

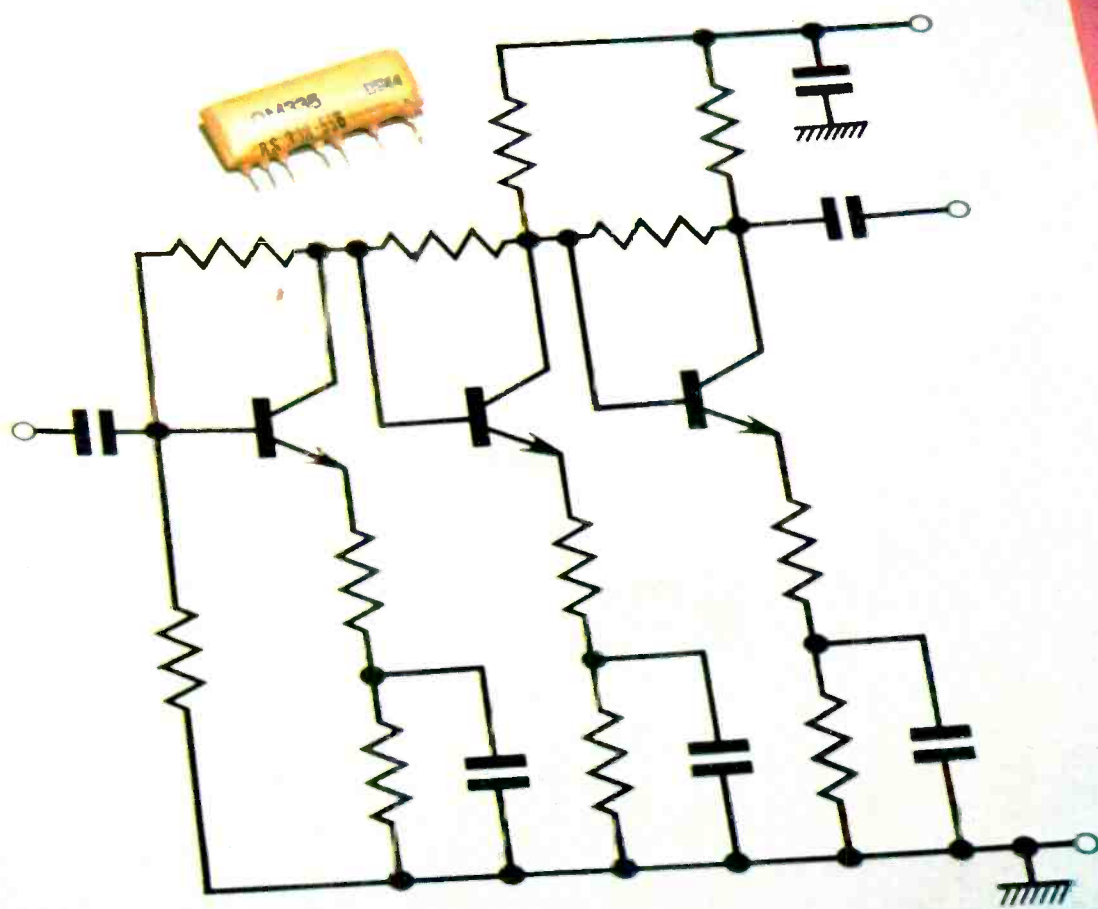
APRIL 1980

Australia 95c; Malaysia \$2.75; New Zealand 95c

55p

# TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



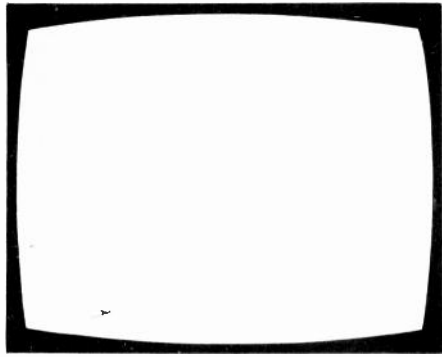
**WIDEBAND PREAMPLIFIER**

**VIDEO DISC SYSTEMS**

**THE PHILIPS TELETEXT SYSTEM**

**SERVICING TIPS**





# TELEVISION

April  
1980

Vol. 30, No. 6  
Issue 354

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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., Lavington House, Lavington Street, London SE1 0PF.

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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 75p 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 in 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

- 289 Leader**
- 290 Teletopics**  
News, comment and developments.
- 292 Readers' PCB Service**
- 295 Wideband Hybrid Preamplifier** *by Luke Theodossiou*  
A versatile amplifier using a Mullard thick-film unit stocked by RS Components. Covers Bands I-V.
- 296 VCR Troubles** *by Steve Beeching, T.Eng.(C.E.I.)*  
The faults this time are mainly on VHS and Philips machines.
- 298 Teletext the Philips Way** *by Harold Peters*  
The Philips/Mullard teletext decoder chips and the features they provide, their use in the Philips and Pye teletext models and simple fault finding.
- 301 Next Month in Television**
- 302 TV Faults** *by Robin D. Smith*  
Faults and their symptoms and how to go about tracking them down.
- 304 Video Disc Systems** *by David K. Matthewson, B.Sc., Ph.D.*  
A review of the development of video disc systems with a survey of the present situation.
- 306 The Gypsy's Warning** *by Les Lawry-Johns*  
Madame Martine's remarkable foresight into the problems of latter day chassis.
- 308 Servicing Zanussi Colour Receivers, Part 2** *by Mike Phelan*  
How to tackle the thyristor line output stage, plus various common faults.
- 311 Test Report: The Intracept Colour Bar Generator** *by Eugene Trundle*  
Extended use in the workshop and in the field has proved the usefulness of this compact generator.
- 312 Long-distance Television** *by Roger Bunney*  
Reports on DX reception and conditions, plus notes on a newly discovered mode of propagation - FAI (field aligned irregularities).
- 315 Some Thorny Problems** *by Nick Lyons*  
During a recent spell it was one Thorn set after another.
- 316 Vintage TV: The Philips 1100U** *by Vivian Capel*  
Interesting features and circuitry in this 1951 model.
- 318 A Look at Capacitors** *by George Wilding*  
The properties and operation of capacitors, looked at from a practical angle.
- 320 TV Servicing: Beginners Start Here . . . Part 31** *by S. Simon*  
Having examined the Thorn 3000 chassis' switch-mode power supply in some detail last month, it's time to consider some of the common faults experienced in other parts of the chassis.
- 323 Workshop Safety** *by Robin D. Smith*  
A note on the RETRA's recently published booklet "Safety in Electrical Testing".
- 324 Service Bureau**
- 326 Test Case 208**

