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POWER SUPPLIES:
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EXPLAINED

YAESU FRG-7:
A NARROW-BAND
FILTER MODIFICATION

NEW RS232C REPLACEMENT

EAST CORNWALL COMPONENTS

TRANSISTORS DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC126	0.35	BC108	0.10	BC302	0.32	BD244A	0.65	BF258	0.30	BT101/300	1.15	BYX36/150	0.22
AC127	0.30	A B or C	0.12	BC303	0.32	BD375	0.32	BF259	0.32	BT101/500	1.25	BYX36/600	0.28
AC128	0.30	BC113	0.14	BC307	0.10	BD410	0.76	BF262	0.30	BT102/300	1.35	BYX48/300	0.72
AC128K	0.34	BC114	0.12	BC308A	0.10	BD434	0.68	BF263	0.30	BT102/500	1.65	BYX49/300	0.47
AC132	0.55	BC115	0.12	BC323	0.99	BD436	0.68	BF270	0.30	BT106	1.50	BYX55/350	0.29
AC141	0.26	BC116	0.15	BC327	0.14	BD437	0.76	BF271	0.28	BT108	1.30	BYX55/600	0.33
AC141	0.26	BC117	0.22	BC328	0.14	BD438	0.76	BF273	0.18	BT109	1.18	BYX71/600	1.18
AC141K	0.40	BC118	0.17	BC337	0.12	BD439	0.68	BF274	0.32	BT116	1.25	BYZ12	0.42
AC142	0.26	BC119	0.30	BC338	0.12	BD507	0.48	BF323	0.92	BT119	3.62	C106D	0.80
AC142K	0.48	BC125	0.12	BC350	0.14	BD508	0.53	BF336	0.26	BT120	3.60	E1222	0.40
AC151	0.45	BC140	0.28	BC440	0.30	BD509	0.54	BF337	0.26	BT121	3.02	E5024	0.30
AC152	0.45	BC141	0.42	BC441	0.32	BD510	0.48	BF338	0.26	BT138/600	1.30	GET872	0.48
AC176	0.28	BC142	0.30	BC461	0.32	BD517	0.56	BF355	0.42	BT151/560R	0.90	ITT44	0.04
AC176K	0.46	BC143	0.30	BC547	0.12	BD520	0.66	BF363	0.82	BT151/300R	1.15	ITT2002	0.11
AC187	0.42	BC147	0.08	BC548	0.12	BD699	1.26	BF367	0.24	BTY79/400R	2.80	ME0402	0.20
AC187K	0.48	A or B	0.10	BC549	0.12	BD707	0.88	BF371	0.27	BU100A	2.30	ME0404/2	0.24
AC188	0.44	BC148	0.08	BC550	0.18	BDX18	2.35	BF422	0.38	BU104	2.00	MEU21	0.60
AC188K	0.50	A or B	0.10	BC550C	0.18	BDX32	2.10	BF450	0.38	BU105	1.20	MJ400	1.25
ACY40	0.88	BC149	0.09	BC557	0.12	BF115	0.32	BF457	0.33	BU105/02	1.56	MJ2955	0.90
AD142	1.10	BC157	0.10	BC558	0.12	BF117	0.54	BF458	0.36	BU108	1.80	MJ3000	1.98
AD143	1.10	BC158	0.10	BCX34	0.27	BF119	0.82	BF459	0.44	BU124	1.75	MJE240	0.60
AD149	0.96	BC159	0.10	BCY70	0.15	BF120	0.38	BFR39	0.22	BU126	1.25	MJE340	0.54
AD161	0.42	BC160	0.30	BCY71	0.17	BF123	0.40	BFR40	0.22	BU133	1.80	MJE370	0.88
AD162	0.42	BC161	0.30	BCY72	0.18	BF125	0.42	BFR41	0.22	BU204	1.35	MJE520	0.48
AD161/AD162	0.98	BC168B	0.12	BCZ10	1.68	BF127	0.38	BFR51	0.30	BU205	1.30	MJE2955	0.99
AF106	0.48	BC169C	0.10	BCZ11	1.45	BF152	0.18	BFR61	0.32	BU206	1.70	MJE3055	0.70
AF114	2.15	BC170	0.14	BD124P	0.80	BF154	0.23	BFR62	0.28	BU208	1.55	MPSLO1	0.28
AF115	2.10	BC170B	0.12	BC130Y	0.68	BF157	0.40	BFR88	0.34	BU208A	1.63	OA47	0.10
AF116	2.10	BC171	0.10	BD131	0.34	BF158	0.22	BFR90	1.72	BU208/02	2.05	OA90	0.08
AF117	2.10	BC171	0.10	BD132	0.34	BF159	0.24	BFT41	0.38	BU326S	1.75	OA91	0.09
AF118	0.85	A or B	0.08	BD131/BD132	0.95	BFR160	0.23	BFT43	0.36	BU407	1.65	OA95	0.18
AF121	0.62	BC172	0.08	BD135	0.32	BF167	0.30	BFW10	0.79	BU407D	1.80	OA200	0.06
AF124	0.48	A or B	0.12	BD136	0.36	BF173	0.25	BFW44	0.76	BUX80	3.70	OA202	0.15
AF125	0.48	BC177	0.20	BD137	0.36	BF177	0.42	BFX29	0.28	BUY20	1.75	OC25	2.10
AF127	0.48	BC178A	0.22	BD138	0.38	BF178	0.30	BFX30	0.30	BUY69A	2.60	OC26	1.70
AF139	0.68	BC182	0.08	BD139	0.38	BF179	0.32	BFX80	3.56	BUY69B	1.98	OC28	1.50
AF178	0.68	A B or C	0.09	BD140	0.38	BF180	0.35	BFX84	0.24	DBY101	0.48	OC29	2.47
AF239	0.68	BC182L	0.09	BD144	160	BF181	0.35	BFZ85	0.26	BY118	1.10	OC35	1.75
AF279S	0.72	A B or C	0.09	BD145	1.82	BF182	0.32	BFX86	0.26	BY122	0.68	OC36	1.75
AL100	2.50	BC183	0.09	BD150A	0.51	BF183	0.32	BFX87	0.26	BY126	0.12	OC42	0.72
AL102	5.90	A B or C	0.10	BD159	0.65	BF184	0.32	BFX89	0.65	BY127	0.10	OC42K	1.40
AL113	2.20	BC183L	0.06	BD160	1.65	BF185	0.32	BFY50	0.21	BY133	0.16	OC44	0.72
ASY80	1.75	A B or C	0.12	BD165	0.45	BF194	0.08	BFY51	0.21	BY135	0.25	OC45	0.58
AU110	1.40	BC184	0.10	BD175	0.60	BF195	0.10	BFY52	0.21	BY164	44	OC71	0.50
AY102	4.32	A B or C	0.10	BD182	1.00	BF196	0.10	BFY57	0.40	BY179	0.66	OC72	0.52
BA102	0.34	BC207	0.15	BD183	1.10	BF197	0.10	BFY90	0.90	BY182	0.87	OC81	0.68
BA110	0.87	BC208	0.16	BD184	1.20	BF198	0.14	BFY90S	1.34	BY184	0.40	OC200	2.45
BA121	0.40	BC212	0.09	BD201	0.72	BF199	0.16	BR100	0.20	BY187	0.72	OC202	2.20
BA129	0.38	A B or C	0.10	BD202	0.87	BF200	0.48	BR101	0.44	BY189	4.75	ORP12	0.85
BA148	0.16	BC212L	0.08	BD204	0.80	BF222	0.48	BR103	0.58	BY198	0.44	R2008B	1.50
BA154	0.08	A B or C	0.10	BD222	0.80	BF224	0.20	BRC443	1.76	BY199	0.47	R2010B	1.52
BA155	0.10	BC213	0.09	BD225	0.86	BF224J	0.16	BRY39	0.38	BY206	0.24	SHG1 5	0.40
BA156	0.08	A or B	0.10	BD232	0.45	BF240	0.20	BRY56	0.42	BY207	0.24	TAG1/100	1.40
BA157	0.28	BC213L	0.10	BD233	0.60	BF241	0.26	BRY61	0.86	BY210/400	0.25	TAG3/400	1.78
BA164	0.14	A or B	0.10	BD234	0.62	BF244	0.26	BSS17	0.56	BY210/600	0.26	TIC44	0.40
BB104B	0.52	BC237	0.11	BD235	0.63	BF244A	0.28	BSS27	0.92	BY210/900	0.30	TIC45	0.45
BB105B	0.30	BC236	0.12	BD236	0.63	BF244C	0.24	BSX19	0.34	BY223	1.20	TIC46	0.48
BB105G	0.48	BC239	0.14	BD237	0.66	BF245A	0.26	BSX20	0.34	BY227	0.26	TIC47	0.70
BB110B	0.42	BC251	0.12	BD238	0.56	BF254	0.15	BSX59	0.62	BY229	0.30	TIC106A	0.70
BC107	0.10	A B or C	0.14	BD241	0.60	BF256	0.40	BSX76	0.29	BY238	0.68	TIP30A	0.46
A or B	0.12	BC301	0.30	BD243A	0.80	BF257	0.32	BT100A/02	0.94	BYX10	0.24	TIP31C	0.54

VOLTAGE REGULATORS

Type	Price (£)
78L05	0.30
78L08	0.30
78L12	0.30
78L15n	0.30
78M05	0.50
78M08	0.50
78M12	0.50
78M15	0.50
78M24	0.50
7805	0.55
7808	0.56
7812	0.55
7815	0.55
7818	0.55
7824	0.55
7905	0.65
7912	0.65
7915	0.65
7918	0.65
7924	0.65
CA3085	0.95
723C	0.36
LM317K	3.50
LM317T	0.90

74LS SERIES

SN74LSOON	0.28
SN74LSO1N	0.28
SN74LSO2N	0.28
SN74LSO3N	0.28
SN74LSO4N	0.32
SN74LS14N	0.58
SN74LS20N	0.28
SN74LS27N	0.28
SN74LS32N	0.28
SN74LS38N	0.43
SN74LS40N	0.28
SN74LS42N	0.65
SN74LS48N	0.70
SN74LS51N	0.34
SN74LS55N	0.25
SN74LS74AN	0.38
SN74LS78AN	0.45
SN74LS90N	0.54
SN74LS123N	1.15
SN74LS138N	0.45
SN74LS164N	0.93
SN74LS165N	1.20
SN74LS190N	0.98
SN74LS244N	1.00
SN74LS245N	2.00
SN74LS247N	1.15
SN74LS283N	0.93
SN74LS353N	1.20
SN74LS367AN	0.60
SN74LS373N	1.20
SN74LS377N	1.40
SN74LS378N	1.15
SN74LS390N	0.89
SN74LS670N	1.88

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.65
ECC82	0.65
ECC83	1.10
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.90
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.65
EF183	0.75
EF184	0.75
EH90	0.54
EL34	3.25
EL84	0.69
EL509	7.85
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	1.36
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.55
PCF801	1.45
PCF802	1.00
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	1.30
PCL86	1.15
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	2.20
PL508	2.40
PL509/519	7.50
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.30
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60
6JB6A	4.00

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ZENER DIODES

400mW Plastic 3V-75V **8p each 10/75p**
1.3W Plastic 3V-200V **15p each 10/£1.40**
1.5W Flange 4.7-47V **£1.26 each**
2.5W Plastic 75-75V **64p each**
20W Stud 75-75v **£1.35 each**

INTEGRATED CIRCUITS

	(£) EACH		(£) EACH		(£) EACH
AN240P	3.42	SN76530P	1.40	TBA570	1.50
AN214Q	3.88	SN76533N	1.60	TBA651	2.80
AN715Q	2.90	SN76650N	1.05	TBA673	2.40
CA3065	1.75	SN76660N	0.75	TBA700	2.85
CA4031P	2.88	SN76666N	0.80	TBA800	1.60
CA4102	3.30	STK015	6.50	TBA810P	1.10
CA4250	3.50	TA7108P	3.20	TBA810S	1.20
CA4400	2.98	TA7120P	2.20	TBA820	1.60
CA4422	3.07	TA7129AP	3.65	TBA890	3.88
LC7120	5.33	TA7130P	1.65	TBA920/Q	3.00
LC7130	5.26	TA7172	1.80	TBA950/2A	3.05
LC7137	5.16	TA7193	5.50	TBA970	4.05
LM380N	0.80	TA7172P	1.80	TBA990	1.88
LM1303N	2.52	TA7176	2.50	TCA160C	3.90
HA1151P	3.12	TA7202P	4.18	TCA270S	4.00
MC1307P	1.85	TA7204P	1.88	TCA270SA	4.02
MC1310P	1.85	TA7205AP	1.50	TCA800	3.10
MC1312P	2.25	TA7208P	3.25	TCA940	1.90
MC1327P	1.75	TA7210P	.50	TDA440	3.80
MC1330P	0.83	TA7222P	1.88	TDA1002	1.90
MC13449P	1.85	TA7223P	3.68	TDA1003A	5.50
MC1350P	1.20	TA7227P	5.60	TDA1004A	2.90
MC1351P	2.50	TA7310P	1.80	TDA1006A	2.40
MC1352P	1.50	TA7609P	4.28	TDA1035S	4.50
MC1357P	.88	TA7611AP	2.88	TDA1044	4.30
MC1358P	1.30	TAA263	2.46	TDA1170S	3.00
MC1496L	1.15	TAA310A	2.68	TDA1190	3.50
ML231B	2.10	TAA550	0.50	TDA1200	2.98
ML232B	2.10	TAA570	1.99	TDA1270Q	3.70
ML237B	2.30	TAA611A12	3.50	TDA1327A	1.66
NE555	0.25	TAA611B12	2.85	TDA1352A/B	1.56
C-mos 555	0.88	TAA630S	3.90	TDA1412	1.20
NE556	0.80	TAA661B	1.70	TDA2002	2.80
SAA1024	5.35	TAA700	2.80	TDA2020	4.60
SAA1025	8.40	TAA840	3.38	TDA2030	2.78
SAS560A	2.50	TAD100	2.80	TDA2140	5.90
SAS560S	1.85	FM FILTER	1.20	TDA2521	4.10
SAS570S	1.85	TBA120A	1.00	TDA2523	3.50
SAS580	2.85	AS,S,SA,SB	1.30	TDA2530	2.70
SAS590	2.82	Q,T,U,UQ	1.32	TDA2540	3.80
SC9503P	1.10	TBA120B	1.30	TDA2541	3.80
SL432A	4.00	TBA231	1.45	TDA2560	3.50
SL901B	5.20	TBA281	2.65	TDA2571A	2.50
SL917B	6.25	TBA395	1.20	TDA2581	3.20
SL1327Q	1.10	TBA480Q	1.50	TDA2590	3.20
SN76003N	2.44	TBA400	2.30	TDA2591	2.98
SN76013N	1.90	TBA510	2.60	TDA2593	2.98
SN76023ND	2.90	TBA510Q	2.60	TDA2610	3.20
SN76033N	2.45	TBA520/Q	1.60	TDA2611A	1.94
SN76110N	1.12	TBA530/Q	1.30	TDA2640	2.90
SN76115N	2.00	TBA540/Q	1.40	TDA2680	3.40
SN76131N	1.65	TBA550/Q	1.52	TDA2690	3.50
SN76226DN	1.86	TBA560C	1.70	TDA3950/A/B	2.60
SN76227N	1.10	TBA560CQ	1.60	UPC554C	1.32
				UPC557H	0.90
				UPC566H	2.95
				UPC575C2	3.20
				UPC1018C	1.10
				UPC1025H	2.90
				UPC1032H	0.90
				UPC1156H	4.20
				UPC1158H	0.76
				UPC1163H	0.98
				UPC1181H	1.60
				UPC1185H2	3.75
				UPC1212C	1.30
				UPC1230H	3.90
				UPC1350C	4.25
				UPC1367C	3.40
				UPC1378H	4.40
				UPC2002H	2.00

VEROBOARD

0.1in Clad

2½ x 3¾	85p
2½ x 5	1.00
3¾ x 3¾	1.05
3½ x 17	3.25
3¾ x 17	4.10
4¾ x 17¾	4.95

0.1in PLAIN.

3¾ x 5	95p
3¾ x 17	2.70
DIP Board	3.85
Vero Strip	1.25

Pkt of 100 pins **50p**
Spot face cutter **1.48**
Pin insert tool **1.83**
Vero Wiring Pen - spool **4.50**

SERVICE AIDS

ALL SERVISOL PRODUCTS
Switch Cleaner **0.98**
Circuit Freezer **1.14**
Foam Cleanser **0.96**
Aero Klene **0.90**
Silicone Grease (Aerosol) **1.64**
Silicone Grease Tbe **1.60**
Antistat Spray **0.98**
Plastic Seal **1.08**
Excel Polish **0.92**
Fire Extin 640g **2.86**
Video Head Cleaner **0.86**
Super 40 Moisture Repellant & Lub **1.62**

SOLDA MOP

Std	0.72
L/Gauge	0.72
Indust	2.90

Additional P&P on above — 30p each

RESISTORS — CARBON FILM 5%

¼W 1R0 to 10M (E12 Range)	**2p each. 15p/10. 75p/100**
½W 2R2 to 10M (E24 Range)	**2p each. 15p/10. 75p/100**
1W 10R to 2M2 (E12 Range)	**7p each. 65p/10. 6.00/100**
2W 10R to 2M2 (E6 Range)	**8p each. 70p/10. 6.00/100**

RESISTOR KITS — each value individually packed

¼W pack 10 each value E12 — 10R to 1M 610 pieces	**5.00**
¼W pack 5 each value E12 — 10R to 1M 305 pieces	**3.00**
½W pack 10 each value E12 — 2R2 to 2M2 730 pieces	**6.00**
½W pack 5 each value E12 — 2R2 to 1M 365 pieces	**3.00**
1W pack 5 each value E12 — 2R2 to 1M 353 pieces	**15.00**
2W pack 5 each value E6 — 10R to 2M2 317 pieces	**18.00**

RESISTORS — WIREWOUND Generally 5%

2-5W 0·22 to 270R Available in preferred values	**0.20**
4W 1R0 to 10K Available in preferred values	**0.21**
7W 0.47R to 22K Available in preferred values	**0.25**
11W 1R0 to 22K Available in preferred values	**0.29**
17W 1R0 to 22K. Available in preferred values	**0.37**

FUSES

1¼in Quick Blow 100 150 **250mA £1.30** 1 1·25 1·5 2 2·5 3 10 15A **85p** 1 **1¼in Time Delay** 100mA **£3.50** 150mA **£2.25** 250 300 500 600 750 850mA **£1.84** 1 1·25 1·5 1·6 2A **£1.84** 2·5A 3 15 3·5A **£2.82 20mm Quick Blow** 100 125 160 200 250 315 400 500 600 800mA 1 1·25 1·5 2 2·5 3·5 4·5 6·3A **40p 20mm Time Delay** 100 125 150 200mA **£1.80** 250 300 400 500 600 800mA **£1.00** 1 1·25 1·5 2 2·5 3 3A **85p 1in Mains** 2 3·5 7 10 13A **85p**

Manufacturers please note - we can offer very competitive production quantities of 20mm Quick Blow & Time Delay range - apply for quotation

NI-CAD

Universal Ni-Cad charger, charges PP3, AA, C.D Price **£6.00**

RECHARGEABLE BATTERIES

AA HP7	0.85	10/**0.75 each.**
C HP11	1.75	10/**1.65 each.**
D HP2	2.05	10/**1.95 each.**
PP3	3.80	10/**3.70 each.**

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Single Junction Socket	0.60
Plastic Phono	0.10
F M Plugs	0.20
PL259	0.38
Reducer	0.15
2.5mm Plug Metal	0.15
2.5mm Plug Metal	0.16
2.5mm Chassis Socket	0.10
3.5mm Chassis Socket	0.10
2pin ¼in Mono Chassis Socket	0.14
4pin ¼in Mono Chassis Socket	0.20
6pin ¼in Mono Chassis Socket	0.30
4mm Banana Plug	0.15
4mm Banana Socket	0.15
PP3 Battery Connectors	0.08
PP9 Battery Connectors	0.16

Switches

20mm Panel Mounting	0.28
20mm Chassis Mounting	0.06
¼in Panel Mounting	0.35
¼in Chassis Mounting	0.342
Carling ¼in Mounting	0.10

Terminal Blocks

2 amp 12 way	0.19
5 amp 12 way	0.20
15amp 12 way	0.46
32amp 12 way	0.92

Soldering Section

XS25 Watt Iron Kit/complete with stand & plug attached **7.20**

CS 18 Watt as above	7.00
ANTEX 15W IRON	5.00
ANTEX 18W IRON	5.00
ANTEX 25W IRON	5.20
ANTEX ELEMENTS	2.00
ANTEX BITS	0.95
ANTEX STANDS	1.90
SOLDERSUCKER	4.50
500gm SOLDER	6.80
SOLDA MOP	0.70

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MIN 'D' CONNECTORS

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

4000	0.24	4076	0.68	4526	0.60
4001	0.24	4077	0.25	4527	0.65
4002	0.25	4078	0.25	4528	0.68
4007	0.25	4081	0.25	4531	1.30
4011	0.24	4082	0.25	4532	0.65
4012	0.24	4085	0.58	4536	2.65
4013	0.56	4086	0.58	4538	0.60
4014	0.60	4089	1.25	4539	0.90
4015	0.60	4093	0.37	4541	0.90
4016	0.40	4094	0.95	4543	1.25
4017	0.60	4095	0.95	4549	4.00
4018	0.60	4096	0.99	4553	2.45
4020	0.85	4097	2.65	4554	1.92
4021	0.58	4098	0.80	4555	0.35
4022	0.96	4099	1.05	4556	0.55
4023	0.35	4161	0.96		
4024	0.50	4162	0.96		
4025	0.24	4163	0.96		
4027	0.45	4174	0.96		
4028	0.45	4175	1.00		
4029	0.75	4194	0.99		
4030	0.35	4501	0.38		
4031	1.30	4502	0.38		
4033	1.25	4503	0.40		
4034	1.46	4507	0.48		
4035	0.70	4508	1.30		
4036A	2.75	4510	0.55		
4038	0.75	4511	0.55		
4039A	2.80	4512	0.55		
4040	0.80	4514	1.15		
4068	0.24	4515	1.15		
4069	0.24	4516	0.55		
4070	0.25	4517	2.70		
4071	0.24	4518	0.48		
4072	0.25	4020	0.53		
4073	0.25	4521	1.15		
4075	0.25	4522	1.25		

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Z80-AS10/2	8.99

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8	pin	0.08
14	pin	0.10
16	pin	0.11
18	pin	0.14
22	pin	0.21
24	pin	0.25
28	pin	0.30
40	pin	0.34

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200V	0.32
600V	0.50
3A 100V	0.52
600V	0.67
6A 100V	0.66
600V	0.80
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400V	2.50
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400V	3.20

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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.

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Bottom – The new Sovereign 3121 DMM from GSC (p5)

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Cover date June 1985 on sale Thursday, 9 May

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

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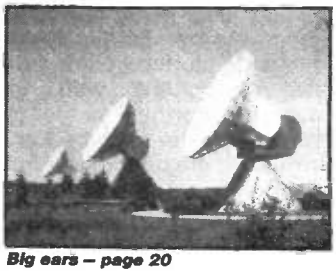

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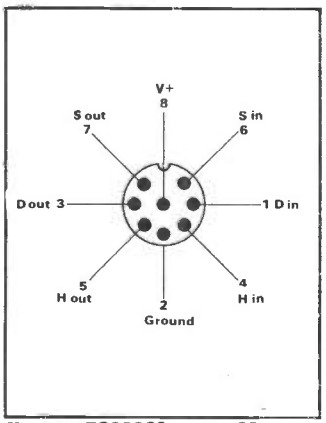

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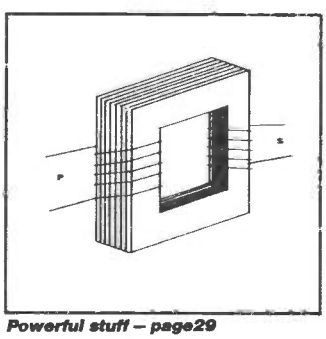


Powerful stuff – page29

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

DESOLDERING TOOLS

The Oryx range of soldering equipment, manufactured by Greenwood Electronics of Reading, has been updated by the re-design of four desoldering tools, together with the addition of a special anti-static version of the Oryx SR3A desoldering pump.

These re-designed tools, the SR series, remove all unwanted solder from printed circuit and other soldered joints and their unique design prevents molten solder from making contact with the actuator spring, a feature which provides for simple and virtually maintenance free operation.

The SR3A has been developed to cater for most electronics applications. It has a safety guard and action is triggered by simple push-button operation.

Nozzles are 16mm long and measure 2mm diameter at the tip and are supplied in packs of three.

A similar model, the SR3A/Micro, has a 21mm nozzle measuring 1.7mm diameter at the tip.

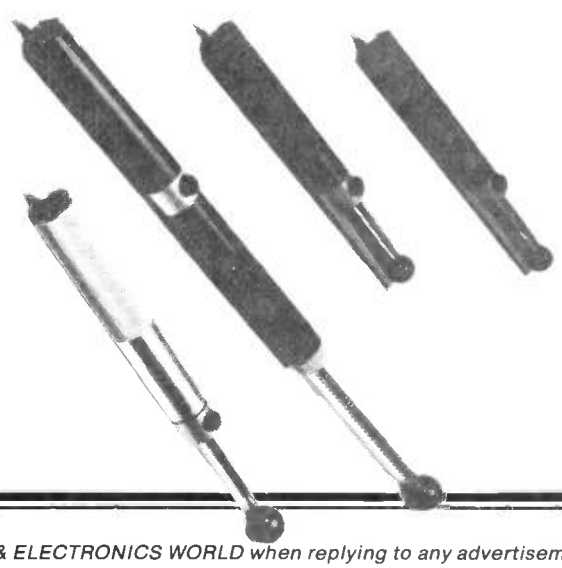
The SR3A/ASN, a new anti-static desolder pump which was designed specifically for British Telecom, is also available as a normal commercial unit.

It is similar to the SR3A but incorporates a special anti-static nozzle and carries BT approval.

The SR2 incorporates a non-recoil spring and double action chamber, which allows the plunger to remain stationary after push-button release.

The range is completed by the SR3A/S, on which the guard has been omitted because the piston throw is less than 50mm. This arrangement offers the advantage of easier spring loading and, because of the short piston throw, minimises the risk of injury to the operator.

Greenwood Electronics Ltd,
Portman Road,
Reading,
Berks RG3 1NE.
Tel: (0734) 595844.



GENLAB

As its name implies Genlab, from CIL Electronics Ltd, performs many day to day laboratory tasks. It basically consists of a 4 inch CRT which displays the menu of functions and instructions accordingly; therefore no handbook is required.

On the front panel are two voltage monitoring sockets for ac or dc measurement from 20mV to 20V, accuracy better than ±0.01% of span. These voltages are monitored by a very fast (50KHz, 16 bit) A/DC, therefore peak values, wave analysis and noise registration are instantly available by choice of menu. Other programs available include X-Y plotting and recording etc. One output is provided with a program for linearity checking waveform generation (square wave, sine wave, sawtooth etc).

One socket is provided for a strain gauge bridge where the bridge supply is controlled from menu by recording direct strain measurements.

An additional facility available is the measurement of inductance, capacitance and resistance. A powerful set of programs are provided for these measurements which include recording, matching and identification.

Genlab retails at £660. Options are 128K RAM card for transient analysis (£200); IEEE card facility (£100); 8K battery pack memory module for long term data logging, connected at the rear (£100); and a 12 channel thermocouple adaptor (£150).

CIL Microsystems Ltd,
Decoy Road,
Worthing,
Sussex BN14 8ND.
Tel: (0903) 210474.

FLAT COLOUR TV

Matsushita Electric Industrial Co Ltd of Osaka, Japan has developed a new colour flat panel for use as a display in new media equipment. The panel has been used by Matsushita to develop a prototype of a flat colour television, featuring a diagonal 10 inch screen and a depth of 9.9cm.

The new colour flat panel features a square, completely flat screen which reproduces distortion-free images throughout the entire display area. The manufacturers claim that these features

make the screen ideal for new media and office automation display applications, where space efficiency is crucial. New media consists of several new electronic services including teletext, videotex, direct broadcast satellite, high definition TV, and cable TV.

The new colour flat panel was developed using Matsushita's Matrix Drive and Deflection System. The panel's screen consists of 3,000 picture cells arranged in a matrix: 200 units horizontally and 15 vertically. Each picture cell is scanned by one electron beam which excites phosphor stripes.

The Matrix Drive and Deflection System produces a colour flat panel providing the flatness of LCD (liquid crystal displays) and EL (electroluminescence) displays, as well as the high colour reproduction, high resolution and brightness of existing colour picture tubes.

Matsushita's flat colour TV prototype provides a resolution of 270 TV lines, a contrast ratio of more than 50, and a brightness of over 70fL.

Matsushita Electric Industrial Co Ltd,
Kadoma,
Osaka 571,
Japan.

POWER SUPPLIES

A range of three power supply units in kit form is currently available from Electronic & Computer Workshop Ltd. Included in the range are the Velleman 1 amp power supply, a 5-14V dc/1 amp universal power supply and the Pantec stabilised power supply at 2-30V, and 20mA to 2.2A.

The Velleman 1A power supply will enable the user to make a top quality power supply for experimental purposes in the lab or workshop, or for built-in applications. With a voltage adjustable from 1.2V to 35V, the kit contains rectifier, smoothing capacitors and regulator, and is thermal protected. Further specifications include a typical line regulation of 0.01% and a typical load regulation of 0.1%, 100% electrical burn-in and −80dB ripple rejection.

In contrast the Velleman 5-14V dc/1 amp universal power supply serves as a supplementary or permanent power supply for all the Velleman kits needing a power supply of 5-14V dc and current consumption less than 1 amp, for example the digital panel meter. It can of course be used for other units, but the maximum specification must not be exceeded. Other specifications include an input voltage of 7-16V/1 amp, temperature stability at 0.025%/°C and thermal protection.

The Pantec stabilised power supply kit No.3, due to its exceptional features, can be considered a professional power supply. It can be used to feed transmitters, receivers, stereo units and car radios. The high degree of voltage and current stabilisation and regulation is ideal for laboratory applications.

This power supply measures 95 x 70 x 24mm, and features electronic protection against short circuits, output and constant current voltage, and voltage and current regulating potentiometers.

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

PRECISION MULTIMETERS

Now available from GSC is the Sovereign family of digital multimeters, all of which offer low cost true rms measurements for both ac voltage and current.

The model 3121 is a 3½-digit instrument which enables measurement of ac and dc voltages in five individual ranges from 0.2 to 1200V (750V at ac), with a 100μV maximum resolution in the 0.2V ranges. Inputs are protected from overvoltages up to ±1200V at dc and 750V rms at ac in all ranges. Other features include a 19999 counts capacity with indication of overrange given by a blinking display. Measurement values are given by a bright 7-segment light-emitting diode (LED), with the polarity automatically shown with the appropriate sign and the decimal point being set according to the selected range.

Models 4120 and 4121 are high performance, 4½-digit instruments both of which offer twenty-eight measurement ranges for dc voltage and current, ac voltage and current, and current resistance, together with a 19999 counts capacity. Voltage measurements can be made up to ±1200V and 750V rms with a maximum resolution of 10μV. The instruments feature a 7-segment LED display with an 11mm numeral height and, model dependent, a basic accuracy of ±0.02% or ±0.05% of reading.

GSC also offer the model 4030, a 4½-digit multimeter which features automatic or manual ranging, a 19999 counts capacity, and the ability to measure ac and dc voltages, ac and dc currents, and resistance. With a bright orange 11mm LED display, the model 4030 has a 1μV resolution, a basic accuracy of 0.02%, and an autozeroing circuit to prevent zero drift.

The multimeters are housed in rugged and attractive metal cases which protect the circuitry from mechanical damage and provide very good EMI shielding. They are all easily-portable.

A choice of options is available for all the multimeters including BCD parallel output, analogue output, isolated IEEE 488-1978 interface talker, battery operation, and model dependent, a self-calibration facility.

High voltage dc probes, rf detector probes, universal test lead kits and BNC adaptors are supplied as accessories.

The model 3121 retails for £295 + VAT and packing.

Global Specialties Corp,
Shire Hill Industrial Estate,
Saffron Walden,
Essex CB11 3AQ.

MULTI-FUNCTION METER

The MPM 70 from CIL Electronics Ltd is basically a low cost intelligent (Z80 microprocessor based) 4½-digit panel meter with RS232 computer link. The standard unit has two inputs with a range of ±20mV, ±200mV and ±2 volts with up to 64 different functions selectable with links located at the rear of the 45mm x 90mm x 75mm standard DIN case.

32 of the functions available include various combinations of offset zero with mathematical operations and RS232 computer or printer linkage. The other 32 functions are for various thermocouple types and temperature ranges for accurate linearisation.

Thermocouple conditioning is provided by connecting an isothermal adaptor at the rear of the case (MPM 72). Linearisation is automatic for the popular thermocouples through their useful working range.

Voltage supply is 9V dc only, accuracy ±0.01% of span with auto zero.

The unit is also available without the display (MPM 71), a useful very low cost (£50) voltage or temperature to RS232 converter for monitoring or data logging.

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

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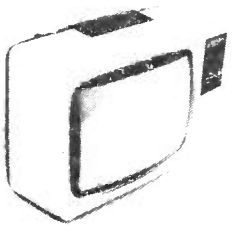

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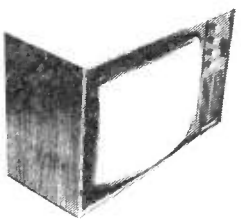

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PDP11/40 Cpu, 124k MMU	£1850.00
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RK05-J 2.5 Mb disk drives	£650.00
KL8JA PDP 8 async i/o	£175.00
MI8E PDP 8 Bootstrap option	£75.00
VT50 VDU and Keyboard – current loop	£175.00
VT52 VDU with RS232 interface	***£250.00***

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

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

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Made to the very highest spec the **TEC Starwriter FP1500-25** features a heavy duty die cast chassis and DIABLO type print mechanism giving superb registration and print quality. Micro-processor electronics offer full DIABLO/QUME command compatability and full control via CPM Wordstar etc. Many other features include bi directional printing, switchable 10 or 12 pitch, full width 381 mm paper handling with upto 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard RS232 serial interface with handshake. Supplied absolutly **BRAND NEW** with 90 day guarantee and **FREE** daisy wheel and dust cover. Order **NOW** or contact sales office for more information. Optional extras RS232 data cable **£10.00**. Tech manual **£7.50** Tractor feed **£140.00**. Spare daisy wheel **£3.00**. Carriage & Ins (UK Mainland) **£10.00**.

PROFESSIONAL KEYBOARD OFFER

An advantageous purchase of brand new surplus allows a great **QWERTY**, full travel, chassis keyboard offer at fractions of their original costs.

ALPHAMERIC 7204/60 full **ASCII** 60 key, upper, lower + control key, parallel TTL output plus strobe. Dim 12" x 6" +5 & -12 DC. ***£39.50.***

DEC LA34 Uncoded keyboard with 67 quality, **GOLD**, normally open switches on standard X, Y matrix. Complete with 3 LED indicators & i/o cable – ideal micro conversions etc. pcb DIM 15" x 4.5" ***£24.95*** Carriage on keyboards £3.00.

66% DISCOUNT ELECTRONIC COMPONENTS EQUIPMENT

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

2.5kls £4.25 + pp £1.25 **5kls £5.90** + £1.80
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GE MODEL 30

A large purchase of these stand alone terminal units offers an EXTREMELY LOW PRICE for a professional printer for direct connection to your micro. The printer has a standard RS232 serial interface with switchable rates of 110, 200 and 300 baud. Upper and lower case characters are printed by a matrix head with character widths up to 132 columns. Unit accepts standard fan fold sprocket fed paper from 4" to 9.5". Many other features such as numeric keypad, electronic keyboard, auto motor on/off and FREE floor stand. Supplied in good S/H working condition – complete with manual ***ONLY £95.00*** ***CARRIAGE & INS. £10.00***

GE TERMIPRINTER

A massive purchase of these desk top printer -terminals enables us to offer you these quality 30 cps printers at a **SUPER LOW PRICE** against their original cost of over £1000. Unit comprises of full QWERTY, electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width – up to 13.5" 120 column paper, upper – lower case, standard RS232 serial interface, internal vertical and horizontal tab settings, standard ribbon adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working ***£130.00*** or untested ***£85.00***, optional floor stand £12.50 Carr & Ins £10.00

EXTEL PRINTERS

EX NEWS SERVICE compact, quality built 50 column matrix printer, type AE11. Unit operates on 5 BIT BAUDOT code from current loop, RS232 or TTL serial interfaces. May be connected direct to micro, or comms receiver via simple filter network to enable printing of most world wide NEWS, TELEX and RTTY services. Supplied in tested second hand condition with 50 and 75 baud xtals, data sheet and large paper roll. ***ONLY £49.95.***
Dimensions 15" D x 5" H x 10" W
CARR £6.00 Spare paper rolls **£4.50 each**

TELETYPE ASR33, I/O TERMINALS

FROM £195 + CAR + VAT

Fully fledged industry standard ASR33 data terminal. Many features including ASCII keyboard and printer for data I/O auto data detect circuitry. RS232 serial interface. 110 baud, 8 bit paper tape punch and reader for off line data preparation and ridiculously cheap and reliable data storage. Supplied in good condition and in working order
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D.C. POWER SUPPLY SPECIALS

Experimentors PSU Ex-GPO. All silicon electronics. Outputs give +5v @ 2 amps +12v @ 800 ma -12v @ 800 ma +24v @ 350 ma and 5v floating @ 50 ma. Dim 160 x 120 x 350 mm. All outputs are fully regulated and short circuit proof. Supplied in NEW or little used condition. Complete with circuit.
Only £15.50 +2 £2.50 pp

FARNELL 5 Volt 40 amps. Type number **G6-40A.** This miniature switching PSU measures only 160mm wide 175mm deep and 90mm high, yet delivers a massive 40 amps!! Fully regulated and smoothed with over voltage protection etc. 120 or 240 volts AC input. Supplied **BRAND NEW** and boxed with circuit at a fraction of the current list price. **Only £130.00 + £3.00** carr & ins.

LAMBDA LMCC 5V BRAND NEW 240v AC input with 5 volts DC at 8 to 10 amps fully regulated output. Completely enclosed unit measures only 9" x 4" x 5" **£29.99**

LAMDA LMCC5V 110v AC input with 5 volts DC at 8 to 10 amps fully regulated output. Slightly smoke damaged, hence **ONLY £10.95**

PERIPHERAL SYSTEM SUPPLY. Runs almost any system. Fully cased unit supplied in a brand new or little used condition. Outputs give 5v @ 11 amps "+" 15-17v @ 8 amps "–" 15-17v @ 8 amps and "+" 24v @ 4 amps. All outputs are crowbar protected and the 5 volt output is fully regulated. Fan cooled. Supplied tested with circuit. **£55.00 + £8.50** carr.

1000's of other POWER SUPPLIES EX STOCK – CALL SALES OFFICE FOR DETAILS

DUAL DISK DRIVE/ WINCHESTER CASES

Very smart, fully enclosed case unit custom made to accept two full height 5¼" floppy disk drives or two 5¼" winchesters such as the RHODIME RO200 or TANDEM series etc. An internal switched mode PSU supplies all the required voltages to enable you to plug in your drives and go!!

Other features include mains filter, internal cables with standard drive connectors, space for internal PCB, standard fan cut out and mounting, air filter. Overall dimensions 28 cm W x 30 cm D x 19 cm H
ONLY £55.00 + £6.00 CARR.

SEMICONDUCTOR 'GRAB BAGS'

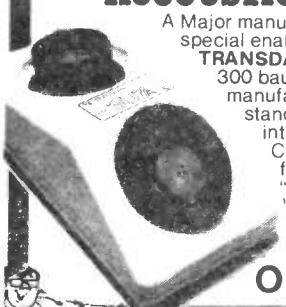
Mixed Semis amazing value contents include transistors, digital, linear, I.C's triacs, diodes, bridge recs., etc. etc. All devices guaranteed brand new full spec. with manufacturer's markings, fully guaranteed.
50+ ***£2.95*** 100+ ***£5.15.***

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

NORTH STAR HORIZON

Pro S100 system with dual 5" floppy drives, software, manuals etc.
£850.00 Call sales office for details

ULTRA COMPACT 300 BAUD ACCOUSTIC MODEM — COUPLER

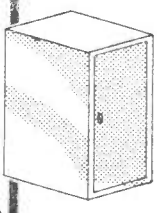


A Major manufacturer's over production and a bulk buy special enables us to offer this **BRAND NEW TRANSDATA 307A** ultra compact, **BT APPROVED**, 300 baud full duplex accoustic modem at a fraction of manufacturer's list price. The unit operates on the standard **CCITT V21** frequencies with **RS232** interface via 25 way 'D' skt.

Combine the adjustable cup system, which fits almost any phone with the benefit of "No jacks or phone cables" and a light weight of only 1.2 Kg and you have a truly portable modem!! Supplied complete with data, 90 day guarantee and ready to use.

ONLY £49.95 + £3.00 pp

PROFESSIONAL 6 FOOT 19" RACK CABINETS



LARGE 19" equipment cabinet. Totally enclosed with locking front and rear doors. An internal sub fram 63" high is pre drilled for standard 19" equipment etc. Other features include internal 12" cooling fan, two-tone blue and grey finish with alloy trims. Mounted on 4 heavy duty castors, mains panel etc. And at a current cost from **IMHOFS** of over **£500** A snip at **ONLY £125**. Supplied in **NEW** or little used condition. Carriage £22.00. Ext. Dim 72.5"h x 23.5"w x 26"d

LOGICAL KEYBOARD

Heavy duty unit in attractive satin alloy case. 55 full travel keys are laid out in a logical format of:

Making a very useful keyboard, ideal for persons unfamiliar with or confused by the standard **QWERTY** layout. All keys generate the equivalent **ASCII** outputs and various control codes shown in data. A 7 bit latched parallel **TTL** output with strobe enables direct connection to any similar micro port etc. Many other features such as internal 240v to 5v PSU, MAINS ON/OFF switch. **Supplied in NEW** or little used condition with data.
ONLY £25.95 Post and packing £4.50

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

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

PRODUCT NEWS

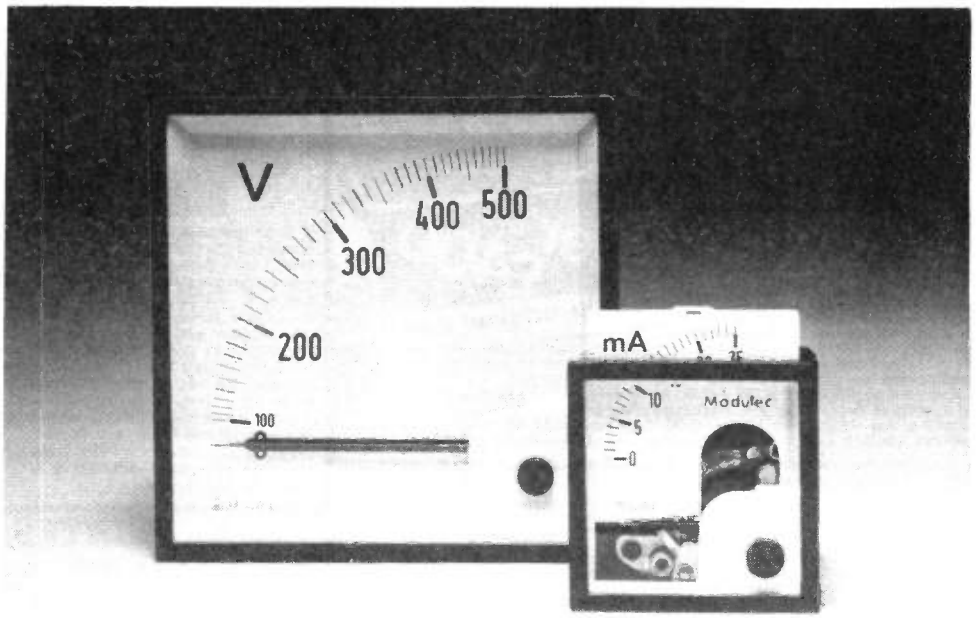
MODUTEC METERS

Modutec claim that competitively priced meters designed to meet European DIN specifications can now be delivered within 48 hours. Two ranges are offered – moving coil meters which are suitable for all dc applications and linear readings of ac through a rectifier circuit, and moving iron meters which have been designed to measure true rms values of ac currents and voltages. Both types are ideally suited to rugged environments.

Available in a choice of four square case sizes (48mm, 72mm, 96mm and 144mm), the meters present a range of electrical measurements from basic ampere and voltage inputs.

A feature is the removable sliding dial facility which, with its dust-proof seal, provides rapid and simple dial changing. With a choice of 90° or 240° presentations, the meters are particularly suitable for use in switchboard, control panel and desk-mounting applications.

Modutec,
Thorn EMI Electronics Ltd,
120 Blyth Road,
Hayes,
Middlesex UB3 1DL.
Tel: (01) 573 3888.



LOGIC ANALYSIS

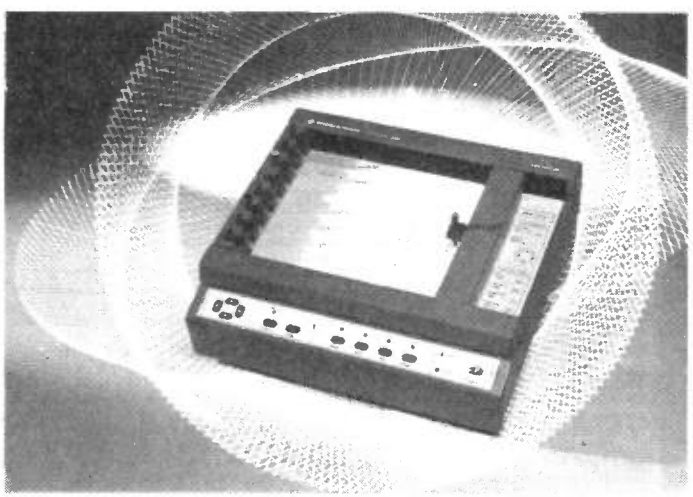
For measurements on circuits in which digital and analogue signals occur at the same time, Rohde & Schwarz have developed the analogue recorder option LAS-B9 for use with the Logic Analysis System LAS. Up to now, this task has required a logic analyser for monitoring the digital lines and a storage oscilloscope for observing the analogue signals. However, mutual triggering has proved cumbersome and possible only to a certain extent.

The LAS fitted with the analogue recorder solves the problem in a simple way: the logic analyser section is used to collect the digital signals and the analogue recorder section to handle the analogue signals. Mutual triggering of the analogue recorder and the logic analyser is possible so that recording of analogue signals as a function of digital events is easier than with two separate units.

The LAS-B9, which is especially well suited for process control and for measurements on signal processors, is fitted with two input channels, each featuring a memory depth of 4096 words with a resolution of 8 bits. A sampling rate of up to 20MHz is programmable.

Also from Rohde & Schwarz is a new eight-pen plotter, the Plotter DOP – an intelligent data terminal which has recently been included in the company's measuring-instrument product line. It produces high-quality documents of measurement results, graphs and charts of commercial data and precise engineering drawings in up to eight programmable colours on DIN-A4 drawing media or overhead-projector transparancies. When driven by a controller (eg PCA 5 or PUC from R&S) via the IEC-625-1 (IEEE-488) interface, the DOP can be used in automatic test assemblies such as those found in all branches of industry, research and development.

With a plotting speed of 45cm/S or three characters per second with alphanumeric text, R&S claim that



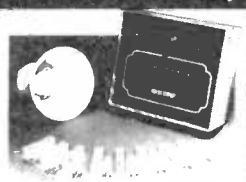
the DOP is one of the fastest instruments in its class and can not only be operated as a plotter or monitor but also as an automatic or interactive digitiser. There are 18 different character sets available including calligraphic fonts, and with macrocommands for vectors, circles, segments, axes, bars and batching the DOP is extremely easy to program.

Six types of lines (full through to dotted), five different marker symbols and the eight programmable colours provide a large number of ways of presenting and distinguishing hardcopy. User's co-ordinates, programmable scaling factors for the X and Y axes and a definable clipping area are additional capabilities which simplify the programming and application of the DOP. The 1-Kbyte input buffer allows the DOP to respond quickly to a request for graphical evaluation from the controller; the latter can then immediately begin to process the next series of measurements.

Rohde & Schwarz
GmbH & Co,
Pressestelle,
Mühldorfstr 15,
Postfach 80 14 69,
D-8000 München 80,
West Germany.

Intruder Alarms and Accessories

A COMPLETE SECURITY SYSTEM FOR ONLY £39.95 + V.A.T.



contains:

Control Unit	CA 1250
Enclosure & mechanical fixings	HW 1250
Key Switch & 2 keys	KS 3901
L.E.D's	LED 1
5½" Horn Speaker	HS 588
4 high quality surface mounting Magnetic Switches	MS 1025

With only a few hours of your time it is possible to assemble and install an effective security system to protect your family and property, at the amazingly low cost of £39.95 + V.A.T. No compromises have been made and no corners have been cut. The outstanding value results from volume production and direct supply. Assembly is straightforward with the detailed instructions provided. When installed you can enjoy the peace of mind that results from a secure home. Should you wish to increase the level of security, the system may be extended at any time with additional magnetic switches, pressure pads or ultrasonic sensors. Don't wait until it's too late – order today.
Order Code: CS 1370.

EXTENDED SYSTEM CS 1480 Price £62.50 + V.A.T.

This system contains, in addition to the CS 1370, an ultrasonic detector type US 5063 + its enclosure, an additional horn speaker and a further 2 magnetic switches. This system represents outstanding value for money for the high level of security provided.
Order Code: CS 1480.

SELF-CONTAINED ULTRASONIC ALARM UNIT CK 5063 only £37.00 + V.A.T.

Requires no installation. Easily assembled using our professionally built and tested modules.

