23 in the lower right-hand corner. The 23cm oscillator is visible to the bottom left: this leads into a buffer and then to the amplifier stages proper. Note the PCB striplines and the narrow printed chokes in the collector lines. You will also see the large number of rivets soldered on both sides of the PCB: these are essential for keeping ground inductance to a minimum. Both products are recommended; check out last month's issue for more details.

That's it again: see you next time, and keep those letters coming in. REW

DX-TV RECEPTION REPORTS



Compiled by Keith Hamer and Garry Smith

Traditionally October is the month for greatly enhanced tropospheric openings. Over the years DX-TV enthusiasts have found that the month usually lives up to expectations, but 1985 was exceptional. It must surely rate as one of the most important and intense periods for many years in the eyes of both TV DXers and amateur TV enthusiasts.

The trop opening was a lengthy affair with DX reception beginning on the 10th and continuing until the 30th. All TV bands were affected but the most staggering results were gained in Band III. We have had at least two reports of Russian TV reception on channels R9 and R12, the latter channel's vision frequency being 223.25MHz. Band III DX from Czechoslovakia, Poland and even the tiny island of Bornholm out in the Baltic Sea was a reality for some!

Of course, such reception isn't entirely new. Russia was received in the UK on UHF some years ago, but it is extremely rare and conditions have to be truly exceptional to produce such reception. Our sympathy goes to any DXer who missed this tropospheric extravaganza – you must either have sat there with blinkers on or the set switched off!

Sporadic-E DX also had its moments during October. The 15th produced a late morning opening with a range of signals which one would normally only associate with the main sporadic-E season. The low-power Austrian relay of ORF was noted on channel E3 that day, along with a new Italian private TV transmitter with a slight frequency deviation from channel IA – it was a little LF. More about this later.

To summarise, October was an important milestone in DX-TV activity with plenty to see and, more importantly, a wide selection of DX to whet the appetite of any budding newcomer to the hobby.

New test cards

We mentioned in a recent issue of *Radio & Electronics World* that a new test pattern had been logged around the channel IA vision frequency. It was assumed that it originated from the pirate station of Nord Center Television in northern Italy. Apparently it doesn't. A DXer in Finland has kindly volunteered some information. It would appear that a new Italian private transmitter has been established on this channel. Unfortunately its exact location isn't yet known, but it has been received in Finland on several occasions during the latter part of the sporadic-E season.

The test pattern resembles the familiar Fu3K, but there are one or two differences. The identification reads 'RADIO-TELE-UNO'. A similar test card was featured in the April 1983 issue of *R&EW*. Our thanks to Jukka Kotovirta of Espoo, Finland for supplying this information.

On October 15th at 1252GMT, Mark Dent of Leeds saw a new Spanish test card on channel E3 carrying the identification 'VALENCIA' together with the date. Several changes have taken place during the past season with Spanish regional test patterns, and it's a real battle to keep up to date with the latest versions!

Were any enthusiastic DXers tuned in to channel E25 at 0310GMT on the 14th? A colour bar test pattern with the lower portion in red was unearthed. It featured the identification 'REF'. The aerial direction and signal strength suggests that Yorkshire Television was radiating this pattern from the Belmont transmitter near Louth in Lincolnshire. Can anyone shed further light on this mystery?

Did you spot it?

Last month we mentioned John Bray's Hessischer Rundfunk test card reception as having emanated from the channel E7 outlet at Brotjacklriegel. Of course this was a deliberate mistake (!); the transmitter was in fact Hoher Meissner. Brotjacklriegel radiates the 1st network programme from Bayerischer Rundfunk.

Reception reports

Taking a holiday in some far away location creates the opportunity to sample exotic DX, providing one has access to a TV set of course. Tony Privett of Basingstoke recently visited Lanzarote in the Canary Islands, suitably armed with a small 2-inch Sanyo receiver in the hope of receiving some good reception out of Africa. The villa in which he stayed was supposedly wired for both VHF and UHF reception, but upon closer inspection of the inside of the aerial outlet box he found it to be VHF only.

To add to his problems the sockets were of the phono variety. Fortunately a cork from a wine bottle allowed him to jam the cable into the socket (remember this dodge if you ever visit Lanzarote) until he found the correct type of plug amongst a whole heap of electrical bits in the basement of the only shop in the village. It sometimes makes you wonder if it's all worthwhile. Anyway, after much fiddling Tony managed to obtain pictures from RTVE-1 and RTM (Morocco) in Bands I and III. The RTVE-2 service could only be received at UHF out on the patio using the set's own aerial.

Back in the UK Tony reports some impressive DX, especially from Denmark which, he says, is usually conspicuous by its absence. His best catches were East Germany (DDR:F1) on channel E8, which was identified by the test card on the 28th, Norway on E9 and E11 (from Lyngdal and Halden respectively) and West Germany on E8 from Hannover radiating NDR-1 programmes.

Several instances of DX in Band I occurred. ORF from Austria came through on the 15th shortly after 1300 on channels E2a and E4, while on R1 and R2 a Russian news programme was being broadcast by TSS. Other Band I DX during the month included West Germany on E2 and Yugoslavia on E3.

Simon Hamer of Powys found DX-TV conditions at his valley location pretty lousy on the 27th. Not to be outdone he took his portable gear to the summit of one of the local hills. It was extremely cold with thick fog all around. However, it was all worthwhile and very rewarding with Denmark (DR) being received on channels E5, E6, E7, E8 and E10. A variety of programmes were seen during the afternoon, starting with tennis at 1445, then 'OBS' at 1600 (this appeared to be a public announcement service), followed by a 'SONDAG-TV' caption.

Then the inevitable happened. Did his car battery run flat perhaps? Did the TV pack in? No, 'Dynasty' came on with subtitles and, surprisingly, a warning about abnormal atmospheric interference. The caption read: 'ATMOSFÆRIK KRAEFTIG I HELE LANDET', which roughly translated meant that reception was likely to be fairly rotten throughout the whole of Denmark!

According to Simon's letter, 'the DDR:F1 service from East Germany violated New Radnor airspace and goose-stepped in on E11'. The news programme 'AKTUELLE KAMERA' appeared at 1600 with an item about South Africa. Norwegian signals were well to the fore on channels E5, E6, E7, E8 and E9, with an English subtitled film and a documentary about West Beirut. Programmes from West German TV were available on E8, E9 and E10 with a German film, followed by the ARD '1' logo at 1500. By rotating his Band III array, Simon could pick up as many as three different countries on the same channel.

Details of other programmes noted that afternoon may help some enthusiasts solve a few mysteries. A 'Daffy Duck' cartoon was logged on E8 and E11 from RTBF1 (Belgium), 'Bring 'em Back Alive' (a feature film) was shown by BRT-1 (Belgium) at 1515, and a 'SEHEN' caption on channel E47 from the West German service of ARD/WDR III was seen at 1500. RTE-1 (channels IF and IH) and RTE-2 (channels II and IJ) were in evidence from the opposite direction to Europe, namely from Eire. Various UHF transmitters in France were noted by Simon, some being co-channel with West Germany's 2nd network, ZDF.

Gled ny or!

The tropospheric opening improved Simon's knowledge of Norwegian and Danish. He found it interesting to hear English film sound-tracks and read the subtitles. The Norwegian subtitling is slightly larger than that used by Danish TV so this could help identification during busy openings, especially as the two languages seem very similar to the uninitiated!

Iain Menzies (Aberdeen) has advised that DX on October 12th and 13th was completely void of any tropospheric activity, despite news from the RSGB that that particular weekend was the best experienced in the UK during the last ten years. Well, it was everywhere else apart from Aberdeen! Fortunately several Scandinavian stations made an appearance on the 17th, with the Danish UHF outlet on channel E51 (22kW) being the most 'exotic'.

Philip Heaney (Norwich) took advantage of the improved tropospheric conditions. Using a D-100 DX-TV converter feeding a monochrome UHF portable, in conjunction with a Triax MTH-13 array for Band III and twin Triax BB grids for UHF, he succeeded in receiving signals from at least eight European countries. On October 13th RTE from Eire appeared on channels ID, IG, IF and II. West Germany's 2nd network (ZDF) was present on UHF.

Further stations in West Germany were noted the following day, including Saarländischer Rundfunk on channel E42 from Saarbrücken, SWF on E39, E25, E9 and E10, NDR on E40, and HR-1 on E7 and E8. Luxembourg (RTL+) was in evidence on channel E7. The 24th was packed with Scandinavian signals, including Denmark (DR) on E5, E6, E7, E8 and E10 with the PM5534 test card at 0800, Sweden (SR/SVT) on E7, E8, E9, E11 (PM5534 test card at around 0830), E22, E24, E26, E27, E41, E43 (test card at 1345) and Norwegian transmissions from NRK on channels E5 (Stord), E7 (Hovdefjell), E8 (Bokn), E9 (Lyngdal) and E11 (Halden).

Perhaps the most impressive DX for Philip occurred on the 25th when the slightly modified PM5544 test card appeared from TVP in Poland on channels R8 (from Katowice or Bialystok) and R10 (Gdansk). Reception on R8 was much weaker than that experienced on R10. Taking into account the direction in which his aerial was directed, Philip reckons that signals could well have originated from Bialystok. If so this is a distance of some 950 miles and is by far his best ever DX via the trops.

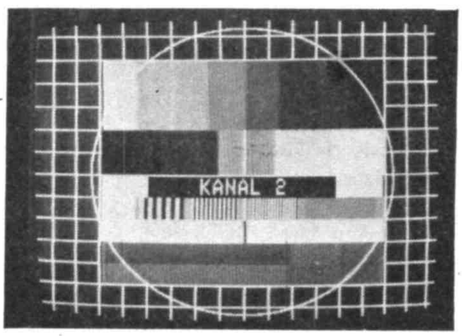
Mark Dent and Kevin Jackson have both sent mammoth logs which reflect the amazing conditions experienced throughout the TV bands in Leeds during October. Sporadic-E activity was noted during the late morning of the 15th, with most European countries making an appearance in the space of 2 hours.

Mark's log

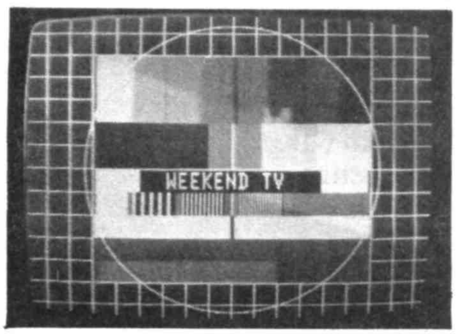
Mark's log for the 15th is as follows: SRG-1 (Switzerland) on channel E2 with the FuBK test card carrying the identification '+PTT SRG 1' at 1113; TSS (Russia) on R1 and R2 with the electronic colour test pattern showing the identification 'UT 1985' at the top. Reception was at 1114; RAI (Italy) on IA and IB with programmes at 1117; CST (Czechoslovakia) on R2 displaying the 'RS-KH' test card at 1122; an unidentified Italian private station on channel IA was noted showing pages of text; TVP (Poland) on R1 with the dark background PM5544 test card at 1133 without identification; BR-1 (Bayerischer Rundfunk, West Germany) on E2 with programmes; JRT (Yugoslavia) with programmes at 1137 on channel E4; TVP on R2 with the PM5544 at 1142; JRT on E3 with the PM5544 at 1150 carrying the inscription 'JRT RTV-LJNA'; TVE (Spain) E3 radiating a new test pattern with the ident 'VALENCIA' plus the date.