OUR NEXT ISSUE DATED MAY WILL BE  
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Quotations for  
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required. (Diff. prices)

PLEASE ADD 15% V.A.T.  
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Baird	6.50	8.50	7.00	—	—	5.00	—	—	—	5.00

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Philips G6 S/S	9.50	—	—	10.00	—	5.00	—	6.00
Thorn 3000	6.00	6.00	—	6.00	—	5.00	20.00	6.00
Pye 691/693	6.00	6.00	—	8.00	—	5.00	—	15.00
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Plus P&P £5.00

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Rebuilt tubes  
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Bush £5.00  
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Philips G6 S/S £5.00  
Thorn 3000 £5.00  
Pye 691 £5.00  
Some new tuners in stock,  
can supply on request. Many  
Foreign Tuners also available  
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Most Lopts available  
from £5.00. Both  
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S/Output transformer  
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NEW SPECIAL OFFER  
AT £8.00

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GEC	19" £60.00	22" £65.00	26" £75.00		20" & 24" D/S	£14.00	Pye, GEC, Bush etc.
Bush	19" £80.00	22" £80.00	26" £90.00		19" & 23" D/S	P/button £12.00	Pye, GEC, Bush etc.
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Briarwood T.V. Limited  
Britain's Mail Order  
T.V. Specialists

# BRIARWOOD



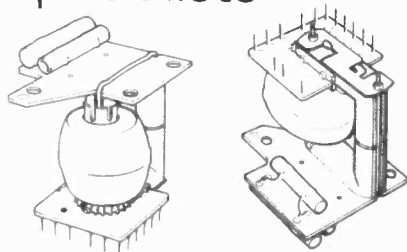
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BRITAIN'S LARGEST SUPPLIERS OF  
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12 Months Guarantee. Please add 15% VAT  
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Various other models available on request



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Philips	G8	9-50	Scantic	Chassis 32.631 - Series 2	12-50
Philips	K70	18-75		2635-1/2635-3/ 2636/2636-2/ 2636-4/2637/ 2638/2639/ 2645/1805-6482	12-50
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Decca	1730	9-25	B & O (Beovision)	3100/3300/3400	14-50
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Decca	100	9-00	Tandberg	CTV 1/2/2-2/ Colour 102/103/ 104/105/106	12-50
Decca Mono	MS1700/2020/ 2001/2401	8-00	Telefunken	CTV 55552	12-00
Korting	51763/51765 - 22" 52665/52666 - 26" 52865/52866 - 26"	12-00	Autovox 90°	Chassis 711A Chassis 2682/2683/ 2684/2282/2283/ 2284	12-00
Korting	53701/02/08/09 54701/02/07/08/547 55606/55700/02/ 711/735/747	11-20	Autovox 110°	Chassis 2693/2694	12-00
ITT	CVC25/30/32	9-00	Siemens	2221-1/222-2/ 2621-1/2621-2/ 2622-1/2622-2/ 2623-1/2623-2/ 2624-1/2624-2	12-50
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Grundig	5010	13-00	Baird	27" 110°	11-20
Grundig	5010 EHT Transformer	14-50	Salora	BP-CTV 225 & 265 BP-7-663291/ BP-7-663691	12-00
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Luxor	Chassis 32.621 - Series 1	12-50			

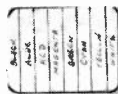
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			Philips G6 Overwind on Exchange basis only		
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MONO					
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Bush 313 Series		8-45	PYE 368		8-45
Decca DR1 to DR24		8-45	PYE 169 or 569		8-45
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ITT K13 VC 200		8-45			

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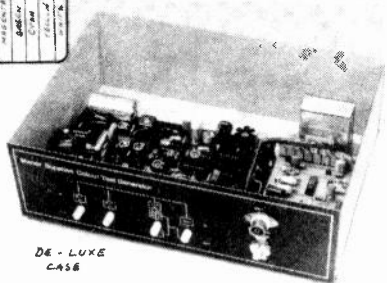
# MANOR SUPPLIES

## PAL COLOUR BAR GENERATOR

plus CROSS HATCH KIT (Mk. 4)



3RD SUCCESSFUL YEAR



DE-LUXE CASE

- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
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- ★ Simple design, only five i.c.s. on colour bar P.C.B.

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- ★★ Kits include drilled P.C. board, with full circuit data, assembly and setting up instructions.
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- ★★ Designed to professional standards.
- ★★ Demonstration models at 172 West End Lane, NW6.
- ★★ Every kit fully guaranteed.

MK4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.50 P&P. VHF MODULATOR (CHI to 4) FOR OVERSEAS £4.00. INFORMATION ON VIDEO TAKE-OFF FOR C.C.T.V.

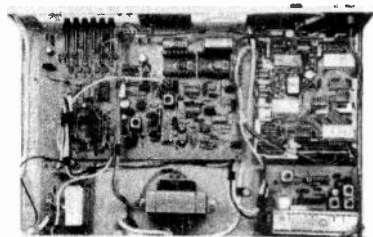
(ALL PRICES INCLUDE 15% VAT)

# MANOR SUPPLIES

## TELETEXT KIT (MK2)

(INCORPORATING MULLARD DECODER 6101VML)

INFRA RED REMOTE CONTROL



- EXTERNAL UNIT, PLUGS INTO AE SOCKET OF TV RECEIVER.
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- INFRA-RED REMOTE CONTROL (MULLARD 5000 SYSTEM) STATION SELECTION, TEXT, MIX, TIME, DOUBLE HEIGHT, HOLD, CLOCK, REVEAL, RESET ETC. ETC.
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- DE-LUXE CASE MEASUREMENTS APPROX. 154 x 104 x 34.
- WORKING MODEL AT 172 WEST END LANE, N.W.6.