- Adjustable range up to 25ft
- Built-in entrance and exit delay
- Built-in timed alarm
- Key operated switch – Off, Test and Operate
- Provision for an extension speaker
- Fully self-contained
- Uses US 5063, PSL 1865 Key Switch 3901 3" Speaker 3515

Now you can assemble a really effective intruder alarm at this low price using tried and tested Riscomp modules. Supplied with full instructions, the kit contains everything necessary to provide an effective warning system for your house or flat. With a built in LED indicator and test position the unit is easily set up requiring no installation. It may simply be placed on a cupboard or desk. Movement within its range will then cause the built-in siren to produce a penetrating 90dbs of sound or even 110dbs with an additional speaker. All parts included and supplied with full instructions for ease of assembly. Size 200 x 180 x 70mm. Order as CK 5063.

ALARM CONTROL UNIT CA 1250

Price £19.95+V.A.T.

The heart of any alarm system is the control unit. The CA 1250 offers every possible feature that is likely to be required when constructing a system whether a highly sophisticated installation or simply controlling a single magnetic switch on the front door.

- Built-in electronic siren drives 2 loud speakers
- Provides exit and entrance delays together with fixed alarm time
- Battery back up with trickle charge facility
- Operates with magnetic switches, pressure pads, ultrasonic or I.R. units
- Anti-tamper and panic facility
- Stabilised output voltage
- 2 operating modes full alarm/anti tamper and panic facility
- Screw connections for ease of installation
- Separate relay contacts for external loads
- Test loop facility

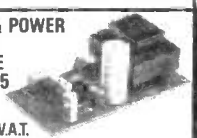
HARDWARE KIT HW 1250

only £9.50 + V.A.T.

This attractive case is designed to house the control unit CA 1250, together with the appropriate LED indicators and key switch. Supplied with the necessary mounting pillars and punched front panel, the unit is given a professional appearance by an adhesive silk screened label. Size 200 x 180 x 700m

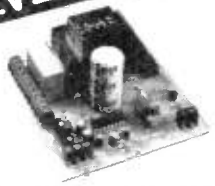
SIREN & POWER SUPPLY MODULE PSL 1865

only £9.95 + V.A.T.



A complete siren and power supply module which is capable of providing sound levels of 110dbs at 2 metres when used with a horn speaker. In addition, the unit provides a stabilised 12V output up to 100mA. A switching relay is also included so that the unit may be used in conjunction with the US 5063 to form a complete alarm.

NEW



TIMER SWITCH & POWER SUPPLY MODULE DP 3570 Price £13.95 + V.A.T.

The DP 3570 consists of an adjustable timer switch and stabilised 12V power supply for use in a wide range of applications including security, lighting control and automatic switching.
The timer section of the module provides switching of loads up to 3A for pre-set times, the duration of which may be set by the user to between 10 secs and 5 mins. The timed period may be triggered by the opening of a loop or the closing of external contacts, with the timed period commencing instantaneously or delayed to provide a form of entrance delay.
The power supply section of the module provides a 12V output of up to 250mA which is sufficient for most applications. The module operates from either 240V a/c supply or a 12V battery for which trickle charge facilities are included. Connections to the module are by means of screw terminal connectors with no soldering needed.

For mounting the unit an attractive moulded enclosure is available.

ME 357 only £2.85 + V.A.T.

INFRA-RED SYSTEM IR 1470 only £25.61+V.A.T.

Consisting of separate transmitter and receiver both of which are housed in attractive moulded cases, the system provides an invisible modulated beam over distances of up to 50ft operating a relay when the beam is broken. Intended for use in security systems, but also ideal for photographic and measurement applications. Size 80 x 50 x 35mm

DIGITAL ULTRASONIC DETECTOR US 5063

only £13.95 + V.A.T.

- 3 levels of discrimination against false alarms
- Crystal control for greater stability
- Adjustable range up to 25ft
- Built-in delays
- 12V operation

This advanced module uses digital signal processing to provide the highest level of sensitivity whilst discriminating against potential false alarm conditions.

ULTRASONIC MODULE ENCLOSURE

only £2.95 + V.A.T.

Suitable metal enclosure for housing an individual ultrasonic module type US 5063 or US 4012. Supplied with the necessary mounting pillars and screws etc. For US 5063 order SC 5063, for US 4012 order SC 4012.

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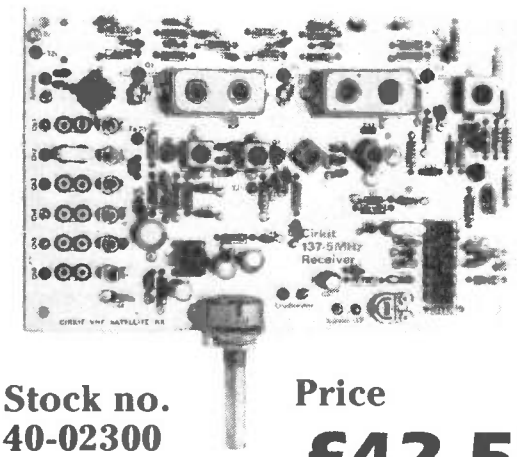
VHF Weather Satellite Receiver



We are proud to announce the introduction of the new Cirkit VHF Satellite Receiver.

This reciver has been designed to receive the data transmissions from NOAA series (and other) weather satellites. These satellites are constantly orbiting the earth and as they pass overhead we are able to receive 'local' pictures live. These show cloud cover, wind direction and pressure zones and are now seen regularly as part of the television weather forecast.
The Cirkit receiver has been designed specifically to receive these transmissions (not modified from a 2m receiver) and offers the following features:

NEW

- ★ High Sensitivity
- ★ Large Image rejection
- ★ Crystal Controlled
- ★ 6 Channel
- ★ PLL Detector
- ★ On Board Audio Amp

Stock no. 40-02300

Price £42.52 + VAT + 60p p&p

The Cirkit Kit

The receiver is built on a double-sided PCB (134 x 87mm) to give stable and repeatable results, all RF coils are pre-wound and full construction and alignment details are supplied with the kit. A complete kit of parts is supplied which includes the following: Double sided fibre glass PCB; All resistors, capacitors, semiconductors and filters; All coils, all TOKO pre-wound types; Pot, switch and sockets; Loudspeaker; Xtal for 137.5MHz; Construction and alignment details.

Cirkit Distribution

Park Lane, Broxbourne, Herts
Tel: (0992) 444111

Please send SAE for full details

PRODUCT NEWS

HIGH SPEED MODEMS

Motorola Information Systems Ltd (formerly Codex UK), have announced the 2605 series of modems, the result of the largest single development effort ever undertaken by Motorola's data communications division. The design and development teams from Motorola claim to have created a network system product line capable of performing much more than just data transmission.

The 2605 series uses the 68000 microprocessor to drive the signal processor, control system activity and provide an array of features, plus a VLSI signal processing chip set, developed by Motorola to implement algorithms for better modem performance.

Another major feature is the use of 8-state trellis coded modulation (TCM), which Motorola consider a far superior technique to the uncoded modulation in general use today.

Motorola say that the key to the high speed data performance of the 2665 model is the use of this 8-state TCM, which employs an error protection scheme, transmitting and interweaving (or trellising) five bits to every four of the original data stream. These added bits allow the receiver to choose those bits which most accurately represent the data transmitted.

There are three models in the series, the 2625, 2645 and 2665.

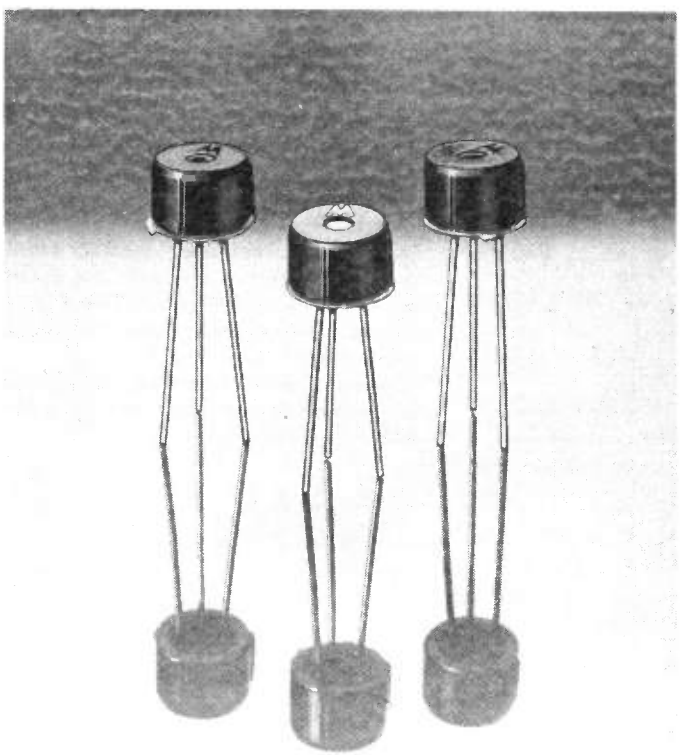
Motorola Information Systems Ltd,
Chervil House,
28 Stafford Road,
Wallington,
Surrey SM6 9AL.
Tel: (01) 669 4343.

FIBRE OPTICS

Motorola is now offering two gallium aluminium arsenide (GaAlAs) LEDs, MFOE3200 and MFOE3201, and a PIN diode detector, MFOD3100, in a new plastic capped, metal header fibre optics package.

These new devices are designed for glass cable, non-hermetic applications under 1Km at less than half the price of metal can devices with comparable performance.

The MFOE3200 emitter offers a minimum of 10μW launched power at a forward current of 50mA, while the MFOE3201 launches a minimum of 20μW at the same forward current level. Both of these 805nm LEDs have a guaranteed minimum analogue bandwidth of 60MHz (a higher bandwidth than any emitter in its price range). The spectral output is matched to the first window, minimum-attenuation region of most glass fibre optic cables.



The MFOD3100 PIN photodiode detector has a fast response time of 5.0nS maximum at 5.0V and an analogue bandwidth greater than 100MHz.

Known as the MOD-line, for moderate performance over moderate distance at a moderate price, the devices are designed for applications which require reasonably high power and fast response time.

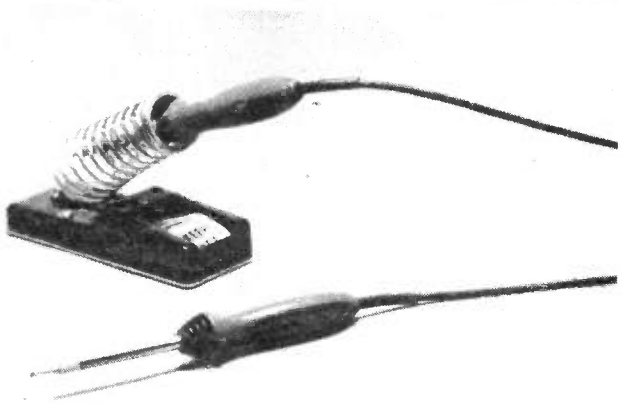
The low cost, rugged, plastic capped package fits in standard active device receptacles without the alignment fittings needed with standard metal can devices.

Uses include 5MHz video, CATV, telephone, office automation, computer to work station, video security, and many other high speed analogue and digital data transmission systems. Additionally, they help resolve radiation problems encountered under the new FCC regulations.

Motorola Semiconductor Products Inc,
PO Box 20912,
Phoenix,
Arizona 85036,
USA.

ORYX IRON

Compact and easy to handle, the Oryx 50 lightweight soldering iron from Greenwood Electronics has a control which allows accurate adjustment of the tip temperature between 200°C and 400°C. The desired temperature is selected by adjustment of an Allen screw in the handle; it is reached within 45 seconds from cold. The temperature is thereafter maintained within ±2%.



The Oryx 50's rapid heating and accurate heat control characteristics are made possible by the use of a 50 watt element and a built-in thermostat. An indicator lamp in the handle aids the temperature setting and provides a visual warning when the iron is switched on.

The Oryx 50 is fitted with a long-life screw-on iron coated tip which is chrome plated for easy initial tinning. A comprehensive range of replacement tips is available and since all the bits are iron coated it is never necessary to file them – they merely need to be wiped clean with a damp cloth or sponge.

An optional bench-top safety stand designed to support and protect the iron when not in use is available and this includes a small sponge for bit cleaning.

Greenwood Electronics Ltd,
Portman Road,
Reading,
Berks RG3 1NE.
Tel: (0734) 595844.

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40-WAY SOCKET **£2.00**

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R53 THERMISTOR **£2.00**

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PRODUCT NEWS

UNIX-based PC

Now available from Rapid Recall is the world's first transportable, fully integrated UNIX-based personal computer, which has multi-tasking/multi-window capabilities and combines processor, printer and disc drive in one 11.2kg (25lb) package.

Produced by Hewlett-Packard and known as the Integral PC, this machine is the first to provide the performance benefits of a ROM-based UNIX operating system in a unit which contains a Motorola 68000 16/32 bit 8MHz processor, an HP Thinkjet 150cps printer, and a 3.5 inch double-sided double-density disc drive of 710K byte formatted capacity.

Also built into the 41 x 33 x 20cm unit is a 23cm (9 inch) electro-luminescent amber display, an HP-IB interface, two HP-HIL front mounted ports for the keyboard and optional mouse device and two expansion ports for extra memory, optional interfaces or a 300/1200 baud modem. A detached 90-key standard Qwerty keyboard, with merged numeric pad, is supplied with the package.

For software development two languages are available: HP-UX 'C' and HP-UX Technical BASIC. The second of these provides all of the maths, HP-GL graphics and I/O commands that reside in HP Series 80 BASIC and its ROM enhancements such as the printer/plotter ROM and mass storage ROM. Under HP-UX Technical BASIC, I/O drivers for HP-IB, RS232, GPIO, BCD and HP-IL are provided to control both Hewlett-Packard's and other manufacturers' devices.

Included in the Integral PC package is the HP-UX operating system, tutorial, diagnostics and utilities discs and a comprehensive instruction manual. The machine operates from universal ac power supplies.

Rapid Recall Limited,
Rapid House, Denmark St,
High Wycombe,
Bucks HP11 2ER.
Tel: (0494) 26271.

NEW RECEIVER

South Midlands Communications are now selling the Yaesu FRG9600 communications receiver, which provides features never offered before, covering 60 through 905MHz continuously with 100 keypad-programmable memory channels.

In addition to FM wide (for FM and TV broadcasts), FM narrow (for two-way police, military, business and amateur communications) and AM wide and narrow (for aeronautical and amateur communications), the FRG9600 also provides SSB (single sideband) reception up to 460MHz, allowing monitoring of amateur and military CW and SSB, and the new ACSB mode now used by the military and experimentally as the mode of the future for VHF. A front panel tuning knob is provided to simplify tuning of SSB and narrowband AM. Seven tuning/scanning rates between 100Hz and 100KHz assure fast and efficient scanning while still permitting easy tuning of narrowband signals.

The scanning system allows either full or limited (keypad programmed) band scanning as well as memory channel scanning, with auto-resume. In addition to carrier sensing scan stop, audio scan stop sensing is also selectable to avoid stopping on inactive 'carrier-only' channels. Scanning steps are selectable, with the wide steps indicated on the front panel display.

Signal strength is indicated by a two-colour graphic S-meter on the display. A 24-hour clock/timer is included, along with a recorder output, for automatic power on/off switching and recording. Additional jacks provide CPU band selection outputs, multiplexed (FM wide) output, AF and RF mute and other control signals for maximum expansion potential with future options or for those who wish to provide their own add-on hardware for special applications.

The Yaesu CAT system provides a direct control link to the CPU in the FRG9600, allowing operators with personal computers to add virtually unlimited customised control functions in software such as multiple organised memory banks, automatic tuning and customised scanning systems, using almost any personal computer and a Yaesu FIF CAT interface unit.

The FRG9600 requires 12V dc, which may be provided using the optional PA-4B/C ac adapter from the ac line.

An optional video IF unit is available for reception of TV pictures (NTSC format) on a video monitor.

South Midlands
Communications Ltd,
SM House,
Rumbridge St,
Totton,
Southampton SO4 4DP.

FET OP-AMP

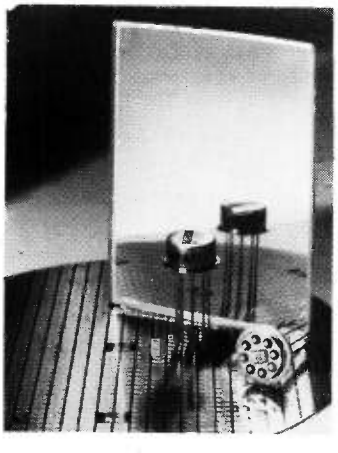
A new precision dual monolithic dielectrically-isolated FET (DiFET) operational amplifier has been announced by Burr-Brown.

Known as the OPA2111, and combining two OPA111 DiFET amplifiers on a single chip, this low-cost space-saving device can be used for a wide variety of applications including precision instrumentation, medical equipment, opto-electronic detector arrays, test equipment, data acquisition and professional audio equipment.

The OPA2111 features low noise of 8nV/√Hz at 10KHz, a bias current of 4pA and a voltage drift of 2.8μV/°C (all maximum values). The noise performance is 100% tested and guaranteed at 10Hz, 100Hz, 1KHz and 10KHz. Other characteristics of the device include a maximum 500μV offset voltage, a minimum 114dB open-loop gain and a 96dB minimum for both common mode rejection and power supply rejection.

Three versions of the op-amp are available: OPA2111AM and OPA2111BM are both specified over the −25°C to 85°C industrial temperature range, while the OPA2111SM is specified over the −25°C to 125°C full MIL temperature range. All versions are supplied hermetically sealed in a metal TO-99 package with industry-standard dual op-amp pinout.

Burr-Brown International
Limited,
Cassiobury House,
11-19 Station Road,
Watford,
Herts WD1 1EA.
Tel: (0923) 33837.



ELEVATOR SOCKETS

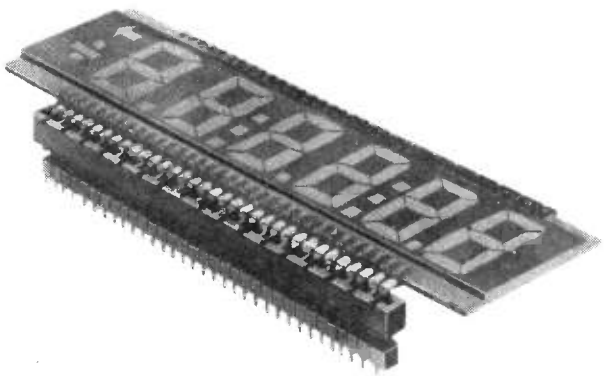
A new series of single row elevator sockets designed to raise the height of PCB mounted display modules has just been introduced by Aries Electronics.

These useful new sockets can raise the height of non-standard or high pin-count displays from 0.350 to 1.250 inches above a PCB without the need for any further hardware.

Single rows of 2 to 34 positions can be held firmly to the desired centre spacing, using spacer bars prior to wave, dip or hand soldering. After soldering, spacer bars may be removed and reused.

The socket body is glass filled thermoplastic, and bifurcated contacts are tin-plated beryllium copper.

Aries Electronics (Europe),
Alfred House,
127 Oatlands Drive,
Weybridge,
Surrey KT13 9LB.
Tel: (0932) 57377.



ADD-IN MEMORY BOARDS

National Semiconductor has quadrupled the RAM capacity on two of its DEC-compatible memory card products by upgrading from 64K dynamic NMOS RAMs to 256K NMOS DRAMs.

The change in capacity will enable one product, the NS23S RAM memory card, to support DEC systems such as the microVAX, PDP 11/73 and micro PDP-11 systems. The upgrade expands board capacity from 512K x 18 (1 megabyte) to 2,408K x 18 (4 megabytes).

The other upgraded board is the NS23C, which is expanded from 128K x 18 (256K) capacity to 512K x 18 (1 megabyte).

The NS23S features block mode transfers, 22-bit addressing capability, on-board parity generation and checking, battery back-up, and also contains an on-board status register to indicate the occurrence and location of parity errors. I/O page size is selectable (2, 4 or 8 Kbytes), and the starting address can be assigned anywhere within the 4 megabyte address range.

The NS23C was first introduced in 1983 as the industry's first dual-wide, Q-BUS card with a control status register (CSR) capable of block mode transfers. It is fully compatible with DEC's LSI-11 minicomputers, including the LSI-11/23 Plus and the Micro/PDP-11. The board supports LSI hardware and software, as well as LSI system and standard peripheral options.

National Semiconductor's memory systems group offers a broad line of DEC-compatible memory boards for use in PDP, LSI and VAX computer systems. All boards manufactured by National are fully tested at the factory, including an extensive burn-in at elevated temperatures, with voltages margined dynamically.

National Semiconductor (UK) Ltd,
301 Harpur Centre,
Horne Lane,
Bedford.
Tel: Bedford (0234) 47147.

CUSTOMISED DISASSEMBLY

A custom microcracker disassembler package has been added to the range of dedicated disassembly options available for the PM3551A logic analyser system from Philips Test and Measuring.

The PM8850/60 disa-C custom package enables the user to define his own disassembly mnemonics and can hold up to four user-defined disassemblers, all accessible through the analyser's option menu using freely chosen symbolic names.

Applications for this new option include proprietary CPUs such as military chips, other CPUs not covered by existing disassemblers, bit-slice implementations, IEEE 488 (IEC 625) and RS232C bus systems, and intelligent peripherals.

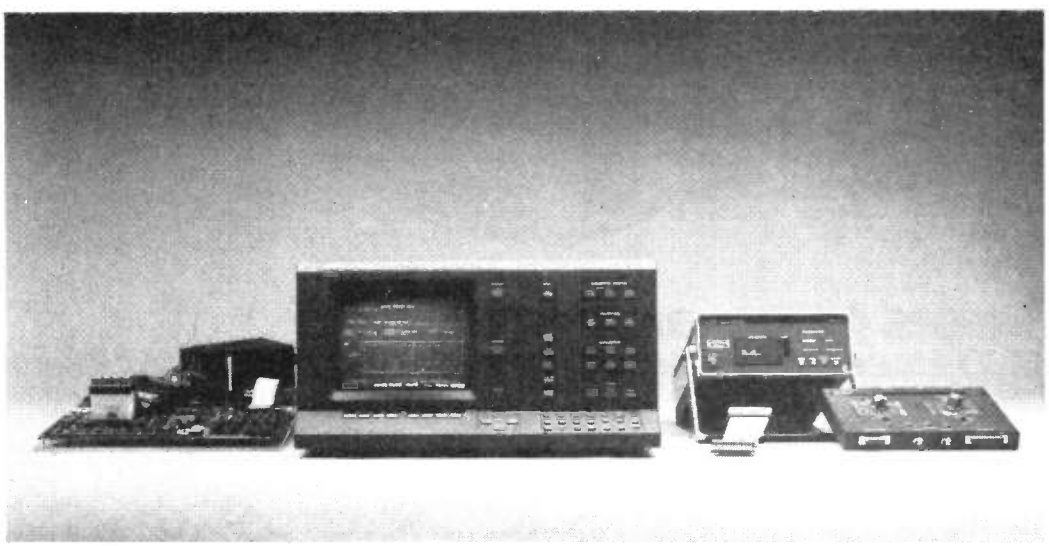
All software required to carry out disassembly from the state analyser is incorporated in the package. The user has only to enter application-specific data, ie the bit patterns to be decoded and their corresponding mnemonics. The analyser is set up automatically by the option when any required disassembler is selected.

The Philips PM3551A logic analyser family provides a fully modular range of both state and timing analysers with particularly versatile operation and ease of use. Basic units have three clocks and can for instance be supplied with either 35 state-only or eight 50MHz and four 300MHz timing channels. The four 300MHz timing channels can be formatted alternatively as eight 50MHz inputs.

Units can be expanded to incorporate both state and timing channels with a maximum of 59 state channels plus 16 timing channels. A wide range of other options is available, including interfaces for both IEEE 488 (IEC 625) and RS232C and disassembly packages for most popular eight and sixteen-bit microprocessors.

The custom microcracker disassembler package is priced at £525 excluding VAT.

Philips Test and Measuring,
Pye Unicam Ltd,
York Street,
Cambridge CB1 2PX.
Tel: (0223) 358866.



ICOM AT 1

Come and hear the Icom range on stand A68-70 at the RSGB National Amateur Radio Exhibition

This year at the NEC, Thanet Electronics will only have demonstration facilities on their main stand, but the range and scope of these will enable you to appreciate fully the superb specifications and quality of all ICOM Amateur Radio Equipment.

You will be able to try out receivers and transceivers as base stations, mobiles and hand-portables in all the popular frequency ranges.

Buying ICOM equipment at the NEC. will not be a problem as it will be readily available at any of the authorised ICOM dealers exhibiting at the show.

A new exciting set will be seen at this years show. it is the ICOM IC-3200E FM Dual-band transceiver (144-430/440 MHz). This is the smallest transceiver available.

The IC-3200E employs a function key for low-priority operations to simplify the front panel. LCD display is easy to read in bright places, showing frequency, VFO A/B, memory channel duplex mode and S/RF meter information.

New! IC-3200E

Other features include a 10 channel memory able to store operating frequencies, Simplex or Duplex. A memory lock-out function allows the memory scan to skip programmed channels when not required. The IC-3200E has a built-in duplexer and can operate on one antenna for both VHF and UHF. Options include: IC-PS45 DC. power supply, HS-15 mobile mic, SM6 and SM8 desk mics, SP-10 external speaker and UT-23 speech synthesizer.

A great future is predicted for the IC-3200E against its rivals, due to the reasonable price of this model. For more details come and see us on stand A68-70. BCNU.

IC-290D/290E

290D is the state of the art 2 meter mobile, it has 5 memories and VFO's to store your favourite repeaters and a priority channel to check your most important frequency automatically. Programmable offsets are included for odd repeater splits. tuning is 5KHz or 1KHz.

The squelch on SSB silently scans for signals, while 2 VFO's with equalising capability mark your signal frequency with the touch of a button. Other features include: RIT, 1 KHz or 100Hz tuning/CW sidetone, AGC slow or fast in SSB and CW, Noise blanker to suppress pulse type noises on SSB/CW.

You can scan the whole band between VFO's/scan memories and VFO's. Adjustable scan rate 144 to 146 MHz, remote tuning with optional IC-HM1 microphone. Digital frequency display, Hi/Low power switch. Optional Nicad battery system allows retention of memory.

Soon to be announced!

IC-735 New Compact HF and R7000 VHF/UHF Receiver.

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

THE N.E.C.

IC-505, 50MHz A New Dimension for the U.K.

At last, permits are now available in the U.K. for the 50MHz (FM) band. If you wish to use this less crowded amateur frequency the IC-505 SSB CW portable transceiver has already gained an excellent reputation world-wide.

The IC-505 features microprocessor frequency control, dual VFO's and 6-channel memories with memory scan. LCD ensures clear visibility even in sunlight. The 505 accepts a standard dry-cell pack, rechargeable nicad battery pack (BP10) or 13.8V external power supply.

Standard accessory circuits such as split switch, noise blanker, squelch and CW break-in are incorporated in the 505.

Other accessories available include the EX-248 FM unit, BC-15 charger unit and the LC-10 carrying case.

All these features make the IC-505 a great transceiver that will enable you to operate on the 50MHz band, after all the rest of the world does!

Special Offer! Tono Linear Amplifiers

2M – 100W, £79.00.
MR – 150W, £139.00.
Also available, new G-series with GaAs FET pre-amp.
2M – 130G, £159.00.
2M – 90G, £149.00.
2M – 40G, £ 89.00.
4M – 70G, £179.00.
all inc. VAT.

Carriage charge is free for Cue Dee and Tono special offers.

Authorised Icom dealers in the UK

Alexian Electronics Ltd. Edinburgh, 031-554 2591.
Alyntronics, Newcastle. 0632-761002.
Amateur Radio Exchange, London (Ealing), 01-992 5765.
Amcomm, London (S. Harrow), 01-422 9585.
Arrow Electronics Ltd., Chelmsford Essex, 0245-381673/26.
Beamrite, Cardiff, 0222-486884.
Booth Holding (Bath) Ltd., Bristol, 02217-2402.
Bredhurst Electronics Ltd., W. Sussex. 0444-400786.
Dressler (UK) Ltd., London (S. Harrow), 01-558 0854.
D.W. Electronics, Widnes Cheshire. 051-420 2559.
Hobbytronics, Knutsford Cheshire. 0565-4040.
Photo Acoustics Ltd., Buckinghamshire. 0908-610625.
Radcomm Electronics, Co. Cork. Ireland. 01035321-632725.
Radio Shack Ltd., London NW6. 01-624 7174.
Scotcomms, Edinburgh, 031-657 2430.
Tyrone Amateur Electronics, Co. Tyrone, N. Ireland. 0662-2043.
Reg Ward & Co. Ltd., S.W. England. 0297-34918.
Waters & Stanton Electronics, Hockley Essex, 0702-206835.

Listed here are 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.

Cue Dee Antennas Special Offer!

CUE DEE antennas are designed to last for decades – the best possible aluminium alloy for this purpose is used (SIS 4212-06).

The booms are made of 28mm tubing with 1.5mm wall, with colour marks clearly indicating where to fit the elements. By using tubular boom, and a synthetic guy wire on the long yagis, the windload is reduced by a factor 0.66 compared to using square shaped material for boom and guying.

The driver element is made of 12mm tubing and features a PTFE (Teflon) insulated gamma match which is pre-tuned at the factory and made for 50 ohm feeder with a PL 259 type connector. No further adjustments or power consuming balun needed. This matching system ensures a clean radiation pattern and transfers the power without losses.

The parasitic elements are made of 6mm solid rod and mounted to the boom with the aid of a CUE DEE element washer, boom to element part and a screw. This, together with our intelligible assembly manual, makes an extremely easy and solid assembly which assures the long life of a CUE DEE antenna.

2 metre Yagis.
4144A – 4 element, 8dBd gain £19.00.
10144 – 10 element, 11.4dBd gain £37.00.
15144 – 15 element, 14dBd gain £49.00.
Order now while stocks last.

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NEWS DESK

Patently obvious

Codex Corporation and Racal-Milgo have announced the settlement of almost a decade of patent-related litigation in the US and England. The settlement includes worldwide cross-licence of each other's patents for modems and multiplexers, termination of all litigation, and payment of 8.3 million US dollars by Racal to Codex.

The litigation began in January 1976 with two suits by Milgo, one against a Codex modem customer for infringement of Milgo patents and one against Codex to invalidate Codex's basic patent on the modulation method used in international standard (CCITT V.29) 9600 bits per second modems.

The Milgo patents were subsequently ruled to be invalid and legal costs (ultimately determined to be 740,000 US dollars, including interest) were awarded to Codex. The Codex patent was upheld in England and Racal-Milgo was ordered to pay over profits made on infringing modems. The settlement concludes these and a number of related actions.

Codex is a wholly-owned subsidiary of Motorola Inc and a member of Motorola's Information Systems Group. Racal Milgo is a wholly-owned subsidiary of the British company Racal Electronics plc. The two companies are the leading suppliers of high-speed modems and data communications equipment throughout the world.

Containerised TV station

Incomtel have developed a powerful dual 10KW TV transmitter station complex which, being totally self-sufficient within multiple 20 foot long steel containers, can begin broadcasting within days of arriving on site anywhere from a remote jungle clearing to an isolated desert range.

This new TV station package, which will be manufactured and fully commissioned ready for immediate service before being shipped, is already attracting worldwide interest and looks set to be as successful as the rugged mobile 'go anywhere' radio station launched by Incomtel for export markets in 1984.

This first containerised TV station is very powerful with a 10KW transmission potential, but smaller or larger configurations can be tailored by Incomtel engineers to precisely meet customer specifications. A 1KW TV station in just one container could, for example, serve a town the size of Reading in Berkshire.

According to Incomtel there is no faster way to introduce a TV service to a region, and the savings for the customer will be in both time and money, since no permanent buildings will be needed and relocation is fast and simple. Other customers, with established TV networks, have also shown interest in a containerised station to back their permanent installation, ensuring broadcasting continuity around the clock in the event of an emergency or breakdown.

The only civil engineering works required are mast foundations and concrete bases for the main containers and the diesel generating set.

Full information is available from: *Incomtel, 225 Goldhawk Road, London W12.*

British Electronics Week

By 1988, the British Electronics Week, which is to be held from 30 April – 2 May at Olympia, will be the biggest electronics event in Europe.

This is the confident prediction of organiser Evan Steadman, who is planning to expand the event to fill both Earls Court and Olympia by adding new specialised exhibitions as well as increasing international participation.

The show has overtaken the Paris components show in terms of numbers of exhibitors, and by 1988 should have overtaken the German Electronica event as well.

Evidence of the increased international participation is provided by the first inward mission, which is being sponsored by the Westminster Chamber of Commerce and will take place during the 1985 event. Over the next three years, many more inward missions will follow to both the British Electronics Week and other high-technology events organised by the Evan Steadman Communications Group, and it is anticipated that these will result in multi-national participation in the form of group stands representing different countries.

The 1985 British Electronics Week, comprising the All-Electronics/ECIF Show, Fibre Optics and Electronic Product Design, has already received stand bookings from 811 companies, which makes it one-third larger than the Paris Salon des Composants Electroniques and more than twice the size of the 1984 Internepcon Show. The last Electronica show boasted 1197 individual stand holders.

For more information contact: *Evan Steadman Communications Group, The Hub, Emson Close, Saffron Walden, Essex CB10 1HL.*

All-Electronics/ECIF Show

House of Instruments, the specialised electronic test and measurement company recently acquired by Advance Power Supplies, is exhibiting several new product ranges at the 1985 All-Electronics/ECIF Show, from 30 April-2 May at Olympia, London.

New products include oscilloscopes from Trio and Intron, power supplies from Trio, logic analysers and multimeters from Soar, specialised TV test equipment from Sadelta, and line conditioners from Advance.

New Trio products on show include the CS1021, a 20MHz 2 channel general purpose oscilloscope offering a very competitive price/performance specification, and the

CS2150, a 4 channel, 8-trace dual-sweep instrument with a 150MHz bandwidth.

Also on show is the new Intron DMS522 dual-channel digital storage oscilloscope, offering separate 2MHz 9-bit analogue/digital converters on each channel so that frequencies of up to 400KHz can be accurately depicted.

The Soar family of compact logic analysers, designed for handheld or benchtop use, will be displayed, along with the Sadelta PAL/RGB42 colour pattern generator, which uses digital-storage techniques to provide test patterns to aid in the production, installation and servicing of colour, monochrome and stereo TV sets, video and RGB monitors and video recorders.

Being featured for the first time as part of the HI display is the Advance Adline series of ac line conditioners, which combine electronic tap-switching techniques with super-isolation transformers to protect computers and other digital electronic equipment from the effects of mains variations and spikes.

Morse code training unit

Orders worth over £340,000 for the Racal Morse Code Training Unit have been received from the UK Ministry of Defence, the Caribbean, the Middle East, Africa and the Far East, according to Racal-SES Limited.

The MA2238, launched only a year ago, is an advanced Morse code training aid providing great flexibility to both instructor and student. It will be used to teach and examine prospective Morse operators.

The microprocessor-based trainer produces very accurately timed Morse encoded signals at between one and 60 words per minute. Precise control of transmission speed allows it to be used by up to 24 students who can be tested to exacting standards.

Text is entered by the instructor into a character memory from the unit's Qwerty keyboard, with full text editing facilities. The memory may also be loaded with random characters generated internally, its contents being stored or loaded from either a standard audio cassette tape recorder or via a V24 telegraph interface. Hard copy of the full memory contents or the last exercise sent as Morse code can be printed for marking and debriefing.

Realistic operating conditions are created by introducing, through a multiport mixer, externally produced interference signals in the form of off-air radio noise or simulated jamming signals, using equipment such as the Racal Jamcat.

The Racal Morse Code Training Unit has the facility to merge up to three characters together by removing inter-character spaces. This allows additional characters, eg barred letters, end of message formats, and characters from foreign languages to be generated.

Racal-SES Ltd can be contacted at: *Bath Road, Burnham, Slough, Berks SL1 6BJ.*

Vodafones

Swan National Leasing, one of Britain's largest contract car hire companies, is the first to provide Vodafone cellular telephones within its leasing packages.

Swan National Leasing, which has more than 7,000 business cars on fleet, has joined forces with Racal-Vodafone to offer monthly rental of a Vodafone to all its customers.

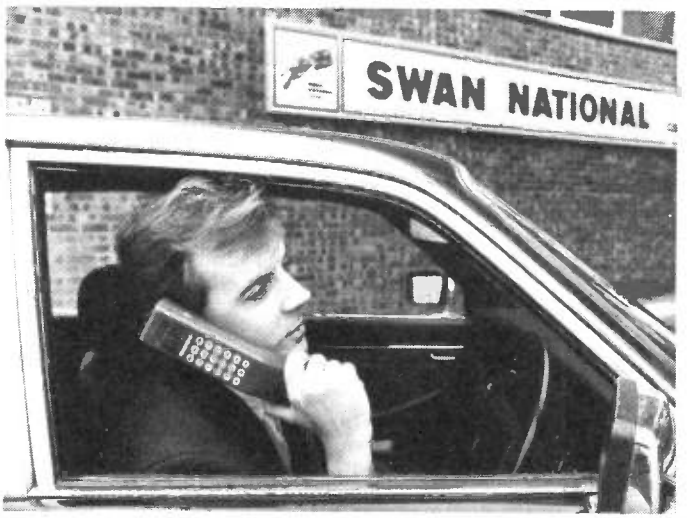
The cost of a Vodafone, including installation, connection, service and insurance, is included within the monthly car contract rental and the price is adjusted in relation to the type of package and the length of contract. The customer is invoiced separately by Racal for the calls made on the Vodafone.

Vodafone cellular telephones are already in use by thousands of businessmen who are now never out of contact.

A Vodafone in a car provides national and international phone calls when driving around and will shortly provide reliable data transfer while on the move.

The Vodafone network should cover 80% of the population by mid 1986.

For further information contact: *Racal Vodafone Ltd, The Courtyard, London Road, Newbury, Berks RG13 1JL.*



PCB design system

Visula, a new printed circuit board computer-aided design system developed for the electronics industry, has been announced by Racal-Redac.

Ian Orrock, managing director of Racal-Redac, believes that as this new state-of-the-art product is able to cope with all the latest PCB technologies it will create tremendous interest in the industry, spur further growth for the company and secure their market leadership.

Visula involved over 175 man-years of effort and will enable customers to design electronic products hitherto thought impossible. It is claimed to be the most powerful system of its kind yet developed for the industry, and together with modern components will allow printed circuit boards to be developed that are down to one-fifth of the size of an existing IC board.

The Visula software is an integral part of Racal-Redac's CIEE (computer integrated electronic engineering) environment, which provides electronic companies with a complete range of products for all aspects of electronic design.

Initial shipments of the Visula system are scheduled from March 1985.

Power 85

The Power Supply Manufacturers Association (PSMA) is sponsoring a new exhibition and conference called 'Power 85', which is to be held at the Metropole Hotel, Brighton, from 21 to 23 May 1985.

The new exhibition will provide the engineer with an opportunity to see power supplies and alternative power sources – such as batteries and solar cells – from all the major manufacturers under one roof.

The conference programme has been designed to be of value to the power supply user and will include papers on power supply applications, latest developments in the technology and a glimpse at the future.

The PSMA is of the opinion that there is a real need for such an exhibition since power supply coverage at other exhibitions is extremely fragmented, even though every item of electronic equipment ever produced requires some form of power supply.

Power 85 will provide a unique opportunity to discuss specific requirements with all of the power supply manufacturers and examine all of the competing products.

The exhibition organisers, TCM Expositions Ltd, report that stand space is selling quickly and expect the entire event will comprise around 140 stands in total.

For further information contact: *M A Poftawka, PSMA, 7-8 Saville Row, London W1X 1AF. Tel: (01) 437 4127.*

OUT NOW!

CIRKIT'S SPRING CATALOGUE

Packed with over 4,000 different components plus associated new products for the electronics hobbyist, and sporting a lively new format, Cirkit's spring components catalogue is to be published on 11th April. It will be available from leading newsagents throughout the country at the cover price of £1.15.

Products introduced for the first time in the catalogue include the BBC Model B micro computer as well as a range of computer add-ons such as disc drives, expansion boards, speech synthesizers, disc interfaces and the new widely acclaimed AMX Mouse, which performs such useful functions as computer aided design and word processing with fingertip control.

Additional product introductions are calculators from Texas Instruments, Cooper Tools' Weller W12D soldering iron, plus new tools, kits and modules. Among the innovative new kits is a heart rate monitor, which will enable hobbyists to test their own fitness. The assembled unit provides audio/visual and analogue output which facilitates connection to a chart recorder, oscilloscope or personal computer.

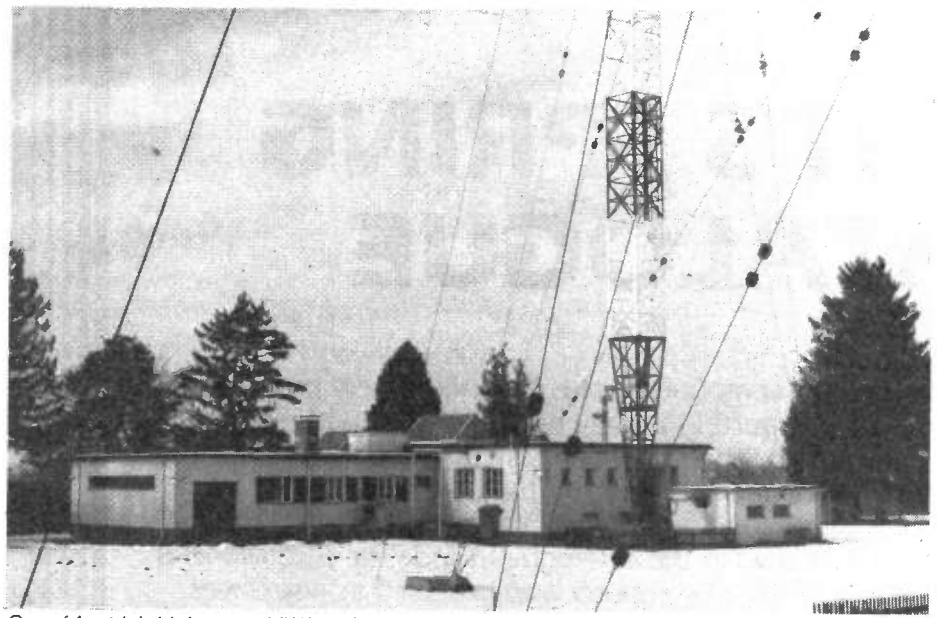
Also new from Cirkit is a weather satellite receiver kit, which will allow hobbyists to follow weather patterns such as cloud cover and wind direction. The assembled kit will receive 137 MHz satellite transmission and display them on a home computer by linking up with a simple aerial, interface and the use of appropriate software.

Cirkit Distribution

Park Lane Broxbourne Herts EN10 7NQ. Tel: (0992) 444111
200 North Service Road, Brentwood, Essex. Tel: (0277) 211490
53 Burrfields, Portsmouth, Hants. Tel: (0705) 669021

SPECTRUM WATCH

NIGEL CAWTHORNE G3TXF



One of Austria's high power MW installations, at Lauterach. Two 25KW transmitters feed a 2-elememt directional array on 1026KHz

The medium wave broadcast band is used in different ways by different countries. Some countries have cut back their national services on the medium wave in favour of greater use of VHF FM for domestic services.

As examples, both Sweden and Austria have several allocations in the medium wave band, but neither country is using its allocations to the full. Over recent years they have both reduced the number of their medium wave outlets.

A new high-powered 600KW MW transmitter has just been brought into service on 1179KHz at Soelvesborg on Sweden's one remaining active MW outlet. The antenna system at the new transmitter site consists of two 135 metre towers. The installation is capable of being extended to 1,200KW in the future.

Daytime coverage with the new 600KW transmitter is expected to be some 15 million people, whereas in the hours of darkness Radio Sweden is expecting the new transmitter to cover up to 165 million people. During the daytime the transmitter will carry Sweden's national programme, but in the evenings it will be transmitting the international service. This transmitter should be clearly audible in the UK.

The new station at Soelvesborg will be Sweden's only active MW allocation. Various groups and organisations in Sweden are requesting that the unused MW allocations be made available to broadcasters other than the state radio. The decline in usage of the medium wave has been caused by the ever increasing density of coverage obtained on the VHF FM domestic networks.

VOA upgrades

Any casual search across the short wave bands is likely to lead to an encounter with both of the two giants of these bands: Radio Moscow and the Voice of America. The Voice of America, as one of the world's most prolific SW broadcasters, is currently working on a billion dollar programme to upgrade and extend its international broadcast facilities.

As well as using five main transmitter sites located in the US, the VOA also uses a number of relay stations around the world. In order to obtain round-the-clock coverage of particular target areas on the short wave broadcasting bands, it is of great benefit to have a strategically placed network of relay stations that can transmit the programmes over a relatively short distance into the target area, rather than having to rely on long-distance propagation.

The VOA is planning on upgrading and in some cases rebuilding its overseas relay station network. Many of the existing VOA transmitters have been in service for at least twenty years, and some transmitters are pre-war.

One of the VOA's many relay stations is located at a beach-side location just outside Tangiers in northern Morocco. From this superb location, the VOA is able to transmit directly into Europe, Africa and the Middle East. The VOA is reported to be spending $200 million on upgrading its Tangiers facilities. The new high-powered broadcast transmitters that will be installed will also be made available for use with the Moroccan external broadcasting service.

As a first stage in this massive re-equipment programme, the VOA have recently purchased 500KW SW transmitters from a number of manufacturers. Marconi is to supply the VOA with one of their 500KW B.6127 short wave broadcast transmitters for use at the VOA's main east coast transmitter station at Greenville, North Carolina.

Pre-set

The transmitter being supplied by Marconi covers the range 3.95 to 26.1MHz. The technique used with high power broadcast transmitters for changing frequency is to have a number of pre-set frequencies, and the Marconi B.6127 can have up to 128 pre-set frequencies programmed into the memory. The transmitter is claimed to be able to tune from any one pre-set frequency to any other in less than 30 seconds. Within the same band, the time to change frequency is usually less than 10 seconds.

This might seem a long time when compared to modern broadband HF transceivers as used by amateurs, but it should be remembered that when dealing with RF power levels that are measured in fractions of megawatts, component sizes all become large. The output of the transmitter might typically be fed into co-ax up to 6 or 8 inches in diameter.

The PA used in the Marconi 500KW transmitter is a Thomson tetrode. The driver amplifier uses a water-cooled 4CW25000A, which is a tube with a dissipation of up to 25KW. And that's just the driver!

The total VOA requirement might be for up to a hundred 500KW SW transmitters. This project is certainly the largest single purchase of high power SW transmitters that is likely to take place over the next decade.

UK frequency allocation

The DTI has just announced that the Frequency Allocation Table for the UK will be published later this year. Frequency allocation information in the UK has always been a part of the cloak and dagger industry. The publication of the Frequency Allocation Table will hopefully lead to more reasoned and

informed argument by those who are interested in the well-being of that important natural resource, the radio frequency spectrum.

Spectrum pricing study

Spectrum Watch last month mentioned the concept of a radio spectrum usage charge based on the bandwidth used. A point made was that in terms of bandwidth available, the amateur radio licence seemed to be good value for money.

The DTI has now commissioned a study into the whole question of 'radio spectrum pricing'. A firm of management consultants has been invited by the DTI to undertake the first part of a feasibility study on the pricing of the radio spectrum.

Mr Pattie, Minister of State for Industry and Information Technology, is quoted as saying that 'there are two main areas we want investigated in the feasibility study. The first is whether there are any benefits to be had from bringing market forces and the price mechanism to the area of spectrum management. The second is whether this is technically and administratively feasible within a regulatory framework'.

The first part of the study will take about six months to complete and will evaluate current and future usage of the fixed service. The 'fixed service' is defined as both point-to-point and point-to-multipoint radio links, mostly in the UHF and microwave frequency bands, which may be operated by either private or common carrier operators.

The second part will study all other areas of spectrum usage, including private mobile radio, broadcasting, amateur and CB radio, emergency services and other specialised needs. It is expected that the full study should be completed by autumn 1986.

Six metre group

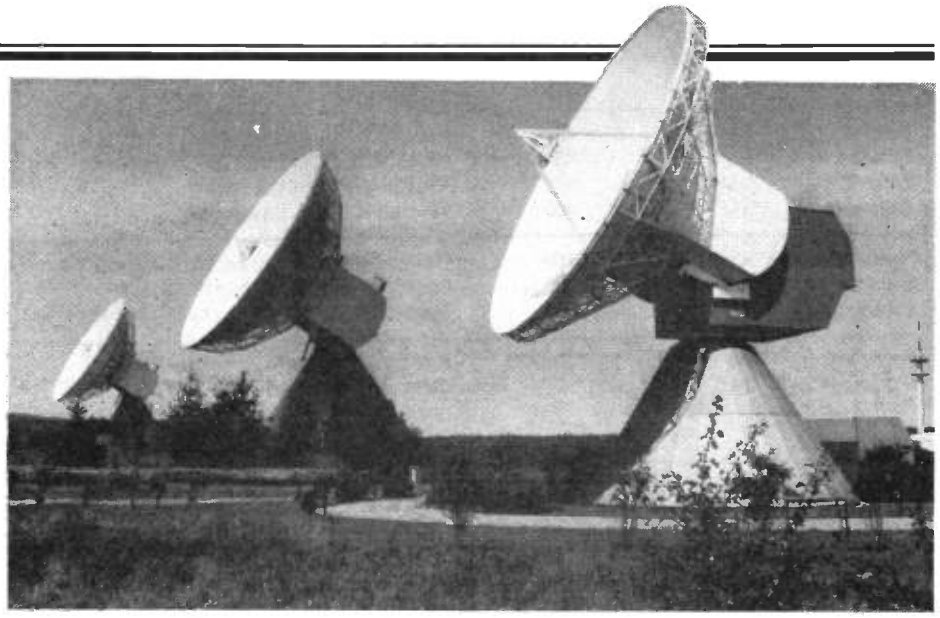
The close-down of the VHF Band I and III 405-line TV transmitters in the UK has led to the liberation of a large amount of spectrum which for many years has been the exclusive domain of the television broadcasters. Although land mobile radio services are getting the lion's share of Band III, it appears that amateurs are likely to get a permanent six metre allocation within what was VHF television Band I.