Programmes from TVE-1 were noted at 1253 on channel E4; SR/SVT (Sweden) E2

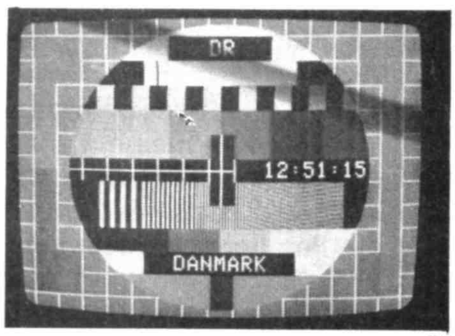
DX-TV PHOTO FILE • DX-TV PHOTO FILE • DX-TV



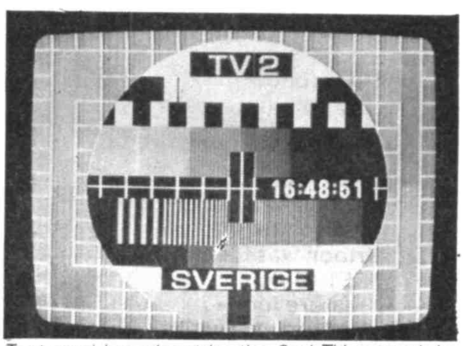
FuBK electronic test card radiated by Kanal 2 in Denmark



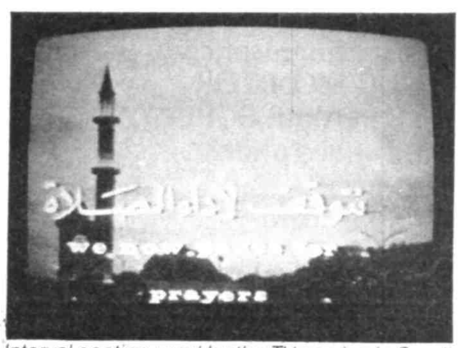
Test card used by the Danish regional service 'Weekend TV'



PM5534 test card of the state-owned TV network in Denmark



Test card broadcast by the 2nd TV network in Sweden



Interval caption used by the TV service in Saudi Arabia

Bahrain TV announcer with ident (pics Michael Summers Larsen & Fred Pilkington) with the 'TV 1 SVERIGE' PM5534 at 1316; ORF (Austria) on E2a and the 100W E3 relay with the 'ORF FS1' PM5544 test pattern at 1334.

Impressive trops

Mark was very impressed with the tropospheric opening experienced for most of the month. The 12th brought in Switzerland on channel E7 relaying the German-language programmes from Säntis. On October 13th the bands were full of very strong signals from France with various test cards. Despite not having video switching facilities he could still decipher most of the inscriptions. Towards the end of the month, reception from Denmark, Norway and Sweden predominated with signal paths in excess of 1000km. The new Danish UHF transmitter on channel E51 was seen, albeit rather weak.

The most impressive DX was logged on the 26th when three Polish Band III outlets appeared with programmes and were subsequently identified by the 'dt' news caption. The transmitters were Koszalin (channel R8), Gdansk (R10) and Szczecin (R12). Even further afield a Russian Band III transmission was resolved on R12. It is thought to have originated from Kalingrad.

Kevin also saw the Polish and Russian DX in Band III. An added bonus was a Russian signal on R9 which is thought to have come from Kaunas in Lithuania. He has commented that the Polish reception on R8 lasted some 4½ hours at fair strength. The 26th brought in a few surprises for Kevin, with all three main Danish E5 transmitters being resolved including the 10kW outlet on the island of Bornholm. Closer to home, his log includes Switzerland on E12 from the Niederhorn transmitter with SRG programmes on the 13th, and a couple of 525-line UHF signals from AFRTS in Belgium on channel E34 ('SHAPE'). AFRTS were also noted on E71 from the base in the Netherlands. Kevin's reception reports for October were so extensive that they easily filled 16 sheets of A4 paper. It was obviously a good month for DX-TV in Leeds!

Very active

William Maries (Studley, Warwickshire) has again been very active with DX-TV, thanks to the trops during October. Perhaps the best day for William was the 24th. NOS-1 appeared during the morning with schools programmes on channels E4, E6 and E39. The Belgian French-language service of RTBF-1 was noted on E8 with the PM5544 test card. BRT-1 (Belgian Flemish-language network) was received later in the day on channel E10. Unscrambled programmes from the French service 'Canal Plus' were in evidence at 1215 on channel L9, while on E6, E8 and E10 the Danmarks Radio PM5534 test pattern made an appearance.

On channel E7 a crosshatch pattern was noted from DR. Also received on the 24th via enhanced trops were SR/SVT-1 (E8), ZDF (E35 and E37) from West Germany plus ARD with programmes during the evening on E9 and E10.

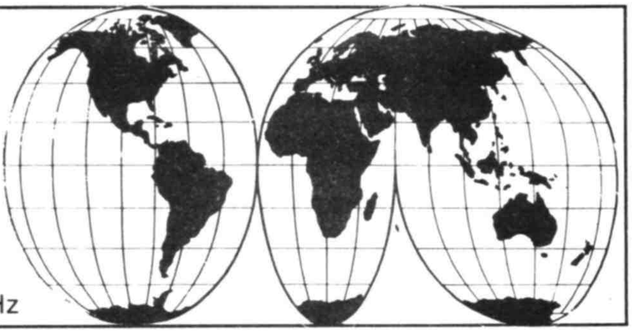
Service information

West Germany: There are some new identifications used on various FuBK test cards. Hamburg includes the inscription 'LF-HH', Schleswig-Holstein uses 'NDR-KIEL' (channels E4, E5, E10 and E28) and Niedersachsen transmits 'NDR-1 HANNOVER'. The WDR-3 outlet at Düsseldorf on channel E39 radiates 'DSSD KAN 39'.

Czechoslovakia: The FuBK test card broadcast by CST-2 uses a new identification, namely 'ODK 2'.

This month's service information was kindly supplied by Rijn Muntjewerff of Beemster in the Netherlands. REW

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

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

Continuing with the review of 'middle-ground' Asian stations on the 60 metre band (**4750** to **5060**), commenced in the previous issue of this journal, the attention of readers is now focused on transmissions emanating from Pakistan and Sri Lanka.

Pakistan

The Pakistan Broadcasting Corporation operates a Home and Regional Service on the 60 metre band, the former being radiated from Rawalpindi on **5010** nominal, Regional Service programmes being featured by Islamabad, Karachi, Peshawar and Quetta. Some of these transmitters are frequently heard here in the UK during our autumn, winter and early spring months and reported to DXer organisations.

Progressing from the low to the high end of the 60 metre band, we start by bringing to mind PBC Islamabad on **4775**. This 100kW transmitter relays Peshawar from 1300 to 1600. Islamabad is often heard but the frequency can vary on occasion from **4733** up to **4778**.

PBC Karachi on **4815** radiates the Regional Service from 0230 to 0600 and from 1400 to 1900 with a power of 10kW. This one features in my log fairly often.

The PBC Regional Service station at Quetta may be heard on **4879**, at which point on the dial it operates from 0045 to 0400 (Friday until 0345) and from 1100 to 1600, with a power of 10kW. The frequency can vary slightly from that shown, Quetta not often being featured in the SWL press.

More often logged here in the UK and Western Europe is the PBC transmitter at Peshawar, which can be found on **4950**. It radiates the Regional Service from 1300 to 1345 and from 1400 to 1500. The Foreign Service in Dari is broadcast from 1600 to 1800. The power is 10kW.

Probably the Pakistan station most often reported on the band is PBC Rawalpindi, transmitting the Home Service on **5010**. It is scheduled on the air from 0045 to 0400 and from 1500 to 1800 with a power of 10kW. As with some other Pakistan transmitters, the frequency can vary from the nominal.

A somewhat complicated schedule is applicable to PBC Islamabad radiating the Regional Service on a variable **5060**. At 10kW, it signs on at 0045 (at 0130 from November to March and during Ramadan) to 0230 (to 0210 during September and October); from 1400 during September and October (from 1630 from November to February); and from 1600 during the remaining periods. It closes this latter transmission at 1800 all year.

Azad (Free) Kashmir Radio operates around **4790.5** at 10kW, opening at a variable 1400 and signing off with a seemingly interminable choral NA (National Anthem) around 1805. This transmitter is reported to be located in Trarkhel, Pakistan. In common with other DXers, the writer has been unable to find the precise location of Trarkhel. As far as can be determined, this is Islamabad identifying as Trarkhel, featuring programmes in Urdu and Kashmiri.

Sri Lanka

The Sri Lanka Broadcasting Corporation operates a Home Service on the band but these programmes are not heard all that well here in the UK. From time to time the signals from Sri Lanka, the ancient Taprobane, do come through a readable signal strengths, this applying particularly to the **4902** channel – but more about this channel later.

SLBC Colombo, with a transmitter at Ekala, on **4870** broadcasts the Commercial Service in Sinhala from 0000 to 1730 at 10kW. This one is only occasionally logged in the UK.

On **4902** is that 10kW Sri Lankan transmitter most often heard by the writer. Colombo on this channel radiates the Home Service 1 in Sinhala from 0000 to 0230 (Saturday and Sunday until 0630) and from 1030 to 1730. On full moon days there is a Special All Night Service from 1730 to 2400 and it is during this period that most of the loggings are made – listen for the continuous chanting of the Buddhist monks from around 1630 to 1900 or so. Buddhism was introduced into Taprobane during the 3rd century BC.

SLBC Colombo on **4940** is seldom heard but at 10kW it features the Commercial Service in English from 0030 to 0430 and from 0730 to 0830 (Saturday and Sunday until 1730), Monday to Friday from 1100 to 1730. It is a great pity that this one is co-channel with some USSR transmitters which effectively block the signals from Sri Lanka.

On **4960** the 10kW Colombo transmitter radiates the Commercial Service in Tamil from 1400 to 1730 and the Home Service 2 in Tamil from 0000 to 0300 and from 1130 to 1400.

The **4968** channel of SLBC Colombo has the Home Service 2 in Tamil from 0000 to 0300 and from 1130 to 1400 with the Commercial Service from 1400 to 1730. There is an Educational Service in Tamil from 1120 to 1400 on Saturday and Sunday. At 10kW, this one is rarely heard here in the UK.

SLBC Colombo on **5020** is scheduled with the Home Service 1 in Tamil from 0000 to 0300 and with the Commercial Service in Tamil from 1400 to 1730. The power is 10kW and it is seldom heard in Western Europe or the UK.

AROUND THE DIAL

The intention here is to provide sufficient information to enable those interested to obtain similar results. Listed in this section are those thought to be worth emulating.

AFRICA

Angola

Emissor Regional da Huilla on **4820** at 2258, OM announcements in Portuguese, the National Anthem and off at 2300. This one is best heard after co-channel Radio Botswana signs off at 2100. Beware, however – the latter sometimes continues until 2300. ER da Huilla has obviously extended its transmitting period, being listed on the air from 0400 to 1700, but is now closing, as indicated above, at 2300. The power is 25kW.

Radio Nacional de Angola, Luanda on a measured **4935.4** at 2144, OM with Afro pop songs in Portuguese. The schedule is unknown to the writer but ER de Angola on this channel has been reported around 0330 and past 2200. The power is thought to be 10kW.

Ascension Island

BBC Atlantic Relay on **9600** at 0325, OM with a review of African affairs in a programme of the English language World Service, this particular transmission being timed from 0300 to 0430 and directed to East Africa.

Cameroon

Garoua on **5010** at 0531, OM with a newscast of local and then world events followed by the station identification, all in English. Into French at 0540. The Home Service is on this channel from 0425 to 0800 (Saturday and Sunday until 0700) and from 1645 to 2200 at 100kW.

Djibouti Republic

Djibouti on **4780** at 0337, YL with a song, some local-style music then OM with a talk in Somali. The National Service is on the air from 0300 to 0800 (Friday from 0500 to 0900) and from 0900 to 1900 with a power of 20kW. The Somali programme during this schedule is from 0300 to 0430, from 1100 to 1300 and from 1600 to 1730.

Mali

Bamako on **4783** at 0612, quotations from the Holy Quran. Also heard in parallel on **4835** at 0615, OM with announcements, YLs with songs complete with a drum backing.

Mozambique

Radio Mozambique, Maputo on **4733** at 1922, OM with a talk in Portuguese, some light music Palm Court style then OM with the station identification after four chimes at 2030.

South Africa

RSA Johannesburg on **15220** at 0724, YL with a talk about local art galleries during an English presentaion for Gambia, Ghana, Malawi, Nigeria, Sierra Leone, Zambia and Zimbabwe, timed from 0630 to 0730.

CENTRAL AMERICA

Deutsche-Welle, Cologne Relay, Antigua on **9690** at 0944, YL with a talk in the German programme for Australia, New Zealand, Japan, East Asia from 0800 to 1000.

NORTH AMERICA

WYFR Family Radio, Okeechobee, Florida, USA on **17845** at 1853, OM with a religious programme in English. Transmissions on this frequency are beamed to Europe in various languages from 1545 to 2045.