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CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET £12.65 p.p. 50p. (ALUM CASE £2.60 p.p. 80p.) COMPLETE TESTED UNITS READY FOR USE (DE LUXE CASE) £26.00 p.p. £1.25.

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£1.75, 5PSN £2.00, 6PSN £2.10, Special Offer 6PSN £1.15 p.p. 40p.

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LINE OUTPUT TRANSFORMERS. New guar. p.p. £1.00.

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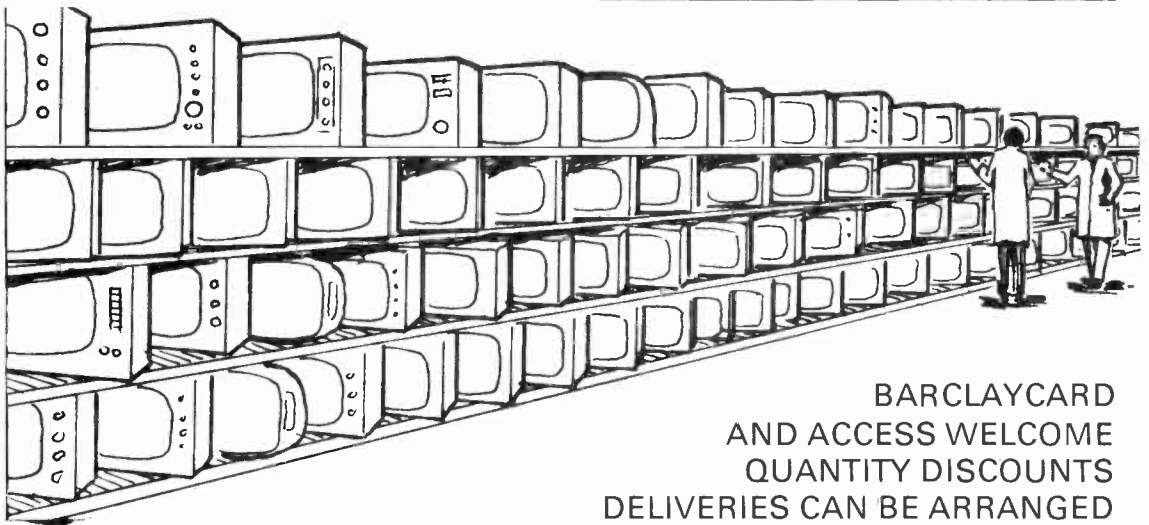
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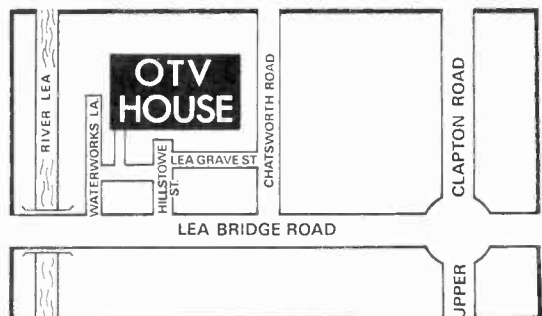
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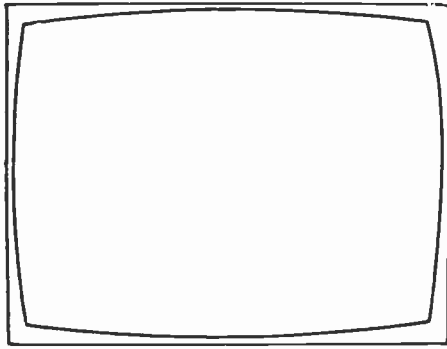
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AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU06	1.32	2N404	1.30	2N3904	0.20
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AC128K	0.55	BC108*	0.15	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BR339	0.60	MPSU131	0.59	2N697	0.46	2N3906	0.20
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65	BF254	0.48	BR356	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65	BF255	0.58	BSS27	0.92	OC28	1.48	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256*	0.49	BT105	1.50	OC29	1.60	2N714	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212*	0.17	BC548*	0.13	BD436	0.71	BF257	0.44	BT109	3.99	OC35	1.25	2N916	0.46	2N4226	1.17
AC151	0.31	BC116*	0.23	BC213*	0.16	BC549*	0.15	BD437	0.45	BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	0.30	BC213*	0.16	BC550	0.24	BD438	0.75	BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
AC153	0.42	BC118	0.24	BC214*	0.18	BC556	0.23	BD519	0.88	BF262	0.73	BL102	3.35	OC44	0.68	2N1164	8.29	2N4292	0.32
AC153K	0.52	BC119	0.34	BC214*	0.18	BC557*	0.16	BD520	0.88	BF263	0.88	BL105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.17	BD599	0.87	BF270	0.47	BLU0502	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.16	BD600	1.23	BF271	0.42	BLU08	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	0.20	BC238*	0.15	8CY10	0.30	BD663BR	0.86	BF272A	0.80	BLU128	2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	8DX18	1.55	BF273	0.33	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	8DX32	2.95	BF274	0.34	BU205	2.58	OC81D	0.95	2N1311	0.47	2N5081	0.20
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	8DY16A	0.63	BF336	0.63	BU206	2.59	OC139	1.30	2N1893	0.55	2N5084	0.40
AC189	0.52	BC137	0.20	BC253*	0.19	BCY72	0.27	8DY19	1.35	BF337	0.39	BU208	2.75	OC140	0.35	2N2102	0.71	2N5086	0.49
AC188K	0.61	BC138	0.35	BC261A*	0.28	BD115	1.35	BDY20	2.29	BF338	0.68	BU407	1.38	OC170	0.80	2N2127	0.55	2N5087	0.50
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BDY38	1.38	BF355	0.72	BUV77	2.50	OC171	0.82	2N2128	0.38	2N5208	0.59
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48	BF362	0.49	IC106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
AC197	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF363	0.49	IC106E	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
AC198	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF367	0.29	IC111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
AC208	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF123	0.85	BF457	0.43	DA0N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
AC209	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.88	BF457	0.46	E300	0.42	OC271	1.98	2N2401	0.80	2N5449	0.18
AD139	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.68	BF458	0.49	E1222	0.47	ON236A	0.94	2N2484	0.35	2N5457	0.76
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51	BF459	0.52	E5024	0.19	R2008B	2.59	2N2570	0.74	2N5458	0.40
AD143	1.78	BC153	0.38	BC295*	0.36	BD137	0.62	BF137F	0.78	BF459	0.47	GF372	0.18	R2010B	2.38	2N2906	0.82	2N5459	0.78
AD149	1.48	BC154	0.42	BC300	0.62	BD138	0.47	BF152	0.19	BF459	0.46	GF378	0.17	R2322	0.75	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25	BF459	0.27	MF0404/02	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
AD161/162	1.22	BC158*	0.12	BC302	0.86	BD140	0.50	BF159	0.27	BF459	0.27	MF6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20	BF440	0.29	MF6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	0.35	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84	BF441	0.30	MJ2955	1.30	TC44	0.25	2N2905*	0.39	2N6122	0.60
AF115	0.35	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BF450	0.29	MJ3000	1.58	TC46	0.35	2N2906*	0.36	2N6178	1.07
AF116	0.41	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BF452	0.33	MJ3040	0.68	TC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	0.42	BC168B	0.14	BC309*	0.18	BD157	0.51	BF166	0.50	BF452	0.29	MJ3431	0.72	TI2P9A	0.47	2N2926G	0.14	2N6211	2.78
AF118	0.98	BC169	0.15	BC317*	0.15	BD158	0.75	BF167	0.38	BF452	0.28	MJ370	0.74	TI330A	0.50	2N2926G	0.14	2N6337BP	4.24
AF121	0.68	BC170*	0.15	BC318*	0.16	BD159	0.67	BF173	0.35	BF459	0.30	MJ371	0.79	TI330B	0.51	2N2935	1.12	2N6338	0.78
AF122	0.58	BC171*	0.15	BC319*	0.19	BD160	2.89	BF177	0.80	BF459	0.29	MJ520	0.85	TI331C	0.67	2N3053	0.48	2N6343A	2.25
AF125	1.48	BC172*	0.12	BC320	0.17	BD167	0.67	BF178	0.46	BF459	0.30	MJ521	0.95	TI332A	0.56	2N3054	0.66	2N6390D	1.50
AF126	0.36	BC173*	0.22	BC321A	0.18	BD165	0.66	BF179	0.58	BF459	0.42	MJ525	1.20	TI332C	0.72	2N3055	0.72	2N6391	1.45
AF127	0.86	BC174A & B	0.22	BC322	0.28	BD166	0.88	BF180	0.53	BF441	0.48	MJ5300	1.95	TI333A	0.77	2N3250	0.52	2N6391	1.45
AF139	0.58	BC176	0.26	BC323	1.15	BD175	0.90	BF181	0.53	BF443	0.55	MJ5305	1.22	TI334A	0.84	2N3254	0.58	2N6392	1.48
AF147	0.52	BC177*	0.20	BC327	0.16	BD177	0.58	BF182	0.44	BF444	1.02	MPF102	0.40	TI341A	0.72	2N3391A	0.38	3N128	1.60
AF149	0.45	BC178*	0.22	BC328	0.18	BD178	0.82	BF183	0.52	BF445	2.58	MPS3702	0.33	TI342A	0.80	2N3633	0.60	40250	0.98
AF178	1.35	BC178*	0.22	BC337	0.47	BD181	1.94	BF184	0.44	BF445	0.19	MPS3705	0.30	TI342B	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	2.40	BF185	0.42	BF446	0.20	MPS5521	0.36	TI342C	0.58	2N3705	0.19	40327	0.67
AF180	1.35	BC182	0.15	BC340	0.19	BD183	1.34	BF186	0.42	BF446	0.65	MPS5523	0.36	TI543	0.44	2N3707	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC341	0.17	BD184	2.30	BF187	0.14	BF446	0.38	MPS556	0.44	TI573	1.38	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC348A & B	0.17	BD187	1.20	BF195*	0.13	BF446	0.43	MPSA05	0.30	TI590	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14	BC349	0.17	BD188	1.25	BF196	0.14	BF450	0.38	MPSA06	0.32	TI591	0.28	2N3708	0.17	40429	0.88
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15	BF451	0.37	MPSA55	0.43	2TX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF198	0.29	BF452	0.36	MPSA56	0.45	2TX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BF453	0.36	MPSA93	0.56	2TX123	0.23	2N3772	2.08	40603	1.13
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BF459	1.98	MPSU01	0.33	2TX300	0.16	2N3773	2.90	40636	1.26
AL103	1.58	BC187	0.27	BC360	0.59	BD233	0.62	BF218	0.42	BPX25	1.62	MPSU01	0.61	2TX304	0.26	2N3794	0.40	40654	0.89