A UK Six Metre Group was formed in 1982 by G4JCC for amateurs sharing a common interest in the 50MHz band. The aims of the group are defined as:

1) To try and obtain a general allocation for all UK amateurs on 50-54MHz.

2) To exchange information with other members on propagation, news, technical notes, etc, relating to 50MHz.

3) To encourage interest in the 50MHz band in other amateurs both in the UK and in Region 1.



The Usingen satellite receiving station will provide the up-link for TV-SAT

The AGM of the Six Metre Group is held at the RSGB's VHF Convention at Sandown Park. If you are interested in becoming a member and furthering the cause of a six metre amateur allocation in the UK, contact either *Peter Turner G4IIL, Flat 6, 132 Marine Parade, Brighton, Sussex* or *Alan Wright GW3LDH, 6 Cwm Eithin, Wrexham, Clwyd, Wales.*

European DBS

The countdown to European DBS services has started. As part of collaborative agreement, the French and Germans are working together to build a pair of similar direct broadcast satellites. The German satellite, called TV-SAT, is expected to be launched early in 1986. The French sister satellite, TDF-1, is expected to be launched by Ariane in July 1986.

Co-operation between France and Germany in the field of satellites dates back to the Symphonie communications test satellite project which started in 1968. It was in 1980 that France and Germany signed a protocol which laid the foundations of today's Franco-German DBS project.

In accordance with the WARC plan, each satellite will use up to five channels. Although the satellite transponders have been designed to carry five programme channels each, transmissions are expected to consist of two or three TV channels per satellite as well as a group of 16 digitalised stereo programmes which will use the equivalent of one TV transponder.

Transmissions from the ground station up to the satellites will be in the range 17.3 – 18.1GHz, and down-link channels will be in the range 11.7–12.1GHz. As well as allocating channels, the WARC also attributed maximum power levels to each user. For direct broadcasting from satellites the output power from the final amplifier is in the order of a few hundred watts, whereas on communications satellites which have been used for transmitting signals to cable head-ends the power levels are measured in tens of watts.

In the same way that early communications satellites were described as 'test' satellites, TDF-1 and TV-SAT are being described as 'pre-operational'. There will not be any stand-by satellite as there often is in the case of fully operational satellites. Operational satellites would also have a higher degree of redundancy built-in than is the case with TDF-1 and TV-SAT. There will however be one or possibly two unused transmission channels which will form part of the redundancy of Europe's first DBS satellites.

Operating DBS will not be cheap. In a recent report prepared by the BBC the operational costs of the UK's own DBS project were described as being likely to be £1,000 million over ten years.

Cellular across Europe

If you are looking for a prime example of European non co-operation and disunity, you need look no further than cellular radio. Europe is now a patchwork of dissimilar and non-compatible systems. The only major part of Europe that has got its act together in cellular radio is Scandinavia. The four Scandinavian countries have a common cellular radio system that works equally well in Sweden, Denmark, Norway and Finland. The number of users on the Scandinavian NMT cellular radio network at the beginning of 1985 was 136,000. However, once you step outside Scandinavia 'cross-border incompatibility' is the name of the game. The UK and Eire both use TACS on 900MHz, which is not in use anywhere else in Europe.

Even those bastions of European co-operation, France and Germany, are currently installing totally incompatible mobile car telephone networks,

Country	System	Frequency/MHz	Remarks
UK	TACS	900	Derivative of the US AMPS system. On-air in London area in January 1985.
Eire	TACS	900	Likely to be compatible with UK.
Norway Sweden Finland Denmark	NMT NMT NMT NMT	450 450 450 450	Pan-Scandinavian network. In operation since 1982. At end of 1984 there were 136,000 users on the network. A 900MHz version is being developed.
Netherlands Belgium Luxembourg	NMT NMT NMT	450 450 450	Compatible network within the Benelux countries, but not compatible with Scandinavian or Austria NMT 450 networks.
France	Radiocom 2000	200/420	National system, incompatible with any other system. Not truly cellular because of the absence of a 'hands-off' facility. Being installed in 1985.
Austria	NMT	450	National system, not compatible with other NMT 450MHz systems. Put into service in late 1984.
Spain	NMT	450	Local networks in Madrid and Barcelona only.
Germany	Netz-C	450	National system being installed in 1985. Similar network is being supplied to South Africa.

although to be fair both France and Germany are working hard on a future generation of cellular radio networks which may well be digital and which should be compatible all across Europe.

Such a pan-European mobile radio telephone network is unlikely to become reality before the middle of the 1990s.

The Netherlands, Belgium and Luxembourg have just gone for a version of NMT that will not be compatible with either the NMT system in Scandinavia nor with the newly installed NMT 450MHz system in Austria!

In fact European compatibility is sliding backwards with cellular radio rather than going forwards. Prior to the installation of the new systems in the Netherlands, West Germany and Austria, there was a network called Netz-B in operation which was compatible between those countries. A car radio-telephone user could have access to the network from the same vehicle whether he was in Austria, Germany or the Netherlands. The current generation of mobile radio-telephone networks in these countries with their much higher capacities will not be compatible across borders.

The next generation of radio-telephone networks is certainly the last chance for Europeans to get their act together on cellular radio. However, when the time comes for decision making national interests may well dominate again, with the result that the part of the 'European dream' which includes compatible mobile radio-telephone equipment working all the way from northern Norway to southern Spain may never become reality.

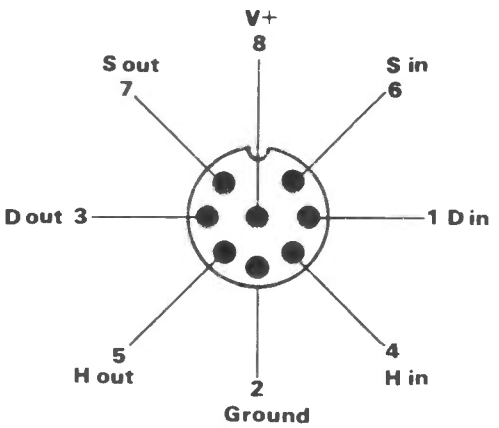
AN RS232C REPLACEMENT

New BSI interfacing proposals introduced and explained by RJ Redding

Earlier articles in *Radio and Electronics World* in June and October 1984 referred to the confusions and difficulties of the serial interface known as 'RS232C'. It is very pleasing to report that salvation may be at hand in a proposed new serial interface based on 5 volt operation and using an 8-pin plug. What is significant is that this proposal is being sponsored by a government department – the Central Computer and Telecommunications Agency (CCTA) – via their Public Services Working Party, to which a number of large agencies of national importance subscribe.

The matter seems to have come to a head with the CCTA's involvement with the proposed UK 'Kneetop' computer, because the normal RS232C and parallel type connectors would not fit. As many people have found, these old conventions and so-called 'industry standards' are unrealistic for portable and solid-state equipment. The result is that the CCTA has put forward a proposal not only to update and rationalise the RS232C, but also describing how it may be extended to cover parallel operation, as used for printers and often referred to as 'Centronics'.

9600 baud
1 Start bit
8 Data bits
1 Stop bit



5 volt operation

It is based on 5 volt operation, and leads eventually to a three-wire link between intelligent devices by the use of software control of the data. The document, entitled *Proposed Serial Interface Standard (S5/8),* is a very comprehensive abridged technical specification.

The September 1984 draft runs to 13 pages and will delight anyone who has struggled in practice with these interfacing problems. It says why 25-way 'D' type connectors are unsuitable and recommends the use of 3, 5 and 8 way DIN plugs, all of which fit into one 8-pin circular DIN connector, 45326, whose proposed pin connections are shown in the diagram. The complications of 'receive' and 'transmit' are avoided by using the terms of 'In' and 'Out'.

For the present we may need to know the status of some apparatus and that some of the applications will require a handshake. The pins are therefore also referred to as input and output, with the letters D, H and S referring to the logical descriptions, data, handshake and status.

The 8th pin in the centre is designated V+, and provides a supply so that various equipment can become 'self powered' or line powered instead of requiring a separate power connection, while the outer ring can be used as a ground for screens or a chassis earth if required.

The choice of the DIN plug is a good one, and has merits over telephone types. Not only is the DIN plug available worldwide, it is consumer orientated and the price is a fraction of conventional terminations. Further, a large number of standard cables are currently available; for example, the audio 'mirror' cable is directly applicable, representing a 'null modem' in which the handshakes and the data connections are interchanged on the signal lines. Alternative cross wiring and buffering is described in detail.

The bi-directional 24V dc of the original serial interface has long been regarded as obsolescent, but the various implementations as in 12 and 5 volt versions by different manufacturers have caused many compatability problems. The new standard proposes 5 volt logic signals as listed in the table. This should settle the loading aspect until CMOS is superseded, without hurting anyone who has been brave enough to adopt RS422 or RS423.

When will it be implemented?

Implementation depends entirely upon the interest shown by designers and users of the apparatus. They should obtain a copy of the draft, study it carefully and then write back with comments, whether critical or favourable, to the *PSWP-CCTA, 157/161 Millbank, London SW1P 4RT.* It is to be submitted formally to the British Standards Institution shortly, and the more comments that can be quoted the more likely is effective action.

The writing of standards is a long and tedious business, as the wrter has found in industrial association with the British Standards Institution since 1955. In practice it is easier and quicker to provide a new standard than it is to revise an old one. It is to be hoped that this one will be developed and published by a brand new committee, because hand-held portable electrical equipment is a fresh subject.

If it is merely regarded as a revision of RS232, then discussion of it could easily be confused by earlier teleprinter and telecommunications practice which is just no longer relevant.

Originally such standards were an engineering tool and the means by which engineers agreed a common terminology, and basic items on which to base further development. However, this last decade has seen a growing tendency to use standards as the basis of legal contracts and to quote them in legislation. The result is that standards have acquired a negative rather than a positive role, and suggestions of alteration or updating are viewed with alarm and dismay.

Worse still, perhaps, is the attitude of looking to a standard as a novices' guide or Bible for what is required or necessary, or to refer to 'industry standard' as a means of maintaining the status quo.

So we need no longer moan and endure. Get hold of the document and say why you disagree – or start using it now!

Signal Levels

5 volt CMOS logic
Logical 1 ('on') voltage >+3.5V
Logical 0 ('off') voltage <+1.5V
2.5 volt nominal input threshold
Output drive 1mA min (source or sink)
Input resistance 47KΩ nominal

MODIFYING THE YAESU FRG-7

Martin Evans explains how to 'sharpen your frog' with the addition of a narrow-band filter

Many short wave listeners on a limited budget will consider buying a secondhand Yaesu FRG-7. In good condition, such a set will meet most of the needs of those who do not demand the very latest and best of receivers, but its most serious shortcoming as far as the radio amateur is concerned is its lack of selectivity on SSB. It has only one ceramic IF filter and this has a passband of more than 3KHz above and below the IF.

This is all right, and indeed necessary, for SW broadcast listening in the AM mode. The wide passband is not usually a problem when listening to non-amateur SSB, eg maritime or aircraft bands where channels are properly spaced, but on crowded amateur bands SSB reception can be very difficult. The author has found that a switchable alternative narrow-band filter can be fitted to the FRG-7, and this greatly improves reception of those SSB signals that would otherwise be unreadable because of adjacent-channel interference.

Fitting the filter

It was decided to retain the original LFC-6 455KHz filter for the AM broadcast mode, and switch in the narrow-band filter when needed. A miniature c-o switch was fitted to the front panel as shown in *Figure 1*.

With the chassis removed from its case, carefully remove all front panel control knobs and the tuning dial bezel. Accurately mark a point between the volume and mode controls at the same height as these, and drill a small pilot hole through the aluminium fascia and on through the steel panel. Be careful not to let swarf fall into the circuitry and do not damage any components.

Undo the four corner screws and remove the fascia. Drill out the pilot hole in the steel panel to the right size to mount the new switch, which can now be fixed in place. Enlarge the hole in the fascia to clear the mounting nut, chamfer or smooth the edges and paint to match the rest of the panel.

The narrow-band filter (CFM455J1, from Ambit/Cirkit) was mounted on a small printed circuit board, together with a single transistor output buffer stage that ensured correct loading of the ceramic ladder filter. The circuit diagram is shown in *Figure 2*.

Double-sided copper board was used to make the circuit board. The filter and transistor are on the upper surface, which was left as a ground plane and screen, drilled and chamfered away where leads pass through it. The tracks were cut in the lower surface and most of the components surface mounted on this

Fig 1 *The switch to select filters installed between the volume and mode controls. When the toggle is up, towards the SSB positions, the narrow-band filter is in use. The down position selects the original filter, for AM reception*

side, as can be seen in *Figure 3*. The whole assembly was fitted below the FRG-7 IF/AF unit on two insulating pillars screwed to convenient holes found in the IF/AF board.

Before fitting the new filter assembly it is necessary to break one track in the IF/AF board and solder some leads in place. Break the short track between the output pin of the LFC-6 filter and the junction of R421 and the base of Q405. Solder a lead from the transistor side of the break to the common terminal of the miniature c-o switch and take another lead from the output pin of LFC-6 to that terminal which is connected when the toggle of the switch is down, pointing towards the AM positions of the mode switch. The author used subminiature screened leads, earthing the screening nearby.

Solder a lead to the junction of C417, R420 and the input pin of LFC-6. This will later be connected to the input of the CFM455J1 filter through a 560Ω resistor. One may also solder plain leads to 0V and +10V points on the IF/AF board at this stage.

When the circuit board has been fixed in place on its pillars behind the c-o switch *(Figure 3)* the remaining connections are made. The IF signal from C417 is soldered to the 560Ω input to the new filter. The output of the BC107 emitter follower is taken via the 10nF capacitor to that terminal of the c-o switch which is connected when the toggle is up, pointing towards the USB and LSB positions of the mode switch. Connection of the 0V and +10V leads completes the circuit.

Temperature compensation

The CFM455J1 has an effective pass-

band of about 3KHz, and the SSB local oscillator ('BFO') must be tuned accurately to the HF and LF shoulders of this passband for optimum LSB and USB reception respectively.

This is where the next problem arises: the frequency of the FRG-7 SSB oscillator drifts quite badly. It is dependent upon ambient temperature, being high at low temperatures. It also drifts down as the set warms up. After an hour or two the temperature inside the set will reach 4 to 6°C above ambient. There is also some additional long-term drift of uncertain cause.

Drift

The total drift is tolerable with the wide passband of the LFC-6 but not with the narrow-band filter. If one goes into a chilly shack and turns on the FRG-7 and the shack heaters, the temperature inside the set is likely to rise more than 10°C in the next hour or so. This will drop the BFO frequency by more or less 1KHz. The drift is worse at low temperatures than above 20°C, and is slightly worse in LSB than in USB mode.

Drifting this much off the treble end of the SSB passband will merely give poor quality reception, but drifting it off the bass end of a 300-3300Hz speech signal will render it almost unintelligible. Therefore, unless you have a constant temperature shack and can turn the set on half an hour before using SSB in narrow-band mode, some temperature compensation must be applied to the SSB oscillator.

The change in frequency (f) against ambient temperatures near 20°C was found to be about −140ppm/°C in the author's set. The SSB oscillator f is determined by T406 and the two capacitors C435 and C436 in the modified Colpitts oscillator at Q408. These 620pF capacitors are mica and probably have a very low, slightly positive, temperature coefficient (tc). Most of the drift must be due to a substantial tc of inductance in T406. Replacing both mica capacitors by 620pF capacitors having a tc of about −280ppm/°C should give zero drift near 20°C.

In practice, the simplest partial compensation was to replace both these mica capacitors by 620pF miniature polystyrene ones *(Figure 4)*. The Mullard KS series are made in this value to various tolerances, 426-46201 being a ±1%-type number.

Polystyrene capacitors have good stability and a tc in the range −100 to −200ppm/°C. This gave very low drift between 20-23°C ambient (with 15 minute warm-up time) and was found entirely satisfactory for ambient temperatures down to 17°C. Polystyrene melts readily, so a heatsink is essential when soldering.

If minimum drift is needed at lower ambient temperatures, then one must replace one or both of the mica capacitors with something having a larger negative tc, such as a small value mica in parallel with some N750 ceramic capacitors. Try, for example, replacing only the C435 mica with a 180pF silver mica carrying two 220pF N750 ceramics in parallel between its leads.

C435 lies right next to the coil T406. The temperature compensating ceramics should be placed in between T406 and C436. Space is very tight and C436 will have to be removed temporarily to install the compensating assembly right next to the coil shield. Due to the non-linear nature of the drift, however, compensation that gives minimum drift at low temperatures will over-compensate above 20°C, resulting in a positive drift of f against temperature.

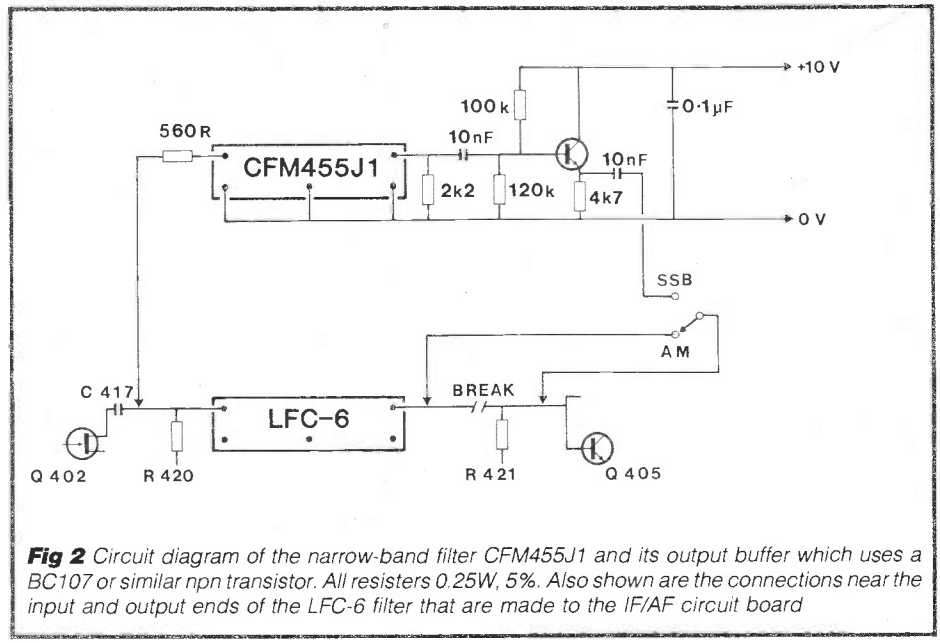
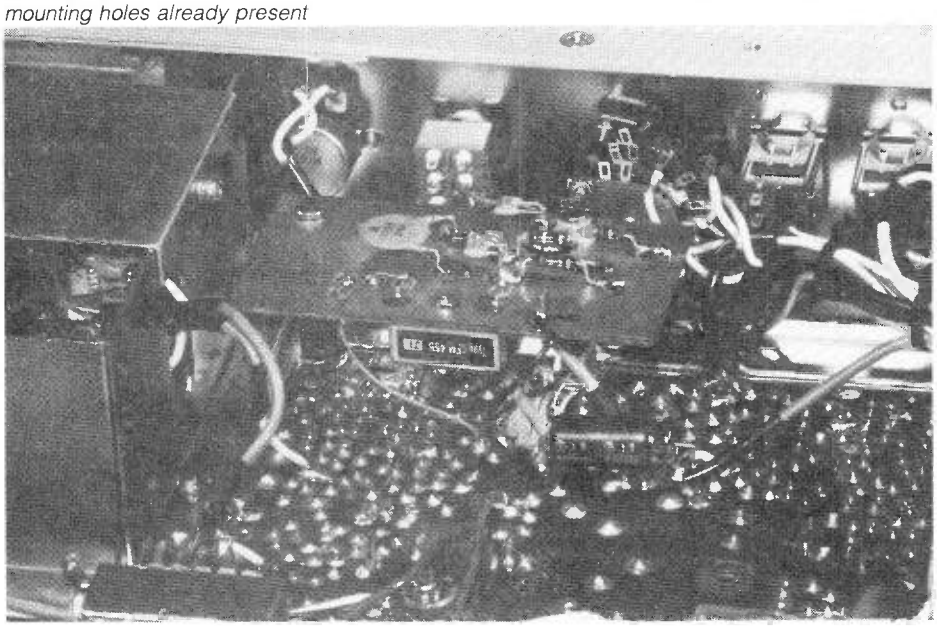


Fig 2 *Circuit diagram of the narrow-band filter CFM455J1 and its output buffer which uses a BC107 or similar npn transistor. All resisters 0.25W, 5%. Also shown are the connections near the input and output ends of the LFC-6 filter that are made to the IF/AF circuit board*

Fig 3 *Showing the underside of the IF/AF board, with the narrow-band filter circuit on its board. Insulated pillars hold it in place behind the switches, the other ends of the pillars being screwed to mounting holes already present*



Tuning the BFO

When all modifications have been completed, the SSB local oscillator (BFO) will have to be set up to inject the correct frequencies. For LSB working it is tuned to the HF shoulder of the filter's passband, and to the LF shoulder for USB. In the set modified by the author these frequencies were 457.2 and 453.1KHz respectively, but manufacturer's tolerances on the CFM455J1 passband may require slightly different frequencies in other cases.

Even if temperature compensating capacitors have been fitted, the receiver

should have stood at an average ambient temperature for several hours and be given 15-30 minutes to warm up before setting the BFO frequencies. The frequencies can be measured at test point TP405, but unless f is very incorrect the re-tuning to suit the new filter can be done without a frequency meter.

LSB mode

The LSB mode is set up first. Apply an unmodulated crystal controlled RF signal to the aerial input, or find a steady CW transmission. Select LSB mode and the original LFC-6 filter. Tune through the test signal, when beat frequencies should be heard both above and below the zero beat point. Note the zero beat point on the tuning dial, and set the dial to about 5KHz *above* this point. Switch over to the narrow-band filter and tune down and through the zero beat point. The BFO f is correct if one hears beats from about 3-4KHz down through zero and faintly to about 100Hz on the other side, beyond which the beats should rapidly become inaudible.

If beats can be heard above 4KHz on the HF side of zero, and become inaudible before reaching zero beat, then BFO f is too high and the adjusting core of T406 must be carefully screwed in a fraction of a turn clockwise. If, however, one can hear beats higher than 100Hz on the wrong side of zero, then BFO f is too low. Continue testing and adjusting T406 in this way until the zero beat point is near the HF roll-off point of the CFM455J1.

USB mode

Tuning the BFO for the USB is done in a complementary manner, but now it is the preset capacitor TC404 which is adjusted. Start in USB mode with the original filter and again find the zero beat point on the tuning dial. Set the tuning dial 5KHz *lower* and switch over to the new filter. Again, the setting is correct when one hears beats from about 3-4KHz down, through zero and cutting off fairly sharply at 100-200Hz on the other side as one moves up the tuning scale. Do not disturb the setting of T406, but set BFO f by adjusting TC404 only.

These recommendations, to allow about 100Hz from the unwanted sideband to come through at a low level, are designed to accommodate slight drifting of the BFO f without significant loss of bass from any SSB transmission. The treble end is much more tolerant of slight losses due to drifting.

The S-meter readings will be lower when the narrow-band filter is in use, mainly because less overall RF power is reaching the meter driver, Q407. This is a minor matter: S-readings are rather non-linear anyway with the FRG-7!

Improvement

The general background noise drops considerably when the narrow-band filter is switched in, quite apart from the removal of adjacent channel interference.

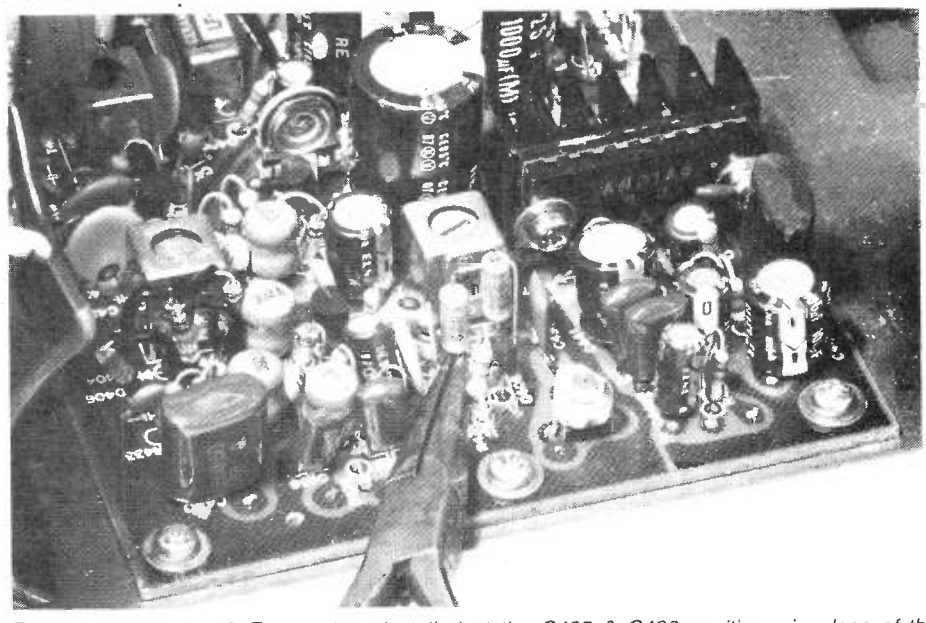
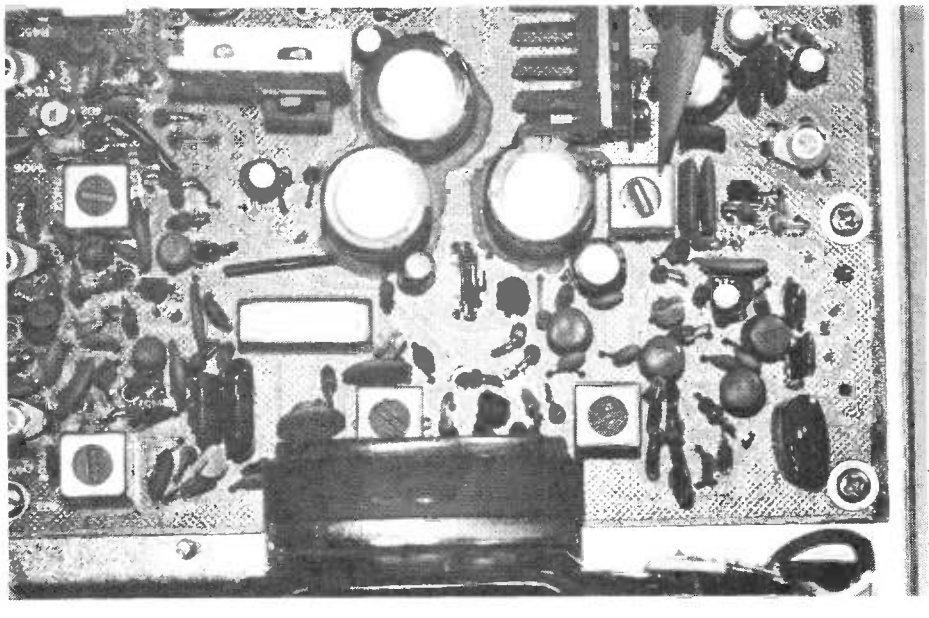


Fig 4 *Polystyrene 620pF capacitors installed at the C435 & C436 positions, in place of the mica originals. Polystyrene melts easily so fine pliers should be used as a heatsink, as shown, when soldering. The adjustable inductance T406 is seen immediately behind these capacitors and the trimmer capacitor TC404 is seen to the right of the pliers. Testpoint TP405, where the BFO frequency can be measured, is hidden behind the large capacitor in the near corner on the left*

Fig 5 *The top side of the IF/AF circuit board. The pencil points to T406, the inductance for the SSB local oscillator. Immediately to its right are seen the two original mica 620pF capacitors. The original LCF-6 455KHz filter remains in place behind the left-hand edge of the loudspeaker magnet*



Do you operate a piece of equipment which has been improved by modification, as described here? If so, why not share your knowledge with other readers by writing to us with details of your rig?

AMATEUR RADIO WORLD

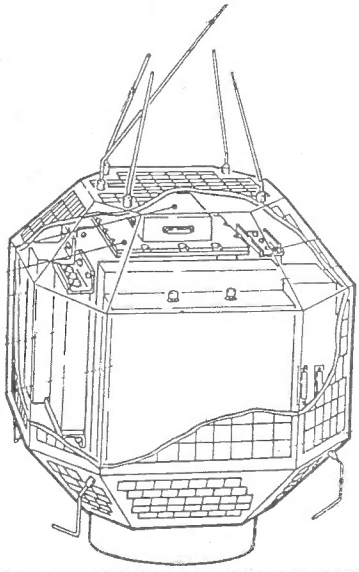
Compiled by Arthur C Gee G2UK

Details of the Japanese amateur radio satellite JAS-1 are beginning to come through. The Japan Amateur Radio League (JARL) with support from JAMSAT (the Japanese AMSAT) is developing the satellite, the objectives of which are: to provide reliable worldwide amateur radio communications; to research satellite control engineering and satellite tracking systems; and to test and prove the performance of analogue and digital transponders developed by radio amateurs.

It will be launched by the National Space Development Agency of Japan (NASDA) early in 1986. NASDA has already approved launching of JAS-1 along with the Experimental Geodetic Payload using NASDA's experimental launch vehicle, the H-1 rocket, from Japan's launch site, Tanegashima.

A new capability of the JAS-1 is its digital transponder with memory, in addition to a normal analogue transponder. It will be possible to load messages into the transponder memory which can be relayed upon receipt of an appropriate access code. In this way it will be able to carry messages on a store-and-forward basis, between amateurs anywhere in the world.

The proposed orbital parameters are a circular orbit at an altitude of approximately 1500Km (930 miles), period 120 minutes, inclination 50 degrees, and a projected life of three years. The satellite will weigh 50Kg and will be a polyhedron of 26 faces covered with solar cells, measuring 400mm in diameter by 470mm in height. Transponder input will be 145.9 to 146MHz, with output frequency 435.9 to 435.8MHz inverted SSB (required uplink power 100W EIRP).



New Russian satellites are proposed, *viz* RS9 and RS10. They are expected to be launched at the end of this year or early in 1986, and are said to be a 'double satellite' system in which the two satellites are mounted on one structure, travelling together. It is expected that there will be a beacon on 29.4MHz and a Mode A transponder, ie 2 metres up and 10 metres down, and also a Mode K transponder, ie 15 metres up and 10 metres down. The latter will be new to the amateur satellite world and should be interesting.

UoSAT-1 has had its 21MHz (15 metres) beacon running recently and observations indicate that the radiation from a satellite on this frequency is subject to quite deep fading, so a thorough investigation of this phenomenon should prove valuable.

Amateur radio validation document

The Department of Trade and Industry has advised the RSGB that some confusion seems to have arisen over just what the purpose is of the amateur radio validation document. It is sent by the Post Office on behalf of the DTI to all radio amateurs who have received their licences since 1 October last.

It was introduced to provide a wallet-sized means of proving current validity of the transmitting licence instead of having to carry the full licence document around. Upon receipt, this document should be signed and retained until either a change of name or address or until the licence reaches its expiry date. It should not be returned to the Post Office for any other reason.

The solar cycle

The present solar cycle appears to be progressing much more quickly than was expected. The time between minimum and maximum averages out at about 4½ years, which would have put the last maximum at mid-1980. In fact it occurred in December 1979. The time between maximum and minimum usually works out at about 6¾ years, which would put the expected minimum at around August of this year. However, if one takes the usually accepted time of 11¼ years between successive minima the next minimum should occur about 1987. The pundits consider present trends will lead to a very low minimum indeed in this solar cycle.

World's largest AR station, PA6FLD

On 31 March last, Radio Nederland Wereldomroep put into operation a new transmitting centre located on the Flevopolder. But before it entered service a unique amateur radio experiment was carried out. On the third weekend in February, two amateur radio transmitters were connected up to some of the largest short wave broadcast directional antennae in the world!

Transmissions took place for a period of 36 hours. Not only did this give the radio amateur operators concerned a unique chance to work with such high gain antennae, but it offered a rare opportunity for radio amateurs and short wave listeners to listen out for a station with a difference.

One of the transmitters operated on a non-directional antenna intended for European reception, while the other used the giant curtain arrays at the Flevo short wave transmitter site. The general direction of the beam from the giant directional array followed the pattern of the regular English language broadcasts from Radio Netherlands. We hope to report on the results of this experiment later.

Ham radio beats thieves

An interesting story appears in the current Royal Naval Amateur Radio Society newsletter. There are quite a number of amateur radio maritime networks around the world. One of the oldest, the United Kingdom Maritime Net, recently received a report from a sailing ham in Alicante, Spain, that the 40 foot ketch *Frizella* had been stolen. Such reports are repeated twice a day at regular times, in this case 0800 and 1800hrs GMT on 14303KHz, and the news spreads worldwide via other similar nets in a remarkably short time.

About two weeks later an alert member of the network in the Canary Islands spotted what looked like the *Frizella* entering Arrecife in Lanzarote. Registration and engine serial numbers were

obtained and identified her without doubt as the stolen yacht. It would appear that she was on her way to South America, where incidently other sailing hams had been alerted to this possibility.

Whilst these daily nets are basically for the informal exchange of positions, weather reports and harbour information, some dramatic rescues have been assisted by amateur radio, not least Richard Broadhead's remarkable rescue of his fellow competitor Jacques de Roux, whose yacht sank in the South Pacific during the last Whitbread Round-the-World race.

Initially alerted by the French boat's 'panic' button on his satellite transponder, a radio amateur in Rhode Island alerted the UK Maritime Net team who passed the information on to their New Zealand counterparts. Luckily they were in touch with Richard Broadhead, who happened to be the nearest boat to Jacques de Roux. Although he was 300 miles away Richard turned round, and in a dramatic rescue took Jacques off his sinking yacht with just four inches of freeboard left!

For the SWL, the UK Maritime Net can provide hours of intensely interesting listening, and for those contemplating sailing, the investment in a Radio Amateur Transmitting Licence can not only provide companionship when under way but a means of communication if in distress.

The UK Maritime Net is organised by David Jolly G3TJY, and he reports that the net has almost outgrown itself and that he would welcome any assistance in the way of stand-by controllers to relieve him and G8OS when they go on holiday, or when sickness or work interferes with the daily skeds. All you need is to be reasonably clued-up marine-wise and not too garrulous! If you have the free time, why not contact him at *Little Russel, Lytchett Minster, Poole, Dorset BH16 6JD.*

'Operation Raleigh'

'Operation Raleigh' is a follow-up to 'Operation Drake', which was a four year round-the-world self training operation aboard a sailing vessel called *The Eye of the Wind.* This expedition was a great success, so much so that Operation Raleigh was planned as a follow-up to it. It takes young people from all walks of life and of various nationalities on world-wide cruises visiting remote parts of the world, where they face challenges and hardships to broaden their horizons.

During their travels they will participate in numerous scientific projects, and full radio services will be available from the vessel they will use this time, the *Sir Walter Raleigh.* HRH the Prince of Wales is the project's patron.

A fully equipped satellite-linked computing laboratory donated by Acorn Computers Ltd of Cambridge will be on board the *Sir Walter Raleigh.* It is equipped with eleven BBC Micro systems, of which seven will be used in the field on various research projects. The remaining systems will play a key role in ship administration and in the pre-analysis of research data from projects carried out on board ship and in the field. The ship's computers will be linked by satellite to micros in the UK based at Leeds University.

The amateur radio callsign will be GB2SWR/MM and contacts in the usual amateur radio bands should be possible as the vessel circumnavigates the world. A number of rare islands should become operational during the voyage. If all goes well, the first such expedition will be in late 1985 to South Georgia, with the South Sandwich Islands as a possible additional location.

Each participant has to find around £2500, and sponsorships are being eagerly sought. NEW

CONSTRUCTING POWER SUPPLIES

Roger Alban GW3SPA begins a series of articles describing the design and construction of PSUs

The author, who enjoys experimenting and building equipment from the debris of his junk box, has suffered in the past from one big handicap: the lack of a versatile power supply with voltage and current protection. An examination of the glossy brochures available revealed the high prices being asked for laboratory-type power supplies, and rather dampened the appetite.

Following a recent visit to a local amateur radio convention I discovered the wide range of secondhand components on the market, such as computer grade capacitors, heatsinks and semiconductors suitable for building a power supply at a reasonable price. This convinced me to attempt to build my own variable voltage power supply.

One problem area soon encountered was the lack of a suitable mains transformer in the junk box. A search of the stands of the local radio convention revealed that there was a dearth of such transformers, and those that were deemed to be near suitable had a price tag equivalent to their weight in gold.

Another problem area was the lack of the ability to vary the voltage to any great extent using custom-designed integrated circuit voltage regulators. It was also apparent that I would have to spend a great deal of time searching from one book to another to refresh the 'grey matter' to be able to embark upon the design.

This series of articles is intended to bring together the information that is required for any amateur to build a power supply to meet individual requirements, and concludes with the design of a 10 amp variable voltage power supply incorporating current limiting and overvoltage protection.

The transformer requirements

The transformer design significantly determines the eventual capabilities of the power supply. If the secondary voltage is too high, then extra voltage drop, and therefore power, will have to be dissipated in the pass transfer heatsinks. In some instances the power to be dissipated may prove impractical for reasonably sized heatsinks.

If the secondary voltage is too low then the power supply will suffer from poor voltage regulation. The regulation will not have sufficient voltage at hand to absorb the voltage drop of the transformer and the various components taking load current within the power supply under full load condition. In practice it is desirable to have a transformer producing exactly the required secondary voltage.

The power rating of the transformer is also important. It is undesirable to overload a transformer, as this will cause unnecessary additional power losses within it which will result in overheating. In practice it is difficult to find the ideal transformer either in the junk box or available as surplus equipment.

However, there is a remedy; the possibility exists of modifying an existing transformer from the junk box to provide the ideal secondary voltage. This in turn will effect the maximum secondary current because the power rating of the transformer must remain unaltered.

Transformer theory

Before one can embark on modifying the transformer secondary, a clear understanding of the operation of the transformer is required.

A transformer is very simple in principal, consisting of two windings on the same iron core as illustrated in *Figure 1.* The iron core ensures that almost all the magnetic flux caused by the current in the primary coil links the turns of the secondary coil. An alternating current in the primary will cause alternating induced voltages in both the primary and secondary windings. The magnitude of the two voltages will be proportional to the number of turns in primary and secondary windings.

A circuit using a transformer is shown in *Figure 2.* A resistor represents a load to which power is to be supplied, connected to the secondary winding S via a switch, and the primary winding P is connected to an ac supply (eg 240V 50Hz mains).

With the switch open, a small current flows through the primary winding, sufficient to produce an induced voltage which will just balance the supply voltage throughout the supply cycle. This small current is called the magnetising current, and its job is to produce the magnetic flux in the core.

When the switch is closed the induced voltage in the secondary winding causes an alternating current to flow through the load. This load current also flows through the secondary winding itself, and would produce a large additional flux in the iron core if there were no change in the primary current.

However, an additional current is automatically allowed to flow in the primary circuit, of such a magnitude that the flux it produces just balances that due to the load current. This additional current in the primary circuit is obtained from the mains supply. The transformer merely serves to pass on this power to the load, only absorbing a small amount in core and heat losses in the windings

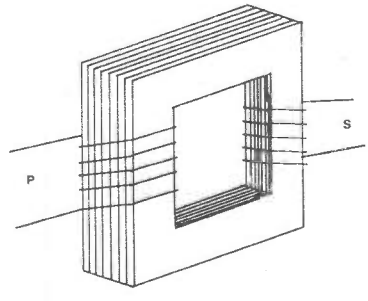


Fig 1 *Transformer construction*

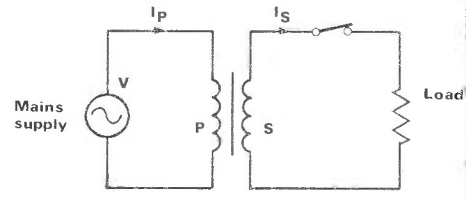


Fig 2 *Basic circuit using a transformer*

depending upon the efficiency of the transformer.

The usefulness of the transformer arises because the load can be operated at a voltage different from that of the supply. If the number of turns on primary and secondary windings respectively are Np and Ns and the induced voltages are Ep and Es (rms values), then:

$$\frac{Es}{Ep} = \frac{Ns}{Np}$$

Ep must be equal to the supply voltage, and Es is the voltage across the load. Thus:

$$\frac{\text{Load voltage}}{\text{Supply voltage}} = \frac{Ns}{Np}$$

and the load can work at a voltage higher or lower than that of the supply.

All the power from the supply is assumed to be delivered to the load, so that the product of current and voltage must be the same in the primary circuit as in the secondary circuit. Writing Ip and Is as the rms currents in primary and secondary, this means that:

$$\text{Primary power rating} = \text{Secondary power rating}$$
$$Ep \times Ip = Es \times Is$$

$$\text{Therefore} \quad \frac{Ip}{Is} = \frac{Es}{Ep} = \frac{Ns}{Np}$$

The above formulae show that the winding with the largest number of turns operates at a higher voltage, but lower current.

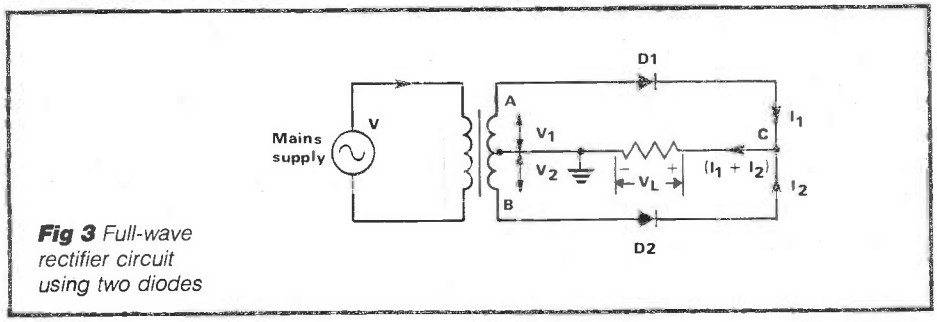


Fig 3 *Full-wave rectifier circuit using two diodes*

Transformer modification

On taking a fresh look at the transformers available in the junk box, I came across a number of mains transformers that had been designed to run 12V, 50 watt quartz lamps. The transformers were not impregnated and there was sufficient room on the core to add additional turns to the secondary if necessary, without dismantling the laminations.

The turns ratio of the transformer was unknown. The actual open circuit secondary terminal voltage of the transformers was measured and found to be 13.2 volts rms. From my design calculations for the power supply to be discussed later I required a secondary terminal voltage of approximately 21V rms.

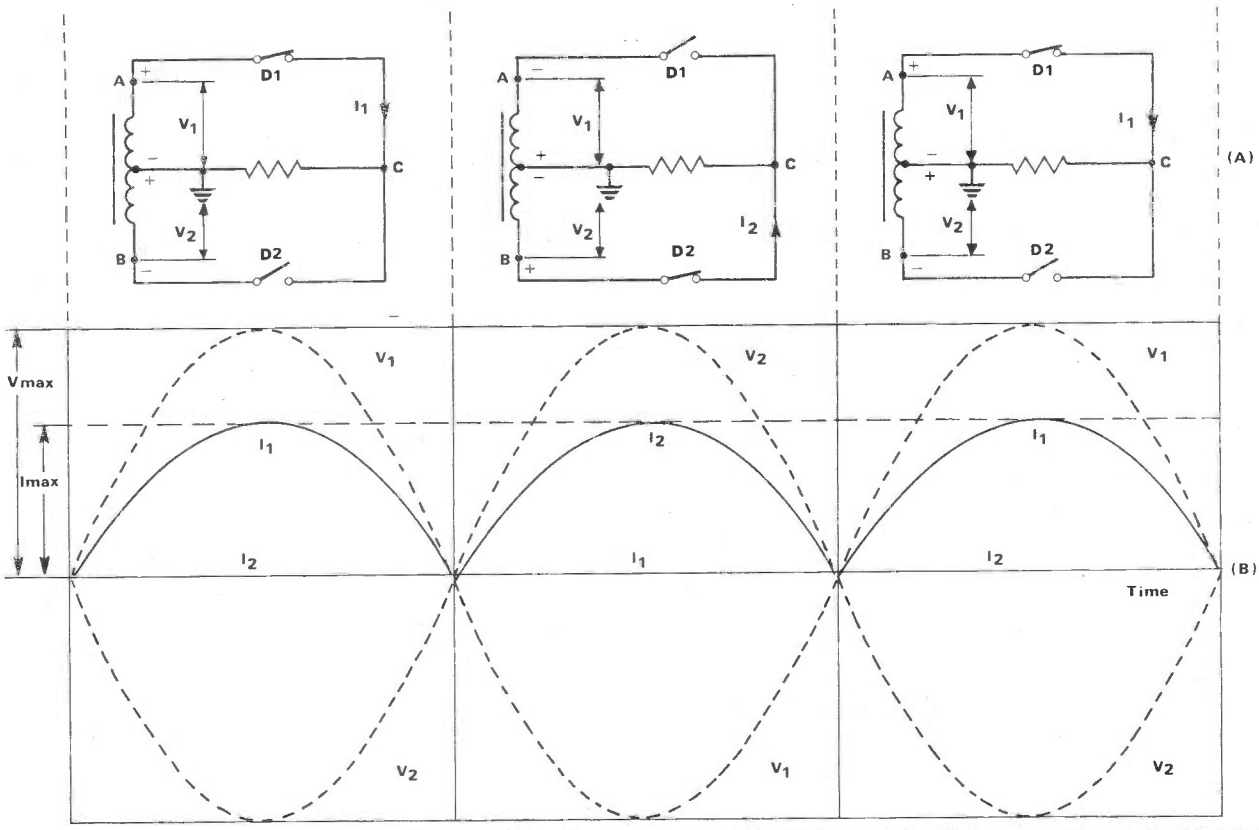
A separate winding comprising of 10 turns of 22swg copper wire was wound around the core of the transformer and the open circuit terminal voltage was measured and found to be 2.2V rms. Therefore, the volts per turn for this transformer is 0.22V rms.

The difference between the open circuit terminal voltage of the transformer and the actual required value is 21.0−13.2 = 7.8V. To obtain an additional 7.8V at the secondary will mean that the secondary winding will have to be increased by an addition of turns calculated as follows:

$$\frac{7.8 \text{ volts}}{0.22 \text{ volts}} \approx 35 \text{ turns}$$

The additional turns were added to the transformer and the open circuit secondary voltage measured and found to be approximately 21V rms. Markings on the

Fig 4 *The action of the full-wave rectifier circuit*



transformer indicated its rating of 110VA, which is capable of continuously running a 55 watt lamp.

Prior to modifying the transformer the maximum current obtained from the secondary was 55W÷13.2V = 4.17A rms. Now that the transformer has been modified by increasing the secondary voltage, the maximum secondary current is 55W÷21V = 2.61A rms. If this transformer is used in a power supply designed to deliver a maximum load current of 10A, the design will require a minimum of four transformers! More about this later.

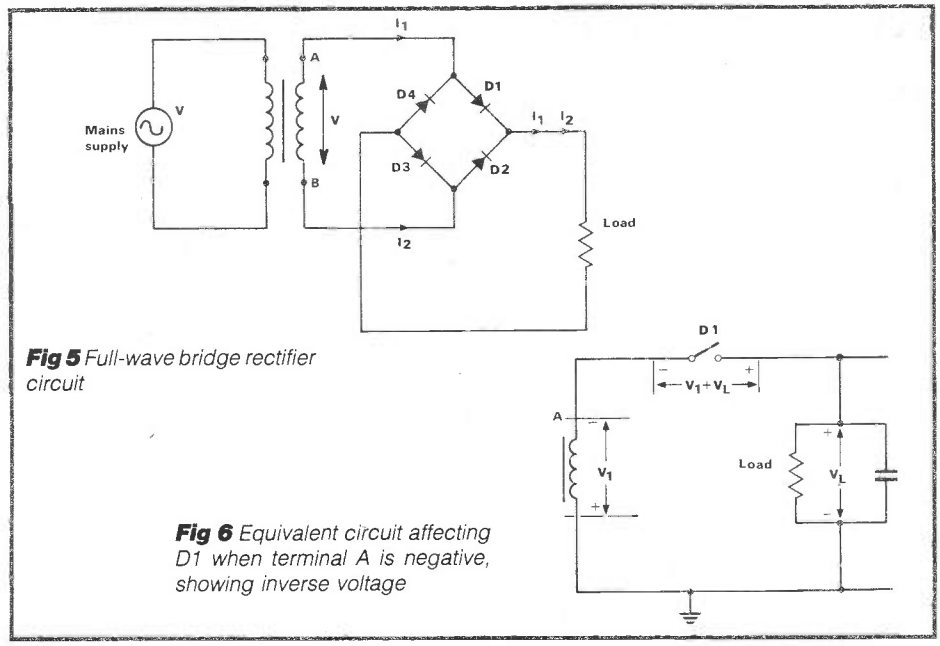


Fig 5 *Full-wave bridge rectifier circuit*

Fig 6 *Equivalent circuit affecting D1 when terminal A is negative, showing inverse voltage*

The rectifier

In the vast majority of power supplies a rectifier is connected to the secondary of the transformer to convert ac to dc. The configuration of the secondary winding of the transformer will determine the type of rectifier circuit used.

If the secondary winding has a centre tap it is possible to use a full-wave rectifier using two diodes, as shown in *Figure 3*. The centre tap creates two ac supplies which are effectively connected in series, the centre tap being the common terminal which is connected to earth. The two supplies will be at the same mains frequency with the same maximum value, and will be in exact phase opposition: ie when terminal A is at its positive maximum, terminal B will be at its negative maximum.