SOUTH AMERICA

Ecuador

Radio Rio Amazonas, Macuma on **4870** at 0353, OM with announcements in Spanish, OM with a song complete with marimba backing then off at 0410 without the National Anthem. At 5kW, this one is on the air from 1000 to around 0400.

Radio Quito, Quito on **4920.5** at 0417, OM with a talk in Spanish all about European politics. Part of the Red Informativa Nacional Network, R Quito operates from 1000 to 0500 with a power of 5kW.

HCJB Quito on **6215** at 0258, anthem, OM with the station identification and a programme in Russian which was not jammed – oh dear! Also logged on this channel at 0700, pips time-check, OM station identification and then the English programmed DX Party Line directed to the South Pacific (announced).

Netherlands Antilles

Bonaire (Radio Nederlands Relay) on **9590** at 0330, pips time-check, YL with the station identification and Spanish transmission for North and Central America, scheduled from 0330 to 0425.

ASIA

Bangladesh

Dhaka on **4895** at 1546, YL and OM with a newscast in English, OM with the station identification. The power and schedule are not known at the time of writing.

China

Yunnan PBS, Kunming on **4760** at 1535, OM with a song then YL with announcements during a Home Service programme. The language used is Chinese and the schedule is from 2150 to 0100, from 0250 to 0600 and from 1015 to 1600 with a power of 50kW.

Radio Beijing on **5880** at 1551, YL with announcements then YL with a song in Chinese. The Home Service 1 is entirely in Chinese except for an English language lesson from 1430 to 1500. The schedule on this frequency is from 2000 to 0100 and from 1100 to 1730. This one is seldom reported and was logged while searching for RRI Pekanbaru, which operates around **5881** but sometimes on **5886** – no doubt to the consternation of its regular listeners.

India

AIR Gauhati on **3235** at 1555, YLs with a discussion in vernacular; AIR Delhi on **3365** at 1552, OM with a talk in English; AIR Calcutta on **4820** at 1540, OM with a song, local-style music; AIR Delhi on **4860** at 1543, YL with the news in English; and AIR Madras on **4960** at 1548, OM with a song in Hindi.

Pakistan

Azad Kashmir (Free Kashmir) on **4790** at 1530, OM with a song in, presumably, Kashmiri. This, as previously mentioned, is thought to be Islamabad identifying as 'Trarkhel' and scheduled on the air from 1400 to around 1800.

Karachi on **4815** at 1955, OM with quotations from the Holy Quran, choral rendition of the National Anthem and off at 1900.

Islamabad on a measured **5103.7** at 1517, OM with a talk in a vernacular. Schedule and power unknown.

SOUTH-EAST ASIA

Singapore

Radio Singapore on **5052** at 1554, OM with a pop song in English. The Home Service in English is on this channel from 2200 to 0100 and from 1000 to 1605 at 10kW.

Indonesia

RRI Padang on **4002** at 1605, OM with a newscast in Indonesian. Padang is on the air from 2300 to 0100 and from 0945 to 1700 with a power of 10kW.

RRI Ujung Pandang on **4719.3** at 1531, YL with songs in Indonesian complete with piano backing then YL with announcements. The power is 50kW and the schedule is from 0800 to 1600, but the latter can vary to 1520.

Malaysia

Kuala Lumpur on **15295** at 1535, OM with quotations from the Holy Quran during an Arabic transmission for South-East Asia, timed from 1530 to 1700.

NEAR AND MIDDLE EAST

Iran

Teheran on **9022** at 1931, YL with announcements then OM with the station identification at the start of the English programme for North Africa, North America and Europe, scheduled from 1930 to 2030.

Iraq

Baghdad on **13700** at 1948, YL with a talk in Arabic followed by some local-style music in the Home Service Voice of the Masses programme which may be heard on this channel from 1400 to 2200.

Yemen (North)

San'a on **9780** at 0320, OM with a talk in Arabic, also logged in parallel on **4853.**

EUROPE

Bulgaria

Radio Stolnik on **7670** at 2017, YL with a ballad then OM with announcements, all in Programme 1 (Khorizont), timed here from 0400 to 2030.

USSR

Moscow on **9850** at 0810, clock ticking, YL with station identification in Russian then news from Tass at dictation speed for internal centres. Also logged in parallel on **5780, 6770, 7340, 7420, 9730** and **9850.**

PACIFIC

Marianas

KYOI Saipan on **11900** at 1001, OM with station identification and announcements in English, YL Japanese. Address for reports given as 1001 Bishop Street, Honolulu, Hawaii 96813, USA.

KYOI Saipan on **15190** at 0955, pops, OM announcements and station identification in English, YL in Japanese. Off at 1000 to commence transmission on **11900** (announced).

Guam

KTWR Agana on **9820** at 1506, YL and OM with a talk in Japanese, YL with songs then OM with a religious talk for South-East Asia and India. Programmes in various languages are on this frequency from 1245 to 1600.

NOW HEAR THIS

Reykjavik, Iceland on **9958** at 1902, OM with a talk in Icelandic to Northern Europe, the transmission being USB and timed from 1855 to 1945.

NOW LOG THESE

Omdurman, Sudan on a measured **5038.8** at 2130, OMs with a discussion in Arabic, some local-style music and songs in a Voice of the Sudanese Nation programme to Ethiopia and Somalia, 1600 to 2200. The power is 20kW.

RRI Sibolga, Indonesia on **5256** at 1550, YL with songs in Indonesian, OM with some announcements. The schedule of this 1kW transmitter is from 2300 to 0100 and from 1000 to around 1700. REW

NEXT ISSUE

Radio & Electronics World
The communications and electronics magazine

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Dr Kiam-Laine extols the virtues of the auto-transformer, a beast little understood by radio amateurs

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MEDIUM WAVE DXING

by Steve Whitt

Welcome to yet another MW-DX column with 1986 well and truly upon us – a year in which we will be approaching the forthcoming sunspot minimum and observing what could potentially be the best MW conditions for many years. Perhaps you have resolved to make 1986 the year for a new aerial system, or even a new receiver; well this month we will continue to look at aerials for MW-DX, moving on to more advanced aerials such as loops and Beverages.

The Beverage

The Beverage aerial (named after its inventor) is the true long wire aerial, since for correct operation it needs to be electrically in excess of one wavelength long, ie over 1000 feet for good MW performance. In fact the longer the wire, the more directional the aerial becomes and the greater the signal pick-up.

A Beverage can operate in two modes; either in a bidirectional configuration (*Figure 1*) or as a unidirectional antenna (*Figure 2*).In both cases currents are induced in the wire by electromagnetic waves, these currents travelling in both directions along its length, but in the bidirectional configuration the energy received from the wave propagating away from the receiver is reflected back to the receiver at the unterminated end of the wire, whereas in the unidirectional mode of operation this travelling wave is absorbed by the terminating resistor and not returned to the receiver. In both cases, however, induced currents flowing towards the receiver will be detected by the receiver.

To erect a Beverage aerial you need to put up over 1000 feet of wire in as straight a line as possible mounted about 3-5 metres above a relatively flat ground surface. The aerial should of course point in the direction of the great circle towards the target reception area.

To support the wire telegraph poles would be ideal, but in practice trees or fence posts can be used to good effect; just ensure that the aerial wire is insulated from its supports. If you prefer the unidirectional arrangement, the aerial needs to be terminated at the distant end by a non-inductive (ie carbon) resistor of about 500-700 ohms rated at over 1 watt. It is interesting to note that the Beverage does not rely on good earth conductivity for its performance and will often operate best over rocky or sandy soils.

The Beverage is ideal for the DIY experimenter since most of its parameters are fairly uncritical, and even if it does not perform as well as possible it is nevertheless certain to provide better DX than almost any other MW aerial.

MW loop aerials

Although the Beverage will leave loop aerials standing in the DX stakes, it has to be recognised that for most DXers space is at a premium and an indoor aerial is far more practical. In its favour, the loop aerial is highly directional, frequency selective, and of course portable.

In its most basic form (illustrated last month) a loop comprises a coil or wire of fairly large proportions tuned to resonance at the frequency of interest by a parallel capacitor. Many designs of various shapes and sizes have appeared in radio magazines, as well as a number of enhancements designed to improve reception further.

Frequency selectivity

One of the key parameters of a loop is its frequency selectivity, ie its ability to reject interfering signals on adjacent frequencies. This is governed by its Q ('quality') factor, which is in turn influenced by its construction and design as well as the means by which signals are coupled from the aerial into the receiver. A high Q factor can be obtained by minimising resistive losses in the loop winding (use the thickest possible multi-stranded Litz wire), and by minimising electrical loading of the loop (use a very high input impedance buffer amplifier).

Good design will normally limit the maximum Q to about 300-500, but loop designs have appeared that allow full control over the Q (up to around 1000) by cleverly applying small amounts of positive (or regenerative) feedback.

One loop parameter that is often overlooked is that of strong signal handling. The signal coupling between aerial and receiver is often affected by an inductive link (*Figure 3*) or by introducing a high impedance buffer amplifier (*Figure 4*). Use of the former method usually impairs the Q factor and the directional properties of the loop. The latter method, however, can often result in poor behaviour in the presence of strong signals, since the buffer amplifier is usually based around FETs or MOSFETs in order to preserve a high input impedance.

To put the situation in perspective,

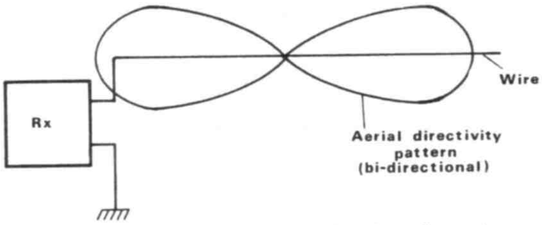

Fig 1 *A Beverage in a bidirectional configuration*

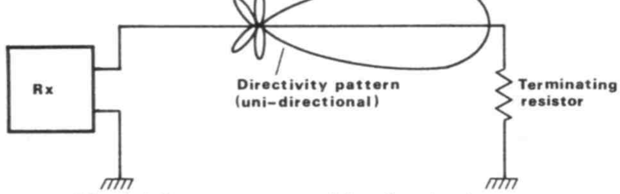

Fig 2 *A Beverage as a unidirectional antenna*

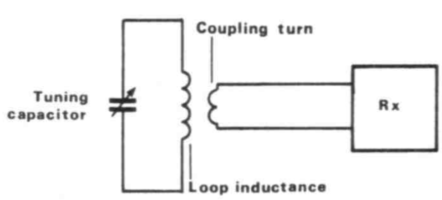

Fig 3 *Inductive coupling to receiver*

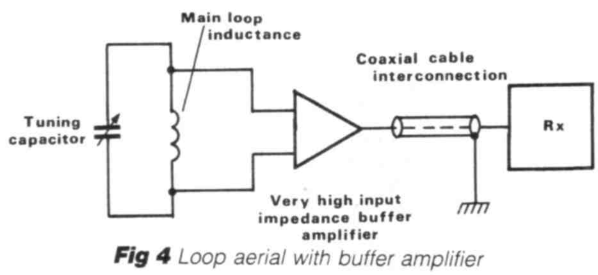

Fig 4 *Loop aerial with buffer amplifier*

LATEST LITERATURE

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Part 1: Fundamentals. Part 2: Applications

These two volumes, edited by R S Roberts of the Royal Television Society, are based on the RTS' Television Engineering Course, and consequently benefit from the sort of feedback not usually available to authors writing in isolation. Each section is penned by the relevant lecturer for the course, each of whom is an experienced engineer (the BBC Research Department and Marconi Communications Systems feature prominently in the authors' credits).

Part 1 covers, as its subtitle suggests, the basics of producing television pictures. This coverage ranges from the physiology of the human eye to a fairly detailed description of the PAL and NTSC systems. Also included are methods of modulation, digital techniques, standards, camera tubes, propagation theory etc.

Part 2 details various 'larger' aspects of television, taking in the UHF television network, satellite broadcasting, the TV receiver, video tape recording, cable and optical fibre transmission etc (with a most interesting chapter on measurement and testing methods).

