

AUGUST 1984

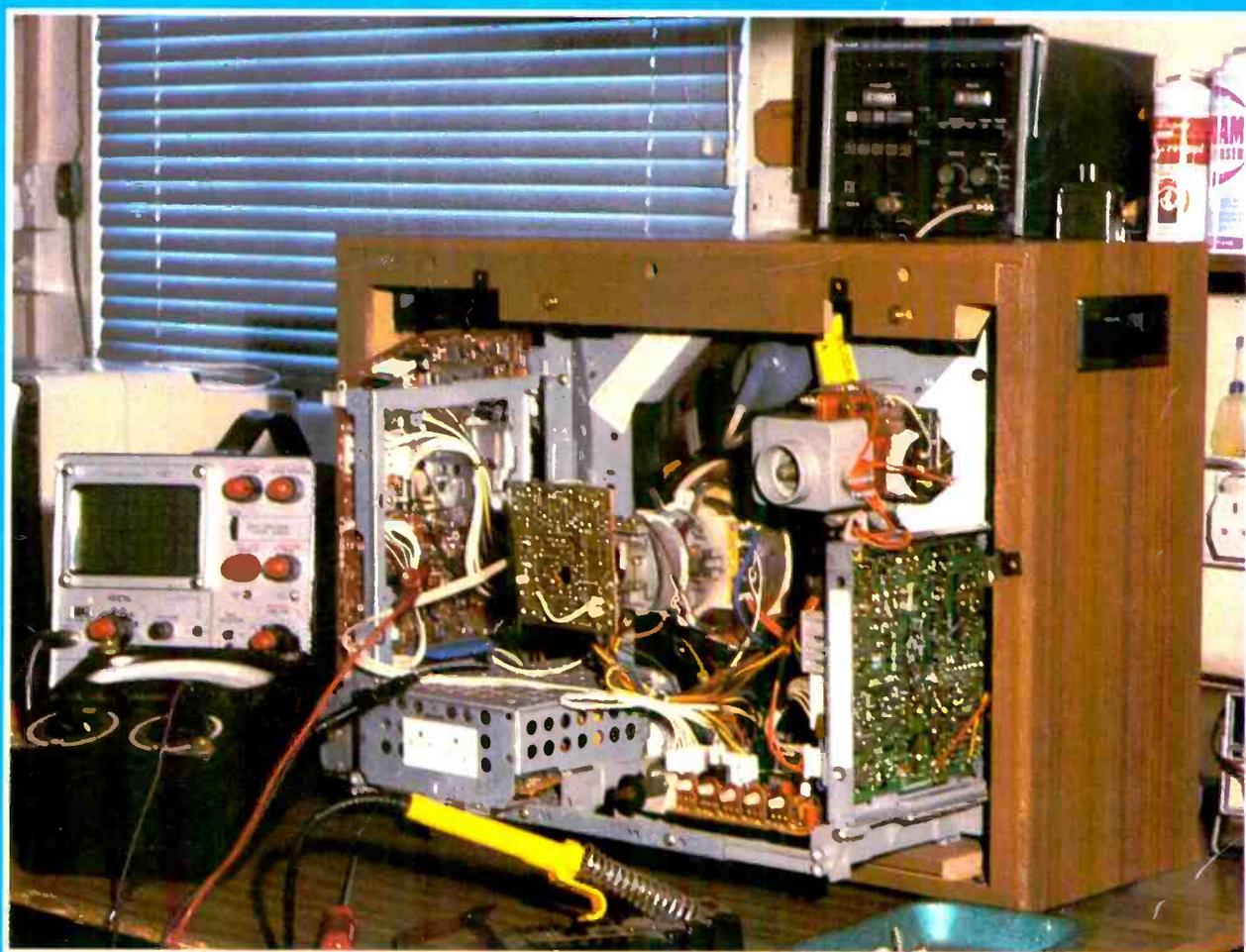
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TELEVISION

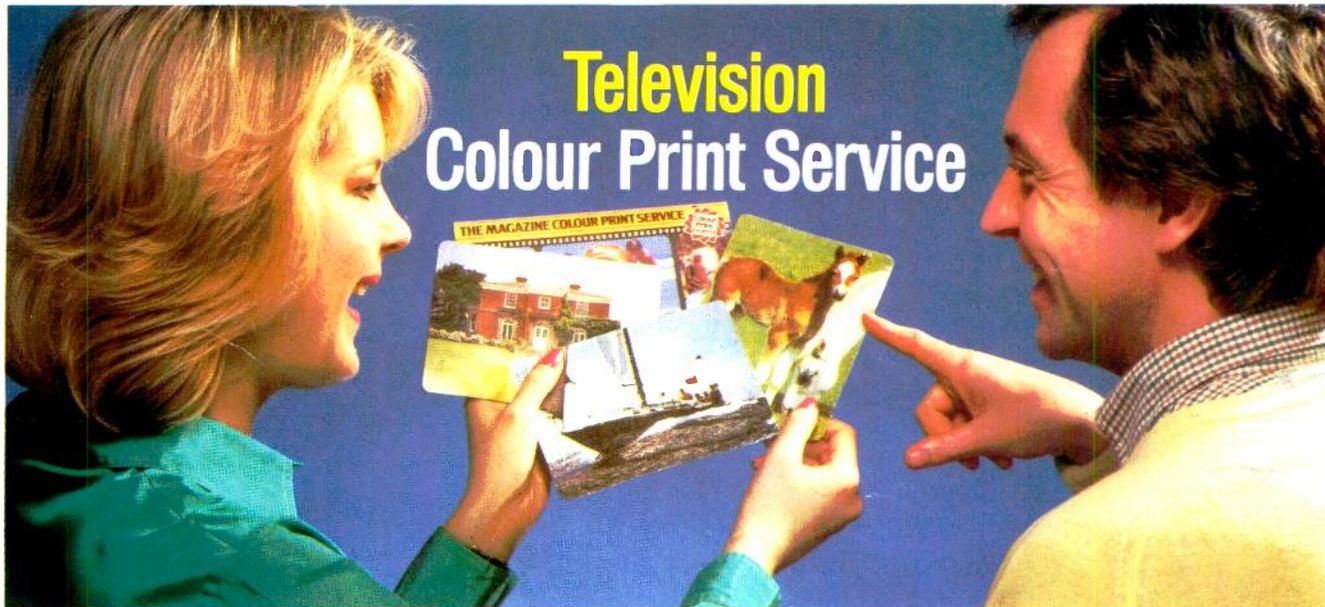
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Servicing the Sony KV2000UB



Stereo TV Sound Systems
TV Receiver Fault Mechanisms
Vintage Hi-Fi TV Sound Unit
Test Report ● VCR Clinic
TV Fault Finding ● DX-TV



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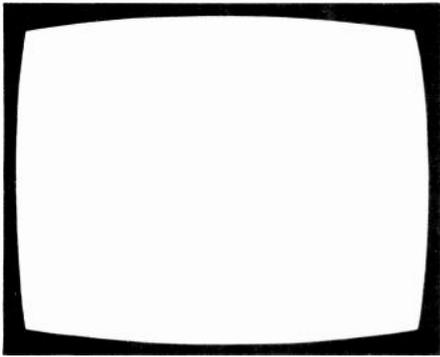
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TELEVISION

August
1984

Vol. 34, No. 10
Issue 406

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All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

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Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at £1.20p inclusive of postage and packing.

QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.

Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

529 Leader

530 Stereo TV Sound

Adding a second sound channel to a TV transmission presents a number of problems. A review of the difficulties and the various techniques that have been tried.

David Looser

535 Some Confessions

Effective diagnosis in the field isn't always achieved... especially when various hounds are present to complicate matters.

Les Lawry-Johns

536 Servicing the Sony KV2000UB, Part 1

This was the first 20in. Sony colour set sold in the UK and was a very popular model. As with all Sony sets, care is required when fault finding - a recommended test sequence should be followed. This part deals with the chopper power supply and the line timebase.

David Botto

537 Next Month in Television

540 The Unaohm EP730AFM Panoramic Monitor

A detailed test report on this unusual item which provides pictures, a visual display of signal strength and panoramic spectrum displays covering Bands I-V. An asset to anyone who has to sort out signals and interference and install aerial systems.

Eugene Trundle

543 Teletopics

News, comment and developments.

545 TV Fault Finding

Notes on faults and servicing from Mick Dutton, Tony Thompson and Malcolm Burrell.

546 VCR Clinic

Fault reports from Steve Beeching, T.Eng. (C.E.I.), Ian Hutton and Les Harris.

550 Long-distance Television

Reports on DX conditions and reception and news from abroad. The problem of interference caused by home computers is increasing.

Roger Bunney

552 TV Fault Mechanisms

The basic causes of most TV faults are few in number. A review of the factors that lead to set failure.

Tony Thompson

555 Letters

556 Servicing the Grundig 2 x 4 Super, Part 2

This time the signals side of the machine.

Mike Phelan

588 A Vintage Hi-Fi TV Sound Unit

A vintage hi-fi audio circuit using a pair of ECL80s in a push-pull configuration. The unit is a plug-in replacement for the standard PCL82/6 audio valves.

Chas E. Miller

560 Service Bureau

561 Test Case 260

OUR NEXT ISSUE DATED SEPTEMBER WILL
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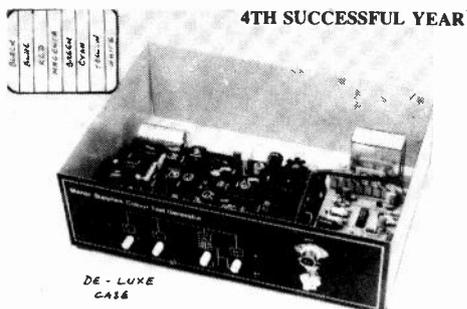
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PYE 725 90"	10.50	DECCA 100	7.50
PYE 169	10.00	UNIVERSAL IIT or REMO	6.00
DECCA 90/100	8.58	GEC 2100	7.40
DECCA 1700	9.00	GEC 2200 (20AX)	6.50
DECCA 1730	8.58	GEC 2040/2028	6.60
DECCA 2230	8.58	GEC 2110 Pre Jan '77	7.00
GEC 2110	9.45	GEC 2110 Post Jan '77	7.00
GEC 2040	9.50	PHILIPS G8 Short Focus Lead	6.75
GEC 2200	6.65	PHILIPS G8 Long Focus 550	6.75
IIT CVC 1-9	10.85	PHILIPS G9	6.37
IIT CVC 25/30/32	8.65	Pye/Philips K3 Tripler	10.65
IIT CVC 20	8.60	PYE 691/3	6.58
THORN 3000 EHT	9.95	PYE 713/4 Lead	8.79
THORN 3000 SCAN	7.95	PYE 713 Doubler 5 Lead	8.79
THORN 8000	11.33	PHILIPS/Pye KT3	6.67
THORN 8500	11.33	PYE 731/725	7.60
THORN 9000	10.65	R.B.M. A823 (plug in) AV	7.60
THORN 3000/3500		KORTING (similar to Siemens TVK1)	
Mains	10.00		
THORN 1591	8.68	IIT KB CVCS/9	6.90
THORN 1691	9.68	IIT KB CVC20/25/30 (Mullard)	5.95
THORN TX10	12.50	RRI T20	6.60
THORN 1615	9.75		
PHILIPS KT3	7.70		
RANK BUSHRANGER	£10.00		
PYE 741	8.20		
THORN 9800	23.00		
B+ O (2000, 3000)	12.70		
B+ O (3000 EHT)	18.90		

MAINS DROPPERS	NEW VALVES
DECCA 20	2.48
DECCA 27R/47R	1.40
DECCA 56R/68R	1.40
R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.80
PYE 725/31 3R0/56R/27R	1.84
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2165	1.75
PHILIPS 210/5051 -1/18R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.20
THORN 1500	1.38
THORN 1600	1.77
THORN 3500	94
THORN 8000	1.24
THORN 8500	1.36
THORN 9800	1.30
DECCA 3R9 Modulohm	60

THERMAL CUT OUT	
THORN 3000 2A Metal	1.60
GEC 2040 Metal	2.50
THORN 8000 Plastic	2.35

CRYSTALS & FILTERS	MULTITURN POTS
6Mhz	74
5.5Mhz	74
4.3Mhz	1.30
8.8Mhz	1.30
9.94Mhz	6.00
10.692Mhz	6.00

OTHER-MISTERS	
PL508	2.90
PL509/19	1.13
PL508	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL83	1.82
UY85	1.35
PL2802T	4.00
40K06	5.30
211U8	3.00
PFL200	1.86
PL36	1.87
PL81	94
PL83	1.43
PL84	84
PL504	1.65

L.E.O's	
5mm Red, Green, Yellow	14
T1 Amber	22
T1 3mm Red, Green, Yellow	14
Flashing Red COX21	62
COX22	66
3 Colour VJ18P	76
Panel Clips 3mm	4
5mm	4

DISC CERAMIC CAPS	
8Kv (12Kv)	
39pF, 200pF	
150pF, 220pF	
180pF, 250pF	
63V/100V	
A range of pref. values 22pF-4700pF	8p

POLYESTER CAPS	
250V 0.01mF	10p
0.1mF	
0.22mF	
400V 0.01mF	10p
0.1mF	
0.22mF	

TANTALUM CAPACITORS		
6.3V	47mF	38
	100mF	82
16V	10mF	20
	22mF	25
	47mF	94
25V	22mF	42
35V	0.1mF	12
	0.22mF	12
	0.47mF	12
	1mF	12
	2.2mF	15
	4.7mF	24
	10mF	52

CONVERGENCE POTS	
3W/5R-6R-10R-15R-20R	
50R-100R-200R-500R	60

METRIC CONVERGENCE POTS	
PHILIPS G8	
5R-10R-15R-20R-50R	60

FUSES	Per Pack type of 10
1 1/2" QUICK BLOW	
100ma	73
250ma-500ma-750ma-1A	80
1.5A-2A-2.5A-3A-5A	60
1 1/2" ANTISURGE	
250ma, 500ma, 600ma, 630ma, 750ma, 850ma,	
1A, 1.25A, 1.5A, 2A	1.70
2.5A, 3A, 5A	2.70
20mm ANTISURGE	
80ma	4.80
100ma	2.50
160ma, 200ma	2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A,	
2A	1.30
2.5A, 3.15A, 4A, 400ma	1.90
20mm QUICK BLOW	
100ma, 250ma, 500ma, 630ma, 800ma	90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	60
1" MAINS	
2A, 3A, 5A, 10A, 13A	1.00

NEW MONO TUBES	MULLARD COLOUREX*
MULL. A31/510 110" 12"	18.50
MULL. A34/510 110" 14"	20.00
A50/120WR 110" 20"	18.00
A61/120WR 110" 24"	17.50
VEGA 12" 90" (Jap Types)	15.00
CME1520 (15" Mono)	15.00
18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
22" A56/120X	48.00
25" A63/200X	55.00
26" A66/120X	60.00
26" A67/120X	62.00
22" A56/500X	60.00
A51 570X	72.00
A56 510	60.00
A66 510	92.00

REBUILT COLOUR TUBES	SLIDER POTENT
ALL AVAILABLE EX-STOCK ON GLASS FOR GLASS EXCHANGE FROM TRADE COUNTER. SOME TYPES AVAILABLE WITHOUT EXCHANGE FOR SMALL GLASS CHARGE	
17" A44/271X	32.00
18" A47/342X (Low Focus)	32.00
18" A47/343X (Std Focus)	32.00
20" A51/110X	30.00
19" A49/120X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (410X) 110"	36.00
26" A66/140X (410X) 110"	36.00
20" A51/161X	60.00
27" A56/510X	50.00
A56 540X	60.00
A66 540X	75.00
A66 500X	64.00

MIDGET CONTROLS	WIREWOUND RESISTORS*
Insulated Spindle Length 44mm	
Log or Lin Without Switch	
5K-10K-25K-50K-100K-250K-500K-1M	39p
With O.P.S.T. Switch	
Log: 5K-10K-25K-50K-100K	81p
250K, 500K, 1M, 2M	
Dual gang Controls	1.25
16mm Rotary Controls 15K, 22K, 100K, 1M, 10K	1.98

THICK FILM RESISTOR NETWORK	EVER READY BATTERIES
THORN 3500 (5 pin connection)	
PYE 731 (6 pin connection)	2.98
THORN 9000 (Circuit Ref. R704/7)	1.98

STOP PRESS				
Special Prices				
5 1/4" Floppy Disc				
1-10	10-40	50-90	100+	
SS/SD	1.61	1.17	1.12	1.05
SS/DD	1.70	1.23	1.17	1.10
DS/DD	2.00	1.44	1.37	1.29

SERVICE MANUALS (Zero VAT)	
THORN 1590/1	4.00
1615	2.95
1640/1	5.00
9000	8.20
9800	6.80
Tx9	18.50
Tx10	19.20
VICDO 3V22	24.00
3V29/30	33.00
DECCA 30	3.60
80	5.35
70/90	3.90
100	4.60
110	3.90
PHILIPS G8 520	7.00
G9	4.20
G11	3.90
K30	3.90
KT3	3.90
G8550	5.00

CARBON RESISTORS*	
1W 3R3-8M2	20
1W 3R3-8M2	30
1W 10R-10M	26
2W 10R-10M	62
Sold in packs of 10 per type i.e. per value	

RECHARGEABLES	
EVER READY	
RX6 (HP7)	1.10
RX14 (HP11)	1.95
RX20 (HP2)	2.15
RX22 (PP3)	3.78
Universal Charger	6.00

P. V. TUBES

PLEASE NOTE OUR NEW ADDRESS - COME AND SEE US
 104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.
 Tel: 0254 36521/32611 Telex: 635562 Griffin G (For P.V.)

HOW TO ORDER
 ADD 65p per order P+P (U.K.). Heavier parcels e.g. cable, service aids, degaus, coils please allow £1.20 P+P (U.K.). Export orders charged at cost. First Class Mail is used whenever possible. Add 15% VAT to total except where it states zero rate.

Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. As our regular customers know, orders telephoned in before 4 p.m. will be despatched the same day. V.A.T. invoice on request. Give us a ring - we'll give you service. Please ask if what you need is not listed - we will try to help. Prices are subject to change without notice.

SEMICONDUCTORS

AC107	35	BC557	8	BF337	41
AC126	30	BC558	9	BF338	41
AC127	32	BCY72	13	BF355	56
AC128	32	BD115	45	BF362	68
AC128K	40	BD116A	65	BF363	72
AC141K	39	BD124P	79	BF371	30
AC142K	38	BD131	50	BF392	35
AC176	35	BD132	49	BF422	34
AC176K	35	BD133	60	BF423	46
AC186	41	BD135	38	BF435	35
AC187	38	BD136	38	BF457	35
AC187K	38	BD137	38	BF458	43
AC188	35	BD138	35	BF459	43
AC188K	39	BD139	35	BF460	86
AD143	82	BD140	44	BF462	86
AD161	54	BD144	1.70	BF469	46
AD162	54	BD150	60	BF470	66
AD161/82 MP	1.15	BD159	65	BF597	10
AF106	49	BD166	52	BF757	54
AF114	89	BD179	70	BF758	54
AF118	1.20	BD182	1.20	BF839	27
AF121	75	BD183	75	BF840	30
AF124	48	BD201	85	BF879	85
AF125	46	BD202	91	BF890	1.74
AF126	46	BD203	80	BF742	39
AF127	38	BD204	99	BF743	43
AF139	58	BD222	46	BF810	60
AF178	1.54	BD223	56	BF829	40
AF239	60	BD225	47	BF834	42
AL102	2.00	BD232	68	BF835	30
AU106	2.50	BD233	60	BF836	70
AU107	2.00	BD234	63	BF838	46
AU113	2.00	BD235	80	BF850	30
BC107	20	BD236	65	BF851	30
BC108	20	BD237	57	BF852	24
BC109	20	BD238	85	BF890	95
BC114	12	BD243	85	BR100	34
BC115	17	BD244	85	BR101	45
BC116A	16	BD410	79	BR103	83
BC117	30	BD434	74	BR4443	94
BC118	24	BD437	88	BR4444	98
BC119	36	BD438	94	BR446	40
BC139	28	BD507	52	BR339	56
BC140	32	BD508	55	BR555	45
BC141	26	BD509	56	BR556	57
BC142	30	BD510	60	BSW67	68
BC143	31	BD578A	81	BT100	1.65
BC147	13	BD517	60	BT101	1.20
BC148	9	BD520	75	BT102/500	1.60
BC149	12	BD526	62	BT106	1.20
BC157	16	BD535	82	BT107	1.69
BC158	16	BD536	91	BT108	1.69
BC159	15	BD696A	1.49	BT109	99
BC160	25	BD697	1.24	BT116	1.21
BC161	28	BD698	1.39	BT119	3.66
BC170B	15	BD699	1.50	BT120	3.66
BC171	15	BD707	95	BT151/800	1.20
BC172	15	BDX32	2.10	BU104	2.00
BC173	12	BF115	38	BU105	1.58
BC174	10	BF117	36	BU108	1.80
BC177	27	BF125	26	BU124	1.90
BC178	26	BF127	47	BU126	1.75
BC182L	9	BF154	23	BU204	1.50
BC183L	12	BF158	18	BU205	1.42
BC184L	14	BF160	27	BU206	1.80
BC186	18	BF167	24	BU208	1.60
BC187	18	BF173	22	BU208A	1.65
BC204	10	BF177	52	BU208/02	2.10
BC208	13	BF178	46	BU326A	1.75
BC209	10	BF179	28	BU407	1.70
BC212	9	BF180	39	BU426	3.07
BC212L	13	BF181	39	BU500	2.30
BC213	13	BF182	36	BU526	2.46
BC214	10	BF183	29	BU508	3.20
BC237	14	BF184	36	BU806	1.40
BC238	14	BF185	36	BU807	2.94
BC251A	18	BF194/394	16	BUW84	1.45
BC252	12	BF195	16	BUW91A	3.84
BC261	18	BF196	16	BUX84	1.50
BC262	18	BF197	16	E1222	40
BC300	50	BF198	16	MCR101	45
BC301	53	BF199	21	MCR220	1.50
BC303	33	BF200	35	MED411	20
BC307	20	BF224	25	NJE340	68
BC308	25	BF225	20	NJE520	50
BC323	99	BF241	25	NJ3000	1.98
BC327	18	BF256	55	MPSA92	35
BC328	18	BF257	28	MR814	45
BC337	18	BF258	25	MR854	55
BC338	18	BF259	35	MR475	2.46
BC461	30	BF262	84	MR479	2.60
BC547	13	BF263	75	QM447	99
BC548	13	BF271	24	OM448	99
BCX32	30	BF273	24	OT112	1.91
BC549	8	BF274	24	OT121	1.91
BC550	7	BF336	36	R2008B	1.90

INTEGRATED CIRCUITS

R2010B	1.92	AN214Q	3.91	SN76003N	2.49
RZ265	1.50	AN240	3.84	= SN76013N	
RZ322	67	AN318	3.98	SN76023N	2.00
RZ323	67	AN262	2.45	SN76110N	1.15
RZ461	1.50	AN301	5.15	SN76115N	2.27
RZ540	2.80	AN715Q	3.97	SN76131N	2.00
RCGA16334	99	AN6340	7.85	SN76226DN	2.00
RCGA16029	99	AN6341	4.45	SN76227N	1.18
RCGA16039	99	AN6341N	5.10	SN76532N	1.50
RCGA16091	2.95	AN6344	7.85	SN76533N	1.70
RCGA16092	99	AN6344N	5.10	SN76533N	1.70
RCGA16040	96	BA521	2.80	SN76603N	2.49
RCGA16041	84	BA536	3.00	SN76544N	2.35
RCGA16334	90	CA555	46	SN76650N	1.05
RCGA16335	99	CA556	86	SN76660N	80
RCGA16739	99	CA566	84	SN76666N	80
RCGA16957	2.88	CA741	25	SN766530A	1.47
TIC45	9.00	CA748	45	STK015	6.25
TIC46	60	CA3065	1.80	STK032	13.25
TIL32	65	HA1124	1.85	STK043	11.06
TIL78	43	HA1151	3.89	STK093	5.65
TIP29C	48	HA1322	2.65	STK435	9.06
TIP30A	47	HA1342	2.49	STK436	5.50
TIP30C	43	HA1366WR	2.80	STK457	7.85
TIP31C	55	HA1366N	2.60	STK437	8.20
TIP32C	42	HA1392	3.95	STK441	8.10
TIP33B	75	HA11219	2.49	STK461=465	9.10
TIP34B	1.06	LA4031P	3.21	STK463	14.30
TIP41C	47	LA4032P	2.90	SW153	2.74
TIP42C	50	LA4102	3.37	TA7050P	95
TIP47	70	LA4250	3.67	TA7051P	95
TIP120	65	LA4400	3.05	TA7083P	2.20
TIP295	93	LA4424	3.28	TA7074P	1.00
TIP3055	60	LC7130	5.93	TA7108P	3.43
TIS91	21	LC7120	5.87	TA7120P	2.43
TU106/02	1.80	LC7137	5.50	TA7129AP	3.76
2N698	81	LM1011	3.25	TA7130P	1.93
2N918	22	LM1340T	7.5	TA7141P	95
2N2904	51	LM1303N	2.63	TA7146P	4.67
2N2905	28	MB3712	1.95	TA7193P	5.67
2N3054	80	MC1307	1.99	TA7171P	1.85
2N3055	80	MC1310P	1.60	TA7172P	1.85
2N3702	11	MC1327	1.70	TA7173P	1.85
2N3703	10	MC1351P	9.93	TA7176P	2.60
2N3705	10	MC1330P	2.90	TA7202P	4.27
2N3706	10	MC1349	1.99	TA7204P	3.77
2N3708	17	MC1350	1.50	TA7205AP	3.72
2N5294	48	MC1352	1.50	TA7208P	3.40
2N5296	69	MC1358P	1.75	TA7210P	6.60
2N5298	68	MC1495L	3.00	TA7222	2.42
2S8337	1.86	MC19002	3.90	TA7223P	3.74
2N5496	53	MC14018CP	66	TA7227P	5.98
2N6107	75	MC14049UB	43	TA7228P	5.98
2N6109	81	MC7742	1.35	TA7310P	2.78
2SA715	1.98	MC7812	1.35	TA7609P	4.39
2SC495	1.10	ML231	2.20	TA7611AP	2.92
2SC496	1.31	ETTR6016	2.20	TAA300	58
2SC643A	1.50	ML232	2.20	TAA310	2.83
2SC1096	1.72	ML236	5.35	TAA320	2.00
2SC1172Y	2.20	ML237	2.50	TAA350A	60
2SC1173Y	1.69	ML238	6.00	TAA550	55
2SC1306	2.73	ML239	2.50	TAA630	3.90
2SC1307	3.00	ML920	4.12	TAA8400S1	1.96
2SC1449	1.67	ML922	3.29	TAA661B	1.20
2SC1520	2.67	ML926	2.18	TBA120A	80
2SC1678	2.80	ML928	2.18	(A), (S), (AS), (SA)	
2SC1909	2.90	MMS387ANN	4.15	TBA120B	1.30
2SC1953	1.44	MMS402N	6.65	TBA120SB	1.37
2SC2028	1.82	MRF475	2.50	TBA120T	95
2SC2029	2.60	MRF477	10.00	TBA120U	1.10
2SC2078	1.90	MSN5807	7.87	TBA395	1.20
2SC2091	2.30	MS1513L	2.80	TBA396	80
2SC2166	2.73	MS1515L	3.28	TBA440N	2.75
DEC1	2.20	SAA1025	4.40	(TBA1441)	
DEC2	2.20	SAA1124	2.50	TBA440P	2.50
THY15/80	2.20	SAA1250	3.94	TBA480Q	1.50
BU208B	2.20	SAA1251	4.90	TBA510	3.00
BUW81A	3.84	SAAS000	4.39	TBA520(O)	1.68
		SAAS010	6.30	TBA530(O)	1.38
		SAAS012	6.50	TBA540	1.68
		SAAS020	5.90	TBA550(O)	1.58
		SAAS030	8.25	TBA560(O)	1.59
		SAAS050	8.50	TBA570	1.79
		SAA3210	2.93	TBA690	1.50
		SAS560S	1.89	TBA641BX1	3.50
		SAS570S	1.89	TBA673	2.45
		SAS660	3.25	TBA700	2.12
		SAS670	3.25	TBA720	2.64
		SAS80	2.90	TBA750	2.98
		SAS90	2.90	TBA800	1.82
		SL9018	5.50	TBA810AS	1.10
		SL9178	6.50	TBA820	1.70
		SL1310	1.80	TBA820M	1.25
		SL1327Q	1.20	TBA890	3.94
		SL1430	1.25	TBA920(O)	3.00
		SL1432	3.36	TBA950(2X)	3.05
		SL76544	2.05	TBA970	4.09

We will try to supply the original part when we can. Under certain circumstances we may have to supply an equivalent.