The waveforms of V1 and V2 are shown by dotted lines in *Figure 4(b)*. The equivalent circuit for each part of the cycle is shown by the sketches in *Figure 4(a)*, each diode being represented by a switch. During these half-cycles, when terminal A is positive diode D1 conducts and current I1 flows. Diode D2 remains non-conducting and I2 is zero.

During the alternate half-cycle when terminal B is positive and terminal A negative, D2 conducts and D1 becomes non-conductive. Current I2 then flows while current I1 is zero.

It can be seen that there are two separate rectifying circuits. The benefit of a full-wave rectifier circuit is that the two current paths through D1 and D2 at point C maintain current flow in the same direction throughout the majority of the mains frequency cycle.

The main disadvantage of this circuit is that the voltage across the load is approximately equal to V1 (=V2) which is half the total secondary voltage.

Bridge rectifiers

To overcome this disadvantage a bridge rectifier circuit can be used, as shown in *Figure 5*. When terminal A is positive, diodes D1 and D3 will conduct and diodes D2 and D4 will not. Current I1 flows through D1 into the top of the load resistance and back to terminal B of the transformer via D3.

When terminal B is positive, diodes D2 and D4 will conduct, and diodes D1 and D3 will not. Current I2 flows through D2 into the top of the load resistor and back to terminal A of the transformer via D4.

The waveforms obtained are similar to those shown in *Figure 4(b)*, with the exception that the voltage across the load resistor is approximately equal to the secondary voltage V.

So far we have dealt with diodes that are ideal, ie they behave like switches. In practice the junction of a diode under load conditions will have a forward voltage, V_F, which in power diodes can be assumed to be approximately 1 volt. Therefore the total voltage drop using the circuit containing the centre tapped secondary will be 1 volt, and for the bridge rectifier the voltage drop will be 2 volts.

It is also worth taking into consideration the power dissipated by the rectifier circuit. Let us assume that we are designing a power supply with a maximum load current capability of 10 amps. The power being dissipated in the bridge rectifier will be:

$$W = V \times I = 2 \times 10$$
$$= 20 \text{ watts}$$

In some high current power supplies it will be necessary to connect the rectifiers to a heatsink, to effectively dissipate the unwanted power loss in the form of radiated heat.

Diode ratings

The current rating of each individual diode is also important. Usually the rectifier is connected to a reservoir capacitor, which upon switch-on will take a high charge current. If diodes of the wrong current rating are used, there exists a possibility that they will be destroyed. It is therefore advisable to derate individual diodes by as much as 50% as a safety precaution.

In my experience it does no harm to obtain diodes quite cheaply that are rated as much as 10 times the maximum load current envisaged. At least it protects the power supply against accidental short circuit at the terminals on occasion.

Yet another danger to the diode occurs during the periods when it is not conducting.

Figure 6 shows the equivalent circuit affecting D1 of the full-wave circuit, during the half-cycle when terminal A is negative. The voltage across D1 is seen to be such as to make the anode negative with respect to the cathode, and then is equal to $V1 + V_L$.

This voltage is a maximum at the negative peak of V1, when we have V1 = V_{max}, but also V_L approximately equal to V_{max}. The voltage across the diode will be $V1 + V_L$ which is approximately twice V_{max}. This voltage is called the peak inverse voltage (PIV) applied to the diode. The greatest safe value is called the peak inverse rating of the device.

In the modified transformer the open circuit secondary voltage measured was 21V rms, which has a peak value of $21 \times \sqrt{2}$, or approximately 30V peak. Therefore the minimum PIV of the diode should not be less than $2 \times 30 = 60$V. In practice it is advisable to select diodes with a PIV ten times this value to take account of the odd transient.

Next month

Next month we take a look at how the performance of the full-wave rectifier circuit can be improved by the use of a suitable reservior capacitor. The action of the modified circuit is examined, as well as the constraints imposed upon reducing the ripple by increasing the capacitor's value because of the danger of damaging the rectifier. REW

INTEGRATED CIRCUITS

AN124	2.50			STK437	7.95	TBA651R	2.50	TDA2581	2.25
AN214Q	2.50	MC1351P	1.50	STK439	7.95	TBA720A	2.45	TDA2582	2.95
AN239	2.50	MC1357	2.35	STK461	11.50	TBA750Q	2.55	TDA2593	2.95
AN240P	2.80	MC1358	1.55	TA7061AP	1.50	TBA800	0.89	TDA2600	5.50
AN264	2.50	MC14518CP		TA7108P	1.50	TBA810AS	1.55	TDA2610	2.50
AN612	2.15		7.50	TA7120P	1.55	TBA810P	1.55	TDA2611A	1.95
AN362L	2.50	MC1495	3.00	TA7129P	2.50	TBA820M	0.75	TDA2640	3.50
AN7140	3.50	MC1496	1.25	TA7130P	1.50	TBA820Q	1.45	TDA2680A	2.75
AN7145	3.50	MC145106P		TA7137P	1.00	TBA890	2.50	TDA2690	2.45
AN7145M	3.95		7.95	TA7176AP	2.95	TBA920	1.55	TDA3310	2.95
AN7150	2.95	MC1723	0.50	TA7193P	3.95	TBA950/2X		TDA4600	2.50
BA521	3.35	MC3357	2.75	TA7203	2.95		2.35	TDA9503	3.15
CA1352E	1.75	MC3401L	2.50	TA7204P	2.15	TBA990	1.49	TDA3560	3.95
CA3086	0.45	ML231B	1.75	TA7205AP	1.15	TBA990Q	1.49	TEA1009	1.35
CA3123E	1.95	ML232B	2.50	TA7222AP	1.80	TCA270	1.10	UPC566H	2.95
CA314OT	1.15	MSM5807	8.75	TA7227P	4.25	TCA270SQ		UPC575C2	
ETT6016	2.50	PLL02A	5.75	TA7310P	1.80		1.10		2.75
HA1339A	2.95	SAA500A	3.60	TA7313AP	2.95	TCA650	2.50	UPC1025H	
HA1366W	2.75	SAA1025	7.25	TA7314P	2.95	TCA800	2.95		1.95
HA1377	3.50	SAA5010	6.35	TA7137P	1.00	TCA830S	1.95	UPC1028H	
HA1156W	1.50	SAS560S	1.75	TA7314P	2.95	TCA940	1.65		1.95
HA1551	2.95	SAS570S	1.75	TA7321P	2.25	TCA940	2.20	UPC1032H	
LA1230	1.15	SAS580	2.85	TA7609P	3.95	TDA1001	1.95		1.50
LA4102	2.95	SA/SB/T/U		TA7611AP	2.95	TDA1002A	1.95	UPC1156H	
LA4140	2.95		1.00	TAA310A	1.95	TDA1003A	3.95		2.75
LA4031P	1.95	SL901B	4.85	TAA320A	1.95	TDA1004A	3.25	UPC1158H	
LA4420	1.95	SL917B	6.65	TAA350A	1.95	TDA1006A	2.50		0.75
LA4430	2.50	SL1310	1.80	TAA550	0.25	TDA1010	2.15	UPC1167C2	
LA4400	4.15	SL1327	1.10	TAA570	1.95	TDA1035	2.50		1.15
LA4422	2.50	SL1327Q	1.10	TAA661B	1.20	TDA1037	1.95	UPC1181H	
LA4461	3.95	SN76003N	1.95	TAA700	1.70	TDA1044	2.15		1.25
LC7120	3.25	SN76013N	1.95	TBA120AS/B/-C	1.00	TDA1170	1.95	UPC1182H	
LC7130	3.50	SN76023N	2.75			TDA1190	2.15		2.95
LC7131	5.50	SN76033N	1.95	TBA395	1.50	TDA1270Q	3.95	UPC1185H	
LC7137	5.50	SN76110N	0.89	TBA396	0.75	TDA1327	1.70		3.95
LM1011	3.15	SN76115N	1.25	TBA440N	2.55	TDA2002	1.95	UPC1191V	1.50
LM324N	0.45	SN76131N	1.30	TBA480Q	1.25	TDA2003	2.95	UPC1350C	
LM380N8	1.50	SN76226DN		TBA510	2.50	TDA2010	1.95		2.95
LM380N8	1.75		2.95	TBA510Q	2.50	TDA2020	2.95	UPC1353C	
LM383T	2.95	SN76227N	1.05	TBA520	1.10	TDA2030	2.80		2.45
LM390N	3.50	SN76533N	1.55	TBA520Q	1.10	TDA2140	3.95	UPC1365C	
M51513L	2.30	SN76544N	2.55	TBA530	1.10	TDA2151	1.95		3.95
M5155L	2.95	SN76570N	1.00	TBA530Q	1.10	TDA2160	2.50	UPC2002H	
M51521L	1.50	SN76650N	1.15	TBA540	1.25	TDA2521	3.25		1.95
MB3712	2.00	SN76660N	0.90	TBA540Q	1.35	TDA2522	1.95	555	0.35
MB3756	2.50	STK014	7.95	TBA550Q	1.95	TDA2523	2.95	556	0.42
MC1307P	1.00	STK015	5.95	TBA560C	1.45	TDA2524	1.95	723	0.50
MC1310P	1.95	STK043	9.50	TBA560Q	1.45	TDA2530	1.95	741	0.35
MC1327	0.95	STK415	7.95	TBA570	1.00	TDA2532	1.95	747	0.50
MC1327Q	0.95	STK433	5.95	TBA641A12		TDA2540	1.95	748	0.35
MC1349P	1.20	STK435	7.95		2.50	TDA2541	2.15	7808	0.60
						TDA2560	2.15	7805	0.55
						TDA2571	2.95	7812	0.55
								7815	0.55

SEMICONDUCTORS

AAY12	0.25	BC182	0.10	BD238	0.40	BFX88	0.25	TIP32C	0.42
AC126	0.45	BC182LB	0.10	BD242	0.55	BFY50	0.21	TIP33B	0.95
AC127	0.20	BC183	0.10	BD246	0.75	BFY51	0.21	TIP34B	0.95
AC128	0.28	BC183L	0.09	BD376	0.32	BFY52	0.25	TIP41A	0.45
AC128K	0.32	BC184LB	0.09	BD410	0.55	BFY90	0.77	TIP41C	0.45
AC141	0.28	BC204	0.10	BD434	0.55	BLY48	1.75	TIP42C	0.47
AC141K	0.34	BC207B	0.13	BD437	0.75	BR100	0.26	TIP47	0.65
AC142K	0.30	BC208B	0.13	BD438	0.75	BR101	0.49	TIP120	0.60
AC176	0.22	BC212	0.09	BD520	0.65	BR103	0.55	TIP125	0.55
AC176K	0.31	BC212L	0.09	BD538	0.55	BR303	0.95	TIP142	1.75
AC187	0.25	BC212LA	0.09	BD597	0.95	BRC4443	1.15	TIP146	2.75
AC187K	0.28	BC213	0.09	BD701	1.25	BRY39	0.45	TIP161	2.95
AC188	0.25	BC213L	0.09	BD702	1.25	BT100A/02	0.85	TIP2955	0.80
AC188K	0.37	BC214	0.09	BD707	0.90	BT106	1.49	TIP3055	0.55
AD142	0.79	BC214C	0.09	BDX32	1.50	BT116	1.20	TIS91	0.20
AD143	0.62	BC214L	0.09	BF115	0.35	BT119	3.15	TV106/2	1.50
AD149	0.70	BC237B	0.09	BF119	0.55	BT120	1.65	ZRF0112	16.50
AD161	0.39	BC238	0.09	BF127	0.39	BU105	1.95	2N1100	6.50
AD162	0.39	BC239	0.12	BF154	0.20	BU108	1.69	2N1308	1.35
AD161/2	0.90	BC251A	0.12	BF158	0.22	BU124	1.25	2N1711	0.30
AF106	0.50	BC252A	0.15	BF160	0.27	BU125	1.25	2N2219	0.28
AF114	1.95	BC258	0.25	BF167	0.27	BU126	1.60	2N2905	0.40
AF121	0.60	BC258A	0.39	BF173	0.22	BU204	1.55	2N3053	0.40
AF124	0.65	BC284	0.30	BF177	0.35	BU205	1.30	2N3054	0.59
AF125	0.35	BC300	0.30	BF178	0.26	BU208	1.39	2N3055	0.52
AF126	0.32	BC301	0.30	BF179	0.34	BU208A	1.52	2N3702	0.12
AF127	0.65	BC303	0.26	BF180	0.29	BU208D	1.55	2N3703	0.12
AF139	0.40	BC307B	0.09	BF181	0.29	BU326	1.20	2N3704	0.12
AF150	0.60	BC327	0.10	BF182	0.29	BU326S	1.50	2N3705	0.12
AF178	1.95	BC328	0.10	BF183	0.29	BU407	1.24	2N3706	0.12
AF239	0.42	BC337	0.10	BF184	0.28	BU500	2.25	2N3708	0.12
AU106	4.50	BC338	0.09	BF185	0.28	BU508A	1.95	2N3733	9.50
AU107	3.50	BC347A	0.13	BF194	0.11	BU526	1.90	2N3773	2.75
AU110	3.50	BC461	0.35	BF195	0.11	BU807	2.25	2N3792	1.35
AY102	2.95	BC478	0.20	BF196	0.11	BUY20	2.15	2N4280	3.50
BC107A	0.11	BC527	0.20	BF197	0.11	BUY69B	1.70	2N4427	1.95
BC107B	0.11	BC547	0.10	BF198	0.16	MJ3000	1.95	2N4444	1.15
BC108	0.10	BC548	0.10	BF199	0.14	MJE340	0.40	2N5294	0.42
BC108A	0.11	BC549A	0.10	BF200	0.40	MJE350		2N5296	0.48
BC108B	0.12	BC550	0.14	BF241	0.15	MJE520	0.48	2N5298	0.50
BC109	0.10	BC557	0.08	BF245	0.30	MJE2955		2N5485	0.45
BC109B	0.12	BC557B	0.08	BF257	0.28	MPSA13	0.29	2N5496	0.95
BC109C	0.12	BC558	0.10	BF258	0.28	MPSA92	0.30	2SA329	0.95
BC114A	0.09	BC639/10	0.30	BF259	0.28	MRF237	3.45	2SA715	0.50
BC116A	0.15	BCY33A	1.50	BF271	0.26	MRF450A		2SC495	0.80
BC117	0.19	BD115	0.30	BF273	0.18		12.50	2SC496	0.80
BC119	0.24	BD124P	0.59	BF336	0.34	MRF453	17.50	2SC931D	0.95
BC125	0.25	BD131	0.42	BF337	0.29	MRF454	23.50	2SC1096	0.80
BC139	0.20	BD132	0.42	BF338	0.32	MRF455	17.50	2SC1106	2.50
BC140	0.31	BD133	0.40	BF355	0.37	MRF475	2.50	2SC1172Y	2.20
BC141	0.25	BD135	0.30	BF362	0.38	MRF477	10.00	2SC1173	1.15
BC142	0.21	BD136	0.30	BF363	0.65	OC16W	1.95	2SC1306	1.00
BC143	0.24	BD137	0.32	BF371	0.25	OC23	1.50	2SC1307	1.50
BC147A	0.12	BD138	0.30	BF394	0.19	OC29	2.25	2SC1364	0.50
BC147B	0.12	BD139	0.32	BF422	0.32	OC36	2.25	2SC1449	0.50
BC148A	0.09	BD140	0.30	BF423	0.28	OC42	0.75	2SC1678	1.25
BC148B	0.09	BD144	1.10	BF457	0.32	OC44	0.75	2SC1909	1.45
BC149	0.09	BD150C	0.29	BF458	0.36	OC45	0.55	2SC1945	2.65
BC153	0.30	BD159	0.65	BF467	0.66	OC70	0.45	2SC1953	0.95
BC157	0.12	BD160	1.50	BF595	0.23	OC71	0.55	2SC1957	0.80
BC158	0.09	BD166	0.55	BF597	0.25	OC75	0.95	2SC1969	1.95
BC159	0.09	BD179	0.72	BFR39	0.23	OC81	0.50	2SC2028	1.15
BC161	0.28	BD182	0.70	BFR40	0.23	OC16W	2.50	2SC2029	1.95
BC170B	0.15	BD201	0.83	BFR81	0.25	R2008B	1.45	2SC2078	1.45
BC171	0.09	BD202	0.65	BFR88	0.30	R2010B	1.45	2SC2091	0.55
BC171A	0.10	BD203	0.78	BFR90	1.50	R2322	0.55	2SC2098	2.95
BC171B	0.10	BD204	0.70	BFR91	1.75	R2323	0.66	2SC2166	1.95
BC172	0.10	BD222	0.46	BFT42	0.35	R2540	2.45	2SC2314	0.80
BC172B	0.10	BD223	0.59	BFT43	0.35	RCA16334	0.90	2SC2371	0.36
BC172C	0.10	BD225	0.48	BFW61	0.60	RCA16335	0.90	2SC931D	0.95
BC173B	0.10	BC232	0.35	BFW92	0.65	S2060D	0.95	1SD234	0.50
BC174	0.09	BD233	0.35	BFX29	0.30	SKE5F	1.45	2SD325E	1.65
BC174A	0.09	BD234	0.35	BFX84	0.26	TIP29	0.40	3N211	1.95
BC177	0.15	BD236	0.49	BFX85	0.32	TIP29C	0.42	3SK88	0.55
BC178	0.15	BD237	0.40	BFX86	0.30	TIP30C	0.43		
						TIP31C	0.55		

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CME822GH	25.00	D14-320GH/82	55.00	M28-132GM	55.00	V4274GH	55.00
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CME202GH	45.00	D16-100GH/79	69.00	M31-184W	55.00	V6007DP31	59.00
CME2024W	45.00	D16-100GH79A	75.00	M31-184GH	55.00	V6007GW	55.00
CME2325W	45.00	D16-100GH97	55.00	M31-184P31	55.00	V6008GH	59.00
CME3126GH	45.00	D18-160GH	69.00	M31-185GH/VR	69.00	V6008W	55.00
CME3128GH	45.00	D21-10GH	55.00	M31-186W	69.00	V6034WA	59.00
CME3128W	45.00	D21-10GJ	59.00	M31-190GH	55.00	V604CLA	59.00
CME3132GH	45.00	D21-10LD	59.00	M31-190GR	55.00	V6048F	55.00
CME3155W	45.00	DB7.36	35.00	M31-190LA	55.00	V6048J	49.00
CRE1400	25.00	DB7.36	55.00	M31-190W	59.00	V6052GH	55.00
CV429	69.00	DG7.5	55.00	M31-191GH	59.00	V6052GR	55.00
CV1450	35.00	DG7.32	45.00	M31-191GR	59.00	V6064BLA	55.00
CV1526	19.00	DH3.91	55.00	M31-191GV	55.00	V6064BP31	55.00
CV2185	15.00	DH7.91	45.00	M31-191W	59.00	V6064CLA	55.00
CV2191	19.00	DP7.5	35.00	M31-192W	59.00	V6069GH	55.00
CV2193	15.00	DP7.6	35.00	M31-195GH	59.00	V6070P31	49.00
CV5119	85.00	DN13.78	35.00	M31-210GH	59.00	V7016A	55.00
CV5320	85.00	F15-101LC	49.00	M31-220W	59.00	V7030	59.00
CVX389	55.00	F16-101GM	55.00	M31-270GY	55.00	V7031GH	59.00
D9-110GH	39.50	F16-101LD	55.00	M31-271P31	55.00	V7031/67A	59.00
D9-120	45.00	F21-130GR	55.00	M31-271GW	55.00	V7035A	49.00
D10-210GH	45.00	F21-130LC	55.00	M31-271W	55.00	V7037GH	45.00
D10-210GH68B	55.00	F21-131GR	79.00	M36-12W	75.00	V8004GR	55.00
D10-210GH72	55.00	F31-10GM	55.00	M36-141LA	75.00	V8006GH	55.00
D10-230GH	35.00	F31-10GR	55.00	M36-141LG	75.00	V8010A	55.00
D10-230GM	35.00	F31-10LC	55.00	M36-141W	75.00	2BP1	9.00
D10/293GY/90	55.00	F31-10LD	55.00	M36-170LG	75.00	3BP1	13.50
D13-30GH	49.50	F31-12LC	55.00	M38-103GR	55.00	4EP1	30.00
D13-33GM	49.00	F31-12LD	55.00	M38-120W	55.00	3H/OBM	55.00
D13-47GH/26	55.00	F31-13GR	55.00	M38-120WA	55.00	3WP1	18.50
D13-47GH/34	55.00	F31-13LD	55.00	M38-121GR	55.00	5BP1	9.00
D13-47GH	55.00	F31-13LG	55.00	M38-121GHR	55.00	5BHP1	30.00
D13-51GL/26	55.00	F41-123LC	150.00	M38-121LA	55.00	5BHP1FF	30.00
D13-51GM/26	55.00	F41-141LG	150.00	M38-121WA	55.00	5BHP31	30.00
D13-450GH/01	55.00	F41-142LC	185.00	M38-122GW	55.00	5CP1	10.00
D13-471GH/26	55.00	M7-120W	19.00	M38-140LA	55.00	6EP7/S	39.00
D13-550GH	55.00	M14-100GM	45.00	M38-141LA	55.00	13BP1	13.50
D13-600GM	59.00	M14-100KA	55.00	M38-142GR	55.00	13BP4	17.50
D13-610GH	59.00	M14.100LC	45.00	M38-142LA	55.00	17DWP4	25.00
D13-610GM	59.00	M17-151GVR	175.00	M38-340P31	55.00	32J/1085	69.00
D13-611GH	59.00	M17-151GR	175.00	M38-341GR	55.00	88D/88B/89D/89L	15.00
D13-611GM	59.00	M19-100GY	55.00	M38-341P31	55.00	1273	39.00
D13-630GH	59.00	M19-101GR	55.00	M38-344P39	55.00	1564	39.00
D14-120GH08	65.00	M19-103W	55.00	M40-120W	59.00	1844	45.00
D14-150GH	75.00	M23-110GH	55.00	M43-12GM/01	55.00	55451GM	75.00
D14-150GM	75.00	M23-111W	55.00	M43-12LG/01	55.00	9442E1	80.00
D14-172GH/84	59.00	M23-111GH	55.00	M44-120LC	55.00	95447GM	75.00
D14-172GR	55.00	M23-112GM	55.00	M44-120GR	55.00	95449	75.00
D14-172GV	55.00	M23-112GV	55.00	M47-25GR/22	55.00	7709631	79.50
D14-173GH	55.00	M23-112GW	55.00	M50-120GH	55.00		
D14-173GM	53.00	M23-112KA	55.00	M50-120GR	55.00		
D14-173GR	55.00	M23-112LD	55.00	M50-120GV	55.00		
D14-181GH/62	55.00	M23-112W	55.00	M50-120LC	55.00		
D14-181GH/98	55.00	M24-120GM	59.00	M61-120LC	75.00		
D14-181GJ	55.00	M24-120GR	59.00	M61-120W	75.00		
D14-181GM	53.00	M24-120LC	59.00	S6AB	45.00		
D14-181GM50	59.00	M24-120WAR	59.00	SE4/D-P7	45.00		
D14-182GH	59.00	M24-121GH	55.00	SE42BP31AL	55.00		
D14-182GM/98	65.00	M24-121LC	59.00	SE42BP31	55.00		
D14-200BE	89.00	M24-121WA	59.00	SE52AP31AL	55.00		
D14-200GA/50	85.00	M28-12GH	55.00	SE5Fp31	55.00		
D14-200GM	75.00	M28-12LC	55.00	T937	55.00		
D14-210GH	75.00	M28-13LC	49.00	T948N	55.00		
				T948H	55.00		

TAPE HEADS

Mono Head	1.50
Auto Reverse	3.50
Stereo Head	2.95

ELECTRO-OPTICAL

9677M	22.00
P4231BAM	19.00
XP1002	29.00
XP1117M	24.00
XP42040	35.00
9524H	25.00

DIODES

AA119	0.08	BY210-800	0.33	1N23B	2.95
BA115	0.13	BY223	0.90	1N23C	2.95
BA145	0.15	BY298-400	0.22	1N23ER	2.95
BA148	0.17	BY299-800	0.22	1N23WE	2.95
BA154	0.06	BYX10	0.20	IN4001	0.04
BA156	0.15	BYX36-150R		IN4003	0.04
BA157	0.30		0.20	IN4004	0.05
BAX13	0.04	BYX38-600R		IN4005	0.05
BAX16	0.06		0.60	IN4007	0.06
BB105B	0.30	BYX55-600	0.30	IN4148	0.02
BT151	0.79	BYX71-600	1.10	IN4448	0.10
BY126	0.10	BZX61	0.15	IN5401	0.12
BY127	0.11	BZY88	0.10	IN5402	0.14
BY133	0.15	BZY95C30	0.35	IN5403	0.12
BY164	0.45	CS4B	4.50	IN5406	0.13
BY176	1.20	CS10B	8.45	IN5407	0.15
BY179	0.63	OA47	0.09	IN5408	0.16
BY182	0.55	OA90	0.05	ITT44	0.04
BY184	0.35	OA91	0.06	ITT923	0.15
BY199	0.40	OA95	0.06	ITT2002	0.10
BY206	0.14	OA202	0.10		
BY208-800	0.33	1N21DR	2.95		

BASES

B5D	5.50
B7G	0.25
B7G SKTD	0.25
B8G	0.35
B8H	0.70
B9A	1.50
B9ASKTD	0.40
B9G	0.75
B10B	0.30
B13B	0.60
B14A	3.00
12 Pin CRT	
	0.95
Nuvistor	2.95
Octal	0.35
SK610	35.00
UX5	1.75
UX7	1.75
Valve Can	0.30
8 Pin Dil	0.14
14 Pin Dil	0.15
16 Pin Dil	0.17
18 Pin Dil	0.18

WIREWOUND RESISTORS

4 Watt 2R4-10K	0.20
7 Watt R47-22K	0.20
11 Watt 1R5-15K	0.25
17 Watt 1R-15K	0.30

ZENER DIODES BZX61 0.15

6V2 7V5 8V2 9V1 10V
11V 12V 13V 15V 16V
18V 20V 22V 24V 27V
30V 33V 36V 39V 47V
51V 56V 68V 75V

THERMISTORS

VA1040	0.23
VA1056S	0.23
VA1104	0.70
VAT8650	0.46
VA1097	0.25

BZY88 0.07

2V7 3V 3V3 3V6 3V9
4V3 4V7 5V1 5V6 6V2
6V8 7V5 6V2 9V1 10V
11V 12V 13V 15V 18V
20V 24V 27V 30V

BATTERIES

7V Power Mike batteries TR175 £2.25 ea other prices on request

LINE OUTPUT TRANSFORMERS

DECCA 100	7.95
DECCA 1700 MONO	9.95
DECCA 1730	8.95
DECCA 2230	8.25
GEC 2040	8.95
GRUNDIG 1500	15.45
GRUNDIG 5010-6010 2222,5011-6011	13.45
ITT CVC20	8.20
ITT CVC30	8.25
PHILIPS G8	8.50
PHILIPS G9	8.99
PHILIPS G11	13.39
PYE 725	10.95
RBM T20A	12.40
TANDBERGE 90°	11.15
TELEFUNKEN 711A	11.15
THORN 1590	9.50
THORN 8000	9.20
THORN 9000	9.95
THORN 9800	22.40
THORN MAINS TRANSFORMER 3000/3500	9.70

SOLDERING EQUIPMENT

25W Antex Iron	4.59
Weller Instant Heat Gun	11.30
240V Weller Marsman	4.74
½ Kilo Solder 60/40	6.95

EHT MULTIPLIERS

ITT CVC20	6.35
ITT CVC30	6.35
PHILIPS G8 550	6.96
RANK T20A	6.91
THORN 3000/3500	7.57
THORN 8500	5.50
THORN 9000	8.00
UNIVERSAL TRIPLER	5.45

REPLACEMENT ELECTROLYTIC CAPACITORS

DECCA 30 (400-400/350V)	2.85
DECCA 80/100 (400/350V)	2.99
DECCA 1700 (200-200-400-350V)	3.55
GEC 2110 (600/300V)	2.25
ITT CVC20 (220/400V)	1.80
PHILIPS G8 (600/300V)	2.25
PHILIPS G9 (2200/63V)	1.19
PHILIPS G11 (470/250V)	2.35

POTENTIOMETERS

STANDARD VERTICAL POTS	0.12
MIN. VERTICAL POTS	0.12
STANDARD HORIZONTAL POTS	0.12
MIN. HORIZONTAL POTS	0.12
CONVERGENCE PRE-SETS	0.30
SLIDERS LOG	0.48
SLIDER LINEAR	0.48

SPARES & AIDS

FOAM CLEANSER	0.79
FREZE IT	0.82
SOLDA MOP	0.64
SWITCH CLEANER	0.79
WD40	1.25
PUSH PUSH MAINS SWITCH (DECCA, GEC, RANK, THORN ETC)	1.02
PYE IF GAIN MODULE	6.99
ANODE CAP (27KV)	0.69

PUSH BUTTON UNITS

DECCA, ITT, CVC20 6 WAY	7.95
ITT CVC5 7 WAY	10.19
PHILIPS G8 (550) 6 WAY	14.49

VARICAP TUNERS

ELC1043/05 MULLARD	8.65
ELC1043/06 MULLARD	8.65
U321	8.25
U322	8.25

20MM ANTI SURGE FUSES

100MA-800MA	15p each
1A-5AMP	12p each

20MM QUICK BLOW FUSES

100MA	8p each
200MA-5AMP	5p each

P.M. COMPONENTS LTD

PHONE 0474 813225 3 LINES

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A2900 11.50
A3042 24.00
A3283 24.00
AC/THI 4.00
ACT22 59.75
AC/S2PEN 8.50
AH221 39.00
AH238 39.00
AL80 6.00
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ARP12 0.70
ARP34 1.25
ARP35 2.00
ATP4 2.50
AX50 5.50
AZ11 4.50
AZ31 2.50
BL63 2.00
BS450 67.00
BS810 55.00
BS814 55.00
CIK 19.00
C3JA 21.00
C6A 9.00
C1112G 70.00
C1108 54.95
C1134 32.00
C1148A 115.00
C1149/1 130.00
C1150/1 135.00
C1534 32.00
CCA 2.50
CC3L 0.90
CL33 2.00
CV Nos Prices on request
D63 1.20
DA41 22.50
DA42 17.50
DA90 4.50
DA100 125.00
DAF91 0.45
DAF91 0.70
DAF96 1.00
DC70 1.75
DC90 1.20
DCX4-1000 12.00
DCX4-5000 25.00
DET16 28.50
DET18 28.50
DET23 35.00
DET24 39.00
DET25 22.00
DF91 0.70
DF92 0.50
DF96 0.65
DF97 1.00
DH63 1.20
DH77 0.90
DH79 0.56
DH149 2.00
DK91 0.90
DK92 1.20
DK96 2.50
DL35 2.50
DL63 1.00
DL70 2.50
DL73 2.50
DL91 1.50
DL92 0.95
DL93 1.10
DL94 2.50
DL96 2.50
DLS10 13.50
DLS16 10.00
DM70 1.95
DM160 2.75
DY51 1.50
DY86/87 0.65
DY802 0.72
E80CF 11.00
E80F 18.50
E81CC 3.15
E81L 12.00
E82CC 3.50
E83CC 3.50
E83F 5.50
E86C 9.50
E88C 7.95
E88CC 3.50
E88CC Siemans Special 5.95
E90CC 7.95
E90F 7.95
E91H 4.50
E92CC 3.95
E99F 6.90
E130L 19.95
E180CC 6.50
E182CC 9.00
E180F 6.50
E186F 8.50
E188CC 7.50
E280F 19.50
E283CC 10.00
E288CC 13.50
E55L 42.00
E810F 25.00
E1148 1.00
E1524 6.95
EA50 1.00
EA76 1.95
EA79 1.95
EAA91 0.50
EABC80 0.70
EAC91 2.50
EAF42 1.20
EAF801 2.00
EB34 1.50

EB41 3.95
EB91 0.85
EBC33 2.50
EBC41 1.95
EBC81 1.50
EBC90 0.90
EBC91 0.90
EB91 0.50
EBF80 0.65
EBF83 0.65
EBF85 0.95
EBF89 0.70
EBF93 0.95
EBL1 2.50
EBL21 2.00
EC52 0.75
EC70 1.75
EC80 9.50
EC81 7.95
EC86 1.00
EC88 1.00
EC90 1.10
EC91 5.50
EC92 1.75
EC93 1.50
EC95 7.00
EC97 1.10
EC8010 12.00
ECC32 3.50
ECC33 3.50
ECC35 3.50
ECC81 1.15
ECC81 Special quality 1.95
ECC82 0.55
ECC82 Mullard 1.50
ECC82 Philips 1.95
ECC83 0.65
ECC83 Brimar 1.35
ECC83 Philips 1.95
ECC84 0.50
ECC85 0.50
ECC86 2.75
ECC88 0.95
ECC91 2.00
ECC180 0.72
ECC189 0.78
ECC801S 3.50
ECC803S 3.50
ECC804 0.50
ECC2000 12.00
ECF80 1.15
ECF82 1.15
ECF86 2.25
ECF200 1.85
ECF202 1.85
ECF801 0.85
ECF804 6.00
ECF805 2.50
ECF806 10.25
ECH3 2.50
ECH4 3.00
ECH35 3.50
ECH42 1.00
ECH81 0.65
ECH83 0.78
ECH84 0.69
ECH2000 1.50
ECL80 0.50
ECL82 0.65
ECL81 0.55
ECL83 2.50
ECL84 0.74
ECL85 0.69
ECL86 0.80
ECL805 0.69
EF22 2.50
EF37A 2.00
EF39 1.10
EF41 3.50
EF42 3.50
EF50 2.50
EF55 4.95
EF70 1.20
EF71 1.50
EF72 1.20
EF73 1.00
EF80 0.55
EF83 3.50
EF85 0.50
EF86 2.25
EF86 Special quality 3.15
EF89 1.50
EF91 1.95
EF92 2.15
EF93 0.95
EF94 0.95
EF95 1.50
EF97 0.90
EF98 0.90
EF183 0.65
EF184 0.65
EF730 1.80
EF731 3.50
EF732 3.50
EF800 11.00
EF805S 13.50
EF812 0.65
EFL200 1.50
EH90 0.72
EK90 0.72
EL32 0.95
EL33 4.00
EL34 2.25
EL34 Mullard/Phillips 4.50
EL36 1.95
EL37 9.00
EL38 4.75
EL41 3.50
EL42 2.00
EL81 6.95
EL82 0.58
EL83 5.95
EL84 0.75
EL85 4.50
EL86 0.85
EL90 1.75

EL91 6.00
EL95 0.70
EL153 12.15
EL183E 3.50
EL183P 3.50
EL360 6.75
EL500 1.40
EL504 1.40
EL509 5.25
EL519 6.95
EL802 3.65
EL821 8.50
EL822 12.95
EM1 9.00
EM4 9.00
EM80 0.70
EM81 0.70
EM84 1.65
EM85 3.95
EM87 2.50
EN32 16.50
EN91 1.50
EN92 4.50
ESU150 14.95
ESU872 25.00
EY51 0.80
EY81 2.35
EY83 1.50
EY84 5.95
EY86/87 0.50
EY88 0.55
EY91 5.50
EY500A 1.50
EY802 0.70
EZ35 0.75
EZ40 2.75
EZ41 2.15
EZ80 0.75
EZ81 0.75
EZ90 1.50
F6064 2.95
FW4/800 2.95
G55/1K 9.00
G180/2M 9.00
G232 Mullard 3.95
G240/2D 9.00
GC10B 17.50
GC10D 17.50
GC10/4B 17.50
GC10/4E 17.50
GC12/4B 17.50
GD86W 6.00
GDT120M 5.00
GE10 9.00
GN4 6.00
GN10 15.00
GR10G 4.00
GS10C 16.50
GS10H 12.00
GS12D 12.00
GT1C 14.00
GT1C S/S 13.00
GTE175M 8.00
GTR150W 1.00
GU20 35.00
GXU1 13.50
GXU3 24.00
GXU50SS 14.50
GY501 1.20
GY802 1.00
GZ30 1.00
GZ31 1.00
GZ32 1.00
GZ33 4.50
GZ34 2.15
GZ37 4.50
HAA91 1.00
HABC80 0.90
HBC90 0.75
HBC91 0.80
HF93 0.75
HF94 1.50
HK90 1.06
HL2K 3.50
HL23DD 4.00
HL90 0.70
HL92 1.50
H133/DD 3.50
HR2 4.00
HY90 1.00
HVR2 3.00
K3118 86.00
KR6/3 45.00
KT8C 7.00
KT33C 3.50
KT36 2.00
KT44 4.00
KT45 4.00
KT61 4.00
KT63 2.00
KT66/CV1075 special yellow ssss pot 19.50
KT66 USA 9.95
KT66 GEC 14.95
KT77 Gold Lion 10.95
KT81 7.00
KT88 USA 10.95
KT88 Gold Lion 18.95
KTW61 2.50
KTW62 2.50
KTW63 2.00
KTZ63 2.50
L63 1.50
L102/2K 6.95
L120/2K 12.00
LB7-20 95.00
LS9B 6.95
M502A 60.00
M537A 50.00
M5143 165.00
M8079 6.00
M8082 7.50
M8083 3.25
M8091 7.50
M8096 3.00
M8098 5.50

M8099 5.00
M8100 5.50
M8136 7.00
M8137 5.50
M8161 6.50
M8162 5.50
M8163 5.50
M8190 4.50
M8195 6.50
M8196 5.50
M8204 5.50
M8223 4.50
M8224 2.00
M8225 3.50
ME1401 29.50
ME1402 29.50
ME1501 14.00
MH4 3.50
MHLD6 4.00
ML4 4.50
MS4B 5.50
MU14 1.50
N37 12.50
N78 9.85
OA2 0.85
OA2WA 1.50
OA3 2.50
OB2 0.85
OB2WA 1.25
OC2 2.50
OC3 1.50
OD3 1.70
OM4 1.00
OM5B 3.00
OM6 1.75
ORP43 2.50
ORP50 3.95
ORP93 12.00
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 0.50
PCF84 0.65
PCF86 1.20
PCF87 0.40
PCF200 1.80
PCF201 1.80
PCF800 0.40
PCF801 1.35
PCF802 0.50
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 54.95
QB5-1750 139.50
QBL5-3500 495.00
QEO3-10 3.50
QE08-200 £145.00
QF40 65.00
QP25 1.00
QQEO3-12 6.50
QQEO3-20 27.00

QQVO2-6 19.50
QQVO3-10 Mullard 15.00
QQV03-10 5.50
QQVO3-20A 25.00
QQVO3-20B 32.00
QQVO6-40A 27.50
QQVO7-50 63.50
QQZO3-20 42.50
QS75/20 1.50
QS75/40 3.00
QS92/1D 6.00
QS95/10 4.85
QS108/45 4.00
QS150/15 6.95
QS150/30 1.15
QS150/45 7.00
QS1200 3.95
QS1202 3.95
QS1203 4.15
QS1205 3.95
QS1206 3.95
QS1206 1.05
QS1207 0.90
QS1208 0.90
QS1209 3.15
QS1210 1.50
QS1211 1.50
QS1212 3.20
QS1213 5.00
QS1215 2.10
QS1218 5.00
QU37 9.50
QU37 11.50
QVO3-12 4.95
QVO5-25 1.75
QVO6-20 29.50
QV2-250C 45.00
QVO8-100 145.00
QY3-125 65.00
QY4-250 70.00
QY4-400 76.00
R10 4.00
R16 12.00
R17 1.50
R18 2.50
R19 2.50
R20 1.20
R1169 55.00
RG1-125 4.95
RG1-240A 14.50
RG3-250A 3.50
RG3-1250A 35.00
RK2K25 62.50
RK-20A 12.00
RL16 1.50
RPL16 12.00
RPY13 2.50
RPY43 2.50
RPY82 2.50
RR3-250 16.00
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
TD1-100A 25.00
TD03-10F 35.00
TD3-12 4.00
TP25 1.50
TSP4 7.00
TT11 1.50
TT15 34.95
TT21 45.00
TT22 45.00
TT100 57.00
TTR-31MR 65.00
TY2-125A 85.00
TY4-400 70.00
TY8-600W 365.00
TYS2/250 375.00
UL41 4.50
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 0.50
UCF80 1.00
UCH21 1.20
UCH41 2.50
UCH42 2.50
UCH81 0.65
UCL82 1.75
UF85 1.20
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6BN6 1.65
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6HS8 1.95
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6J6 0.65
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30FL1 1.00
30FL2 1.35
30FL12 0.95
30FL13 1.10
30FL14 1.25
30L1 0.45
30L15 0.50
30L17 0.80
30P4MR 1.00
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30P18 0.50
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30PL13 0.60
30PL14 1.75
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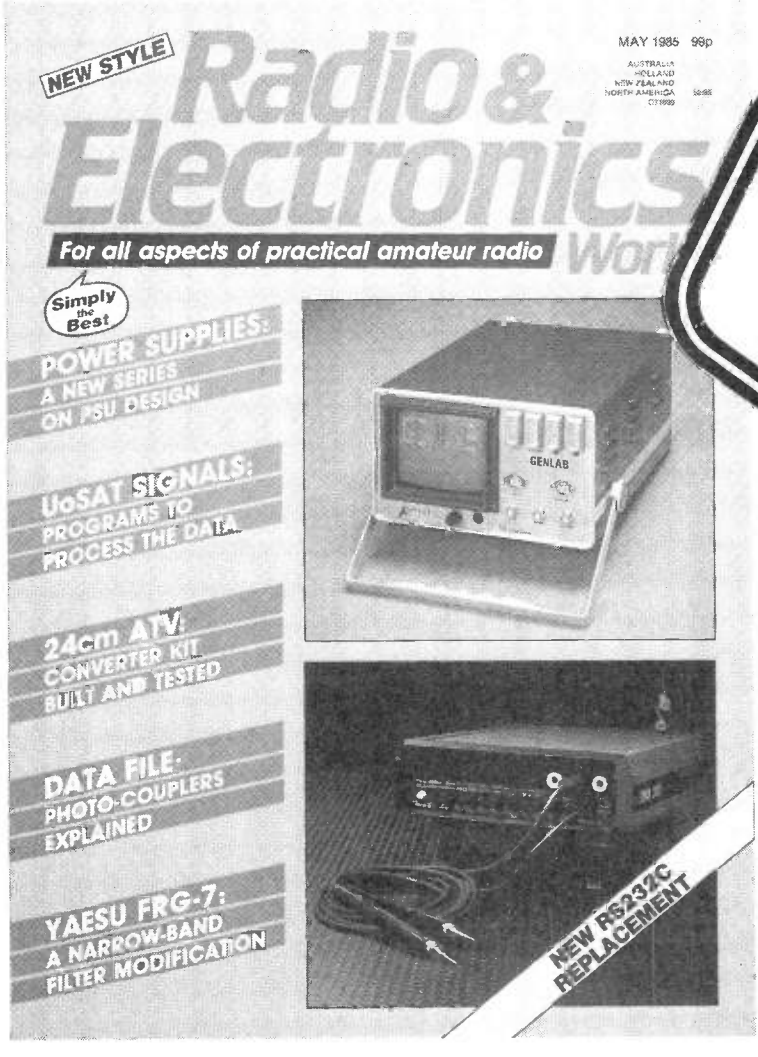

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UoSAT PROGRAMS

Tony Ferneyhough presents an impressive suite of programs for processing the signals from Oscar 9/11

```
L.
   10 REM UOSAT ON THE BEEB
   20 REM BY TREVOR STOCKHILL G4GPQ
   30 REM WITH MODIFICATIONS FOR STORAGE TO MEMORY
   40 REM BY TONY FERNEYHOUGH G8AVH
   90 *KEY2RUN|M
  100MODE3
  110*KEY1MODE3|M:FOR I=&2300 TO &3FFF:IF ?I>=&20 OR ?I=&0D OR ?I=&0A THEN PRINT
CHR$?I;:NEXTELSENEXT:|M
  120 REM:*KEY0PRINT"I|M
  130buffer=&2300
  140HIMEM=buffer
  150ON ERROR GOTO620
  160DIMCODE%100
  170count=&68
  180FORPASS%=0TO2STEP2
  190P%=CODE%
  200[OPT PASS%
  210.init  LDA fbuffer MOD 256
  220       STA count
  230       LDA fbuffer DIV 256
  240       STA count+1
  250.start JSR &FFE0
  260       BCC chaok
  270       CMP £&1B
  280       BED error
  290       JMP start
  300.chaok AND £&7F
  310       LDY £0
  320       STA (count),Y
  330       INC count
  340       BNE NOINC
  350       INC (count+1)
  360       TAX
  370       LDA £&40
  380       CMP count+1
  390       BED error
  400       TXA
  410.NOINC CMP £&0D
  420       BEQ print
  430       CMP £&0A
  440      BEQ exit
  450      CMP £&1F
  460      BPL print
  470      LDA £&7C
  480.print JSR &FFE3
  490.exit  JMP start
  500.error LDA £&7E
  510       JMP &FFF4
  520]
  530NEXT PASS%
  540*FX205,64
  550*FX7,3
  560*FX156,3,252
  570*FX156,2,252
  580*MOTOR1
  590*FX2,1
  600*FX156,1,252
  610CALL init
  620*FX2,0
  630*MOTOR0
  640*FX156,2,252
  650*FX205,0
```

OSCAR 11: This program is a modified version of G4GPQ's original work, with additional features to store data in memory, examine this data, and re-run the program when necessary

```
  4 REM:DATFIL PROGRAM
  5 REM:BY TONY FERNEYHOUGH G8AVH AUGUST 1984
 10 MODE7
 20 NAME=&6000:OS$="":X%=0:Y%=0
 30 VDU(12)
 40 ONERRORGOTO30
 50 PRINTTAB(9,5)"UOSAT2 DATA ON DISK"
 60 PRINTTAB(9,6)STRING$(19,"_")
 70 *INFO DAT*
 80 PRINTTAB(5,20)"Name of file";:INPUT F$
 90 PROC_CLI("*LOAD "+F$)
100 CHAIN"FRAME"
110 DEFPROC_CLI(OS$)
120 #NAME=OS$:Y%=NAME DIV 256:X%=NAME MOD 256
130 CALL &FFF7
140 ENDPROC
```

DATFIL: A menu styled program which extracts from the directory all files that have been saved with the prefix 'DATA'. This enables easy access to the next program

I have been a member of AMSAT-UK for some years and regularly use the various transponding satellites. Recently I have turned my interest towards the intriguing sounds produced by Oscar 9 and 11.

There are many software programs available *(note 1)* to aid calculations of orbital information for these satellites. From these predictions select times for suitable passes and listen on 144.825MHz using an FM receiver and steerable antenna (the antenna can be plane-polarised but circular polarisation is preferable with reasonable gain, ie 10dB or more).

The signal, as it appears over the horizon, will be very weak and it could be detected early on in the pass by using an SSB/CW receiver. This would help to make optimum use of the listening time, which could be as short as 1-3 minutes or as long as 10-12 minutes. With such short listening 'windows', time is of the essence. As the satellite increases in elevation the signal should become very strong (S6-S9) and the characteristic sound of transmitted data should be heard.

Depending on the actual data format the type of sound heard will vary: the type to be examined *(note 2)* can be checked and used with the aid of the accompanying programs. A short machine code program was produced *(note 3)* for use with the BBC Micro, which displays the raw data direct onto the screen as it is received. At this point it is advisable to vary the output level of the receiver until data of the required format is being reliably displayed. The next stage is to make a tape recording of the data, so that it can be used over and over again to ensure that the second program is performing correctly.

To make more use of the data, minor modifications must be made to the machine code program so that the data can be stored in memory and re-examined immediately. It is possible at this stage to save this sample of data onto disk or to discard it and examine further blocks for a better sample.

The first program to examine the 'captured' data takes the information for each of the 68 channels and individually performs a checksum. If the data for any channel is incomplete or incorrect, ie because of transient noises on the signal, a negative value is displayed (−1). This shows the relative success rate of correct data captured for a given frame.

The top line displays the satellite name followed by the date stamp of the pass (not fully functional at this stage). Below this the unchecked and the checksummed data is shown. It is now possible to save this checked data onto disk for use in the next three programs.

The second program extracts the data for channels 00-59 and is used in the telemetry calibration equations. The third and fourth programs use the information from channels 60-67 to provide the status points for the satellite. This is encoded data and must first be converted into binary before it can be used.

It should thus be possible to take the data from any suitable pass and interpret it within a few minutes of UoSAT-2 going below the horizon. The programs have been chained together so that going back and forth between screens presents no difficulty. Should you require it the results can be re-displayed quickly.

Hard copy subroutines have not been included, but these are relatively straightforward to include (it is possible just to use 'CTRL-B' and 'CTRL-C' for this, although it would be better to use VDU2 and VDU3).

Helpful

The programs have been extremely helpful in showing the state of the Oscar 11 satellite at almost any time of its pass. One problem that does occur during the retrieval of information from a spacecraft is that during the pass the various ground control stations must perform their duties (eg fresh information must be sent up/down to control the attitude of the magnetorquers, etc), so sometimes whole strings of garbage will appear on the screen. Also if whole orbit data is being transmitted, or individual messages displayed, the above programs will not perform correctly.

Additions to the program could be made to produce graphs/bar charts so that results obtained from a number of passes could give an even better representation of the state of the satellite and the progress that is actually being made by the various experiments.