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# TELEVISION

## NEDC's PROGRESS REPORT

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### PRICE INCREASE

We regret the need to increase the cover price of *Television* from next month's issue, dated May, to 60p. This is due to the continuing effect of inflation on our overheads and production costs.

### CORRECTION

The circuitry shown in Fig. 2 in Les Lawry-Johns' article in the February issue (page 193) relates to the Rank Z718 chassis, not the Rank T20 chassis. Our apologies.

The recently published 1980 progress report of the NEDC's Electronic Consumer Goods Sector Working Party makes interesting reading. Though we spent £242 millions more on imported consumer electronics goods in 1978 than we managed to export, the report concludes that "there are grounds for optimism that the industry will survive the disappearance of the protection offered by the PAL Licensing system and the fall in TV rental." The UK's consumer electronics industry is overwhelmingly a matter of TV production, which has held up fairly steadily over the past three-four years. Not only that, but a fairly creditable (though unfavourable) import-export performance has been maintained on the TV side. Exports of colour sets over the period 1975-78 (the report's figures go only to the end of 1978) continued at 15-16% of production for example, something you might not have appreciated in view of the amount of industry knocking that seems to go on. Imports jumped about rather more, but don't seem to be too alarming. It's in the "other products" column that the huge import-export imbalance exists – all that Japanese radio and audio equipment (very sad for those of us who can recall when the UK's audio industry led the world – the days of the Leak Point One and Williamson amplifiers, the Ferranti ribbon pickup, and the Lowther PMI and Quad electrostatic (still going strong, that one) speakers, to name but a few).