TUBES

TBA990	1.90	UPC1168C	1.28	AA119	9
TBA1440E	2.44	UPC1176C	1.48	BA102	17
TCA180	1.20	UPC1177H	1.56	BA145	13
TCA760	2.30	UPC1178C	1.28	BA148	17
TCA270SQ	3.10	UPC1180C	1.84	BA154	6
TCA800	2.50	UPC1181H	1.82	BA155	14
TCA830	2.44	UPC1182H	2.95	BA156	15
TCA830S	1.75	UPC1183H	3.66	BA317	26
TCA900	2.20	UPC1185H	3.20	BAX16	8
TCA910	2.20	UPC1188H	2.20	BAX17	4
TCA940	1.95	UPC1190G	1.20	BAX16	8
TDA440	2				

WE WILL ONLY SUPPLY TOP QUALITY, BRANDED COMPONENTS. REPUTATION COUNTS WITH US

G.G.L. COMPONENTS
108 SCOTLAND ROAD, CARLISLE, CUMBRIA CA3 9EY
PHONE (0228) 20358/139693

BUY WITH



E.H.T. TRAYS

RBM T20/22A	7.35
RBM A823	7.80
PHILIPS G8-550	6.95
PHILIPS G9	6.45
THORN1500-3S	4.25
THORN1500-5S	4.55
THORN3000/3500	7.75
THORN8000	4.00
THORN8500/8800	6.90
THORN9000	8.40
PYE 731	6.55
DECCA 2230	6.30
DECCA 80	6.30
DECCA 100	6.76
ITT CVC 20/30	6.85
Universal	5.90

INTEGRATED CIRCUITS	TYPE PRICE (£)	TYPE PRICE (£)	TYPE PRICE (£)	TYPE PRICE (£)	TRAN-SISTORS	TYPE PRICE	TYPE PRICE	TYPE PRICE	TYPE PRICE	LINE O/P TR.	
LA3122	2.10	TBA520	1.30	STK0050	7.50	UPC1185H2	3.30	BC548	10	BR100	18
LA3301	1.97	TBA530	1.00	STK0111	7.35	UPC1188H	3.30	BC567	10	BR101	32
AN103	1.95	LA4350	1.93	TBA540	1.27	STK014	7.65	UPC1190C	2.10	AC127	22
AN214	2.25	LA4031	1.66	TBA550	1.40	STK015	7.15	UPC1198H	1.30	AC128	22
AN217	2.44	LA4031P	2.45	TBA5600	1.60	STK016	7.45	UPC1200V	1.90	AC128K	30
AN240	2.20	LA4032	2.34	TBA7500	2.45	STK020	9.05	UPC1208C	1.85	AC187K	30
AN253	1.93	LA4051	2.79	TBA800	.80	STK032	11.32	UPC1211C	4.05	AC188K	33
AN264	1.77	LA4101	1.88	TBA810AS	1.15	STK035	12.67	UPC1215V	2.50	AD149	70
AN315	1.66	LA4102	1.97	TBA820	1.40	STK036	12.67	UPC1216V	2.00	AD161	42
AN318	6.95	LA4400	2.80	TBA890	2.95	STK043	11.33	UPC1217G	3.35	AD162	42
AN337	4.41	LA4420	1.94	TBA9200	1.50	STK050	20.75	UPC1218H	2.75	AF127	36
AN360	1.45	LA4422	2.75	TBA950/2X	2.65	STK070	21.95	UPC1222	2.05	AU110	2.10
AN5431	2.76	LA4430	1.93	TBA990	1.55	STK077	8.56	UPC1223	3.40	AU113	3.50
AN6332	6.97	LA4460	2.95	TCA270S	1.30	STK078	8.45	UPC1225	3.10	BC107	14
AN7110	1.93	LA4461	2.95	TCA800	1.95	STK082	9.75	UPC1226	2.55	BC108	14
AN7114	2.33	MB3712	2.30	TCA940	1.55	STK086	12.89	UPC1227	2.10	BC109	14
AN7115	2.37	MB3713	2.25	TDA1002A	1.50	STK415	9.66	UPC1230H	3.45	BC141	26
AN7120	2.43	MB8719	5.20	TDA1003A	2.80	STK433	7.25	UPC1245	1.99	BC142	23
AN7140	2.10	MC1327A	1.00	TDA1004A	2.70	STK435	7.75	UPC1250V	2.45	BC143	25
AN7145	3.25	MC1358P	1.60	TDA1035	3.20	STK437	7.77	UPC1350C	4.50	BC147	09
AN7150	2.89	MC1330P	.90	TDA1044	3.10	STK439	7.86	UPC1353C	2.60	BC148	09
HA1151	2.89	ML231B	1.95	TDA1170	3.80	STK441	9.52	UPC1356C2	3.05	BC157	10
HA1137	2.30	ML232B	1.70	TDA1412	3.90	STK443	11.33	UPC1358H	3.05	BC158	11
HA1144	2.39	ML237	2.50	TDA2020	2.95	STK459	9.55	UPC1363C	3.20	BC159	11
HA1151	1.97	ML238	4.22	TDA2522	1.20	STK463	10.88	UPC1365C	5.05	BC160	22
HA1156	1.97	TA7072P	2.75	TDA2523	2.85	STK501	8.98	UPC1366C	2.85	BC172	10
HA1166	2.65	TA7108P	2.10	TDA2530	2.10	UPC41C	2.95	UPC1367C	2.85	BC177	22
HA1197	2.30	TA7120P	2.05	TDA2532	2.20	UPC554C	1.30	UPC1368C	3.78	BC182	11
HA1199	2.30	TA7129	3.00	TDA2540	1.95	UPC555H	0.70	UPC1370C2	3.80	BC182L	11
HA1202	1.75	TA7130P	1.20	TDA2560	1.80	UPC566H3	2.10	UPC1373H	1.20	BC183	11
HA1211	1.87	TA7139P	2.80	TDA2581	1.70	UPC577H	3.00	UPC1377C	4.60	BC184	11
HA1306	2.97	TA7157P	3.00	TDA2590	2.25	UPC585C	1.40	UPC1378H	3.80	BC208	12
HA1319	2.90	TA7171P	3.40	TDA2591	2.70	UPC1009H	2.15	UPC1384C	5.50	BC212	10
HA1322	2.10	TA7172P	3.40	TDA2593	2.30	UPC1017G	2.55	UPC2002H	2.20	BC213L	10
HA1325	2.30	TA7176AP	2.90	TDA2600	5.50	UPC1028H	1.15	DECCA 30(400/400)350V	2.55	BC214	10
HA1338	2.78	TA7193P	4.20	TDA2611A	1.50	UPC1025H	3.30	DECCA 80(100/400)350V	2.90	BC237B	11
HA1339	2.80	TA7202P	3.00	TDA2640	1.80	UPC1026C	1.45	(800)250V	2.00	BC337	11
HA1342A	2.33	TA7203P	3.00	TDA3560	5.10	UPC1028H	2.15	PHILIPS G8(600)300V	2.00	BC338	11
HA1366	2.30	TA7204P	1.80	SAS5605	1.83	UPC1031H	2.40	PHILIPS G9(220)63V	1.15	BC547	10
W/VWR	2.30	TA7205AP	1.60	SAS5705	1.90	UPC1032H	0.85	PHILIPS G11(470)250V	1.95		
HA1368	2.20	TA7208P	2.20	SAS580	2.40	UPC1035C	2.50	PHILIPS G11(470)250V	1.95		
HA1371	2.97	TA7210P	5.60	SAS590	2.40	UPC1042C	2.40	PHILIPS G8S/L	13.90		
HA1374	2.56	TA7222P	1.70	SL901B	4.80	UPC1043C	2.45	PHILIPS G8S/Q	12.00		
HA1377	3.80	TA7223P	3.15	SL917B	6.95	UPC1156H	2.45	HITACHI 4W	8.95		
HA1388	4.20	TA7227	4.65	SN76003N	2.05	UPC1168C	2.70	ITT CVC5 7W	9.40		
HA1397	4.15	TA7310P	1.70	SN76013N	1.80	UPC1170C	1.55	ITT CVC8/9	12.80		
HA11211	2.43	TA7313P	2.10	SN76023N	1.80	UPC1176C	2.15	PHILIPS G11 (TIP SW.)	25.80		
KIA7217	2.75	TAA550	.28	SN76110N	1.90	UPC1177H	2.20	1043/05TFK	8.30		
HA11221	2.77	TBA120AS	.70	SN76226DN	1.45	UPC1178C	2.30	U321 TFK	7.95		
LA1201	1.88	TBA120SB	.90	SN76227N	1.00	UPC1180C	3.05	U322 TFK	7.40		
LA1230	2.30	TBA120U	1.00	SN76660N	.85	UPC1181H	2.20				
LA1365	2.25	TBA395	1.25	STK0039	6.45	UPC1182H	2.35				
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BY227M	23
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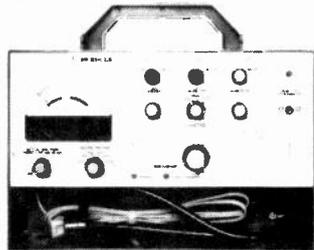
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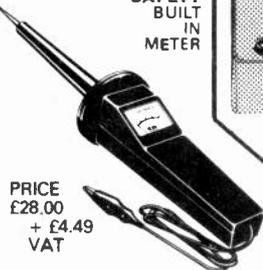
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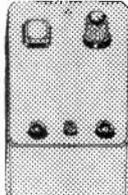
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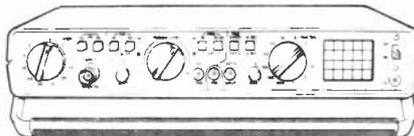
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1.3W Plastic 3V/30V	15p each 10/15	AN214Q	3.88	SN76533N	1.60	UPC1185H2	3.75	1400 150-100-100+100+150/320V2/70	320V2/70	1.95	01/ 0.28
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2.5W Plastic	7.5-75V £1.26 each	CA3065	1.75	SN76660N	0.75	UPC1230H	3.90	3000 100/60/30V	0.56	0.56	E2989D
20W Stud	7.5-75V 87p each	CA4031P	2.88	SN76666N	0.80	UPC1350C	4.75	8000 400/300V	2.10	2.10	0.25
		CA4210	3.30	STK015	6.50	UPC1367C	1.20	3500 175/400V+100+100/350V	1.70	1.70	E2989E
		CA4250	3.50	TA7108P	3.20	UPC1378H	4.40	8000 400/300V	2.10	2.10	0.22
		CA4420	2.98	TA7120P	2.20	UPC2002H	2.80	8000 8500 2500+2500/63V	1.35	1.35	0.22
		CA4422	3.07	TA7129AP	3.65			220/100V	0.98	0.98	0.22
		LC7120	5.33	TA7130P	1.65			1000/70V	0.58	0.58	0.22
		LC7130	5.26	TA7172	1.80			9000 400/400V	2.25	2.25	0.22
		LC7137	5.16	TA7193	5.50			DECCA/0/30 400+400/350V	2.45	2.45	0.22
		LM3800N	0.80	TA7172P	1.80			GEC 2047 2048 2083 2084 2104	3.52	3.52	E2982Z
		LM1303N	2.52	TA7176	2.50			200+200+150+50/300V	2.32	2.32	0.25
		HA1151P	3.12	TA7202P	4.18			600/250V	1.50	1.50	0.22
		MC1307P	1.85	TA7204P	1.86			ITT/KB 200+200+75+25/350V	2.15	2.15	E2989D/P116
		MC1319P	2.50	TA7205AP	3.90			PHILIPS G8 600/300V	1.70	1.70	0.23
		MC1312P	2.25	TA7208P	3.27			G8 G9 600/300V	1.50	1.50	E2930H
		MC1327P	1.25	TA7210P	6.50			G11 470/250V	1.50	1.50	0.72
		MC1330P	0.83	TA7222P	1.88			G9 2200/63V	1.26	1.26	VA1015 0.92
		MC1349P	1.85	TA7227P	5.60			TK48 125+300+100+32/275V	2.65	2.65	VA1033/34/38/
		MC1351P	2.50	TA7230P	1.65			691 Series 200+300/350V	2.15	2.15	19/30/53 all 2.00
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		MC1357P	2.88	TA7611AP	2.88			600+300/300V	2.05	2.05	0.37
		MC1358P	1.30	TA2A263	2.46			A823 2500+2500/30V	0.98	0.98	VA1074 0.20
		MC1496L	1.15	TA2A310A	2.68			220/100V	1.70	1.70	VA1077 0.31
		ML231B	2.10	TA2A550	0.50			600/300V	1.70	1.70	VA1091 0.29
		ML232B	2.10	TA2A570	1.99			22p per metre	2.65	2.65	VA1096/97/
		ML237B	2.30	TA2A611A12	3.20			Red & Black 38p per metre	1.90	1.90	98 all 0.20
		NE555	0.25	TA2A630S	3.90						VA1103 0.32
		C-mos 555	0.88	TA2A661B	1.70						VA1104 0.66
		NE560	0.80	TA2A700	2.80						VA1108/09/10/
		SA41024	5.35	TA2A840	3.38						11/12 all 0.24
		SA41025	8.40	TA2D100	2.80						VA850 1.20
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		SAS580	2.85	O.T.U.U.Q	1.32						
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		SC9530P	1.10	TBA231	1.45						
		SL432A	4.00	TBA281	2.68						
		SL901B	2.50	TBA290	3.40						
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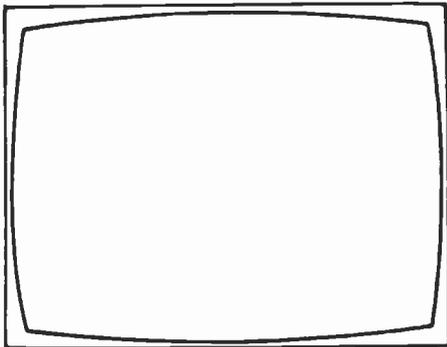
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TELEVISION

DBS PROSPECTS IMPROVE

The conventional view not long since was that there was no conflict of interest between cable and satellite TV. We were to have them both. Satellite links would serve the cable networks, providing programme feeds. The public would also get its DBS channels. A cable socket at every front door plus a dish on the roof or in the garden. We've come a long way in a short time however. As the sums have been worked out, so the vista of endless lines of communication of every possible sort has receded. At present, satellite reception looks to be the more likely way in which most of us will eventually be given a wider choice of programme material. True this will mean fewer channels than a cable service, with less scope for extra facilities and a higher initial outlay for the viewer, but the economics of satellite broadcasting are beginning to look rather less daunting than those associated with cable TV.

The cable lobby has been calling "foul". The government, having first encouraged potential cable operators, then changed the rules of the game – at a delicate time, before anyone had got around to raising the funds required to buy the cables and associated equipment and get them installed. The changes came with the last budget, when the regulations on capital allowances for tax purposes were altered. The effect of this for prospective cable operators was to defer the likely break even point from seven to nine years. Well, having to wait for seven years to show a profit was bad enough. If the prospect is one of having to wait for a decade or so before profitability is achieved one might as well call it a day. The funds would earn a lot more in the building society or some other more prosaic investment.

In what looked like a rather desperate move the Cable Television Association proposed to the Information Technology Minister Kenneth Baker that the government should provide grants under a section of the Industry Act. The section concerned has been used to encourage investment in areas that promise growth, and would help compensate for budget induced difficulties. Industries of all sorts have always had to live with the problems caused by budget changes however. In the event, the Cable Television Association seems to have received a dusty answer.

Even before the budget changes, which could increase cable TV costs by up to 45 per cent, those companies awarded the initial eleven cable franchises were expressing serious doubts about the prospects. Several have already postponed the start of their services by a year, and reservations over the terms of the draft contracts have been expressed. A director of one of the companies has commented that with the increased costs on top of everything else "... quite frankly I do not think cable is going to get off the ground in the United Kingdom".

That could all be part of an attempt to bring pressure on the government. But it doesn't create the sort of image that will encourage prospective cable customers. The impression at present being given is one of companies so strapped for funds that a decidedly lack-lustre service will be on offer when it does come along. The government has been less than helpful, but if the end result is simply that a lot of expensive cable doesn't get installed then at least we'll be spared another of those white elephants born of misplaced enthusiasm.

Both Thorn-EMI and British Telecom have been reviewing the extent of their commitment to cable TV in the light of the present gloomy outlook. Those of us who are dedicated Thorn watchers will see this as a sign of the way in which things are going – Thorn generally get it right. The other side of this coin is the fact that Thorn's interest in satellite broadcasting appears to be on the increase. In addition to being one of those planning to participate in the official UK satellite service, along with other companies, the BBC and the IBA, Thorn are understood to have had talks with the Luxembourg Coronet venture (see Teletopics, July). This venture is primarily intended to provide satellite links for cable TV operators, but the medium-power satellites involved would provide signals receivable by individual households using a dish of a metre or less. Whether Coronet comes to anything remains to be seen. Finances have yet to be raised, and although agreement has been reached with the Luxembourg government there's been strong opposition from European post/telecommunications organisations, Eutelsat and various governments, especially the French, mainly due to Coronet being backed by US interests. Remember that Luxembourg helped pioneer commercial radio however. The Irish government appears to be anxious to establish a satellite service that's likely to be commercial, and various smaller countries have been given satellite channel allocations – San Marino, Lichtenstein, Monaco and Andorra for example. There appears to be a lot of scope for commercial DBS services in Europe, though one can't help but wonder what sort of programmes would be pumped out.

Fifteen organisations have applied to the IBA to participate in the proposed UK satellite TV service. At the time of writing the IBA is reviewing the applications prior to making recommendations to the Home Secretary. For its part the government is introducing measures to assist in getting DBS going. The IBA is to be given the discretionary power to extend the franchises of ITV companies participating in the DBS service at the next renewal date without advertising, i.e. going through the usual franchise renewal procedure. The life of the IBA is to be extended, and a satellite broadcasting board is to be set up to regulate UK DBS services. It seems that DBS TV is at last on the move.

At this point it appears that those interested in investing in TV service extensions in the UK are more inclined to put their money into satellite rather than cable ventures. Apart from the wider coverage, it's likely to be easier to sell the idea of satellite TV to the public than cable.

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COVER PHOTO

Our cover photo this month shows a Sony KV2000UB awaiting attention at the service headquarters of R.N. French Ltd. (Audio Visual Rentals), Sedlescombe, East Sussex. Our thanks for their help.

HELD OVER

Due to shortage of space in this issue the concluding instalment of the TV Test Pattern Generator series has had to be held over until next month.

Stereo TV Sound

David Looser

The American Electronic Industries Association (EIA) recently announced that it was recommending the Zenith proposal for stereo sound on American TV. Following shortly after the BBC's successful tests of a digital sound system, this raised the prospect that there will be at least four totally different and incompatible stereo TV sound systems in use world wide in a few years' time.

The Pilot-tone System

To see how this state of affairs has come about, it's instructive to consider the stereo system widely used for stereo on f.m. radio and why this is unsuitable as it stands for TV use. Fig. 1 shows a simplified block diagram of a coder for this system, which was originally designed by Zenith in the 60s and is known as the "pilot-tone" system. Left and right audio signals are each fed via 50µsec pre-emphasis networks and 15kHz low-pass filters to a matrix which produces a compatible mono signal (L + R) and a stereo difference signal (L - R). The L - R signal is double-sideband, suppressed-carrier, amplitude modulated on to a 38kHz subcarrier which is then combined with the L + R signal and a 19kHz pilot tone to form the composite signal. This composite signal is fed to the f.m. transmitter. Fig. 2 shows the spectrum generated by this process. The low-frequency portion up to 15kHz is occupied by the mono compatible signal (L + R) while the region from 23-53kHz carries the stereo difference signal (L - R).

With this system the bandwidth of the modulation handled by the transmitter and the receiver is increased by a factor of 53/15, or about 3.5 times that of a mono transmission. It's an unfortunate fact that the noise output of an f.m. discriminator increases as the square of the bandwidth. So the noise performance of this stereo system is about twelve times or 22dB worse than that of a mono transmission. This sensitivity to noise applies not only to random noise (hiss) but also to interfering signals, where it can give rise to whistles and other annoying background sounds.

The TV sound carrier (which of course is also f.m.) has to contend with large amounts of interference from the vision carrier. This interference can be coupled into the sound signal in various ways, but the most important factor is the conversion of the vision carrier's amplitude modulation to phase modulation (p.m.). Although this conversion can occur in almost any part of the transmission path, it occurs mainly in the vision transmitter's final power amplifier and the receiver i.f. amplifier's band-shaping filter. At the vision detector, the 6MHz intercarrier sound signal acquires this phase modulation which cannot be removed by the limiting that removes a.m. Since the unwanted p.m. is generated by the vision carrier's a.m., it's a distorted version of the video signal and thus has a similar frequency spectrum to the video signal.

Although the frequency spectrum of a video signal varies with picture content, there's a pattern that's dictated by the scanning process and is thus common to all pictures. The most significant frequencies present are the

field frequency (50Hz) and its harmonics (100Hz, 150Hz etc.) which produce the characteristic buzz sound, and the line frequency (15.625kHz) and its harmonics (31.25kHz etc.). Each of these line scan harmonics also has its own "family" of field harmonics at either side - see Fig. 3.

In a mono transmission the field rate components cause most annoyance. The line frequency will in theory cause a problem but in practice this doesn't arise because its amplitude is much reduced by the de-emphasis components in the receiver and because, for those who can actually hear 15.6kHz, it tends to be masked by acoustic radiation from the set's line scan components. The line scan harmonics, being well beyond the limits of human hearing, are no problem at all. If a stereo transmission using the pilot-tone system is involved however the results will be very different. It will be seen by comparing Figs. 2 and 3 that two line scan harmonics, 2fh at 31.25kHz and 3fh at 46.875kHz, occur within the sidebands of the modulated L - R signal. The subcarrier demodulator would convert them to new frequencies of $38 - 31.25 = 6.75\text{kHz}$ and $46.875 - 38 = 8.875\text{kHz}$, both of which are audible and very annoying. The "family" of field harmonics around each line harmonic would give the whistle a rough quality and, since the amplitudes of these harmonics vary with picture content, the "quality" of the sound would vary with picture content, further increasing the annoyance.

There are three ways of overcoming this problem. (1) To improve the transmission system to reduce the video crosstalk in the audio signal. (2) To alter the stereo system's parameters to reduce its susceptibility to such crosstalk. (3) To abandon the pilot-tone system in favour of something more robust. The Americans have chosen to combine methods (1) and (2) while other countries have opted for a combination of methods (1) and (3).

Split-sound Reception

There are several ways in which the signal-to-interference ratio can be improved, the most obvious being to abandon the use of the intercarrier sound technique. Intercarrier sound is almost always used in TV sets nowadays, but it's quite in order to use a u.h.f. f.m. receiver of conventional superhet design to receive the TV sound. Because such a receiver doesn't use the vision carrier as a "local oscillator" (as in the intercarrier system), it's immune to the effects of p.m. on the vision

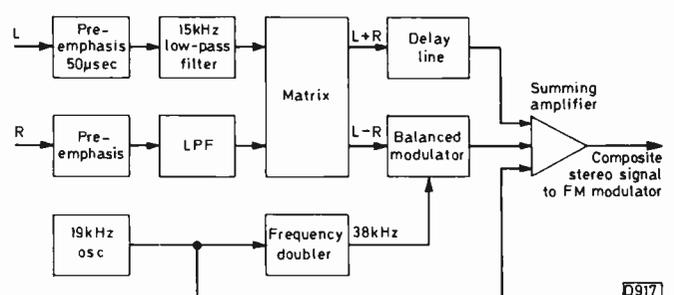


Fig. 1: Pilot-tone coder block diagram.

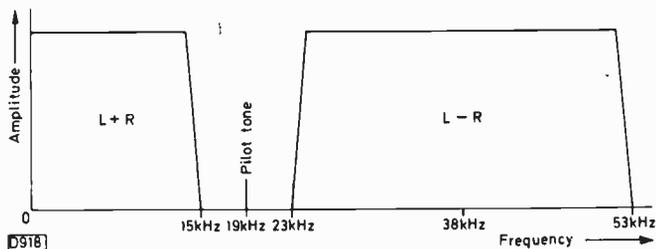


Fig. 2: Pilot-tone system frequency spectrum.

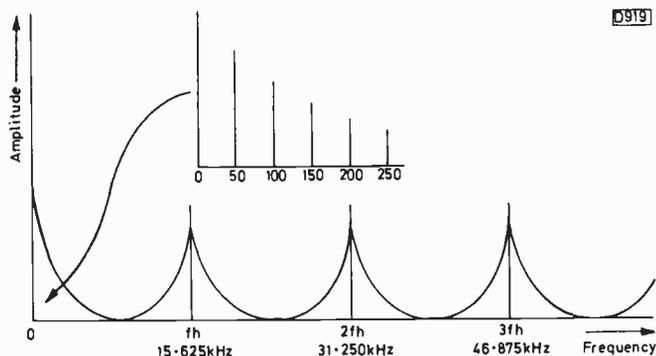


Fig. 3: Video signal spectrum.

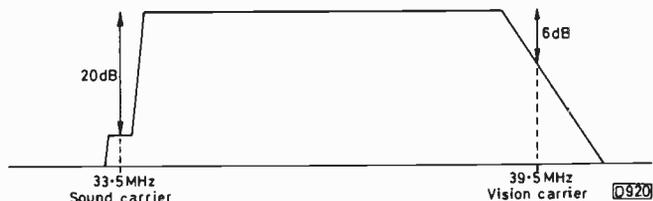


Fig. 4: The i.f. response required for correct reception of a vestigial-sideband transmission.



Fig. 5: Response for improved sound reception.

carrier and should thus be free from video interference.

Unfortunately this technique has its drawbacks. In particular, the tuner's local oscillator stability requirements are severe. To illustrate this point, if it's desired to receive the ch. 37 sound (sound carrier frequency 605.25MHz) using a superhet receiver with an i.f. of 33.5MHz (the standard UK sound i.f.), the local oscillator will be operating at 638.75MHz. Since the peak deviation of the sound carrier is 50kHz, the local oscillator's spurious f.m. must be held at less than 50Hz peak, or 0.1 parts per million, to keep the signal-to-noise ratio better than 60dB. Using a standard varicap tuner, the hum and noise at the tuning pin would have to be kept below $3\mu\text{V}$, a very difficult matter.

The Quasi-split Technique

As an alternative to this "split-sound" technique, it's possible to improve the intercarrier receiver's performance. The problem with the intercarrier receiver centres on the i.f. bandpass shaping required. Nowadays this is done by a filter (often a SAWF) between the tuner and

the i.f. amplifier chip. Fig. 4 shows the required shape. The most noticeable feature of this is the asymmetry around the vision carrier frequency. It's this asymmetry, necessary for the correct reception of vestigial-sideband transmissions, that causes the a.m./p.m. conversion.

It's not possible to have a full bandwidth symmetrical response because most of one sideband is removed at the transmitter, but if a response shape like that shown in Fig. 5 could be adopted then a substantial reduction in vision carrier p.m. could be expected. This is clearly impossible for the vision signal, since it would attenuate all but the lowest frequencies. One way around this is to adopt the so-called "quasi-split" or "split-intercarrier" receiver technique shown in block diagram form in Fig. 6. This arrangement is becoming popular on the continent, largely because of the W. German stereo system (of which more later), and is a valid technique for mono receivers. The split-intercarrier receiver is still an intercarrier receiver and is sensitive to vision carrier p.m. generated in the transmitter and other parts of the receiver, but with care in the design of all parts of the system it can offer a reduction in vision buzz levels of around 10dB.

Improvements to the Pilot-tone System

This improvement is not sufficient to allow noise-free operation with a pilot-tone stereo system, and some alterations to the parameters of the system are called for. The major change suggested by Zenith is to alter the subcarrier frequency to $2f_h$ (31.468kHz in the US system). This means that the major interference within the bandwidth of the modulated L - R signal is reduced to zero when the subcarrier is demodulated. But the field-rate sidebands of this interfering signal are reproduced at their original frequency and produce a similar buzz sound to the field frequency harmonics themselves.

Zenith considered that their proposed changes would be sufficient to produce a system with adequate performance, but the EIA seem to disagree since they've recommended the use of the DBX noise reduction system. This - a rising competitor to the better-known Dolby system for tape noise reduction - offers a noise improvement of about 20dB over the audio band.

The FM-FM System

A different approach was taken by the Japanese when they introduced their own stereo system, which has been in regular broadcast service since 1978. This system, known as the f.m.-f.m. system, uses a frequency modulated subcarrier to overcome the noise problem. This subcarrier, again centred on $2f_h$, carries the L - R signal, the L + R signal being carried at baseband as with the pilot-tone system. Because of the use of an f.m. subcarrier, the L - R signal suffers from a significantly lower noise

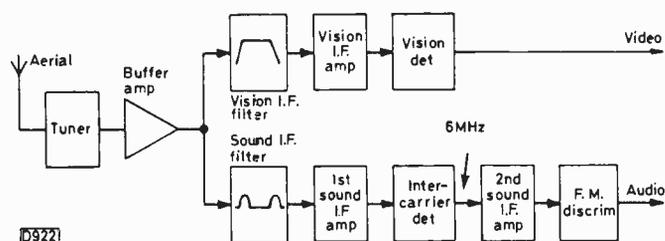


Fig. 6: Block diagram showing the quasi-split technique for improved sound reception.

level than that associated with the Zenith system's a.m. subcarrier. It also allows the subcarrier channel to be used to carry a separate programme from the main channel. This gives bilingual capability or alternatively allows viewers to decide whether they wish to hear the answers in quiz shows in advance of the participants.

These improvements are not obtained without a price however. The price is the relatively high distortion associated with the use of an f.m. subcarrier – due to the fact that the modulated subcarrier must be closely band limited before being combined with the main channel at the transmitter, in order to prevent it causing interference with the main channel. This band limiting removes the f.m. signal's higher order sidebands, i.e. those that enable low-distortion demodulation to take place. In practice the f.m.-f.m. system produces about two per cent distortion on its subcarrier channel, compared to the less than 0.1 per cent that can be achieved with an a.m. subcarrier. In addition the video derived interfering signals, though silent in themselves, can interfere with the subcarrier in a complex way, producing a form of distortion known as "buzz beat". It results in a "rough" sound to high frequencies such as the harmonics of piano or violin music.

In this context it's interesting that the Zenith proposals allow for a second programme to be carried by an f.m. subcarrier at 4fh (62.936kHz). It's admitted that this would be a fairly "lo-fi" service.

The Two-carrier System

Instead of using subcarriers in the manner described above, the "wide open spaces" of the broadcast TV bands suggest an alternative solution – the use of two carriers. This is the method chosen by W. Germany in the system used there since 1980. This uses a second sound carrier, spaced at 0.24MHz from the main one and transmitted at a level of -7dB with respect to it. As with the Japanese f.m.-f.m. system, this allows either a stereo signal or a second programme to be transmitted.

When used in the stereo mode the main carrier carries L + R while the second carrier carries a 2R signal. The reason for transmitting 2R instead of L - R is as follows. Since both carriers are interfered with by the same video signal they acquire the same background noise. If L + R and L - R signals are matrixed to L and R in the decoder, this noise will add in the case of the L signal and cancel in the case of the R signal, producing a one-sided buzz. By using L + R and 2R the noise becomes equal in the two speakers and is at a lower level.

This system seemed to be sufficiently attractive for UK use for the BBC to investigate a UK version. Tests have been carried out using a second carrier spaced at 0.304MHz from the existing sound carrier, i.e. 6.304MHz (actually 6.3046375MHz) from the vision carrier. These tests were considered to be disappointing. To avoid intermodulation effects causing patterning on the picture it was found to be necessary to lower the level of the main sound carrier by 6dB, to -13dB with respect to the vision carrier, and to use a maximum level of -22dB for the second sound carrier. In W. Germany the main sound carrier has always been transmitted at -13dB, and a level of -20dB is used for the second carrier.

The BBC Digital System

The BBC engineers felt that these levels were too low to guarantee high-quality sound reception, particularly in

fringe areas, and as a result the BBC have proposed a further system. This would retain the use of a second carrier, but digitally modulated. A second carrier spaced at 6.55MHz from the vision carrier allows the system to carry about 700kbit/sec, enough for two high-quality sound channels. Digital modulation is inherently more tolerant of poor signal-to-noise ratio in the transmission system than f.m. or any other analogue modulation technique. In addition, since the spectrum occupied by the digital signal is wider than with f.m., the visibility of any intermodulation patterning is reduced.

The BBC system was tested last year in the Wenloe area. This was chosen because the hilly terrain would result in any multipath propagation problems showing up. In addition, the long chains of rebroadcast transmitters that derive their signals from Wenloe enabled the ability of existing, unmodified transposers to handle the system to be evaluated.

The tests were very successful. Using carrier levels of -10dB for the normal f.m. sound and -20dB for the extra digital sound, the system was found to be very robust. Even when the signal had passed through as many as five transposers, the system gave good sound quality at virtually all sites where a colour picture could be received, and even a few where no picture at all could be resolved! Further tests have been carried out to ensure that the additional signal doesn't cause any significant impairment to the picture and performance of existing domestic receivers.

Cost Factors

Assuming that further tests don't bring to light any as yet unexpected problems, the success of the system will depend on one major factor – cost. This has two aspects.

First there's the cost to the broadcaster. Going stereo can be very expensive to a broadcaster, particularly one like the BBC whose operation is spread over many studio and transmitter sites. Re-equipping studios for stereo sound and the addition of two-channel audio capacity to microwave links would be expensive, though possibly most expensive of all would be the extra production costs associated with making programmes in stereo. Compared with this the extra cost of digital encoders at the main transmitters is negligible.

Secondly there's the cost to the viewer. Whilst many would like to receive stereo sound if it was available, it seems that few would be prepared to pay a significantly higher price for sets that enable them to do this. Receivers for the BBC system would, at least in the short term, be noticeably more expensive than those for any of the alternative systems. This is likely to lead to pressure from the trade to adopt one of the other systems. I feel that this would be a pity. The BBC system has several attractive features. Apart from the promise of higher sound quality than the alternative systems could provide, it's the only one in which the stereo signal is entirely separate from the normal mono sound. This means that the mono and stereo signals can each be separately optimised in terms of dynamic range, equalisation etc. for their respective audiences. In particular, the user of a stereo receiver could expect a true "hi-fi" sound that's not been compromised to take account of existing sets with their usually tinny speakers and inadequate audio amplifiers.

Handled properly, stereo could bring to TV sound the quality that's been absent for too long. It would be a pity to accept a compromise for short-term ends.