Such is the scope of these books that the space devoted to each subject is of necessity less than might be ideal (the satellite section, for instance, is disappointingly brief, and has no bibliography or list of suggested further reading). The books would probably not be worth buying for anyone after details of any one specific area, but for the engineer or enthusiastic (and not necessarily particularly knowledgeable) amateur who wants a comprehensive introduction to TV engineering they are excellent. The text generally combines an ease of understanding with as much technical detail as would be required in any such basic guide (although this does, of course, vary from author to author).

Pentech Press Ltd (marketed by John Wiley & Sons Ltd), £24 each. ISBN 0 7273 2104 8 (Part 1) and 2105 6 (Part 2)

INTRODUCING C

Boris Allan

The computer language C is widely used by system developers and programmers, a success attributed by the author of this book to the control it gives over the workings of a machine and to its compactness. In his first chapter Allan outlines the origins and philosophy behind C, and then moves on to programming in Small-C and a detailed description of what C is. A major part of the book is devoted to the construction of a language translator.

The emphasis throughout is on a teach by example approach, to give the reader a full understanding of what this language can do. The lengthy appendices include outlines of BCPL (a forerunner of C) and Unix (the operating system closely associated with C), and a definition of C syntax.

This is definitely a book for keen programmers who are interested in C (and I suppose most keen programmers *are* so interested). To get the most from C will require a knowledge of how computers work, and to get the most from this book will similarly require a familiarity with the details of the terminology and methods of programming.

Collins Professional & Technical Books, £9.95. ISBN 0 00 383105 1

HOW TO GET YOUR COMPUTER PROGRAMS RUNNING

J W Penfold

It is a common problem to find that a computer program, once entered, will not run correctly first time. It is the aim of this book to give some understanding as to why programs written in Basic will not run, and to give pointers to properly debugging such programs.

The first chapter outlines how the computer deals with the commands it is given, and is therefore very useful in gaining some appreciation of how computers work (and why they *won't* with some programs!). The book continues, in an admirably logical order, with the problems concerned with entering program listings, and then explains why and how errors occur in such listings. This is followed by an examination of the various features (loops, subroutines, etc) from which a program is constructed, before moving on to an extensive keyword index which describes their meaning and common problems associated with them.

Most computer users who are familiar with their machine's Basic will find good use for this book, and while it is far from being an encyclopedia of possible programming errors, it promotes the correct attitude to programming and will prove a useful pocket book for any keen computer user.

Bernard Babani (publishing) Ltd, £2.50. ISBN 0 85934 143 7

Texas Instruments

The Texas Instruments LinCMOS integrated circuit manufacturing process allows linear semiconductor devices to operate at low power without the input threshold voltage shifts which would occur if the usual CMOS processes were used.

Thus low power linear circuits can be designed, with reduced operating temperatures and enhanced reliability, and offering smaller equipment sizes and lower end costs.

Also, low power operation increases the number of applications for linear devices in remote and battery or solar-powered equipment.

To back up the TI LinCMOS product range, the company has published *The LinCMOS Design Manual*, which describes these operational amplifiers, timers and comparators and shows how they can be applied in analogue circuits and systems.

Texas Instruments Limited, PO Box 50, Market Harborough, Leicestershire.

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consider just a loop aerial that is not tuned; it is quite possible for signals up to 10mV or so to be induced by local stations, or even the strong night-time Europeans. Now if the loop is tuned to resonance with a typical Q of 300 the resultant potentials across the loop are in the order of *volts* – clearly the buffer amplifier should possess minimal voltage gain, and care needs to be taken to prevent overload effects. In fact these large signals also preclude the use of varicap diodes to tune the loop remotely rather than the more traditional mechanical tuning arrangement.

Unfortunately, in a column of this length I can only touch upon the details of loop design, so I can only recommend that you dig through your magazine back issues for suitable articles. If you have problems or are interested in more details do drop me a line c/o *R&EW*; if there is enough interest a separate article on this subject might be in order.

DX File

This month there is only a short DX File due to a lack of contributions. Remember that other readers will be interested in knowing what you have heard on the MW band, and I will be only too pleased to include your loggings in this section. Please be sure to include details of frequency, time (GMT/UTC), station identity and what you heard.

Dipping into my own log-book, meanwhile, reveals that there was an excellent period of DX at the end of November (20-26) during which the path to North America and the Caribbean was wide open. I heard upwards of 25 different stations, mainly on the east coast of Canada and the USA; other DXers have reported a number of low power (1kW) American stations never before heard in the UK!

In fact conditions were so good that on occasions reception of stations like CJYQ 930, CKYQ 610 and WINS 1010 was possible up to a couple of hours after sunrise. REW

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

Round-the-world trip

As a result of a contact on 30 September with HG4SEA/MM, Robert Senft G0AMP received the following info from Charlie HA4KYN:

On 25 September 1985 two radio amateurs from Hungary, Jozsi and Nandi, operating under the callsign HG4SEA/MM, set off on a two to three year round-the-world boat trip from the port of Optia in YU.

The trip followed six years of preparation and planning, during which time they learned how to navigate, took the Hungarian equivalent of the RAE and learned German and English.

Meanwhile frantic fund-raising was taking place, and in 1981 a Balaton 31 type yacht body was purchased from the Balatonfured shipyard. The rest of the boat, the *St Jupat*, was designed and built by themselves, finally being completed in December 1984.

Among the main sponsors were Videoton Electronik, Kofem and Peky, the latter providing Meka 7800 type VHF navigation equipment.

The station on board comprises a Yaesu FT7B, a Hustler rig, Yaesu mobile antennas and a home-brew ATU from the Hungarian equivalent of the RSGB, the MHSZ Videoton Radio Club.

Jozsi and Nandi plan to visit ZB2, EA9, EA8, ZD8, ZD7 and ZD9, then travel around the Cape of Good Hope to FB8W, FB8Z and VKland, where they will stay for a few months until the cyclone season is over.

The journey will then continue to ZL, Polynesia, where they hope to collect ethnographical items, then they will travel around Cape Horn to LU, PY, the Caribbean, across the Atlantic to EA8 and via Gibraltar to the Adriatic Sea.

Contacts will be attempted on Mondays, Wednesdays and Fridays on 14.262MHz and 21.255MHz at 12.00UT. Net controls are HG1S, HG1W, HA4KYN, HG5A, HG6V, HG7B and HG9R. QSL information should be sent to HA5NP. Other possible frequencies include 3.675, 7.075, 14.265 and 28.505MHz.

Charlie HA4XH, the secretary of MHSZ, would appreciate information regarding contacts made with HG4SEA/MM and the *St Jupat's* whereabouts. His address is: *PO Box 13, Szekesfehervar 8007, Hungary.*

METEOR SCATTER ACTIVITY PERIODS 1986

For the second year running the *VHF/UHF Newsletter* is promoting activity periods on the Random MS calling frequencies. It is hoped that this will encourage stations to be more active on random meteor scatter throughout the year.

The following dates have been arranged and this information has been passed to VHF managers and societies within IARU Region 1

SATURDAY 2200 – 2400GMT	SUNDAY 0600 – 0800GMT
11 January	26 January
8 February	23 February
8 March	23 March
12 April	27 April
10 May	25 May
7 June	22 June
12 July	27 July
9 August	24 August
6 September	21 September
11 October	26 October
8 November	23 November
6 December	21 December

Each month has two activity periods:

1. Saturday 2200 – 2400GMT
2. Sunday 0600 – 0800GMT

Call on 144.1MHz (CW), 5 minutes, or 144.4MHz (SSB), 1 minute

Please send your results heard or worked to: *VHF/UHF Newsletter, PO Box 73, Hereford HR2 9EW. Tel: (087) 387 679.*

Feedback

The November 1985 issue of *Feedback*, the journal of the Bury Radio Society, includes a review of Gwynedd-based Technical Software's RTTY and CW package.

Norman Webster G2DWB was responsible for scrutinising this Rx multimode receive system, which is available for £40, or £25 in kit form. He found few problems in construction of the kit, except for the very small PCB – about the size of a postage stamp!

Overall, he was impressed with the interface kit and software and found that the program does everything one might expect and includes facilities which are not available in packages costing considerably more.

More information is available from Technical Software, Fron, Upper Llandwrog, Caernarfon, Gwynedd LL54 7RF.

Prospective members of the Bury RS should contact the club's secretary, B Tyldesley G4TBT at 4 Colne Road, Burnley, Lancs.

Bury Hamfeast

The Bury Radio Society Hamfeast 1986 will take place on Sunday 9 February at the Mosses Youth and Community Centre, Cecil Street, Bury.

If you are interested in going, or want to find out more about the society's other activities, contact: *Caroline J Ashworth G1PKO, 16 Wheelton Close, Bury, Lancs BL8 2HZ. Tel: (061) 764 5018.*

Morse tests

The Department of Trade and Industry has announced that it has appointed the Radio Society of Great Britain to take over the running of the amateur radio Morse tests from 1 April 1986.

Radio amateurs who wish to operate on the high frequency (HF) bands with the potential for world-wide communication must, in accordance with the requirements of the International Radio Regulations, have a knowledge of the Morse code. In the UK this means that they must have a class A licence as distinct from a class B licence which allows operation on the VHF bands with, generally, much reduced range of contact.

At present the Morse test, which is a prerequisite of the class A licence, is run by British Telecom.

The RSGB's plan includes a test fee of £7, which will be held at this price for two years, and the establishment of at least 70 test centres, one in each county, region or designated island. Tests will be held every two months in each centre.

The DTI sees these proposals as a significant improvement in the service offered to amateurs who wish to take the Morse test.

Learn Morse

The Denby Dale and District Amateur Radio Society plan to organise a Morse class, to begin in January, if there is sufficient interest from members and other amateurs in the area.

If you would like to learn the dreaded code contact Brian G0BFJ as soon as possible.

Junk extravaganza

The Cambridgeshire Repeater Group is holding its fourth annual junk sale on Sunday 23 February at Pye Telecommunications, St Andrew's Road, Cambridge.

Starting at 10.30am, it is an all day event featuring many trade stands as well as a bring-and-buy junk sale.

Admission will be 50p and there will be food and drink available, free parking and talk-in on 2m S22 by G3PYE.

All proceeds from the event are going to benefit amateurs by the provision of repeater services.

For further details contact: *Chris Lorek G4HCL, 11 Bevills Close, Doddington, March, Cambs PE15 0TT. Tel: (0354) 740672 (24hr answering).*

Welsh rally

On Sunday 2 March 1986, the Barry College of Further Education's Radio Society will present the Welsh Amateur Radio Rally at the Barry Leisure Centre, off Holton Road, Barry, South Glamorgan.

This is an annual event where there are many trade and club stands of interest to radio, television and electronics enthusiasts. There is a bring-and-buy stand (no commission), with a small display charge only. Refreshments, licensed bar and swimming pool are available.

The rally will be open from 11am-5pm with talk-in on S22. For further information contact Reg Rowles GW4FOM. Tel: (0222) 565656 (evenings).

Sunday net

The Biggin Hill Amateur Radio Club have a Sunday morning net each week.

All members are invited to gather on 145.350MHz at 9.30am clock time, for about half an hour.

For more details contact: *Robert Senft G0AMP, Mill Hay, Standard Road, Downe, Kent BR6 7HL.*

Crawley ARC

The Crawley Amateur Radio Club has a 2m net at 20.30 local time every Friday.

Details of their other activities can be obtained from: *Dave Hill G4IQM. Tel: Crawley 882641.*

NOTES FROM THE PAST

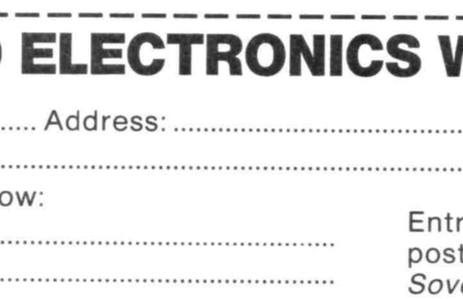
The question of secrecy or the free international exchange of scientific research and discovery has, in recent years, been one of bitter controversy. At first many scientific workers had some doubt as to the extent of the guilt of the early Atom Traitors. There had long been a tradition that the results of all scientific research should be available to all other investigators. Science was held to be international, and the pooling of knowledge made for more rapid progress. This was a grand thing in a peaceful and well-intentioned world, but not when it began to become a one-way traffic and the political ambitions of one of the great powers led to the swallowing up of smaller nations.