While the SWP report concludes that there are grounds for optimism on the TV side, there are nevertheless some worrying aspects. One thing that indigenous UK TV manufacturers seem to have been bad at in recent years is making a profit – not the industry's fault so much as the result of sudden changes of policy by successive governments and, rather more significant, cut-throat high street competition. Unfortunately, lack of profit leads to lack of investment and, eventually, industrial decline.

Of present problems, the report singles out "the quality, price and availability of UK made components." It also comments that "there is evidence to suggest that devices imported by UK manufacturers from Japan and the Far East also compare unfavourably with the quality levels attained by the Japanese setmakers". This is a tricky problem to overcome, since you can't use improved components until they are available . . . One can't help but feel however that this is a problem that's been all too well known for all too long.

The report gives the impression that much reliance is being placed on Japanese setmakers to modernise and to improve the performance of the UK's TV setmaking industry. It comments that: "Five Japanese companies have CTV manufacturing plants in the UK, and it is hoped that their presence, with their ambitious productivity and export plans, and the pressures they can bring to bear on component supply, will do much to improve the sector's overall performance." It seems that "inward investment" from Japan is to be used to make up for the UK industry's lack of profits in recent years – the bait presumably being access to the EEC market.

So the current optimism takes on a rather curious light. Not doing too badly, and with enough Japanese help production will hold up. What of the future? Here the report expresses "concern about the lack of new product manufacture and development . . ." There is, it points out, "still no UK production of a long list of developments." Perhaps those helpful Japanese will start making VCRs in the UK, while if Philips are successful with their video discs we could perhaps expect a share of this market. Otherwise however we can't help feeling that an awful lot of tosh is at present being spoken about future developments. The SWP "believes that the coming of the 'Information Society' . . . is the most important event the electronic consumer goods industry will face over the next decade." One recent newspaper report we read talked of relating "everyman's thinking to the changed world in which information becomes the prime factor in production, relegating all the traditional ones like capital, labour and land." A horrendous forecast of a world of information for information's sake.

The SWP thinks that once homes are provided with interactive terminals people will use the services available, "e.g. electronic shopping and electronic mail." We'd suggest however that people won't use something they either don't need, have no inclination to use or have no time for. Should government funding be used to get the "information society" under way, i.e. provide the interactive terminals? Well, one of the UK's problems over the last couple of decades has been a tendency to invest in high-technology developments of doubtful use – things like Concorde. It's pertinent to remember that the Japanese success story has been based on the efficient manufacture of relatively low-technology products – motorcycles, cars, cameras, domestic electronic equipment and so on. We'd perhaps do better to rely not only on Japanese "inward investment" but also on their example in concentrating on sound products for which there's an obvious market.

# Teletopics

## HOME SATELLITE TV RECEPTION IN THE US

Various moves appear to be bringing closer the opening up of a home satellite TV receiving market in the US. The Federal Communications Commission has ruled that TVRO (TV receive only) stations can be built without a licence being required – this follows a period during which licence applications were granted on a "routine" basis. Satellite transmissions are widely used by US cable TV operators to increase the amount of programme material they can offer subscribers. The cable operators pay the programme originating companies to link up with the satellite transmissions, and it appears that scrambling will have to be adopted to obtain revenue from domestic users. The Communications Satellite Corporation (Comsat) has started negotiating with Sears Roebuck, the USA's largest volume retailer, on the development and supply of direct satellite to home TV equipment. This could consist of a three foot dish aerial plus descrambling and receiving units, at an installation cost expected to be in the region of \$200-\$300. The service itself would operate on a subscription basis, with viewers paying a monthly charge, and would require FCC approval. A number of amateur enthusiasts are already receiving the at present unscrambled satellite transmissions.

## BREAKFAST TV?

The present ITV franchises run to the end of 1981, and the IBA has now published details of the terms under which the new franchises will be offered. Of particular interest is the fact that the IBA will consider applications from organisations prepared to provide a nationwide breakfast time service – to operate between 6 and 9.15 a.m., seven days a week, with a suggested normal starting time of around 7 a.m. The contract would be for a service consisting primarily, but not exclusively, of news, information and current affairs. While the service would be nationwide, it's hoped that there would be regional elements.

## MULLARD REORGANISE TUBE PRODUCTION

Mullard are planning a major reorganisation of their colour tube manufacturing arrangements. Production of tube components and the glassware is to be concentrated at the Simonstown, Lancashire plant, with tube processing and finishing at Durham. The changes will take place over the next two years, with a loss of 200 jobs this year and a further 850 jobs in 1981, though it's hoped that most of this loss will be accounted for by natural wastage. The aim is to optimise the use of production capacity with improved utilisation of all resources. In recent times Mullard have been running their tube making operation at a loss – they've not been helped by the strong pound. Tube manufacture is highly competitive internationally, but Mullard have emphasized their intention of remaining in the business, and will continue with substantial investment – in fact production is to be increased to 1.5 million tubes a

year, split between the 20 and 22in. sizes which at present account for 75 per cent of UK market requirements. Other tube sizes will be available from associated companies. During the coming year, production will be changing over from the 20AX to the new 30AX tube, with continuation of the 90° 20in. tube. In view of the high-volume demand for 20 and 22in. tubes in W. Europe, Mullard expect to remain a strong net exporter of colour tubes.

## TAKEOVER ACTIVITY

Two major takeovers have changed the face of the UK electronics industry recently – first Thorn's takeover of EMI, and more recently Racal's takeover of Decca. The later leaves an interesting question in connection with TV setmaking, since Racal's activities are wholly in the professional and military markets. It's understood that Binatone and Rediffusion have both expressed interest in the Decca TV manufacturing capability, with its modern plant at Bridgnorth, Shropshire. Binatone are interested in producing their 2in. Microvision sets in the plant, and are also understood to have in mind a joint CTV operation with a S. Korean setmaker.