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Salora FR067	10.25
Salora FR029	10.25

300 Mixed Resistors	1.50	10 Spark Gaps	1.00
300 Mixed Capacitors	1.50	10-16 pin Quil IC Socket	90p
150 Mixed Electrolytics	2.00	20 Assorted TV Knobs	1.00
100 W/W Resistors	1.00	10-16 pin Quil to Dil IC Socket	90p
20 Mixed Conv Pots	1.00	100 Mixed Diodes	1.00
40 Mixed Pots	1.50	50 Mixed Mica Washers	65p
20 Mixed Sliders	1.00	300 Mixed Resistors & Capacitors	1.50
40 Mixed Presets	60p	10-16 pin Dil to Dil IC Socket	1.00
20 Mixed VDR & Thermistors	1.00	50 Electrolytics & 50 Capacitors	1.00
20 Mixed Ferrite Cores	50p	50 Mixed Poly Capacitors	1.00
100 Mixed Ceramic Discs	1.00	30 Mixed Neons & Bulbs	1.00
20 Mixed Valve Bases	1.00		

AC128	39	BC172	9	BC559	8	BF179	28	NKT276	1.65
AC131	40	BC174B	23	BC595	8	BF173	29	NKT453	2.00
AC138	40	BC177	24	BC334	22	BF180	33	DT112	1.92
AC141K	39	BC182B	12	BCX34	11	BF184	30	DT121	2.08
AC142K	38	BC183L	12	BD115	49	BF185	30	R1038	80
AC153	39	BC184L	13	BD131	30	BF194	16	R1039	80
AC176	33	BC187	24	BD132	46	BF196	16	R2008B	1.40
AC176K/	BC204	15	BD133	59	BF196	16	R2010B	1.10	
AC128K	93	BC208	9	BD139	36	BF197	15	R2030	70
AC188	38	BC212L	9	BD140	38	BF198	19	R2265	1.30
AD142	1.18	BC213L	12	BD144	1.70	BF199	15	R2305	80
AD143	1.08	BC237	12	BD150	50	BF223	18	R2322	50
AD149	98	BC238B	8	BD163	98	BF224	19	R2443	25
AD161	32	BC238L	8	BD201	74	BF228	19	RCA16446	30
AD162	32	BC250A	15	BD203	78	BF240	20	RCA16599	1.25
AD263	1.05	BC251	8	BD204	99	BF241	21	RCA16600	1.40
AF127	45	BC252A	20	BD222	48	BF256	10	RCA16799	1.13
AF139	38	BC294	37	BD225	52	BF257	20	RCA16800	1.42
AF239	41	BC301	32	BD232	50	BF259	28	RCA16802	1.38
BC107	15	BC303	31	BD233	60	BF259	28	S1299	2.25
BC108	15	BC307	10	BD234	60	BF271	25	S28000	1.25
BC109	15	BC308	8	BD237	55	BF274	11	S5080A/B	3.50
BC115	16	BC309	14	BD238	65	BF274	11	T4652V	1.30
BC117	21	BC327	18	BD241	59	BF338	29	T9003V	1.25
BC125	26	BC328	18	BD244	85	BF335	34	T9010V	1.45
BC126	23	BC327	17	BD278A	81	BF362	50	T9053V	1.30
BC139	27	BC338	17	BD386	68	BF391	21	T9054V	1.10
BC141	34	BC347	8	BD433	71	BF394	16	TIC45X	5.00
BC142	30	BC394	8	BD437	83	BF422	47	TIC46	48
BC143	31	BC454	8	BD592	1.20	BF423	53	TIC106C	40
BC147	12	BC455	8	BD598	1.20	BF450	43	TIP29	42
BC148	12	BC456	10	BD677G	1.35	BF453	53	TIP30	42
BC149	12	BC460	40	BD707	95	BF458	37	TIP31	35
BC153	16	BC463	22	BD708	95	BF459	40	TIP32	43
BC1540R	16	BC546	8	BDX10	83	BF461	59	TIP33	61
BC154YL	16	BC547	12	BDY20	1.09	BF568	15	TIP41	42
BC157	12	BC548	12	BDY32	99	BF595	14	TIP42	45
BC159	12	BC549	8	BF137	20	BF694	16	TIP44	45
BC159	15	BC557	10	BF153	20	BF757	62	TIP110	61
BC171	9	BC558	10	BF154	25	BF852	31	TIS91	25
								ZTX550	30

INTEGRATED CIRCUITS

BRC1330	1.40	SN7613ND	1.80	TBA530	1.26	DAA2002	2.80
BRC3064	1.00	SN76023N	1.80	TBA540	1.00	DAA2030	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.82	DAA2522	2.61
BRC/M/300	1.00	SN76115	2.00	TBA560C	1.50	DAA2530	2.61
CA3060	1.58	SN76131N	1.50	TBA641	2.05	DAA2540	3.50
LM1303P	1.48	SN76228N	1.25	TBA720A	2.50	DAA2560	3.50
ML231B	2.20	SN76227N	1.00	TBA750	2.49	DAA2581	1.96
ML237B	2.00	SN76530P	1.30	TBA800	2.20	DAA2591	1.96
ML239B	2.96	SN76622N	1.00	TBA810S	1.62	DAA2611A	1.95
MC1327AP	1.25	SN76660N	0.80	TBA810AS	1.00	DAA2640	2.90
MC1358P	1.30	SN76666N	75p	TBA920	1.00	DAA2690A	1.50
MC1455P	18p	SN76744	1.00	TBA960	1.00	DAA3560	6.00
MC14516BCP	60p	TA7117P	1.92	TBA1440	2.08	DAA3603	2.90
SA11025	7.20	TA7109AP	1.00	TBA1440	1.95	TCEP100	3.48
SA11124	4.50	TAA611	2.80	TCA270SA	1.05	MC14426P	4.80
SA15010	6.00	TBA120B	1.20	TCA270C	1.05	MC14429P	4.50
SL432A	1.80	TBA120C	1.20	TCA270CQ	1.05	MC14514	5.00
SL1430	2.50	TBA120CQ	70p	TDA1004A	1.05	UA758PC	2.50
SN15846N	60p	TBA120S	70p	TDA1004A	4.00	UA1008A	2.66
SN74123N	65p	TBA120U	1.00	TDA1035T	3.50	ULN2165	1.30
SN74154N	1.40	TBA395	1.00	TDA1037	2.72	ULN2166A	1.25
SN76001N	1.40	TBA480Q	1.00	TDA11705	1.50	UPC1385C	5.75
SN76110N	1.14	TBA510	1.90	TDA1200	2.42	SC9889P	1.40
				TDA1270	2.76	SC9511P	1.40
				TDA1327	2.53	SW153	2.50

Thorn 8/8K5 ex equip panels	untested	2.88	Thorn 3/3K5 ex equip panels	untested	3.75	Thorn 4000 PSU panel ex factory	2.50
PSU	3.75	LTB	3.75	PSU	3.75	Thorn 3K5 beam limiter board	1.75
FTB	4.00	Video	2.50	new	1.75	Thorn 3K5 PSU bottom board	2.75
Decoder	4.00	Chroma	2.00	PC206 new	2.75	Thorn 3K5 IF panel new	3.00
Thorn 9K ex equip panels	untested	12.00	FTB	1.75	Thorn 3/3K5 EHT & scan TX +	1.00	
PSU	5.00	Conv. 3K	3.00	R2008B on alum chassis ex	1.00	Thorn 8/8K5 damaged FTB for	1.25
Decoder	5.00	Conv. 3K5	3.75	spares	1.25	Thorn 8/8K5 damaged decoder	2.25
Thorn 9K6 ex equip panel	untested	5.75	Autovox Decoder FG/01	new	5.00	Thorn 8/8K5 damaged decoder	2.25
Decoder	5.75	ex-factory	3.75	for spares	2.25		
UHF TV Aerial for portable		50p	Coax Plugs		10 for 1.65		
Indoor Aerial Parabolic Type Reflector			Band Change Switch Assy, Pye 725		40p		
to Help Combat Ghosting Problems			2.50	Flush Mounting TV/FM Diplexer	1.00		
Line Connectors			38p	Switched Flush Fitting Aerial Outlet	1.00		

Pye 78+161	50p	EHT TRAYS	
Pye 147+260	90p	Thorn 8000	5.50
Thorn 56+1K+47+12	1.24	Thorn 9000	3.50
Thorn 50+40+1K5 60p	6.00	Thorn 8500	6.00
Thorn 128+16+1K7+	50p	Thorn 9000	7.90
116+462+126	50p	Thorn 9600	6.00
Thorn 120+72+300	50p	Thorn 900/950	1.50
		Thorn 713 4 lead	5.83
RBM 250+14+58	63p	Pye 713 5 lead	5.97
(TV161)	90p	Pye 725	6.35
Pye 3R5+15+45 (713)	90p	Decca Bradford	5.00
Philips 2R2+682	90p	Korting A29100	7.10
Philips 47R	90p	Baird 8750	7.10
Thorn 350+20+148+	1.40	Philips G8 (520)	6.50
1K5+317	1.40	Philips G8 (550)	6.50
Thorn 6+1+10	92p	Universal	5.00
Thorn 3000 Metal 1.45			
Thorn 8/8500 Plastic	1.45		

MULTISECTION CAPACITORS

100+150+150	350V 50p	200+200+100	350V 55p
220+47	350V 50p	200+200+75+25	350V 60p
200+150+50	350V 60p	50+50+8	300V 55p
200+200+100	325V 54p	100+50+100	350V 55p
32+32+16	275V 52p	100+150+50	350V 55p
200+200+100+32	350V 70p	2500+2500 (Thorn 8K)	63V 1.20
100+50+150	350V 58p	150+150+100	300V 1.80
400+400	200V 72p	175+100+100	350V 2.25
32+32+16	350V 52p	Thorn TX9	1.00
200+32+300+100	350V 70p	175+1	

CAPACITORS 91 5 x .0047/1500 AB23 Chassis 1.50 92 10 x 220MFD 16V Elect 0.50 93 10 x .047MFD 400V Muf Pol 0.50 94 5 x 4.7/100V C514 T3500 1.25 95 5 x .47/1000 Dublier 3.00 97 10 x Q1/2000V W/E 2.00 98 5 x 1/250 Supp ITT etc. 1.50	68 Grundig 3010/1500 3.00 69 Thorn 3500 7.50 70 Thorn 8500 5.40 71 Philips G8 6.30 72 Pye 731 4.50 89 10 x Anti Track EHT Cap 2.00	179 TDA2532 2.40 180 TDA2540 1.05 181 TDA2541 2.67 182 TDA2580 3.20 183 TDA2571 2.15 184 TDA2591 0.90 185 TDA2593 2.23 190 TDA2600 4.00 191 TDA2611 1.24 192 TDA2640 2.35 210 ETTR8016 2.20 211 ETTR8016 2.20 212 BTTR8016 2.20 220 SL901B Int Circuit 5.00	030 GEC 2100 Hybrid 4.00 032 Thorn T x 9 Chass. 14.50 033 Philips KT3 8.00 034 RRI T24 Chass. 14.00 035 Sanyo CTP5101 9.50 037 Split Diode EHT Lead 1.35	SPECIFIC COMPONENTS 351 Thorn 1591 Speaker 2.00 352 Thorn 1600 Dropper 0.50 353 T x 10 Preset Drawer 3.00 354 T x 10 CRT Base Assy 4.00 355 3" Round BR Speaker 1.00 358 5 x Tho/3500 200 Conv. Pot. 1.00 359 5 x Tho/3500 50R Conv. Pot. 1.00 360 5 x TCE3500 A1 Rectifier 0.75 362 T9000 Rem. Receive Assy 5.00 363 T3500 Mains TX 5.00 364 T8500 Mains TX 7.50 365 T8500 (Plastic) Cut TX 1.50 370 Pye 731 Thick Film Resis. 1.50 371 Pye 713/731 Vis. Gain Mod. 6.50 372 Pye 731 3R3 50W Metal cld. 1.29 373 100K x3 Drawer Pset Alt Pye 731 2.00 378 Grundig 5010/8010 Vid Mod. 4.00 384 5 x 10R Phil. G8 Conv. Pot. 2.40 385 5 x 15R Phil. G8 Conv. Pot. 2.40 386 5 x Phil G8 2k x2 Lin. Bright. 2.50 387 5 x Phil. G8 10k Log. Colour 2.50 388 5 x Phil. G8 47k Log. Vol. 2.50 389 G8 Plastic Mains Switch 0.75	390 G8 Metal Mains Switch 1.23 391 G8 Line Stor/Eq. 2.25 392 G8 R/G Symmetry Coil 3.33 397 20 x 3.15A A/S 20mm Fuse 1.50 398 20 x 800MA A/S 20mm Fuse 1.50 399 20 x 2.5A A/S 20mm Fuse 1.00 400 20 x 2A A/S 20mm Fuse 1.00 401 20 x 1A A/S 20mm Fuse 1.00 402 20 x 1.25A A/S 20mm Fuse 1.00 403 5 x RRI T20 Tube Base 4.35 410 Phil. G11 E/W Load/ Coil 1.50 411 Phil. G11 Bridge TX 1.50 412 Philips G11 Speaker 1.00 413 10 x TDA2600 IC Holder 1.50 415 PALKT3 Speaker 1.50 435 10 x Decca 30 10R Fuse 0.50 437 Decca 30 47k Vol.+Switch 1.25 453 5 x 5R Universal Conv. Pot. 1.00 454 5 x 20R Universal Conv. Pot. 1.00 455 5 x 100R Universal Conv. Pot. 1.00 456 5 x 470R Universal Conv. Pot. 1.00 457 10 x 100k Tun/Pres TCE etc. 3.00 458 10 x 100k Tuner Preset G8 3.00 459 ELC1043/05 Tuner 6.00	480 ELC1043/05 Tuner 6.00 461 U321 New Tuner 7.95 462 U322 New Tuner 7.95 463 98003 Posister 0.90 464 98009 Posister 0.90 465 Mull.D150 Delay Line 0.95 466 5 x VA1104 2.70 469 Cut Out Metal GEC 2100 1.00 470 5 x GEC2100 3 Lag Thermist. 1.00 479 5 x Gen. Purp. Ro- tary Swtch. 3.00 480 5 x Gen. Purp.Push/ Swtch. 3.75 481 20 x Neons GEC etc. 2.25 482 5 x Univ. Aerial Skt. Kit 5.50 483 10 x Metal Coax Plug 1.70 484 Focus Unit T20 Type 1.50 485 Foc/Unit Thorn 8500 Type 1.25 486 4.43Mhz Crystal 0.40 488 10 x Ring Type Spk/ Gap 1.50 489 TX10 Chass. Focus Unit 7.00 497 De-Soldering Pump 3.50 498 1 x 10 Trimming Tool 1.00
EHT TRAYS 50 ITT CVC 5/9 3.00 51 Decca 1730/1830 4.00 52 Decca 80 Series 4.50 53 GEC 2040 Hybrid 3.00 54 T1500 5 Stick 3.50 55 Thorn 9000 7.00 56 Thorn 1400 2.00 57 Philips G9 3.50 58 Universal ITT Type 4.50 59 5 x TV11 EHT Rec for PTVs 1.00 60 3 x TV45 EHT Rec 2718 1.00 61 ITT CVC 45 4.00 63 RRI Z179 3.00 64 Pye 691/697 3.50 65 Pye CT200 4 Lead 3.50 66 Pye CT200 5 Lead 4.50 67 Korting 90 DGR Hyb 5.00	INTEGRATED CIRCUITS 140 5 x TDA440 3.00 141 5 x TBA120AS 1.00 142 5 x TBA540 4.00 143 5 x TBA5400 4.00 145 5 x TBA560 3.50 146 5 x TBA810S 3.00 147 5 x TBA9200 4.50 148 5 x TBA990 3.25 149 5 x TBA5200 4.00 150 5 x TBA530 4.25 151 5 x TBA950 4.50 154 10 x TCA270SQ 4.00 155 5 x MCI327Q 2.50 180 TDA1170 1.35 181 TDA1190 1.90 182 TDA1006A 1.45 184 TDA1035 1.83 185 TDA1044 2.23 186 TDA1190 1.90 187 TDA1412 0.90 172 TDA2002 1.00 173 TDA2020 2.50 174 TDA2030 2.15 178 TDA2523 2.35	LINE OUTPUT TX 001 Philips G8 7.50 002 Decca 30 Series 7.00 003 Decca 100 Series 6.50 004 ITT CVC 25/30/32 7.00 005 Philips G9 7.50 006 RRI T20 9.92 007 RRI A823 7.00 008 RRI Z718 18" 18.95 009 RRI Z718 20/22/26" V.C.R. 7.95 010 RRI A774 Mono 10.87 011 Thorn 1890/91 7.00 012 Thorn 1615 6.50 013 ITT CVC 45 6.50 014 Phil TX Chass. 5.00 015 RRI Ranger 1/2 5.00 016 ITT CVC 5/9 0.50 017 Philips E2 Chass. 5.00 018 Thorn 9000 12.00 019 Thorn 9500/9600 8.50 020 Polish 161 Mono 6.00 021 Thorn 3500 Scant 4.50 022 Thorn 8500 11.00 023 Thorn 1590/91 8.50 024 Thorn 1500 15K 4.00 025 GEC 2040/2100 Hybrid CTV 4.00 026 Bush 161 Mono 5.00 027 GEC Single Std Mono 5.00 028 Pye 691 (wired) 5.00	PUSH BUTTON UNITS 110 Pye 713 4 Way 7.87 111 Pye 715 6 Way 11.95 112 Phil G8 Square 12.75 113 Phil G8 Sloping 14.50 114 Thorn 9000 2.50 115 Thorn 1615 4 Way 7.87 116 Decca 6 Way 6.95 117 Decca 4 Way 6.90 118 GEC 2110 6 Way 7.95 119 GEC 2136/7 Tapered 7.95 120 ITT CVC5 9.25 121 ITT CVC8 11.45 122 ITT 6 Way with V.C.R. 7.95 123 RRI A823 etc. 7.95 124 Hitachi 4 Way 7.95 125 RRI T20 6 Way 8.95	SMOOTHING CAPACITORS 80 220/400 CVC32/ T20 1.20 81 200+300 Pye 691 2.00 82 600/300 Phil G8 1.90 83 175+100+100 T3500 1.50 84 2000/100 Volt 0.50 85 470 Mfd G11 1.50 86 400+400 Decca 30 2.50 87 200+200+75+25 ITT CVC5/9 1.50 88 400/400V Tho 9000 1.50 89 470/25 Thorn 1590/ 91 91 0.80	TRANSISTOR/DIODES 230 10 x AC128 1.50 235 50 x BC213L 2.50 250 10 x BD124 9.00 251 10 x BD131 1.80 270 10 x BU208A 0.50 271 10 x BU208 7.50 272 10 x BU326 10.00 273 5 x BU205 3.75 280 25 x 2N3055 (Texas) 7.50 281 10 x 2N2905 (Equiv. BC161/303) 0.50 290 10 x BT106 Thyristor 9.00 292 5 x BT119 4.50 293 5 x BT120 4.50 335 50 x BY127 Diodes 3.00 340 25 x TIP41A 6.50 341 25 x TIP41C 7.00	

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Some Confessions

Les Lawry-Johns

It's either that I'm getting old and senile (true says HB) or it's that I'm drinking too much in a frantic effort to thin down my blood (my story). The result of a recent blood test showed it to be 70 per cent proof. Maybe this explains my antics, which are becoming more and more worrying. Listen to this.

The 3500

You'd think these elderly Thorn sets couldn't possibly cause a problem. They never used to. When I was capable of rational thought, that is. Anyway, June phoned to say that her's had gone wrong and that she couldn't bring it in. It's the large 26in. version in a heavy cabinet, so this was understandable. I said I'd call. At the same time another lady popped in to say that her large G8 required attention and would I call. I thought I'd do June first, then pop over and do her. June said her colour had gone (I thought).

So, armed with the usual boxes plus a 3500 decoder panel, a G8 line output transformer and tripler, I set off. On arrival at June's I was savaged by her dog. My fault. I'd gone in the back way and opened the kitchen door. I was flat on my back with him about to rip my throat out when a puzzled look came over his dear old face as he recognised whom he was about to kill. "Get off Piddler you fool, its only me" I gasped. Then he trotted off to find his ball and threw it at me, thinking it was fun time. June came down from wherever she'd been and dragged him away, enabling me to collect my things and go through to where the set lived.

I switched it on and it hummed away to itself, but no colourless picture appeared. I queried this with June who insisted she'd reported that the colour went first, then the set went off. Ah. Remove rear cover and check voltage at h.t. fuse. 30V instead of 60V. So I raised the right side line timebase panel and unhooked the tripler. Still 30V. I then checked the R2008 line output transistor which was o.k. and went on to check other things that tend to load the h.t. line. Nothing came to light. I was inclined to suspect the e.h.t. transformer, and thought it would be prudent to nip back to the shop, pick up a spare panel and fit this to clear the job up quickly. It took some ten minutes, during which time Piddler forgot who I was which led to a repeat performance.

"Stop it you daft bugger. Go and find your ball and leave me alone for Gawd's sake." He trotted off into the lounge and settled on the armchair next to the set. Once more June dragged him off and I was left to fit a replacement panel. Hummm the set went, and again there was 30V at the 60V fuse. Check tube base voltages for clues. Cathodes normal at over 100V – but so were the grids. These should have been at zero or slightly negative. I could hear a slight bubbling noise and the penny then dropped. No negative supply to the grid bias control meant that the tripler wasn't working. Oh dear. Off went the set and off went I to get a tripler.

Something was worrying me. If the tripler had caused the trouble in the first place it could well have damaged the transformer on my replacement panel. So I thought it

would be wise to pick up another working panel as well as a tripler – if I had one. I managed to find one and test it in the rig. It said it was o.k. Back to June's. This time Piddler wagged his tail and dropped his ball under my feet. Over I went and bang went the panel.

"I hate you, soppo great sod" I bawled.

"Come along darling" said June as she dragged him off again.

I fitted the tripler first and my fears were confirmed by 30V at the h.t. fuse. Fit spare panel. The e.h.t. now rustled up nicely, but the Channel 4 test pattern lacked height and linearity. Whilst I was adjusting the controls the 60V fuse failed. It hadn't done this before so something new was afoot. The R2008 had shorted – and I was at the end of my tether. Blinking back the tears, I fitted a new transistor and wondered what would happen next.

With a new 2.5A fuse in place the picture was back and I carried on setting up the test pattern, finding it difficult to obtain full height without a fold-up at the bottom or teletext at the top. At last it was done and I reported to June. She surveyed the picture and expressed satisfaction. Suddenly there was a clonk as something dropped down and the picture became severely rippled. I knew what had happened. Tripping over Piddler's ball had jolted the panel with the result that the core of the coil in the 60V line had been loosened. It had now dropped on to the decoder board.

Once more the rear cover was removed, after which the core was retrieved, fitted and secured. I was paid off and departed, cursing myself at making a right muck up of a straightforward job. At least a G8 wouldn't cause any troubles. Not a dear old G8.

The G8

Still feeling confused, I arrived at my next destination. The door was opened and a pretty little bitch hurled herself at me. After various doggie pleasantries she ran through to show me where the set was. Taking the back off, I checked the left side fuses to ensure that h.t. was present. It was, and as expected the 800mA fuse on the right side scan panel was open-circuit. I checked the current briefly. Over 1A and the line output transformer was discoloured. A new transformer was fitted with no trouble at all. The snag was that I'd forgotten to pack 800mA fuses. Since the normal current is under 500mA, I fitted a 630mA anti-surge type. The set then worked nicely and after being paid and saying goodbye I prepared to depart.

As I was about to drive off there was an irate call.



One way of seeking business, or
"Oh Lord would it spoil some vast eternal plan
If I were a wealthy man?"

“Didn’t last long did it?” So back with the gear and I could hear the power supply tripping away. The 630mA fuse had failed, but why was the power supply tripping? Absence of the load after failure of the fuse should have produced sullen silence.

I then did what I should have done initially. I’d merely checked that the h.t. was present, not measuring it carefully. It was 220V, not 200-205V. I set it at 200V and the tripping stopped. The load on the right side fuse was under 500mA so I went through my pockets. Joy – an 800mA fuse!

“There’ll be no callbacks this time madam” said I, wishing that I could be a bit more sure. All was well however and it was back to base, feeling shattered at this lack of expertise, care and ability to think straight.

The Fidelity

A Fidelity CTV14R colour portable was awaiting our (lack of?) attention. We’d sold it a year or so ago. The owner’s complaint about it was repeated but intermittent shut down, reverting to channel one each time. He said it was random channel change, but it was really shutting down then coming on again in the start-up condition.

Servicing the Sony KV2000UB

Part 1

David Botto

This was one of the most popular Sony TV sets. There are two versions, the Mk. I and Mk. II. They differ in many respects, but it’s simple to find out which version you have on the bench. As is usual with Sony receivers, the KV2000UB is made up of a number of printed circuit boards that are identified by letters. In the Mk. I version there are two main signals panels, A and B: the Mk. II version has a single, larger A panel containing the circuit functions of the two previous boards. Looking into the rear of the Mk. II version with the back removed, you’ll see the larger A board mounted vertically on the left-hand side. Much of the discrete component i.f. and decoder circuitry used in the Mk. I version is replaced by three i.c.s on this later panel.

Power supply panel F is at the bottom left. The mains bridge rectifier is followed by a transistor chopper circuit which incorporates three protection arrangements, ECL (excess current limiting), ECC (excess current cut-out) and OVP (over-voltage protection). These protective circuits are well designed and if a fault condition causes any one of them to sense that all is not in order the receiver trips or shuts down completely. The power supply circuit (Mk. I version) is shown in Fig. 1. The panel is accessible and dealing with faults is straightforward – provided you understand the principles of operation.

The a.c. mains supply passes via switch S901, connector F1, the mains fuse and filter then R602 (2.7 Ω , 7W w.w. non-flammable)/thermistor TH601 (part no. 1-800-356-00) to bridge rectifier diodes D601-4 (four U05Gs). The 320V produced across reservoir capacitors C606/C621 is fed to the chopper circuit via fuse F602. T601 is the chopper transformer and Q607 the chopper transistor. The 18.5V supply at the collector of the driver transistor Q606 is derived from the 320V rail via R617 (33k Ω , 7W metal oxide non-flammable).

Transistors Q604/5 are connected in an astable

Slight pressure on the front panel produced the shut down and restart. A tap on the top did the same. So we removed the back and applied pressure here and there. It seemed that the front panel was the focal point, so we removed it, expecting to find a cracked track or a dry-joint. No amount of disturbance would produce the shut down with the panel out however, so we tried the main panel. This did it and out came the panel. Again no disturbance would produce the shut down. Tapping the now nearly empty cabinet did. I was puzzled and idly tapped the tube base – very lightly. That did it. Oh please, not the tube! Lightly disturbing the base panel then led us to the focus control, where the earthy end was not securely bonded to the print. Resoldering this restored continuous operation. Well, well!

Greetings

Best wishes to Alan Daines of Canterbury, a hard working member of the clan. Keep it going Alan. Message via Stan Westover of SEME. Thanks to A.S. Foster of Brixham, Devon. The doctor had only one hand on my shoulder, rest assured. They don’t really do that... do they?

multivibrator circuit that acts as a pulse-width modulator. The start-up supply for the multivibrator and the error amplifier transistor Q601 is obtained via R604 and R605 (both 47k Ω , 1W metal oxide non-flammable). Once the circuit is working normally these stages are supplied by D609/D614 which produce 21V across the reservoir capacitor C612. The emitter of the error-amplifier transistor is held constant at 12V by R612/D605 – R612 should always be replaced with a 1W type.

The multivibrator free runs at about 10.8kHz – measured using our workshop frequency counter. In normal operation it’s triggered by pulses from the line output transformer T801. In the Mk. I version these are derived from tag 4, which also supplies the 33V rectifier D803: in the Mk. II version they are taken from tag 6 which supplies the 18V rectifier.

Preset VR601 sets the voltage at the base of Q601. This voltage is derived from the 135V h.t. line via R607 etc. and varies with any h.t. voltage fluctuations. Q601’s collector voltage is thus varied to provide the control action – at the junction of R615/6 in the pulse-width modulator circuit. If the voltage at the base of Q601 falls, the on time of Q604 will be increased, and vice versa.

In addition to the 135V supply, panel F produces a 16V start-up supply for the line oscillator i.c. This is developed across C626 and appears at pin 2 of connector F3.

The ECC circuit operates if the power supply’s output is short-circuited or more than twice the correct load current flows. Under these circumstances the voltage across C610, which is charged via D606/R614, rises sufficiently for Q603 and Q602 to latch on, shorting the base of Q604 in the multivibrator circuit and thus killing the 135V h.t. supply.

The ECL circuit operates if the peak current flowing into the load exceeds 1.3A. Under these circumstances the voltage across R628 will be sufficient to turn Q608

hard on. The effect of this on the multivibrator circuit is to switch Q604 off and leave Q605 on, again killing the h.t. supply. Even a brief overload will trigger the ECL protection circuit.

The OVP circuit operates when the 135V line rises above its correct level. In this event zener diode D615 conducts, switching on Q602/3.

There are some differences in the Mk. II version of the F board. The mains filter circuit T603/C601/C629 can be missing; C606/621 are replaced by a single 250 μ F unit (C606); L602 becomes L601 and fuse F602 is deleted. Several component reference numbers differ, e.g. D609 and D614 are interchanged.

Power Supply Fault Finding

A common fault with these receivers is tripping – the set seems to be trying to work but can't quite make it! To deal with this you need a variac or a tapped mains input transformer – something that's essential for tests on the KV2000UB – to enable you to reduce the mains input voltage. Start off with about 150V a.c. If the set then starts to work, you've almost certainly got a fault on the power supply panel.

Connect a digital voltmeter – best for all tests on this receiver – across the h.t. line. A handy place is pin 1 of socket F3. Slowly turn up the mains input voltage. If the h.t. voltage rises above 135V and the set cuts out at about 140-150V, the OVP circuit is operating and there's a fault in the power supply regulation.

The first component to suspect, always assuming that some person unknown hasn't twiddled VR601, is the h.t. reservoir capacitor C620 (it's C622 in later versions of the Mk. II chassis). The h.t. voltage goes high when this capacitor's capacitance falls – if it starts to leak, line ripple appears on the h.t. line, giving the rather puzzling effect of blanking out the luminance signal. Then test resistors R607 (33k Ω , 2W metal oxide non-flammable), R633/R609 (1k Ω), R610 (2.7k Ω) and R608 (3.9k Ω). Replace these last three with small 1W types for greater reliability. Carefully check the preset VR601 and make sure that thermistor Th602 (TH4700) is intact.

Should you ever have low h.t., probably with picture ballooning, and VR601 has no effect when turned, Q601 almost certainly has an internal short-circuit.

When the set trips and reducing the mains input to 110V a.c. doesn't restore operation – or perhaps the set is completely dead – the power pack can easily be checked for correct operation before moving on elsewhere. To do this, remove connectors F3 and F4 and connect a dummy load – a 100W, 240V bulb works well – between pin 1 of F3 and chassis. With 240V mains input the lamp should light and the h.t. rail should measure 135V d.c. plus. Also check for 16V d.c. plus at pin 2 of F3. If it's not present, check R538 (1.2 Ω , 1/8W), D611 and D612 (R640/D612/D613 in later versions). Make sure that there are no dry-joints at the appropriate winding of T601. The 16V supply reservoir capacitor C626 (100 μ F 25V) likes to dry up, causing all manner of problems – such as intermittent start up.

If the lamp doesn't light, further tests on the power pack will be required. Fortunately it's easy to work on if tackled in the right way. If the mains fuse F601 has blown, check C601 (0.22 μ F, 300V Mylar) – replace it using one with a higher working voltage rating. Also check C629, though this one seldom seems to fail, and the diodes in the bridge. The mains switch S901 has been known to go open-circuit.

next month in

TELEVISION

● VCR SERVO SYSTEMS

We all know that VCRs require servos to maintain close control of the capstan and head drum motors. In practice however it's all too easy to get confused when trying to come to grips with the servo system used in a particular machine. The reason for this is the wide variety of servo arrangements in use. They vary from the very simple – some early machines used only one motor – to the latest designs employing digital techniques. The basic principles remain the same: the difficulty lies in relating them to the various circuit arrangements found in practice. Eugene Trundle reviews the approaches that have been adopted in machines of different age and complexity, relating these approaches to the basic servo requirements.

● SERVICING THE GRUNDIG GSC100

This was the basic Grundig "second generation" thyristor line timebase chassis, using the current-dumping width/e.h.t. regulation principle instead of the transistor employed in earlier Grundig solid-state colour chassis. Denis Mott provides a run-down on common fault conditions. Much of the information also applies to the GSC200 chassis which differs only in its i.f. module.

● IPSALO-2

Salora's ingenious Ipsalo-1 circuit was described in our September 1980 issue. Ipsalo-2 is used in the subsequent H and J chassis. In both cases a single transformer acts as the switch-mode power supply and line output transformer: Ipsalo-2 uses a transistor drive circuit.

● SERVICING FEATURES

VCR Clinic, TV Fault Finding, plus Les and more on the Sony KV2000UB and the Grundig 2 x 4 Super.

● TV TEST PATTERN GENERATOR

The concluding instalment provides layouts for the main boards, setting up instructions and notes on modifications made during the development of the design.

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Connect the receiver to the a.c. supply via the variac and gradually increase the input from about 110V a.c. while measuring the voltage across C606. This should rise to 320V d.c. A word of warning. If F602 has blown and the set is connected to the mains supply and then disconnected, C606 and C621 will take a little time to discharge (via R603). So don't touch the fuseholder until these capacitors have been discharged or you could get a very nasty shock. Discharge them to chassis via a 5k Ω resistor – whatever you do don't short out these capacitors or horrible things may happen with damage to the circuitry.

The power panel can be removed by disconnecting F1-4, unscrewing two self-tapping screws at the rear, then sliding it out. The metal cover is easy to remove by taking out the four screws that hold it to the printed board. You will now need a d.c. supply so that the panel can be operated whilst disconnected from the mains and the rest of the receiver. Use either a really well-smoothed supply or two PP9 batteries to produce 18V, negative to chassis. Connect the positive side of this supply to the cathode of D614 (Mk. I version). The current flow from the 18V supply should be about 17-18mA.

Use an oscilloscope with 10:1 probe to check the waveforms at the collector and base of Q604. These should be as shown in Fig. 2. Remember that the multivibrator is running free, so there may be some slight variations in these waveforms. If all is well, reduce the d.c. supply to 9V (or one 9V battery) and link the anode of D614 to the junction of VR601/R608 – leave the 9V supply connected to the cathode of D614. It's helpful to solder short lengths of bare wire, only half an inch, to the various test points to make connections easier. Mark or note the position of VR601's slider before disturbing it. Connect the scope to Q605's collector. With the d.c. supply now at 9V, the consumption should be about 9.8mA. If all's in order, the waveform shown in Fig. 3 should be seen. Turn VR601 anticlockwise and the pulse width will narrow: turn it clockwise and it will widen. Return the slider of VR601 to its initial position and check the waveforms at the base and collector of the driver transistor Q606 (see Fig. 4).

To check the action of the protection transistors Q602/3, connect one end of a 10k Ω resistor to the 9V positive supply and touch the anode of the zener diode D615 with the other end. The waveform at the collector of Q605 will disappear and you'll have to disconnect the 9V supply and reconnect it to start things up again.

Leaving all connections as they are, connect a linking wire from the positive side of the 9V supply to the junction of L602/R617. Increase the supply to 18V d.c. The complete power pack is now operating from the 18V d.c. supply and the waveforms at the base and collector of the chopper transistor Q607 should be as shown in Fig. 5. A digital voltmeter connected between pin 1 of F3 and chassis should give a reading of about 11.5V d.c. The start-up voltage at pin 2 of F3 should be 1.2V d.c. plus.

The procedure outlined above should enable faults on board F to be speedily located. If the chopper transistor has failed, don't replace it before making further tests. It's best to replace the insulating washer as well. Dried out electrolytics and leaky diodes can cause problems. Check the print for dry-joints, especially around the chopper transformer T601. Rapid checks on semiconductor devices and capacitors can be made with a component tester connected to the scope, saving lots of time.