At the time of the development of radar there was the menace of Nazism. The screen of secrecy became essential for our own defence. We live today in a world of suspicious distrust and barely concealed aggression. The free exchange of scientific knowledge is now tempered with the need for security. Humanity seems already to be centuries behind our technical knowledge.

WIN A TRANSISTOR TESTER

★ FREE COMPETITION ★

The new TT/903 transistor tester, from Repro Electronic Systems, is a unique development in pocket test equipment. It will test transistors in circuit as well as out of circuit



How to enter: All you have to do is compose an extremely witty and clever limerick(!) on any aspect of radio or electronics.

The one which the Editor considers the funniest will win the author a TT/903 and will be published in a future issue of ***Radio and Electronics World***

RADIO AND ELECTRONICS WORLD COMPETITION

Name.................................. Address: ....

....

Write your limerick below:

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Entries must be received by 14 March 1986 and posted to: ***Radio and Electronics World,*** *Sovereign House, Brentwood, Essex CM14 4SE.*

This competition is not open to employees of ***Radio and Electronics World Magazines*** or their relatives.

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU

We are pleased to be able to offer readers the opportunity to sell your unwanted equipment or advertise your 'wants'.

Simply complete the order form at the end of these ads, feel free to use an extra sheet of paper if there is not enough space on the order form. We will accept ads not on our order form.

Send to: ***Radio & Electronics World***, Sovereign House, Brentwood, Essex CM14 4SE

DEADLINE AND CONDITIONS

Advertisements will be inserted in the first available issue on a first come first served basis. We reserve the right to edit and exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ Eddystone 840C, in good condition, £45. Mr N Appleton, 82A Gillygate, York. Tel: (0904) 644695.

■ Heathkit OS2 scope, £39. Minnimitter low-pass filter, 30MHz, £10. Microphones – AKG D509, £20. Shure 5885B Unisphere B, £20. Reslo ribbon, £10. Film Industries ribbon, £10. Junkers Morse key, £12. Pair of Quad ESL63 loudspeakers, still under warranty, £995. No offers. Pair of Spendor speaker stands, £18. Two Revox A77 power amp boards, £18 each. One A77 record amp board, £15. B J Whitty, 'Fourways', Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: (0704) 840328.

■ Stabilised 0-50 volt 0.5 amp bench power supplies (made by IE) with current limiting adjustable up to 0.5 amp. Separate voltage and current meters. Working, and in good condition, only £15 each. Must be collected. Tel: Burgh Heath 56973 (Surrey), evenings and weekends.

■ Belcom LS-202E hand-held 2 metre multimode transceiver including Nicad pack, carry case, speaker mike. Excellent condition, sell for £150 or exchange for colour monitor or possibly Sony ICF7600D. Alan, tel: (01) 977 8938.

■ Dual 10-band professional graphic equaliser, £195. Allen & Heath Brenell ADT unit, £195. 10-output line distribution amplifier, rack mounting, £180. All carriage extra. BJ Whitty, 'Fourways', Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: (0704) 840328.

■ Yaesu FT290R, Nicad charger, case, £265. Diawa 30 watt linear, £38, or together £285. Lowe SRX30 digital receiver, £125. Commodore 2031 disk drive, offers. Yaesu FRT7700 ATU, £30. LAR receive ATU, £25. Storno CQM700 FM hi-band, 25W, synthesised, £25. Telereader CWR 610, £110. LP filter, £5. Tel: Dave, Hornchurch (04024) 55733 6-9pm evenings or Prestel MBX 402455733 anytime.

■ Pair of 2m hand-helds, £45 each. Tel: David, (01) 444 8872.

■ Sanyo Beta video recorder, soft touch control, VHF/UHF tuner, PAL, SECAM, NTSC select, camera input, remote control input, video in/out sockets. National 19 inch colour TV, VHF/UHF tuner, video in/out sockets, 8 channel selector, PAL, SECAM, NTSC selection. Both TV and video in very good condition, £300 for complete system. Mick O'Donnell. Tel: Milton Keynes (0908) 316052.

■ SX200N scanner, £200. Pye Cambridge dash and boot, offers. Edwards, 2 Beach Rd, Burton, Bradstock, Bridport, Dorset DT6 4RF. Tel: (0308) 897 625.

■ Avometer Model 40, £30. Marconi RF power meter, £25. Taylor signal generator model 68AM, £30. Pye HF SWR/power meter, £30. All in good order. QQV03-20A, QQV03-10 and many other valves. Also lots of speakers, relays, Cambridge and Westminster bits. Walker, 23 Forest Hill, Yeovil BA20 2PF. Tel: (0935) 25225.

■ Software for 48K Spectrum. Filing program ideal for keeping stock of ICs, transistors etc. Also tape header reader, plus filing program for names and addresses etc. Also Morse tutor program, and resistor decoder. All on one cassette tape. Send £2.50, which includes post and packing, to Mike Day, 39 Valnord Lane, St Peter Port, Guernsey, Channel Islands.

■ Racal RA17 professional communications receiver, 0.5-30.0MHz, 30 bands, vgc with manual, £145. Racal MA197B preselector/preamp for RA17, £45. Marconi TF144G signal generator, vgc, £35. Creed 75 teleprinter, £20. Teleprinter terminal, £10. G8JDE QTHr. Tel: Sambrook (095 279) 375.

■ Racal RA17L 0.5MHz – 30MHz Rx. Good condition, spare valves and circuit diagram. Plus Datong AD270 active antenna, £225. Tel: (051) 336 4239.

■ Free components and free samples when you send for my clearance list of parts, equipment, valves, etc, 30p in stamps appreciated. Bargains include assorted packs (price includes postage): 100 new capacitors, £1.75; 200 new resistors, £1.25; 300 new hardware items including solder tags, bolts, grub screws, washers, rods, £1.25; circuit boards with hundreds of components, minimum of 10 boards per pack (about 3kg), only £5.00. K Bailey, 40 Seymour Close, Selly Park, Birmingham B29 7JD. Tel: (021) 472 3688.

■ Collectors item: B41 receiver, 15kHz to 700kHz, believed to have come off HMS Ark Royal, but no proof. Offers invited. Buyer collects, or post extra. Tel: Newquay (06373) 78221. Ask for Malc.

■ KDK 2025 2m FM transceiver, 144-149MHz, 10 memories, mounting bracket. £150 ono (or will px for 2m hand-held, IC2E etc). GI4KIX. Tel: Belfast (0232) 790855.

■ Tandy TRC-1001 27MHz FM h/held CB. In excellent condition (hardly used), fitted with rechargeable batteries, also Tandy charging unit, Tandy hand microphone, 12 volt cigar lighter adaptor, and a Swiss made (Spycher & Beck) conductive rubber aerial, with original packing and handbook, £75 ono inc p&p and ins. Please contact Mr K Jackson, 54 Shakespeare Towers, Leeds, West Yorkshire LS9 7UG.

■ Monitor, 14inch green screen, £40. Monitor, 19 inch 6 channel, £45. Terminal unit, 11 inch green screen, CCITT, V23/V24, £50. Hallicrafters S27 VHF receiver, £45. Hallicrafters S72 HF receiver, £45. Eddystone 680X HF receiver, £110. Eddystone 880/2 HF receiver, £225. Tel: Wokingham 782236.

■ Crotech 3030 scope, 15MHz single beam. One year young, less than 10 hrs use. Mint condition. Offered with manuals, probes at £150. Farnell 15amp PSU. Most reliable, not switch mode. Ideal for linears etc, £40. CTE International 1kW 26-30MHz linear. Convert to other HF bands? £150 ono. R Softley, 14 Topps Drive, Bedworth, Nuneaton, Warwickshire CV12 0DE.

■ Swap my new IC4E 70cm plus a DC1 & BC35 fast charger + 4 Nicad packs, two BP3, BP4 and BP2 fast Nicad, also two sizes cases, also HM1 sp/mik and full workshop service manuals: all above for an FT790 70cm plus postage both ways. It must be clean with Nicads, case etc. Tel: (0473) 85526 asap: wanted for contest.

■ Heathkit, new. Just built from kit by pro, transceiver with power pack, also mic and stand HF unit model SB102, 1.8 – 30MHz coverage, SSB. Also model HP23B power unit, not used, complete. Offers. Tel: (0705) 376008 (Cosham, Hants).

■ Icom IC251E transceiver with muTek board, £450. Icom SM5 desk microphone for above, £25. Datong PC1 HF-2m converter, £110. Tono 2m-90G linear amplifier, £115. M Modules 432-28MHz down-converter, £25. Heathkit HW 202 2m FM Tx/Rx 6 channel xtal rig, 20 watts, no crystals, £45. G1GZA QTHr. Tel: Thornbury (0454) 412185.

■ AR2001 scanning Rx, 25-550MHz, as new, £290 ono. Tel: (0224) 822682 ext 125 or (0224) 638179 evenings.

■ Small qty 7107CPL common anode display DVM ICs, cost over £8 each, £3 (c/w circuit diagram and uses for chip). Four 7-segment displays to match, £3. Also small qty new, unused resistors, capacitors, ICs etc. Send £2 for a really good handful. Shack clear-out! All new and unused. Prices include p&p. For info on the chip see 1984/5 Maplin catalogue. Chris Barker, 52 Spode Street, Stoke on Trent, Staffs ST4 4DY.

■ TW400A in very good condition and complete with original packing. This is the ideal mobile rig with 25 watts out on 2m and 70cm. Still for sale due to several time wasters, £350. Tel: (0905) 620041 anytime.

■ Exatron micro sponge continuous loop wafer computer data storage device interfaced via RS232, but can be made to interface via parallel by the addition of 2 ICs, 1 DIP switch and 1 25-pin connector. Includes own microprocessor, book containing circuit diagram list of components and other data, £65.00 ono. Also encoded qwerty keyboard with sound board and data, £20.00 ono. Steve Parsons, 4 Clifton Place, Ilfracombe, N Devon EX34 9JJ Tel: (0271) 66431.

■ R278 225/400MHz, 1750 chan, 250 volt with manual. Audio amp, needs attention, £50. Buyer to collect please. EV Cartmale, 11 Homestead Lane, Welwyn Garden City, Herts AL7 4LT. Tel: (0707) 331449.

■ VTX5000 Micronet and Prestel modem and interface for Spectrum computer. 1200/75 baud full duplex with ROM-based software, complete package. Also can be used 1200/1200 baud half duplex under software control (program on tape or Microdrive). In original box with manual. Also Spectrum Micronet book, £40. Mr Falconer, 462 London Road, High Wycombe, Bucks HP11 1LP. Tel: (0494) 451 252.

■ Dragon 64 colour home computer. 64K memory with built-in RS232 and Centronics printer interfaces, complete with all leads, data recorder, software, books etc. Ideal for RTTY, £100. Buyer collects or pays carriage. Contact Ian or Simon on Lincoln (0522) 46145.

■ Realistic DX-160 5 band communication receiver, 160-10 metres 12 & 240 volt. Despite age has not been used very much at all, £75. Please write to Mr M Richards, c/o 'Bridle Ways', Aughton, Collingbourne, Kingston, Nr Marlborough, Wilts.

■ Sommerkamp FL200 Tx, very clean cond, fitted with conservative outboard PSU, £80 ono. Murphy AP100335 Rx, 600kHz-30MHz, S-meter, good appearance, with cct. Needs PSU: 250dc 6.3ac. £40 ono. G3VRU QTHr. Tel: Worksop (0909) 722133.

■ Weather satellite APT station for BBC B micro. Built and tested interface board 2.0 in HB aluminium case, plus software ROM. Includes both IDC leads and sockets plus power cable to BBC, needs only Rx and aerial to receive pictures on your TV (recommend Timestep Rx and case drilled and wired to accept same). Would cost you £120 but selling lot for £75, no offers. Caters for all satellites. Good pictures. S Pocock GM4GTU Tel: Aberdeen (0224) 743039 evenings QTHr.