## TRANSMITTER OPENINGS

The following relay transmitters are now in operation:

**Aberystwyth.** TV4 ch. 54, BBC-Wales ch. 58, HTV-Wales ch. 61, BBC-2 ch. 64. Receiving aerial group C/D.

**Sutton-in-Craven.** Yorkshire Television ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-1 ch. 33. Receiving aerial group A.

**Uley,** Gloucestershire. BBC-1 ch. 40, HTV-West ch. 43, BBC-2 ch. 46, TV4 ch. 50. Receiving aerial group B.

The above transmissions are vertically polarised.

## VINTAGE EQUIPMENT

Interest in vintage wireless and TV seems to be increasing. We recently received a wodge of interesting information from The Vintage Wireless Company, whose office and showroom are at 64 Broad Street, Staple Hill, Bristol BS16 5NL. The company specialises in the sale of domestic radio and TV receivers from the period 1922-1955, parts and data for the above, restoration and overhauls (but not basic repairs), and so on. Where for example would you go for service data on the Baird Televisor? Well, it's in their list (would we be correct in assuming an article from *Newnes Complete Wireless*, which we stupidly lost during a change of office location rather more years ago than we care to dwell upon?). The company issues a monthly news sheet, which is available for a subscription of £2 a year (UK and Eire – £3 via airmail elsewhere). Two vintage radios are available from stock – the Philco People's Set of 1936, and the just post-war Ekco Model A22. Both in gorgeous Bakelite cabinets – the Ekco one was the last of a line of circular cabinet receivers, and has three wavebands. Not exactly cheap at £150 plus VAT, but rebuilt throughout and with a six months' guarantee.

## MATSUSHITA-JVC AGREE ON VIDEO DISC SYSTEM

Matsushita and JVC have announced the adoption of the JVC VHD (video high density) video disc system as a common format which they hope will eventually become the standard world-wide video disc system. Matsushita had

previously been developing a system using a grooved disc and pressure pick-up. This has now been dropped in favour of JVC's system, which stores the signal capacitively and employs electro-tracking. The grooveless disc makes random access and special effects possible, since the pick-up can move freely over the disc's surface. The video, audio and tracking signals are simulataneously picked up as capacitive variations, servo control being used to guide the pickup. The information is impressed on the disc in the form of a series of pits, and the discs can be produced using conventional disc pressing techniques. The system in fact seems to combine the information storage principle of the RCA video disc with the tracking/control idea of the Philips system.

### **PHILIPS VIDEO CENTRE**

Philips intend to start production later this year of what they call a video centre – a 26in. colour set combined with a 2000 series VCR and a built-in 6in. monochrome monitor. There'll be hi-fi sound, microcomputer control and infra-red remote control – at a price expected to be in the region of £1,600.

### **ORACLE'S DEALER DEMONSTRATION PAGE**

The ITV Oracle teletext service now includes a special dealer demonstration display – page 414. This consists of a number of pages, drawn from the general magazine and changing every minute or so when the receiver is left on page 414. The idea is to provide an attractive, changing multi-page demonstration of the varied offerings of Oracle for unattended window or showroom display.

### **NEW SETS**

Sony have introduced a completely new range of TV sets – four colour models and a stereo portable radio cassette recorder with built-in 4in. monochrome receiver (Model FX414BE). The latter features microphone mixing facilities, a one-touch recording system with auto shut-off in the record and playback modes, and triple purpose signal strength/battery state/recording level meters. The colour sets are the 16in. Model KV1612UB, 20in. Models KV2020UB and KV2022UB, and the 22 in. Model KV2204UB. All except the KV2020UB feature infra-red remote control. Improved power consumption is a feature quoted – the 22in. model has a power consumption of 98W for example, an improvement of 20W on its predecessor (Model KV2200UB).

ITT have added to their range a 16in. colour portable, Model CP9350. Features include infra-red remote control and a black stripe c.r.t.

About the only UK manufacturer of large screen monochrome sets these days is Pye. Two new models have been announced – the 24in. Model 185 and 20in. Model 182. They are fitted with the Pye/Philips E2 chassis.

Fidelity Radio have introduced their first TV set, a 12in. monochrome portable which has been designed and is produced exclusively by themselves. Use of the latest technology, together with the company's long experience of value-for-money volume production in the radio and audio fields (where Fidelity is the UK's leading manufacturer) should ensure that the set is one of the lowest priced quality models on the market. Fidelity's automated assembly methods will enable some 70,000 sets to be produced in the first year, rising to 100,000 units in the second year. The

monochrome portable market in the UK at present takes about 1.2 million sets a year. The new Fidelity model is expected to reach shops in the autumn. Rotary tuning will be used for programme selection.

### **RCA'S HI FI COLOUR**

RCA's latest up-market colour sets in the US incorporate an interesting new signal processing arrangement. It consists of a comb filter, using a CCD MOSFET i.c., which is employed to separate the luminance and chrominance components of the video signal. This means that the full luminance bandwidth is retained, increasing the horizontal resolution (from 260 lines to 330 lines), while the dot crawl and cross-colour that are an unavoidable part of conventional colour signal processing are removed. The filter is designed for the NTSC system of course, and it's not known whether development of a version for PAL operation is envisaged. (The comb filter principle is used in delay line PAL decoders to separate the U and V components of the chrominance signal.)

### **SINCLAIR DOES IT AGAIN!**

That well known electronics innovator Clive Sinclair has come up with a personal computer, type ZX80, designed to sell at under £100 – well £99.95 including VAT for the basic machine, plus £8.95 for the mains adaptor. The machine comes with a 128 page operating manual, which explains computer programming using the BASIC computer language. The ZX80 measures only 9 × 7 × 2in., and weighs 12oz. The price has been kept down by rationalising the design and omitting a display system – you simply plug it into a standard domestic TV set. The heart of the computer is a Nippon Electric Z80A microprocessor i.c., which operates in conjunction with a specially designed memory i.c. Apparently some 40,000 personal computers, most of them American, have been sold in the UK over the last couple of years. Mr. Sinclair feels that the main market for the ZX80 will be educational – for teaching children about computers and enabling businessmen to get acquainted with computer operation at home. He doesn't see much of a domestic market (storing accounts, recipes, telephone numbers etc.), and the machine is not intended for general business use. The ZX80 will also be available in kit form at £79.95.