If the power supply works all right when loaded with a 100W bulb but not when connected to the rest of the set,

a few simple tests will quickly reveal in which section of the receiver the fault lies.

Fault Isolation

Connect a digital voltmeter between the h.t. line and chassis on panel F. Unplug connector F4 from the board and switch the mains supply on. F4 feeds the audio circuit and the tuning system. If the 135V supply is present there's almost certainly a fault in the audio circuit. Check the driver and output transistors and the 33 μ F smoothing electrolytic – this is C249, C247 or C253 in different versions. The audio section is reliable, but has been known to fail.

If the fault is still present, switch off, replace F4 and remove connector E5 on the E (line output) panel. Switch on. If the 135V line is absent you've eliminated boards B and D (timebase board). Switch off and replace E5. Remove E2, power up and if the 135V line is present there's a fault on the tube/RGB output board C. Check transistors Q701-3 (type 2SC1127 or 2SC2278) and, in the Mk. I version, D701 (HF-1C) and C709 (4.7 μ F, 250V electrolytic).

If you've still no 135V line, switch off, replace E2 and disconnect E6 in the centre of the E board. This takes the line scan coils, the pincushion transformer and the horizontal shift system out of circuit. Switch on and see whether the 135V line is present along with a vertical line at the centre of the screen.

If there are still no results, switch off, replace E6 and disconnect E1. This disconnects the e.h.t. department, containing the tripler etc.

If there are still no signs of the 135V line when the set is switched on again the fault must be on board E. All this plugging and unplugging sounds like hard work but can be done in a few minutes. It's a good idea to clean the connectors as you remove them, with just a spot of switch cleaner.

Line Timebase Faults

The first thing to check on board E is the efficiency diode, D806 (SID30-15) in earlier versions, D807 (ERC26-15) in later sets. Secondly check the gate controlled switch line output device Q901 (SG613). This is the same device as used in the KV1810UB (see previous article, March 1983). Fortunately, it's much less vulnerable in the KV2000UB. Remember that these devices are very expensive however: never replace one without at the same time replacing its insulating washer, the efficiency diode, and the protection capacitor C812/C814 (depending on version). Also examine choke L807/806 (SRC – sine resonance choke) for any signs of burning or overheating. Change C901 as well – it's connected across Q901.

Then check the whole of board E for dry-joints. Connect the scope, via the 10:1 probe, to the base of Q901 and supply 110V a.c. to the receiver. A picture and the drive waveform shown in Fig. 6 should be obtained. Slowly and cautiously increase the mains input to 240V.

If the set keeps tripping and the connector unplugging procedure previously outlined has been carried out, check the line driver transistor's collector feed resistor. This is R808 or R809 depending on version – 39 Ω , 1/8W non-flammable. It likes to go open-circuit with the result that the set trips. If necessary check the start-up diode D507 (SIB01-02) and the following feed resistors: R551 (1k Ω ,

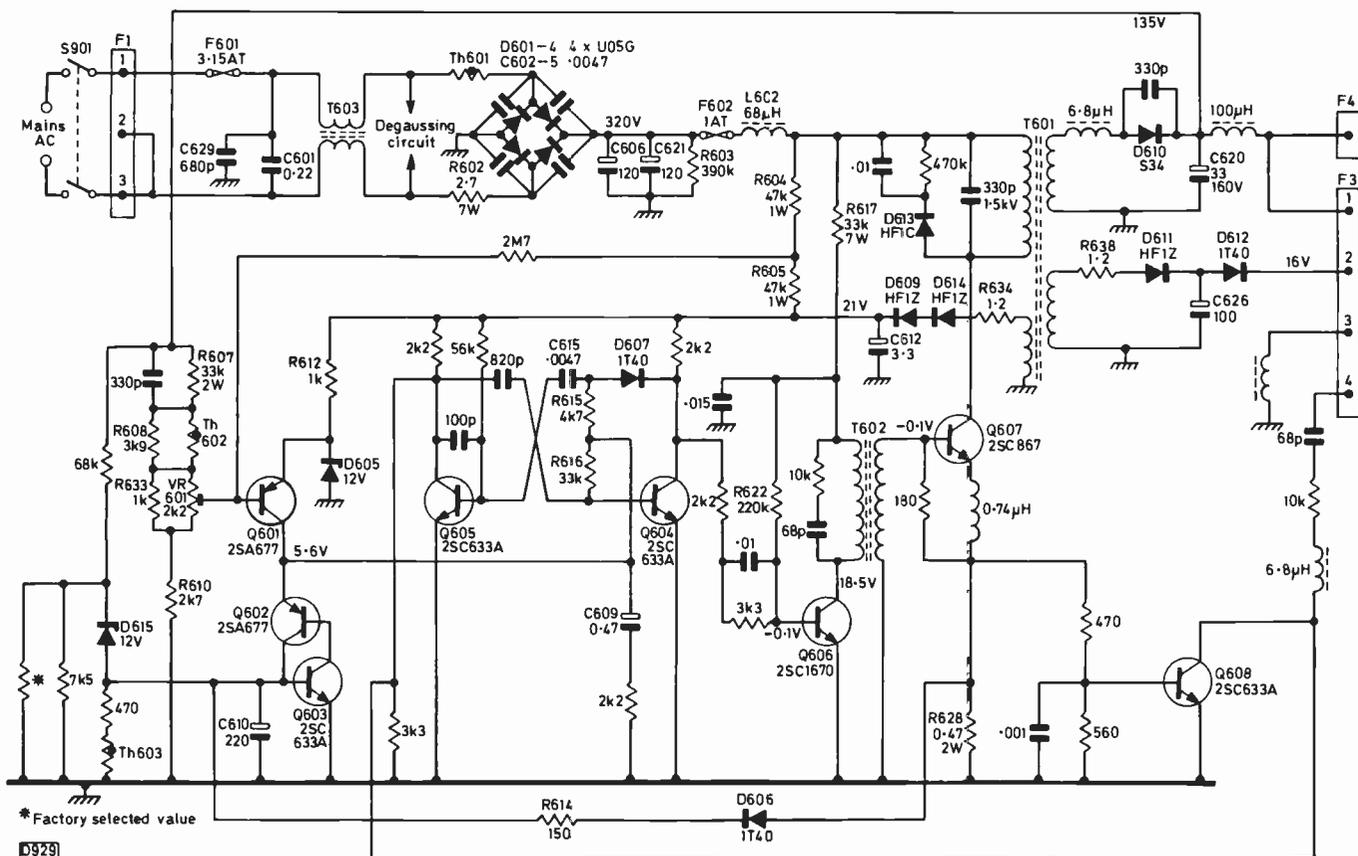


Fig. 1: Power supply circuit, Mk. I version.

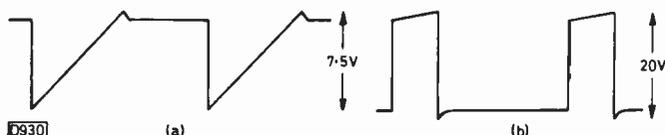


Fig. 2: Waveform at the base of Q604 (a) and at its collector (b) with an 18V supply, free-running at 10.793kHz.

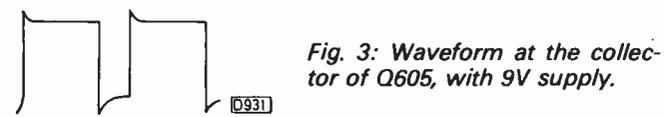


Fig. 3: Waveform at the collector of Q605, with 9V supply.

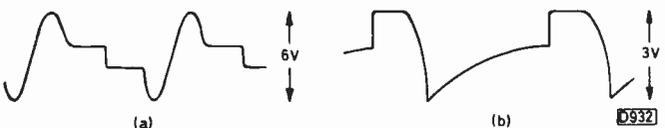


Fig. 4: Waveforms at the collector (a) and base (b) of Q606 with a 9V supply.

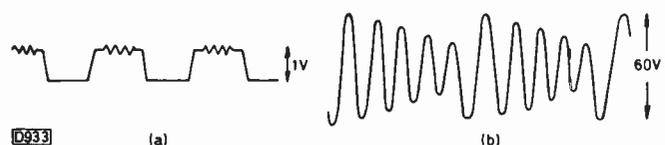


Fig. 5: Waveforms at the base (a) and collector (b) of Q607 with an 18V supply.



Fig. 6 (left): Drive waveform at the base of Q901.

Fig. 7 (right): Waveform at pin 14 of IC502 (CX158).

½W), R555 and R563 (both 120Ω) in the earlier chassis, R552, R555 and R556 respectively in later versions of the Mk. II.

On rare occasions the CX158 line generator i.c. (IC502) has been known to fail or behave intermittently. Before condemning it, examine the various capacitors around this i.c. carefully – the small electrolytics tend to dry up and corrode. C532 (4.7µF) and C530 (3.3µF) are the ones to check first – they are C538 and C535 in later versions of the Mk. II.

To check IC502 – with the receiver disconnected from the mains supply – connect 9V d.c. positive to the cathode of D507 and the scope, via the 10:1 probe, to pin 14. The waveform shown in Fig. 7 should be seen – it may vary as the line oscillator is running free. It's a good idea to heat and cool the i.c. whilst running it at 9V. This helps to show up any tendency to intermittent operation of either the i.c. or associated components. If necessary check the line driver transistor (Q510 or Q507 depending on version).

If the 18.5V supply rectifier D804 (S34) fails or the 33V supply rectifier D803 (HF1) goes short-circuit the set can trip. This is in the Mk. I version. In the Mk. II the supplies are 18V and 33V, the diode references varying with the two variants of this version (before and after serial number 600,001). The 1.2Ω resistor in series with the 18V rectifier sometimes goes open-circuit, the result being tripping.

There are several low-value, low-wattage resistors on all versions of the E board. It's a good policy to test them all – it takes only minutes and can save hours of time in fault location. C807 (330µF, 50V) on the Mk. I panel can go partially open-circuit, giving rise to weird effects in the field timebase circuitry.

In Part 2 we'll deal with the rest of the timebase circuitry, the signals panels and mention a few odd faults.

The Unaohm EP730AFM Panoramic Monitor

Eugene Trundle

When the u.h.f. network in the UK is complete – and it's almost there – there'll be about 650 TV transmitting sites, each radiating four services. This represents around 2,600 vision transmitters operating on the 44 channels available. The corresponding sound transmissions bring the total number of carriers in the u.h.f. broadcast band to over 5,000. There have been developments in Band II as well. Where there were once but three national programmes, a multiplicity of local services has sprung up in the last few years. Down here on the south coast the v.h.f./f.m. band is crowded with Continental broadcasts, despite their being "behind" the directional Band II receiving aerial. Although activity in Bands I/III is currently declining in the UK, there are various European CCIR standard B transmissions that are receivable in southern England and these have to be sorted from such 405-line transmissions that remain.

Where does all this leave the aerial rigger? Straddling the chimney with his dipole in his hand! No problem in a Welsh valley where he's cut off from the rest of the world, alone with his 80W relay down the road and multiple reflections off the hillsides around. But thoroughly confused perhaps in the home counties, midlands and coastal areas, with transmissions from several sites, wanted and unwanted, adjacent and dispersed, all perking up on his field strength meter so that its little needle works like a fiddler's elbow as the bands are tuned . . . Is this the BBC-2 vision signal from the Bretch Hill relay or the sound carrier from Sutton Coldfield BBC-1? Has the pointer gone off the Band II clock as a result of Wrotham's Radio 4, or are we picking up the CB rig down the road? These and similar problems assail the hapless aerial contractor all the time. With the blossoming of Ch. 4 and S4C transmissions and the spread of teletext receivers, our rigger's lot is not getting any happier – and the customer still expects it to be done for a fiver . . .

There's also a race of people called systems engineers. The ones I mean are concerned with installing and maintaining cable TV systems of the multi-outlet type – in blocks of flats, hotels, schools and similar places. They often need to check the level, balance, reflections and

other parameters of their v.h.f. and u.h.f. signal carriers. Again, a simple field strength meter is becoming inadequate – and the average tenant's TV set may be in poorer shape than his distribution system! TV service and installation men who know not a smoke cowl from a hip tile also have an increasing need to be able to analyse the r.f. signals coming into their equipment – and generated by it where r.f. modulators are concerned, as is increasingly the case with domestic equipment.

Panoramic Principle

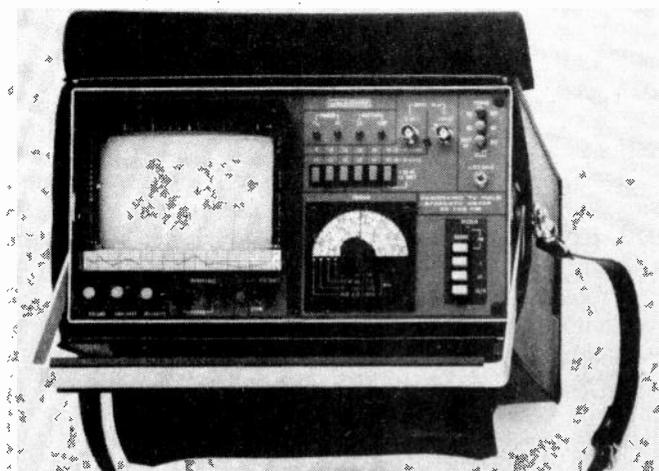
The idea of a spectrum type of broadcast band display really came along with the advent of the varicap tuner – an early example was the excellent panoramic monitor featured in the November 1971 issue of this magazine. The mechanics are surprisingly simple. A field frequency sawtooth waveform is applied to the tuner's tuning voltage input so that it scans the band under observation every 20msec. As the sweep is field synchronous, it's only necessary to apply the output from the vision detector to the horizontal deflection system to build up a spatial "blip" display of all the carriers picked up. The result is a spectrum-analyser type display. The instrument under review goes a step further, producing a more practical and readable display based on a 625-line raster, with the blips reproduced in white against a black background.

Features of the Unaohm EP730AFM

The accompanying photo shows the EP730AFM panoramic TV field strength meter whose main features consist of a 15cm monochrome tube and a calibrated tuning scale.

In the picture mode the instrument is in effect a portable TV set which provides a very good quality picture. The geometry is reasonable rather than good, and there is a little more than three per cent raster expansion over the range of the brightness and contrast controls – this e.h.t. regulation was the same with mains and battery operation. The definition is very good, with all the Ch. 4 test pattern gratings easy to see. The finest grating (5.25MHz) seems to be about 3dB down on the others. To help in identifying short-term reflections and similar shortcomings (very important with text reception), a "zoom" button stretches the picture horizontally so that the test pattern frequency gratings or needle pulse can be closely examined. There's also an audio channel with built-in speaker.

The second mode of operation is "field strength". Here the upper section of the screen displays a horizontal white bar whose length varies according to the strength of the input signal. A scale at the top is calibrated in dB relative to $1\mu\text{V}/\text{m}$ to read field strength within the range $20\text{dB}\mu\text{V}$ ($10\mu\text{V}$) to $130\text{dB}\mu\text{V}$ (3V). This is done in conjunction with a pair of BNC input sockets and a series of push-button attenuators. To cater for tuner tolerances, each instrument comes with an individual calibration graph at the bottom of the screen. This gives the required correction factor to the readings obtained. Unless one's looking for a very high



The Unaohm EP730AFM panoramic field strength meter.

degree of accuracy it can be ignored!

It's becoming conventional nowadays to quote field strengths in $\text{dB}\mu\text{V}$. The conversion to microvolts or millivolts is easy – particularly with this instrument, since a small slide-rule type abac is supplied as an accessory. There's a carrier frequency chart on the back of this: beware of the sound carrier frequencies given – they're for the Continental system, 5.5MHz above the vision carrier!

The third and most interesting mode however is the "panoramic" one, in which the whole of the selected Band's spectrum is displayed. A typical example is shown in Fig. 1, where the four channels of the local group A relay can be seen – the long traces represent the vision carriers and their shorter companions the accompanying sound carriers. Further up the display a group of carriers from a more distant transmitter, operating towards the top of Band V, can be seen. Similar displays are provided in the other bands covered, though the modulation differs – the display shows this.

Identification of individual carriers is facilitated by the electronic cursor at the left. This takes the form of a black line that moves up and down the displayed band with the action of the tuning dial: overlay this with the carrier in question then, on switching to the TV mode, the picture and sound will come up. In Band II the programme is reproduced through the loudspeaker (push the dB button), a beacon lighting up where appropriate to indicate the presence of a stereo subcarrier.

By selecting "expansion" while in the panoramic display mode any section of the band being displayed can be closely examined. Manipulation of the tuning and expansion controls enables the user to zoom in on individual carriers. A typical example is shown in Fig. 2, where the sound and vision signals from a single u.h.f. transmitter occupy almost the entire screen area.

Basically, the machine is mains powered. A sealed lead-acid accumulator is available as an optional extra however. This fits inside the case and can be recharged by the mains-powered charger incorporated. A fully charged

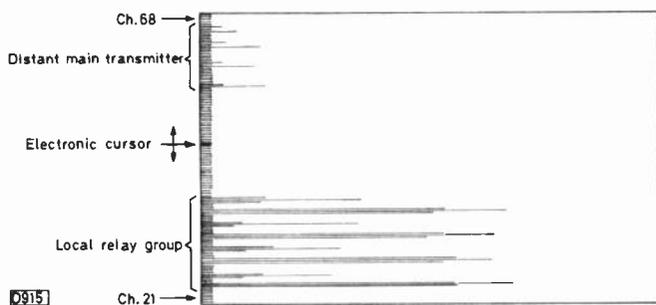


Fig. 1: U.H.F. band display, with the four transmissions of a local group A relay dominant at the bottom.

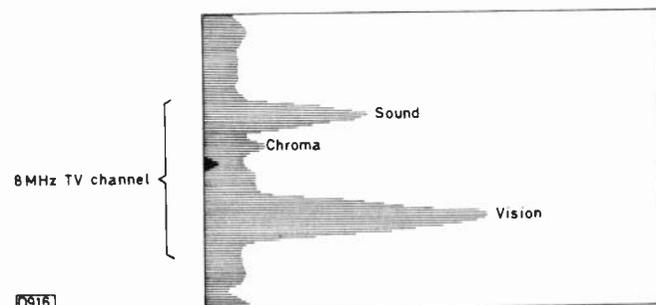


Fig. 2: The expanded mode – a single channel from Fig. 1 enlarged for detailed examination.

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Table 1: Specification

Sensitivity: 20-130dB μ V in ten ranges (0dB = 1 μ V at 75 Ω).
Input Impedance: 75 Ω with a.c. coupling. BNC type input socket.
Field strength accuracy: \pm 3dB on Bands I-III, \pm 4dB on Bands IV/V.
Coverage: Band I 45-100MHz; Band II 88-110MHz; Band III 110-290MHz; Bands IV/V 470-860MHz.
Frequency readout accuracy: \pm 2%.
Monitor: CCIR standard I. Others on request.
Field strength indicator: Peak white to sync tip amplitude. Analogue readout.
Spectrum analysis: Panoramic display of selected band, with selective expansion of any section.
Picture zoom: Double size expansion in the horizontal direction.
Display: 15cm rectangular monochrome tube with magnetic deflection and electrostatic focusing.
Audio output: 300mW via built-in speaker.
Stereo indication: Red LED beacon.
D.C. output: 11V at 50mA.
Power: 220V \pm 10%, 50Hz, or 12V d.c. from optional accumulator. Battery charge facility.
Dimensions: 30 \times 16 \times 39cm.
Weight: 8kg without accumulator.

accumulator will give two-three hours' use. Whilst on the subject of power supplies, a facility is provided for powering a mast-head amplifier at 11V. For the odd non-standard supply systems that may be encountered, recourse can be made to the set-back power supply itself, though I found that most 16V systems operate well enough at 11V. Other features are listed in the specification table above.

A good range of accessories is supplied with the instrument, including a BNC/coaxial adaptor, protection cover, carrying strap, viewing hood and an instruction manual. The latter contains a basic circuit diagram which is just adequate for first-line servicing.

On Test

I lived with this instrument for a couple of weeks, during which I spent a lot of time playing with it. I found that my signals at home were all around an enviable 15mV and wondered why there were no overloading problems with the TV set or VCR. The machine didn't tell me why my teletext reception is a bit garbled, so I assume that this isn't due to aerial or reception problems. I discovered that the broadcast signals are attenuated by exactly 6dB in the VCR (a Sanyo VTC9300PN which does not incorporate an aerial amplifier) and that the VCR's r.f. output is just 2mV. Studying the VCR's output signal characteristics further, I was surprised to find that the vision/sound carrier ratio (two sound carriers, one each side of the double-sideband vision carrier) is 8:1 instead of the conventional 2:1! The 260 μ V's worth of sound is adequate for all the TV sets I've used it with however. Intriguingly, the ITV and Ch. 4 ratios were found to be very close to 2:1 while the BBC-1 and BBC-2 ratios were around 2.6:1.

Having exhausted the possibilities of the local relay, I went into the wider world and found the instrument very useful when installing and adjusting aerials of all types. Imbalance amongst the received channels can be seen at a glance, though the displayed carrier amplitudes tend to jump up and down rather disconcertingly in the panoramic mode. Not all of this is due to amplitude modulation of

the vision signal: it seems to arise from a beat effect between the "blip" and the line structure of the raster – the effect is much less marked in the expand mode.

The instrument really comes into its own when swinging a directional aerial to null out interference from a co- or adjacent channel source. For v.h.f. radio aerial alignment, a compromise between the field strengths of the various transmitters required can easily be obtained. The instrument is not really suited to chimney-pot life, even with the accumulator fitted: it's fairly weighty and burdensome when climbing a ladder or balancing on a roof ridge, and the carrying strap has a similar effect to a cheese-cutting wire!

The detection of ghosts due to TV signal reflections, with or without use of the picture zoom feature, was easy on test-pattern transmissions, difficult with other programme material. For complete analysis of received picture quality, the ideal is to examine the pulse-and-bar and text waveforms. More on this below.

I'd no standard against which to check the absolute accuracy of the field strength readings, but had no reason to disbelieve the quoted accuracy. This was reinforced by investigation of the accuracy of the attenuators fitted – I found a maximum error of just over 1dB, with virtually no variation over the bands. Frequency calibration, measured at three widely different points, is well within two per cent – the dial and pointer system don't allow much greater sighting accuracy than this anyway.

Interference tracing and suppression is greatly facilitated by this instrument. It's much easier to tune a notch filter on an expanded panoramic display than when observing a live picture. Other sorts of interference, including harmonics of amateur radio transmissions and CB rigs, are quite easily seen and recognised, even when they're sporadic in nature. It was fascinating to watch odd transmissions such as v.h.f. communications, beacons and so on coming and going, and with continuous coverage from 45-290MHz and 470-860MHz there's a lot to see! Radio amateurs, experimenters, BT interference investigators and r.f. test engineers should all find uses for this instrument. I imagine that the DX-TV enthusiast would also find it a boon. There would seem to be much potential for the instrument in the educational field, bringing to life as it does the theory of modulation, sidebands and r.f. spectra.

As mentioned above, it's useful to be able to analyse the vertical interval test signals and teletext data lines. In the absence of a facility for this on a test set like the EP730A the best course is to add a video output socket for driving other equipment. Modification and fitting details are available from the importers. Equipment for eyeheight checking and VITS analysis will hopefully become cheap enough one day for general use: the aerial installer and the systems man may then be able to assess quantitatively the more subtle characteristics of the signal he's providing – it would be very nice to quote figures rather than guesses as to the goodness of received signals.

Conclusion

The value and desirability of this instrument depend entirely on how involved you are in this type of work and the standards you set. Though it does have shortcomings, it's a vast improvement on the traditional field strength meter and is, as far as I'm aware, unique in its price bracket and able to fulfil many of the functions of very expensive professional spectrum analysers. £639 plus

VAT is not an unreasonable price if the instrument will be well used, and I get the impression that it will last the course. A spares, recalibration and repair service is provided by the importer's service agents. The instrument is

available from Advid Electronics, 17a Mill Lane, Welwyn, Herts AL6 9EU (telephone 0438 832641 and 714159).

Finally I must thank my colleague J. Guppy for his advice and assistance in the preparation of this review.

Teletopics

TV CHIPS

Details of several interesting new i.c.s for TV receiver use have been released recently. The Mullard TDA4503 is a 28-pin device that handles most post-tuner signal processing, i.e. vision and sound i.f. amplification and demodulation, a.g.c., a.f.c., sync separation and the generation of line and field drive pulses. It can be used as the basis of a monochrome set in conjunction with a tuner and audio, video, field and line output stages. A similar device, the TDA 4500, is already in use in the Thorn TX90 chassis. For a low-cost colour set the TDA4503 can be used with the Mullard TDA3565 decoder i.c. This addition to the TDA3500 series of single-chip decoders has only 18 pins, resulting in an economical design. An i.c. incorporating all small-signal colour receiver functions (the TDA4501) is under development.

The TDA4503 operates at typically 10.5V 75mA and is encapsulated in a SOT117 DIL pack with internal heatspreader.

Mullard are also working on a two-chip signal handling system for use in more sophisticated colour receivers that employ microcomputer control. These i.c.s, designated TDA8430 and TDA8460, are expected to be in volume production by the end of 1985. They're analogue devices but will be digitally controlled to reduce the number of adjustments necessary during manufacture. A Philips/Mullard spokesman commented that the analogue approach will offer a more economical solution to TV signal processing for "at least five years - maybe even ten". CCD field stores are also being developed.

The SGS TDA8170 field output chip is encapsulated in a seven-lead "Heptawatt" flat-pack with tab for heatsink attachment. It's suitable for use in monochrome and colour receivers and is said to be capable of driving all types of yokes in common use. The TDA8172 version is modified for use in receivers with digital signal processing.

BBC'S DIGITAL SOUND SUCCESS

On May 24th BBC engineers carried out what is believed to have been the first "all-digital" transmission (from the initial recording through to the receivers) of stereo TV sound, using the Crystal Palace transmitter after normal closedown. The programme consisted of a pop concert with the sound recorded in digital form. Equipment used for the transmission included a Studer sampling-rate changer to convert from 44.4 to 32kHz and a BBC-designed software-controlled processor to alter the pre-emphasis characteristic from that used by the recorder to that required for transmission. These tests are the latest in a series that began at Wenvoe last October - that test confirmed the ruggedness of digital stereo TV sound in difficult reception areas, the Crystal Palace trial establishing the compatibility of the system, i.e. that no significant interference is caused to sound or vision reception on

existing receivers. The BBC is now convinced that a digital system is the best way of providing stereo TV sound from a terrestrial transmitter and is holding discussions with the Home Office, the IBA and the industry to establish an agreed UK specification. Now that compatibility has been established it's hoped to arrange for tests to be carried out from time to time during normal broadcasting hours.

NARROW-BAND TV DEMONSTRATION

Demonstrations with several amateur-built TV cameras working on a low line standard were given at the tenth annual convention of the Narrow Bandwidth Television Association at Clifton, Nottingham on April 29th. Tony Bridgewater, until 1968 Chief Engineer, BBC Television and a pioneer of broadcast television, was a guest at the convention. He spoke of his experience in both planning and operating the Baird 30-line system during the period 1928-35.

The N.B.T.V.A. was formed in the early 70s to link amateurs working on the application of modern techniques to low-definition and mechanical TV. Membership has grown steadily in the UK and in several other countries and members are at present exploring the possibilities of continuous, moving-image TV using a bandwidth of under 15kHz. Systems that have been tried frequently involve mechanical image analysis. A common standard, which was used at the recent demonstration, is 32 lines at 12.5 frames per second. This can be tape recorded and is a viable amateur radio technique. Remarkable detail can be reproduced within its 6-9kHz bandwidth. Work in progress includes trial transmissions on the amateur bands. For further details contact the chairman Doug Pitt, 1 Burnwood Drive, Wollaton, Notts.

BIB DISC CLEANER

Bib have introduced a cleaning kit for use with laser scanned video and audio discs. It consists of a bottle of special formula cleaning liquid, applicator cloths and a chamois polisher. The kit is packed in a storage wallet for dust free protection and has a recommended retail price of £2.99 including VAT.

CALL FOR A SCOTTISH ATV BEACON

Amateur television enthusiasts in Central Scotland who would be willing to participate in financial support or the construction of a 24cm ATV repeater for the area are asked to contact Norrie Macdonald, GM4BVU, 3 Townhill Road, Earnock, Hamilton, Lanarkshire ML3 9UX.

IBC 84

Some ninety papers are to be delivered during the fourteen technical sessions that will form part of the tenth International Broadcasting Convention at Brighton from September 21-25th. They'll cover technical developments in sound and TV broadcasting and allied fields, including satellite broadcasting and reception, higher definition television and video scrambling techniques. A record number

of firms (134) will be present at the IBC exhibition. IBC 84 is sponsored by the Electronic Engineering Association, the Institution of Electrical Engineers, the Institute of Electrical and Electronics Engineers, the Institution of Electronic and Radio Engineers, the Royal Television Society and the Society of Motion Picture and Television Engineers. For further information apply to the IBC Secretariat, IEE, Savoy Place, London WC2R 0BL.

VIDEO SHOP DECLINE

The number of outlets devoted to selling and renting prerecorded video tapes is declining and, according to Steve Bernard of distributors RCA, could fall sharply from some 6,000 to 3,500-4,000 by the end of the year. Research carried out by RCA suggests that about half the population regard the local video shop as a sort of sex emporium catering mainly for "extreme tastes". As a result, tape rental is being taken over by supermarkets, tobacconists and other outlets that concentrate on a small selection of best sellers. Derek Mann, chairman of the Video Trade Association, feels that video shopkeepers' interests would be best served by a single trade association – at present there are at least twelve.

BANDWIDTH COMPRESSION FOR HDTV

The Japanese broadcasting authority NHK has announced the development of a system called MUSE (Multiple Sub-Nyquist Sampling/Encoding) that enables a 20MHz high-definition TV channel to be compressed for transmission via an 8MHz channel. It relies on the eye's insensitivity to fine detail in a moving picture. The key to MUSE is a multiple sub-sampling system that reduces the number of picture elements per field to a quarter of the initial number. The receiver requires a 10Mbit memory to carry out conversion to the basic standard: four fields per frame are used, reducing the frame rate from 30 to 15 per second. Experiments with MUSE and other HDTV techniques are being conducted via the Japanese BS2a satellite.

US SCRAMBLED TV SERVICE ABANDONED

The US TV network ABC has abandoned after only five months a novel service it was operating as a pilot project in the Chicago area. The idea was to broadcast scrambled programmes during the periods when the transmitters are normally off air. Subscribers could hire a decoder that enabled the transmissions to be recorded on a standard VCR for viewing later. Despite the growing number of VCRs in use in the USA, it seems that the system was not sufficiently attractive to viewers at an economic price.

DBS LATEST

Fifteen firms, rather more than expected, have applied to the IBA to participate in the proposed UK DBS service. They will form a "third force" in partnership with the BBC and ITV companies as outlined last month.

Luxor has announced that it expects to be able to supply equipment for DBS reception in the UK at £320 per installation, to include the electronics, a 60cm dish aerial, setting up and VAT. This assumes a production run of some 200,000 units – a further reduction in price of around ten per cent is anticipated at higher production volumes. Luxor claims to have around twenty per cent of

the domestic satellite receiver market in the USA.

A new DBS transmission standard for European use has been proposed by the French government. The system, called D2-MAC, appears to have certain features in common with the MAC-C system proposed by the IBA last year and backed by both the UK government and the EBU. Philips and Thomson are both backing the new French system.

ALL-DAY ITV POSTPONED

The ITV companies, represented by the Independent Television Companies Association, have informed the IBA that they intend to postpone plans for all-day programming until 1986. The IBA had offered to transmit ITV services after TV-am closedown, but there are doubts whether the likely advertising revenue would make this worth while.

Meanwhile Channel 4 is to extend transmission times from mid-October. Programmes will begin at 2:30 p.m. during weekdays and at 1 p.m. over the weekend.

VIDEO EQUIPMENT

Panasonic have introduced a lightweight portable video recording system consisting of a VCR, Model NV180, that uses standard sized cassettes instead of the VHS C type, the WVPA1E camera and VWET180 tuner/timer. The VCR and tuner/timer together weigh about 6lb, the camera being just over 2lb.

Sony's Betamax VCR with hi-fi sound, Model SLHF100UB, was demonstrated at the recent trade shows. It lays the sound signal on the tape helically along with the video signal, as with the VHS hi-fi sound system.

CED video disc players are now being produced by Korean manufacturer Samsung.

Markplan have introduced a combined VCR/TV set called the Videoport. It's primarily intended for professional/business use and is priced at £1,600 plus VAT. A 12in. colour tube is used for the display.

TV EQUIPMENT

A couple of a.c./d.c. colour portable TV/video monitors have been introduced by Panasonic. Model TC1100G has an 11in. tube and Model TC801G an 8in. tube. Features include video/audio input/output terminals, a dark-tinted glass cover to improve viewing under all lighting conditions, dual-standard PAL operation, and DEF-MOS memory up/down tuning with three controls, plus, minus and store. The suggested retail prices are £388.50 and £355.50 respectively.