The original machine code program

```
L.
   5 REM:PROGRAM TO DIPLAY FRAME OF DATA
   6 REM:AND EXCLUSIVE OR-ING EACH CHANNEL
   7 REM:BY TONY FERNEYHOUGH G8AVH
   8 REM:AUGUST 1984
  10*KEY0D.!M|NL.!M
  20DIM CD(70):U=1:L=0:NF=0:FI=0:NL=0
  30NL$=CHR$(&0A)+CHR$(&0D)
  50MODE3
  60S=FN_FIND(&2300,&1E)
  70 IF S>=&3F97 THEN PRINTTAB(0,23)"All data from this file has been examined.
Press 'D' to load different data file.";:GOTO910
  80NF=NF+1:E=FN_FIND(S+1,&1E)
  90@%=&03:PRINTTAB(0,1)"  Frame size ="E-S" bytes.   Frame No."NF;:IFE-S<>469
 THEN FI=FI+1:PRINTSPC(6)"Invalid frame(s)="FI:@%=&06
 100PRINT:PRINT
 110IFE-S<>469THENS=E:GOTO70
 120FOR T=S TO S+34
 130IFT=S+19THENPRINT"Date.";ELSEIFT=S+21ORT=S+23THENPRINT"/";
 140IFT=S+25THENPRINT"   Week.";
 150IFT=S+26THENPRINT"   Time.";ELSEIFT=S+28ORT=S+30THENPRINT"/";
 160IF ?T<>&0D AND T?1=&0ATHEN ?T=&0D AND T?1=&0A
 190IF ?T>=&30 OR ?T=&0D OR ?T=&0A THEN PRINTCHR$?T;ELSEPRINT" ";
 200NEXT:SD=S:S=E:?&3F97=&1E
 300CHAN%=0:FOR U=SD+35 TO SD+466 STEP 6
 310IF ?U=&0D THEN U=U+2:PRINTNL$;
 320 CD$=CHR$(?U)+CHR$(U?1)+CHR$(U?2)+CHR$(U?3)+CHR$(U?4)+CHR$(U?5)
 350CHAN%=CHAN%+1:CD(CHAN%)=FN_CHECKSUM(CD$,CHAN%)
 360PRINTCD$;" ";
 370NEXT:PRINT:PRINTTAB(0,12)"The data below is correct for each channel,-1 ind
icates invalid data.":PRINT
 380 @%=&06:FORNL=0TO60STEP10
 390FOR L=1+NL TO 10+NL:IF CD(L)=-1 THEN PRINT CD(L);ELSE IFL>=61THENPRINT~CD(L
);ELSE PRINTCD(L) AND &FFF;
 400NEXT:PRINTNL$;:NEXT
 900PRINT:PRINTTAB(0,22)"Print next block (P) save data to disk (S) or run tele
m program (T).";:PRINT
 910Y$=INKEY$(20)
 920IFY$="P"THEN CHAN%=0:GOTO80
 930IFY$="S" THEN PROC_SAVE
 940IFY$="T"THEN CHAIN"TELEM"
 950IFY$="D"THEN CHAIN"DATFIL"
 960GOTO910
1000DEFFN_FIND(START,CHAR)
1010LOCALJ
1020J=START
1040REPEAT
1050J=J+1
1060UNTIL?J=CHAR
1070=J
1100DEFFN_CHECKSUM(D$,V%)
1110LOCALCS,TC,I,F,C$,AS$
1120CS=0:TC=0:I=0:F=0
1140REPEAT:I=I+1
1145 IF V%<=60 THEN AS$="" ELSE AS$="&"
1150C$=MID$(D$,I,1)
1160IFV%<=60 THEN PROC_DECIMAL ELSE IF I>2 THEN PROC_HEX ELSE PROC_DECIMAL
1170UNTILI=50RF=1
1180C$=MID$(D$,6,1):IF NOT((C$>="0" AND C$<="9") OR (C$>="A" AND C$<="F"))THEN
=-1
1190IFTC=EVAL("&"+MID$(D$,6,1))ANDF=0THEN=EVAL(AS$+MID$(D$,3,3))ELSE=-1
1200DEFPROC_SAVE
1210E%=OPENOUT "NDATA"
1230FOR CHAN%=1 TO 70
1240PRINT£E%,CD(CHAN%)
1250NEXT
1260CLOSE£E%
1270ENDPROC
1300DEFPROC_HEX
1310IF (C$>="0" AND C$<="9") OR (C$>="A" AND C$<="F") THEN CS=EVAL("&"+C$):TC=T
C EOR CS  ELSE F=1
1320ENDPROC
1330DEFPROC_DECIMAL
1340IF (C$>="0" AND C$<="9") THEN CS=EVAL(C$):TC=TC EOR CS  ELSE F=1
1350ENDPROC
```

FRAME: This takes and examines the data selected and stored in memory, and prints out a correct-sized frame plus the channels after they have been exclusive or-ed

```
L.
   4 REM.TELEMETRY CALIBRATION PROGRAM
   5 REM:BY TONY FERNEYHOUGH G8AVH AUGUST 1984
   6 *KEY0MODE3!ML.!N!M
  10MODE0:N=70:DIM CD(N):IK$="1":SD=0:TD=0
  20PROC_LOAD
  30T1=27:T2=40:T3=68
  40 VDU23,240,28,99,99,28,0,0,0,0
 100N=0:@%=&020208:VDU(12)
 110PROC_TITLE
 130 PRINT"00  Solar array current -Y"TAB(T1)1.9*(516-CD(1))"mA."TAB(T2)"20  So
lar array current -X"TAB(T3)1.9*(516-CD(21))"mA."
 140 PRINT"01  Nav mag X axis"TAB(T1)0.1485*CD(2)-68"uT."TAB(T2)"21  +10V  line
 current"TAB(T3)0.97*CD(22)"mA."
 150 PRINT"02  Nav mag Z axis"TAB(T1)0.1523*CD(3)-69.3"uT."TAB(T2)"22  PCM volt
age +10V"TAB(T3)0.015*CD(23)"V."
 160 PRINT"03  Nav mag Y axis"TAB(T1)0.1507*CD(4)-69"uT."TAB(T2)"23  P/W logic
 curr.(+5V)"TAB(T3)0.14*CD(24)"mA."
 170 PRINT"04  Sun sensor £1"TAB(T1)CD(5)TAB(T2)"24  P/W Geiger curr.(+14V)"TAB
(T3)0.21*CD(25)"mA."
 180 PRINT"05  Sun sensor £2"TAB(T1)CD(6)TAB(T2)"25  P/W Elec sp.curr.(+10V)"TA
B(T3)0.096*CD(26)"mA."
 190 PRINT"06  Sun sensor £3"TAB(T1)CD(7)TAB(T2)"26  P/W Elec sp.curr.(-10V)"TA
B(T3)0.93*CD(27)"mA."
 200 PRINT"07  Sun sensor £4"TAB(T1)CD(8)TAB(T2)"27  Facet temp -X"TAB(T3)(480-
CD(28))/5CHR$(240)"C."
 210 PRINT"08  Sun sensor £5"TAB(T1)CD(9)TAB(T2)"28  Facet temp -Y"TAB(T3)(480-
CD(29))/5CHR$(240)"C."
 220 PRINT"09  Sun sensor £6"TAB(T1)CD(10)TAB(T2)"29  Facet temp -Z"TAB(T3)(480
-CD(30))/5CHR$(240)"C."
 240PRINTTAB(0,15)"10  Solar array curr. +Y"TAB(T1)1.9*(516-CD(11))"mA."TAB(T2)
"30  Solar array curr. +X"TAB(T3)1.9*(516-CD(31))"mA."
 250 PRINT"11  Nav mag (Wing) temp"TAB(T1)(330-CD(12))/3.45CHR$(240)"C."TAB(T2)
"31  -10V line current"TAB(T3)0.48*CD(32)"mA."
 260 PRINT"12  Horizon sensor"TAB(T1)CD(13)TAB(T2)"32  PCM voltage -10V"TAB(T3)
0.036*CD(33)"V."
 270PRINT"13  Spare   (tbd)"TAB(T1)CD(14)TAB(T2)"33  1802 comp curr.(+10V)"TAB(
T3)0.21*CD(34)"mA."
 280PRINT"14  DCE RAMUNIT current"TAB(T1)(CD(15)-70.4)/6.7"mA."TAB(T2)"34  Digi
talker curr.(+5V)"TAB(T3)0.13*CD(35)"mA."
```

```
 290PRINT"15  DCE CPU current"TAB(T1)(CD(16)-18
acon power O/P"TAB(T3)(2.5*CD(36))-275"mW."
 300PRINT"16  DCE GMEM current"TAB(T1)(CD(17)-1
beacon curr."TAB(T3)0.22*CD(37)"mA."
 310PRINT"17  Facet temp +X"TAB(T1)(480-CD(18))
z beacon temp."TAB(T3)(480-CD(38))/5CHR$(240)"C.
 320PRINT"18  Facet temp +Y"TAB(T1)(480-CD(19))
Decoder temp(+Y)"TAB(T3)(480-CD(39))/5CHR$(240)
 330PRINT"19  Facet temp +Z"TAB(T1)(480-CD(20))
etry temp(+X)"TAB(T3)(480-CD(49))/5CHR$(240)"C."
 335@%=0:PRINTTAB(0,26)"The data for channels "
 340FORN=1TO40:IFCD(N)=-1THENSD=CD(N):PRINT N-1
 345PRINT"is invalid"
 350@%=&020208
 360IFSD=0THENPRINTTAB(0,26)STRING$(60," ")
 370GOTO700
 400VDU12:PROC_TITLE
 410PRINT"40  Solar array volts(+30V)"TAB(T1)(0
 420PRINT"41  +5V line curr."TAB(T1)0.97*CD(42)
 430PRINT"42  PCM volts +5V"TAB(T1)0.0084*CD(43
 440PRINT"43  DSR curr.(+5V)"TAB(T1)0.21*CD(44)
 450PRINT"44  Command RX curr."TAB(T1)0.92*CD(4
 460PRINT"45  435Mhz beacon pwr o/p"TAB(T1)(2.5
 470PRINT"46  435Mhz beacon curr."TAB(T1)0.44*C
 480 PRINT"47  435Mhz beacon temp."TAB(T1)(480-
 490PRINT"48  P/W temp. (-X)"TAB(T1)(480-CD(49)
 500PRINT"49  BCR temp.(-Y)"TAB(T1)(480-CD(50))
 510PRINTTAB(0,15)"50  Batt. ch/disch. curr."TA
 520PRINT"51  +14V line curr."TAB(T1)CD(52)
 530PRINT"52  Batt. volts(+14V)"TAB(T1)0.021*CD
 540PRINT"53  Batt. cell volts (MUX)"TAB(T1)CD(
 550PRINT"54  Telem. curr.(+10v)"TAB(T1)0.02*CD
 560PRINT"55  2.4GHz beacon pwr o/p"TAB(T1)((CD
 570PRINT"56  2.4GHz beacon curr."TAB(T1)0.45*C
 580PRINT"57  Battery temp."TAB(T1)(480-CD(58))
 590PRINT"58  2.4GHz beacon temp."TAB(T1)(480-C
 600PRINT"59  CCD imager temp."TAB(T1)(480-CD(6
 610@%=0:PRINTTAB(0,26)"The data for channels "
 620FORN=41TO60:IFCD(N)=-1THENTD=CD(N):PRINT N-
 630 NEXT ELSE NEXT
 640PRINT"is invalid"
 650IFTD=0THENPRINTTAB(0,26)STRING$(60," ")
 700 REM:
 710PRINTTAB(0,27)"Press (D) for 'DATFIL'  or (
)+CHR$(&0D)"   or (1) for page 1 or (2) for page
 720 IK$=INKEY$(20)
 730IF IK$="D" THEN CHAIN"DATFIL"
 740IF IK$="2" THEN 400
 750IF IK$="1" THEN 100
 760 IF IK$="S" THEN CHAIN"STAT1"
 770 GOTO720
 900DEFPROC_TITLE
 905PRINT:PRINT
 910PRINT"Chan."TAB(12)"Name"TAB(31)"Value.";:I
AB(52)"Name."TAB(72)"Value.";
 920MOVE0,910:DRAW640,910:PRINT:IFIK$="1"THENMO
 930MOVE0,560:DRAW640,560:PRINT:IFIK$="1"THENMO
 940 MOVE0,200:DRAW640,200:IFIK$="1"THENMOVE640
 950ENDPROC
1000DEFPROC_LOAD
1020E%=OPENIN "NDATA"
1040FORCHAN%=1 TO 70
1050INPUT£E%,CD(CHAN%)
1060NEXT
1070CLOSE£E%
1080ENDPROC
10000 VDU23,241,0,0,17,17,17,17,47,64,0
>
```

TELEM: This displays the telemetry calibration channels

```
   4 REM:STATUS PROGRAM PART 1.
   5 REM:BY TONY FERNEYHOUGH G8AVH AUGUST 1984
   6 *KEY0MODE3!ML.!N!M
  10 DIM CD(70),D$(10),H$(15),SP$(30),SA$(48,2)
  15 PRINTSP$(L)" ";
  20 @%=0:J=0:T1=42
  30 MODE0
  40 FORK=0TO9:H$(K)=CHR$(K+48):NEXT:FORK=10TO1
  50 PROC_LOAD
  60  FOR SON =1 TO 48:FOR SOFF=0 TO 1:READ SA$
 100 PRINT
 110 FORI=61TO70:PROC_DECHEX:NEXT
 120FOR J=0 TO9
 130 FOR T=1 TO 3
 140 PROC_HEXBIN
 150 REM:PRINTSP$(L)" ";
 160 L=L+1:NEXT:NEXT
 170PRINTSPC(25)"UOSAT-2 Status Points."
 180 PRINT"No."SPC(10)"Item"SPC(17)"State"SPC(3)
"
 190 V=0:FOR COL=1 TO 12:FOR ROW=1 TO 4:V=V+1:S
XT:NEXT
 200 PRINT" 1 145Mhz Gen.Beacon power"TAB(T1)"25
 210 PRINT" 2 435Mhz Eng.Beacon power"TAB(T1)"26
 220 PRINT" 3 2401 Mhz Eng.Beacon power"TAB(T1)"
 230 PRINT" 4 Telem.chan.mode select"TAB(T1)"28"
 240 PRINT" 5 Telem.chan.dwell adr.load"TAB(T1)"
"
 250 PRINT" 6 Telem.chan.dwell addr.source"TAB(T
0"
 260 PRINT" 7 Primary      power"TAB(T1)"31 Expt
 270 PRINT" 8"SPC(14)"error count bit 1"TAB(T1)"
 280 PRINT" 9"SPC(14)"error count bit 2"TAB(T1)"
 290 PRINT"10 Spacecraft   bootstrap"TAB(T1)"34
 300 PRINT"11"SPC(14)"error count bit 3"TAB(T1)"
 310 PRINT"12 Computer     bootstrap"TAB(T1)"36
 320 PRINT"13 Gravity"SPC(11)"pyros"TAB(T1)"37 E
 330 PRINT"14 Gradient"SPC(10)"pyros"TAB(T1)"38
 340 PRINT"15"TAB(T1)"39 DCE"SPC(6)"power"
 350 PRINT"16 Boom"TAB(T1)"40"
 360 PRINT"17 Deployment"TAB(T1)"41"SPC(10)"PROM
 370 PRINT"18 Attitude"TAB(T1)"42 Expt."SPC(4)"C
 380 PRINT"19"SPC(22)"-X"TAB(T1)"43 Nav.magneto
 390 PRINT"20 Control"SPC(14)"-Y"TAB(T1)"44 Spac
 400 PRINT"21"SPC(22)"-Z"TAB(T1)"45 Status calib
 410 PRINT"22 Magnetorquers"TAB(T1)"46 BCR statu
 415 PRINT"23 435 Mhz PSK mode"TAB(T1)"47 435 Mh
 420 PRINT"24 2401 Mhz PSK mode"TAB(T1)"48 2401
 430 N=5:X=250:Y=430:PROC_BRAK:N=6:X=220:Y=592:P
RAK:N=5:X=850:Y=745:PROC_BRAK:N=3:X=900:Y=540:PRO
K
 440 K=1:PROC_VALUE
 460 PRINT
```

```
B(T1)(CD(16)-187.1)/2"mA."TAB(T2)"35  145Mhz be
)-275"mW."
AB(T1)(CD(17)-121.3)/2.1"mA."TAB(T2)"36  145Mhz
mA."
T1)(480-CD(18))/5CHR$(240)"C."TAB(T2)"37  145Mh
)/5CHR$(240)"C."
T1)(480-CD(19))/5CHR$(240)"C."TAB(T2)"38  Comm.
39))/5CHR$(240)"C."
T1)(480-CD(20))/5CHR$(240)"C."TAB(T2)"39  Telem
/5CHR$(240)"C."
 for channels ";
CD(N):PRINT N-1" ";:NEXT ELSE NEXT


NG$(60," ")


+30V)"TAB(T1)(0.1*CD(41))-51.6"V."
(T1)0.97*CD(42)"mA."
T1)0.0084*CD(43)"V."
(T1)0.21*CD(44)"mA."
AB(T1)0.92*CD(45)"mA."
o/p"TAB(T1)(2.5*CD(46))-200"mW."
."TAB(T1)0.44*CD(47)"mA."
."TAB(T1)(480-CD(48))/5CHR$(240)"C."
(T1)(480-CD(49))/5CHR$(240)"C."
T1)(480-CD(50))/5CHR$(240)"C."
disch. curr."TAB(T1)8.8*(CD(51)-513)"mA."
B(T1)CD(52)
TAB(T1)0.021*CD(53)"V"
MUX)"TAB(T1)CD(54)
"TAB(T1)0.02*CD(55)"mA."
o/p"TAB(T1)((CD(56)+50)^2)/480"mW."
."TAB(T1)0.45*CD(57)"mA."
T1)(480-CD(58))/5CHR$(240)"C."
."TAB(T1)(480-CD(59))/5CHR$(240)"C."
AB(T1)(480-CD(60))/5CHR$(240)"C."
 for channels ";
=CD(N):PRINT N-1" ";


NG$(60," ")


 'DATFIL'  or (S) for 'STAT1' programs"CHR$(&0A
or (2) for page 2. ";

"


"



(31)"Value.";:IFIK$="1"THENPRINTTAB(T2)"Chan."T


IFIK$="1"THENMOVE640,910:DRAW1400,910
IFIK$="1"THENMOVE640,560:DRAW1400,560
="1"THENMOVE640,200:DRAW1400,200



7,64,0
```

ration channels 00 to 59 with all pertinent values inserted

```
VH AUGUST 1984

$(30),SA$(48,2),S(48):L=1


NEXT:FORK=10TO15:H$(K)=CHR$(K+55):NEXT

0 TO 1:READ SA$(SON,SOFF):NEXT:NEXT

T



Points."
17)"State"SPC(3)"No."SPC(10)"Item"SPC(15)"State

=1 TO 4:V=V+1:S(V)=VAL(MID$(SP$(COL),ROW,1)):NE

power"TAB(T1)"25 Attitude Ctl.Magnetorquers"
power"TAB(T1)"26 Digitalker expt power"
n power"TAB(T1)"27 CCD          power"
lect"TAB(T1)"28"SPC(11)"integ.period bit 0"
dr.load"TAB(T1)"29 Camera     integ.period bit 1

ddr.source"TAB(T1)"30"SPC(11)"Vid.amp.gain bit

"TAB(T1)"31 Expt"SPC(6)"vid.amp.gain bit 1"
t bit 1"TAB(T1)"32 DSR power"
t bit 2"TAB(T1)"33 DSR mode"
trap"TAB(T1)"34 DSR mode"
t bit 3"TAB(T1)"35 Radiation '     A EHT pwr"
trap"TAB(T1)"36 Detectors     B EHT pwr"
ros"TAB(T1)"37 Geiger         C EHT pwr"
yros"TAB(T1)"38 Electron spect.sensor EHT pwr"
(6)"power"

"41"SPC(10)"PROM select"
2 Expt."SPC(4)"CPU clock rate (Mhz)"
"43 Nav.magnetometer pwr"
"TAB(T1)"44 Space dust expt.pwr"
"45 Status calibrate"
T1)"46 BCR status"
AB(T1)"47 435 Mhz beacon mod.select"
TAB(T1)"48 2401 Mhz beacon mod.select"
=6:X=220:Y=592:PROC_BRAK:N=5:X=290:Y=270:PROC_B
:X=900:Y=540:PROC_BRAK:N=4:X=840:Y=385:PROC_BRA
```

```
 490 PRINTTAB(0,28)"Press (2) for next page or (D) for 'DATFIL' program"
 500 IK$=INKEY$(20)
 510 IF IK$="2" THEN CHAIN"SP2"
 520 IF IK$="D" THEN CHAIN"DATFIL"
 550 GOTO500
 900 DATA OFF,ON,OFF,ON,OFF,ON,RUN,DWELL,OFF,ON,GND,COMP,OFF,ON," 0"," 1"," 0",
" 1",PROM,UART," 0"," 1"," A"," B",SAFE,ARM,HOLD,FIRE,SAFE,ARM,HOLD,DEPL,EXTD,RE
TR,SAFE,ARM,ON,OFF,ON,OFF,ON,OFF,REV,FORW,NRZI,RZIC,NRZI,RZIC
 910 DATA HIGH,LOW,OFF,ON,OFF,ON," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1",OFF,ON
,READ,WRIT,RUN,RSET,OFF,ON,OFF,ON,OFF,ON,OFF,ON,OFF,ON,RSET,RUN," A"," B","0.9",
"1.8",OFF,ON,OFF,ON," "," "," 0"," 1",AFSK,PSK,AFSK,PSK
 990END
1000 DEFPROC_LOAD
1020 E%=OPENIN "NDATA"
1030 FORCHAN%=1TO 70
1040 INPUT£E%,CD(CHAN%)
1050 NEXT
1060 CLOSE£E%
1070 ENDPROC
1100 DEFPROC_DECHEX
1110 X=CD(I)
1120 D$(J)=H$((X AND 3840)/256)+H$((X AND 240)/16)+H$((X AND 15))
1130 J=J+1
1140 ENDPROC
1200 DEFPROC_HEXBIN
1210 TD$=MID$(D$(J),T,1)
1220 IFASC(TD$)>57THENTD$=STR$(ASC(TD$)-55)
1230 SP$(L)=STR$((VAL(TD$)ANDB)/B)+STR$((VAL(TD$)AND4)/4)+STR$((VAL(TD$)AND2)/2
)+STR$(VAL(TD$)AND1)
1250 ENDPROC
1300 DEFPROC_VALUE
1310 LOCAL T,I
1320 T=3:I=0
1330 FORI=K TOK+23:PRINTTAB(35,T);SA$(I,S(I));:PRINTTAB(75,T);SA$(I+24,S(I+24))
:T=T+1:NEXT
1340 ENDPROC
1400 DEFPROC_BRAK
1410 LOCAL M,I
1420 M=N/4
1430 MOVE(-30^3)/1500+X,-30*M+Y
1440 FORI=-30TO30STEP10:DRAW(I^3)/1500+X,I*M+Y:NEXT
1450 FORI=-30TO30STEP10:DRAW-(I^3)/1500+X,I*M+Y+60*M:NEXT
1460 ENDPROC
>
```

STAT 1 and SP2: These display all 96 status points interpolated from the data in channels 60 to 67

```
  4 REM:STATUS PROGRAM PART 2
  5 REM:BY TONY FERNEYHOUGH G8AVH AUGUST 1984
  6 *KEY0MODE3:ML.:N:M
  9 MODE 3
 10 DIM CD(70),D$(10),H$(15),SP$(30),SA$(48,2),S(48):L=1
 20 @%=0:J=0:T1=42
 30 MODE0
 40 FORK=0TO9:H$(K)=CHR$(K+48):NEXT:FORK=10TO15:H$(K)=CHR$(K+55):NEXT
 50 PROC_LOAD
 60  FOR SON =1 TO 48:FOR SOFF=0 TO 1:READ SA$(SON,SOFF):NEXT:NEXT
100 PRINT
110 FORI=61TO70:PROC_DECHEX:NEXT
120FOR J=0 TO9
130 FOR T=1 TO 3
140 PROC_HEXBIN
150 REM:PRINTSP$(L)" ";
160 L=L+1:NEXT:NEXT
170PRINTSPC(25)"UOSAT-2 Status Points."
180 PRINT"No."SPC(10)"Item"SPC(17)"State"SPC(3)"No."SPC(10)"Item"SPC(15)"State
"
190 V=0:FOR COL=13 TO 24:FOR ROW=1 TO 4:V=V+1:S(V)=VAL(MID$(SP$(COL),ROW,1)):N
EXT:NEXT
200 PRINT"49 Engineering data    bit 1"TAB(T1)"73 P/W channel plate ctl  bit 0
"
210 PRINT"50     -----"CHR$(34)"-----       bit 2"TAB(T1)"74      -----"CHR$34"--
---        bit 1"
220 PRINT"51     -----"CHR$(34)"-----       bit 3"TAB(T1)"75      -----"CHR$34"--
---        bit 2"
230 PRINT"52     -----"CHR$(34)"-----       bit 4"TAB(T1)"76 Space dust  (MSB)"
240 PRINT"53     -----"CHR$(34)"-----       bit 5"TAB(T1)"77  ---"CHR$34"---"
250 PRINT"54 Command Watchdog"TAB(T1)"78  ---"CHR$34"---"
260 PRINT"55 Command Watchdog reset"TAB(T1)"79  ---"CHR$34"---"
270 PRINT"56 145 MHz. Beacon Select"TAB(T1)"80  ---"CHR$34"---"
280 PRINT"57   -----"CHR$(34)"-----"TAB(T1)"81  ---"CHR$34"---"
290 PRINT"58    -----"CHR$(34)"-----"TAB(T1)"82  ---"CHR$34"---"
300 PRINT"59    -----"CHR$(34)"-----"TAB(T1)"83  ---"CHR$34"---    (LSB)"
310 PRINT"60    -----"CHR$(34)"-----"TAB(T1)"84 DSR write cycle complete"
320 PRINT"61    -----"CHR$(34)"-----"TAB(T1)"85 1802 CWD output"
330 PRINT"62 145 MHz beacon data rate"TAB(T1)"86 1802 Telemetry port  (MSB)"
340 PRINT"63     -----"CHR$34"-----"TAB(T1)"87   -----"CHR$34"-----"
350 PRINT"64 435 MHz beacon data rate"TAB(T1)"88   -----"CHR$34"-----"
360 PRINT"65     -----"CHR$34"-----"TAB(T1)"89   -----"CHR$34"-----"
370 PRINT"66     -----"CHR$34"-----"TAB(T1)"90   -----"CHR$34"-----"
380 PRINT"67 Particle/Wavecounter ctl"TAB(T1)"91   -----"CHR$34"-----"
390 PRINT"68 Beacon lockout latch"TAB(T1)"92   -----"CHR$34"-----"
400 PRINT"69 Engineering data      bit 6"TAB(T1)"93   -----"CHR$34"-----"
410 PRINT"70     -----"CHR$34"-----        bit 7"TAB(T1)"94   -----"CHR$34"----
-"
415 PRINT"71     -----"CHR$34"-----        bit 8"TAB(T1)"95   -----"CHR$34"----
-"
420 PRINT"72     -----"CHR$34"-----        bit 9"TAB(T1)"96   -----"CHR$34"----
-       (LSB)"
430K=1:PROC_VALUE
500 PRINTTAB(0,28)"Press (1) for page 1 or (D) for 'DATFIL' program"
510 IK$=INKEY$(20)
520 IF IK$="1" THEN CHAIN "STAT1"
530 IF IK$="D" THEN CHAIN "DATFIL"
550 GOTO510
900 DATA " 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1",DIS,ENAB," 0"," 1",
"   "," A","  "," B","  "," C","  "," D","  "," E","  "," F","  "," A","  "," B"
,"  "," A","  "," B","  "," C",CNT,RSET,ENAB,DIS," 0"," 1"," 0"," 1"," 0"," 1"
905DATA " 0"," 1"
910 DATA " 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"
," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"
," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 1"," 0"," 4"," 0"," 1"
915 DATA " 0"," 1"," 0"," 1"
990END
1000 DEFPROC_LOAD
1020 E%=OPENIN "NDATA"
1030 FORCHAN%=1TO 70
1040 INPUT£E%,CD(CHAN%)
1050 NEXT
1060 CLOSE£E%
1070 ENDPROC
```

```
1100 DEFPROC_DECHEX
1110 X=CD(I)
1120 D$(J)=H$((X AND 3840)/256)+H$((X AND 240)/16)+H$((X AND 15))
1130 J=J+1
1140 ENDPROC
1200 DEFPROC_HEXBIN
1210 TD$=MID$(D$(J),T,1)
1220 IFASC(TD$)>57THENTD$=STR$(ASC(TD$)-55)
1230 SP$(L)=STR$((VAL(TD$)ANDB)/B)+STR$((VAL(TD$)AND4)/4)+STR$((VAL(TD$)AND2)/2
)+STR$(VAL(TD$)AND1)
1250 ENDPROC
1300 DEFPROC_VALUE
1310 LOCAL T,I
1320 T=3:I=0
1330 FORI=K TOK+23:PRINTTAB(35,T);SA$(I,S(I));:PRINTTAB(75,T);SA$(I+24,S(I+24))
:T=T+1:NEXT
1340 ENDPROC
1400 DEFPROC_BRAK(N,X,Y)
1410 LOCAL M,I
1420 M=N/4
1430 MOVE(-30^3)/1500+X,-30*M+Y
1440 FORI=-30TO30STEP10:DRAW(I^3)/1500+X,I*M+Y:NEXT
1450 FORI=-30TO30STEP10:DRAW-(I^3)/1500+X,I*M+Y+60*M:NEXT
1460 ENDPROC
```

produced by Trevor Stockhill has been modified so that not only is the data displayed on the screen direct from the tape/receiver, but it is also stored in memory from 2300H to 2300+1CFF. This is because Mode 0 and Mode 3 use a considerable amount of memory. So after allowing workspace for the programs I decided that the values chosen were the maximum available unless different techniques were used to display the data (ie if the results were sent direct to the printer and not displayed on the screen at all then more memory would be available for storage of the received data). Having preferred to do things by the first method, it still gave me enough room to store sufficient data for processing up to 15 frames.

Enough information

At the moment I have only been able to recover up to about ten usable frames at any one time, but as this only represents about 1 minute of the pass, there is plenty of opportunity to get enough information from each pass to more than satisfy my needs.

A further modification has been made so that when the allocated memory space has been filled, by pressing function key f1 the data can be redisplayed to see how successfully that particular block was received and stored. If it is not to your liking then press f2 to re-run the program and repeat the above process until the best sample of data stored in memory is ready for saving to disk. To do this type ★SAVE "FILENAME" 2300+1CFF.

The listing for program 1 (DATFIL) can be used menu-style to select the particular data file that has previously been saved. This program makes use of the command line indicator facility of the Beeb, which enables a string to access the disk from within the program. I have chosen to use the word DATA plus the day of the month and the month as the name for each file saved to disk (ie DATA198 refers to data recorded and saved on the 19th of August). The selected file is then ★LOAD-ed into memory ready for use by program 2.

This program (FRAME) examines the memory starting at location 2300H looking for 1EH, and then counts up all the subsequent bytes until 1EH is encountered again (1E HEX is the first character/byte of the frame): if the count equals 469 bytes then that frame of data is displayed on the screen.

The 6 bytes associated with each channel are then exclusive-ored and the results printed out. If the data for any channel is corrupted or incorrect then the value of −1 is returned; thus it becomes quite evident if the data has been recorded successfully for this particular frame. If the results displayed are unsatisfactory then press 'P' and the next correct-length frame will be examined by the program. The top line keeps track of the frame size and the number of valid/invalid frames.

Once a suitable frame has been chosen press 'S' and this data is saved to disk as filename 'NDATA'. If 'R' is now pressed the screen clears and program 3 (TELEM) will run.

For ease of use and clarity this program has been divided into two parts, channels 00 to 39 filling one screen and channels 40 to 59 displayed on the next screen. I have called these page 1 and page 2, and moving from one to the other is possible. Channels that do not have unit values at present have no published formulae available but hopefully this will be put right before long. It seems that channel 13 may *not* be spare as indicated!

The final two programs process the data contained in channels 60 to 67 which need an extra stage of decoding before use can be made of them. The file 'NDATA' has all the results saved in decimal, so the first job is to convert these back to HEX. This is done by the procedure DECHEX at lines 1100-1140. The next stage is to convert the HEX into binary using procedure HEXBIN at lines 1200-1250.

Both processes are similar in function; each value is masked out to give the correct conversion at each stage. Comparison is made between the binary and the in-program data at lines 900-915 and stored in the array created in line 60. Because I have organised these programs this way a direct transfer from screen to paper is not suitable until I have added a full screen dump utility, but the end product so far has produced more than satisfying results.

Notes

Note 1. Satellite Tracking Software for the Radio Amateur by John Branegan C Eng, MIERE, GM4IHJ is available from AMSAT-UK, suitable for ZX81, BBC model B or the Spectrum. This software is on disk, tape or in book form with listings and descriptive explanations.

Note 2. UoSAT-2 Telemetry on the BBC Micro by Terry Weatherley G3WDI. *Radio and Electronics World,* December 1984.

Note 3. This machine code program was originally written by Trevor Stockhill G4GPQ and made available through AMSAT-UK and *Radio and Electronics World* (December 1984).

Note 4. Further information about UoSAT-1 and 2 can be obtained in the form of data sheets for the price of large SAE (A4 size) from: *University of Surrey, Department of Electronics and Electrical Engineering, Guildford, Surrey GU25XH.*

Finally, I wish to thank my sons, Michael and Stephen, whose time and patience with me on the finer points of the software helped to complete the project.

NB: Since this article was written the software has been updated, and is now menu-driven to make it easier to use. The improved version has been made available (on disk only) through *Timestep Electronics, Wickhambrook, Newmarket, Suffolk,* at £12.95 inclusive. NEW

```
 Frame size =467 bytes.   Frame No.=  1      Invalid frame(s)=  1


 Frame size =469 bytes.   Frame No.=  2

 UOSAT 2          Date.00/05/27   Week.3   Time.15/43/53

004994 01391A 023023 036050 040567 050432 060262 070557 080484 09037D
105224 11348F 120003 130673 142205 153698 16182C 17495E 184739 195481
205236 211893 226600 230001 240006 250007 261005 274643 284709 295187
303198 310376 32285E 335894 340007 35278B 363363 37439A 38498E 395179
408419 411224 426451 430007 44168F 450001 460002 475060 485180 494832
505536 51096B 52696E 537023 546777 550000 560003 575124 585080 595119
608248 615BD4 629E03 633341 644402 651D0F 66E00E 670001 68000E 69000F
The data below is correct for each channel,-1 indicates invalid data.

  499   391   302   605    56    43    26    55    48    37
  522   348     0    67   220   369   182   495   473   548
  523   189   660     0     0     0   100   464   470   518
  319    37   285   589     0   278   336   439   498   517
  841   122   645     0   168     0     0   506   518   483
  553    96   696   702   677     0     0   512   508   511
  824   5BD   9E0   334   440   1D0   E00     0     0     0

Print next block (P) save data to disk (S) or run telem program (T).
```

Screen dump after running FRAME

UoSAT 2 SATELLITE

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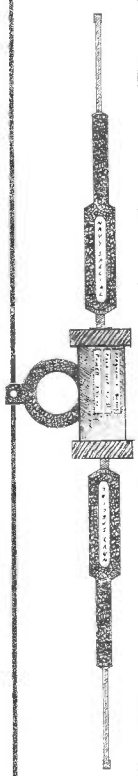

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TV RECEPTION

Combining low-level TV signals to make them usable

by Ivor Nathan

In fringe areas, good television reception is dependent upon a well-sited, efficient aerial that is directed at the group of four transmitters providing the best local signals. The aerial must also be placed so that all four channels are resolved as equally as possible.

Because of this optimum positioning it is most unlikely that the same aerial can be used for DX reception unless it is either of the rotary type or if the site happens to be about central to adjacent fringe areas. This can, in effect, be useful because it means that any low-level signals reaching the site will not be swamped by adjacent-channel strong signals which provide the main service.

With this in mind, and dependent upon individual locations, extra channels can be received either to provide alternative entertainment or to allow DX studies to be made. Separate aerials are used and the low-level signals are combined to improve the gain of the entire system.

Initial experiments should be made by using an indoor UHF television aerial connected to an extension coaxial cable, so that the aerial can momentarily be placed in widely differing positions (including the loft and out-of-doors) and alternative signals can be located. If any distant signals are receivable on the main aerial, it is highly advisable to tune the receiver to one of them as a starting point, before changing to the temporary aerial. It is also helpful if one person can watch the screen while a weak signal is displayed, and a second person move the temporary aerial according to relayed instructions.

At UHF signals must almost literally be plucked from the air, and dramatic changes can occur when the aerial is moved by even one foot. It must also be borne in mind that, at extreme ranges, propagation paths become distorted and the aerial might need to be tilted to ensure maximum signal pick-up.

Once the best position for an alternative aerial has been found, it must be installed and then suitably integrated with the existing system. Some methods of achieving this integration are described later.

At the author's location in North London, close to the Hertfordshire border, two positions were found where a separate aerial could receive signals not obtainable with the yagi aerial installed in the loft for reception of the four channels carried by the London main transmitters.

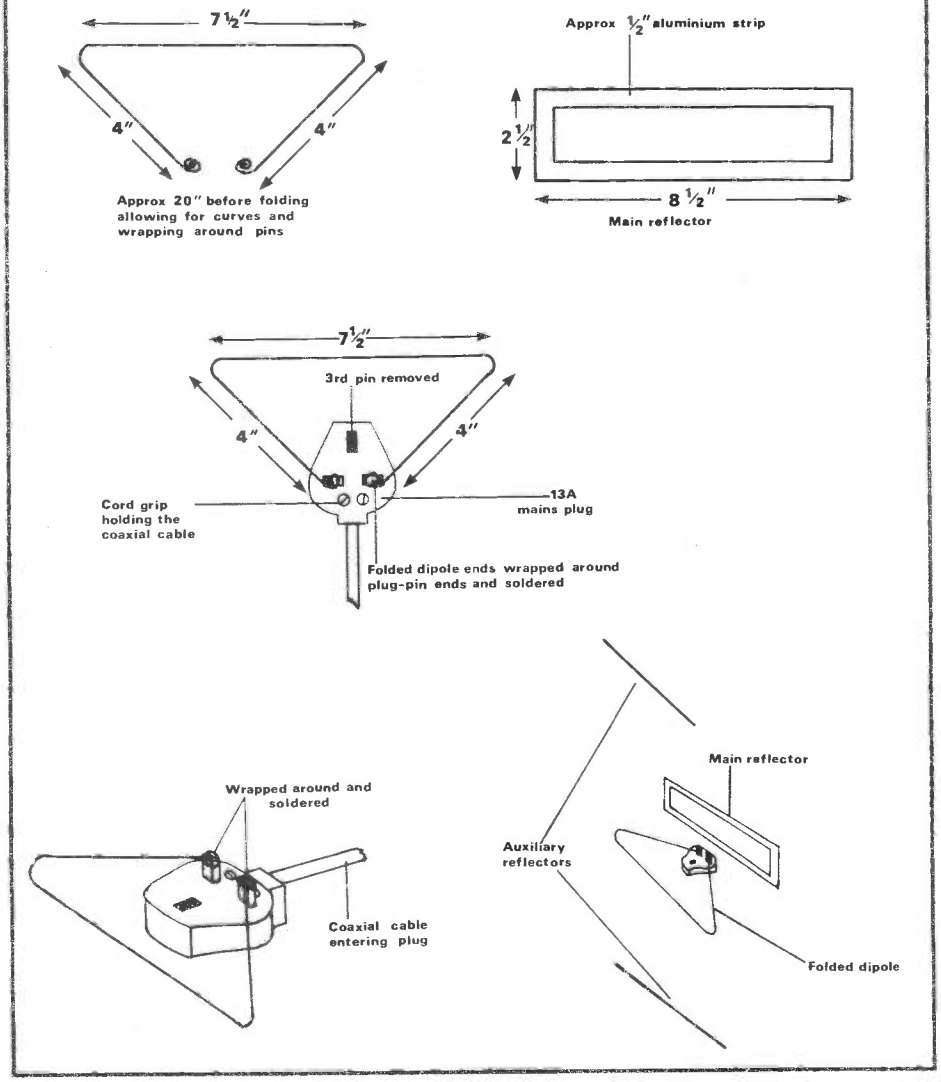
These alternative signals were the result of fringe reception of 'South' transmissions from Hannington as opposed to 'London and South-East England' transmissions from Crystal Palace. Readers will, of course, obtain individual results according to their own geographical positions and local conditions.

The first alternative position was found to be at an optimum outside the back of the house just below the gutter, so a small yagi aerial was permanently fitted there. The second alternative position was found to be at an optimum inside the loft roof-space, well away from the 'local' aerial.

Unfortunately, because of an adjacent plastic water-tank, there was no room to fit a conventional yagi aerial. Because of this, a folded dipole was specially constructed using three reflectors (co-planer but slightly curved) and no directors, as shown in *Figure 1.* The complete assembly resembles a shallow parabola, is extremely directional, and when positioned for horizontally-polarised signals easily fits into a confined space (ie tall but narrow).

The folded dipole is made of heavy-gauge tinned-copper wire, and is mounted on a 13 amp mains plug from

Fig 1 *Folded dipole with three reflectors*



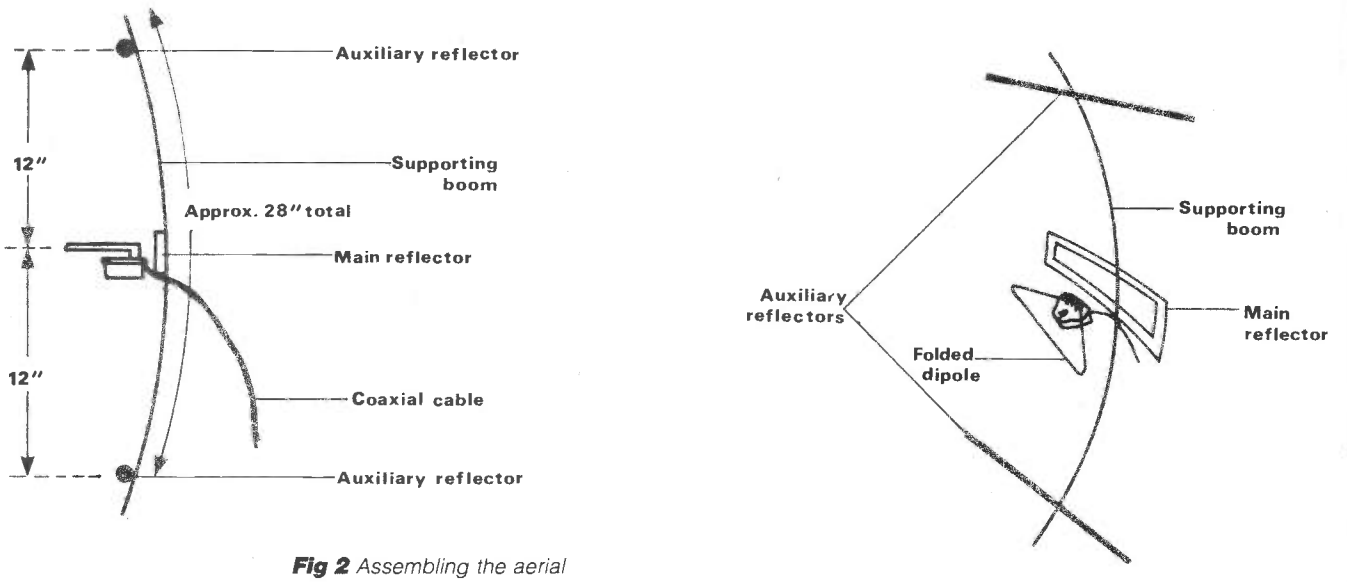


Fig 2 *Assembling the aerial*

which the third (earth) pin has been removed. Before folding, the wire should be cut to a length of 20in, which allows for bends and for the ends to be wrapped around the plug pins before being soldered. The low-loss coaxial feeder can be attached by using the fitted connecting screws inside the plug, and then firmly retained by the cord-grip.

The main reflector, to be positioned 2in behind the dipole, can be made of aluminium strip to the dimensions shown. It is probably easiest to bolt four separate pieces together to form a rectangle having outside measurements of 8½in by 2½in. The two auxiliary reflectors can each be made of heavy-gauge tinned-copper wire cut to a length of 8½in.

The four component parts of the aerial are then mounted onto a plastic boom about 28in in length and bent approximately to the shape shown in *Figure 2*. The folded dipole can be self-supported by securing the low-loss coaxial feeder to the boom so that the dipole is held 2in in front of the rectangular reflector.

For ease of bending, aluminium strip can be used instead of plastic, but then suitable insulation must be used to preserve electrical isolation between the aerial elements, the feeder connections and the supporting boom.

The signals provided by each of the newly-installed aerials were found to be unsatisfactory for entertainment purposes, so a method was devised of combining the two sets of aerial outputs so that a usable level could be achieved.

Conventional resistive splitters (diplexers) were out of the question because a typical insertion loss of 6dB would attenuate low-level signals to such an extent that there wouldibe no advantage in attempting to combine them. In addition it was desirable, and cartainly much more convenient, to bring all the signals from the three aerials eventually to a common, low-loss down-lead.

Firstly, it was decided to combine the two loft aerials into a common down-lead by constructing a splitter that would favour the four strong local channels from the main aerial but accept most of the low-level signal output of the adjacent aerial. *Figure 3* shows how the main aerial was *directly* coupled, with the DX aerial *loosely* coupled via a 10pF capacitor, to a common low-loss down-lead.

Experimental transpositions of the aerial connections resulted in unacceptable degradation of local signals, so the DX aerial in the loft remained permanently loosely coupled via the capacitor. The splitter was housed in a stripped-down VHF diplexer case made of metal; any suitable small metal container will do.

Secondly, now that local signals and a portion of the distant signals were arriving at the receiver through a common down-lead, another splitter *(Figure 4)* was constructed so that the distant signals from the new outside

Fig 3 *Splitter for combining the two loft aerials*

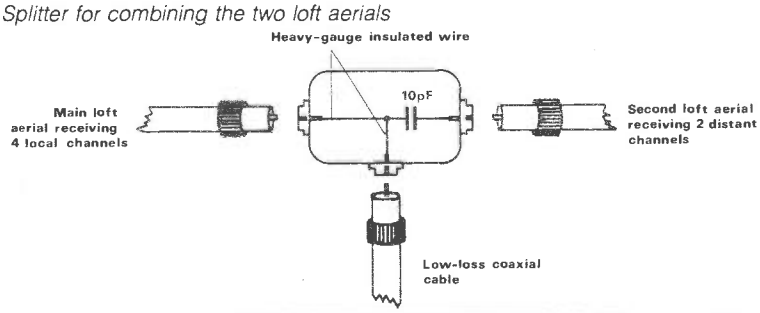
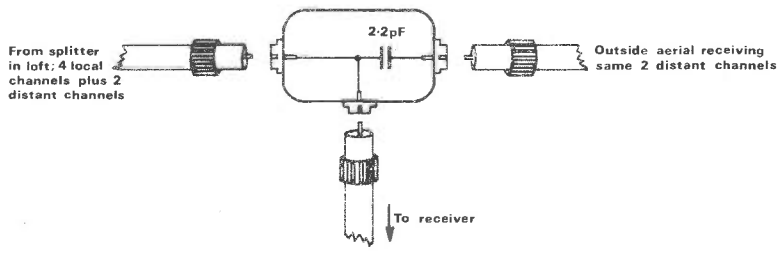


Fig 4 *Splitter for combining third aerial at receiver end*



aerial could be added at the receiver end.

Attenuation

Because all of the signals were now arriving at the 'bottom' end of several runs of low-loss coaxial cable they were slightly attenuated, and this latter splitter needed to be slightly different to the one installed in the loft. The value of capacitor required was only 2.2pF; higher values resulted in aerial mismatch, with consequent degradation of local-signal picture quality.

However, it is worth noting that a commercially-made resistive splitter was totally unsuitable at the receiver end because, although it admitted the distant signals, it caused mis-matching problems to such an extent that there was vision-on-sound when receiving local signals.

Complete

Figure 5 shows the complete system currently in use enabling, in this instance, six different channels to be received and fed to a single length of low-loss coaxial cable at the receiver end, with no need for changeover switches or any other form of inconvenience. REW

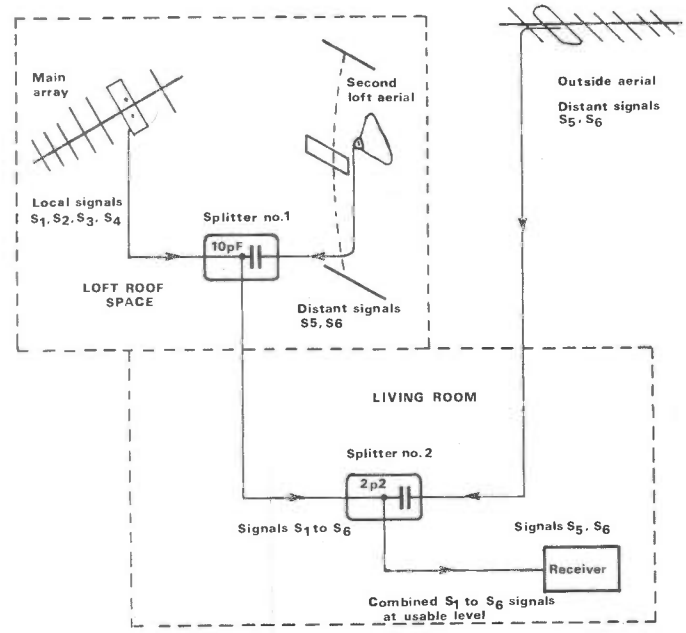


Fig 5 *The complete system*

DATA FILE . . .

Ray Marston deals with opto-coupler devices and their applications

In the last five editions of *Data File* we have taken a fairly detailed look at the general subject of 'opto-electronics' and at various types of opto-electronic device, including the LED and the photo-transistor. This month we concentrate on the so-called 'opto-coupler' devices, which incorporate an LED and a photo-transistor in a single package and which have a wide range of practical applications.