### **BBC DEVELOPMENTS**

We've mentioned before in these pages the BBC's work on developing a TV subtitling system to aid deaf viewers. The system so far developed was demonstrated recently at a joint colloquium with the IBA (who are doing similar work), held at the IEE headquarters. The system uses a "Palantype" shorthand keyboard of the type used for verbatim court reporting. The shorthand the operator types normally appears on a narrow strip of paper. The keyboard has been modified however to provide an electronic output which can be fed into a computer. The latter in turn transcribes the messages into full English. The computer has a "dictionary" of over 80,000 words, and can convert the shorthand codes into correctly spelt English with "more than satisfactory accuracy". For transmission, the computer's output is simply linked to the Ceefax system.

The BBC can already transmit subtitles via Ceefax so that only those who want to see them need do so, but the problem is the expense of preparing the subtitles – it can

take up to thirty hours to prepare full but carefully edited subtitles for a one-hour TV programme. Palantype subtitling holds out the possibility of being much cheaper. The operator still has to listen to dialogue before typing however, so that "instant" subtitling of unscripted material is not quite possible – the Palantype subtitles would appear on the screen some five seconds behind the actual dialogue.

The results of the latest Palantype subtitling experiments are more than 95 per cent accurate – a very sophisticated computer programme that even allows for the individual characteristics of the operators, and the kind of shortcuts they might take when following rapid speech, is used to achieve this degree of accuracy.

Other BBC development projects include an all-digital telecine machine. The sensor consists of a 1,024 element linear array which scans the film sequentially at 25 or 24 frames per second to produce 625- or 525-line sequential outputs that are digitally stored. The information held in the field store is reordered and read out as a conventional 625-line/50 field or 525-line/60 field interlaced video signal.

The telecine machine's processing stages include matrix colour, gamma and aperture correction. To do this

processing digitally, the picture's dark areas should be coded to the accuracy of an 11-bit sample. The BBC's research team has devised a practical alternative to a full 11-bit analogue-to-digital conversion (ADC) however. This consists of a second 8-bit ADC, with preamplification by a factor of eight: the second ADC contributes three additional bits whenever the signal falls 12.5 per cent below peak white.

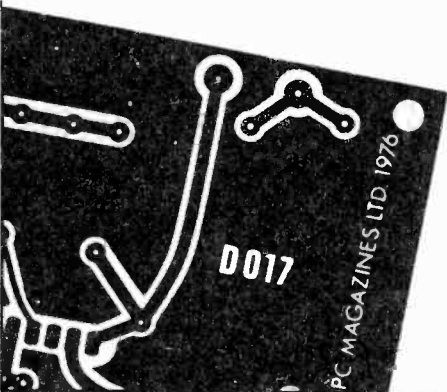
Another contribution to picture quality comes from the correction process needed with the linear sensor array. Correction for element-to-element sensitivity variations, unevenness in the illumination at the gate, and colour shading can all be entered into a single-line digital store each time the array is reloaded – the correction coefficients are simply applied as part of the digital signal processing.

An all-digital telecine machine can provide an improved picture – the BBC's machine is claimed to give an exceptionally clear and uniform picture – and as with other digital equipment there are the important features of stability and simple operation. The BBC expects to see all-digital telecine machines on the market within the next five years.



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Any correspondence concerning this service must be addressed to **READERS' PCB SERVICES LTD**, and not to the Editorial offices.



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AD161	75	AU111 2.90	BC142	39	BC213L	15*	BC636	27	BD222	.35	BF179	49	BF262	49	BF484	49	E1222	39	R2306	90	40636	1.75	
AD162	75	AU112 2.40	BC143	39	BC213L	15*	BC636	27	BD222	.45	BF180	49	BF263	52	BF484	49	ME8001	26	R2540	3.00	2N697	40	
AF115	60	AU113 2.90	BC147	15*	BC214L	15*	BC636	27	BD222	.45	BF180	49	BF263	52	BF484	49	MJE340	40	TIP29	43	2N2905	51	
AF116	60	AU110 1.29	BC148	10*	BC237	15*	BC636	27	BD222	.45	BF182	50	BF273	19*	BF488	49	MJE520	45	TIP30	58	2N3053	50	
AF117	80	BC107	18*	BC149	15*	BC238	14*	BD115	49	BD234	.47	BF183	50	BF374	24	BF490	49	MJE2955	149	TIP31	37	2N3055	74
AF118	59	BC108	18*	BC153	15*	BC239	12*	BD116	71	BD231	.58	BF184	49	BF374	43	BF510	50	MJE3055	129	TIP32	40	2N3703	20
AF125	59	BC109	18*	BC154	15*	BC239	12*	BD131	69	BD238	.50	BF185	49	BF336	49	BF512	50	OC28	2.40	TIP33	81	2N3704	23
AF126	61	BC113	15*	BC157	15*	BC237	15*	BD132	60	BD435	.78	BF194	15*	BF337	49	BFY90	1.19	OC35	2.00	TIP34	74	2N3705	19*
AF127	60	BC114	15*	BC158	15*	BC237	15*	BD133	69	BD437	.75	BF195	14*	BF338	49	BSY79	65	OC36	2.10	TIP41	43	2N3705	19*
AF139	60	BC115	20*	BC159	15*	BC238	14*	BD135	58	BD509	.58	BF196	14*	BF355	80	BRY39	49	OC44	40	TIP42	60	2N3707	19*
AF178	1.54	BC116	20*	BC160	39	BC384LC	22	BD136	58	BD509	.49	BF197	14*	BF362	47	BU105/01	1.69	OC45	43	TIP47	94	2N5296	69
AF180	1.60	BC117	19*	BC170B	20*	BC461	27	BD140	58	BD509	2.17	BF198	14*	BF363	47	BU105/02	1.64	OC71	49	TIP112	90	2N5298	77
AF181	1.61	BC118	19*	BC171	15*	BC462	85	BD144	2.49	BF175	.59	BF199	14*	BF422	47	BU108	1.80	OC72	49	TIP117	1.00	2N5496	61
				BC172	19*	BC463	65	BD150A	89	BF121	.21	BF200	21	BF423	51	BU110	3.00	OC76	37	TIP121	66	2SC1172Y	2.90