An "audiovision" system called TriCon has been introduced by ITT. Instead of connecting cables, the units are linked via 11-pin connectors at the top, bottom and sides. There are seven units, as follows, also a matching trolley stand: 7010 record deck; 7020 cassette deck; 7040 preamplifier/audio control unit; 7060 LW/MW/FM stereo tuner; 7070 TV tuner; 7080 22in. receiver/monitor with teletext decoder; 7090 speaker unit. The latter has bass, mid and treble speakers with built-in amplifiers and level controls for the mid and treble units.

Ferguson have introduced a 22in. component TV set, Model 22B5, based on the TX10 chassis. Called the "Professional Series", the comprehensive specification includes microcomputer control, teletext, a SCART socket, jack connector and bargraph plus numerical displays.

TV Fault Finding

Reports from Mick Dutton,
Tony Thompson and Malcolm Burrell

Amstrad Colour Portables

Two of these sets came in for repair recently. The first was a 10in. model (CTV1000) whose problem was intermittent line hold drift. This was easily solved once the back had been removed: the line hold control, a vertical preset, was dry-jointed on one leg. The second was a 14in. model (CTV1400) with the complaint of intermittent no results. The h.t. and e.h.t. supplies were present in the fault condition, and the audio output stage was lively. We decided to check the low-voltage supplies and found that the 12V rail was missing. This was due to a crack in the print between pin 6 of the line output transformer and the 2.2Ω surge limiter resistor R749. **M.D.**

Decca 120 Chassis

A common cause of the no results symptom in this chassis is failure of the BU426A chopper transistor (Q801). Before replacing this it's worth checking the two series-connected resistors R808 (47kΩ) and R810 (150kΩ) to make sure that they are not open-circuit. This applies to other chassis using a TDA4600 i.c. in a self-oscillating chopper circuit, for example R165 (300kΩ) in later versions of the Thorn TX9 and R646 (270kΩ) in the Grundig CUC series chassis. **M.D.**

ITT80-110° Chassis

The problem was top foldover with the TDA2652 field timebase i.c. getting very hot. Changing the i.c. and the two diodes D421/2 (they looked as though they'd been running warm) in the output stage supply circuit made no difference. The output stage supply reservoir capacitor C421 (220μF) was eventually found to be open-circuit. I've since been told that this is quite a common problem. **M.D.**

Thorn 1696/7 Chassis

The problem with this monochrome portable was a hum bar. The l.t. rail was found to be 0.5V low but could be corrected by means of the preset control. A check on the mains rectifier diodes and reservoir capacitor proved negative so we decided to look into the regulator circuit where we found a crack in the print between the collector of the series regulator transistor and its control circuit. Repairs here cured the problem. **M.D.**

Luxor 90° Hybrid CTVs

In my article on the Luxor/Rediffusion 90° colour chassis (July and September 1982 issues of *Television*) I mentioned that I'd not had trouble with the l.t. supply bridge rectifier. Well, guess what? You're right of course! Don't confuse this bridge, which is near the inner edge of the transistor regulator/sound output panel, with the h.t. one that consists of separate diodes mounted on a small plug-in unit on the main horizontal power panel – bottom left as viewed from the rear of the set. This latter bridge gives its share of trouble but the diodes can be easily replaced with BY127s. The l.t. one is an encapsulated type and should be replaced whenever its 710mA time-delay feed

fuse, which is on the power board, has been killed. The fuses are not component identified but this one is easy to recognise as the input to it should be 26V a.c., slightly more if the fuse has ruptured. The bridge can be replaced with four BY126s, two mounted on one side of the sound panel and two on the other side. If you plan to do this, note carefully the sense of the plus and minus signs on the block: it's all too easy to get confused.

We had an odd fault with one of these sets recently. The complaint was "lines". When I saw the fault, it had some of the hallmarks of interference – three or four narrow horizontal sections of the picture appeared broken and twitching, though the sound was all right. The latter didn't preclude external interference as a possible cause, as the f.m. sound system gives efficient a.m. limiting (though not every set shines in this respect!). As I altered the brightness however I noticed that the fault varied in intensity, being worse at lower brightness levels. This suggested e.h.t. problems – perhaps a winding on the line output transformer about to break down or arcing in one of the line output stage valves.

As a first line of attack I changed the PCF802 line oscillator valve – I've had weird problems with this on various occasions. For once it was blameless. The line output stage cover was then removed so that the valves could be scrutinised for signs of arcing between the electrodes or the bluish glow that denotes impaired vacuum. Nothing. It then occurred to me to check the c.r.t. base panel where there are several spark gaps that give trouble, though the usual effect is bands of colour imbalance in time with the gap "ticking". You often find that these gaps have been open circuited because of their nuisance value, which is unfortunate for the tube's comfort to say the least. Anyway, there was a dry-joint where the lead carrying the focus potential is anchored, and when this had been attended to the fault had cleared. **T.T.**

Grundig 2222

This set initially had a stabiliser fault, but I noticed that one of the neons flickered. So the touch tune unit was replaced. Now to get this out you first have to remove the "electronic module" which lives on the side of the set and contains the tuning potentiometers and several chips. The neon was changed, and the set was then checked before refitting everything.

When I switched on however the tuning voltage had disappeared. A lot of checking ensued before I discovered that there was no voltage at any of the potentiometer sliders. A further check showed that 30V was being fed to the potentiometer bank, which is rather difficult to remove from the panel. Closer examination revealed that though not shown on the circuit each track is fed via a common strip of carbon track. A check on the voltage at each end showed that it was open circuit, possibly due to my clumsy handling.

Ideally the bank should have been replaced, but we didn't have one and the customer was screaming. It looked as if a temporary repair would be impossible, but I remembered once seeing an engineer clean a volume control and then run a pencil round the track. This was

worth a try, so I borrowed a pencil and ran it over the area of the open-circuit track. On switching on again the tuning voltage was present and the set worked normally. I haven't seen it since, but we must remember to order a new bank of potentiometers . . .

M.B.

Glue and Matchsticks!

I've always had reservations about these new adhesives that enable heavyweight boxers to swing from the ceiling. In most household repairs I find they only fasten my fingers together. One day however I had a Grundig set –

one of those with a thyristor line timebase – the fault being a rather narrow picture. Occasionally the set would trip. Investigation revealed that the commutating transformer was falling apart: a drop of glue on the former held it together firmly and restored normal working.

Next day I repaired the line panel in a Philips G8. Clumsy as usual, I snapped the linearity coil. The adhesive was rather more reluctant to work on this until a matchstick was inserted inside the former to link the two halves together. It then worked quite happily, reminding me of an uncle who told me some twenty years ago "never to be without a matchstick in the toolbox!"

M.B.

VCR Clinic

*Reports from Steve Beeching, T.Eng. (C.E.I.),
Ian Hutton and Les Harris*

Sharp VC9500

A local engineer, Dave, dropped in with a Sharp VC9500 that suffered from sound warble. "No problem" said I. "I'll stick a new capstan motor in it." A valid point to note here is never to open your mouth unless you're prepared to stick your foot in it!

The fault persisted after the new motor was fitted, so various tension measurements were made with my extremely expensive Tentelometer tension meter. The take-up tension varied between 20gms and "wrap the needle round the stop" kgm. This was entirely due to the reel motor practising some kind of stop/start method of take-up drive. Replacing this motor put matters right. **S.B.**

Mitsubishis

Those of you in the servicing trade will know how difficult it is to work your way around an unfamiliar machine. This was the case with a couple of Mitsubishis that came to me from another dealer. The first was an HS304 with an intermittent timer. If it was left for a longish period, say a weekend, then set on Monday morning for timed operation, the first go always failed. After that it worked fine. I spent a lot of time checking through the system. When it failed, the tape started to thread then unthreaded again. As power supply line switching was involved various checks and tests were made on this side of things, all to no avail. I decided to call Mitsubishi.

"Can I speak to VCR technical please?"

"No. They answer calls only between 2 and 4 p.m."

"What happens if you have a fault outside these hours?" Silence.

"You'll have to call back." Click. Sh . . .

Once you do get through however they're very helpful. I related the symptoms and my findings to the man at the other end of the phone.

"Have you checked the PG pulse level?"

"No. Should I? What's that got to do with the timer?"

"Well the power supplies load up and if the PG level is low the systems control thinks the drum's stopped!"

No way, it can't be, I thought whilst checking the PG level. Guess what? It was low and what's more after setting the correct level the timer fault went away.

The other machine was an HS320 that acted funny, like threading up whilst the tape was being ejected and then unthreading again. We initially thought the trouble was due to a damaged front panel, but after fitting a replacement the fault remained along with a reluctance some-

times to thread up when play was selected, resulting in a semi-fast forward. Not knowing the machine's history we decided to fit a new microcomputer control i.c. This was done with difficulty because the low-cost print lifts when heat is applied. That didn't do any good either, so between 2 and 4 p.m. I phoned the man again.

"Have you checked the after loading and unloading switches?"

"No. Where are they?"

"Hidden in the top left-hand corner."

Well, he'd been right last time. So I checked the adjustment of the AL/UL bracket – and another peculiar fault went away. **S.B.**

Hitachi VT19

We've had some fun recently with Hitachi VT19s – after they've been in service for a couple of months. The main fault is intermittent clock setting. My friend Dave had three in various states – one reset intermittently and then couldn't be reset, another couldn't be reset after failing, whilst a third had no clock display at all. Hitachi were very nice about it and gave us some modifications which included replacing transistor Q1795 on the power supply back-up board with a 2SD468. As neither of us had one, we put in BC338s. **S.B.**

JVC HRD110

"My JVC HRD110 works only with JVC tapes" said the customer.

I was in a rough mood. "Got taste then, hasn't it?"

Andy pointed out that if I didn't mend it, we'd lose tape library revenue.

The left-hand cassette detector slide switch lever wasn't in its guide slot. **S.B.**

JVC HR7655

A friend of ours rents a JVC HR7655 from us. He rang one day to say that he couldn't set the channel select on the programmable timer. I didn't think much about it as a fellow JVC engineer agreed that it must be the microcomputer i.c., so I ordered a replacement. Tim brought the HR7655 in a couple of weeks later and sure enough when it was put into the programme set mode the channel indicator didn't pulsate nor could it be set. So the

replacement i.c. was fitted. The problem remained. Then smarty-pants Andy pointed out that the tuning selector switch shouldn't be left in the "skip" position but in the "off" position. In this position the channel select could be set and the channel numbers flickered correctly.

I think Tim was mumbling something about no one touching it and he'd murder the kids as he left with the machine. **S.B.**

Clock Faults

Having had enough of making mistakes and mis-judgements due to off-hand diagnosis, I decided to take more care with a couple of Panasonic (note – not National any more!) VCRs that had strange timer faults.

The report with the first one, an NV2000, was of clock resetting to zero and not keeping time. Now we're aware of such things as multisocket adaptors and faulty 13A sockets. This one had a loose neutral connection in the plug. So I set the clock and we put the machine on soak test in the showroom. Next day it was pointed out that the machine showed 5:56 a.m. at 8:56. I decided that someone had set the clock wrongly. Next day the minutes were again correct but the hours were wrong. The timer i.c. was the cause of the trouble.

The complaint with the second machine, a new NV370, was that the timer would reset to zero, and after being correctly set would reset to zero later. It was put on soak test for a couple of days and nothing happened till just after 5 p.m. on the second day – after Andy had told the customer that nothing was wrong and he was on his way to collect it. The clock reset to zero. I reset it once more and a few minutes later it again reset to zero. After checking the timer supply line and a "reset level" potentiometer I put the machine back on soak test.

It was fine the following day, but on the second day it reset to zero once more just after 5 p.m. I decided to leave it but there were cries of "look at this". The clock display was randomly flashing different digits at different brightness levels. I put it back on the bench and froze the timer i.c. The display went back to zero. Just for fun I set the clock and heated the timer chip with a hairdryer. First it reset to zero, then it proceeded to give a display that any disco would be proud of.

Pity about the idler pulleys in this model. Maybe the modified ones will be more reliable. **S.B.**

Tape Chewing

Here are some mechanical causes of tape chewing we've experienced.

Hitachi VT11E: Take-up spool stopping due to the fast forward/rewind/play idler stopping in the play mode. The cure is to replace the idler.

Hitachi VT9300/9500/9700: Take-up spool stopping due to a worn play idler. Replace the idler.

Panasonic NV370 and NV850: The cause is again a worn play/fast forward/rewind idler. If the idler has a blue dot on the right-hand side it should be replaced with a modified one that has a black spot on the left-hand side (part no. VXP0521). **I.H.**

Sanyo VTC5400

I've had the same fault on several of these machines – the tape jammed in the machine and no functions working. On inspection I found that the motors would rotate but the machine wouldn't load due to the loading ring being

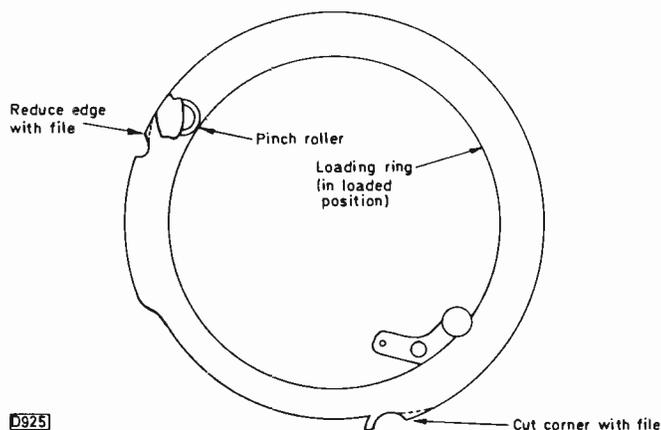


Fig. 1: Loading ring problem, Sanyo Model VTC5400.

jammed. What happens is that the loading end roller catches on a sharp edge on the ring. Filing a small piece off the sharp edge allows the ring to run smoothly on the roller, curing the problem. You'll find that there are two of these sharp edges on the ring (see Fig. 1) – file both down and fit a new loading belt (Sanyo now supply a smaller one). **I.H.**

Sony SLC6 Mk. II

There's an official Sony modification for tape damage upon insertion of the cassette. I've had this problem and the modification does indeed provide the cure. Details are as follows.

- (1) Cut the track between pin 23 of IC501 and R530 on panel SS-9. Add a 1S1555 diode between these points, anode to pin 23.
- (2) Add a 1S1555 diode between pin 30 of the i.c. and R530, anode to pin 30.
- (3) Add a 1S1555 diode between pin 37 and pin 2 of the i.c., anode to pin 37.
- (4) Add a 3.9k Ω resistor in parallel with R579.

The modification also cures another fault. The complaint is that the machine erases only half of the previous recording. Usually the new recording appears on the bottom half of the picture while the previous recording is left on the top half. The cause is that the tension arm is not brought back far enough when the tape is ejected: thus when the next tape is put in the machine the arm doesn't pull the tape far enough across the erase head. **I.H.**

Ferguson 3V29/30

The fault was no colour on playback. On tracing the signal through the machine I found that there was an input at pin 18 of the colour processing i.c. (IC401) but no output at pin 7. Voltage checks then showed that the colour killer was operating. Pin 8 of the i.c. goes via diode D401 to the ch. set/monochrome/colour switch at the back of the machine, and on disconnecting the plug to this switch the colour returned. A measurement from the switch to chassis gave a reading of 200 Ω ! So the switch was removed from the panel and checked. As it seemed to be o.k. the board was checked for a short. Again no luck. Refitting the switch gave us colour for a short while then off it went again. Another resistance check at the switch produced a reading of 500 Ω . So where was this resistance? I found it just before having a nervous breakdown. There was this clear, tacky substance on the rear panel – it could have been flux. Anyway, cleaning it off cleared the fault. **L.H.**

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

18029	1.58	2SC1061	0.54	2SD8988	2.87	AN320	4.97	BC171	0.10	BD186	0.38	BF137	0.11	BLY49	2.00	BY203/20	0.10
16181	1.13	2SC1066	1.05	40408	0.45	AN322	4.38	BC172	0.09	BD188	0.66	BF152	0.28	BR100	0.20	BY206	0.17
16182	1.13	2SC1104	2.80	40594	1.39	AN331	2.99	BC172B	0.24	BD175	0.39	BF153	0.37	BR101	0.37	BY207	0.22
16334	0.06	2SC1106	4.12	40595	1.39	AN337	3.99	BC173	0.15	BD177	0.39	BF154	0.23	BR103	0.45	BY210-400	0.24
16335	0.72	2SC1114	0.61	40636	0.86	AN340P	1.06	BC174B	0.24	BD179	0.44	BF157	0.23	BR888	0.58	BY210-600	0.27
16446	0.09	2SC1124	1.10	40871	1.39	AN355	3.36	BC177	0.18	BD181	0.90	BF158	0.16	BRC-M-300	1.58	BY210-600	0.38
16800	1.25	2SC1151A	4.29	40872	1.39	AN362	1.47	BC178	0.23	BD182	0.90	BF159	0.16	BRC116	0.80	BY223	0.85
16799	2.16	2SC1152	4.25	60857	1.10	AN511	2.34	BC179	0.23	BD183	0.90	BF160	0.28	BRC1330	1.80	BY224-400	0.90
16801	0.86	2SC1157	4.12	74LS132	0.72	AN5132	3.99	BC182	0.08	BD184	1.10	BF167	0.34	BRC300	1.82	BY225-100	0.79
16802	1.83	2SC1162	0.95	74LS138	0.85	AN5250	3.33	BC182B	0.23	BD187	0.40	BF173	0.40	BRC4443	1.12	BY226	0.28
16803	1.83	2SC1172	1.92	74LS157	0.79	AN5435	2.00	BC182L	0.09	BD189	0.35	BF177	0.50	BRC4444	1.12	BY227	0.44
16805	1.35	2SC1195	2.63	74LS161A	1.18	AN5610	6.75	BC182LB	0.12	BD190	0.59	BF178	0.36	BRC5296	0.70	BY228	0.54
17074	6.00	2SC1213	0.75	74LS196	1.25	AN5613	3.72	BC183	0.09	BD201	0.54	BF179	0.32	BRC6109	0.75	BY255	0.97
17127	3.91	2SC1226	1.32	74LS20	0.25	AN5620X	4.63	BC183L	0.09	BD202	0.54	BF180	0.32	BRC82	0.98	BY298	0.25
17376	0.85	2SC1306	0.85	74LS244	1.85	AN6320N	3.89	BC183LB	0.23	BD203	0.54	BF181	0.29	BRC83	0.98	BY299	0.25
1N4001	0.05	2SC1307	1.35	74LS30	0.29	AN6342	1.36	BC184	0.09	BD204	0.54	BF182	0.30	BRC84	0.98	BY476A	0.76
1N4002	0.05	2SC1316	3.40	74LS367	1.05	AN6344	4.00	BC184L	0.09	BD207	1.00	BF183	0.35	BRX44	0.54	BY656	0.30
1N4003	0.05	2SC1364	0.49	74LS373	1.55	AN6363	10.20	BC184LB	0.23	BD208	1.00	BF184	0.39	BRX48	0.45	BYX10	0.28
1N4004	0.06	2SC1383	1.39	74LS47	1.05	AN6551	0.56	BC186	0.24	BD222	0.44	BF186	0.35	BRX739	0.50	BYX55-350	0.48
1N4005	0.07	2SC1398	0.51	74LS73	0.39	AN6552	0.52	BC187	0.18	BD225	0.44	BF194	0.12	BRX75	0.80	BYX55-600	0.25
1N4006	0.07	2SC1410	2.17	74LS74	0.39	AN7145	2.04	BC204	0.14	BD228	0.57	BF195	0.15	BRX76	0.38	BYX71-350	0.67
1N4007	0.07	2SC1413	3.88	74LS75	0.52	AN7150	2.22	BC207	0.12	BD229	0.63	BF196	0.15	BRX99	1.17	BYX71-600	0.85
1N4148	0.83	2SC1505	0.56	74LS86	0.49	AN7151	2.05	BC212	0.10	BD231	0.45	BF197	0.14	BSS38	0.30	BYX94	0.18
1N4448	0.12	2SC1578	6.67	74LS90	0.75	AN7156	2.05	BC212B	0.23	BD232	0.44	BF198	0.15	BSTBD1409	2.40	BYX96	1.09
1N5401	0.12	2SC1617	3.35	74LS92	0.75	AN7158	2.34	BC212L	0.09	BD234	0.38	BF199	0.15	BSTBD1405	4.37	BZV15-C12	0.72
1N5402	0.13	2SC1670	2.84	74LS93	0.75	AN7218	1.49	BC212LB	0.23	BD235	0.43	BF200	0.32	BSTCD146	2.25	BZV15-C12R	0.72
1N5403	0.14	2SC1678	1.25	74LS95B	0.85	AP58076	4.25	BC213	0.09	BD236	0.45	BF216	0.33	BSTCD233	2.25	BZV15-C24	0.72
1N5404	0.15	2SC1810	1.40	7805 TO-220	0.63	AS580S	1.43	BC213L	0.09	BD237	0.38	BF218	0.32	BSTCD246	4.51	BZV15-C24R	0.72
1N5408	0.18	2SC1815	0.41	7805 TO-3	1.05	AU106	1.96	BC213LB	0.23	BD238	0.29	BF222	0.50	BSTC1233	3.91	BZV15-C30R	0.72
1N914	0.05	2SC1829	2.01	7806	0.66	AU110	1.96	BC214	0.10	BD239	0.44	BF224	0.15	BSTC3146	0.71	BZV16 Range	0.16
1S44	0.06	2SC1875	4.77	7808	0.54	AU113	2.15	BC214L	0.12	BD240	0.36	BF237	0.59	BSTCC0143	2.79	BZV17-C11	0.54
1S5012A	0.73	2SC1891	3.35	7812 TO-3	0.54	AY102	2.62	BC214LB	0.23	BD240D	0.47	BF240	0.15	BSTCC0843	3.06	BZV17-C12	0.54
1S921	0.09	2SC1929	2.25	7812 TO-220	1.05	AY105K	1.89	BC225	0.24	BD241	0.45	BF241	0.15	BSV57B	2.68	BZV17-C15	0.54
2582	1.94	2SC1942	5.70	7815	0.55	AY106	1.98	BC237	0.09	BD242	0.45	BF244	0.23	BSW68	0.38	BZV17-C30	0.54
2N1302	0.24	2SC1945	4.11	7818	0.55	BA102	0.30	BC238	0.09	BD243	0.44	BF245A	0.33	BZV17-C47	0.54		
2N1303	0.34	2SC1953	1.75	7824	0.55	BA1310 (IC)	1.72	BC238A	0.11	BD243A	0.50	BF256	0.18	BZV17 Range	0.09		
2N1308	0.38	2SC1957	0.86	AC107	0.66	BA1320 (IC)	1.22	BC238B	0.08	BD244	0.44	BF256	0.25	BZV18 Range	0.09		
2N1309	0.29	2SC1959	0.36	AC117	0.39	BA1330 (IC)	1.82	BC251A	0.15	BD244A	0.77	BF256LC	0.38	BZV19-C12	0.99		
2N1322A	0.34	2SC1962	1.75	AC123K	0.95	BA145	0.17	BC252	0.12	BD245C	0.80	BF257	0.30	BZV19-C18	0.99		
2N2846	0.75	2SC1969	2.92	AC128	0.28	BA154	0.08	BC258	0.22	BD246C	0.74	BF258	0.29	BZV19-C24	0.99		
2N2904	0.32	2SC2027	2.67	AC138	0.08	BA155-01	0.12	BC261A	0.20	BD253	0.95	BF259	0.30	BZV19-C24R	0.99		
2N2905	0.39	2SC2028	1.91	AC141	0.26	BA156	0.12	BC262	0.20	BD278A	0.80	BF262	0.51	BZV19-C30	0.99		
2N2906	0.34	2SC2029	1.49	AC142K	0.39	BA157	0.17	BC287	0.45	BD317	1.96	BF263	0.51	BZV19-C47	0.99		
2N3053	0.24	2SC2057	1.47	AC151	0.25	BA159	0.12	BC294	0.45	BD318	2.08	BF264	0.33	BZV19-C88	0.99		
2N3054	0.90	2SC2073	1.80	AC153	0.30	BA182	0.17	BC301	0.36	BD375	0.38	BF271	0.30	BZV19-C77V5	0.99		
2N3055	0.55	2SC2078	1.25	AC153K	0.36	BA222 (IC)	1.26	BC302	0.30	BD377	0.23	BF273	0.18	BZV19-C77V5	0.99		
2N3055H	0.77	2SC2091	0.59	AC176	0.17	BA284/2	0.15	BC303	0.34	BD379	0.69	BF274	0.18	BZV19	1.80	ZK18	2.47
2N3442	1.05	2SC2122A	4.65	AC176K	0.40	BA301 (IC)	0.92	BC307	0.09	BD380	0.69	BF324	0.18	BZV20	1.60	C106D	0.46
2N3702	0.12	2SC2141	1.69	AC178	0.25	BA302	0.30	BC307A	0.14	BD410	0.44	BF336	0.27	BZV21	2.25	C1129	0.52
2N3703	0.12	2SC2186	1.35	AC183	0.65	BA311 (IC)	1.06	BC308	0.12	BD412	5.78	BF337	0.36	BZV22	2.25	CA1310E	2.45
2N3704	0.12	2SC2216	0.62	AC186	0.20	BA312 (IC)	0.95	BC308A	0.09	BD418	0.76	BF338	0.36	BZV23	1.80	CA304A	3.18
2N3705	0.12	2SC2238	2.29	AC186K	0.50	BA313 (IC)	1.28	BC309	0.15	BD433	0.33	BF355	0.36	BZV25	2.25	CA3046	2.23
2N3706	0.12	2SC2271	3.64	AC187	0.35	BA313 (IC)	0.87	BC317A	0.11	BD434	0.39	BF362	0.54	BZV26	2.25	CA3080	1.50
2N3707	0.14	2SC2278	1.03	AC187-01	0.40	BA317	0.07	BC323	0.92	BD436	0.42	BF363	0.45	BZV28	2.25	CA3085	1.17
2N3711	1.45	2SC2336-KIT	7.61	AC187K	0.39	BA318	0.08	BC327	0.15	BD436	0.42	BF371	0.54	BT128P	2.79	CA3089	3.35
2N3771	1.05	2SC2526	1.70	AC188	0.33	BA328 (IC)	0.80	BC328	0.10	BD437	0.41	BF391	0.36	BT129	2.25	CA3089E	1.30
2N3772	1.55	2SC2551	0.95	AC188-01	0.40	BA333 (IC)	1.24	BC330	0.08	BD438	0.44	BF393	0.90	BT151-800R	1.47	CA3090	1.25
2N3773	1.85	2SC2570	0.90	AC188K	0.39	BA401 (IC)	1.58	BC338	0.10	BD441	1.29	BF417	1.20	BT151 500R	1.25	CA3094	2.00
2N3819	0.28	2SC2570A	1.85	AC193K	0.59	BA511 (IC)	0.98	BC380	0.30	BD442	0.56	BF418	1.70	BT16018	1.20	CA3131EN	2.83
2N3823	1.06	2SC2644	4.38	AC194K	0.59	BA521 (IC)	1.81	BC388	0.23	BD507	0.54	BF422	0.26	BT16218	2.20	CA3132EN	2.83
2N3904	0.56	2SC2671	1.99	AD140	0.96	BA532 (IC)	1.88	BC440	0.99	BD508	0.54	BF423	0.26	BT18024	4.02	CAH78023N	6.00
2N3908	0.56	2SC2728	0.95	AD142	0.96	BA536 (IC)	2.72	BC441	0.40	BD509	1.29	BF435	0.49	BT18124	4.44	CBF18848N-07	1.41
2N4101	1.10	2SC372	1.27	AD143	0.96	BA6304A (IC)	2.85	BC454	0.32	BD510	0.45	BF450	0.69	BT18214	5.44	CD4001	0.24
2N4240	3.00	2SC373	1.05	AD145	1.45	BA843 (IC)	3.60	BC455	0.32	BD518	1.36	BF451	0.37	BT18224	2.70	CD4002	0.24
2N4443	1.35	2SC383	1.20	AD149	0.81	BAV10	1.10	BC460	0.38	BD519	1.36	BF457	0.26	BU105	1.06	CD4008	0.96
2N4444	1.12	2SC388	0.45	AD161	0.30	BAV18	0.10	BC461	0.42	BD529	0.38	BF458	0.35	BU106	2.25	CD4011	0.23
2N4914	0.65	2SC41	1.99	AD162	0.30	BAV19	0.10	BC462	0.27	BD530	0.80	BF459	0.35	BU108	1.90	CD4012	0.24
2N5064	0.64	2SC458	0.55	AD262	0.95	BAV20	0.10	BC463	0.58	BD533	0.80	BF460	0.54	BU109S	1.90	CD4013	0.37
2N5293	0.45	2SC495	0.83	AF114	2.24	BAV21	0.17	BC464	0.58	BD534	0.36	BF469	0.27	BU110	2.52	CD4016	0.37
2N5294	0.45	2SC506	3.36	AF115	0.79	BAV12	0.10	BC465	0.58	BD536	0.44	BF470	0.28	BU111Y	3.78	CD4017	0.74
2N5296	0.40	2SC515A	1.28	AF116	0.79	BAV13	0.10	BC477	0.25	BD536	0.55	BF471	0.26	BU124	1.25	CD4020	0.92
2N5297	0																