Opto-coupler basics

An LED is a light-generating device, and a photo-transistor is a light-sensitive device. Consequently, if the two devices are mounted close together in a single light-excluding package so that the LED light can fall on the photo-transistor face *(Figure 1),* and the device is then connected into the circuit of *Figure 2,* it will be found that the conduction current of Tr1 can be controlled via the conduction current of the LED, even though the two devices are physically separated.

Such a package is known as an 'opto-coupler', since the input (LED) and the output (photo-transistor) devices are optically coupled.

In *Figure 2,* when SW1 is open no current flows in the LED, so no light falls on the face of Tr1, which is virtually open-circuit with zero voltage developed across output resistor R2. When SW1 is closed current flows through the LED via R1, and the resulting light falls on Tr1 face, causing the photo-transistor to conduct and generate an output voltage across R2.

Note that the simple optically-coupled circuit of *Figure 2* can be used with digital input/output signals only, but that in practice the circuit can easily be modified for use with analogue input/output signals: we'll show how later.

Fully isolated

The most important point to note about the opto-coupler device of *Figure 1* is that a circuit connected to its input can be electrically fully isolated from the output circuit, and that a potential difference of hundreds or thousands of volts can safely exist between these two circuits without adversely influencing the opto-coupler action. This characteristic is the main attraction of this type of opto-coupled device, which is generally known as an 'isolating' opto-coupler.

Typical 'isolating' opto-coupler applications include low- to high-voltage (or vice versa) signal coupling: interfacing of a computer output signal to external electronic circuitry and motors, etc: interfacing of 'grounded' low-voltage circuitry to 'floating' high-voltage circuitry driven directly from the mains power line, etc. Opto-couplers can also be used to replace low power relays and pulse transformers in many applications.

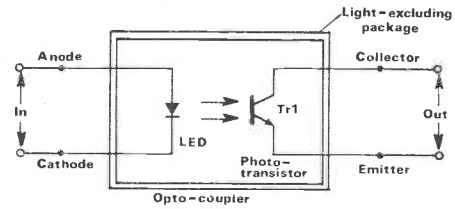


Fig 1 *Basic opto-coupler device*

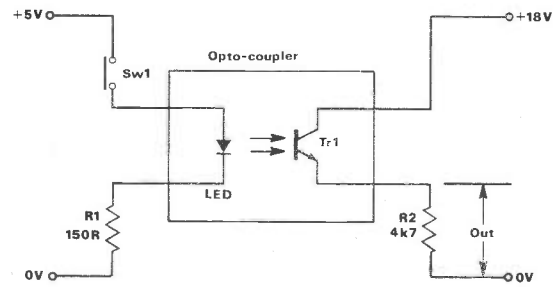


Fig 2 *Basic opto-coupler circuit*

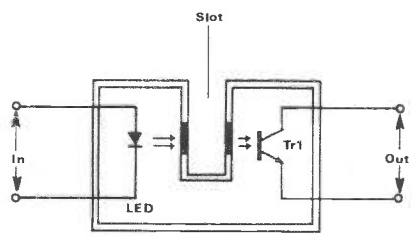


Fig 3 *'Slotted' opto-coupler*

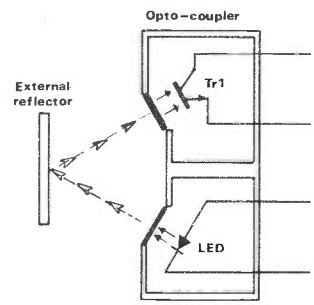


Fig 4 *'Reflective' opto-coupler*

Special opto-couplers

The *Figure 1* device is a simple 'isolating' opto-coupler. *Figures 3* and *4* show two other types of opto-coupler device. The device shown in *Figure 3* is known as a 'slotted' opto-coupler, and has a slot moulded into the package between the LED light-source and the photo-transistor light-sensor.

Normally, light can pass from the LED to Tr1 without significant attenuation by the slot. The opto-coupling can, however, be completely blocked by placing an opaque object in the slot. The slotted opto-coupler can thus be used in a variety of applications, including end-of-tape detection, limit switching, and liquid-level detection.

The device shown in *Figure 4* is known as a reflective opto-coupler. Here, the LED and Tr1 are optically screened from each other within the package, both facing outwards (in the same direction) from the package. The construction is such that an opto-coupled link can be set up by a reflective object (metallic paint or tape, etc) placed a short distance outside the package, in line with both the LED and Tr1.

The reflective opto-coupler can thus be used in applications such as tape-position detection, engine-shaft revolution counting, and engine-shaft speed detection, etc.

Transfer ratios

One of the most important parameters of an opto-coupler device is its opto-coupling 'efficiency', and to maximise this parameter the LED and the photo-transistor (which usually operate in the infra-red range) are always closely matched spectrally.

The most convenient way of specifying

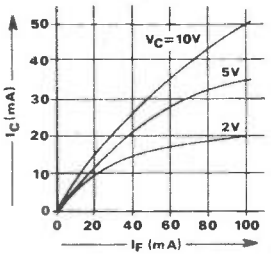


Fig 5 *Characteristics of an opto-coupler at various values of output transistor collector voltage*

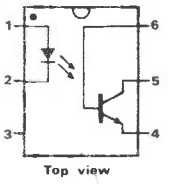


Fig 6 *Typical simple isolating opto-coupler*

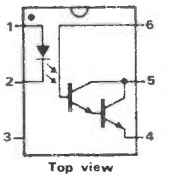


Fig 7 *Typical Darlington isolating opto-coupler*

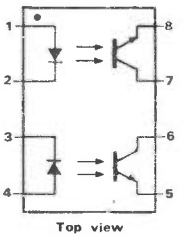


Fig 8 *Dual isolating opto-coupler*

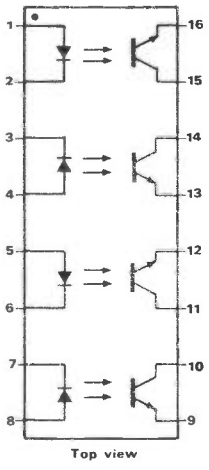


Fig 9 *Quad isolating opto-coupler*

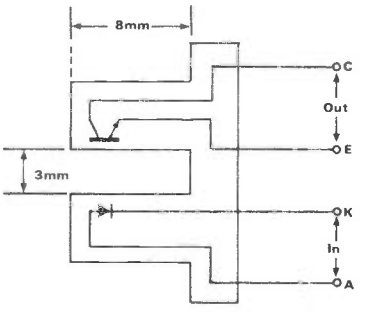


Fig 10 *Slotted opto-coupler*

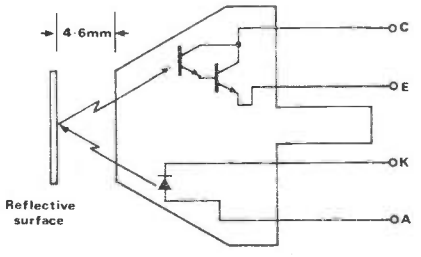


Fig 11 *Reflective opto-coupler*

Parameter	Isolating opto-couplers				Slotted opto-coupler	Reflective opto-coupler
	Simple type	Darlington type	Dual type	Quad type		
Isolating voltage	±4KV	±4KV	±1.5KV	±1.5KV	NA	NA
V_{CE} (max)	30V	30V	30V	30V	30V	15V
I_F (max)	60mA	60mA	100mA	100mA	50mA	40mA
CTR (min)	20%	300%	12.5%	12.5%	10%	0.5%
Bandwidth	300KHz	30KHz	200KHz	200KHz	300KHz	20KHz
Outline	Fig 6	Fig 7	Fig 8	Fig 9	Fig 10	Fig 11

Fig 12 *Parameters of the Figures 6 to 11 devices*

opto-coupling efficiency is to quote the output-to-input 'current transfer ratio' (CTR) of the device, ie the ratio of the output current (I_C) measured at the collector of the photo-transistor, to the input current (I_F) flowing into the LED. Thus, CTR = I_C/I_F.

In practice, CTR may be expressed as a simple figure such as '0.5', or (by multiplying this figure by 100) as a percentage figure such as '50%'.

Simple isolating opto-couplers with single-transistor output stages have 'typical' CTR values in the range 20% to 100%. The actual 'typical' CTR value depends on the input and output operating currents and on the supply-voltage value of the transistor. *Figure 5* shows three typical sets of output/input currents obtained at different V_C values.

It should be noted that, because of variations in LED radiation efficiency and photo-transistor current gains, the actual CTR values of individual opto-couplers may vary significantly from the 'typical' value. An opto-coupler with a 'typical' value of 60% may, for example, in fact have a true value in the range 20% to 180% in an individual device.

Other parameters

Other important opto-coupler parameters include the following:

Isolation voltage: this is the maximum permissible dc voltage that can be allowed to exist between the input and output circuits. Typical values vary from 500V to 4KV.

VCE (max): this is the maximum permissible dc voltage that can be applied across the output transistor. Typical values vary from 20V to 80V.

IF (max): this is the maximum permissible dc current that can be allowed to flow in the input LED. Typical values vary from 40mA to 100mA.

Bandwidth: this is the typical maximum signal frequency (in KHz) that can be usefully passed through the opto-coupler when the device is operated in its 'normal' mode. Typical values vary from 20KHz to 500KHz, depending on the type of device construction.

Practical opto-couplers

Opto-couplers are produced by several different manufacturers. They are available in a limited number of basic forms, but are retailed under a vast number of different 'type' numbers. Rather than list all of these types individually, we will simply look at 'typical' examples of these devices in the present article.

Practical opto-coupler devices are available in six basic forms, and these are illustrated in *Figures 6* to *11*. The table of *Figure 12* lists the typical parameter values of these six devices.

The simple isolating opto-coupler *(Figure 6)* uses a single photo-transistor output stage and is normally housed in a 6-pin package, with the base terminal of the photo-transistor externally available. In normal use the base is left open-circuit, and under this condition the opto-coupler has a minimum CTR value of 20% and a useful bandwidth of 300KHz.

The photo-transistor can be converted to a photo-diode by shorting the base (pin 6) and emitter (pin 4) terminals together: under this condition the CTR value falls to about 0.2% but the bandwidth rises to about 30MHz.

The Darlington opto-coupler *(Figure 7)* is also housed in a 6-pin package and has its photo-transistor base externally available. Because of the high current gain of the Darlington, this coupler has a typical minimum CTR value of about 300%, but has a useful bandwidth of only 30KHz.

The dual and quad opto-couplers of *Figures 8* and *9* both use single-transistor output stages in which the base terminal is not externally available.

Note in all four of these 'isolating' devices that the input pins are on one

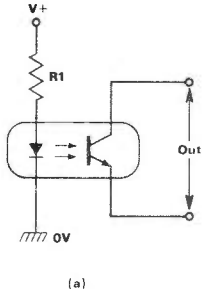


Fig 13a *Limiting LED current with a resistor connected to the anode*

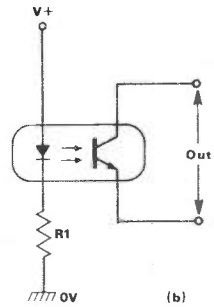


Fig 13b *Limiting LED current with a resistor connected to the cathrode*

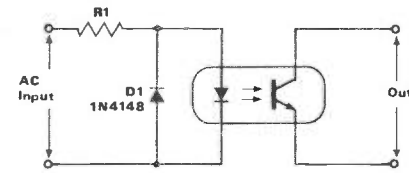


Fig 14 *Protecting the input LED against reverse voltages using an external diode*

side of the package and the output pins are on the other. This construction facilitates the maximum possible values of isolating voltage. Also note in the multi-channel devices of *Figures 8* and *9* that although these devices have isolating voltage values of 1.5KV, voltages greater than 500V should not be allowed to exist between adjacent channels.

Isolating voltage values are not specified for the 'slotted' and 'reflective' opto-coupler devices of *Figures 10* and *11*. The *Figure 10* device has a typical slot width of about 3mm, and uses a single output transistor to give an 'open' minimum CTR value of 10% and a bandwidth of 300KHz.

Finally, the 'reflective' opto-coupler of *Figure 11* uses a Darlington output stage and has a useful bandwidth of only 20KHz. Even so, the device has a typical minimum CTR value of only 0.5% at a reflective range of 5mm from a surface with a reflection efficiency of 90%, when the input LED is operated at its maximum current of 40mA.

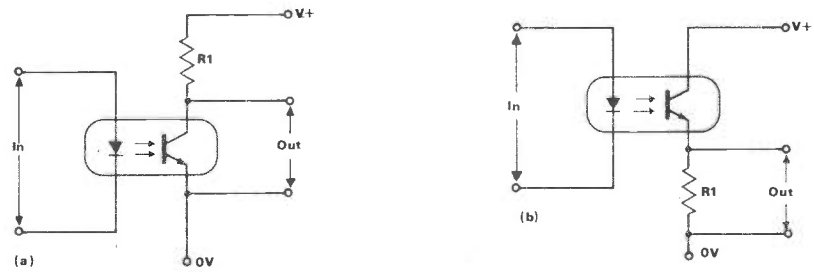


Fig 15 *An external 'output' resistor, wired in series with the photo-transistor, can be connected to either (a) the collector, or (b) the emitter*

Usage notes

Opto-couplers are very easy devices to use, with the input side being used in the manner of a normal LED and the output used in the manner of a normal photo-transistor. Recent editions of this opto-electronics mini-series have given very detailed information on how to use both of these devices. The following notes give a summary of the salient 'usage' points.

The input current to the opto-coupler LED must be limited via a series-connected external resistor which, as shown in *Figure 13,* can be connected on either the anode or the cathode side of the LED. If the LED is to be driven from an ac source, or there is a possibility of a reverse voltage being applied across the LED, the LED must be protected from reverse voltages by an external diode connected as shown in *Figure 14.*

The operating current of the photo-transistor can be converted into a voltage by wiring an external resistor in series with the collector of the device. This resistor can in fact be connected to either the collector or the emitter of the photo-transistor, as shown in *Figure 15.* The greater the value of this resistor, the greater is the sensitivity of the circuit but the lower is its bandwidth.

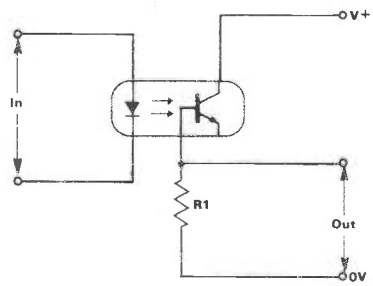


Fig 16 *If its base is available, the photo-transistor can be made to act as a photo-diode*

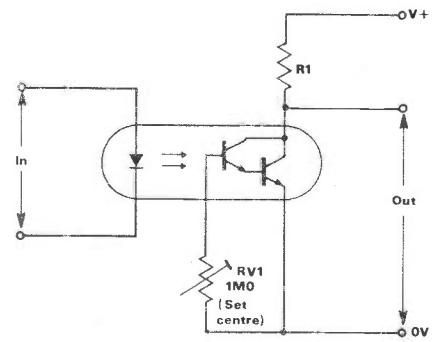


Fig 17 *The CTR value can be varied using RV1*

In normal use, the photo-transistor is used with its base terminal open-circuit. If desired, however, the photo-transistor can be converted into a photo-diode by using the base terminal as shown in *Figure 16* and ignoring the emitter terminal (or shorting it to the base). This connection results in a greatly increased bandwidth (typically 30MHz), but a greatly reduced CTR value (typically 0.2%).

Alternatively, the base terminal can be used to vary the CTR value of the opto-coupler by wiring an external resistor (RV1) between the base and emitter, as shown in the Darlington example of *Figure 17*: with RV1 open-circuit, the CTR value is that of a normal Darlington opto-coupler (typically 300% minimum): with RV1 short-circuit, the CTR value is that of a diode-connected photo-transistor (typically 0.2%).

Digital interfacing

Opto-coupler devices are ideally suited for use in digital interfacing applications in which the input and output circuits are driven by different power supplies. They can be used to interface digital ICs of the same family (TTL, CMOS, etc), or digital ICs of different families, or to interface the digital outputs of home computers to motors, relays and lamps, etc.

Figure 18 shows how to interface TTL circuits. The opto-coupler LED and current-limiting resistor R1 are connected between the 5 volt positive supply rail and the output driving terminal of the TTL device (rather than

between the TTL output and ground), because TTL outputs can usually sink a fairly high current (typically 16mA) but can source only a very low current (typically 400μA).

The open-circuit output voltage of a TTL IC falls to less than 0.4V when in the logic '0' state, but may rise to only 2.4V in the logic '1' state if the IC is not fitted with an internal 'pull-up' resistor. In such a case, the opto-coupler LED current will not fall to zero when the TTL output is at logic '1'. This snag can be overcome by fitting an external pull-up resistor (R3) as shown in *Figure 18*.

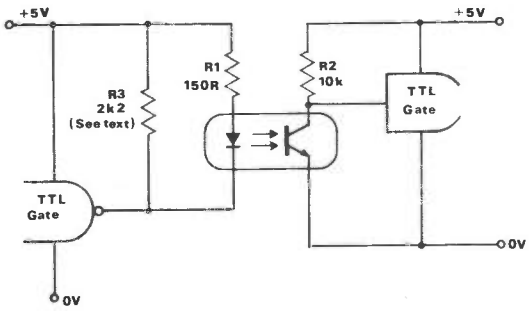


Fig 18 *TTL interface*

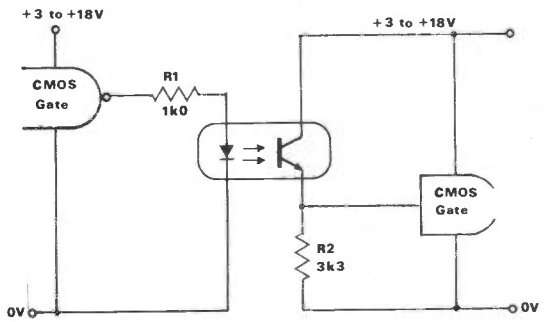


Fig 19 *CMOS interface*

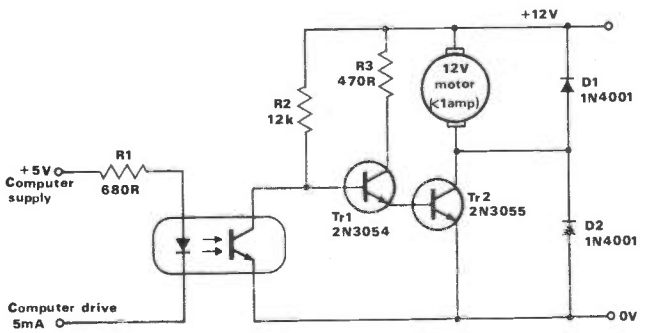


Fig 20 *Computer-driven dc motor*

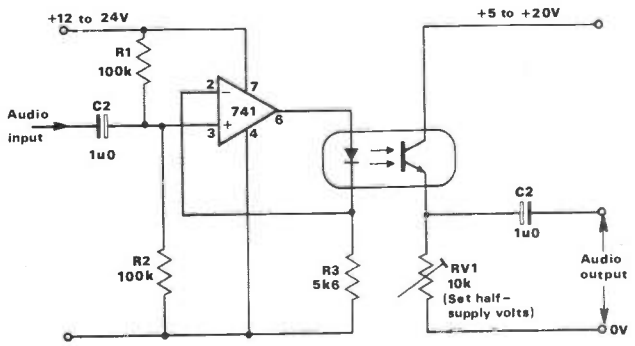


Fig 21 *Audio-coupling circuit*

The opto-coupler photo-transistor should be wired between the input and ground of the TTL IC as shown, since a TTL input needs to be pulled down to below 800mV at 1.6mA to ensure correct logic '0' operation. Note that the *Figure 18* circuit provides non-inverting opto-coupling action.

CMOS IC outputs can source or sink currents (up to several mA) with equal ease. Consequently, these devices can be interfaced by using a 'sink' configuration similar to that of *Figure 18*, or they can use the 'source' configuration shown in *Figure 19*. In either case, the R2 value must be large enough to provide an output voltage swing that switches fully between the CMOS logic '0' and logic '1' states.

Figure 20 shows how the opto-coupler can be used to interface a computer's digital output signal (5V, 5mA) to a 12 volt dc motor that draws an operating current of less than 1 amp. With the computer output high, the opto-coupler LED and photo-transistor are both off, so the motor is driven on via Tr1 and Tr2. When the computer output goes low, the LED and photo-transistor are driven on, so Tr1-Tr2 and the motor are cut off.

Analogue interfacing

An opto-coupler can be used to interface analogue signals from one circuit to another by setting up a 'standing' current through its LED and then modulating this current with the analogue signal. *Figure 21* shows this technique used to make an audio-coupling circuit.

Here, the op-amp is connected in the unity-gain voltage-follower mode, with the opto-coupler LED wired into its negative feedback loop so that the voltage across R3 (and thus the current through the LED) precisely follows the voltage applied to the non-inverting input terminal (pin 3) of the op-amp.

This terminal is dc biased at half-supply volts via the R1-R2 potential divider, and can be ac-modulated by an audio signal applied via C1. The quiescent LED current is set at 1-2mA via R3.

On the output side of the opto-coupler, a quiescent current in the photo-transistor is set up by the opto-coupler action, which causes a quiescent voltage to be set up across RV1, which should have its value adjusted to give a quiescent output value of half-supply voltage. The audio output signal appears across RV1 and is decoupled via C2.

Next month

In next month's edition of *Data File* we will conclude this 'mini-series' by looking at miscellaneous aspects of opto-electronics, including light-intensity control techniques. REW

AA117	9p	BD682	45p	OC35	100p	3N.128	55p	ECL80	57p	4520	51p	74LS148	120p	MB3712	150p
AA119	9p	BDX32	100p	OC36	120p	3N.143	65p	ECL82	55p	4521	105p	74LS151	45p	MB3730	200p
AAY32	9p	BDX65	80p	OC45	50p	**DIODES**		ECL84	57p	4522	60p	74LS153	50p	MB3756	200p
AC107	22p	BDY92	100p	OC71	30p	AA119	9p	ECL85	57p	4526	57p	74LS154	180p	MC1327	70p
AC126	17p	BF180	16p	OC72	50p	BY100	40p	ECL86	49p	4527	57p	74LS155	55p	NE555	20p
AC127	18p	BF181	18p	OC200	180p	BY103	32p	EF80	31p	4528	57p	74LS156	55p	NE556	40p
AC128	18p	BF183	20p	R2008B	100p	BY126	6p	EF85	34p	4529	100p	74LS157	35p	SAS560	110p
AC128K	22p	BF184	20p	R2010B	100p	BY127	8p	EF89	43p	4532	62p	74LS158	80p	SAS570	110p
AC141K	30p	BF185	20p	TAG4443	76p	BY133	8p	EF183	46p	4551	95p	74LS160	65p	SN76003N	140p
AC142K	30p	BF194	8p	TAG4444	76p	BY164	40p	EF184	53p	4553	230p	74LS161	55p	SN76013N	140p
AC153K	22p	BF195	8p	TIP29	18p	BY176	68p	EL34	190p	4555	30p	74LS162	55p	SN76023N	140p
AC176	18p	BF196	9p	TIP29A	22p	BY179	35p	EL36	60p	4556	47p	74LS163	80p	SN76033N	160p
AC176K	20p	BF197	7p	TIP29C	25p	BY182	32p	EL84	50p	4557	220p	74LS164	65p	SN76110N	70p
AC187	18p	BF198	7p	TIP30	25p	BY184	32p	EL95	50p	4583	85p	74LS165	95p	SN76115	70p
AC187K	20p	BF199	8p	TIP30C	30p	BY187	32p	EL500	80p	4584	42p	74LS166	120p	T2800D	52p
AC188	17p	BF200	16p	TIP31A	24p	BY196	20p	EL504	100p	4585	58p	74LS168	120p	TA-7120	55p
AC188K	23p	BF240	16p	TIP31C	30p	BY206	11p	EY86	31p			74LS169	80p	TA-7137P	53p
ACY18	45p	BF241	10p	TIP32	24p	BY207	11p	EY87	31p	**74 SERIES**		74LS170	120p	TA-7146P	400p
ACY19	45p	BF255	12p	TIP32A	24p	BY208	18p	EY88	42p	7400	22p	74LS174	55p	TA-7193P	400p
AD142	80p	BF256	15p	TIP32C	28p	BY210	22p	EZ35	45p	7401	18p	74LS175	55p	TA-7200	200p
AD149	45p	BF257	18p	TIP33	50p	BY223	72p	EZ80	50p	7402	18p	74LS190	70p	TA-7201	200p
AD161	22p	BF258	18p	TIP34	50p	BY225	120p	EZ81	55p	7403	22p	74LS191	65p	TA-7203	180p
AD162	22p	BF259	18p	TIP41A	28p	BY226	18p	GZ34	180p	7404	40p	74LS192	80p	TA-7204	110p
AF124	25p	BF262	25p	TIP41C	25p	BY227	19p	PC97	100p	7405	10p	74LS193	73p	TA-7205	80p
AF125	25p	BF263	25p	TIP42A	22p	BY228	32p	PCC85	42p	7406	40p	74LS194	65p	TA-7210	200p
AF126	25p	BF270	18p	TIP42C	28p	BY296	20p	PCF80	58p	7407	40p	74LS195	60p	TA-7222AP	120p
AF127	25p	BF273	18p	TIP47	40p	BY298	26p	PCF200	135p	7408	28p	74LS196	72p	TA-7310P	100p
AF139	22p	BF311	21p	TIP48	40p	BY299	28p	PCF801	110p	7409	20p	74LS197	52p	TA-7609	270p
AF239	22p	BF324	28p	TIP50	60p	BY476	90p	PCF802	57p	7413	38p	74LS221	75p	TAA550	16p
AL112	70p	BF336	20p	TIP51	120p	BYX10	15p	PCF806	115p	7414	45p	74LS240	80p	TBA120S	45p
AL113	80p	BF337	20p	TIP52	120p	BYX55/350	30p	PCH200	100p	7417	32p	74LS241	72p	TBA395	60p
ASZ15	100p	BF338	20p	TIP53	120p	BYX55/600	30p	PCL81	54p	7420	22p	74LS242	78p	TBA396	60p
ASZ17	100p	BF355	28p	TIP54	140p	BYX55/800	32p	PCL82	63p	7421	25p	74LS243	78p	TBA520	100p
AU110	110p	BF362	30p	TIP105	68p	BYX70/300	29p	PCL84	50p	7425	15p	74LS244	80p	TBA530	100p
AY102	180p	BF367	13p	TIP106	68p	BYX70/500	32p	PCL85	58p	7430	25p	74LS245	90p	TBA540	100p
AY106	180p	BF371	17p	TIP107	68p	BYX70/800	36p	PCL86	55p	7437	28p	74LS247	80p	TBA560	100p
BA145	10p	BF414	18p	TIP110	47p	BYX71/600	80p	PCL805	55p	7442	48p	74LS248	80p	TBA750	100p
BA148	10p	BF420	16p	TIP111	50p	OA47	9p	PFL200	85p	7447	60p	74LS249	99p	TBA800	35p
BA154	9p	BF421	18p	TIP112	48p	OA90	4p	PL36	80p	7450	22p	74LS251	30p	TBA810S	80p
BA157	12p	BF422	21p	TIP115	45p	OA91	4p	PL82	45p	7451	10p	74LS253	65p	TBA820	75p
BB101	13p	BF423	15p	TIP116	45p	OA200	7p	PL83	32p	7454	25p	74LS256	65p	TBA920	100p
BB103	16p	BF440	16p	TIP117	50p	OA202	7p	PL84	50p	7470	30p	74LS257	60p	TBA950	100p
BB105B	16p	BF451	17p	TIP120	43p	IN.914	2p	PL95	140p	7473	30p	74LS258	65p	TBA990	100p
BB205B	24p	BF455	14p	TIP121	46p	IN.4001	4p	PL500	110p	7474	40p	74LS259	95p	TCA270	40p
BC107	7p	BF458	19p	TIP122	47p	IN.4002	4p	PL504	95p	7475	25p	74LS260	65p	TCA800	200p
BC108	7p	BF459	19p	TIP125	47p	IN.4003	4p	PL508	170p	7481	90p	74LS266	22p	TCA940	100p
BC109	7p	BF461	60p	TIP126	56p	IN.4004	4p	PL519	450p	7482	70p	74LS273	80p	TDA1170	100p
BC115	10p	BF462	62p	TIP127	56p	IN.4005	4p	PY81	70p	7485	45p	74LS279	55p	TDA1412	50p
BC118	11p	BF469	30p	TIP141	90p	IN.4006	4p	PY88	45p	7486	28p	74LS280	160p	TDA2002	80p
BC140	19p	BF470	28p	TIP142	90p	IN.4007	5p	PY500A	160p	7489	100p	74LS290	30p	TDA2003	150p
BC141	19p	BF471	28p	TIP145	65p	IN.4148	2p			7490	35p	74LS293	30p	TDA2020	140p
BC142	19p	BF479	30p	TIP146	90p	IN.5400	9p	**CMOS**		7492	45p	74LS365	44p	TDA2030	140p
BC143	19p	BF493	18p	TIP147	100p	IN.5401	10p	4000	20p	7493	35p	74LS366	44p	TDA2522	90p
BC147	6p	BF494	16p	TIP2955	42p	IN.5402	10p	4001	20p	7495	48p	74LS367	47p	TDA2530	100p
BC148	6p	BF595	16p	TIP3054	45p	IN.5403	11p	4002	20p	7497	80p	74LS368	43p	TDA2532	100p
BC149	6p	BF595	16p	TIP3055	42p	IN.5404	11p	4006	65p	74107	30p	74LS373	85p	TDA2540	100p
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BC159	6p	BF615	30p	TIS44	40p	IN.5406	13p	4008	52p	74116	85p	74LS375	70p	TDA2593	100p
BC182	6p	BF758	41p	TIS61	15p	IN.5407	13p	4009	40p	74119	85p	74LS399	85p	TDA2690	100p
BC182L	6p	BF869	22p	TIS88A	45p	IN.5408	13p	4010	50p	74122	40p	74LS670	130p	UPC-555H	80p
BC183	6p	BF870	22p	TIS90	15p			4011	20p	74123	20p			UPC-556H	80p
BC183L	6p	BF872	23p	TIS91	18p	**ZENERS**		4012	23p	74125	40p	**LINEAR IC'S**		UPC-575C2	100p
BC184	6p	BF960	38p	TIS93	20p	400MW		4013	30p	74126	45p	AN-214P	200p	UPC-577H	64p
BC184L	6p	BF963	40p	VK1010	88p	BZY88 Range		4014	50p	74132	42p	AN-240P	150p	UPC-592H2	95p
BC212	6p	BF964	38p	VN.10KM	60p	2V7 to 39V	6p	4015	42p	74141	55p	AN-360	120p	UPC-1001H	220p
BC212L	6p	BF966	40p	VN.46AF	88p	1.3W Zeners		4016	30p	74145	70p	AN-7110	140p	UPC-1025H	230p
BC213	6p	BFR40	25p	VN.66AF	100p	BZX61 Range		4017	43p	74153	45p	AN-7114	160p	UPC-1026C	105p
BC213L	6p	BFR51	21p	VN.88AF	115p	2V7 to 39V	12p	4018	45p	74155	45p	AN-7115	160p	UPC-1028H	90p
BC214	6p	BFR62	21p	VN.89AF	110p	**JAPANESE**		4019	50p	74157	45p	AN-7120	140p	UPC-1031H2	180p
BC214L	6p	BFR79	25p	ZTX107	11p	**TRANSISTORS**		4020	72p	74160	50p	AY3-1270	680p	UPC-1032H	70p
BC237	7p	BFR90	52p	ZTX108	11p	2SB324	55p	4021	52p	74164	50p	AY3-1350	300p	UPC-1155H	200p
BC238	7p	BFR91	99p	ZTX109	12p	2SB507	68p	4022	52p	74167	35p	AY3-8910	360p	UPC-1156H	140p
BC300	16p	BFX29	20p	ZTX212	27p	2SB754	80p	4023	24p	74173	50p	AY3-8912	400p	UPC-1181H	118p
BC301	15p	BFX84	20p	ZTX300	13p	2SC495	60p	4024	35p	74174	70p	AY5-3600	570p	UPC-1182H	180p
BC302	15p	BFX85	20p	ZTX301	16p	2SC1060	99p	4025	22p	74175	65p	CA270	40p	UPC-1185H2	250p
BC303	18p	BFX87	15p	ZTX302	16p	2SC1061	200p	4026	75p	74176	45p	CA3046	80p	UPC-1350C	180p
BC327	6p	BFX88	15p	ZTX303	24p	2SC1096	78p	4027	35p	74180	50p	CA3048	190p		
BC328	6p	BFX89	60p	ZTX304	17p	2SC1161	110p	4028	40p	74182	45p	CA3060	280p	**COMPUTER ICS**	
BC337	6p	BFY17	30p	ZTX320	29p	2SC1172	150p	4029	55p	74192	40p	CA3080E	70p	2114	200p
BC338	6p	BFY18	40p	ZTX326	29p	2SC1306	90p	4030	30p	74196	40p	CA3086	85p	2516	200p
BC557	6p	BFY41	28p	ZTX500	13p	2SC1307	100p	4031	120p	74197	45p	CA3089E	150p	2532	370p
BCY32	150p	BFY50	14p	ZTX501	13p	2SC1678	120p	4032	64p	74393	70p	CA3090AQ	300p	2716	300p
BCY33	150p	BFY51	14p	ZTX502	18p	2SC1969	130p	4033	115p			CA3130E	80p	2732	400p
BCY34	150p	BFY52	14p	ZTX503	18p	2SC2028	75p	4034	140p	**74LS SERIES**		CA3130S	100p	2764	425p
BCY42	20p	BFY56	20p	ZTX504	25p	2SC2029	120p	4035	50p	74LS00	24p	CA3140E	38p	27128	900p
BCY56	16p	BFY57	25p	ZTX550	24p	2SC2078	120p	4036	220p	74LS01	24p	CA3189E	250p	4116	75p
BCY70	16p	BFY64	25p	2N.696	26p			4037	100p	74LS02	24p	CA3240E	90p	4164	300p
BCY71	16p	BFY90	45p	2N.697	22p	**LOW PROFILE**		4038	65p	74LS03	24p	HA-1156W	110p	6116	400p
BCY72	16p	BLY48	85p	2N.698	40p	**SOCKETS**		4039	220p	74S04	24p	HA-1197	150p	6264-15	2000p
BD115	28p	BLY49	85p	2N.699	45p	8 pin	8p	4040	52p	74LS05	23p	HA-1306W	170p	6502	320p
BD124P	50p	BR100	14p	2N.706A	22p	14 pin	8p	4041	40p	74LS08	24p	HA-1319	250p	6802	220p
BD124	110p	BR101	43p	2N.708	22p	16 pin	9p	4042	47p	74LS09	25p	HA-1339	17p	6809	600p
BD128	35p	BR103	37p	2N.914	28p	18 pin	12p	4043	42p	74S10	25p	HA-1342	170p	6821	150p
BD131	25p	BSX20	16p	2N.918	36p	20 pin	14p	4044	45p	74S11	25p	HA-1366WR	160p	6840	320p
BD132	25p	BSX26	18p	2N.930	18p	22 pin	15p	4045	95p	74LS12	25p	HA-1368	160p	6850	130p
BD135	20p	BSX29	19p	2N.1131	28p	24 pin	18p	4046	55p	74LS13	30p	HA-1377	220p	8080A	400p
BD136	20p	BT106	90p	2N.1132	28p	28 pin	20p	4047	58p	74S14	40p	HA-1389	140p	8085A	530p
BD137	20p	BT109	90p	2N.1613	24p	40 pin	23p	4048	48p	74LS15	24p	HA-1392	230p	8155	470p
BD138	20p	BT116	80p	2N.1711	24p			4049	33p	74LS20	24p	HA-1397	250p	8156	380p
BD139	20p	BT119	100p	2N.2102	50p	**VOLTAGE**		4050	30p	74LS21	24p	HA-1398	240p	8250	880p
BD140	20p	BT120	100p	2N.2160	300p	**REGULATORS**		4051	57p	74LS22	24p	LA-1201	85p	8251	470p
BD144	90p	BT138/600	60p	2N.2218A	24p	7805	35p	4052	55p	74LS24	47p	LA-1352	120p	8253	580p
BD150	30p	BT146/750	99p	2N.2219	24p	7812	35p	4053	54p	74LS26	24p	LA-1365	140p	8255	600p
BD157	38p	BT151/650	88p	2N.2221	23p	7815	35p	4054	74p	74LS27	24p	LA-3301	120p	8288	1000p
BD158	38p	BT151/800	88p	2N.2222	23p	7818	35p	4055	75p	74LS28	24p	LA-3350	120p		
BD166	30p	BTY79/500	140p	2N.2369	15p	7824	35p	4056	75p	74LS30	24p	LA-3361	115p		
BD175	30p	BU100A	110p	2N.2484	30p	7905	35p	4060	60p	74LS32	24p	LA-4030	200p		
BD177	30p	BU104	100p	2N.2646	40p	7912	40p	4063	78p	73LS33	25p	LA-4031	140p		
BD179	32p	BU105	80p	2N.2904	20p	7915	40p	4066	38p	74LS37	24p	LA-4032	140p		
BD181	45p	BU108	100p	2N.2905	20p	7918	40p	4067	220p	74LS38	24p	LA-4050	130p		
BD182	50p	BU110	110p	2N.2906	18p	7924	40p	4068	24p	74LS40	24p	LA-4051	160p		
BD183	50p	BU111	140p	2N.2907	18p	78L05	28p	4069	24p	74LS42	45p	LA-4100	120p		
BD201	33p	BU124	60p	2N.2926	8p	78L12	28p	4070	23p	74LS47	78p	LA-4101	100p		
BD202	38p	BU126	70p	2N.3019	28p	78L15	28p	4071	23p	74LS48	75p	LA-4102SK	140p		
BD203	42p	BU204	75p	2N.3053	18p	78L18	28p	4072	23p	74LS51	24p	LA-4112	250p		
BD204	42p	BU205	70p	2N.3054	35p	78L24	28p	4073	23p	74LS54	24p	LA-4125	210p		
BO222	31p	BU208	75p	2N.3055	35p	78L24	28p	4075	23p	75LS55	24p	LA-4140	70p		
BD225	31p	BU208A	80p	2N.3055H	80p	79L05	40p	4076	60p	74LS73	28p	LA-4201	120p		
BD232	31p	BU208D	100p	2N.3440	58p	79L12	40p	4077	24p	74LS74	33p	LA-4220	120p		
BD234	32p	BU325	85p	2N.3442	85p	79L15	40p	4078	24p	74LS75	36p	LA-4400	180p		
BD235	28p	BU326	68p	2N.3702	9p	LM309K	100p	4081	24p	74LS76	28p	LA-4420	140p		
BD236	30p	BU406	85p	2N.3703	9p	LM317K	220p	4082	24p	74LS78	35p	LA-4422	130p		
BD237	21p	BU406D	95p	2N.3704	9p	LM317T	180p	4085	55p	74LS83	65p	LA-4430	130p		
BD238	24p	BU407	75p	2N.3705	9p	LM323K	420p	4086	60p	74LS85	75p	LA-4460	170p		
BD244	50p	BU407D	95p	2N.3706	9p	LM723	32p	4089	110p	74LS86	32p	LA-4461	180p		
BD245	50p	BU408	85p	2N.3707	9p	78HGKC	570p	4093	32p	74LS90	48p	LA-5112	120p		
BD433	28p	BU408D	95p	2N.3708	9p	78HO5KC	520p	4094	65p	74LS91	55p	LM301	26p		
BD434	30p	BU409	95p	2N.3771	85p	78GU1C	190p	4095	65p	74LS92	50p	LM311	35p		
BD435	31p	BU426	120p	2N.3772	90p	79GU1C	215p	4098	70p	74LS93	45p	LM324	35p		
BD437	28p	BU500	110p	2N.3773	100p	79HGKC	570p	4099	70p	74LS95	50p	LM325	45p		
BD438	36p	BU526	80p	2N.3819	29p			4501	34p	74LS96	60p	LM339	40p		
BD439	40p	BU801	95p	2N.3866	38p	**VALVES**		4502	50p	74LS107	39p	LM348	60p		
BD440	40p	BU806	120p	2N.3903	11p	DAF96	50p	4503	36p	74LS109	39p	LM380	100p		
BD441	40p	BU807	95p	2N.3904	11p	DF96	50p	4504	72p	74LS112	40p	LM381	180p		
BD442	40p	C106D	23p	2N.3905	11p	DL92	47p	4505	340p	74LS113	32p	LM382	130p		
BD533	50p	MJ2500	100p	2N.3906	11p	DY86	50p	4506	60p	74LS114	42p	LM387	100p		
BD534	38p	MJ2501	110p	2N.4031	25p	DY87	50p	4507	34p	74LS122	55p	LM709 DIL	90p		
BD535	38p	MJ2955	85p	2N.4036	25p	DY802	45p	4508	110p	74LS123	70p	LM723	40p		
BD536	38p	MJ3000	115p	2N.4037	25p	EABC80	50p	4510	52p	74LS124	95p	LM741 DIL	18p		
BD537	40p	MJ3001	115p	2N.4058	13p	EB91	44p	4511	45p	74LS125	38p	LM741 MET	45p		
BD538	40p	MJE29A	30p	2N.4443	76p	EBF80	45p	4512	52p	74LS126	42p	LM747	58p		
BD675	40p	MJE30A	30p	2N.4444	76p	EBF89	50p	4513	120p	74LS132	53p	LM748	35p		
BD676	40p	MJE340	25p	2N.5061	20p	ECC82	40p	4514	100p	74LS133	45p	LM1458	33p		
BD677	38p	MJE350	30p	2N.5294	30p	ECC83	43p	4515	100p	74LS136	35p	LM3900	30p		
BD678	40p	MJE520	30p	2N.5296	30p	ECC84	40p	4516	52p	74LS138	47p	M-51513L	160p		
BD680	40p	MJE2955K	90p	2N.6106	40p	ECC85	40p	4517	200p	74LS139	45p	M-51515BL	270p		
BD679	40p	OC28	100p	2N.6107	40p	ECH81	49p	4518	45p	74LS145	90p	M-51516	280p		
BD681	45p	OC29	80p	2N.6109	40p	ECH84	52p	4519	32p	74LS147	130p	M-51517L	280p		

AY3-1015	290p
AY5-3600	570p
SPO256AL2	550p
Z80ACPU	250p
Z80BCPU	500p
Z80ADMA	650p
Z80AP10	280p
Z80BP10	600p
Z80ACTC	280p
Z80BCTC	600p
Z80AS10	680p
Z80AS10/1	700p
Z80AS10/2	700p
Z80ADART	680

LED

LED 3mm RED	6p
LED 3mm YEL	10p
LED 3mm GRN	10p
LED 5mm RED	6p
LED 5mm YEL	10p
LED 5mm GRN	10p

OPTO ELECTRONICS

2N.5777	40p
OCP71	100p
ORP12	85p
ORP60	100p
ORP61	100p

DISPLAYS

MAN.72	115p
MAN.74	115p
MAN.4640	180p
MAN.8910	230p
DL.747	180p

TRIACS PLASTIC

TIC206D-4A/400V	60p
TIC225D-6A/400V	68p
TIC226D-8A/400V	68p
TIC236D-12A/400V	85p
TIC246D-16A/400V	105p
TIC253D-20A/400V	150p
TIC263D-25A/400V	205p
T2800D	52p

THYRISTORS

2N.5061-0.8A/60V	20p
2N.5062-0.8A/100V	28p
2N.5064-0.8A/200V	29p
C106D 4A/400V	23p
TIC116C 8A/300V	59p
TIC116D 8A/400V	70p
TIC116M 8A/600V	78p
TIC126D 12A/400V	75p
TIC126M 12A/600V	90p
2N.4444	75p
BT106	90p
BT116	80p
BT119	100p
BT120	100p
TIC44	22p
TIC45	27p
TIC47	32p

BRIDGE RECTIFIERS

W005 1A/50V	16p
W01 1A/100V	18p
W02 1A/200V	19p
W04 1A/400V	21p
W06 1A/600V	23p
W08 1A/800V	28p
BR81D 2A/100V	35p
BR82D 2A/200V	36p
BR84D 2A/400V	42p
BR86D 2A/600V	54p
BR88D 2A/800V	58p
BR32 3A/200V	55p
BR34 3A/400V	68p
BR36 3A/600V	78p
BR62 6A/200V	100p
BR64 6A/400V	60p
BR251 25A/100V	180p
BY164	40p
BY179	38p

ELECTROLYTIC CAPACITORS

4700UF-16V CAN	80p
4700UF-40V CAN	80p
*4700UF-40V CAN	92p
*6500UF-50V CAN	100p
6800UF-40V CAN	85p
10000UF-16V CAN	83p
10000UF-25V CAN	87p
*15000UF-10V CAN	85p
33000UF-16V CAN	88p
47000UF-6.3V CAN	85p
2000+2K/35V CAN	68p
2200UF-40V CAN	36p
2350+2350-63V CAN	125p
*2800UF-100V CAN	92p

*Computer Grade Types
Computer grade types have screw terminals.
Other types are tag terminal.

SONY THYRISTORS

SG613	500p
SG264	460p

CRYSTALS

FREQ IN MHZ	
1.0	200p
2.00	200p
2.45760(L)	180p
2.45760	180p
2.5	200p
2.662	200p
3.276	115p
3.5795	95p
4.0	110p
4.194	130p
4.43	95p
4.608	150p
4.9152	150p
5.0	130p
6.0	115p
7.0	125p
8.0	125p
8.867	125p
10.0	140p
10.50	200p
10.70	150p
11.0	250p
12.0	120p
14.0	125p
14.138	120p
14.756	200p
15.0	160p
16.0	130p
18.0	130p
18.432	130p
19.969	130p
20.0	180p
24.0	250p
48.0	180p

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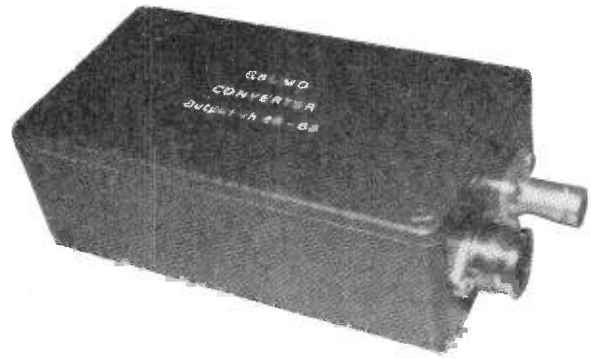
24cm BUDGET CONVERTOR KIT—reviewed by Andy Emmerson—

Regular readers will need no reminding that 24cm amateur TV activity is on the increase, and some may be thinking of investigating further. Of course, the committed among us have set up complete transmit/receive stations, but the cost of this will put many TVers off. All the same, a simple set-up in areas with plenty of activity will enable you to look in and get a feel for 24 without breaking the bank.

A new low-cost converter is now available from Solent Scientific, and if you are just thinking of dipping your feet into the water this might be for you.

Most 24cm TV operation is FM, and normal TV receivers are for AM signals. All the same, you can get pretty reasonable results by 'slope detecting' the FM pictures, just as an AM radio will receive FM signals. Reception in each case is a few P or S points down, but a good pre-amplifier will help.

There are two types of converter on the market: tunable and fixed. The tunable ones are intended for FM demodulators and include front-end tuning, which puts the price up. Fixed converters on the other hand take a block of frequencies and convert them down to a lower group, typically the broadcast UHF TV channels, so that a normal TV set can be used. There are two converters of this type around but only the Solent model was sent in for review, so that's the one we'll discuss here.



Shake the box?

Solent Scientific, run by Allan Latham G8CMQ, is one of the newer firms producing amateur radio gear. Most of their products are supplied in kit form to keep down costs, and this converter is no exception. In case you are wondering if your capabilities run to making this up I shall run through what's involved.

Some kits are what I call 'shake the box', like a plastic aeroplane kit – you hardly need any glue as the parts fit together so well and the whole construction effort takes about five minutes. On that basis Allan's converter is a bit more tricky, but all the parts are supplied (except case and connectors, which are always a matter of choice). When he sent the review kit he asked me to 'build it like a beginner – see how long it takes and how easy it is'. What do you mean, 'like a beginner'? I *am* a beginner when it comes to this sort of thing!

All found, too

Opening the bag I found about 40 components, a set of instructions and a beautiful printed circuit board. This latter has a superb finish and has through-hole plating, which indicates the quality. The instructions are well written but would benefit from better presentation; they do not match up to the rest of the product. The magic words, 'If in doubt – ask' and a telephone number are at the bottom of each page; this also shows that the manufacturer has a commitment to his product.

OK – let's start. A quick look at the instructions and we're off. I had already sorted out two BNC sockets and the DIN power connector, and worked out which size of diecast box to use. Maplin do a rather nice Bimbox which comes ready finished in dark hammer-finish grey, so all I had to do was drill the holes in the right places.

Total assembly took three hours: all the components are surface-mounted, so you can tack-solder them in place on the tracks of the board. Lead lengths must be kept short, but this is no difficulty.

When you are soldering transistors which are working at 1.2GHz you have to be a little careful, and the thing to avoid is great dollops of solder.

The technique is to tin the legs of the transistors quickly and lay down a tiny bit of solder on the printed tracks. Then take it off again! Yes, it's true: some solder-wick type braid goes down on the track followed by the bit of the soldering iron and it (nearly) all comes off.

Now you can place the pre-tinned lead onto the track, press down the hot bit of the soldering iron and you get a perfect

sweated joint with the minimum of unnecessary solder.

Do not lay excess solder along the tracks to 'thicken' them – it will just impede the minute RF currents. Don't bother to place track pins in the holes either, since these are already plated through.

Now switch on . . .

Directions are also given for testing and alignment. These are again simple to follow and you should get 'every egg a chicken'. A genuine far-field signal is far better than a local source, however well attenuated, so try to get someone to send you a signal over the air. Of course, if you are lucky enough to live near a TV repeater this is easy.