■ Leak Seventy stereo amplifier, 35 watts per channel, £45. UHF TV aerial for caravan, lorry, boat. £12. TV pre-amp, 7dB, £8. Stereo record player with speakers, £15. Rubbishy stereo tuner, £10. Two metre Tandy Patrolman receiver, £50. Crystalled R1, R2 and R7. Eight track cartridge player, £10. Various cartridges, £1.50 each. Punk rock records, various Crass, Conflict, DKs. Mono radio cassette, £8. Walkmate, £15. Mike, 14 Doverfield Road, Brixton, London SW2 5NB Tel: (01) 674 0513 after midday.

■ Magazines: *Radio Communications* 1968, 1971, 1976 complete vols. 1975, 1977, 1981, 1982 nearly complete. *Short Wave Mag* 1970 complete, 1973 nearly complete. *Wireless World* Oct 79-Dec 80. £2 per volume, buyer collects or pays parcel post. Phone Steve G8KDL, (0473) 54405 evenings.

■ Free: clearing out an assortment of electronic bits and pieces in bags. You will have to take pot luck from hardware, pots, resistors, diodes, transistors, wire, and many other items. Just send three 12p stamps and name and address for post and packing. D Martin, 6 Downland Garden, Epsom, Surrey KT18 5SJ (post only).

■ TS520, mint condition, unmodified, £300 plus carriage ono or buyer collect. P H Huntsman G3KBQ QTHr. Tel: (0434) 602488.

■ Yaesu FRG-7700 and FRT-7700, mint condition £250. 40 The Oval, North Anston, Nr Sheffield.

■ Racal Syncal 20 watt transceiver, good condition, sensible price. BJ Whitty, 'Fourways', Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: (0704) 840328.

■ Realistic Patrolman radio, or similar with UHF coverage, and portable. Tel: (01) 444 8872 (David). Also pair 2m handhelds for sale, £45 each.

■ Sony ICF 7600D comms receiver, must be in unused or perfect condition. Mick, tel: Milton Keynes (0908) 316052.

■ Manual for Trio 2200G 2 metre portable. Willing to photocopy and return. Also wanted: KW Century or Argosy transceiver. Willing to come and see working rig. Please write: A J Anderson G0BFM, 44 Devizes, Wilts SN10 4EB.

■ Receiver RF board for Pye F9AM base station set or 2N4255 and UC734 transistors or any info where I might try. Also has anyone got a cheap 144MHz mobile rig or hand-held. Walker, 23 Forest Hill, Yeovil. Tel: (0935) 25225.

■ All-transistor car radio covering medium and popular short wave bands, not necessarily in working condition but must be complete. Fair price paid. All correspondence costs refunded. Also IC AY-5-12 24 A, good price offered. IJ McPherson, Box 13, Pareora, Sth Canterbury, New Zealand.

■ Two metre linear amplifier, I/P 2-3 watts O/P irrelevant. Home-brew or commercial. Would also like 2m, 70cm Tx/Rx multimode or FM, must be cheap (skint student). Phone or write Mr B Garner, 24 Lynwood, Guildford, Surrey GU2 5NY. Tel: (0483) 504773.

■ Yaesu FT707, FP707, FC707 ATU, FU707DM memory bank, must be mint condition and gwo. Good price paid for same. Tel: (0282) 59320

■ Early wireless sets, especially TRF receivers and battery operated portables using 2V valves. Also wanted post-war handbag portable receivers using miniature valves, and any crystal sets. Please telephone Reading 883799.

■ Trio 2400: I need the base charger. Model No is, I believe, ST1. Tel: (0782) 612868, ask for Allan.

■ Wanted by retired airline pilot wishing to become a radio & TV amateur, introductory information on selection of suitable equipment including satellite Rx etc. Replies to: Tom Froggatt afc, 'Chinon', Mont Cambrai, St Lawrence, Jersey, CI. Tel: (0534) 23872.

■ Amstrad Orion radio, Grandstand CB base station, 934MHz base station, Uniace colour TV, multi-standard continuous tuning portable, prefereably pre-amp for VHF/UHF TV, Omnidirectional TV aerial (VHF/UHF), AOR2002 scanning receiver, Trio R-2000 communications rcvr, small hand-held, TH-21E,FT-202/R etc. 44MHz crystals, any simplex channels. Any old communications recevers. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: (01) 674 0513 after midday please.

■ I have to get a B&W TV operating again before I can get my new radio, but I am having a bit of trouble with it. Could anyone with TV knowledge help out? Many thanks. Write to: D Martin, 6 Downland Garden, Epsom, Surrey KT18 5SJ.

■ Does anyone have data sheets for the wire-ended triode type EC1000? (Photocopy will do). Also wanted, Western Digital Microengine WD9000 5-chip set (revision 18 or later). Please state price. Phone or write to: Jim, 5 Victoria Road, Castletown, IOM. Tel: (0624) 824380.

■ Operators' handbook and/or circuit diagram for Regency M400E scanning Rx. Will reimburse any expense. Mr D Munro, 3 Sinclair Terrace, Wick, Caithness. Tel: (0955) 2085.

■ Any items of software or hardware for a UK101 computer. Very interested in the Sprite board or updated EPROMs. Please send details of what you have and price required. David Wells, 11 Cheviot Close, Nuneaton. Tel: (0203) 383017.

■ Reward! £5 offered for 6P7 valve. Manuals for Hallicrafters 5-10 and Sky Buddy receivers wanted. Will buy or borrow to copy, will refund and guarantee return within week. Also wanted ART13 transmitter and LF unit or any other units. BC348 receiver, must be original. All types of USA aircraft gear, WHY. J A Carr, 18 Friars Close, Cheadle, Stoke-on-Trent, Staffs ST10 1AT. Tel: (0538) 754103.

■ HF transceiver, must have GC receive. Ideally looking for military manpack, eg Racal TRA961, or similar by Plessey, Redifon, Collins, etc. P/ex for collection of military rado equipment, 1960s to current manufacture. List available. Consider amateur TCVR if GC receive. Also have large map collection and Osborne 01 portable computer with much software for sale. R J Sayers, 120 Birmingham Rd, Redditch, Worcs B97 6EP.

■ Urgent: manual, circuit for Dartronic model 381 scope, photostats or original. Also junk scope or any parts, am rebuilding one (incomplete) but parts missing, cannot get t/base to oscillate. All expenses paid within reason (OAP). My friend G4ZAG (phone 881 4697) wishes to contact anyone who has got mixer stage of PW Seven to work OK, giving voltages of BF256 or equivalent. Mr G Davies, 40 Woodchurch Lane, Ellesmere Port, Cheshire. Tel: (051) 339 7098.

■ Yaesu SP107P speaker with phone patch, FC107 aerial tuner (grey), Yaesu monitor scope, Yaesu HF linear amp, what have you? Cash waiting. Chris Lorek G4HCL, 11 Bevills Close, Doddington, March, Cambs PE15 0TT. Tel: (0354) 740672 any time.

■ Trio 820S in mint condition with all filters. Handbook: Plessey Rx type PR155G or photocopy. Handbook: Marconi oscilloscope TF2201 with TM6967 and TM6971 plug-ins. G I Sydenham, 41 Alexandra Road, Beccles, Suffolk NR34 9OD. Tel: (0502) 715419.

■ Dish between 9ft and 12ft dia. Can dismantle and collect any distance. Please state price and details. Clive Conrad, 361 Heath End Rd, Nuneaton, Warwicks CV10 7HG.

FREE CLASSIFIED AD ORDER FORM

Send to: Radio & Electronics World Classified Ads·Sovereign House · Brentwood · Essex · CM14 4SE

Classification: (tick appropriate box) If you want to insert ads under more than one classification use separate sheets for second and subsequent ads

For Sale .... ☐ Wanted.. ☐

USE BLOCK CAPITALS (One word per box)
To avoid mistakes please write clearly and punctuate your ad

Name/Address Postcode/Telephone							

USE SEPARATE SHEET FOR MORE WORDS

Ensure that you have included your name and address, and/or telephone number

CONDITIONS: Your ad will be published in the first available issue. We will not accept trade advertisements. We reserve the right to exclude any advertisement.

SMALL ADS

Telephone the advertising department on: 0277 219876 for details

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ESR

13a Station Road
Cullercoats — North Shields
Tyne & Wear — NE30 4PQ

Telephone 091 2514363

TRANSISTORS — RESISTORS — CAPACITORS — DIODES — LED'S — SCR'S — ICS — VOLTAGE REGULATORS — DISPLAYS — AUDIO & EDGE CONNECTORS — VERO/PCB'S — INSTRUMENT CASES & BOXES — POWER AMPLIFIERS & MODULES — MICROPHONES & STANDS.

WRITE OR PHONE FOR FREE PRICE LIST.

B45HG VIDEO

Transmit from your video recorder throughout the house. Price £8.90 + P&P 50p. SAE for leaflet:

Electronic Mailorder
62 Bridge Street, Ramsbottom
Lancs BL0 9AG
Tel: 070682-3036

YEASU FT 757 GX CAT CONTROL PROGRAM FOR BBC COMPUTER

Full control of transceiver, with selectable freq step rates, 300 memory storage per file. Split and A/B Vfo selection. In fact all the extras that are missing from Yeasu. This is a boon to the SWL it allows scanning of all your special stations without twiddling the knob. This works with the Yeasu interface or we can supply one at less than half price. The prog is available on disc at £10 or 16K Rom at £15.00. We have thoughts on other programs for Yeasu 9600 and 8800 let us know your interest regarding other CAT progs.
Other products RTTY RC Boards units for the BBC Com 64 Amstrad and many mor computers. Also AMTOR for the BBC. Amtor timing Pc boards now available.

Please SAE or Ring
J MELVIN G3LIV
2 Salters Court,
Gosforth, Newcastle,
Tyne & Wear NE3 5BM
TEL: 091 2843028

FIBRE OPTICS

Best quality Mitsubishi Rayon 0.5mm cut to length – 25p per metre. Add 75p for postage, packing and data.
JAR Microengineering Ltd
63 Alexandra Street, Thurmaston, Leicester LE4 8FE. (0533) 696568

JAYCEE ELECTRONICS
JOHN GM30PW
20 Woodside Way, Glenrothes, Fife KY7 5DP
Tel: 0592 756962
Open: Tues-Sat 9-5
APPROVED TRIO
Quality secondhand equipment in stock. Full range of TRIO goodies. Jaybeam – Microwave Modules – LAR.

QSL CARDS

Printing on colour or white gloss cards printed to your own design. Save money by having a reprint of your own cards. We also print all jobs for clubs or customers printing.

Send to: **Treadle Press, King Street, Bude, Cornwall**

XXX ADULT VIDEO CLUB

For the genuine adult films. Available only from ourselves. Ring
0924-471811 (24hrs)
For the intimate details or write
ADULT VIDEO CLUB
P.O. Box 12, Batley, W. Yorks.

TAR AERIALS AND COMMUNICATIONS
Specialists in Aerial Components, Lashings & Masts
Dealers in Jaybeam, Icom, Yaesu and others. Visit the
THE COMMUNCIATIONS CENTRE
KING WILLIAM STREET, AMBLECOTE
STOURBRIDGE, WEST MIDLANDS DY4 4CY
TEL: 0384 390944

Radio & Electronics World — *The communications and electronics magazine*

SMALL ADS

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

RATES
per single column centimetre:
1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

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

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

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

COPY enclosed........☐ to follow........☐

PAYMENT ENCLOSED:........ £ —

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order

CHARGE TO MY ACCOUNT........☐

COMPANY ....

ADDRESS ....

SIGNATURE .... TELEPHONE..................

....

	C	P	I							

Radio & Electronics World
The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
			series rates for consecutive insertions		
61 x 90	⅛ page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

depth mm x width mm	ad space	1 issue (colour rates exclude cost of separations)	3 issues	6 issues	12 issues
			series rates for consecutive insertions		
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

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

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Jan 86	14 Nov 85	20 Nov 85	22 Nov 85	12 Dec 85
Feb 86	9 Dec 85*	13 Dec 85*	17 Dec 85*	9 Jan 85
Mar 86	16 Jan 86	22 Jan 86	24 Jan 86	13 Feb 86
Apr 86	13 Feb 86	19 Feb 86	21 Feb 86	13 Mar 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.

ADVERTISERS INDEX

EAST CORNWALL COMPONENTS

We wish you a happy and successful 1986

NEW 1986 Catalogue is now available – range of components greatly increased – over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15.00). Includes 50p Credit Note, Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now – will be despatched within 7 days.