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

ESM532C	4.18	LM1303P/N	1.50	MPSU05	0.78	SAA5010	4.90	SN74190	1.81	T8029V	4.41	TBA395	1.35	TDA1230	2.93	TDA9503	2.80
ESM832C	4.18	LM1310P/N	1.25	MPSU10	0.78	SAA5012	6.50	SN7420N	0.30	T8032V	0.89	TBA395L	1.80	TDA1235	3.52	TDA9513	2.40
ESM732C	4.18	LM3065N	0.77	MPSU55	0.90	SAA5020	5.25	SN7430	0.20	T8033V	0.73	TBA396	1.80	TDA1270	2.04	TE52	1.25
ETTR8016	2.85	LM317CKC	1.30	MPSU56	0.30	SAA5030	7.50	SN7440N	0.24	T8035V	0.66	TBA400	2.17	TDA1327A	1.65	TE53B	0.36
FNDS500	5.25	LM339N	0.80	MPSU80	1.20	SAA5040A	14.75	SN7473	0.56	T8036	0.84	TBA440P	1.55	TDA1327B	1.05	TE626	1.35
FT3055	1.85	LM3407	1.29	MR510	0.30	SAA5050	8.50	SN7474N	0.92	T8037	1.91	TBA480	1.42	TDA1330	1.60	TEA1002	3.15
GF758	0.82	LM3407S	0.75	MR812	0.80	SAA661B	1.80	SN7490AN	0.73	T8041V	0.86	TBA480Q	1.67	TDA1365	6.35	TEA1009	0.96
GF759	1.82	LM3407T2	0.75	MR814	0.46	SAA700	3.00	SN75110N	0.75	T8044V	1.09	TBA500PQ	1.55	TDA1412	0.95	TEA1020SP	5.34
GF761	0.78	LM3422N	0.56	MSSD7002	0.85	SAB1009B	4.53	SN7601AANQ	2.25	T8045	0.89	TBA510	1.95	TDA1420	1.48	TEA1067	0.46
GH3F	1.65	LM394N01	1.84	MV5240	0.52	SAB1046P	3.66	SN76033N	2.81	T8049	1.10	TBA510S	6.39	TDA1470	2.63	TC106C	0.55
HA11211	2.30	LM567CN	1.30	MV5480	0.30	SAB3011	7.34	SN78013N	3.63	T8052V	0.78	TBA520	1.67	TDA1512	2.20	TC106M	0.55
HA11215	4.00	LM748	1.85	MV5480-02	0.55	SAB3012	5.34	SN78013ND	2.25	T8058	0.46	TBA520Q	1.35	TDA1670	3.05	TC116D	0.80
HA11225	3.90	LM8360	2.78	ME545B	2.95	SAB3013	3.20	SN78013NDG	0.87	T8059	1.05	TBA530	0.86	TDA1770	5.56	TC144	0.65
HA11226	7.56	LM8361	2.78	ME545B	3.00	SAB3021	7.18	SN78023N	1.35	T8001V	1.89	TBA530Q	0.85	TDA1905	1.25	TC145	0.70
HA11229	2.51	MI024	2.55	ME5534N	1.48	SAB3022B	12.34	SN78023ND	2.94	T8003V	0.86	TBA540	0.98	TDA1908	1.25	TC147	0.70
HA11235	3.00	MI025	2.70	ME555	0.34	SAB3023B	11.18	SN78033N	2.33	T8005V	2.16	TBA540Q	1.15	TDA1910	2.38	TP120	0.96
HA1124	4.70	MI124	4.54	ME556	0.75	SAB3024	4.77	SN78105N	2.36	T8010V	0.87	TBA550	1.95	TDA1940	2.54	TP121	0.48
HA11244	4.32	MI130	4.70	ME556DN	3.16	SAB3209	4.75	SN78110N	1.13	T8011V	1.27	TBA550Q	2.25	TDA1950	2.54	TP112	0.86
HA1125	3.90	MI191	5.84	ME559N	1.20	SAB3210	2.93	SN78115AN	1.46	T8013V	5.81	TBA580C	0.86	TDA2002	1.20	TP117	0.86
HA11251	3.30	MI93	18.55	ME645BN	3.00	SAB4209	12.75	SN78131	1.74	T8014V	1.52	TBA580CQ	1.15	TDA2003	1.05	TP120	0.73
HA1137W	2.57	MI102L	4.82	ME646N	3.00	SAF1031	2.30	SN78226DN	1.20	T8016	0.82	TBA570	1.55	TDA2004	2.52	TP121	1.80
HA1138	3.56	MI115P	4.79	ME650N	3.94	SAF1032	5.80	SN78227N	0.87	T8022N	0.39	TBA570A	1.55	TDA2006	1.25	TP126	0.36
HA11414	2.50	MI1231P	2.34	ME645BN	3.00	SAF1033	11.86	SN78228N	2.97	T8034V	1.25	TBA570J	1.35	TDA2010	2.79	TP127	1.90
HA1144	6.30	MI244P	3.75	MP1106	4.80	SASS010	7.62	SN78231	2.75	T8035V	1.26	TBA625A	1.97	TDA2020	2.75	TP2955	0.78
HA1156	1.23	MI34-9341	4.30	QA200	0.10	SASS500	1.88	SN78242	4.31	T8038V	6.15	TBA625B	1.97	TDA2030	1.65	TP298A	0.41
HA11580	7.80	MI394P	6.25	QA47	0.10	SASS500S	2.57	SN78243	4.75	T8051	2.55	TBA625C	1.97	TDA2140	1.44	TP298	0.57
HA1180	3.45	MI42P	0.30	QA90	0.07	SASS500T	2.85	SN78322	2.51	T8053V	1.03	TBA641A12	3.75	TDA2150	5.63	TP298C	0.40
HA1186	3.08	MI434P	6.86	QA91	0.00	SASS500S	1.81	SN78360	1.97	T8054V	0.92	TBA641EX1	2.07	TDA2151	1.75	TP3055	0.87
HA1187	5.13	MI44P	3.02	QA95	0.00	SASS500S	0.80	SN78390	2.60	T8057V	0.83	TBA651	1.80	TDA2160	3.64	TP30A	0.4
HA11711	16.13	MI513L	2.16	OC28	0.96	SASS500	2.42	SN78510N	0.95	T8063V	2.94	TBA673	2.35	TDA2161	1.88	TP30B	0.73
HA11713	6.70	MI51515BL	3.00	OC29	1.95	SASS500	4.81	SN78510N	1.90	T8064	1.35	TBA700C	2.19	TDA2190	3.11	TP31B	0.35
HA11714	7.05	MI51516L	3.00	OC35	0.96	SASS500	4.55	SN78530P	0.96	TA7020P	4.36	TBA720	2.85	TDA2192	1.02	TP31C	0.63
HA11715	7.95	MI51517L	2.90	OC36	1.16	SASS500	2.32	SN78532N	1.56	TA7027	4.36	TBA730	1.75	TDA2520	2.15	TP32B	1.35
HA11718	6.79	MI5152L	1.90	OC44	0.40	SASS500	2.50	SN78533N	1.56	TA7050	1.58	TBA750G	1.46	TDA2521	2.15	TP32C	0.86
HA11724	15.00	MI5152Z	4.00	OC46	0.40	SASS500	1.29	SN78540N	1.80	TA7051	1.58	TBA780	1.55	TDA2522	2.81	TP33C	1.25
HA11725	16.00	MI5191P	4.49	OC75	0.40	SASS500	1.29	SN78544	1.80	TA7080AP	0.80	TBA780	3.00	TDA2523	2.75	TP34	1.87
HA1180	4.08	MI5192	2.80	ON188	1.70	SASS500S	1.29	SN78545	4.55	TA7081AP	0.78	TBA800	0.80	TDA2524	4.50	TP41A	0.39
HA1203	1.56	MI53273P	0.92	ON226	2.90	SASS500S	1.29	SN78546	3.15	TA7089	1.52	TBA810AS	1.46	TDA2525	2.96	TP41B	0.28
HA1306	1.74	MI53274P	1.20	OT112	0.98	SASS500	1.29	SN78548N	3.15	TA7070P	1.52	TBA810S	1.46	TDA2530	2.19	TP41C	0.44
HA1322	1.74	MA06	0.97	OT121	0.70	SASS500	1.29	SN78549	3.15	TA7071	3.35	TBA810T	1.46	TDA2532	2.51	TP42A	0.39
HA1339	1.76	MA8001	0.74	PD144	2.83	SASS500	1.29	SN78551	1.30	TA7072P	1.35	TBA820	0.83	TDA2533	2.09	TP42B	0.71
HA1342	1.80	MB3705	1.82	PT1017	2.43	SASS500	2.30	SN78550	2.30	TA7073P	4.05	TBA820M	1.85	TDA2540	1.95	TP42C	0.44
HA1350	2.97	MB3712	2.85	PT2014	2.76	SASS500	1.30	SN78570	1.10	TA7074P	1.95	TBA890	1.95	TDA2541	1.95	TP47	0.85
HA1365	3.85	MB3713	1.30	PT6042	1.82	SBA550B	1.95	SN78611	2.35	TA7076P	4.95	TBA900	2.25	TDA2545Q	3.16	TP48	1.83
HA1366WR	1.82	MB3730	2.94	R1038	1.99	SBA750	1.46	SN78620	2.35	TA7089P	1.41	TBA920	1.50	TDA2560	1.97	TP49	3.20
HA1367	3.20	MC1300Z	4.86	R1039	1.29	SC9488P	1.90	SN78622	1.50	TA7089N	3.85	TBA940	1.70	TDA2571A	2.81	TP54	1.21
HA1368	1.89	MC1303P	1.96	R2008B	1.99	SC9503	1.50	SN78623	0.62	TA7093P	1.64	TBA950	1.55	TDA2575A	2.58	TP59	0.22
HA1368R	1.86	MC1307P	1.90	R2009	1.29	SC9504P	1.46	SN78630	3.85	TA7102P	5.34	TBA970	2.80	TDA2576A	2.58	TP59	0.22
HA1370	2.97	MC1310P	1.25	R2001B	1.20	SC9511P	1.90	SN78640	2.31	TA7102P	1.40	TBA970Q	2.98	TDA2577	5.31	TP61CP	2.82
HA1377	2.80	MC1327P	1.20	R2029	1.20	SC9517	1.20	SN78650N	1.24	TA7109	3.37	TBA990	1.85	TDA2582	1.98	TMS1000F NL	10.78
HA1389	1.82	MC1330P	1.23	R2030	1.20	SG284A	4.38	SN78651	1.35	TA7120P	0.58	TBA990Q	1.95	TDA2582	2.80	TMS3748 NS	11.86
HA1389R	1.74	MC1349P	1.20	R2257	2.16	SG613	7.88	SN78680N	1.25	TA7122B/P	0.54	TBA231	2.33	TDA2591	2.00	TMS411F	1.87
HA1392	2.80	MC1350P	1.18	R2285	1.95	SG629	6.28	SN78685N	1.35	TA7124P	2.90	TC4001	1.29	TDA2591Q	2.00	TV100	1.20
HA1397	2.97	MC1351P	1.75	R2305	1.87	SG653	9.37	SN78686N	0.98	TA7130P	1.15	TC4053BP	3.94	TDA2591Q	2.00	TY8010 J	2.70
HA1398	2.80	MC1352P	0.81	R2306	1.23	SH-1020N	4.76	SN76705	3.98	TA7136AP	1.15	TC15150	1.82	TDA2593	2.24	U05G	1.83
HA1406	1.80	MC1357P	1.95	R2322	1.26	SH-1125HD	10.70	SN76705N	3.99	TA7137P	0.85	TC160B	1.82	TDA2594	2.80	U135M I	2.80
HA17723	5.40	MC1358P	1.95	R2323	1.23	SH-1130N	6.30	SN76707N	3.95	TA7141AP	3.51	TC270Q	1.55	TDA2600	5.00	U370K J	0.44
HBF4030AF	2.25	MC14001	0.75	R2348	1.82	SKB2/08	0.70	SN76709	4.95	TA7146P	0.84	TC270S	1.95	TDA2611A	1.55	UA72 3CP	5.82
HD4480	15.00	MC14011	2.13	R2354A	1.82	SKE2F 1/04	1.26	SN76709N	4.65	TA7148P	1.51	TC270SQ	1.85	TDA2611AQ	2.25	UA72 3BP J	3.06
HD44801A05	15.90	MC14013	0.37	R2354B	1.82	SKE2G 2/04	0.95	SN76730	4.82	TA7149P	2.10	TC290A	2.90	TDA26120	4.25	UA72 3BP SC	1.07
HM6231	8.50	MC14016CP	0.37	R2441	1.23	SKE2G 3/04	0.95	SN76810N	0.23	TA7153P	4.53	TC420A	1.95	TDA2620	1.96	UA741 17P J	2.14
HM6232	7.71	MC14025	0.54	R2443	0.80	SKE4F 1/02	1.26	SN76920N	2.63	TA7161P	5.96	TC440	1.85	TDA2630	2.34	UA741 17P J	2.14
HM9102	2.92	MC14049UBC	0.52	R2461	2.10	SKE4F 1/06	0.86	SN94041	3.45	FA7162P	4.25	TC4500A	1.95	TDA2630	2.40	UL MZ 204	7.00
HM9104	2.94	MC1438R	0.95	R2477	0.92	SKE4F 2/06	2.10	SN94042	3.95	FA7169	4.80	TC4530	1.80	TDA2640	2.25	UL MZ 204	7.00
HT4207	15.00	MC14433P	2.56	R2501	1.16	SKE4F 2/08	0.80	SP8385	0.50	FA7171P	2.53	TC640	2.83	TDA2643	6.93	UL MZ 216F	1.95
IS689	1.87	MC14510BAL	3.15	R2540	1.80	SKE4G 2/10	0.87	ST4A41C	2.27	FA7172P	1.28	TC640S	1.85	TDA2651	2.95	UPC 1001H	2.50
IS751	1.87	MC14565BCP	3.15	R2540X	3.00	SKE5F 3/02	1.45	STK0029	3.42	FA7176P	2.25	TC660S	2.83	TDA2652	7.05	UPC 1009C	5.74
ITT2003	0.20	MC1712	3.52	R2615	0.80	SL1310	2.85	STK0039	4.00	FA7193P	4.44	TC730	3.84	TDA2653	2.95	UPC 1020H	2.12
K1749P	2.95	MC7724CP	3.17	RC4195NB	1.96	SL1327E	1.29	STK005									

Long-distance Television

Roger Bunney

This year's Sporadic E season was late in starting though there's been much exotic reception to compensate. There's a lot of news, so we'll give the log without further ado.

- 10/5/84 RTP (Portugal) ch. E2; TVE (Spain) E2, 3.
- 11/5/84 TSS (USSR) R1, 2.
- 14/5/84 SR (Sweden) E2; TVE E3; EPT (Greece) E3.
- 15/5/84 RAI (Italy) IA.
- 16/5/84 RTP E3; TVE E2, 3, 4.
- 17/5/84 TSS R1, 2; RTP E3; TVE E3.
- 18/5/84 TSS R1; TVE E3; EPT E3.
- 19/5/84 TSS R1, 2; TVP (Poland) R1, 2; CST (Czechoslovakia) R1; TVE E2, 3; RAI IA; ARD (W. Germany) E2.
- 20/5/84 TVE E2, 3.
- 21/5/84 SR E2, 3, 4; EPT E3.
- 22/5/84 TSS R1, 2, 3, 4; RAI IA, B; SR E2.
- 23/5/84 TSS R1, 2; TVP R1, 2; CST R1, 2; TVR (Rumania) R2; MTV (Hungary) R1, 2; RAI IA, B; RTP E3; +PTT (Switzerland) E2; TVE E2, 3, 4. Two Arabic signals were present from 1734-1800 BST on ch. E3, JTV (Jordan) Amman and the other unidentified. F.M. radio reached a m.u.f. of 100MHz.
- 24/5/84 TSS R1, 2; RAI IA, B; TVE E2, 3, 4; ORF (Austria) E2a; JRT (Yugoslavia) E3, 4; IRIB (Iran) E2 at 0920-0930 BST.
- 25/5/84 TSS R1, 2; CST R1; MTV R1; RAI IA; RTP E2, 3; TVE E2, 4; JRT E3.
- 26/5/84 TSS R1, 2; ORF E2a; +PTT E2; SR E2.
- 27/5/84 SRT E3; YLE (Finland) E3.
- 28/5/84 TVE E2, 3, 4; RTP E3; RAI IA; +PTT E2; ORF E2a; CST R1; ARD E2; TSS R1, 2; TVP R1.
- 29/5/84 NRK (Norway) E2.
- 30/5/84 RUVV (Iceland) E3, 4; NRK E2; RAI IA, B.
- 31/5/84 TVE E2, 4; RTP E2, 3; RAI IA; MTV R1.
- 1/6/84 TVE E3.
- 2/6/84 TVE E2, 3, 4.
- 3/6/84 TSS R1, 2.
- 4/6/84 RTP E2.
- 5/6/84 MTV R1.

Modes of propagation other than SpE remained generally quiet during the period. The solar disturbances towards the end of the month didn't lead to any sustained auroral activity unfortunately, at least not here in the south, and none has been reported from elsewhere.

Perhaps the most startling reception occurred on the

24th, when both Ray Davies (Norwich) and Cyril Willis (Cambridge) received the FUBK test card from Iran, with the identification "IRIB" and a digital clock insert at the bottom right-hand corner, via multiple-hop SpE. The clock was at +3½ hours BST: the signal was weak and slow fading, resembling tropospheric propagation. A quite remarkable and first achievement in the UK - our congratulations to the pair.

EPT Greece was received on three occasions by Hugh Cocks and Cyril Willis. The EBU lists Akarnaika (ERT-1 network) on ch. E3, with 1.58kW e.r.p. and horizontal polarization (20E59, 38N49). The PM5544 test pattern is used, with the EPT identification clearly visible.

May 23rd produced several sittings of Arab transmitters, with two stations floating between 1734-1800.

An increasing number of computer interference reports have been received and further information on suppression methods is being sought. Radio amateurs have been noted at 50MHz twice during normal 405-line broadcast hours - such operation is supposed to be confined to non-broadcast hours until January 1985.

During the afternoon of May 20th Cyril Willis logged a French system L, ch.2 (just l.f. of ch. E4) signal via SpE. This suggests that the Canal Plus service will be operational in Band I from Corsica.

My thanks to Iain Menzies (Aberdeen), Hugh Cocks (E. Sussex), Cyril Willis (Cambridge), Paul Barton (Harrogate) and Brian Renforth (Newcastle) for sending in details of their reception to supplement my own log.

Nova TV

Following our request for information on Nova TV in the Dublin area, Peter Coghlan has written in with details. Test transmissions started on December 3rd on chs. E60 and E66, using system I with full specification PAL colour. The ch. E66 signal was transmitted from the studio in Herebert St., Dublin at 25W e.r.p. and was received and re-radiated at 100W from Three Rock Mountain. The test pattern consisted of colour bars with a central white band and the identification "NTV ch. 60/66". Programmes consisted of news, information and films. The equipment was seized on December 8th. Following this the Radio Nova v.h.f./f.m. radio programme was jammed, though transmissions continue at 102.7MHz (stereo) and 819kHz. Radio Nova can be contacted at PO Box 1433, Dublin 1 (telephone 01-931 710).

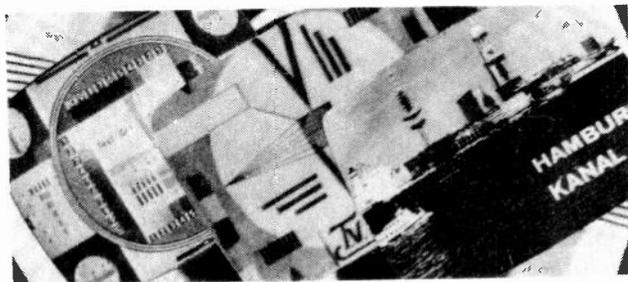
News Items

Faroe Islands: Ryn Muntjewerff reports that the following transmitters are now carrying out tests: Torshavn ch. E6 116-145kW directional, Sudbury ch. E9 5.6kW, plus one



Left and centre, two examples of DX-TV reception in the Falkland Islands - Argentina ch. A2 La Plata and A3 Rosario respectively. Right, the American Forces identification slide, received on ch. E70 by Ryn Muntjewerff.

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WB2 2 element budget array	£27.40	Jaybeam – Astrabeam 5-5el	£21.60
WB3 3 element (very popular)	£31.40	ABM8-8el., 9.5dB gain	£27.35
WB4 4 element high gain	£35.40	ABM12-12el., 11.6dB gain	£33.85
WB5 crossed dipoles (WB1) for omnidirectional use	£34.10	Antiference – HC2015R-17el., multi refl. 12dB gain	£35.10
WB6 as WB5 but with reflectors	£37.85		

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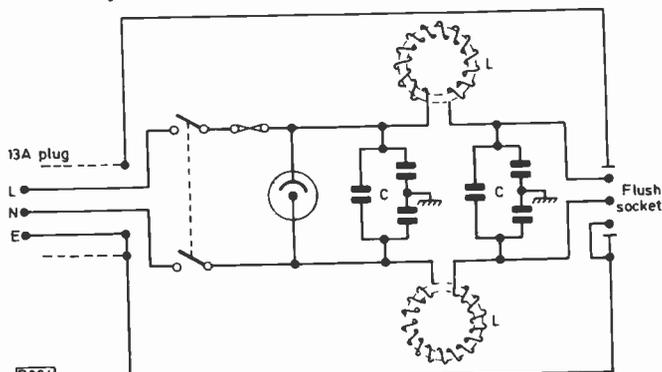


number of 49MHz devices outlawed by the Telecoms Bill could become legal overnight. The possibility of land mobile operation in Band I is recognised and comments from the PMR industry are awaited.

The DTI has proposed that the 173.2-173.35MHz band is made available for wideband low-power alarms in addition to low-power telemetry/telecontrol.

From our Correspondents . . .

Mel Thurlbourn (Leighton Buzzard) has sent us some excellent photographs he took whilst at Port Stanley – DX-TV Falkland Islands style. Whilst in the area he met Mike Peake who's had considerable success there over several years. Apart from stations in Argentina he's



0924

Fig. 1: Simple mains filter. Suitable ferrite toroids (FX1588 etc.) are available from Bredhurst Electronics, High Street, Handcross, W. Sussex RH17 6BW at 40p plus postage. Wind on ten turns of PVC covered wire. C = RS238-299 suppressor capacitor pack. An RS509-995 diecast box was used.

700W ch. E10 relay. This could be an ideal source of Band III signals via aurora. The PM5544 test pattern carries the identification "SJONVARP FOROYA".

Private TV: A "private" TV service operated by a local newspaper is in operation at Vaesteras, Sweden. Another private TV service is expected to start in Lower Saxony, W. Germany, in mid-1985.

In brief: RUV (Iceland) now transmits programmes on Thursdays . . . SR-TV (Sweden) is using the PM5534 pattern with either TV1 or TV2 identification and no regional/transmitter identification.

Satellites: The Australian Homestead/ABC TV downlink service is due to start at the end of next year, using the PAL standard . . . Hungary plans to establish a satellite TV receiving equipment manufacturing capability to exploit reception of neighbouring countries' TV services . . . The discussions over alternative proposals for a Luxembourg satellite TV service continue.

Computer Interference

The problem of interference due to computers seems to be increasing rapidly. I've found that some Sinclair Spectrum computers radiate over 200ft. My own unit produces severe radiation which is very difficult to reduce. Experiments with a double ferrite toroid (two FX1588 units) and densely screened coaxial cable wound ten times around and through the toroids adjacent to the Spectrum's r.f. output reduced the problem only slightly. Toroids can also be used on the mains lead, but the main problem seems to be the plastic case. Removal of the cassette leads has no effect and advice from Sinclair is being sought.

Further problems have been caused by a neighbour who's started a part-time word processing operation using a Commodore VDU, keyboard, disc drives, printer etc. This produces an effect similar to short-wave overloading in a badly designed preamplifier. The interference is not as intense as that from the Spectrum (the equipment is metal cased) and the use of toroids provides a solution. A mains distribution extension box with filtering (see Fig. 1) has been provided to ensure that the r.f. doesn't flow into the immediate house wiring. The coil around the toroids consists of single-core PVC covered lead, though three-strand lead would suffice. I was fortunate in acquiring a short length of screened mains three-core.

The increasing use of cheap home computers is going to make matters worse and we'd welcome comments from readers with experience in dealing with the problem. Incidentally, the British Telecom Radio Interference Service is in the process of being transferred to the Department of Trade and Industry. I've heard that problems at v.h.f. in the Bournemouth/Poole area are being caused by r.f. heating in a biscuit factory that operates 24 hours a day.

The Future of Bands I/III

The DTI have released a study document entitled "Bands I and III" (Cmnd 9241) which is available from HMSO at £4.15. The document outlines various uses, systems and possibilities and it must be said that things look tough for the TV-DXer in the UK.

What could become a serious problem is the suggestion of frequency allocations for "low-power devices" – the plan is to exempt a range of such devices from the need for a transmitting licence or special permission. The paper comments that "many of these devices operate at 49MHz and it would seem appropriate to set aside a small band to be used with a minimum of restriction . . ." – the vast

received Cuiaba ch. A2 (system M) in central Brazil and Santiago (Chile). Another distant reception was Rosario in central Argentina. Transequatorial skip reception of system M signals has been seen but identification is impossible.

Commercial Corner

M. Barson informs us that reinforced polyester masts are available from Met Antennas, 12 Kingsdown Road, St. Margarets at Cliffs, Dover CT15 6AZ (telephone 0304 853021). These enable optimum performance to be obtained from aerials (especially if vertically mounted) that would be affected by the use of a metal mast. A 1.5m or double 1.5m kit is available with 1.5in diameter.

Allan Latham (G8CMQ) can supply ATV converters for 23/24cm (1.3GHz) in either kit, partial or wholly

assembled form, also u.h.f. f.m. receivers (i.e. video f.m.) and a low-power 23/24cm source for test/alignment purposes (though a four-mile range has been attained). For further information send s.a.e. to Solent Scientific, 75 Chalk Hill, Southampton (telephone 0703 464 675).

Transmitter Information

Belgium: Brussels-RAC BRT-2 ch. E25 10kW e.r.p. horizontal. Wavre chs. E25/28 now listed as taken out of service.

Egypt: The transmitting authority is now known as the Egyptian Radio and Television Union (ERTU). The first service is being transmitted on ch. E4 and the second service on ch. E2 from Dumyat at 0.9kW.

Switzerland: The sound e.r.p. for all transmitters is now 5 per cent of the vision e.r.p. (formally 10 per cent).

TV Fault Mechanisms

Tony Thompson

Despite the apparently endless variety of the faults we encounter in TV sets their basic causes are few in number, consisting of weak spots in circuit design, poor physical construction and layout, the use of unsuitable components, and inadequate quality control during all or some stages of manufacture. Added to this there's the problem of adverse operating conditions, also the use of poor repair methods.

Basic Design Problems

Let's consider these in practical terms. There's inevitably an element of compromise in circuit design. Often it's the availability of certain key components that dictates the final form the circuitry takes. The average viewer sees nothing of the latest i.c.s etc. buried deep within his set, but can't fail to be impressed by the latest tuning systems with digital displays and so on. Appearance and price are key factors in selling sets, and styling is arguably the most important aspect of the design brief.

There's nothing new about this. The demands of styling seem on occasion to have called for technology to fit – as with the case of wide-angle deflection tubes to reduce cabinet depth. The situation in the industry in the early sixties was so bad that many companies, in desperate bids to remain in the field, cut production costs and technical quality while placing the emphasis on appearance. Reliability and accessibility both suffered. Many of these sets were troublesome from the time they were installed – tuning the biscuit cores on an awkwardly placed fireball tuner was a matter of hit and miss (and watch out for the mains switch with your hand in the back!). But the sets looked good and sold in millions, creating a boom that was equalled only when colour became popular in the early seventies.

The latest solid-state designs with their low component counts make it easier to reconcile such contradictory factors as those mentioned. It's no longer necessary to try to cram a quart into a pint pot. In fact a glance in most new sets will reveal that the situation is quite different. The crowded days have gone forever, and because of this and advances in the technology used reliability has in-

creased in leaps and bounds.

There remains however a vast quantity of middling sets that though reliable in any sensible interpretation of the term were built at a time when chassis were more massive, more delicate and consumed more power. It is these that are likely to fail, simply because the design problems at the time of their manufacture didn't allow for maximum reliability over an extended lifetime. Some manufacturers regarded the average lifetime as about five years – this for an average colour set of the early seventies! Most such sets are still running, but few reliably. It's usually the critical components that give up, apparently suddenly.

Mechanical Considerations

Take mains droppers. Like all resistors they function by dissipating power in the form of heat. A dropper dissipates a considerable amount of energy and gets very hot as it does so. It follows that they should be sufficiently substantial to do the job asked of them and that they should be mounted where air can circulate freely to carry away the heat. In addition they shouldn't be sited in areas likely to be affected by this heat. If on a board they should be mounted well above the surface. The lifetime of most electronic components is reduced by the presence of high ambient temperatures.

Remember too that the connections to such high-power resistors are likely to become hot due to thermal conduction. Dry-joints are likely unless some provision is made for this. In the past some manufacturers advocated the use of high-temperature solder alloy, but this was inconvenient for field servicing. Most cheap irons had to struggle to melt the stuff, with the result that normal solder and hefty wire wrapping came to be adapted – which is o.k. for loom-connected droppers. The body of the dropper must of course be of a high-grade insulating and heat-resisting material. Fortunately the ideal material exists – ceramic!

Large electrolytic capacitors should be mounted either by means of a stout metal fixing such as a clip to a chassis member or, for economy, directly into the board with extensions from the outer casing soldered firmly into earthed print areas for support. It's undoubtedly wrong to mount such components upright, i.e. with the tags down, as electrolyte can leak and cause damage, possibly quite extensive. Similarly they should not be mounted in hot spots or above the dropper.

For reasons basically the same as those given for electrolytics, careful thought about the placing of transformers is necessary. They should not be mounted on

panels without support, especially in the case of a vertical panel, or their weight will strain the soldered joints and lead to cracked print, arcing at the tags and intermittent operation.

The placing of triplers seems on the face of things a simple matter. Keep them well clear of the chassis metal-work by means of high-grade plastic stand-offs, and make sure that there's a hazard-free path for the lead to the tube's anode cavity.

Most of the foregoing is common sense, but it's amazing how many sets can be found in which one or more of these guidelines have been ignored.

Poor performance due to such mechanical problems is commonplace in most makes of receiver, but some models seem to have more than their fair share. It would appear that manufacturers are sometimes slow to learn from their mistakes. Take valveholders for example. Charred panels and poor or corroded pin contact often occur with output valves, resulting on occasion in the issue of modified panels with stand-off holders. Why were they not fitted in the first place? Possibly because the man who designed the panel didn't know where it would be mounted in the set. All right, it's easy to be wise with hindsight. But these people were not new to the game. Valveholders in monochrome sets had been giving similar trouble for many years.

Again, what looks elegant in the scaled up panel drawings becomes dangerously thin print tracks on the finished board. Much trouble was and still is caused by panel flexing with heat/cold cycles, as a result of which the flimsy print goes intermittent.

Valves have a tendency to develop electrode sag when horizontally mounted, but in practice only the less robust types suffer from this malady. These of course were the frame grid types with their ultra-close electrode spacing. I have a suspicion however that the heaters of power valves are more likely to go open-circuit when the valve is not vertically mounted, possibly due to heater-cathode shorts in situations where the cathode is at a high potential.

Practical Example

It's interesting to take a particular well known chassis from the past and consider the design/reliability aspects. We'll take the Thorn 1500, a popular single-standard monochrome chassis that was produced in vast numbers over several years and was the mainstay of many a rental company on the monochrome front.

First impressions are a little mixed, though there's a good spot for the dropper – horizontally mounted along the top rear edge of the vertical, single-panel chassis. Couldn't be better for heat dissipation. Being horizontal, the heat from a lower section can't affect the higher sections. The dropper is linked to the print by long, slender tags – sufficiently long to limit heat transfer, so few problems at the board joints.

The big panel has plenty of metal support. Being vertical, the few valves are of necessity mounted horizontally. Accessibility is good and the valves are in an updraught. The main electrolytic is also mounted horizontally: it's purpose designed for this, being a short, stubby type with substantial mounting lugs. This minimises leverage on the panel, and in practice few dry-joints develop at the capacitor's leadouts even with sets that have seen a lot of service.

One snag we've often had with this chassis is poor valve-to-holder contact. The holders seem to be inadequate for

the job and are best replaced if trouble persists.

If all is well with the electrolytic, it certainly isn't with the field output transformer. The slender tags take the weight, with the result that dry-joints giving intermittent field collapse are quite common. Additional support should have been provided at this point.

Lastly, quite a reliable four-button manual tuner is made a nuisance by the fact that the spring-loaded bar used to rotate the tuner vanes is crudely soft-soldered into retaining forks and, as there's no damping during channel changing, the physical blow it receives practically guarantees fractured joints and the sudden loss of one or more of the preset channels. We resolder to repair – until the next time.

The foregoing should not be taken as condemnation of the 1500. It was and still is a successful design of its type, easy to work on and predictable in its fault patterns. There's evidence of compromise, but no more so than in any other set – if you look. It seems then that the designers managed to balance the requirements of their brief with medium-term reliability and cost. But even if you get everything right mechanically, there will still be the occasional electronic component failure. Let's take a look at the problems that arise with different types of components.

Resistors

Resistors fail by going open-circuit (permanently or intermittently) or by changing value. Burn-ups occur most often with low to medium values, usually resulting in reduced resistance. The process may be slow initially therefore but the effect will gather pace, and will begin to affect other components, perhaps loading a power transistor or valve. Resistors in such locations often show evidence of distress in the form of discolouration – sometimes to the point where their value is no longer readable. The component may disintegrate on being removed from the panel. The inference is that the rating was adequate in the short term but not in the long.

Wirewound resistors rarely change value – though this is not totally unknown. The main malady affecting this type of resistor is of course dry-joints, especially when they are of the printed circuit type with short, rigid leadouts so that the component has to be mounted close to the soldered joint. The link on the fusible type often becomes brittle.

Resistors that are subject to high voltages lead a hard life, especially if they suffer from spiky transients or have a high potential difference across them. This is why many megohm value resistors go open-circuit with no external sign of distress – though the types used in early focus chain circuits, for example those in Autovox sets, are often found with a neat, circular burn mark right around their bodies. Many sets use special high-voltage resistors in such applications: you can spot them by looking for the spiral track.

Presets give trouble in several ways, not least of which is intermittency due to a gradual loss of springyness in the slider construction. Most seem to be not robustly enough made. Convergence potentiometers on the other hand are generally well made, failure being more often due to poor circuit design. Carbon track rotary or slider type controls often give trouble in solid-state circuitry. The reasons for this seem to be twofold. First the values used are often smaller than the values used in the equivalent valve circuitry, so that the component is more likely to add its own noise as the slider is shifted along the track. Secondly,

in order to obtain adequate coupling under low-impedance conditions the designer usually employs electrolytics which by their nature tend to have slight leakage currents, causing a current flow through the potentiometer. This produces an audible rustling as the slider is adjusted, so if you've just changed a noisy potentiometer and not cured the problem, check the coupling components.

Capacitors

Capacitors of the electrolytic type seem to have a limited life, often drying up and going down to a fraction of their original value or going short- or open-circuit. Paper or mixed-dielectric types, usually used in medium to high voltage positions such as for mains and boost line filtering, often short out in a very definite way. If you can't see it from the outside, dismantling the faulty capacitor will show a hole punched through the tubular layers of foil and dielectric. The reason for the failure is often that the component rating is too tight, i.e. boost capacitors rated at 600V when at least 1kV should have been chosen. Capacitors used for line output stage harmonic tuning should be above reproach. When they fail the result can be a dramatic rise in the e.h.t. voltage. If they've gone open-circuit that is: shorted ones cause fires . . .

Working Environment

Atmospheric conditions affect sets considerably. Dampness in particular causes tracking around the tube's e.h.t. cavity connection and "spray" from sharp points on line output transformers, c.r.t. bases and other high potential areas. In some sets this can lead to violent discharges that deal death blows to vulnerable components that are, due to lack of foresight by the designer, within range. This is not to mention the hapless service engineer's feelings when confronted with such a set. I well remember some of Les's comments on a Rank Z718 chassis where there was a truly spectacular e.h.t. flashover, apparently causing a vast area of air between the cavity connector and the power supply panel to ionise. You're not alone Les: I've also been practically blinded by the same problem, and the cost of the repairs to the power supply and decoder panels didn't exactly please the customer.

High-frequency coronal discharge can damage components such as tuning capacitors that may be mounted on the transformer's tags, but it's my belief that far worse damage is done by the e.h.t. potential developed after rectification. It can puncture the tripler itself, flash through wrongly dressed leads and cause a blaze, or track from the cavity connection across the glass to the Aquadag coating so severely that not only is the e.h.t. cap damaged but the tube glass can become badly scarred, rendering the tube unusable. The remedy is to clean and dry the area thoroughly, fit new anti-discharge capacitors that have a high air-spaced construction, and treat the area with silicone grease. Coronal areas on the transformer can be treated with grease too, or use a sealant. Don't forget to position the e.h.t. lead with care, using any plastic locating clips to keep it firmly out of harm's way. The same comment applies to other wiring looms, especially any that might swing near the tripler or line output transformer, or the dropper units.