You are given two choices of output frequency: when you build the converter you can have the 23 and 24cm bands coming out between channels 21 and 41 or from 48 to 68. In this way you should be able to avoid breakthrough from strong local broadcast signals. I selected the upper block and found that 1255MHz, the normal simplex video frequency, came out on channel 56 with a load of strong radar on channel 49. The exact channels will, however, vary slightly according to how you build the converter.

Test results

The circuit uses a 2SC3358 in the first stage, which has a 1.1dB noise figure at 1.0GHz, while Solent Scientific claim a noise figure of 3dB or less across the whole band. I passed my completed unit to John Wood G3YQC, who has access to a test laboratory. With an HP8614A signal generator and an HP8558B spectrum analyser we measured:

Overall gain . . . 18dB

Local oscillator frequency . . . 472-780MHz

Bandwidth at 3dB down . . . 67MHz.

Performance was noted by John as very stable and agreeably 'tame'. Voltage regulation was exactly as specified, so long as supply was greater than 11.5 volts. The overall gain was a little lower than might be expected for three RF and one IF amplifiers, but the diode mixer can be expected to have losses.

My experience confirms these findings and I find the converter very satisfactory and reliable. The apparent lack of gain is not a significant comment, since any serious worker should also have a pre-amp, which will help things along a lot. In addition, the TV tuner which this converter feeds will have gain, which all adds up to the total conversion gain figure.

Last things last

Yes, the price; I never let the price override other considerations (except when I cannot afford things). Anyway, this little kit will set you back a very reasonable £34.95, plus another pound for postage and packing. If you prefer to buy it ready assembled and aligned the price goes up to £48.95, and fitted in a box with connectors it costs £62.95. I feel that the kit version offers best value for money, and you should enjoy building a project that is as straightforward as this one. Verdict: good value and very worthwhile.

The converter is available from *Solent Scientific, 75 Chalk Hill, Southampton (tel: (0703) 464675).* A catalogue and price list of the full range of products is available for a stamped addressed envelope.

Footnote: aerials are important, too

Remember that a good aerial helps. Effective do-it-yourself designs include the Quad Loop given in *The UHF Compendium* and the 'Worthing' stack array in the July 1984 issue of *Amateur Radio.*

Alternatively the helical antenna made by Sandpiper Communications is an excellent choice.

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

Completely different

Five radio amateurs from Goole, Yorkshire, are planning a unique trip for the first weekend in May – to the most northerly, southerly, easterly and westerly points of mainland Britain.

Determined to arrange 'something completely different' to publicise the hobby generally and their town's Radio and Electronics Society in particular, they asked Renault UK Ltd to lend them a new car for the gruelling, 2,000-odd mile exercise. The French manufacturer, which has been importing vehicles through the port of Goole for more than 10 years, duly obliged.

They intend driving up to the north of Scotland on the Friday night/Saturday morning, reaching their first 'target', Dunnet Head, well before noon. Their next destination will be the most westerly tip of mainland Britain, Ardnamurchan Point, which they hope to reach by Saturday afternoon.

All they will have to do then (!) is drive down to the Lizard, probably completing that leg of the trip first thing on Sunday morning, and then comes the long haul to Lowestoft, which should be reached by mid-afternoon. They aim to be back at Goole by the evening.

The Goole Society believes the journey should be possible without too many difficulties and intends to operate non-stop on 144/145MHz throughout the weekend; a severe test for any rig, let alone the poor Renault 5! There are hopes that a special event callsign – GB8 Round Britain Trip/M – will be issued, although it's by no means certain that the DTI will approve such a mobile identification. If not the society's own callsign, G8HSG, will be used.

Either way, the weekend trippers will issue special QSL cards to those lucky enough to link up with the Renault. It's hoped that fellow amateurs will donate at least 50 pence or £1 for each card, as one of the principal aims of the trip will be to raise money for charity.

Two good causes have been earmarked for help: the £100,000 'Stop-the-Rot' appeal at Goole Parish Church, which needs major repairs, and the National Society for the Prevention of Cruelty to Children. Sponsor forms will also be available for people guessing the precise distance covered, while the amateurs are hoping to 'sell' the car's body panels to local/national businesses eager to have their names advertised between 'the four corners.'

The team of five are all members of the Goole Radio and Electronics Society, namely: Steve Anderson G6VBU, the society's public relations officer; Ray Thornton G6KCE, secretary; Richard Sugden G8IOH, treasurer; Geoff Cowling G8ERX; and Dennis Lockwood G6REL.

If they succeed on this venture they are going to plan something a little more challenging next year!

Glasgow Exhibition

After hosting during the past two years two of the largest and most successful amateur radio shows ever staged north of the border, the West of Scotland Amateur Radio Society is this year organising the Glasgow Amateur Radio Exhibition, which it plans to make an annual event each spring.

Already, trade exhibitors have booked more space than was taken up at last year's show.

Saturday 11 May from 11am to 5pm is the time, and Cardonald College is the venue. 'It has proved to be an ideal setting from everyone's point of view,' says Tom Hughes GM3EDZ, who is chairman of the organising committee.

'The college is close to the M8, which avoids congested city traffic and provides easy access from all over Scotland and the south, and it has extensive car parks, halls, lecture theatres and catering facilities.

'When we have held the past two autumn conventions there, the response from exhibitors and amateurs from all over Scotland, the north of England and as far afield as Northern Ireland has been terrific. That is what encourages us to believe that Glasgow is the place to stage an annual show which will, in time, build up to rival those held in the south.'

In addition to the trade stands, this year's exhibition will feature a large information and bookstall from the RSGB and exhibits on special interest aspects of the hobby such as amateur TV, data and satellite communication.

There will also be a large bring-and-buy sale and during the day a series of lectures on topical developments in amateur radio will take place.

Further information can be obtained from: *Ian McGarvie GM4JDU, 3 Kelso Avenue, Paisley PA2 9JE.*

Annual rally

The annual mobile rally of the Plymouth Amateur Radio Club will be held on 26 May at 10am. The venue will be the Devonport Secondary School, Park Ave, Devonport, Plymouth.

There will be a wide variety of attractions including a secondhand stall and bar, and talk-in will be provided on S22 and RB2 by G3PRC.

Everybody is welcome at club meetings, held on alternate Mondays at 7pm at the Plymouth Albion Rugby Club.

Morse tests

Ken Saunders G8SFM, of the Swindon and District Amateur Radio Club, has arranged for Morse tests to be held at the Swindon Rally on Sunday 12 May.

The pass rate at last year's rally was 85% and the organisers are hoping for a similar result this year. Interested readers should send the normal application form and fee of £15.00 (cheques made payable to British Telecom International) to Ken at *'Tamarisk', Tetbury Lane, Leighterton, Glos GL8 8UP.* He can also supply application forms for anyone who does not already have one.

'ACCumulator'

The Amateur Computer Club has sent us the latest edition of its newsletter, *ACCumulator.* This issue contains articles on a Z80 analyser, the C language and robotics.

If readers are interested in becoming members of the club they should send £6.00 (cheques made payable to the Amateur Computer Club) to: *Andy Leeder (Membership Secretary), Church Farm, Stratton St Michael, Norwich NR15 2QB.*

RTTY and data repeater

The UK FM Group (Western) put its thirteenth amateur radio repeater station, GB3MT, on the air on Tuesday 5 February. In contrast to its other repeaters in the North West, this one is an RTTY and data unit.

The repeater operates in the 432MHz band on channel RB12 from Winter Hill near Bolton, Lancs. Aerial polarisation is 45 degrees slant to allow use by horizontally and vertically polarised stations.

Operation is at present on 50 baud Murray code, but ASCII operation, probably at 1200 baud, will be implemented shortly.

If the RSGB approve, the UKFMG(W) hope to attach a 'mailbox' to GB3MT to allow radio amateurs to leave messages for one another for collection at some later time. This is similar to the bulletin boards available on the telephone network.

The unit has been built and funded by the UKFMG(W). Membership of the group costs £4.00 per annum and the membership secretary is: *Mr A Baker G4NYP, 26 Brooklands Drive, Goostrey, Crewe, Cheshire CW4 8JB.*

Wirral and District ARC members on a site visit to the Boat Museum in preparation for GB2IWF

Waterways Festival

The Wirral and District Amateur Radio Club will be providing a 'special event' amateur radio station at the International Waterways Festival, to be held over the Spring bank holiday on 25 to 27 May, at the Boat Museum, Ellesmere Port.

Under the authority of the Department of Trade and Industry, the club has been granted a special callsign for the occasion, GB2IWF. The station will operate on frequencies within the short wave, VHF and UHF amateur bands and for the whole three days, with the possibility of some evening and night work taking place.

It is hoped to make contact with many amateur radio stations at home and abroad, and the club would particularly like to make contact with any amateurs in the visiting craft. For those stations who do make contact with GB2IWF on the site, there will be a specially printed QSL card available to prove it. Both local and visiting amateurs, and other festival visitors, are welcome to come and see the station in operation; it should be possible for visiting amateurs to operate from the GB2IWF station.

The event will provide a valuable platform for the club to demonstrate various aspects of amateur radio to the general public, and further information on the hobby will be available on site.

The festival itself should be a fascinating mixture of living history on and around the waterways of this country. Easy access is provided by the M53, the mid-Wirral motorway, at Junction 9. There will be ample free parking for cars, coaches and boats and public transport passes close by.

For further information on the Wirral and District ARC contact: *The Secretary, Gerry Scott, 19 Penkett Road, Wallasey, Merseyside L45 7QF.*

Stolen goods

We recently heard from an unfortunate reader, Mr Roy Bailey G6WLE of Berkshire, who had the following amateur radio equipment stolen on the night of 13/14 February:

Yaesu FT708R, serial number 041387, with speaker mic, Ni-cad battery and ¼ wave whip. This transceiver has been modified by removing the resistor to the ear socket, giving an improved audio level to an external speaker. The power output has been upgraded to 1½ watts.

70cm linear amplifier, home-made from a Wood & Douglas 70LIN10 kit. It comprises an aluminium die-cast box, approx 4¾ x 3¾ x 1½ inches, with a black heatsink of almost the same length fixed to the underside. At one end there are two BNC square base sockets, bolted through only two of the four holes, and a 3-pin, in-line power socket between them. This socket is of the unique configuration fitted to Alinco linears. At the other end are two LEDs, one green and one red, and an on/off switch. Inside is a standard 70LIN10 circuit board. The leads from the power socket are extended to the board by two pieces of green lead, while the connection between the switch and the positive terminal of the board is a thin red lead. The bottom of the box is covered with black adhesive insulating tape. The controls on the outside of the box are marked by blue Dymo tape on which the lettering is almost unreadable.

Oscar 2m/70cm dual-band antenna, mounted on an old mag mount that originally held a cheaper antenna. The socket is a Revco right-angled type and the 12 feet or so of coaxial cable is terminated in a BNC plug. The outside of the antenna and the mount are somewhat rust stained.

Home-made duplexer, in an aluminium die-cast box, approx 1½in square and 1in thick, with a BNC socket at one end and two leads, approximately 35cm long, at the other. These leads leave the box through rubber grommets and are terminated in BNC plugs.

Yaesu PA3 car adapter/charger, standard item, with cigar socket plug on one lead and a double power and charger plug on the other.

If you are offered any of these items, or you have knowledge of any attempt to sell them, please contact your local police station and/or Roy on (048839) 441. There is a reward of £25 for information leading to the recovery of all of the above equipment. For single items the reward will be in proportion to the value.

CB shop

We recently received a letter from Mr C A Pickering of Birmingham, who has an idea for a new business enterprise:

'I am very keen to start up a CB and electrical shop, but it is obviously pointless to do so in an area which is already served by a good local supplier.

'For this reason I would like to ask all the fanatics out there if they know of any area (in England!) where there is a large demand for such a shop without repair facilities. Every area suggested will be thoroughly investigated, so a single reply may help a deprived area.'

If readers think they can help Mr Pickering he can be contacted at: *10 Fulbrook Grove, Weoley Castle, Birmingham B29 5DS.*

Midland mobile rally

The Midland Amateur Radio Society (MARS) is holding a mobile radio rally on Sunday 12 May at Drayton Manor Park, Tamworth, Staffs.

Amongst the attractions will be trade stands, Raynet, repeater groups, side shows, a flea market, children's entertainment and a zoo!

We have also been sent a copy of *Probe,* the newsletter of MARS. The January/February edition covers much of interest, containing a discussion on Raynet, an article describing an 'Aerial tuning unit for 160 and 80' and news of the Midland Amateur Radio Club – the other one, based in Texas.

The club's HQ is: *294a Broad Street, Birmingham.*

RTTY/AMTOR for the blind

We have received more news from Philip Stanley G6TLI, who says that further experimentation has prompted him to write again to give some more details of further capabilities available in the Braid speech synthesiser:

'Firstly may I state that we have found out that there is an interface available that can convert from Centronics parallel to RS-232C serial for those particular users of computers that have only the parallel port for the printer. This is usually readily available from most computer hardware retailers, although I must add that the Centronics port can be fitted as an alternative by Braid Systems Ltd, but there would be a delay in delivery if required.

'One particular question that we have been asked by various visitors when demonstrating this unit is, 'Can it read CW?' The answer to this is yes, providing that you are using a modem that converts the CW into ASCII code. Possibly the best system that can do this is the ICS Electronics model AMT-2 because it is compatible with the Braid

synthesiser, ie the speed of input and output data being 300 baud.

'However, the receiving of this particular mode does have one or two disadvantages, firstly because you do have to lock perfectly onto the signal you are trying to decode (which could take up quite some considerable time). Secondly, at the moment there is not a computer available that can decode perfect 100% Morse because of various differences of sending from one station to another and also the condition of propagation, QRM, etc.

'There is one great advantage however for those SWLs and 'B' licensed operators who wish to study Morse using their home computers if the particular computer has an RS-232C printer port. Then quite simply all you have to do is connect the Braid synth to the output port, set up the speed and parity levels (details of which usually come with the computer handbook) and upon loading the software for CW all you do is press the particular letters, numbers, or text you require and the unit will then convert it into speech (each letter or number is spoken after a return key is pressed).

'You may perhaps want to write a small program that can convert text to be spoken after every word upon receipt of a space code, which is fairly simple to do.

'The idea of this particular unit is basically to decode all data communications which are transmitted, from amateur radio through to general coverage stations, ie Reuters News and Associated Press etc.

'The other main feature is that not only can it help with regard to the facilities mentioned, but the whole purpose of the unit originally was to help those individuals interested in the art of computer programming. Incidentally, our dear friend Steve (G4VWW-IK3CSU) has successfully written a program in BASIC converting miles to kilometres, fahrenheit to centigrade etc, and has only been learning to program for two weeks!'

For further details send an SAE to: *Phillip Stanley G6TLI, 67 Clapham Road, London SW9 0HY.*

Bristol Call Book

The Bristol RSGB Group has very kindly sent us a copy of the Bristol Radio Amateur Call Book, now in its fifth edition. It contains the names and addresses of licensed amateurs in Bristol postal districts BS1 to BS21, which cover approximately 50% of the county of Avon.

The group has also brought to our attention the Bristol Activity Award, which is designed to promote amateur radio activity in this area. Any station in any country which logs a sufficient number of stations in postal districts BS1 to BS21 will qualify for the award.

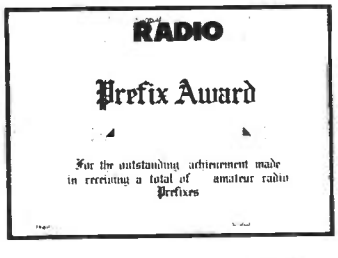
The Bristol Group is one of the oldest radio groups in the country, going back to 1913 when it was known as the Bristol Wireless Association. During its long history the group has been very active both on the local and national amateur radio scenes. Meetings are held on the last Monday of each month (except for bank holidays, when the meetings are brought forward a week) in the Queens Building at Bristol University.

The Bristol Call Book, price 40p + 20p p&p, which includes full details of the Activity Award, can be obtained from *C R Hollister (Honorary Secretary), 34 Battersby Way, Henbury, Bristol BS10 7SU.*

Prefix Award

Those of you who have the good sense to read our sister magazine, *Amateur Radio*, will be familiar with the *Amateur Radio Prefix Award.*

To qualify, you need to have logged 250, 500 or 1000 prefixes. Information originally appeared in the January *Amateur Radio.* Enquiries should be directed to the magazine or to Trevor Morgan GW4OXB.


RADIO

Prefix Award

For the outstanding achievement made in receiving a total of amateur radio Prefixes

NOTES FROM THE PAST

A recurring theme. . .

In common with all licensed amateurs throughout the world, I am anxiously awaiting the outcome of the four month conference (at Geneva) on frequency allocations. It seems, as usual, that every user of the 'ether' is claiming more space and there are now new and strong claims such as for space rocket control, 'blips' and data communication.

The tiny parts of the spectrum allocated to amateurs have, over the years, been whittled down at each succeeding conference, and some of the little they nominally retain is 'shared' (when they lose priority), or worse still blatantly stolen. The propaganda broadcast stations are the chief offenders in the latter respect. They are not only an unnecessary evil, but a double evil. Each is marked by a jamming station to worsen the congestion. Quite frequently, too, a counter-propaganda broadcaster of greater power swells the pandemonium.

No one could fairly deny the validity of the amateurs' claim. They have a right by tradition, it gives opportunity for private experiment, it contributes to international friendship, provides a ready-made network of communication in times of emergency and serves as a training ground for young technicians.

In a world where rules have become far more important than the person, where the private citizen is treated more like an ant on an ant-hill and the democracies grow more totalitarian every year, our few precious remaining liberties must be vigorously defended.

At the conference the voice of world amateurs will be heard, although the weight and influence carried may be small. Let us hope that a sense of fair play may prevail and that the slender amateur allocations will not be further plundered merely because they are the most defenceless of the groups concerned.

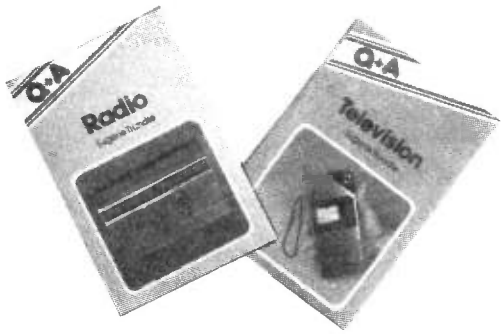
While workers sleep

People who want round-the-clock TV always stress the supposed needs of the sick and bedridden to bolster their case. In the last couple of years I have become quite an experienced invalid and, believe me, those dreary, time-filling programmes merely irritate or depress, both of which are bad things even for those in good health.

True, the BBC have put on a few worthwhile items lately, but they seem extremely shamefaced about doing it. They tack them on at the end of the evening when viewers who have to go to work next day are really past their bedtime. Perhaps our timid programme planners have decided it's better late than never – it isn't, at least not that late!

LATEST LITERATURE

Clubs, manufacturers, publishers and agents are invited to send details of new books, catalogues, data sheets, etc for inclusion on this page



QUESTIONS & ANSWERS

Two new titles have been introduced this month in the *Questions & Answers* series from Newnes Books: *Radio* and *Television,* both written by Eugene Trundle.

Like the others in this series, these inexpensive pocket-sized volumes provide a wealth of basic but useful information on these topics which will be of particular assistance to the beginner. Although not overly technical, and without going into very much detail, they do manage to explain some quite modern and complicated aspects of television and radio in a way which can be understood by almost anyone.

Q & A Television contains chapters examining the principles and working of television cameras and receivers, covering waveforms, timebases, modulation and techniques of transmission and reception of TV signals, along with a host of other related items. It also contains a chapter on colour TV.

In addition the book examines the working of broadcast television systems, including relays and microwave links, as well as taking a look into the future of some of the latest advanced TV concepts and techniques, including data displays, telesoftware and DBS satellite broadcasts.

Q & A Radio maintains the high standard of its companion. Its first few chapters deal with basic radio and electrical theory from its most basic elements, including sections which cover the way in which various types of component work and just how their functions are put into operation in radio.

This information is put to good use in the chapters on radio building blocks and receiving circuits. These chapters progress logically through the various component elements of radio hardware, culminating in touch-control and synthesised tuning techniques, including some tips on home construction.

The book includes an interesting chapter on CB and amateur radio, and although none of the information contained is unique to this book, it does nonetheless do a very good job of bringing a variety of useful titbits together in one place in an easy-to-read and entertaining format. Indeed this last feature could be attributed to both books in general.

Q & A Radio concludes with a particularly useful chapter on test gear: how the equipment works, what it can be made to do and, to an extent, why you as a hobbyist should want to do such things in the first place! As with the rest of the book the chapter combines an examination of the theory involved with practical advice for owners or would-be purchasers of test gear.

Looking at both books they certainly represent excellent value for the beginner, with several worthwhile features in common. In both cases author Eugene Trundle has managed to keep the books' content at exactly the right level, resisting the obvious temptation to go into more detail at the expense of what his readers want. By breaking the books up into 'question and answer' sections he has produced a very readable introduction to the subjects being covered, a feat which is often not achieved by other writers, even at this comparatively low level. Each book is well if simply illustrated, and each contains a surprisingly comprehensive index which makes the books useful as a source of quick reference.

Newnes Technical Books, £2.95 (each).

WRTH

This year's edition of the broadcast DXer's 'bible', *The World Radio TV Handbook*, is now available. For many of you who will have purchased one or more of the previous 38 editions the book will need no introduction, and all that needs to be said is that this year's *WRTH* is as good as ever. For those of you who have never actually laid eyes on this magnificent book, perhaps a more detailed recommendation is in order.

The *raison d'etre* of this book is its attempt to list the times, frequencies and languages of every domestic and external transmission by every radio station in the world: the fact that it comes as close as is humanly possible to doing so is utterly amazing.

The world's broadcasters are listed by country, each entry containing valuable information for the DXer such as names and addresses and verification (QSL) policy. The listings include domestic and local stations which, in Latin America for instance, represents a tremendous feat and results in a unique compendium of useful knowledge. Were the book to consist of no more than these listings it would be invaluable; the fact that it contains so much more besides goes to make it even better.

These 'bonus' features include maps of the world's transmitter locations, names and addresses of standard time and frequency stations, a list (by time) of English language broadcasts from around the world, a frequency-by-frequency listing of all the world's medium and short wave stations, a list of DX clubs worldwide and much, much more.

By careful cross-referencing of these various listings one can identify an unknown station on a given frequency, or choose a programme to listen to at a given time, or find out just about anything you might want to know about broadcast stations and the DXing hobby.

In addition to all of this, the book also contains a selection of well written feature articles and equipment reviews which should be of interest to most hobbyists. Articles in the 39th Edition cover spectrum allocations, solar activity, HF propagation predictions and a feature on the new 2KW Radio Nederlands Tx installation, with reviews of the Icom R71 and Bearcat DX1000 among others.

The message is clear: if you're interested in DXing and you haven't got an up-to-date copy of the *WRTH* go out and buy it now.

Billboard Publications,
7 Carnaby St
London W1V 1PG
£17.95

A selection of recent catalogues

Global Specialties

A 12 page two-colour catalogue from GSC details the company's range of testing and design instruments.

Divided for easy reference into product sections, the catalogue has comprehensive information on the GSC range of multiplexers, frequency standards, pulse and function generators, capacitance meters and power supplies.

A full technical specification is given for each product, together with its key features and applications.

Global Specialties Corporation,
Shire Hill Industrial Estate,
Saffron Walden,
Essex CB11 3AQ.

New England Instrument Co

A 12 page two-colour catalogue of low cost pressure sensors, transmitters, custom instrumentation and circuit boards has recently been published by the New England Instrument Company.

This publication brings together all the information needed to order NEI pressure sensors and related products. It is divided into 9 sections: answers to frequently asked questions; P200G indicating pressure sensors; P100B non-indicating pressure sensors; P150S liquid level sensors; Series P200GS CNG senders and receivers; P500D low pressure sensors; B420 low cost 4-20mA transmitters; custom instrumentation and circuits; application notes.

Copies of this catalogue are available to all designers interested in lowering their pressure sensor costs.

New England Instrument Division,
Robertshaw Controls Company,
820 Perimeter Road,
Manchester NH 03103.

National Semiconductor

National Semiconductor Corporation has announced the availability of a 16 page, four-colour overview brochure on the CIM (CMOS Industrial Microcomputer) computer board family.

The CIM brochure is designed to provide manufacturers and designers with an overview on National's microCMOS process, a technology that offers both the speed of NMOS and the power and noise immunity of CMOS. MicroCMOS technology has been used at National to develop microprocessors such as the NSC800 family and the NS32C016 of the Series 32000 family.

In addition to overview information, the brochure specifically covers topics such as National's rationale in designing microCMOS; a buy-versus-build cost comparison on board development; why National's state-of-the-art bus structure CIMBUS is the most functional for CMOS applications; available software development resources, and National's 3 year warranty on the CIM boards.

A copy of the CIM brochure can be obtained free of charge by writing to the Literature Department.

National Semiconductor Corporation,
Industriestrasse 10,
D-8080 Fürstenfeldbruck,
West Germany.

B&R Electrical Products

Recently published is the third edition of B&R's successful phone/mail order components catalogue, offering same-day despatch of orders received before 3.30pm. Many new products are featured, including tools, fuses, solid-state and miniature power relays, cermet trim-pots etc, increasing the size of the catalogue by about 15%.

With no minimum order charge and offering attractive quantity discounts, the catalogue caters for both prototype development engineers and production buyers. It includes all the most popular items from the company's range of more than half a million part numbers.

Readers who have previously registered for the B&R catalogue will automatically receive their copy, but others should apply now and fill in the registration card at the back of the catalogue to ensure receipt of future editions.

B&R Electrical Products Ltd,
Templefields,
Harlow,
Essex CM20 2BG.

Rendar

A new brochure from Rendar Limited, *International Cordsets,* shows the company's stock range of cordsets (mains leads) for worldwide markets.

For each cordset the conductor size, current rating, colour and length are indicated and a drawing clearly shows the connector(s) fitted.

Rendar cordsets are available for the UK, Europe (including local variants), Australia/New Zealand, USA/Canada, Israel and South Africa.

The new brochure is invaluable for OEMs exporting equipment anywhere in the world. Copies are available free of charge.

Rendar Limited,
Durban Road,
South Bersted,
Bognor Regis,
West Sussex PO22 9RL.

MSS

Microsystem Services (MSS), sole UK distributors for Force Computers GmbH, have announced the availability of a new free brochure entitled *System 68000 VMEbus Product Guide III 1984/85.*

The 48 page colour publication provides detailed descriptions of CPU boards, memory boards, serial and parallel I/O boards, interfaces, graphics subsystems and complete Force VME systems. A software section describes the PDOS real-time and UNIX-based operating systems and the guide also includes several application examples showing the use of boards and systems.

Microsystem Services,
PO Box 37,
Lincoln Road,
Cressex Industrial Estate,
High Wycombe,
Bucks HP12 3XJ.

Factron

Over 1,100 functional and in-circuit test device models are cross-referenced in the new Component Library book for Factron's series 700 automatic test range. These are all root devices, the very high total size is not inflated by separate models for ROMs and PALs, and it also includes a higher than average number of LSI and VLSI models.

The volume consists of three tables: a component look-up index with devices referenced by their generic name and corresponding Factron number, a cross-reference detailing all the equivalent devices from different manufacturers, referencing over 4,000 devices, and a table using the Factron name to reference both the in-circuit test routine and ASSET functional model.

The test routines include truth table tests and algorithmically-generated sequences for extended-length patterns without increasing RAM capacity. Forthcoming device support in the library will include various new 68000 family ICs including the 68008, more 6800 processors and peripherals, the 1800 family, some more Z80 peripherals and some 9900 devices.

Factron-Schlumberger,
Ferndown Industrial Estate,
Wimborne,
Dorset BH21 7PP.

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VP5	200	Assorted Capacitors All Types	£1.00
VP6	200	Ceramic Caps Miniature – Mixed	£1.00
VP7	100	Mixed Ceramics Disc. 1pf – 56pf	£1.00
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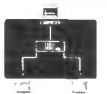

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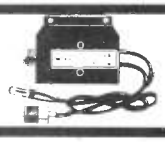

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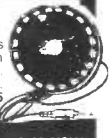

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ATV ON THE AIR

Presented by Andy Emmerson G8PTH

It's a long time since I took a trip to Brissel: of course it's a very pleasant city, and unlike some places they have the excellent sense to publish a handy guide to the local dialect. You can buy this phrasebook on the station bookstall, and once armed with a copy of this you can set forth into the city itself in the sure knowledge that you won't be foxed by the native lingo. Actually, once you get into the swing of it it's rather fun, what with TV camerals and the like.

Spotlight on Bristol

Oh dear, what did Shaun G8VPG and his fellow Bristolians do to be insulted like this? Simple, he wrote me a letter. And a very comprehensive letter it was too, giving a complete rundown on the ATV scene in the Bristol region. I think it gives a fascinating insight into what can be achieved, so I shall dip into it here. We really could do with some more letters like this, so how about it? Start scribbling . . .

Activity on 70cm

In the Bristol and Bath area two days are set aside for ATV, Sunday and Wednesday. The fun starts after 1830 or so, with talkback centred on 144.750 FM, horizontal of course. Many stations monitor this frequency at other times and activity can often be found on other evenings as well. On 70cm there are around twenty stations with full vision transceive facilities, and some of the most active are: G8VPG, G8UUE, G8GLQ, G4ZQF, G4BVK, G3AHB, G6ZKC, G6OCV, G4ZBL, G6RQP, G4WGE and G8X20.

The following are active on receive only: G1IXE, G4YQR, G4YQH and G8XYN.

Shaun himself is half-way between most of these stations, so he is well placed to receive most of their signals. He is located some ten miles away from the main centre of activity in north-west Bristol though, so his reports are more useful for far-field testing when people have made changes to their stations. Not too far away is a growing band of ATVers in the Forest of Dean, who usually provide a reliable contact, even under flat conditions. Those involved are: G1EYF, G6TSL, G8WGO and G1DIV.

Higher things

There is growing activity on 24cm too, with the keen hope that the repeater GB3UT will be on the air soon. The chief constructors, Ian G8XZD and Pete G4JQP from the Mendip Repeater Group, hope to have it completed in the early part of 1985. Shaun does hope however that there will be plenty of simplex activity too. Here is how he and others are preparing for 24cm.

G8VPQ: FM and AM receive with Wood & Douglas downconverter plus VIDIF board for FM, Band I TV tuner for AM. FM transmit uses the whole W&D package, running an estimated 6 watts to a 23 element Tonna aerial (the 1250MHz version). Shaun says all his TV gear is home-built from Wood & Douglas parts, which he finds to be excellent.

G4ZBL: Receive as above and transmit likely to be similar once completed.

G8GLQ: Fortop downconverter and Band I television for AM IF. No FM capability (why not?!?). Transmits about 1.5 watts of tripled AM into a J-Beam corner reflector.

G4ZQF: Uses a CQ Centre converter and 23 element Tonna. No FM capability (this is really too bad!).

Apart from these G8XZD is also active on AM, but details of his gear are not known.

'I am convinced,' writes Shaun, 'that FM is the way ahead on this band and have equipped my station accordingly (multimode receive, FM-only transmit). However, there is a considerable body of AM devotees locally, especially those concerned with GB3UT. It will be interesting to see how activity splits between the two modes in a year or two's time.'

As well as activity on 1.3GHz, some of the Avonians are thinking about experiments on 10GHz. Shaun now has a half-metre dish and a Solfan in-line microwave head, as does Steve G4ZBL. Initial activity will be FM phone, but Shaun hopes to use the gear on TV as well eventually. He thinks it is a shame that the latest BATC handbook has dropped the X-Band transceiver project.

A formal association

Finally from Shaun a few words about the North Bristol TV Group. This is an association of members of the North Bristol Amateur Radio Club who are interested in ATV. Present membership includes G4ZQF, G8UUE, G6OCV, G8XYN, G8WAX, G4ZBL and G8VPG.

Their main object is to group together for events where they can give a hand or where a combined effort would lead to a more effective outcome. Last summer they put up a colour TV link on 70cm to televise a local school's fete. They also entered the international ATV contest in September from Roger G4ZQF's house (the best-sited QTH in the group). Apart from this further portable operation is planned from the local mountain-top, Lansdown (Bath) which is 800 feet above sea level.

Other news

All this activity takes my breath away. If you are impressed too why not emulate these people. If you are already organised like this why not drop me a line care of the editor and you too can be featured in this column.

GB3TV, the Dunstable repeater, goes from strength to strength, with activity most afternoons and evenings. Several members have got hold of a rather spectacular piece of software for the Spectrum computer and are relaying a bulletin board through the box. You can now read the Dunstable Downs Radio Club's fixtures 'on the box', and also profiles of the various people who work through the repeater.

One of these is using a Solent Scientific 10mW test transmitter alone into a beam antenna, and gets a very creditable picture through the box. He lives in a 'hole' where 70cm is useless and the repeater is his only means of 'getting out' with TV.

There are also plans to put a micro at the repeater site and to devise a means of calling up specific programs or test patterns when users wish to align a receiver or aerial without having to bribe someone else to bring up the repeater (not very successful at 3am, which is the sort of time I finish my projects and am ready to test them!). There are also persistent rumours that GB3GV (Leicester) is preparing to move to a better site.

Envoi

Apologies if you are still looking for a cut-price Sony effects unit – it looks as if others have beaten you to the bargains. You had better snap up a Sinclair Spectrum while they are around at the new reduced price! That's all for this time so see you next month. REW

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DX-TV

RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

For the long distance television enthusiast, January was quite a memorable month. The closedown of the last remaining 405-line transmitters in Bands I and III meant reasonably clear channels with the possibility of receiving signals on previously occupied frequencies. The closedown on 3 January coincided with the Quadrantids meteor shower peak, and those who bothered to monitor Bands I and III during the day were rewarded with sightings from rare stations.

Sporadic-E unveiled itself several times during the month with Iceland and Spain being well to the fore. At the end of the month there was a slight tropospheric lift, although it wasn't really much to shout about.

Pings and bursts

Despite a fair amount of early warning the Quadrantids meteor showers of early January came and went without detection, judging from most log reports received. Perhaps most enthusiasts declined to take advantage of Band III either through lack of confidence or simply because only one DX receiver was available. Possibly some DXers felt that Band I would be more productive and consequently more fun.

However, Band III was extremely active with Sweden being a particularly frequent visitor on channels E5, E6, E7, E8 and E9. Several strong 'pings' occurred here in Derby, thus making identification on the PM5534 test card easily readable. Shortly after appearing on a Band III channel a ping would occur on a Band I channel, namely E4.

This seems to be a characteristic of meteor shower DX. The higher frequencies are affected first and the pings are of short duration. On Band I channels relatively long duration signals are usually noted, particularly on E2 and R1. In fact, Band I reception via meteor shower during January often resembled Sporadic-E propagation. Perhaps this explains the general lack of comments about the Quadrantids from our readers.

Proper test cards

The universal use of electronically generated test cards (except by the BBC, who can't seem to be bothered to use any type these days) and that other boring phenomenon which we're all plagued with, sample teletext pages (here the BBC excels!), means that nowadays test transmissions tend to take on a 'prepackaged' format. There are only two television services receivable in the UK which retain good old-fashioned monoscopic test cards for regular daytime test transmissions. These are TSS in Russia (they radiate a test card known as the '0249' at certain times) and ORF in Austria.

ORF transmit the 'Telefunken TO5' test card, which alternates with the PM5544 on both the 1st and 2nd networks although not necessarily screened at the same time. The Austrian Telefunken and PM5544 test cards carry the same electronically superimposed identification 'ORF FS1' or 'ORF FS2' depending upon the network.

The Telefunken test card is occasionally confused with the RETMA Resolution Chart 1956. At first glance they do perhaps look similar, but there are differences, especially within the centre circle. The frequency wedges are different and the Telefunken exhibits five characteristic angled stripes immediately to the left of the upper vertical wedge.

Another similar style monoscopic test card is the RMA Resolution Chart 1946. At one time it was used by the 1st and 2nd networks of NOS in the Netherlands and RTP-2 in Portugal. It resembles the Telefunken TO5 test card in many ways, but the RMA test card has a larger circle and does not feature the five stripes.

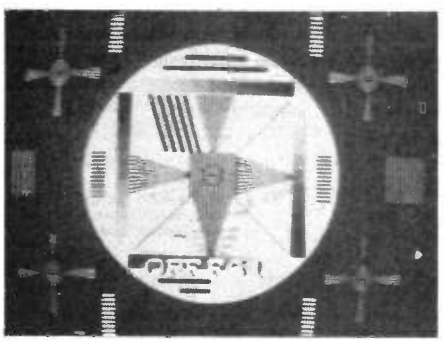
As mentioned earlier most of the monoscopic test cards disappeared years ago, and some readers may be wondering why we have raided the archives to feature some of them in this column. Well, several DX-TV enthusiasts have been surprised recently to see some of the old favourites reappear.

On 23 January, Simon Hamer of New Radnor in Powys noted CST-Czechoslovakia on channel R1 with their old monoscopic test card carrying the identification 'CESKOSLOVENSKO' towards the top. This particular test card was used by CST until 1971, when an electronically generated monochrome test card was introduced. This was similar to the 'RS-KH' test pattern. Another version of the old CST test card is featured this month. We have never actually seen this on the screen but it is apparently shown for special engineering tests. Perhaps the electronic 'RS-KH' was temporarily out of action for a while.

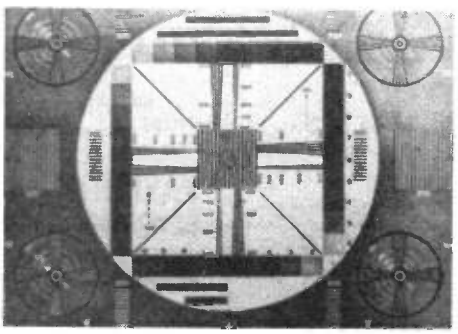
Startling

On 11 January, John Bray of St Neots in Cambridgeshire was startled to find a weak test card 'G' appear on his screen for approximately thirty seconds. Reception was on Channel E2 shortly after midday. A flick through his copy of the *Guide to World-wide Television Test Cards – Edition 2* informed him that Bulgaria were the last users of this test card in the European area, but of course they don't operate in Band I and certainly not on the 'E' channels. The test card shown in the book was the basic version with the designation letter 'G' at the bottom. John's test card had a white segment.

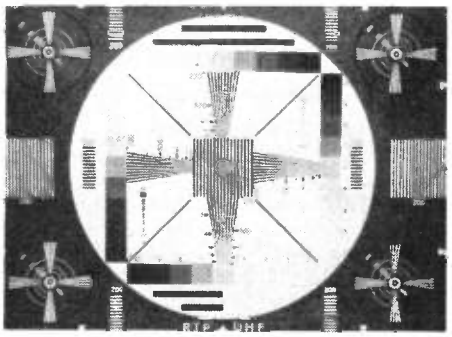
Our own conclusion was that NRK were transmitting it for some reason on that day. Norway, Denmark and Finland were



Telefunken TO5 monoscopic test card still used by ORF in Austria



The RETMA 1956 test card used in the late '60s by some European TV services



RMA 1946 test card used in the past by Dutch and Portuguese TV services

the main users of test card 'G' until the arrival of colour in the early seventies. Out of these three countries only Norway operates on E2. Details of John's reception were forwarded to Norsk Rikskringkasting (NRK), but they inform us that test card 'G' has not been radiated in Norway for over a decade. Can anyone clear up this mystery?

John also tells us that he saw the old Swedish tuning card on channel E2 on 6 December 1984. This consisted of a girl's head within a circle which also contained a 10-step greyscale.

It seems that for some strange reason several European services are radiating old monoscopic test cards, so be on the look-out. A comprehensive selection of such test cards plus up-to-date patterns, clock and identification captions can be found in the *Guide to World-wide Television Test Cards*. It's available, price £2.95 including postage world-wide (add 70p for airmail) from: *HS Publications, 17 Collingham Gardens, Derby DE3 4FS.*

New French identification

The identification on the PM5544 test card radiated by Télédiffusion de France (TDF) has undergone a few changes. The initials 'TDF' are retained at the top but the lower black rectangle now carries additional information. The 1st network of Télévision Française uses 'tf 1 RES 1', 'A2 RES 2' is used by the 2nd network of Antenne 2, and France Régions-3 (3rd network) radiates 'FR3 RES 3'.

The Canal Plus service on channel F7 is still undergoing tests. Yet another test pattern has been pressed into service. It consists of a cross-hatch with a circle completely filled with a greyscale or a set of colour bars.

Band I stays in Norway

In the March issue of ***R&EW*** we mentioned that a limited number of 50MHz permits were being issued to Norwegian amateur radio enthusiasts for the use of this band outside television broadcasting hours. There was also a rumour that the Band I service of NRK would close completely during 1985-86. However, correspondence from the Norwegian authorities on this subject states that there is no intention to close Band I. It would mean major alterations to the transmitter distribution links, since the whole network is based on main VHF transmitters supplying low power relays at UHF. To quote the authorities, 'One channel E2 transmitter feeds 50 transposers'. So it seems that the rumours were somewhat ill-founded!

DX-TV log for January

This month we are featuring Clive Athowe's DX-TV log covering January. Note the predominance of Band III meteor shower activity.

2/1/85: TSS (Russia) on channel R1 with programmes via Sporadic-E; TSS R1 on colour bars; PM5534 test card via meteor shower (MS) at 1300GMT on E5/R6.

3/1/85: CST (Czechoslovakia) R6 on 'RS-KH' EZO-type electronic test card, noted several times via MS; TVP (Poland) R6 with PM5544 which has a dark background, noted three times via MS; TSS R6 with several 'pings' of programmes via MS; SR-1 (Sweden) E5 radiating the 'TV 1 SVERIGE' PM5534 via MS, noted several times; DDR:F1 (East Germany) E5 on electronic test pattern via MS; NRK (Norway) with the 'NORGE LYNGEN' PM5544 on channel E5 via MS. According to Clive the shower peaked around midday but lasted well into the evening when many programmes were seen on E5/R6.

4/1/85: CST R6 showing the 'RS-KH' test card (MS).

5/1/85: NRK E2 with the 'NORGE MELHUS' PM5544 test card received via Sporadic-E.

6/1/85: TSS on channel R6 with a caption using the Cyrillic alphabet (MS); TVP R2 programmes; RAI (Italy) on channel IA with programmes via Sporadic-E.

7/1/85: SR-1 on E5 with the 'TV1 SVERIGE' test card, noted twice via meteor shower..

8/1/85: CST R6 with the EZO-type test card via MS.

9/1/85: SR-1 E5 on PM5534; CST R6 on EZO-type test card; several unidentified signals via MS on E5/R6.

11/1/85: TDF (France) with Canal Plus on channel F7 with a 'new' test pattern, possibly from the Rouen transmitter.

15/1/85: TSS R6 showing the colour electronic test card and received via MS.

17/1/85: Unidentified PM5544 via MS; unidentified programme via MS on channel E10(!).

22/1/85: TSS on R2 with 'EESTI TV TALLIN' blockboard-type test pattern via MS.

23/1/85: TSS R6 with electronic test card via MS; SR-1 on PM5534 via MS on E5.

24/1/85: CST R6 with 'RS-KH' test card via meteor shower.

29/1/85: TVE (Spain) on channels E2, E3 and E4 radiating the GTE colour test card with 'tve tve' identification during the morning. Very strong signals were noted via Sporadic-E.

Our thanks to Clive (Blofield, Norwich) for sending his impressive DX-TV log.

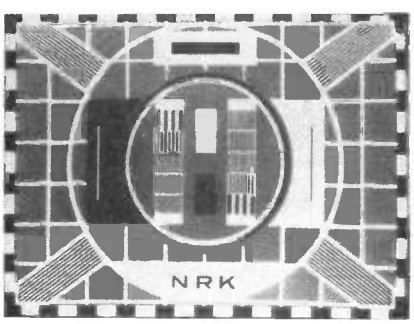
Reception reports

Quick checks on Band I channels gave Simon Hamer of Powys Sporadic-E reception on the following dates: 6th, 9th, 14th, 17th, 19th, 20th, 23rd, and 30th. Russia, Sweden, Norway and Czechoslovakia were all logged during daytime openings.

Italy on channel IA and Austria on E2a were seen during the evenings of the 30th and 9th respectively. A surprise opening on the 21st occurred and the Icelandic PM5544 test card from RUV appeared on channel E4. The identification was 'RUV ISLAND' and it was an 'exotic' for Simon. His valley location means that he is shielded from the north and reception from Iceland could only be achieved by using a vertical array. Possibly some form of local polarisation change took place.

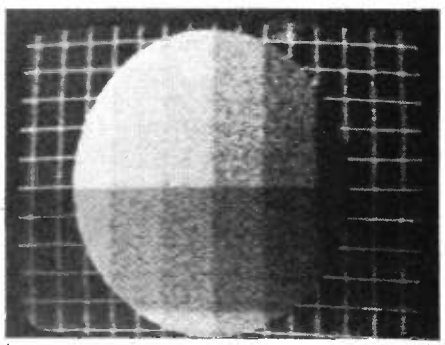
Tony Privett of Basingstoke has supplied a computer-styled log report for January. DX was located on most Band I channels virtually every day. The highlights include: TSS (Russia) with the news at 1627 on the 2nd identified by the 'HOBOCTN' caption; YLE (Finland) on E4 with the 'YLE TV1' FuBK test card on the 3rd, probably via meteor shower; TVE (Spain) on E2 and E4 on the 6th. The Spanish reception consisted of the GTE colour test card at around 0840.

The slight tropospheric lift towards the end of the month permitted Tony to receive Dutch, Belgian and West German signals in colour and with sound.



Test card 'G' used by Norway in the late '60s and early '70s (courtesy of NRK, Oslo)

Swedish tuning card for colour TV, used several years ago

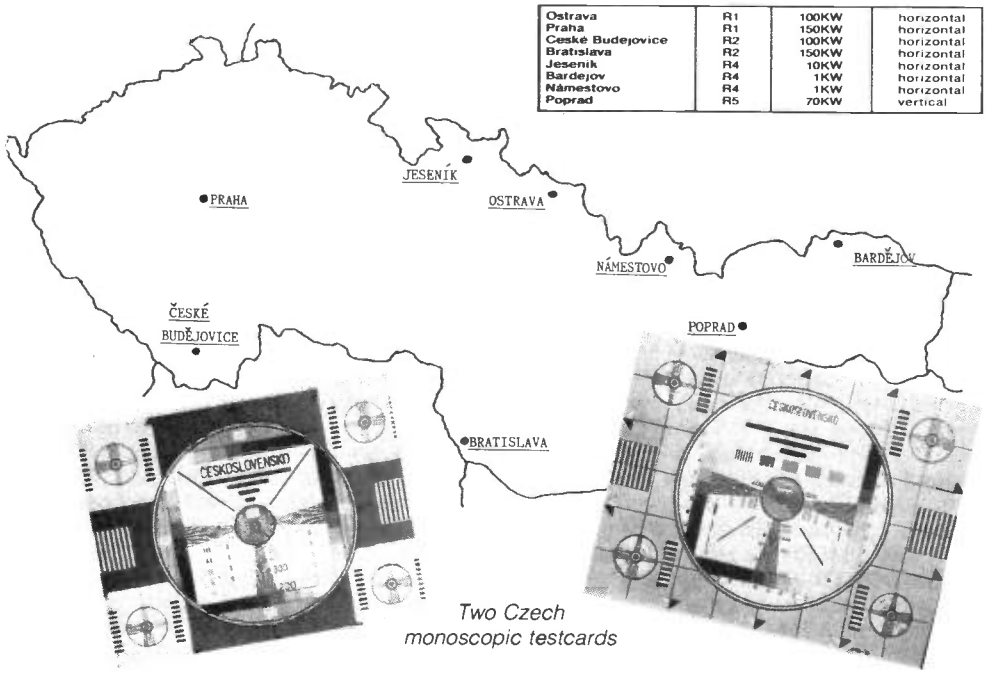


A new test pattern noted on F7 from the French 'Canal Plus' service

DX-TV RECEPTION REPORTS

CZECHOSLOVAKIA

Ostrava	R1	100KW	horizontal
Praha	R1	150KW	horizontal
České Budejovice	R2	100KW	horizontal
Bratislava	R2	150KW	horizontal
Jesenik	R4	10KW	horizontal
Bardejov	R4	1KW	horizontal
Námestovo	R4	1KW	horizontal
Poprad	R5	70KW	vertical



Two Czech monoscopic testcards

RTL-Luxembourg was in evidence on channels E21, E24 and E27.

A French-speaking station on E60 still hasn't been identified, but we assume the service is using system 'B' and not 'L' as in France.

Tony has managed to acquire direct from Sanyo a multi-standard monochrome receiver with a 2½ inch screen. The model number is TPM2770 and it covers UHF channels E21 to E69, Bands I and III plus the American system 'M' channels A2-A13 and A14-A69. This type of receiver would seem ideally suited to DX-TV work, especially during Band I openings. The reduced bandwidth on system 'M' channels should allow better selectivity and therefore greater discrimination between unwanted adjacent channels.

Bob Brooks of South Wirral is experiencing problems from nearby home computers during certain times of the day. The interference is caused chiefly through bad and insufficient (or even total lack of) screening in the computer. Incidentally, video recorders can also produce odd effects at VHF frequencies. We have personally experienced problems on the FM radio band with interference coming from two Sony C7 video recorders. It seems to be hard luck if you and your neighbour site equipment next to the adjoining wall of your semi!

Despite the interference problems, Bob has successfully noted most European countries, in particular the Polish PM5544 test card on 6 January. Unusually the pattern carried identification, 'TVP-WAR', indicating that it originated from the studios in Warszawa.

Clive Athowe, while taking a well-earned break from his Quadrantids meteor shower reception, has been road-testing an SX-400N scanner. The narrowband facility has been very good indeed, with West German TV sound noted on most days on channels E21 to E35. The RTE-2 (Eire) channel I transmitter at Mt Leinster on 221.75MHz was resolved every day too at a distance of over 300 miles.