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Metal Line Socket	0.32
Single Junction Socket	0.80
Plastic Phono	0.10
F M Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15

FUSEHOLDERS

20mm Panel Mounting	0.28
20mm Chassis Mounting	0.06
1¼" Panel Mounting	0.35
1¼" Chassis Mounting	0.12
Carline 1¼" Holder	0.10

TELEPHONE SPECIAL

BT App Telephone Plug + 3m Lead	1.25
BT App Master Socket Inc. Wiring Instrns	2.85
BT App Secondary Socket	1.95
4 way plug	0.58ea 10/£5.50
BT 4-Core Cable per metre	.15
100 metres	12.00
Cable clips for above	100/75p

NI-CAD

Universal Ni-Cad charger, charges PP3, AA, C, D
Price **£5.10**

RECHARGEABLE BATTERIES

AA (HP7)	**0.95 ea**	**10/0.85 ea.**
C (HP11)	**2.14 ea**	**10/0.98 ea.**
D (HP2)	**2.30 ea**	**10/2.10 ea.**
PP3	**3.75 ea**	**10/3.65 ea.**

SPEAKERS

4" round 1.6W, 4ohm	**£1.50pr**
4" round 1.6W, 4ohm. Plus Mounting Bracket	**£1.00ea**
2¼" round 0.4W 8ohm	**£0.85ea**

SPECIAL OFFER – FEB ONLY

CERAMIC KIT – 50 volts Cer.Caps
5 each value total of 125
(each value individually packed and marked
£3.75 per kit
Look for our 'Special Offer' for each month

SANYO DYNAMIC MICROPHONE

c/w 1 metre of cable + plug, on/off switch and stand Imp. 500 ohm model no HM95 **£1.50ea**

ZENER DIODES

400mW Plastic 3V-30V **8p each 10/70p**
1/1.3W Plastic 4.7V-120V
12p each 10/£1.10
*1.5W Plastic 11V-75V **1.25 each 10/11.50**
*2.5W Plastic 75V-75V **0.75 each 10/7.00**
*15W Plastic 12V-30V **85p each 10/8.00**
*20W Metal 7.5W-68V **1.32 each 10/11.60**
*Only Available while Stocks Last
*Zener Diode Pack-400mW-5 each-value-11 values-individually packed & marked
55 Zener Diodes **3.50 per pack**

MIN 'D' CONNECTORS

		9way	15way	25way	37way
PLUGS	Solder Lug	.52	.65	.88	1.45
	R. Angle	.89	1.34	1.98	3.48
SOCKETS	Solder Lug	.78	.98	1.33	2.48
	R Angle	1.18	1.78	2.70	4.15
COVERS		.95	95	.98	1.00

RESISTORS – CARBON FILM 5%

¼W 1RO to 10M (E12 Range)	**2p each. 15p/10. 75p/100**
½W 1RO to 10M (E24 Range)	**2p each. 15p/10. 75p/100**
1W 10R to 1OM (E12 Range)	**7p each. 40p/10. 3.50/100**
2W 10R to 1OMm (E6 Range)	**8p each. 60p/10. 5.00/100**

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12—10R—1M 610 pieces	5.75
¼W pack 5 each value E12—10R—1M 305 pieces	3.35
½W pack 10 each value E12—2R2—2M2 730 pieces	7.95
½W pack 5 each value E12—2R2—2M2 365 pieces	4.75
1W pack 5 each value E12—1OR—1OM 365 pieces	15.00
2W pack 5 each value E6—10R—1OM 365 pieces	18.50

RESISTORS – WIREWOUND Generally 5%

2.5W 0.22 to 270R	**15p each 1.40/10**
4W 1RO to 10K. 1RO to 680R	**14p each**
1K—3K3	**15p each**
4K7—6K8	**18p each**
10K	**22p each**
7W 1RO to 22K. 1RO to 5K6	**15p each**
6K8—12K	**16p each**
15K—22K	**17p each**
11W 1RO to 22K. 1RO—4K7	**18p each**
6K8—10K	**19p each**
15K—22K	**22p each**
17W 1RO to 22K. 1RO—10K	**24p each**
15K—22K	**25p each**
Support pillars for 4W/7W/11W/17W/	**4p each 30p/10**
25W 0.47R—47OR	**1.48 each 12.50/10**
50W 0.47R—47OR	**1.85 each 13.00/10**

CHART RECORDER SPECIAL

Brand new 3 channel pen recorders complete with charts. Full spec upon request once only price **£40 + £10 p&p + VAT**

Terminal Blocks

2 amp 12 way	**0.20**
5 amp 12 way	**0.24**
15 amp 12 way	**0.42**
32 amp 12 way	**0.88**

CAPACITORS

Mixed Dialectic.

.01mf 1000V	**0.30**
.022mf 1000V	**0.20**
.1mf 1000V	**0.48**
.47mf 1000V	**0.78**

POTENTIOMETERS

Carbon Track, Rotary 0.25W Log & 1 in values. All ¼in Spindle, 20ml body dia. Shaft 2" long.

4K7-2M2 Single Gang Log	.40	10/**3.80**
1K — 2M2 Single Gang Lin	.38	10/**3.50**
5K — 2M2 Single Gang DP Switch Log	1.05	10/**9.50**
5K — 2M2 Double Gang Log & Lin	1.25	10/**10.50**

CERAMIC CAPACITOR PACK

50V. Ceramic Capacitors – 5 each value 25 values – each value individually marked and packed – 125 total. **£3.50** per pack.

D C MOTORS (Min)

35/0866-12 volts 25mmx38mm	**75p each**	**10/£6.00**
35/5529 volts 35mmx42mm	**85p each**	**10/£7.00**
35/1296-12 volts + m/bracket 25mmx38mm	***80p each**	**10/£6.50**
35/0166-12 volts + m/bracket 38mmx42mm	**82p each**	**10/£6.70**
SPDC 12 volt Fujiya + Speed Control Board 32mmx38mm	**£2.50 each**	**£10/£22.00**

All prices are subject to change without notice

Soldering Section

XS25W Iron Kit/complete with stand & plug attached	**10.00**
CS 18W as above	**9.90**
Antex 15W iron	**5.25**
Antex 18W iron	**5.50**
Antex 25W iron	**5.75**
Antex elements	**2.75**
Antex bits	**0.90**
Antex stands	**2.10**
Soldersucker	**4.50**
Spare nozzles for Soldersucker	**0.65**

SERVICE AIDS

Switch Cleaner	**1.18**
Circuit Freezer	**1.34**
Foam Cleanser	**1.16**
Aero Klene	**1.10**
Plastic Seal	**1.28**
Excel Polish	**1.12**
Antistat Spray	**1.18**
Aero Duster	**1.40**
Super 40	**1.82**
Video Head Cleaner	**1.06**
Fire Extinguisher	**3.06**
Silicone Grease Aer	**1.42**
Ditto Tube	**1.64**
Heat Sink Compound	**1.08**
Solda Mop 0.12mm	**0.74**
Ditto 0.06mm	**0.76**

PRESETS

0.25W Type 100R-4m7 V&H **10p ea 10/90p**
0.1W Type 100R-1M V&H **7p each 10/65p**

CMOS

4000	0.19	4502	0.58
4001	0.24	4503	0.38
4002	0.24	4507	0.45
4006	0.68	4508	1.28
4007	0.24	4510	0.54
4008	0.59	4511	0.54
4009	0.44	4512	0.54
4010	0.39	4514	1.10
4011	0.23	4515	1.20
4012	0.24	4516	0.60
4013	0.35	4517	2.70
4014	0.58	4518	0.48
4015	0.58	4020	0.50
4016	0.38	4521	1.10
4017	0.54	4522	1.20
4018	0.59	4526	0.58
4019	0.59	4527	0.64
4020	0.78	4528	0.68
4021	0.58	4531	1.20
4022	0.68	4532	0.64
4023	0.30	4536	2.50
4024	0.49	4538	0.78
4025	0.24	4539	0.80
4026	0.89	4541	0.94
4027	0.44	4543	0.70
4028	0.44	4549	3.98
4029	0.73	4553	2.40
4030	0.33	4554	1.80
4031	1.28	4555	0.34
4033	1.25	4556	0.54
4034	1.40	4557	2.40
4035	0.68	4558	1.10
4036	2.48	4559	3.90
4038	0.73	4560	1.50
4039A	2.70	4562	3.48
4040	0.58	4566	1.60
4042	0.48	4569	1.75
4043	0.42	4583	1.00
4044	0.48	4584	0.54
4046	0.58	4585	0.55
4049	0.38	40100	2.10
4050	0.34	40101	1.20
4051	0.68	40102	1.30
4051	0.68	40103	3.95
4052	0.58	40104	1.15
4053	0.58	40105	2.10
4066	0.44		
4068	0.24		
4069	0.24		
4070	0.24		
4071	0.24		
4072	0.24		
4073	0.24		
4075	0.24		
4076	0.68		
4077	0.24		
4078	0.24		
4081	0.24		
4082	0.24		
4085	0.58		
4086	0.58		
4089	1.22		
*4093	0.37		
4094	0.70		
4095	0.93		
4096	0.98		
4097	2.65		
4098	0.78		
4099	0.75		
4161	0.96		
4162	0.96		
4163	0.96		
4174	0.96		
4175	1.00		
4195	0.99		
4501	0.38		

INTEGRATED CIRCUITS (£) EACH

709	0.35	UPC57512	1.45
741	0.25	UPC741G	0.95
747	0.70	UPC1156H	2.75
AN214Q	3.80	UPC1180	2.75
AN240P	3.42	UPC1218H	1.80
BTT6218	1.98	UPC1370C2	2.50
CA301AT	2.88	UPC2002H	2.75
CA58E	0.66	UPC2002U	2.75
CA810CM	1.20		
CA3020	2.10		
CA3065	1.60		
CA3080E	0.68		
CA3130E	0.90		
CA3140	0.45		
HA1366W	1.59		
LA4422	3.20		
LC7131	4.90		
LC7137	5.40		
LM324N	0.45		
LM380N8-P	1.15		
LM380N14-P	1.80		
LM1011N	3.20		
LM1458N	0.98		
LM3900N	0.85		
M51513L	2.30		
M51515L	3.18		
MC1307P	1.99		
MC1327P	1.50		
MC1330P	1.60		
ML23213	2.10		
ML23713	2.30		
NE555	0.25		
SAA1025	4.00		
SAS560	2.50		
SAS570	1.85		
SAS580	2.85		
SN76033N	2.50		
SN76131N	1.99		
SN76226DN	1.70		
SN76227N	1.10		
SN7666ON	0.75		
SN76666NO	1.40		
STK015	6.20		
TA7146P	4.60		
TA7203P	2.76		
TA7204P	1.50		
TA7205AP	1.30		
TA7222P	2.32		
TAA550	0.50		
TAA611A12	3.50		
TAD100	2.90		
TDA120A	0.80		
AS/S/SB/T/U	0.80		
TDA120B	1.30		
SA/SQ/UQ	1.30		
TBA520	1.50		
TBA530	1.20		
TBA540	1.64		
TDA560C	1.50		
TDA800	0.80		
TBA810S	1.20		
TBA950/2A	3.05		
TCA270SA	4.02		
TDA1003A	5.50		
TDA1006A	2.45		
TDA1035S	2.20		
TDA1170S	1.99		
TDA1352A	1.80		
TDA2002	1.80		
TDA2020	4.00		
TDA2030	1.90		
TDA2140	2.90		
TDA2160	2.50		
TDA2522	2.75		
TDA2530	2.20		
TDA2532	2.80		
TDA2543	3.20		
TDA2581	4.60		