I've said it before, but it gives me the creeps to see top-heavy vases of flowers adorning set tops. Educate the customer if you can.

Then there's the tendency of some folk to put the set

into a space that just fits it, such as a niche alongside a custom-built fireplace. This, and where curtains muffle the back of the set, restricts the natural flow of air, producing a heat build up. The life of any component or even the entire set can be shortened by this – design tolerances can be only so wide.

Sets used in smokey atmospheres, such as in pubs and clubs, get gummed up, but the only real problem that this causes is where sets have touch tuning or remote control – the tarry build up may interfere with the action.

Semiconductor Devices

Diodes used for power rectification may be found mounted hard against a panel – in fact some types of diode packaging allow for this. I contend that it's wrong: the component is sure to warm up in operation and should be allowed to breathe.

Hot spots can cause failure. Transistors are often sat on a panel, soldered firmly in place with a substantial heatsink attached. This is typical with a group of RGB output transistors. The design has allowed for heating with the heatsink, but it seems that nobody has considered that the leadout/casing joints could become strained and intermittent. Such transistors should be mounted a little way above the panel to allow the wires a little flexibility and prevent any heating of the soldered panel joints leading to dry-jointed connections.

Fairly substantial components such as thyristors will often be found fixed in such a way that their only support is the soldering on their leads. Add heatsinks and you've got potential trouble. In the main however designers seem to have given thought to such components and other than natural failures little trouble of an avoidable type is experienced.

Hints and Tips

When it comes to replacing components such as resistors, transistors and diodes in vulnerable positions, leave a little space between the component and the panel. Where there's a considerable voltage difference across a resistor supplying a valve screen grid or in a boost line it doesn't hurt to increase the rating a little – say from $\frac{1}{2}$ W to 1W – though the manufacturer's specifications should be observed when it comes to safety rated components.

Make sure you refit heatsinks – manufacturers don't fit anything that's not needed! It's worth checking the tightness of fuseholders in older sets, or where adverse conditions have turned all the normally bright bits such as preset sliders a dull brownish yellow. On/off switches are often responsible for intermittency or the dead set condition: if they don't feel right they're best changed. Badly fitting mains plugs and loose wiring in them can cause faults that damage power supply components – it's always worth a quick look. E.H.T. settings are often incorrect and should be checked to ensure reliability – even a slight increase in the h.t. voltage can affect the life of a set and its tube.

Finally, many faults don't just happen – they spend years developing. But with the improved design of present day sets it's likely that an ever larger percentage of our future service calls will be to deal with problems of a mechanical rather than an electrical nature, such as broken knobs and switches, damaged panel mountings, intermittent aerial sockets and the like. I wonder what the field engineer's toolbox will contain in ten years' time?!

Letters

SHARP VC7300

A problem with the Sharp Model VC7300 was mentioned in the March VCR Clinic. I've had experience of this fault and would suggest that lubrication of the main solenoid plunger will not provide a permanent cure. The cause of the trouble is side tension on the plunger due to the length of the cotter pin, making the plunger jam in the solenoid cylinder. The fault is intermittent and can be dealt with as shown in Fig. 1. Remove the spring and refit it directly in line with the solenoid plunger – a hook can be made by cutting off a lead from an old 10W resistor, doubling it over to form a loop and pushing the ends into the split cotter pin. Hook the other end of the spring into the fast forward/rewind solenoid.

Bob Jones,
Perth, Western Australia.

BATTERY ELIMINATOR FOR THE AVO 8

Though RS Components now have available a 15V battery for the AVO Model 8 an alternative solution is this simple battery eliminator which can easily be fitted. The circuit is shown in Fig. 2. It can be built on Vero board and mounted between the shunt boards. The 15V outputs and the inverter positive are wired to the battery contact studs while the inverter negative connection is made to switch contact N on the d.c. ranges switch cam. The lead from switch contact N goes to a pin marked D on the shunt board.

Les Harris,
Church, Accrington, Lancs.

TUNING TROUBLES

When a Philips G8 tuner push-button unit becomes "rather fiddly to tune" (Tony Thompson, June) a common cause is rotary backlash between the potentiometer spindle and its small plastic bevel wheel, whose boss splays and cracks. In advanced cases tuning becomes impossible, but even then there's an effective and simple remedy. A 6BA nut, drilled and tapped 4BA, is of suitable size to serve as a collar that can be forced over the splayed boss, making it grip the spindle flats firmly ever after. Getting at these little black bevels may seem to be a daunting puzzle, but they give in to a logical attack. Note precisely how the metal bracket comes away, to save time and temper later, and watch the Y-shaped switch blades which are easily lost.

Elderly GEC 2040 mechanical tuners are prone to two common faults that are also curable by simple means. If a depressed push-button can be shaken sideways far enough to disturb the tuning, this is due to wear of the spindle hole in the rear plate which is detachable (two screws) without removing the tuner. A few well aimed centre punch indentations will deform one side of the hole inwards, and careful trimming with a round file can restore the hole to a close, freely sliding fit – best kept that way by greasing the spindle.

If the frictional grip of the tuning nut on its screw becomes slack the result is annoying, inadvertent detuning when switching channels. The friction can be increased by fitting a spring collar to compress the nut. To take out the

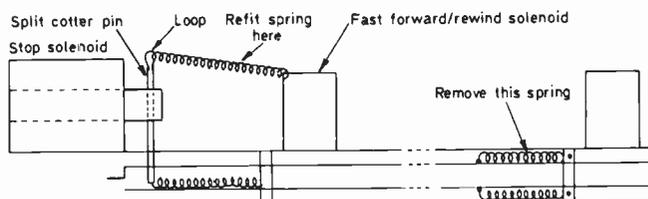
spindle, detach the rear plate, the front plate (four screws), the small circlip, washer, spring and spacer – but leave the nut on the screw. This resilient plastic "nut" is basically of C-shaped section, with a projecting boss of approximately 5/16in. diameter, over which a spring collar can be fitted. The latter can be made from a single-coil spring washer (nominal ¼in. bolt size) by grinding away about a quarter of its circumference so that its gap passes over the screw. The boss, being rounded and tapered, may tend to throw off the collar, but a few strokes with a file to make a reverse taper undercut will make the boss retain it. The spring collar can be bent by trial and error until the degree of frictional grip is satisfactory. During reassembly, fifth and sixth buttons can easily be added if desired, taking spindles from a scrapped tuner. The extra holes are easy to cut in the cabinet trim.

L. A. C. Dopping-Heperstal,
Amphill, Beds.

BASEBAND LINKS

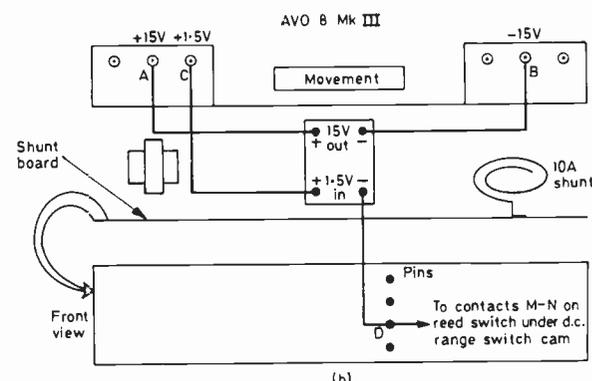
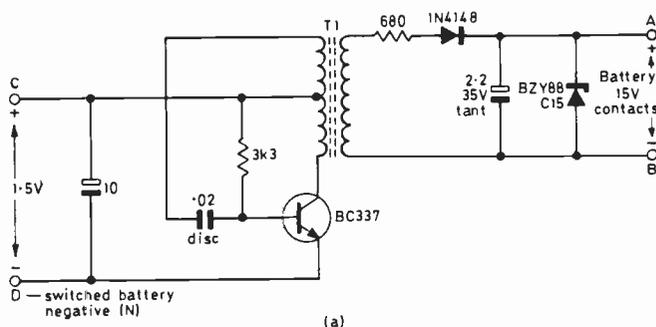
There was mention last month of signal degradation due to PAL encoding/decoding and the use of a u.h.f. link between a TV set and equipment such as computers, games and VCRs.

When the signal is locally generated in RGB form I agree that baseband links have much to recommend them – for data and graphics involving colour the use of PAL



D926

Fig. 1: Suggested modification to the Sharp VC7300.



D927

Fig. 2: Battery eliminator for the AVO Model 8. T1 is an audio driver transformer from a Japanese transistor radio.

coding and decoding is little short of disastrous. In the case of VCRs and video disc players however the signal is already PAL coded, in most cases with bandwidth limiting, i.e. 2.5MHz luminance and less than 500kHz chrominance. In this case baseband linkage is of very little advantage, especially in view of the spaghetti web of wires involved, and the tremendous problems encountered (with some TV/VCR combinations) by setmakers and the retail trade due to "bleed" of the audio signal from the TV receiver into the VCR's sound recording system.

Regarding modulator performance, I've yet to encounter any drift in VCR u.h.f. modulators, even with sets (like Finlux) that have synthesis tuning without a.f.c. In my experience a correctly adjusted modulator will on any make of VCR give pictures and sound that are indistinguishable from off-air transmissions, even in an A-B comparison test. Save your leads and AV/RGB sockets for computers and MAC-C satellite tuners.

E. Trundle,

St. Leonards on Sea, Sussex.

Servicing the Grundig 2x4 Super

Part 2

Mike Phelan

This time we'll take a look at the signal sections of the machine – where better to start than at the aerial?

HF Sections

The aerial amplifier/splitter and r.f. modulator are combined in one unit and any suggestion of a snowy picture in the E-E mode and/or with loop-through throws suspicion on this (we'll refer to it simply as the modulator). If E-E operation only is noisy, connect the aerial directly to the tuner through a suitable adaptor as the tuner could be faulty.

Before condemning the modulator, check that the -22V supply is present at pin 6 of the edge connector. This comes from pin 22 of the power supply and is usually o.k. there, but the print that runs all round the edge of the mother board tends to crack where the latter is attached to the cabinet. Unless you relish the job of removing all the modules, the tape deck and finally the board itself, take six inches of wire, nudge, wink, say no more! There's also a 33V supply to the KE (set channel) control. If this is absent the monitor will have to be tuned down to ch. 21 or thereabouts – see the power supply notes last month. 15V supplies should be present at pins 4 and 5.

The tuner is the same unit that's used in most Grundig colour sets produced during the 70s. It's very reliable and to date the only problem we've had has been leakage in the feedthrough capacitor that carries the tuning voltage – this results in drifting.

We haven't had any problems with the i.f. strip, which is as well since the unit cannot be worked on while it's in the machine.

Luminance Module

A block diagram of the luminance module is shown in Fig. 3. Briefly, during playback the switch in IC731 is normally in the position that allows the direct f.m. signal through for processing. In the slow, still and search modes pulses from the DTF board operate the switch on alternate fields so that the signal via IC705 and the 64µsec delay line (equal to the head offset) passes through. This obviates the need to add a dummy vertical pulse. IC731 also contains the dropout detector and switch – the dropout channel has its own f.m. limiter and demodulator, with a 128µsec delay line in the signal path. When a dropout occurs, IC783 is switched off and IC741 on so that the delayed signal passes to the following stages. For

dropouts of more than one line duration the same line is continually recycled and fed out, giving a series of vertical random bars that disappear gradually as losses occur.

Both the dropout threshold (DS) and insertion level (YAD) are adjustable. There's a test tape available for these adjustments, but we made our own. Purists please ignore the following! We put a small piece of adhesive tape half way round the machine's lower drum and made a recording of monochrome grey-scale bars containing a horizontal noise band. DS can then be adjusted so that the noise is just replaced by inserted video and YAD so that the level corresponds with the mid-grey of the grey-scale wedge.

The crispener circuit works in the same way as that used in certain Philips machines – by differentiating the signal twice, inverting it and adding it to the delayed original signal. There's a control at the front of the machine to enable the crispener level to be adjusted.

The record circuit is straightforward.

To date, the only troubles have been total lack of E-E signal due to failure of IC860, no playback due to failure of IC731, and one or two instances of strange cogging and clipping caused by failure of various small capacitors associated with filters. Sync pulling coupled with low contrast on playback and E-E is normally due to someone having had a go at the video modulation depth potentiometer in the r.f. modulator (this is accessible through a hole in the cabinet).

Chroma Module

A block diagram of the chroma module is shown in Fig. 4. Fortunately there have been no chroma faults in the few hundred of these machines that have passed through our hands!

An interesting feature is the separation of the chroma and luminance signals and their recombination to give the E-E signal on record. The usual 625kHz oscillator locked by the line sync pulses provides the a.f.c. loop. In the playback mode the output from this is mixed with the output from the 4.43MHz crystal oscillator T503. The 4.43MHz oscillator is inoperative in the record mode. Instead the output from the 8.86MHz oscillator, which is locked to the burst, is used after division by two. This is in effect the opposite of the VHS method, i.e. there's no playback a.p.c. loop.

There are a few more peculiar features. For example the burst amplitude is boosted by 6dB when recording and

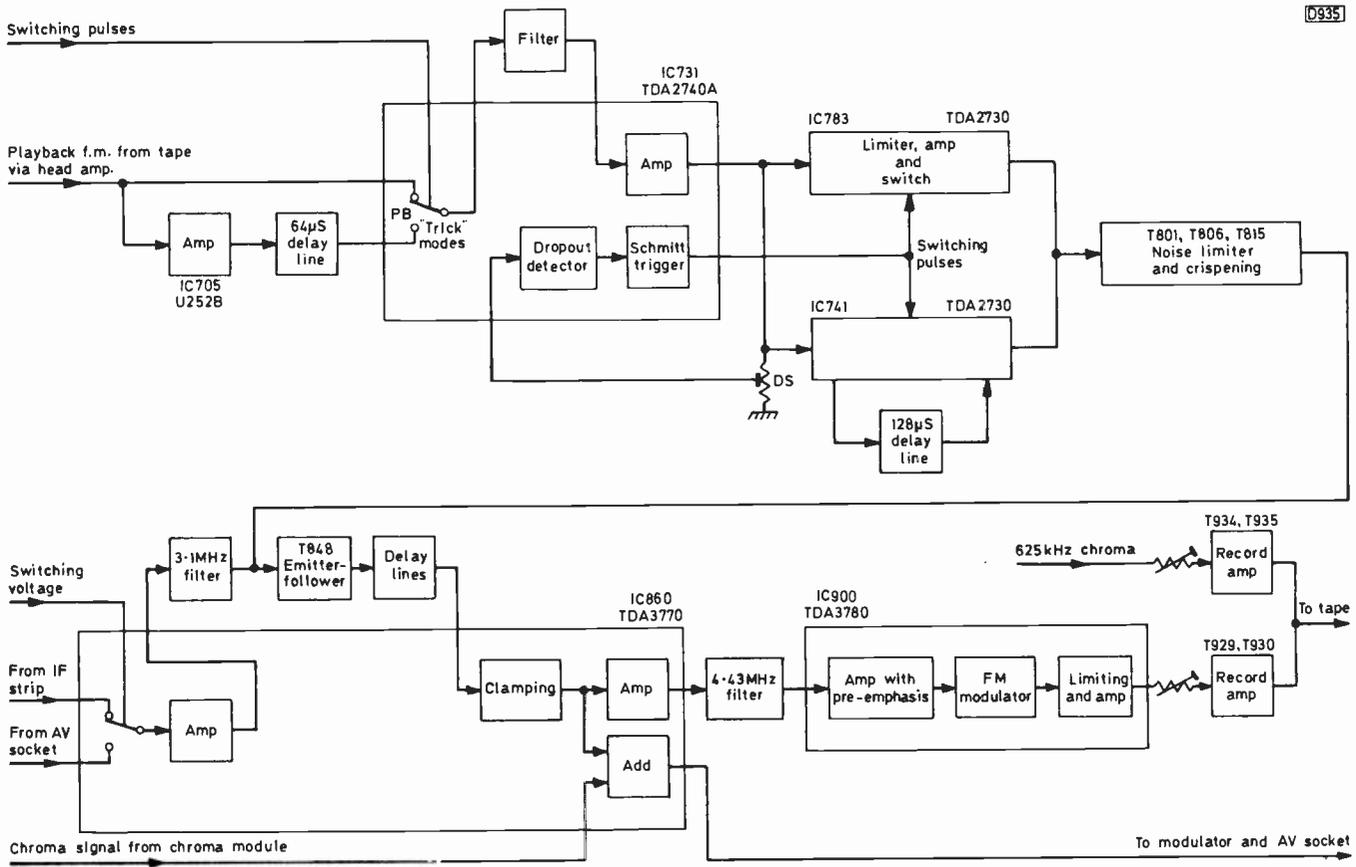


Fig. 3: Block diagram of the luminance module.

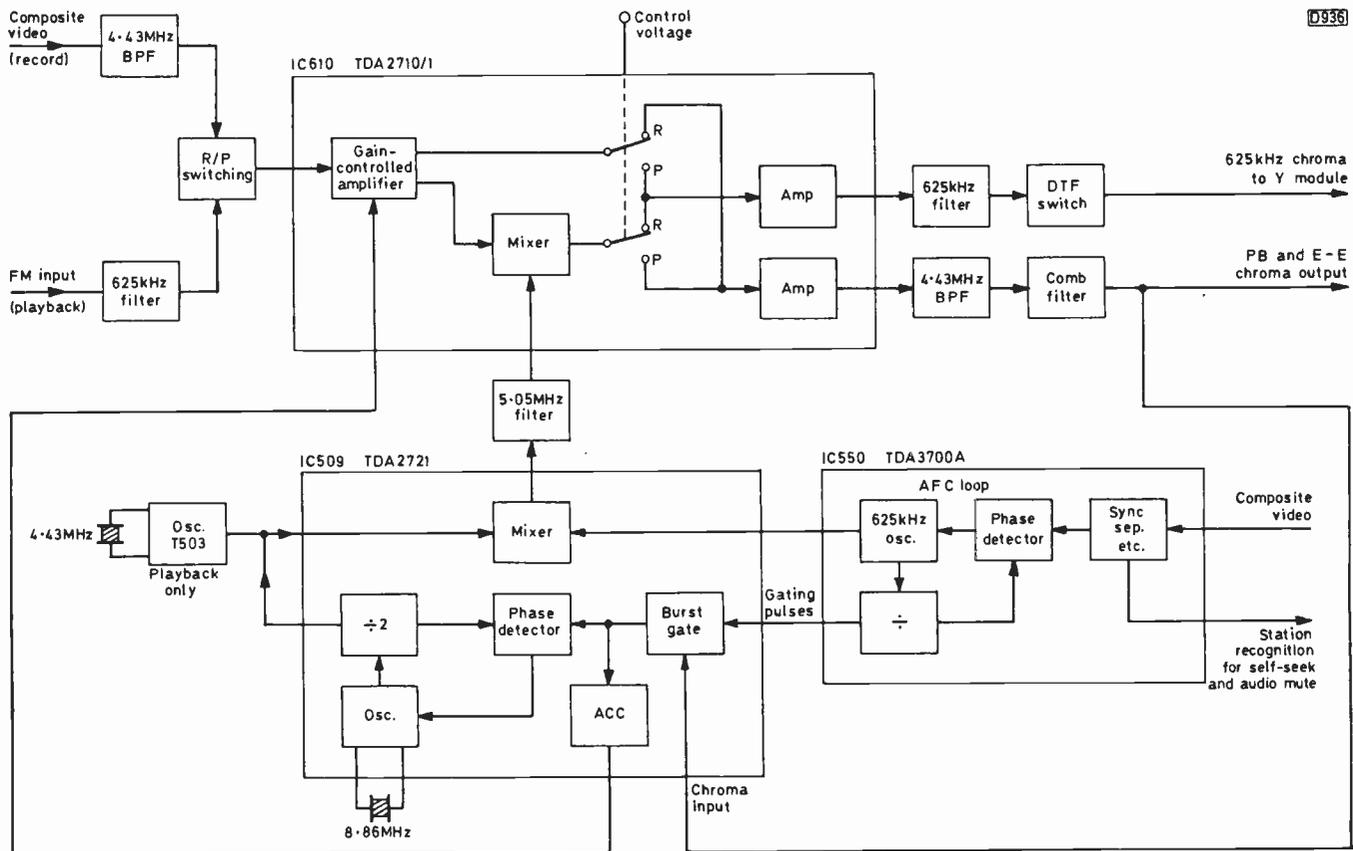


Fig. 4: Block diagram of the chrominance module.

reduced by the same amount on playback, and the chroma channel is muted for 90µsec after the field sync so that the DTF burst (more on this next month) does not interfere with the chroma signal on playback. The chroma is

remarkably noise-free on this machine, and there's none of the edge patterning effect found on others.

In Part 3 we'll be covering the servos and the DTF (dynamic track following) system.

A Vintage Hi-Fi TV Sound Unit

Chas E. Miller

A common complaint from TV viewers over the years has been that the sound quality produced by a receiver doesn't match the picture quality. Anyone who watches a jazz concert for example will be familiar with the sight of a bass player plucking away like mad to no audible effect whatsoever from the TV set's "super hi-fi full-range 2 $\frac{1}{2}$ in. speaker"! The general design of the audio output stages used in hybrid colour sets followed much the same lines as those found in the "midget" radios of thirty odd years ago. The tiny output transformers and under-sized speakers live on, producing noises that are no more acceptable than they were long ago.

One obvious solution would be to extract the TV sound and feed it to a decent audio system. Various ways of doing this have been described in past articles. There are problems with this, not the least of them being the live TV chassis. For a long time I toyed with the idea of producing a small add-on unit that could be plugged into the audio output valve socket in a hybrid receiver to give reasonable quality sound with a minimum of trouble. The targets I set for the design proved rather difficult to achieve however.

Requirements

First and foremost there had to be a push-pull output stage, with all the attendant advantages such as cancellation of hum voltages and magnetizing currents in the output transformer, permitting the use of a modestly sized unit without incurring other penalties. It had to be a true plug-in replacement for the standard output valve (usually a PCL86), drawing the same heater and h.t. currents. This implied no more than 13.3V at 0.3A for the heaters, and around 230V at 45mA for the h.t. supply. A minimum of two triodes and two pentodes would be required (a.f. amplifier, phase inverter and push-pull output), but even the use of double valves seemed to be ruled out since most

triode-pentodes require some 12.5-16V each for the heaters for a start. The idea remained no more than that for a long time, until I found the complete answer during one of my trips down memory lane for a vintage TV article.

I was browsing through some ancient service manuals – they must have been literally thrown out by someone, since my son rescued them from a rubbish tip – when I came across one for the Ferguson Models 983T and 988T. These were Band I only receivers released in early 1951. The 988T was a 12in. table model while the 983T was housed in a console cabinet. This made it possible to employ an 8in. speaker in the 983T. It was complemented by the addition of a push-pull output stage – they did things like that in those days! It was evident that this had involved the same design problems that had been exercising my mind, and it was highly satisfying to discover how they'd been overcome.

The valves chosen were ECL80s, small triode-pentodes that were originally designed for use as the field blocking oscillator and output stage but which came to see service in all sorts of applications – in audio, sync and multivibrator circuits, even as the frequency changer in some sets. Their advantage was the modest heater requirements – 6.3V at 0.3A – though for some applications there was the disadvantage of a common cathode for both sections of the valve. The total h.t. consumption for a pair of them would amount to very nearly the 45mA mentioned earlier, with a 200V h.t. rail.

Circuit Description

The circuit used in the 983T, modified very slightly for this add-on unit, is shown in Fig. 1. V1A is a voltage amplifier and, to overcome the common cathode restriction, V2A is an inverter with unity gain (controlled by

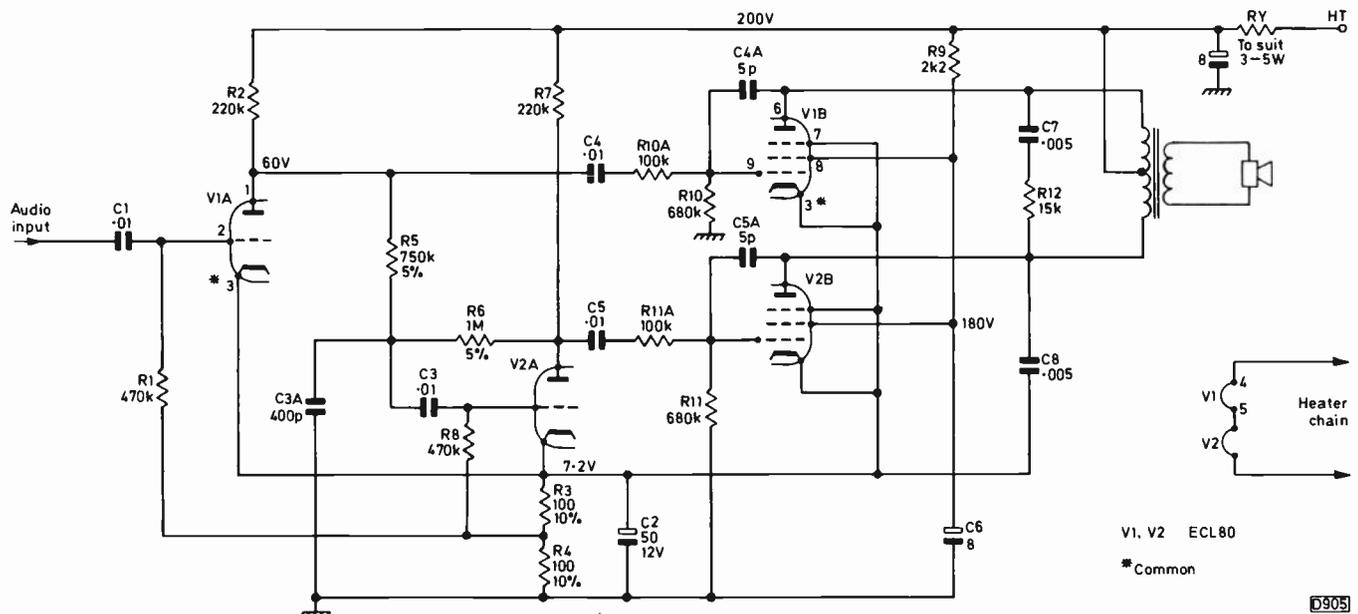


Fig. 1: Circuit of the vintage hi-fi sound adaptor module.

feedback via R6). The antiphase outputs obtained at the anodes of the two triodes drive the push-pull output pentodes. It's a delightfully simple circuit that can be built up quickly and easily.

Construction

Literally everything required was already to hand – in some cases from the junk box! The valves in particular were no problem, since the ECL80 was an extremely popular valve and a dedicated hoarder such as you-know-who is bound to have quantities of them stashed away. The chassis consists of a standard two-gang metal box, switch sockets for the use of, which was conveniently stamped on its base to give knock-outs for conduit entry. Two of these knock-outs were just the right size for B9A valveholders. A standard twelve-position tagstrip was rivetted down the centre of the box to carry much of the wiring, the box itself being inverted so that all components except the valves and the output transformer are contained within it.

The transformer is a standard RS multi-ratio type – I'd several in stock from way back. As I couldn't find any reference anywhere to the correct matching for a pair of ECL80s in push-pull, I adopted the reasonably reliable formula of multiplying the anode resistance of a single valve by 1.4. In many cases this gives an acceptable approximation, as was confirmed by the results achieved with this unit. The ECL80's pentode section has an anode resistance of 11k Ω , indicating the need for a 15.4k Ω anode-to-anode load for a pair. This was satisfied by using primary tapings 1 and 4, with 2 as the centre tap. As I was using a 3 Ω speaker, the secondary tapings were C and D.

Modifications

Simple though the circuitry is, it will be apparent at even a quick glance that if anything should go wrong the circuit has the makings of a very efficient cathode-coupled multivibrator. With hindsight, it seems likely that stray capacitances formed by the wiring in the original Ferguson sets had some beneficial stabilising effects. During the initial testing of my version I found that there was supersonic oscillation, the only direct confirmation of this being a heavy negative voltage at the grid of V2A. It was suppressed by adding a 400pF capacitor (value selected at random) between the junction of R5/6 and chassis. The oscillation was caused by positive feedback, which degraded the frequency response. Fitting C3A greatly improved matters. It transpired that Ferguson subsequently modified their circuit, adding 100k Ω grid stoppers and 5pF feedback capacitors in the output stages (R10A/R11A/C4A/C5A). I didn't find this necessary, but these components could be added if instability is experienced.

Interconnections

All connections to the TV set were made via a B9A plug, itself very old new stock – if you see what I mean! Ordinary thin flexible leads were used for the h.t. and heater supplies and for earthing, with a fine screened cable for the audio input. The exact connection will depend on the set being adapted. In most cases the input from the slider of the volume control is taken to the grid of the triode section of the PCL86 (pin 1). Thus the amplifier's input will be tapped from this pin. In GEC hybrid colour sets however the volume control is connected between the triode and pentode sections of the PCL86, so in this case

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ECC83	£9.76	EH90	£9.90	PCC85+	£9.54	PR200.Maz	£1.30	UCL83	£1.85
ECC84	£9.80	EL34.Mul	£3.20	PCC89	£9.70	PL36	£1.45	UF89	£2.00
ECC85	£9.95	EL84+	£9.70	PCC805	£1.30	PL81	£9.70	UL41	£4.80
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Irwin Drive, Horsham, W. Sussex RH12 1NL.

pins 1 and 9 of the adaptor must be connected together and the a.f. taken from pin 8. The earth connection (an ordinary cable plus the screening) is taken to pin 2, which in GEC sets is connected directly to chassis. In other sets it will be necessary to add a shorting link beneath the valveholder. The h.t. is tapped from pin 6 (pentode anode). If it's necessary to reduce the h.t. voltage (in general 200V should not be exceeded) this can be done very conveniently by removing the h.t. and anode leads from the original audio output transformer and linking them via a suitable resistor with decoupling – if the rail is already at about 200V, simply bridge across the transformer. For sets using a PCL82 audio valve the connections are the same for the audio input and h.t. (pins 1 and 6 respectively), with either pin 2 or 8 used for earthing via a link inserted in the set. The heater connections are 4 and 5 in both cases.

Results

The results were most satisfying and made the whole project worthwhile. The most noticeable improvement is with music that's been heard many times before, for example that with the test pattern or commercials. The sound has that elusive and hard to describe quality that makes for listening pleasure: the frequency response seems to be even throughout the range, with the lower notes clear and the treble free of tinniness. The sound will be enhanced even more if a good external speaker is used. At present I'm using (not unnaturally) a vintage 8in. unit taken from a Bush TUG68. Do try this little amplifier: it's very easy to build and will repay the time spent.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1.00 postal order (made out to IPC Magazines Ltd.), the query coupon on page 561 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

TOSHIBA V5250B/SONY SL8000UB

The problem shows up with prerecorded tapes. Red lines streak across blue areas of the picture, making it unstable from a colour point of view. Turning down the colour produces a normal monochrome picture while adjusting the tracking control produces head switching noise at one extreme and a slight improvement of the colour at the other. The machine plays back its own recordings perfectly.

We've encountered this sort of problem on several occasions. In each case it's been solved by cleaning the tracks of all the presets associated with the chroma circuitry, then realigning the chroma section following the procedure given in the manual – this either cures the trouble directly or pinpoints the fault area. An accurate oscilloscope and frequency counter are required for alignment.

PHILIPS G8 CHASSIS

When the Channel 4 test pattern is viewed the top two inches or so of the verticals can be seen to oscillate slightly. There's also slight tearing towards the bottom of the picture, over just a few lines.

The usual cause of this trouble is failure of the electrolytic C4518 (47 μ F) that decouples the supply to the line oscillator.

RANK A823A CHASSIS

The trouble started as intermittent loss of colour, then after a few days there was complete loss of colour. Changing channels would produce the colour momentarily, and adjustment of the ident control 3RV4 has now restored the colour except during the first ten minutes after switch on, when it's intermittent and smeary in the top half of the picture. Tuning for colour seems to be very critical.

Check that the line hold control setting is correct. Trouble here will upset the burst gating and thus the colour. Items worth checking in this area are the 15V zener diode 5D3 and the smoothing electrolytic 5C31 (400 μ F). The cause of the trouble could be on the i.f. panel: try careful adjustment of the i.f. gain control 2RV2 and the preset colour control 2RV6.

ITT CVC25 CHASSIS

One of the scan-correction capacitors (C69) had to be replaced due to a width fault, but within two days the set was back with a burnt out EW correction transformer (L22/3). C69 and the transformer were replaced but continue to run hot.

Assuming that the EW controls have some effect on the

picture and that the EW correction driver transistor T13 is not leaky, we suggest that you disconnect L26 in the shift circuit. If this appears to cure the problem, replace the shift transformer L26/7. If not, it's likely that one of the EW modulator diodes D24/5 is in trouble or that the EW loading coil L24 has short-circuit turns.

PYE 697 CHASSIS

All of a sudden the picture went very bright, then very dull with loss of colour, though the raster is still full sized and the geometry correct. The decoder and CDA panels have been replaced with known good ones and the tube is o.k., but the fault is still present.