Kevin Jackson of Leeds has kindly forwarded a complete list of Czechoslovakian 1st and 2nd network transmitters. The ones which will most interest DXers are in Bands I and II. These are listed in the table. This listing shows 1st network transmitters which are capable of being received in the UK via Sporadic-E propagation.

The list which Kevin has sent also includes CCIR and OIRT channel allocations from Band I through to channel 69 in Band V. A mystery is an additional allocation and reference to 'channel 81'. Its vision frequency is 951.25MHz and the sound frequency is 956.75MHz in the case of CCIR system 'G' (5.5MHz sound/vision spacing), and 957.75MHz for OIRT system 'K' with 6.5MHz sound/vision spacing. The brief text accompanying it is, unfortunately, in the Czech language, and reads 'Dalsí vyssí kanály jsou cleneny s odstupem 8MHz az do kanálu c. 81'. Kevin would like to know what the translation is. Any offers?

Service Information

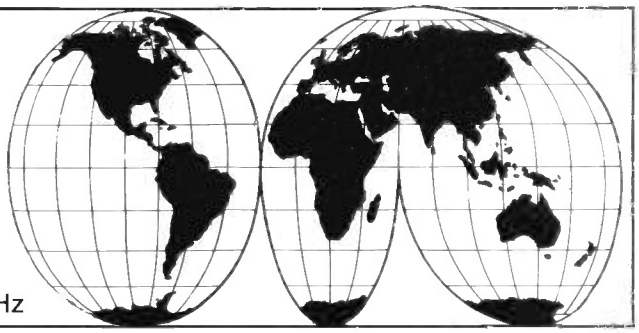
Belgium: There are rumours that a BFBS (British Forces Broadcasting Service) transmitter will soon be installed. Further details are not currently available.

Luxembourg: Radio-Télé-Luxembourg have the following transmitters in service:

Dudelange E21 RTL 1000KW SECAM;
Dudelange E27 RTL 1000KW PAL;
Dudelange E7 RTL PLUS 140KW PAL;
Marnach E24 RTL PLUS 20KW PAL.

Our thanks to Gösta van der Linden of Rotterdam, Netherlands for supplying this month's service information.

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

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

Continuing our review of some of the Chinese regional stations, we now move up the dial from the 90 metre band (**3200** to **3400**) to the 60 metre band (**4750** to **5050**).

If you often tune to **4750** around 2300 you may eventually manage to hear Xizang PBS (People's Broadcasting Station) at Lhasa in Tibet opening at that time to 0205. It is also on the air from 0355 to 0600 and from 1000 to 1455 in Chinese, including an English language lesson from 1400 to 1430 and programmes in Tibetan from 0100 to 0120 and from 1230 to 1250. Xizang is frequently logged by UK DXers.

Less frequently reported is Yunnan PBS, which operates on **4760** from Kunming. The schedule is from 2250 to 2400, from 0100 to 0800 and from 0900 to 1600. This is Yunnan 1 which has a power of 50KW, as indeed does Lhasa.

Rather more difficult in my experience is Zhejiang PBS, Hangzhou on **4785** with local programmes from 2100 to 0520 and from 0850 to 1510. There are English language lessons from 2140 to 2210 and from 1330 to 1400. The power is variable from 10 to 50KW. Listen around 2300 when co-channel Baku Relay in the USSR is off the air.

Sometimes logged during the late evenings is Liaoning PBS at Shenyang on **4830** working to the scheduled Chinese programmes from 2050 to 0100, from 0250 to 0640 and from 0855 to 1500, these times also including an English language lesson from 0000 to 0030 and Japanese language lessons from 2100 to 2130 and from 0900 to 0930. The frequency of this one can vary to **4831** on occasion.

Slightly higher up the band is Heilongjiang PBS sited at Harbin, from where it operates the Home Service 2 in Chinese and some relays of Beijing 1 from 2055 (from May to October inclusive 2000) to 2300, from 0155 to 0500 and from 0850 to 1355, which includes English language lessons from 2115 to 2145 and from 1310 to 1340. Heilongjiang PBS may also be heard in parallel on **4925.**

The easiest of all Chinese regionals to log on the 60 metre band is undoubtedly Gansu PBS at Lanzhou on **4865** with the Home Service and some relays of Beijing. The transmission periods are timed from 2130 to 0130, from 0330 to 0620 and from 0900 to 1600, the late evening period being most favourable for reception here in the UK.

Adjust your receiver to the **4915** channel for possible reception of Guangxi PBS based in Nanning, from where it radiates Guangxi 1 programmes in Chinese and Liuzhou dialects from 2110 to 0500 and from 0850 to 1600 with English language lessons from 0430 to 0500 and from 1330 to 1400. I have logged this one on several occasions during the late afternoon.

Qinghai PBS, Xining is on **4940** with relays of the Home Service 1 and local programmes in Chinese. The schedule is from 2225 to 0115, from 0340 to 0630 and from 0955 to 1530 with the inevitable English language lessons timed from 2300 to 2330, from 1000 to 1030 and from 1400 to 1430. This one is in parallel on **3950.**

At Urumqi, Xinjiang PBS transmits on **4970** featuring the Home Service in Chinese from 0000 to 0230 and from 1200 to 1720, this including a relay of the Beijing programme in Kazakh from 0100 to 0125. Xinjiang is also on the air with a relay of the Beijing Foreign Service in Russian from 1800 to 2055. All periods are in parallel on **5440.**

Logged here in the UK on favourable occasions is the Changsha-located Hunan PBS on **4990** from where it is timed on the air from 2100 to 0100, from 0320 to 0515 and from 0920 to 1440 in Chinese, with an English language lesson from 1330 to 1400.

The seldom logged Guangxi PBS on **5010** located at Nanning is scheduled from 2125 to 0000, from 0255 to 0620 and from 0950 to 1500 with an English language lesson from 2315 to 2345.

More likely to be heard than the above is Jiangxi PBS at Nanchang, from where it is on the air from 2100 to 1500 including the usual English lessons from 2130 to 2200, and from 1300 to 1330. The frequency is **5020.**

The foregoing is not a complete list of Chinese regionals, but does include most of those likely to be heard here in the UK. Some of them are comparatively easy to log whilst others are difficult in the extreme. However, the short waves are apt to produce surprises at the most unlikely times – you may even manage to hear the 10KW Fujian PBS at Fuzhou, scheduled in Chinese and Amoy from 2050 to 1700 on **4975,** or the nearby **4980** channel with signals from Hubei PBS at Wuhan (it closes at 1610). In either case count yourself fortunate indeed.

Good luck!

AROUND THE DIAL

Make yourself comfortable, switch on the reciever, adjust the dial or digits to the frequencies at the times listed here and you may log the following

AFRICA

Benin

Cotonou on **4870** at 1808, OMs with a discussion in one of the eighteen local vernaculars, this being followed by some folk music in typical African style.

Cameroon

Radio Bertoua on **4750** at 0409, OM with announcements in a vernacular then into a programme of fast rhythmic local music. R Bertoua is scheduled from 0430 to 0800 and from 1600 to 2200 with a power of 20KW. This must have been an extended sked.

Cape Verde

Voz de Sao Vicente on **3930** at 2359 when signing off with an orchestral version of the National Anthem, this being followed by four musical chimes. Previously on **3931**, this 10KW transmitter operates from 1200 to 1400 and from 1800 to 2400 Monday to Friday inclusive. Saturday from 1200 (Sunday from 0900) to 2400.

Chad

N'djamena on **4904** at 0526, OM with announcements in vernacular, YLs with songs complete with a background of African drums. The evening session of this one is from 1730 to 2100 (Saturday until 2200) and the power is 100KW.

Djibouti

Radio Djibouti on **4780** at 0427, stringed-instrument music, OM with a song in Somali. The schedule is from 0300 to 0800 (Friday 0500 to 0900) and from 0900 to 1900 with a power of 20KW.

For those interested in receiving Somalia, we have logged Mogadishu on **7200** at 2028, OM with a song in Arabic then OM with the station identification at 2032.

Egypt

Cairo on **17675** at 1117, recitations from the Holy Quran during the Arabic transmission for South and South East Asia, timed from 1115 to 1215.

Ethiopia

Addis Ababa on **9560** at 1401, OM with the news in an Arabic programme for East Africa, scheduled from 1400 to 1500.

Liberia

ELWA Monrovia on **3230** at 2030, OMs with a discussion in vernacular. This transmitter is owned and operated by the Cultural Missionary Broad-

casting Service of the Sudan Interior Mission. The Home Service logged here is on the air from 0610 to 0802 and from 1805 to 2222. The power is 10KW.

Madagascar

Radio Nederlands Relay on **11730** at 2050, YL with the station identification and announcements during the English transmission to Central and West Africa, timed from 2030 to 2130.

South Africa

RSA Johannesburg on **25790** at 1446, OM and YL being interviewed about the local theatre scene during an English programme for Africa, Europe and the Middle East and scheduled from 1300 to 1600.

Tunisia

Tunis on **7225** at 2004, OM with a newscast in Arabic in a transmission of the External Service directed to Europe daily from 1900 to 2100 on this frequency.

Tunis has also been heard on **17820** at 0630, OM with a talk in the Arabic programmed National Network which is on this channel from 0600 to 1600.

THE AMERICAS

Bolivia

Radio Santa Ana on a measured **4803.5** at 0346, YL with folk songs, OM with announcements and promos in Spanish. R Santa Ana in Yacuma operates from 1100 to 1800 and from 2130 to 0300 but all times are variable, as is the frequency. The power is 1KW.

Brazil

Radio Relogio Federal, Rio de Janeiro on **4905** at 0330, OM with announcements, station identification in Portuguese, all with underlying time-check pips every minute. The schedule is from 0800 to 0300 with a power of 5KW but again my observations are at variance with published data.

Colombia

Ondas del Meta, Villavivencio on **4885** at 0324, YL and OM songs in Spanish, OM promos then local pops on records. The frequency shown is nominal but it can vary slightly, and the schedule is from 1000 (varies to 0900) to 0500 (varies at times to 0330 but also occasionally works around-the-clock). The power is 5KW.

Radio Sutatenza, Bogata on **5095** at 0311, OM announcements then YL with a song in Spanish complete with guitar backing. R Sutatenza operates from 0900 (Sunday from 1000) to 0400 (Sunday until 0300) and the power is 50KW.

Cuba

Havana on **11850** at 1906, YL with a newscast in the French programme for Africa and the Mediterranean area, timed from 1900 to 2010.

Ecuador

HCJB Quito on **3220** at 0304, OM with a religious talk in Spanish. HCJB on this channel features programmes in Quechua from 0900 to 1300 and from 2130 to 0200 and in Spanish from 0200 to 0500. The power is 10KW.

Radio Zaracay, Santo Domingo on **3395** at 0320, OM with announcements in Spanish then some local-style dance music. The schedule is from 1000 to 1400 and from 2000 to 0500 (Sunday until 0400) and the power is 25KW.

Paraguay

Radio Nacional, Asuncion on a measured **9732** at 0057, OM with sports commentary then station identification in Spanish. This 100KW transmitter is listed on **9735** and is scheduled on the air from 1000 to 1800 and from 2100 to 0300.

Venezuela

Radio Juventud, Barquisimeto on **4900** at 0356, OM with station identification, announcements in Spanish followed by a choral rendition of the National Anthem and carrier off at 0400. R Juventud is scheduled from 1000 to 0400 with a power of 10KW. Most Venezuelans close at 0400 but recently I have logged some of them close to 0500 at weekends.

ASIA

Afghanistan

Kabul on **4450** at 1515, YL with a song, local music then OM with announcements in the Home Service relayed on this channel by a USSR-based transmitter. This service is scheduled from 0125 to 0200, from 0330 to 0430 and from 1430 to 1930.

China

PLA (People's Liberation Army) Fuzhou, Fujian on **3400** at 1530, Chinese music, YL with announcements in Chinese. From November to March the schedule is 0745 to 1800, from April to October it is from 1000 to 1730. The power is 10KW.

India

AIR (All India Radio) Calcutta on **4820** at 1525, OM with a talk in vernacular. At 10KW, Calcutta operates from 0025 to 0210 and from 1230 to 1732. There is an English newscast at 1530.

AIR Delhi on **4860** at 1531, OM with a newscast in English. The late afternoon slot is from 1445 to a variable closing at 1630. The power is 10KW.

Iraq

Baghdad on **9635** at 2056, OM and YL with songs, Arabic music, pips time-check at 2100 then OM with the station identification in Arabic. Also logged in parallel on **9745.** This was a transmission in the 'Voice of the Masses' external service.

Pakistan

Islamabad on a measured **4762** at 1555, OM station identification in vernacular and announcements, YL with a talk from 1600 to 1612, OM with a newscast then YL with station identification. Still on channel at 1647 fade-out. This one has since been logged on a measured **4777**, so take your choice!

Azad Kashmir Radio, Trarkhel (announced) on **4790** at 1617, YL with announcements in vernacular, YL and OM with songs. This one has a Home Service and relays of Radio Pakistan. The schedule is from 0125 (varies to 0015) to 0430 and from 1410 to 1800 with a power of 10KW.

EUROPE

Albania

Tirana on **9500** at 1420, choir with songs in the English transmission for Australia and South East Asia, scheduled from 1400 to 1430.

Hungary

Budapest on **9835** at 1050, OM with announcements then some recorded pop music during an English programme for Europe, timed from 1050 to 1120.

Norway

Oslo on **9590** at 1335, OM and YL with a talk in the Norwegian programme to Europe, the Middle East, Africa and Central America, which is scheduled from 1300 to 1345.

Poland

Warsaw on **9540** at 1129, interval signal, OM station identification then into the French programme for Europe, timed from 1130 to 1200.

Sweden

Stockholm on **9630** at 1107, OMs with a discussion about the current local football scene in an English programme for Europe and the Pacific, timed from 1100 to 1130.

Vatican

Vatican City on **11700** at 2014, interval signal, OM station identification then the Portuguese programme for Africa, scheduled from 2015 to 2030. Also heard in parallel on **11760.**

NOW HEAR THIS

Radio Nueva America, La Paz, Bolivia on a measured **4796.3** at 0324, OM with a talk in Spanish, twice mentioning an address in La Paz. Closing at 0400, the power is 1KW.

DOTS AND DASHES

Changing the scenery, a few ventures to Top Band resulted in some DX using the CW mode. EA3VY, IK5DYQ, LA1GCA, OE5KE, OH0BA, RA4FE, RB5IIM, SM6EHY, SP5INQ, UA6HOF, YU4EXA and 4X4NJ amongst others made the change worthwhile, as did a couple of forays on the 7MHz band during the very early mornings.

The 40 metre key-bashers were CX2SA, KP4IH, LU2DC, PY1ZFF, UF6FHM, UH8EAA, UZ9SWY, VK3AMZ, YV1JXC, ZS5MY, 5B4DN and 8P6NW.

All of which brings to a close this month's short wave saga.

NEXT ISSUE

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SPECTRUM INTERFACE

Build a versatile interface for your Spectrum from this straightforward design by A P Dean

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As a follow-up to his outline of Z80 Morse decoding, Dr M A Kiam-Laine presents a machine code program

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Ray Marston concludes the opto-electronics series with a miscellany of opto-devices

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This project from David Silvester works beautifully, and with his outline of amplifier design theory you will know why it does so

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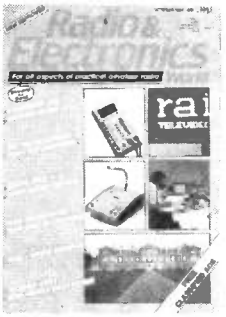
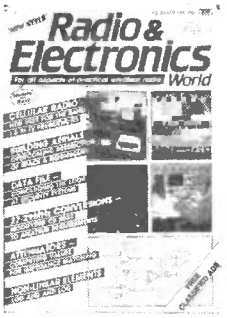
All issues from October 1981 onwards are still available, with the exceptions of January and February 1982, and December 1983. All orders must be pre-paid, the cost of each issue being £1.00 inclusive of postage and packing. A contents index spanning the issues from October 1981 to September 1983 is available on receipt of a stamped addressed envelope. To ensure that you don't miss any future issues, we suggest that you place a regular order with your newsagent or complete the subscription order form found in this issue.

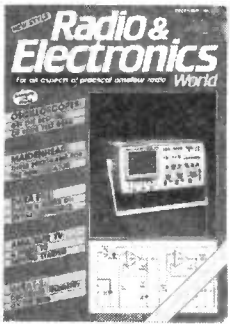
SEPTEMBER 1984
Projects – Low Power Transmitter, an 80m CW design; AM RAD, an experimental signal generator; Spectrum Analyser, further update on this project; Five Station Scanner, an add on unit for the 720 channel airband receiver.
Features – Computing Inductances, a program for winding coils; Data File, a look at alarm systems; Satellite Update, more information about weather satellites; Noise, a look at this electronic phenomenon; Distance and Bearing Program, an aid for station location; Super-Transmatch, a review of Tau Systems ATU kit.



OCTOBER 1984
Projects — Base Mic, construct this processor controlled accessory; One night's work, build an indoor UHF TV aerial.
Features — Modems, the link between computers and radio; Non-linear elements, a look at multipliers; Data File, continuing the look at alarm systems; SSTV for the BBC Micro, getting started in this mode; Testing! Testing! how to use your test gear: multimeters.



NOVEMBER 1984
Features – cellular mobile radio; computing attenuators for calculating resistance values; small aerials, coping with problems of space; 27-29MHz conversions; Data File, concluding the series on security systems; FETs – a beginner's guide; Non-Linear elements, log and anti-log; QSO, interesting contacts from clubs and individuals; ATV on the air, with a look at a range of aerials for the average pocket.

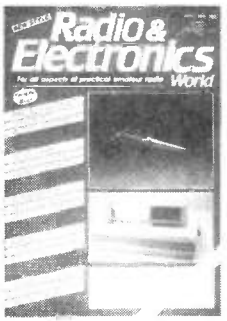


DECEMBER 1984
Features — Cable TV goes on the air; Simple speech processor, a simple device to increase a stations 'talk power', Uosat-2 telemetry, decoding satellite signals using this BBC Micro program; Tatung Einstein review; Testing! Testing! oscilloscopes; ATV — getting started; Data File, LED circuits and opto electronic principles; Morse test, self study course; Computing Maidenhead, three programs relating to the Universal (Maidenhead) Locator; QSO, club and event news; ATV on the Air, with news from the air waves.

JANUARY 1985
Features — Canal Plus, Europe's first VHF/UHF pay-TV service; Phased Vertical Arrays, a computer program for the design and modelling of antenna systems; Russian Satellites, the first part of a series looking at the equipment used to decode signals from the navigation satellites; RF small signal amplifiers, some of the obstacles encountered when constructing radio frequency devices; Principles of Z80 Morse Decoding; Data File, a look at LED sequencer and analogue-value indicator circuits.

FEBRUARY 1985
Features — Airborne TV, some fascinating experiments involving TV transmissions from an aircraft in flight: Direct Broadcast by Satellite, the systems of TV reception via satellite: Touch-sensitive joystick, zapping Klingons is made quicker and easier with this project: The Horseshoe Nail Syndrome, Brian Dale questions the policies of major manufacturers with regard to chip production: Long Waves Live on!, Nigel Cawthorne on long wave broadcasting: Low-pass Filter, clean up your signals with this relatively cheap high power project: Russian Satellites – Part two, the receive section: Data File, more opto-electronics from Ray Marston.

MARCH 1985
Features – Spectrum Watch, a survey of the latest developments in the radio spectrum; Russian Satellites, part three outlines the computing of the received data; Variable Frequency Ramp Generator, a circuit for testing bandpass filters; Electronic Lock, a cheap and versatile project; Data File, seven-segment display driving; Computing, inductance and capacitance values for circuit tracking; Frequency Translation, a follow-up project to November's CB conversion article.



APRIL 1985
Features – *RSGB* Convention preview; Spectrum Watch, progress with cellular radio, and French private TV; Synchronous Rectifiers, examining these and phase-sensitive devices; Amtext on HF, an experiment with Packet Radio; Weather Satellite Pictures, a ROM for the Beeb; Up in the Air, a cheap aid for VHF antenna experimenting; Data File, photo-diodes and LDRs; 934MHz – Dead or Alive, a look at civilised CB.

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FOR SALE

■ Radio amateur computer programs BBC disk based programs to locate world callsign prefixes countries, continents, zones etc. Also band plans, world local-times and locator programs all interactive and on BBC 40 track disk £6.75 inc P & P. Send to R Wilmot G4PEY, Retreat Cottages, Church Lane, Broadbridge Heath, Horsham, Sussex RH12 3ND. Tel: (0403) 69835 for details

■ Pair of Spendor BC2 monitor loudspeakers. £200. Pair of BC2 stands £18. Quad electro-static speaker-bronze £175. Garrard 401 turntable. £40. Dual 10 band graphic equaliser. Professional £195. NRD NDH515 24ch memory unit. £125. Racal dual diversity unit. MA168B plus handbook £45. Sparkrite SX2000 electronic ignition unit. £20. AKG D509 mic £20. All carriage extra. B J Whitty, 'Fourways', Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: (0704) 840328

■ FT101ZD FM mint cond £495. FC902 ATU £90. FTV 901R transverter with 2m module fitted £120. SP901 spkr £20, or £680 the lot. Also Sony ICF2001 gen cov rec with P/S £105. Tel: Maidstone (0622) 859129

■ Acorn Atom: Do you have one of these marvellous machines? £2.50 will buy my Ross software utility ROM. Also some Atom games free to a good home. A J Anderson, 44 The Spring, Market Lavington, Devizes, Wilts SN10 4EB.

■ Satellite TV system. Comprises 1.8 metre fibreglass dish tested at 4 and 12GHz plus tunable C-band LNC (3.6-4.3GHz 1.5dB noise figure plus indoor FM receiver (PLL) with tunable audio. Can be seen working on horizontal complete £450 or may split. Multistandard DX-TV receiver. Nordmende 22 inch remote control teletext PAL/SECAM. Digital tuning all VHF/UHF channels. Covers systems I/BG DK/L (all European standards). Scart plug for video/RGB etc, £400 as new. Also Teleton 14 inch mono TV with VHF/UHF tuning plus switchable 5.5/6MHz sound £50. Also Schrader tunable masthead UHF preamplifier £20. R J Crossley G6BEX Tel: (0582) 604767

■ Panasonic RF3100 LBE 31 bands synthesized receiver, new Sept 1984, cost £199 (now £219), am asking £140. Tel: Worthing 49978

■ SEM multi filter as new £25. Tel: Leeds 677101

■ BCC A14 HP man-pack Tx/Rx 2-8MHz VFO-Xtal 3-30W complete with ni-cads, handset, CW key, dipole, h/book etc, £90.00. WWII signal corps 1-177 valve tester with handbook/charts, 110V to 240V mains unit in working order £35.00. Tel: Swindon (0793) 813644 after 7pm

■ SX400 scanning receiver covers 26MHz to 520MHz, has data interface socket for computer and converter socket for extended coverage, had couple of hours use only, new boxed £489.00. Mr T Manning, 24 Croftdown Road, London NW5. Tel: (01) 485 4251

■ Creed 75 teleprinter, Redifon terminal unit type TT11 and isolation transformer £40. Marconiphone superhet radio type T19A, manufactured about 1935. Good working order, collectors item. Best offer around £40. Olivetti computer terminal, 600/1200 bands, type 349 some data, no means of testing so sold as seen £40. M Levers, 'Waverley', Independent Hill, Alfreton, Derby DE5 7DG

■ Collector's item: Ferguson 146 radio, excellent condition and excellent working order, SW, MW and LW band coverage, genuine offers. Please tel: Wargrave 2037. Buyer collects.

■ IC271E 2m multi-mode, two months old, unused, £575, with new matching PS15 £650, or would take in part exchange FT290R, TR9130, TR9000 or FT77. Also for sale FDK700AX, Mars model £135, postage extra. Mr Waters, 42 Tregundy Rd, Perranporth, Cornwall TR6 0EF

■ Uniden CR2021 comms receiver. 1.5-30MHz, as new. £120 or exchange for Signal R532 airband scanner or similar. Tel: Ware, Redhill, Surrey 66712

■ Receivers Eddystone 840C comm Rx 500KHz-30MHz with circuit diagram. £85. Codar CR70A comm Rx needs service but is in full working order £25. PSU 13.8V 5 amp £10, or £105 the lot. Tel: (654) 1361 (Croydon)

■ QQV03-40A/20A valve bases £1 each. Pye Airel changeover relays £1 each. Pye low band AM Cambridges could be converted to 4m £10 each. Advance PG5002D pulse generator £20. ITT UHF Starphone repeater, could be converted to 70cm £85. Mr S Ritson, Wragmire Cottage, Carleton, Carlisle, Cumbria CA4 0BT. Tel: Southwaite 439

■ Icom 1050 27MHz transceiver modified squelch £25. Pye 4 channel receiver low band £8. Class D wavemeter £5. Icom 1050 on ten metres portable with ni-cads and flexi aerial £35. RCA 813 with ceramic holder £18. Pye base tulip mike £3. American valve car radio £3. Tandy DTMF encoder built in die-cast box £10, 3 soldering irons £8. All items plus postage. McCarthy, tel: Ipswich 215047

■ Retired radio engineer selling up service sheets, manuals for valved radios. 790 includes 400 pre-war, also 200 valves, obsolete types, many new boxed inc types 1.4 volt, 2 volt, 4 volt, 6 volt, International and Mazda Octals; UX, equipment big AVO, AVO test bridge small megger, oscilloscope. Biddlecomb, 42 Drayton Rd, Portsmouth 0PO 2BX. Tel: (0705) 664753

■ Yaesu FRV7700D converter £58. Datong 2 metre converter complete with mains power unit converter £32. Global AT1000 aerial tuner, suitable any short wave receiver £30. All in good condition, complete with details, and post paid. F W Moore, 76 High Street, Ide, Exeter, Devon EX2 9RW. Letters only please

■ BC348M internal ac power pack. OK condition, offers, hundreds of valves. Pre-war octals, UX, 4 pin, 7 pin, British and American. SAE for lists please. A E Jeffrey, 42 Dennis Road, Padstow, Cornwall PL28 8DF

■ Amateur Radio – The Easy Way, Ham Radio course video £24. 1 Grice Close, Kessingland, Lowestoft

■ Cobra 148 GT-LDX (Mk1) 120 channels, USB, LSB, FM, AM, CW. Also built in roger bleep and variable power, good condition £90. Tel: Jason any time 01 802 7343

■ Ex-WD infra red binoculars with power pack and controls, some spares and instruction book, no lamps, £30 ono. M Brown, 15 Hamilton Row, Waterhouses, Co Durham DH7 9AU. Tel: Durham 731585

■ BC348M modded mains pack internal. Hundreds of valves all unused, American UX. Octal. 4 pin. British types, 5 pin. 7 pin. Pre war types SAE for lists please. A E Jeffrey, 42 Dennis Rd, Padstow, Cornwall PL28 8DF

■ Drake T4XB, R4B, AC4 PSU, manuals, spare valves, excellent condx £425. Yaesu FR50B Rx vgc £80. Tel: (0532) 659227 after 8pm or weekends.

■ AR88D receiver 500KHz-32KHz, immaculate, good performer £65. Buyer collect. Tel: Bill G4YZE Bolton (0204) 41317

■ Texas T199/4A 16K computer colour, sound, joysticks extra manuals, leads, space invaders cartridge, inbuilt basic. System expandable, cost £148 as new boxed £69. Tel: (0634) 660037

■ BBC computer add ons. Viewsaset ROM etc as new £35 or exchange ultracalc. RGB wire frame monitor no case £85. Watford DFS ROM £15. Cheetam internal plug-in voice board £15. Disc drive 40 track with leads but no case £45. 27128 EPROM unused £9. Acorn Kenneth Kendal speech chips and sockets excellent unused £38. Tel: Harrogate (0423) 872045, Mr Graham

■ Quality gear for sale. Racal general coverage transmit receive system, comprising RA117E receiver as new and in wooden crate, MA79 drive unit in very good condition, RA218 SSB unit, TA940 100W linear amplifier and power supply etc, £950. Also for sale Redifon SDI synthesised drive unit, current price believed to be over £3,000, my price £300. Sony CRF320 receiver, cost £850, my price £395. Please tel: (0254) 823038 (Lancs)

■ Realistic DX200 receiver, excellent condition, 0.15 to 30MHz all modes, AM, USB, LSB, CW, various controls, volume, RF gain, ant trim, BFO control to listen to SSB and CW, signal strength meter, AGC, mains operated, MRP £169, will accept £70, this is a bargain. RF gain not working properly but probably could be fixed. Paul McCarthy, 3 East Fulton, Unwood, Renfrewshire, Scotland PA3 3TR. Tel: Johnstone 24653

■ AR88D new genuine S-meter £10. R444 VHF AM/FM S-meter etc £45. Tuning units 36MHz to 12GHz £35 each. Also R5032A Rx VHF 100MHz to 156MHz National HRO receiver, spare new HRO 697 power unit. Bob Wright, 249 Sandy Lane, Hindley, Wigan WN2 4ER. Tel: (0942) 55948.

■ Sinclair ZX81 32K memory computer, Maplin keyboard, very nice new case with all inside, £65 ono. Also 4116 250nS, memory chips. 64K. (32 chips) £1 each or 32 for £25. Tel: Dave (061) 226 4053, G6DHI QTHr.

■ FL200B Tx, £85, neatly fitted with PA HTR standby relay and variable Rx mute control. Has outboard PSU. FRDX400 £85. Just revalved, used daily. No 2m or FM. Buyers to inspect/collect (any demo given). G3VRU, 106 Skinner St, Creswell, Worksop S80 4LF.

■ Strad (made by RM Electrics, Gateshead) three wave band receiver (valve). Wooden cabinet, card back missing. Made about 1935. Price £35. Working OK. No model number. Cossor 470 three wave band receiver. Wooden cabinet. Made about 1937 (presently being repaired). Price £35. Ekco A172 three wave band receiver works, but drive cord needs RE stringing a rare 1950's set, possibly an export model. Peter Titlow, 13A High Street, Leiston, Suffolk. Tel: (0728) 831812 or 831610.

■ Radio astronomy receiver 30MHz to 220MHz. Large valve needs 6.3V 250VHT power supply. £45. Bird, 27 Manor Rd, Bolehall, Tamworth, Staffs.

■ G3INX clearing junk box, war and postwar bits: R1155, BC348, VCR97s, valves etc. Also magazines WW, PW, PT, SWM, RSGB (some full years some prewar). Any offers? J G Reeve, 46 Queens Road, Chelmsford, Essex CM2 6HB. Tel: (0245) 355099 evenings.

■ Brand new FT726R base station, two weeks old fitted 2m, 70cm, SAT, duplex, with service manual. Sell for good offer or will consider part exchange for Lap portable computer Nec PC8201. Buyer to collect or arrange collection. Very good reason for sale so be quick. Tel: 8am to 9pm Peter Witnesham 526.

■ Philips digital multimeter, type PM2521 with instruction manual, accept £250. W B Glayzer, 27 Albert Road, Southport, Merseyside. Tel: (0704) 31153.

■ Oscilloscope telequipment D83, dc to 50MHz bandwidth, dual trace, dual vertical amplifier and dual timebase (giving delayed, intensified or mixed sweep). Complete with manuals and x10 probe. Cost new circa £2,400. Accept £495 ono. Tel: Stoneyburn (05016) 231 (Scotland).

■ Building project Omega? I have Cifpu UFO boards and PLL VCO board. QRP PA. Low pass filter board. Active audio filter ant/logic change over board. Notch filter. Pre-selector boards. All boxed. Working, just needs casing and final alignment. Genuine reason for sale: new job in Royal Navy no time. Wanted NF rig or WHY original price over £400, sell £300 ono. Tel: G4PLM, Simon Coalville (0530) 812102 any reasonable time.

FREE CLASSIFIED ADS

■ Sommerkamp FT102 HF transceiver. New bands, FM fitted, mint condition plus new SEM transmatch. Weltz SWR power meter, also Jay Beam vertical tri-band aerial, all equip as new. £795 ono. Tel: Peter (051) 428 6231, any eve after 6pm.

■ Liner 2 2m SSB transceiver £85 ono. Tel: St Albans 34969 after 6pm.

■ FAL disco deck, 50 watts in carrying case (black) with mains leads and speaker leads, very good conditon. £125 ono. Mains power pack for disco, strobe control, + five socket outlets, with heavy duty mains leads, £25 ono. Mr Brine. Tel: Tiverton 820083.

■ Ten-Tec Argosy transceiver complete with type 225KW PSU type 227KW ATU, Argosy mic complete home base or mobile CW/SSB station. Transceiver fitted with type 224 audio CW filter, type 223 noise blanker. Eight months use only, as new, £500 ono. D R Saunders, 754 Stockport Road, Bredbury, Cheshire SK6 2BQ. Tel: evenings (061) 430 5196.

■ Icom IC730 HF, Tx, Rx, FM fitted ICPS20 PSU Yaesu FC700 ATU, all boxed and in good order £590 ono. Delivery arranged by agreement. J Angiolini, Netmerlorn Bridge of Awe, Taynuilt, Argyll PA35 1HT. Tel: (08662) 243.

■ Build the REW radiation monitor (April 1982 issue), Mullard ZP1310 GM tube and construction details, £20. John Balls, 48 Collingwood Road, Great Yarmouth, Norfolk, NR30 4LR. Tel: (0493) 842022.

■ BC348 internal power pack. 240ac hundreds of valves. British, American Ux. Octal types. 6K6GT, 6F6G, 6F6M, 6C6, 6D6, various others all unused. SAE for list please. A E Jeffrey, 42 Dennis Rd, Padstow, Cornwall PL28 8DF.

■ Barlow Wadley XCR30 £55, G2DAF Tx £35, G2DAF Rx £40, Xtal calibrator no10 £4, Armstrong valve tuner/amp £22, Eddystone 'Bug' key £5, Sony stereo centre TC230 £25, Alba L/M/FM tuner £12, Barr and Stroud binocular 7x40 type AP1900A £25. Carriage extra, prefer collection. Tel: Preston 743098 G3BWI QTHr.

■ Tandy 40 channel portable CB, cost £150 accept £65. CB pre-amp £10. HF pre-amp 2-40MHz receive only, no RF switching SWR meter and extension speaker for CB £5. Both 44MHz crystals for 2 metres R-7 S-10 S-11 S-12 S-13 S-17 S-23 etc £1.50 each. Amstrad CB legal FM £15. Bremi 3 amp power supply new £10. All prices include postage and packing. M De-Wynter, 2 Woodside, Wimbledon, London SW19. Tel: (946) 2967, please ask for Jane.

■ Heathkit SB313 SWL receiver with aerial and manual £160. Heathkit GR98 tuneable airband receiver with minor mods, aerial amplifier and manual £35. Pair airlite 62 headphones £15. Tel: 01 701 4803 evenings and weekends.

■ Sharp MZ80B personal computer. Hardly used. A bargain at £300 ono. Can deliver 50 mile radius from Newcastle. Tel: Tyneside 482 6514 after 6pm.

■ Oscilloscope Dynamco 15MHz portable 3½x2in screen dual trace, delay timebase, plus single timebase (new), battery pack converter, service manuals, spare CRT, transformer new good condition. Venner counter/timer 12.5MHz six digit Nixie ovened Xtal. B/W crosshatch generator, transistor old style. Offers. Tel: Medway (0634) 666629 evenings.

■ Vic 1515 graphics printer as new C/W service manual suite Vic 20 or Commadore 64, bargain £125. Texas TI 99/4A computer, PSU modulator and manual £60. Mr J J Kenny, 21 Station Road, Harborne, Birmingham B17 9LP. Tel: (021) 426 1197.

■ Trio TR7730 25W 2m FM transceiver inc mike and manual £140. Yaesu FL2100B HF linear amplifier, inc manual, exc cond £280. Daiwa DK210 keyer plus hi-mound Mk704 paddle £40. Hi-mound MK706 paddle £15. All items vgc. Tel: (0532) 659227 (Leeds).

■ Colt 320DX USB, LSB, AM, 26.515 to 27.855MHz transceiver. Good condition £60. David Green, 252 Abbeydale Road South, Dore, Sheffield, South Yorks. Tel: 364447, after 5pm.

■ H W Sullivan's Wheatstone Bridge £20. G Jones, 32 Borough Street, Brighton, East Sussex.

■ Kenwood TR7800 boxed 2m FM transceiver £180 ono or will part exchange for 2m/70cm hand portable transceiver and cash make up of £80 to £100. Please tel: (0272) 503989. Bristol after 1800hrs, G6YXZ.

■ Trio R1000 general coverage receiver, £160, bargain. Tel: (091) 2673507, Newcastle-on-Tyne.

■ Realistic DX 150A 4 band Rx £25. Cossor dual beam CRO £25. US 453B Rx 190-550KHz unused £20. CR100 Rx new w/change cord need £25. 10p coin operated electric meter variable tariff £10. Arena F211 FM tuner stereo, 5 tunable push buttons, good order £20. Large high power horn loud speaker £25. All plus carriage. Leon Charlish, 7 Cranbourne Ave, Windsor. Tel: Windsor 64761.

■ Transformer 240V 20 watt to 12V 0.6A £8. Galvanoter, very old, offers. Perfect order 19 set. Tel: (0283) 221870.

■ Yaesu FRG7700, FRT7700, long wire, log book, various RSGB books and wall charts. All in excellent condition £300. John Massey. Tel: (0482) 868085 after 7pm.

■ Heathkit SB301 receiver 10-80m with matching speaker. Property of SK amateur, with assembly manual, possibly assist with transport £55. G3VYP, QTHr near Ludlow. Tel: (056 885) 296.

■ Eprom programmer, acorn atom computer, high resolution black and white monitor, tape recorder, books and software. Complete system in working order only £99. C J W, 4, Mill Close, Ackworth Pontefract Yorkshire, WF7 7PU. Tel: (0977) 611395. Buyer collect.

■ BBC and Electron tape back-up program. Make back-up copies of virtually all your tape software. Lock and unlock programs. Send £3.75 for your copy by return post to C J W, 4 Mill Close, Ackworth, Pontefract, Yorkshire WF7 7PU, stating which machine you have.

■ Tandy CB handheld, 40 channels, 4 watts, £65. Two metre scanning receiver, 8 channel RO-7 all REP eaters fitted, crystal controlled, plus re-chargeable battery £45. Sony ICF2001 portable communications RCVR 0.5-30MHz 88-108MHz VHF FM £100. Scanning receiver 76-87MHz and 156-168MHz £80. CB pre-amp £10. Bremi power supply, 3 amp, £12.50. New walkmate personal stereo radio with headphones £12.50. Mike De Wynter, 2 Woodside, Wimbledon, London SW19. Tel: (946) 2967, ask for Jane.

■ BBC model B, software, speech synth, cassette and few extras. £700 worth of equipment all less than 4 months old. Would exchange for HF transceiver such as FT7B. Better class radios with cash adjustment. Radio must be digital display. Tel: Jon: (051 638) 3401 after 6pm.

■ Belcom LS102L boxed, as new, AM, FM, USB, LSB, CW, 26,27,28 and 29MHz, hardly used £240 ono. Borland, 'Beechwood', Kinfauns, Perth. Tel: Perth 32719.

■ WS18, any condition. If complete with or without accessories. G4ULB, Alan Watkins, 9A High St, Langley, Warley, West Midlands, B69 4SN. Tel: (021) 552 1838 day.

■ One Revcone Discone aerial from 100 to 470MHz. Model no DC1/WB. Tel: Clochen 378.

■ Cybernet 934 or Reftec 934MHz with conversion in good condition, for quality minolta SLR camera. SRT101B F1.7 and ERC. Also sun zoom lense 35mm to 70mm, various filters also automatic exten tubes and Tamron 28mm wide angle, Cobra auto flash gun. M G Gibbons, 2 Marton St, Hartlepool, Cleveland, TS248PW.

■ Microwave 24GHz directional coupler and detector with crystal £28, variable attenuator £35. Microwave 10GHz 75mW klystron with micrometer tuning and waveguide mount £18, 25mW klystron £4, professional micrometer wavemeter £78, variable attenuator and detector with crystal £48. QQV0310 £3. 4 rev/min mains reversible motor (suit small beam) £8. Lamp with 2 matched photocells assembly £2. Mann G4FFO. Tel: (0223) 860150.

■ Sommerkamp FT250, good condition. Manual, spare valves, one owner from new, no mods, any trial, buyer collect, £250. Bill Ball. Tel: Penketh 2381 evenings.

■ Kenwood R1000 communication receiver, general coverage. £240 ono. Tel: (065261) 213 (any time).

■ TS700G FM, SSB, CW, AM 2m, variable power output 5mW to 10 watt. Ideal for correct drive to QRO linear. Fitted pre-amp, original packing, both manuals, mike, 22 fixed channels all xtalled, £270. Buyer collects. Good general coverage Rx required. G4DBI QTHr. Tel: (068 45) 68627 after 5pm weekdays, weekends.

■ Exchange DX160 HF receiver in good condition and Skidmaster SK42000 base mike plus cash adjustment for Sony ICF2001 or lafayette HF receiver HA600A. Write or call after 5.30pm please. Philip Howlett, 41 Preston Rd, Toddington, Nr Dunstable, Beds LU5 6EG.

■ FLDX500 270W, FRDX500 fitted FM, £230 ono prefer exchange QRP Tx/Rx buyer collects. BRS32755 2/1, 1 Dunphail Road, Glasgow G34/BX.

■ Sanyo XL400S 8mm sound camera and Sanyo SHV2000 portable 8mm sound projector with built in screen. £250 or exchange for HF linear 70cms base station or WHY. G4NJP, QTHr. Tel: (0262) 673635.

■ 2m colinear, 13ft, clamps, 8m RG58, £45. Resistors, capacitors, potentiometers, ICs incl TTL, transistors, diodes, bargain pack, 50p – £2.50, new transformers, TV set-side 2-output amplifier, Belling, £8. Valves, Apple keyboard £5, Apple Doscard £4, Firmware cards £4, Teletext and general odds/ends, very cheap. Geoff, tel: Hastings 442308, evenings, weekends.

■ Yaesu FRG7700 ant, FRT7700 ATU mint condition ten months old very little used, £255 or exchange for Yaesu 707 or similar mobile Tx/Rx. With cash adjustment either way. Also have x2 SMC Yaesu comul radio 10 channel can be retuned for 2 meter. Mr R Hankinson, 7A The Broadway, Greenford, Middlesex. Tel: 01-575 1167.

■ Yaesu FT209RH (5 watt), 2m, as new – 3 months old, complete with nicads and charger, £220 ono. Reason for sale – upgrading of equipment, purchaser will collect or extra for carriage. Tel: Blackpool 592248

WANTED

■ Exchange of television programmes wanted on video cassette. Available: 3 German and 2 Dutch channels plus Sky Channel. Please write to: A Colon, G Flinckstraat 140, 1072 EM Amsterdam, The Netherlands.

■ Plessey ICs type SB230A, four required. Service manual for Fairchild Dumont scopes, type 766H and 704. Service manual for Hewlett Packard sampling scope, type 185B. J F Manson, 280 Abbey Dale Road, Sheffield S71FL.

■ Manuals for Tektronix 561A, Y plug-in 3A1, timebase 3B1. Have manuals for Marconi TF2200, dual trace and diff plug-ins. Mr R Malone, tel: Bradford (0274) 575916 weekdays after six pm, any time weekends.

■ PFI Tx handbook or copy. Also PFI Tx wanted. Miniature loudspeaker for later type PFI Rx. Any improvement modifications relating to PFIs. Chris McCarthy G3XVL, tel: Ipswich 215047.

■ Black and white television, multi standard VHF and UHF for systems B,D,G,I,M. Please send details and price required. Mr J G Sinclair, 21 River View Centre, Vange, Basildon, Essex SS16 4NE.

■ UHF Rx 770U or similar. Would consider scanner. FM PCB for FRG7. Solid-state HF Rx pref to require repair, same for 2 metre rig. Fairmate A32320 Rx. Tel: Leeds 677101.

■ Info on satellite weather reception, any data, charts etc. Also info on building receiving station and any circuit diagrams and foil patterns and component lists. Also dish construction details. Any help supplied will be very much appreciated. Wanted for schools project, will pay cost of photocopies and postage costs. Please write or telephone after 6pm. Tel: (0481) 26168. Mr M R Day, 39 Valnord Lane, St Peter Port, Guernsey, Channel Islands.

■ RTTY software to link BBC 'B' micro-computer and Maplin TU1000 unit through RS423 interface. Write D Tan, 46 Egerton Road South, Chorlton-cum-Hardy, Manchester M21 1YN. Tel: (061) 881 3090 (evenings only).

■ Gen on Pye Carfax Rx, modifications. Any circuit or info required. Thanks. G2DHV QTHr.

■ Oscilloscope 3-4 inch dual trace. Preferably working condition. J Binks, 13 Nar Wood Cresc, Shipley, W Yorks BD18 4HY.

■ Manual or copy or circuit for Hewlett Packard oscilloscope type 150A. Also plug in module type 152B. Dual trace amp. M Levers, 'Waverley', Independent Mill, Alfreton, Derbys DE5 7DG.

■ AVO8 MkII service/repair sheets wanted urgently. Will borrow or buy all expenses paid. R Lund, 92 Stanford Road, Norbury, London SW16 4QA. Tel: (01) 764 0951.

■ Needed urgently for very old Eddystone receiver, schematic service data/info. Only identity marks: royalty plate/serial number: MH54012. R W Henderson, 109 Mayflower House, Manhattan Drive, Cambridge CB4 1JT. Tel: (0223) 61222, ext 471.

■ Data on 'Foreland' marine Tx/Rx for converting to 2m. Also data on KW Viceroy MkIII. A E Jeffrey, 42 Dennis Road, Padstow, Cornwall PL28 8DF.

■ One SR-CMP08 speaker mic to fit the standard SR-C146A, 2 metre handie portable, four pin jack. Fair price will be paid. One pair Pye UHF pocket phones Tx/Rx with crystals. Must be in working order. Fair price will be paid. Martin, 4A Portnall Road, London W9.

■ Valves, 6C6, 6B7, 42, also coils B, C, D, for HRO M. Tel: (0228) 26436.

■ Vintage radio sets and pre-1950 TV sets. Also 1155 set wanted in complete cond, working or not. Similar sets considered. Private collector, please write. All letters and postage refunded. Mr Chris Davidson, 56 Windmill Park, Great Clacton, Clacton, Essex.P

■ Cathode ray tube DG7-31, would accept s/hand one if in good nick. Must be cheap. Also mains t/former, primary 240V tapped at 110V, 220V, 240V. Secondary, one winding 6.3V, 1.5 amp second winding 0-500V 30mA. S/hand would do, must also be cheap. R Dugan, 15 Fern Dale, Lurgan, Co Armagh, N Ireland BT66 8LQ. Tel: (0762) 42870 after 5pm.

■ 'Sinclair' 2 inch, or 'Standard', 3 inch, UHF mono pocket televisions, wanted by private collector. Must be in good working order. Either post sets to the following address, using recorded-delivery service, for best cash offer by return, or send description of set, plus your asking price, for reply by return. Regret postal service only – no callers. I also buy 4½ inch TV/radio combinations. Write to Dave Grieve, One Burnhead Road, Hawick, Roxburgh TD9 8HB, Scotland.

■ 'Making transistor radios' by R H Warring. Will collect. Tel: (01) 451 3093.

■ For Advance OS2100 or OS2100R oscilloscope EHT unit required. Non working unit or scrap scope considered. Also required manual and/or circuit diagrams for Advance OS2200 oscilloscope. D Russell, 9 South Beach Road, Ardrossan, Ayrshire KA22 8AX. Tel: (0294) 64144.

■ Handbook for KDK 2016E 2 metre FM rig. Buy or borrow please. W H Ferguson, 9 Woodbine Terrace, Hexham NE46 3LE.

■ Eddystone 770S, Eddystone 640 receivers any condition. John GM8MLH, Alt Na Feidh, Dalmally, Argyll PA33 1AA. Tel: (083 82) 304.

■ I am an electronics student and as part of my course I am writing a report on pirate radio stations. I would therefore be interested in any relevant information readers have to offer. Paul Davis, Inglesby, Church Road, Longhope, Glos GL17 0LL. Tel: Glos 830383.

■ Urgent: a single or dual trace scope. Doesn't matter if a bit tatty but must be working. Willing to pay £40 to £50 (negot) plus pay post or can collect in 15 to 20 miles radius. Pete Keirle, 79 Portman Road, North Petherton, Somerset TA6 6ST. Tel: (0278) 662 966.

■ Quadrophonic LPs and 8-tracks + open reel tapes. Also looking for radio valves. Please contact: Peter Leurmans, Bereklauw 9, 5432AN Cuyk, The Netherlands. Tel: (08850) 20238.

■ KW Ezee match or wide spaced split stator variable capacitor 350-0-350pF. Please tel: (0782) 660379 after 6.00pm.

■ National Panasonic DR48 digital general coverage receiver. Also Yaesu YK901 keyboard to use with YR901 CW RTTY reader. Tel: 394336 (Colchester, Essex).

■ Desperately needed – transformer for CD1400 scope – would consider complete rack (inc trans) also circuit for Metrohm insulation – tester (500V) 1Ω/1MΩ centre scale. 49 Oak Crescent, Garforth, Leeds. Tel: (0532) 866897.

■ KW Viceroy service manual MkIII. A E Jeffrey, 42 Dennis Road, Padstow, Cornwall PL28 8DF.

■ Collector seeks German WW2 equipment, parts and literature. Will collect. Also seeks radioset No1 and No11, B-28 Rx, 'Electra'. Offers WS 19, 38, 22 and R1155. Welcome enquiries from other collectors of WW2 mil electronics for swap and exchange of information. Rae Otterstad, Vejdammen 5, DK-2840 Holte, Denmark. Tel: (010) 452 801875.

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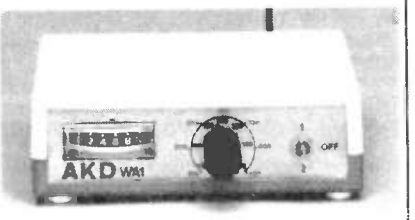

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