74LS

74LS00	0.24	74LS92	0.54	74LS175	0.70
74LS01	0.24	74LS93	0.54	74LS190	0.82
74LS02	0.24	74LS95	0.60	74LS192	0.98
74LS03	0.24	74LS96	1.20	74LS193	0.98
74LS04	0.24	74LS107	0.40	74LS194	0.75
74LS05	0.24	74LS109	0.44	74LS195	0.74
74LS08	0.24	74LS112	0.44	74LS196	0.84
74LS09	0.24	74LS113	0.40	74LS197	0.96
74LS10	0.24	74LS114	0.39	74LS221	0.85
74LS11	0.24	74LS122	0.68	74LS240	0.60
74LS12	0.24	74LS123	1.00	74LS241	0.80
74LS13	0.33	74LS124	1.25	74LS242	0.94
74LS14	0.48	74LS125	0.52	74LS243	0.94
74LS15	0.24	74LS126	0.50	74LS244	0.80
74LS19	0.44	74LS132	0.60	74LS245	1.20
74LS20	0.24	74LS135	0.26	74LS247	1.00
74LS21	0.24	74LS136	0.42	74LS251	0.75
74LS22	0.24	74LS138	0.44	74LS257	0.73
74LS24	0.28	74LS139	0.58	74LS258	0.75
74LS26	0.24	74LS145	0.93	74LS259	1.20
74LS27	0.24	74LS147	1.64	74LS266	0.55
74LS28	0.24	74LS148	1.28	74LS273	1.20
74LS30	0.24	74LS151	0.70	74LS279	0.70
74LS32	0.24	74LS153	0.70	74LS283	0.80
74LS33	0.24	74LS155	0.55	74LS353	1.10
74LS37	0.24	74LS157	0.45	74LS365	0.50
74LS38	0.24	74LS158	0.58	74LS366	0.50
74LS40	0.24	74LS160	0.62	74LS367	0.50
74LS42	0.50	74LS161	0.68	74LS368	0.50
74LS47	0.79	74LS162	0.70	74LS373	1.00
74LS48	0.85	74LS163	0.68	74LS374	1.00
74LS51	0.24	74LS164	0.74	74LS375	0.70
74LS55	0.24	74LS165	1.10	74LS377	1.25
74LS73	0.30	74LS166	1.50	74LS378	0.95
74LS74	0.33	74LS168	1.48	74LS390	0.60
74LS75	0.44	74LS170	1.40		
74LS76	0.38	74LS173	0.98		
74LS78	0.38	74LS174	0.75		
74LS83	0.68				
74LS85	0.82				
74LS86	0.35				
74LS90	0.48				
74LS91	0.90				

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Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC127	0.28	BC125	0.14	BC440	0.36	BF158	0.30	BRY56	0.42	BYX10	0.20	TIS43	0.88
AC128	0.30	BC140	0.27	BC441	0.40	BFR160	0.23	BSX19	0.32	BYX36/150	0.40	TIS88	0.50
AC128K	0.34	BC141	0.26	BC461	0.58	BF167	0.32	BSX20	0.30	BYX36/600	0.48	TIS90	0.27
AC141	0.58	BC142	0.24	BC478	0.24	BF177	0.42	BSX59	0.78	BYX48/300	0.70	TIS20	2.45
AC141K	0.38	BC143	0.26	BC516	0.48	BF178	0.26	BSX76	0.65	BYX55/600	0.30	Y728	0.14
AC142	0.56	BC147	0.18	BC547	0.12	BF180	0.27	BSY52	0.35	BYX71/600	1.18	Y969	2.80
AC142K	0.38	BC147B	0.14	A or B	0.10	BF181	0.27	BSY95A	0.25	BYZ212	0.78	ZE75	0.60
AC151	0.45	BC148	0.10	BC548	0.12	BF182	0.32	BT100A/02	0.90	C106D (400V)	0.48	ZTX107	0.14
AC152	0.45	BC148B	12	A B or C	0.10	BF183	0.32	BT101/300	2.75	C106F (50V)	0.36	ZTX502	0.22
AC153	0.57	BC149	0.10	BC549	0.10	BF184	0.30	BT101/500	3.25	D40C1	1.08	IN4001	0.04
AC153K	0.46	BC149C	0.14	A or B	0.10	BF185	0.28	BT102/300	3.60	D40N1	1.12	IN4003	0.05
AC176	0.30	BC157	0.10	BC550	0.10	BF194A	0.15	BT106	1.15	E1222	0.30	IN4004	0.05
AC176K	0.38	BC158	0.12	A or B	0.10	BF195	0.12	BT108	1.25	E5024	0.30	IN4006	0.07
AC187	0.28	BC159	0.12	BC557	0.10	BF200	0.30	BT109	1.15	GET872	0.60	IN4007	0.07
AC187K	0.38	B/C	0.14	BC558A	0.10	BF222	0.38	BT116	1.20	GET881	1.70	IN4148	0.04
AC188	0.28	BC160	0.30	BCY70	0.16	BF224	0.16	BT119	3.30	GET882	1.90	IN5400	0.12
AC188K	0.38	BC161	0.30	BCZ10	£3.21	BF224J	0.20	BT120	3.50	ITT2001	0.18	IN5402	0.13
ACY22	1.50	BC168B	0.20	BCZ11	£2.60	BF240	0.30	BT121	2.99	ITT2003	0.34	IN5405	.16
AD142	0.88	BC169C	0.12	BD124P	0.70	BF241	0.30	BT138/600	1.30	MCR106/5	1.20	IN5406	0.17
AD143	0.88	BC170	0.16	BD129	0.90	BF244	0.34	BT151/560R	0.90	ME0413	0.70	IN5408	0.19
AD149	0.72	A B or C	0.16	BD130Y	0.68	BF244A	0.30	BTY79/400R	2.80	ME6002	0.26	IS44	0.06
AD161/162	1.20	BC171	0.10	BD131	0.36	BF257	0.22	BU100A	2.30	MEU21	0.62	IS920	0.07
AD162	0.52	A or B	0.10	BD132	0.36	BF258	0.26	BU104	1.80	MJ400	0.45	2N1306	1.42
AF114	1.20	BC172	0.12	BD135	0.26	BF259	0.30	BU105	1.20	MJ2955	1.00	2N2122A	0.34
AF115	2.10	B or C	0.12	BD136	0.26	BF262	0.34	BU105/02	1.55	MJ3000	1.80	2N2222	0.30
AF116	2.10	BC177	0.24	BD137	0.28	BF263	0.38	BU108	1.75	MJE340	0.46	2N2904A	0.48
AF121	0.56	A B or C	0.24	BD138	0.30	BF270	0.30	BU124AE	0.98	MJE520	0.44	2N2926G	0.14
AF124	0.42	BC182	0.10	BD139	0.30	BF271	0.28	BU126	1.40	MJE2955	1.60	2N3053	0.30
AF125	0.58	A B or C	0.10	BD140	0.28	BF273	0.22	BU133	1.90	MJE3055	1.40	2N3054	0.60
AF126	0.58	BC182L	0.12	BD142	1.26	BF274	0.34	BU204	1.30	MPSA05	0.30	2N3055	0.65
AF127	0.38	LA LD LC	0.12	BD145	1.82	BF294	0.46	BU205	1.30	MPSA12	0.30	2N3703	0.10
AF139	0.40	BC183	0.10	BD150B	0.72	BF336	0.32	BU206	1.50	MPSL01	0.34	2N3773	2.80
AF178	2.28	A B or C	0.10	BD160	1.58	BF337	0.28	BU208	1.40	MPSU05	1.05	2N3904	0.20
AF239	0.50	BC183L	0.10	BD165	0.45	BF338	0.28	BU208A	1.40	MPSU06	1.18	2N3906	0.20
AF279S	1.40	LA LB LC	0.10	BD183	0.70	BF355	0.37	BU208/02	2.05	MR502	0.40	2N5294	0.80
AL100	5.40	BC184	0.10	BD201	0.52	BF363	0.35	BU326S	1.75	MR854	0.86	2N6107	0.80
AL102	4.40	A B CL LC LB	0.10	BD202	0.57	BF367	0.24	BU407	1.10	NKT SER18	1.68	2SB337	1.80
ASY80	5.20	BC207	0.15	BD204	0.50	BF371	0.27	BUX80	3.70	OA91	0.07	2SC1098	0.84
ASZ17	2.00	BC212	0.10	BD222	0.80	BF422	0.20	BUY20	2.75	OA210	0.66	2SC1172Y	1.70
AU110	2.80	A B or C	0.10	BD225	0.40	BF450	0.38	BUY69A	2.60	OC26	2.65	2SC1173Y	0.88
AY102	4.32	BC212L	0.09	BD232	0.45	BF457	0.36	BUY69B	1.98	OC35	4.75	2SC1279	0.50
B40C2200	1.03	LA LB	0.10	BD234	0.30	BF458	0.37	BY100	0.80	OC36	1.75	2SC1306	0.92
BA110	0.68	BC213	0.10	BD235	0.30	BF459	0.35	BY103	0.50	OC44	0.72	2SC1307	1.50
BA115	0.14	A B or C	0.10	BD236	0.38	BFR51	0.36	BY122	0.60	OC72	0.70	2SC1413A	2.70
BA121	0.40	BC213L	0.10	BD237	0.38	BFR61	0.32	BY126	0.10	OC81	0.68	2SC1449	0.60
BA129	0.38	LA LB LC	0.10	BD410	0.76	BFR90	0.86	BY127	0.08	ORP12	0.85	2SC1507	0.60
BA148	0.16	BC237	0.11	BD434	0.58	BFT41	0.68	BY133	0.08	R2008B	1.20	2SC1678	1.00
BA155	0.12	BC238	0.12	BD438	0.58	BFT43	0.86	BY135	0.35	R2010B	1.20	2SC1758	0.68
BA157	0.28	BC251	0.14	BD439	0.85	BFW11	0.84	BY164	0.45	R2010B	1.20	2SC1909	1.20
BB105B	0.30	A B	0.14	BD441	1.00	BFW44	0.88	BY179	0.56	R2540	2.71	2SC1923	0.30
BB105G	0.48	BC262	0.26	BD507	1.05	BFX29	0.28	BY182	0.80	TIC45	0.45	2SC1945	2.88
BB110B	0.42	A B	0.28	BD520	1.20	BFX48	0.78	BY184	0.38	TIC47	0.70	2SC21953	0.70
BC107	0.10	BC301	0.30	BD687	0.88	BFX80	6.46	BY187	0.65	TIC29	0.30	2SC1957	0.70
A or B	0.12	BC302	0.30	BD707	0.88	BFZ85	0.35	BY189	6.75	TIP30A	0.32	2SC1969	2.80
BC108	0.10	BC303	0.30	BDX18	1.00	BFY50	0.22	BY198	0.64	TIP31C	0.39	2SC2028	0.73
A B or C	0.13	BC307A	0.18	BDX32	1.48	BFY51	0.22	BY199	0.72	TIP32	0.35	2SC2029	2.70
BC109	0.10	BC317A	0.12	BF115	0.32	BFY52	0.22	BY206	0.14	TIP33A	0.55	2SC2078	1.05
A B or C	0.14	BC323	0.90	BF117	0.50	BFY90	0.80	BY207	0.16	TIP34A	0.70	2SC2091	0.70
BC113	0.42	BC327	0.16	BF119	0.82	BFY90S	1.34	BY210/400	0.21	TIP41C	0.42	2SC2098	2.90
BC115	0.12	BC328	0.16	BF120	0.38	BR100	0.25	BY210/600	0.24	TIP42	0.44	2SC122A	3.20
BC116	0.12	BC337	0.12	BF125	0.42	BR101	0.40	BY210/800	0.28	TIP47	0.42	2SC2314	0.80
BC117	0.22	BC338	0.12	BF127	0.41	BR103	0.50	BY227	0.22	TIP121	0.63	2SC2335	1.50
BC118	0.16	BC350A	0.24	BF154	0.14	BR303	2.75	BY228	0.46	TIP2955	0.70	2SK135	3.80
BC119	0.28	BC351	0.16	BF157	0.46	BRY39	0.50	BY238	0.65	TIP3055	0.58	3N211	3.52

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- BC126 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
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- BC252 10p
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- BC301 30p
- BC303 30p
- BC307 7p
- BC308 7p
- BC309 10p
- BC327 10p
- BC328 10p
- BC328/338 pair 15p
- BC337 10p
- BC338 10p
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- BC350 20p
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- BC384 10p
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- AC124 15p
- AC128 15p
- AC137 15p
- AC151 15p
- AC131 15p
- AC138 15p
- AC152 15p
- AC153K 15p
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- BF161 20p
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- 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
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- BF245b 20p
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- Hitachi TP 007 Battery pack 7.2v/1.6A £7.00
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- 1Kg reel of solder £8.00

- 100 W/W Res £1.50
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