Loss of the line pulses used for gating is the most likely cause of the trouble. This could be quickly checked with a scope. The edge connectors on the timebase panel are a frequent cause of this sort of trouble.

ITT CVC8 CHASSIS

It seems that the e.h.t. system is tiring. Any pictures with a significant amount of light area now defocus quite badly and there are two related effects – a billowing inwards of the right-hand side of the raster on some very white shots, and a fair amount of change in picture size dependent on brightness. I assume that the line output stage valves require replacement. Any other suggestions?

Fitting a new PY500A and PL509 could well do the trick. If the fault is still present after this, check the harmonic tuning capacitor C308 and the damping network components C306 and R422. If this doesn't help and the h.t. voltage is constant, the tripler is suspect.

RANK A823 CHASSIS

I have three of these sets, all suffering from the same complaint to a greater or lesser degree – reduced width on scenes with a dark content, varying from half to one and a half inches on each side of the raster. The reduced width is present only in the areas of dark picture content. The h.t. and e.h.t. voltages are correct on all these sets and new line output transformers and triplers have been tried without success.

The symptom could be due to problems with 6R8/6C6, which are in series with the tripler, or the clipper diode 6D1. Check these items first. The e.h.t. regulation will be poor unless the line output transistors are balanced. Adjust the balance coil for minimum width after reducing the h.t. voltage in the way described in the manual.

HITACHI NP8C CHASSIS

Initially the problem was intermittent colour which returned when the crystal was touched. Replacing the crystal restored the colour for only a week, so the decoder i.c. was replaced. Two weeks later the colour disappeared again.

It seems likely that there's a dry-joint on the decoder board – check for this and make sure that there's 12.5V at pin 22 of the chip and that line-frequency pulses are present at pin 13. If so, link TP502 and TP503 and earth TP504 via a 22k Ω resistor. Adjust R514 (colour sync) for zero beat, then remove the test link and resistor.

ITT VC400 CHASSIS

There's a raster but no picture – the fault occurred suddenly. The sound is tunable throughout each channel but is very distorted at all volume levels. Voltages have been checked and the only discrepancies are no d.c.

voltage at pin 7 (input) of the TDA1330 demodulator i.c. and low voltages around the TDA1352A i.f. amplifier i.c. The TDA1330 i.c. has been replaced.

Ensure that the 11V and 24V rails are correct, then check the components in the a.g.c. gating pulse feed to pin 5 of the TDA1352A – resistor R92 (18k Ω), and the two clipper diodes D3 (ITT44) and D2 (8.2V zener) for leakage. If these are in order and you're sure that the replacement TDA1330 is o.k., the TDA1352A is suspect. This assumes that there's little or no noise on the raster – if there is, suspect the aerial, the tuner or the BC252B i.f. preamplifier transistor T4.

TEST CASE

260

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

“Whaur’s yer local, laddie?” Framed in the doorway stood a huge Scotsman, looking and sounding like Rob Roy himself – apart from the colourful Bermuda shorts.

“The Queen’s Head. Down the road – they’re closed till half past twelve though.”

“Och, no’ the pub . . . the local transmitter. Ye ken?”

“Heathfield, up the road. There’s a relay at Walmington-on-Sea. Where are you?”

“Parked in yer yarrd. Are these transmitters no’ verra good? Thaur’s terrible interference and we’ve tae pit the lights oot befaur we can watch at all. Even the water tap interferes wi’t”.

The subject of this strange conversation turned out to be a JVC CX500GB, a remarkable set with colour TV, radio and a cassette recorder. As we soon discovered, it lived in a twenty-two foot caravan towed by a Jaguar, the like of which was far beyond the ken of the real Rob Roy. In fact his name was Man-Andra – or so his wife (Meg-wumman?) called him. When we tried the little set in the caravan up came a noisy raster only, which was not surprising since the only signal source was its built-in telescopic aerial.

Man-Andra was busy outside, struggling not with a caber but a slim pole on which he’d lashed a u.h.f. aerial. This produced a noisy, ghostly test card falling a centimetre or so short all round the screen. The Caledonian couple poured out their troubles. The radio worked all right, and the tape section was o.k. provided they weren’t recording TV sound. If they were, the results were marred by incorrect speed and wow. Meg-wumman turned on the tap and the picture got worse. Switching from TV to tape replay seemed to cure all the ills, even with the tap on. Further demonstrations involved pulling the curtains and turning the lights on and off, then starting the engine and

revving it alarmingly. The TV section behaved differently under these various conditions, though the ghosting and snow remained throughout.

The upshot of this encounter between Scottish affluence and English logic was not a screwdriver and meter exercise. Though we got the manual out for interest (it’s an ingenious design) we didn’t need to use it. No, Andra and Meg were directed to our local retail department for one of those and some of that. Andra lost one evening of his holiday busily working while Meg-Wumman fretted and scolded. A nice sequel to the story was the arrival, at the end of the week, of a “wee dram” of whisky (down, Les!) for their mentor – it’s with me as I write this. Back to the point however. What did they buy in the shop? What basic problem did it solve? And how on earth did the water tap get involved? We’ll reveal all next month.

SOLUTION TO TEST CASE 259 – page 502 last month –

All very mysterious: an ITT CVC20 with its screen as bright as a searchlight, the tube’s cathodes virtually grounded and a whopping 9V coming from the TCA800’s RGB output pins. The other voltages around the chip were about correct – but it wasn’t the chip itself. What the block diagram of the i.c. in the manual doesn’t show (though it’s obvious perhaps with a little thought) is that the RGB clamps need line frequency drive pulses – the same pulse that triggers the PAL bistable is used. It enters at pin 8, after a bit of delay and shaping by the RC network between this pin and the relevant winding on the line output transformer (pin 12). The pulse at pin 8 should be a positive-going one of 15V peak amplitude. Our scope revealed the presence of a 7V negative-going pulse. This was mucking up the clamping, thus accounting for the trouble.

The pulse at pin 12 of the line output transformer should be of 70V peak amplitude. In fact we found a negative-going 100V pulse at this pin. This was because the winding was open-circuit, as a result of which negative-going pulses from the NS transducer drive winding were being fed back to pin 12. This would have affected the NS raster correction – also the flywheel line sync – but these effects weren’t visible with the bright blank raster present. A new line output transformer was fitted – after we confirmed that the fault was inside the winding rather than at the earth connection.

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TELEVISION AUGUST 1984

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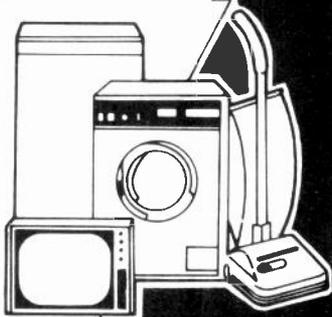
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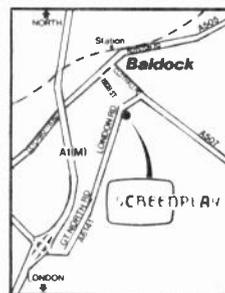
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PYE 205	3.00	3.50	5.00	10.00	-	-
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GEC S/S	6	4	11	8	5	3	5	3	5	3	4	3	10	8	3.00
Decca (H)	6	3							8	4	4	2	3	1	2.50
Pye (H)	8	4	8	4	4	2			6	3	4	2	3	1.50	2.50
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<p>All diodes at 10p or less in this list 20 of one type £1.00</p> <p>OA 47 8p OA 90 8p IN 60 5p IN 541 5p IN 914 3p IN 2069a 10p IN 2070 10p IN 4001 3p IN 4002 3p IN 4003 4p IN 4004 4p IN 4005 4p IN 4006 4p IN 4007 5p IN 4148x40 1p IN 4448x40 1p IN 4742 10p IN 4722 10p IN 4751 10p IN 5235 10p IN 5254 10p IN 5349 10p IN 5392 10p IN 5393 10p IN 5928B 10p IAV 30 10p IM 72Z55 10p IR 106a 20p IR 3051 20p IS 164 10p IS 921 10p IS 3011a 10p IS 3072a 10p IS 5024a 50p IS 5030 50p ITT 210 10p ITT 921 10p ITT 923 10p ITT 1075 10p ITT 2001 10p ITT 2002 10p ITT 4150 10p ZE 1.5 10p ZF 3 10p ZF 3.3 10p ZF 4.3 10p ZF 10 10p ZF 11 10p ZF 12 10p ZF 15 10p ZF 33 10p ZF 43 10p ZF 47 10p ZF 82 10p ZPD 3.9 10p ZPD 4.7 10p ZPD 5.6 10p ZPD 10 10p ZPD 47 10p ZPY 8v2 10p ZPY 12 10p ZPY 16 10p ZPY 24 10p ZPY 43 10p ZPY 47 10p ZPY 56 10p ZTE 2 10p ZTK 22 10p ZTK 33 10p ZTK 33a 10p ZW 13 12p ZW 17 10p ZW 4.3 10p ZW 310 10p ZX 68 30p ZY 47 10p ZY 72 10p AA 113 10p AA 119 8p AA 144 8p BA 102c 10p BA 157 8p BA 159 8p BA 173 8p BA 182 8p BA 201 8p BA 202 8p BA 243 8p BA 248 8p BA 316 5p BA 318 5p BAV 10 10p BAV 21 10p BB 103 10p BB 105Ax12 1p BB 105Bx12 1p BB 105Gx12 1p BB 121a 10p BRC 83c13 10p BZX 46c22 15p BZX 61 9-1 6p BZX 61c110 6p BZX 61c20 10p BZX 61c30 10p BZX 61c220 10p BZX 70c6v2 20p BZX 70c12 8p BZX 70c33 8p 5v1, 5v6, 6v2, 6v8, 7v5, 11, 12, 30, 47, 10p each BZX 83c4v3, 5v6, 8v2, 12, 13, 24, 27, 33, 10p each BZX 84c6v8x10 30p BZX 85c8v2 10p BZX 88c0v7, 3v9, 4v3, 6v2, 8v2, 12, 10p each 1A/1600V 10p CV 8617 10p</p>	<p>Min 12 volt Relays 75p</p> <p>Y 716 10p Y 729 30p Y 730 10p Y 827: 6A/1KV 20p Y 860 30p Y 933 5p Y 969 50p Y 997 30p R 1038 40p R 1039 40p R 2009 80p R 2010b 1p R 2029 50p R 2210 60p R 2257 60p R 2265 50p R 2305 50p R 2306 50p R 2322/2323 pair 80p R 2323 15p R 2396 50p R 2461 80p R 2030 50p R 2443=BD124 40p R2737 40p R2738=TIP41 30p R2775=TIP41c 40p R3129=TIP47 40p S 2008b 80p</p> <p>BU 105/04 80p BU 108 1p BU 124 50p BU 126 80p BU 180a 65p BU 204 70p BU 205 70p BU 206 1p BU 207 1p BU 208 80p BU 208 on heat sink 70p BU 208A 1.10 BU 208D 90p BU 222 1p BU 326 1p BU 407 60p BU 426V 10p BU 500 1.10 BU 508A 1.2 BU 526 75p BU 807 1p BUX 84 50p BUW 84 30p BUY 71 1p</p> <p>TIC 106a 30p TIC 116m 40p TIC 116m/Y 1003 35p TIC 126N 40p TIC 206m 30p TIC 225S 40p TIC 226m 40p TIC 236m 30p TICV 106D 10p (T092 case 2A/400V) TIP 29 20p TIP 30 35p TIP 30A 35p TIP 30B 40p TIP 30C 45p TIP 31 30p TIP 31A/RCA 16334 35p TIP 32 25p TIP 33B 50p TIP 33C 50p TIP 34A 60p TIP 34B 60p TIP 34C 70p TIP 35B 50p TIP 35C 70p TIP 35D 80p TIP 36 50p TIP 36C 70p TIP 41B 40p TIP 41D 70p TIP 42/BRC 6109 30p TIP 48 40p TIP 49 30p TIP 57 30p TIP 100 30p TIP 102 30p TIP 112 30p TIP 115 50p TIP 117 50p TIP 120 35p TIP 125 35p TIP 130 30p TIP 131 25p TIP 136 30p TIP 140 50p TIP 147 50p TIP 640 50p TIP 2955 35p T 6032 30p T 6036 40p T 6040 40p T 6047 40p T 6049 40p T 6051 40p T 6052 40p T 9004 40p T 9005 40p ZTX 102c 10p ZTX 107 10p ZTX 108c 10p ZTX 109k 5p ZTX 213 5p ZTX 341 10p ZTX 342 10p</p> <p>SPECIAL OFFER CVC 21 Chassis complete £35 Computer Transformer 20w/2.5A; 20w/1.5A; 17/5A; 19/5A; 28/05A £3</p>	<p>ZTX 384 10p ZTX 451 10p ZTX 550 10p MJ 2253 60p MJE 3040 60p MJE 2209 10p SP 8385 50p</p> <p>Voltage Regulators +5V/UA78POSSC 30p -5V/LM79MO5CP 25p -8V/79M08c 30p +6V/78M06c 30p +10v/78LA10 20p LM 337 20p LM 342/18 30p LM 340T 5.0 50p -12V/MC 7912 20p +12V/LM 340T12 50p +15V/78M15 15p +18V/MC78M18 20p +24V/78M24 30p MC 7724cp 40p MC 7824 40p TIS 90 10p TIS 91 20p TIS 92 20p TIS 93 20p</p> <p>CB Radio transistor 16119 2A/40v.50Meg 5 for £1.</p> <p>U 19885 40p U 3832 15p U 3845 15p MR 508 10p MR 501 10p MR 502 10p BCW 71R 30p BYF 1202 10p BYF 1204 10p BYF 3126 40p BYF 3214 40p BYX 10 6p BYX 36/600 35p BYX 38/300 25p BYX 55/350 10p BYX 55/600 (Bead) 10p BYX 71/350 20p BYX 71/600 50p BYX 72/300 20p BYV 95B 10p BYV 95C 12p BYV 96D 10p BYZ 106 10p BPW 41 15p BYW 56 2A/1000v G11 8p BZY 93c75 50p BZV 15/18 30p BZV 15/30 30p BZW 70c6v2 10p BZX 79.3v 10p</p> <p>Bush thyristor RCA 76122 1p ITT computer bookset 2020 1.2 G8 20 turn 100K pot 35p Transformer 240v/20v-500mA 75p Viewdata toroidals 1.6 CVC 20 tube base 1.2 Mitsumi tape motor 75p Sankyo tape motor 75p Swiss made 250rpm/240V motor very small 75p Mono scan coil 110" small neck 1.50 Infra red led 15p LD57CA 15p Mono scan coil 1.3 G 8 transductor 1.1 AT 4041/41 transductor 1.1 2K5 Lin pot with 40mm spindle 20p 1982 Hitachi Ae isolator 50p Mullard FM decoder 1401 1.1 Philips service pack, flat films, 57 condensers 56nf-2.2uf 1.2 VHF 3 Transistor rotary tuner DX-TV 1.1 15K-20 turn pots 20p Thorn panel 6x100 pot + changeover switch (Irish) 50p Battery converter TA 75 for colour TV. 12/24v Thorn 3787 1.6 Thorn 3500 2A cut out 75p</p> <p>Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit 1.6</p> <p>SPECIAL OFFER Decca-TTT etc. FEO4/1/250AC/4 Mains filters (grey type) x 4 1.1</p> <p>BRIDGES SKB 2/08 LSA 30p KBL 005 30p KBL 02 30p KBP 04 30p W02 15p W004 15p W005 20p</p> <p>GEC remote panel. Main transformer 3/kc SAA 1025/5N 74141/TBA 231 1.6 AT 2076/55 GEC split diode transformer 1.0 AT 2048/11 LOPTI Mullard 1.250</p>	<p>PHILIPS DIY HOME SECURITY ALARMS KITS Send for details. Prices £54 to £112.</p> <p>10 Mixed TV & radio speakers £5 + £2 post</p> <p>8Ω 4" speakers £1 4700/10v x 10 50p 68/16 x 10 50p 150/16 x 10 50p 47/25 x 10 50p 220/25 x 10 50p 1/250 x 10 50p 8000/30v 50p 470/40v x 10 1p 22/100v x 10 1p 100/350v 70p 400/350v 70p .47/500v 25p 1/600v 25p .022/1kv 10p</p> <p>Philips GP422.4CH (£40 cost) £6 Stereo Dynamic Cartridge</p> <p>12 Volt Aerial Changer over Relays £1</p> <p>GEC Hitachi V/Cap tuner. after 1979 Series £13 6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £12</p> <p>Mullard Broadband R.F. power modules</p> <p>VHF. BGY33 £15 UHF. BGY22E £5 PT4236C £5 PT9783 £5</p> <p>Various Tools and Accessories</p> <p>Philips Freeze £1.00 Foam Cleaner £1.00 Contact Cleaner £1.00 G11 Neon Switch £1.00 GPO 5 way plug 25p 12v screwdriver tester with lead + crocid 25p Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3.00 Sello tape PVC Electric Insulation 25mm x 20M 50p 50mm x 20M 70p Telescopic aerials (radio) £1.00 UHF Radio Aerial 50p Xcelite pliers £3.90 Xcelite snips £5.00 Xcelite cutters £3.90 GKN Supascrew kits £2.50 VU meter 45p Pull up large aerial 75p "V" TV aerial £1.00 Soldering iron 6v/23w £2.50 Weller solder iron 15 watt/25 watt £5.00 Portable TV aerial 75p Phillips snips 1.2 2 way baby alarm/intercom with long leads 1.2 Phillips universal battery tester/charger, fuse/bulb tester To Clear 1.4 Volt/ohm test meters 1000 ohm/volt 1.5 Eisenmann NICAD CHARGER 5.5V/150 ma 1.2 12V Nicad pack. "AA" £2.50 Hitachi TP 007 Battery pack 7.2v/1.6A 1.7 Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V "AA"/1.25V Nicad 60p "C" Nicad 1.1 "D" Nicad 1.3 Duracell PP3 60p Duracell "C" 50p 70ML Silicone Sealer (clear) 1.1 1/2" x 1/2" microphone/speaker 50p Continental 2 pin plug with 5ft mains lead (black & blue) 5 for 1.1 7" Ferrite rod with LW/MW coils 50p Xcukeute 5" bent nose plier £3.50 De-solder pump + 2 nozzels £5.20 Plastic box for i.c.s with anti-static pad 6"x3"x1/2" 75p Can of handy oil "mobil" 40p Flat Red LED 12p 500gm 60/40 solder reel 1.7 Clearweld glue pack 30p Dual v/u meter -20 - +10db 1.1 15 service manuals, Thorn 3504 & 3448, etc £2.50 3 x C90 Cassettes 70p Can Freezer 1.75 K30 thermistor 232266298009 75p</p> <p>75R/25 Watt 25p 18R/11 Watt 25p 120R/17 Watt 20p Front End Music Center. VHF/MW/LW 13"x31" 1.3 Output Stage for music center 1.5 SONY 1400KV Chroma Panel 1.6 SONY 1400KV Tuner unit 1.50 SONY 1400KV Touch button unit 1.50 Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's 1.00</p> <p>Quantity Reductions BY204/4 25 for 1.00 BY206 25 for 1.00 BD132/238 20 for 1.2 W005 bridge 20 for 1.2 G11 touch button red 6 for 1.1 BY210/600 25 for 1.00 BY298 3 amp/fast/R 20 for 1.50 BD239 20 for 1.20 MR856 25 for 1.50 BU126 10 for 1.00 BU205 10 for 1.00 BU105 10 for 1.00 2SC2122A 10 for 1.00 BF458 10 for 1.00 BD136 10 for 1.125 BF224 20 for 1.40 OA90 40 for 1.00 BYX10 100 for 1.00 KT3 multicaps 10 for 1.75 50 High voltage ceramic condensers 1.50 Mixed Mounting Kit for Power Transistors 50p 300 Condensers 1.50 300 Resistors 1.50 150 Electrolytics 1.20 15 Bulbs 40p Video lamps 20 for 1.50, 200 for 1.25 Antistatic Discloth 5 for 1.1 100 Diodes 1.50</p> <p>100 Fuses 1.00 100 W/W Res. 1.50 BF 199 20 for 1.1 BC 547 100 for 1.4 10 x 20 Turn 100k pots. Rank 1.2 Thorn 9 volt power supply regulated 1.30 BF 470 20 for 1.1 Metal BD 124 10 for 1.8 20 Slider Knobs 70p 6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye 1.00</p> <p>Mixed Packs TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits 1.00 50 Mixed AC series Transistor 1.50 15 Panel mount rocker switch 250V/10A 1.50 25 Panel Mount Bulbs & Neons 1.50 10A 1.50 Mixed ribbon cables 1.00 25 LED red/yellow/green 1.50 20L/C Holders 1.20 20 Large LED Red 1.00 20 Small LED Red 1.00 10x20 Turn 100K Pots 1.00 100 Transistor 1.50 20 Convergence Pots 80p 100 Sticks 1.00 10 Thermistors 1.00 20 Slider Pots 1.00 30 Presets 50p 15 VDR + thermistors, degaussing, HT, etc. 1.00 40 glass reed switch 1.1 10 press to make switch 70p 40 Pots 1.50 10 Gun Switches 50p 5 Tube Bases 1.00 1,000 Diodes, Condensers, Resistors on Bandyol 1.00 Luckey Dip 600 gram 1.00 Jungle Bag 5Kg 1.00 20 Knobs 1.00 40 Pots, 1/2" + 6mm spindles for audio/TV 1.00 20mm Fuse Holders 1.00 Chassis Mount 10 for 1.1 IN4001/6 100 mixed 1.250</p> <p>SENDZ COMPONENTS TO ORDER SEE BACK PAGE</p>
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SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

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9000 tube base and panel	£1.50	BY 210/600	8p
9000 Front Panel	£5	BY 210/800	10p
9000 Front Panel (remote)	£8	BY 223	£1
8800/9000 remote unit U705 receiver	£6	BY 224/600: 4.8A/600v bridge	50p
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9000 Cyclops panel	£1.50	BY 227	15p
8000/8500 timebase panel	£8	BY 228	20p
8000/8500/9000 chroma panel	£15	BY 229/400	30p
8800 convergence panel	£6	BY 234	10p
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4000 Chroma	£20	BY 254	10p
4000 Power supply	£3	BY 255	30p
1600 Mains lead, switch		BY 298	10p
3500 6 push button + cable form	£1.50	BY 299	10p
T605 1vNPN T066 80V/6A	10p	BY 406	8p
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3500 Focus unit	£1.50	BY 407a	10p
4000 thick film		BY 602	10p
00S1-010-E003	£1	F 247	10p
00S1-012-E002	£1	XK 3102	50p
00S1-012-0108	£1	XK 3123	50p
00S1-018D	£1	Hitachi 2A/1500V metal case wire end	20p
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3500 2amp thermal cutout	75p	G8 Trans. Philips	£6
3500 IF panel	£2	G11 Split Diode	£12.00
3500 Frame panel	£3	CVC820 Split Diode ITT	£10.00
3500 Video panel	£5	Thorn B/W AD5308F + Stik + Lead	£1.50
3500 Line panel	£3	GEC 2040	£3.00
3500 A1 Diode	20p	GFC 2110	£7.00
Export 3500 IF panel	£2	Mullard AT 2036	£1.50
Remote unit, 11ic, transformer, relay + 5 volt unit	£2	Pye 169 Line Trans	£3.00
IC board with set of SN74LS	£1	Pye mono	£3.00
4000 Tube base	£4	Rank mono T704A	£3.50
3500 A1 pots	50p	CVC32 ITT	£7.50
Beam limiter panel	£1.50	GEC Portable G10T2041	£3.00
3500 Power panel complete	£1	GEC Portable G10T2046	£3.00
3 Way regulated adaptor 240V 6V/7.5/9V/300mA	£3.50	EHT Split Diode Leads	£1.00
Rank/Toshiba preh unit 0354	£9.50	EHT Cable/Metre	20p
2 banks of 3 PB unit, Pye 731	£2	Ex panel "14" Fidelity portable	£5
4 Push button unit preh	£1.00	Triplers	
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00	11 TEZ Rank	£3.00
7 Push button for CVC's ITT	£8.00	G9 Philips	£4.00
KT3 12 Push button unit	£2.00	GEC 2110	£4.00
KT3 (Export) 12 P.B.u	£2	9000 Thorn	£6
6 Push button Unit Thorn	£1.00	9500 Thorn	£4.50
6 Push button unit for GEC 2040 and ELC 1043/05	£6.00	2040 GEC	£3.50
Hearing aid unit	£3	GEC TVM25 Tripler	£2.00
6 Push button unit PYE 713	£7.00	Universal Tripler	£6.00
7 Lamps for P.B./Unit	10p	TVK 76/9	£3.00
Mains Droppers		G8 Philips (Mullard)	£4.50
Pye 731 3+56+27R	50p	Decca 80 100	£4.50
Pye 3R5/15R/45R	50p	Grundig TVK 52	£2.50
Thorn 50/17/1K5	£1.00	11TBO Pye 731	£3.00
120/20/20/48/117	£1.00	11THY	£4.00
270/10/6 for Thorn 4000	50p	D22 for Pye 18" colour portable	£4.00
18/320/70/39	£1.10	L.P. 1193/63	£4.00
Thorn 50-40R-1K5	50p	BG 100/41	£3.25
Ae Socket & Lead		BG 100/61	£3.25
GEC, ITT, Philips, Pye	25p	KT3 B6200/43	£3.50
7x3 Thorn	£1	T/text ultrasonic rec'r panel	£14.00
Rank Toshiba Tube Bases	30p	Video cassette lamps on lead, 12-14V.	50p or 3 for £1.00
Speakers		GEC 8 touch unit assy complete with all I.C.'s + pots	£4.00
6x4 G11	25 ohm	G11 E.W. coils	£1.00
51x24	3 ohm	G11 Trans Suppressors	
5x3	80 ohm	245V	10 for £1.00
5x3	50 ohm	G11 Scan Coils	£5.00
5x3	35 ohm	G11 100K tuner pots	12 for £1
5x3	15 ohm	KT3 IF panel	£6.00
6x4	15 ohm	KT3 line OSC transformer	£1
7x3	70 ohm	KT3/K30 infra-red receiver head	£3
5x3	8 ohm	K30 drawer unit with IC's (home)	£10
7x3	16 ohm	K30 drawer unit with IC's (export)	£10
5" dia	16 ohm	KT3 AE Sockets	25p
5" dia	8 ohm	KT3 receiver panel	£8
6" dia	4 ohm	KT3 line driver transformer	50p
6" dia	3 ohm	Decca 80/100 IF panel	£5
2" dia	8 ohm	NPN PNP 80V 6 Amp O.P. Trans.	pair 25p
3" dia	8 ohm	5 button touch tuner FBC1/2	
KT3 speaker	75p	ITV1/2 video with ic SAS 560T/570T	£7.00
3" dia	15 ohm	Control panel 5 sliders + mains lead	£1.50
Diodes		G11 8 touch button unit replaces old 6 P.B.U.	£24
BY 127	10p	Tube base + base unit for 820 Euro chassis	£4.00
BY 133	10p	GFC Line O/P Trans. & Rec Stick for Portable	£3.00
BY 134	10p	CVC 20/25/30/35/40 decoder panel	£10
BY 164	50p	CVC 20/25/30/35/40 decoder panel (untested)	£5
BY 176	25p	CVC 40/45 IF panel	£5
BY 179	40p	40K Transducer	50p
BY 184	25p	PHILIPS NE511N	£1.20
BY 187	10p	1M337M Reg.	30p
BY 190	40p	20 GEC Black Spark Gaps	£1.00
BY 196	30p	G11 Line Driver Transformer	35p
BY 198	10p		
BY 204/4	8p	BTW 30/50	50p
BY 206	8p	G770/HV34 6K V	3 for 8p
BY 208/800	8p	BTW 92/800R	£3
International Rectifier EHT Diodes		25A473 PNP C/P	10p
6A/600V Stud Diodes	20p		
6A/1000V Stud Diodes	20p		

Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI

Field + Jungle panel for GEC 3133,3135 £10

GEC 2110 line panel with transformer £1.50

GEC 2110 tuner unit + IF Panel £7.00

Pye/Chelsea Line op panel £12.00

Pye 713 IF panel and tuner £7.00

Pye 713 Chroma £10.00

Pye/Chelsea Timebase panel with LOPTI £10.00

Pye 731 Frame Panel £5.00

Pye 731 Convergence Panel £5.00

Pye 731 line O/P panel with transformer + tripler £12.00

Pye 731 Chroma £10.00

Pye 731 IF panel + tuner £10.00

Pye 607/205 Line panel with transformer £10.00

Pye CDA/205 panel £6.00

GEC portable chassis + LOPTI 2114 New £4.00

Thorn 1613/1713 chassis 9.75

Hills 520 multimeter + case. 20,000V/ohm, fuse diode protected + logic test facility. 10meg/1200 volt £19.50

MEW MULLARD TELETEX

Decoder Panel (VM6230) £15.00

Panel 6101 £15.00

Panel 6330 £15.00

G8 Tuner Unit + Panel £8.00

G8 Convergence Panel (late type) £12.00

G8 Line O/P Panel £12.00

G8 Power Supply £6.00

G8 6 Sloping PBU £12.00

G8 IF + Chroma £12.00

G8 Chroma £6.00

G11 IF Detector £3.00

G11 Selector gain module £3

Complete CVC 825 Chassis (both panels) £40.00

AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00

Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00

Z909B RANK IF Panels £2.50

Export 5.5MHz 2 I.C.'s TBA1205B TCA2705C £2.50

Z743 RANK IF Panel £3.00

Export 5.5MHz 3 I.C.'s TBA750+SC9504P+ SC9503P £1.50

Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00

GEC V/cap VHF/UHF tuner and IF + sound O/P PC 706B3 (Export) £12.00

GEC Line O/P PC 659B3 £10.00

GEC Power Supply (Export) £10.00

G11 dynamic correction panel £6

CVC 20 Front panel with sliders + mains input panel £4

CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £14

CVC 5 Mains on/off + 5 pots £2

GEC Convergence panel £1

Universal Focus. Fits Pye, Thorn and Decca Units.

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I.C. SAA 5051 £1

I.C. SAA 5042 70p

I.C. SAA 5030 80p

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7seg Red LED 50p

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2 digit LED 8.8 50p

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4700/63 10p

250/64 10p

3300/70 50p

1/100 x 10 20p

4.7M/100 5p

4700/100 20p

4700/100 75p

47/160 10p

300/160 50p

1/250 Pulse 10p

G11 0.47/250 10p

2.2 250v 10p

3n3/250 A.C. 10p

39/250V 15p

4n7/250 tested 5KV 25p

91/400 30p

22/250 15p

47/250 10p

100/250 20p

G11 470/250V £1.75

500/250 50p

GEC600/250 60p

800/250 £1

32/300 20p

4/350 5p

8/350 8p

12/300 10p

4.7M/350v 10p

16/350 25p

33/350 20p

50/350 30p

220/350 40p

300/350 40p

400/350 50p

10/375 10p

22/375 10p

220/385 75p

330/385 CVC 820HT 60p

0.1/400 15p

KT3 E/W .39/400 20p

.56K/400v 20p

4700pf/400 10p

22/400 10p

8/400 15p

33/400 20p

400/400 40p

394K/400V 20p

220/450 20p

47/500 25p

0.1/600 15p

.047/600 15p

0.047/1000 10p

0.01/1000 10p

0.1/1000 10p

15/1000 20p

.47/250V A.C. 10p

001K/1250 10p

0.0047/1500 10p

005/1500 10p

0105/1500 10p

1n8/1500 15p

2n0/1500 10p

2n2/1500 15p

G11.11000/1500 15p

.01/1600 15p

G11.8200/2KV 15p

0.1/2KV 20p

10n/2KV 15p

2n9/2KV 15p

0.0015/2KV 10p

5n2/2KV 15p

6n2/2KV 15p

2n0/2KV 15p

2n2/2KV 15p

7500pf/2KV 10p

4n7/2KV 15p

8n2/2KV 15p

20n/2KV 15p

0.0082/2500 15p

150/3500 10p

1800/4KV 5p

4.7n/5KV 10p

170/8KV 10p

180/8KV 10p

210/8KV 10p

1000/10KV 10p

210/12KV 10p

1000/12KV 10p

1200/12KV 10p

Multi-Caps

Thorn 3500 175/100/100/350v £1.75

KT3/200/25/25/385v £1.00

300+300+150+100+50MFD 350V £2

47/220/350v 60p

150/150/100/100/100/320v £2.00

2500/2500/63v 50p

470/470/250v 50p

150/200/200/300v 70p

400/400/200v £1.70

300/100/100/16/275v £1.50

100/200/325v 40p

150/150/100/375v £1.50

300/300/100/32/32/300v 2.00

1500/2000/30v 50p

Jelly pot Thorn 00D4/013 £3

150/150/100/100/320v £2.00

100/350 + 300/200/100/16/275v £2.00

300+300/300 £1.00

225+25/380 70p

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CMS 12 £2.00

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CMU 30 £7.00

CMU 40 £7.00

CMU 45 £7.00

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GMR 64 £5.00

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G11, Full remote top button assy. £12.00

G11, Full remote repair service (exchange unit) £12.00

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BF194	20p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	10p
BF240	20p
BF244	40p
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
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