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BT106	1.50	OT112 1.50
BT108	1.30	TIC46 80

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BY164	60	KBS01 1.40
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BYW61	3.20	BR1 52
BYW62	3.20	BR2 74
BYW62	4.70	BR3 86
ITTC3D	6.0	BR4 82

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AA112	20*	BA115	22	BAX16	.08*	BY206	19*	BYX10	10*	IN4007	16*
AA116	16*	BA145	16*	BY126	20*	BY207	22*	OA47	18*	IN4148	06
AA117	16*	BA155	20*	BY127	15*	BY210/400	40	OA91	18*	IN4448	34
AA119	16*	BA156	20*	BY133	22*	BY210/800	50	IN4001	10*	IN5401	24
AA143	20*	BA202	18*	BY176	1.84	BY227	40	IN4002	10*	IN5402	32
AA144	14*	BA219	18*	BY182	1.03	BY251	35	IN4003	12*	IN5408	42
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AY106	2.30	BA317	44	BY187	1.00	BY298	70	IN4005	12*	ITT2002	38
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BT1601B	3.97	SN76023N	1.90	TBA720A	2.64
CS00	2.67	SN76023ND	1.51	TBA750	2.00
CA270AE	3.80	SN76033N	1.90	TBA800	1.62
CA270BE	3.70	SN76110N	1.90	TBA810AS	2.22
CA505	4.61	SN76226DN	1.96	TBA810S	2.22
CA158E	4.10	SN76227N	1.70	TBA820	1.50
CA2920AE	2.66	SN76228N	1.85	TBA890	3.94
CA2121	2.40	SN76530P	1.50	TBA920	3.23
CA3089E	4.46	SN76532N	2.00	TBA940	3.09
CA3090D	1.96	SN76533N	2.00	TBA9502A	3.07
ETT6016	3.20	SN76544N	2.00	TBA970	4.09
ETT6016	3.20	SN76546N	2.90	TBA990	2.93
LM1351	2.00	SN76566	1.30	TBA1440C	3.33
LM1370	2.38	TAA350A	2.80	TBA1441	3.33
MC1307P	2.80	TAA550A	.80	TCA270	3.00
MC1310P	2.40	TAA550B	.80	TCA270S	4.09
MC1327AP	3.27	TAA550C	.80	TCA290A	2.04
MC1327P	1.50	TAA570	1.98	TCA420A	3.23
MC1330P	1.00	TAA591	2.77	TCA440	1.98
MC1349P	1.99	TAA6118	2.83	TCA640	2.97
MC1351P	1.98	TAA630S	2.50	TCA650	3.42
MC1352P	1.65	TAA6618	2.63	TCA730	3.22
MC1358P	1.60	TAA700	3.91	TCA750	2.43
MC7724CP	1.60	TBA231	1.29	TCA800	3.12
ML237B	2.80	TBA240A	4.67	TCA820	2.27
SA457D	2.98	TBA325	1.57	TCA830S	2.13
SA4700	4.90	TBA395	3.34	TCA900	3.00
SAS605	3.30	TBA396	2.79	TCA910	2.90
SAS570S	3.30	TBA440C	3.30	TCA940	1.90
SAS580	3.64	TBA440N	3.30	TCE100P	3.54
SAS590	3.64	TBA480	2.20	TDA440	3.33
SAS660	4.20	TBA500	2.63	TDA440N	3.33
SAS670	4.20	TBA510	2.63	TDA1170	3.81
SC9503P	1.60	TBA520	2.00	TDA1412	4.18
SC9504P	1.84	TBA530	2.00	TDA2522	4.18
SC9506P	3.20	TBA540	2.20	TDA2530	3.83
SL437F	7.20	TBA550	2.90	TDA2560	3.83
SL901B	5.40	TBA560C	2.34	TDA2590	2.68
SL917B	6.99	TBA570	2.50	TDA2600	2.93
SL918A	6.99	TBA641A12	2.71	TDA3950	2.57
SN16848N	2.50	TBA641B11	3.99	TMS384BNC	4.37
SN16848NG	2.50	TBA641B13	3.00	ZTK33A	4.72

### EHT MULTIPLIER TRAYS

TCE1400 (5 Stick)	3.80
TCE1500 (3 Stick)	3.80
TCE1500 (5 Stick)	4.30
ITT CVC 5,7,8 & 9	6.40
ITT CVC 20.30	6.40
GEC 2028, 1040	6.40
GEC 2100	6.40
GEC 2200	6.40
PVE 691,693	5.50
PVE 731 (4 lead)	6.40
PVE 731 (5 lead)	6.40
PVE 713 15 17	6.40
PHILIPS 520,540,550	6.40
PHILIPS 550 (long lead)	6.40
PHILIPS G9	6.40
DECCA CS1730, 1830	4.00
DECCA CS2030, 2230 etc	6.40
DECCA CS19120, 213	6.40
DECCA 80/100/Telpro	6.40

### REPLACEMENT T.V. ELECTROLYTICS

TCE 1400	150, 100, 100, 100, 150, 325v	3.70
TCE 1500	150, 100, 150, 300v	2.05
TCE 950	100, 300, 100, 16 + 300v	1.60
TCE 3000/3600	650, 200+200, 300v	2.70
TCE 3000/3500	1000, 63v	1.06
TCE 8000	700, 250v	1.73
DECCA	400, 400 = 350v	3.72
DECCA	200, 200, 100, 300v	2.85
RR1/ITT	300, 300, 100+50 = 375v	2.20
GEK	1000, 2000, 35v	2.70
GEC/PH		

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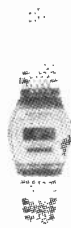
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Dual Time Zone  
Facility**

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- Split and timing modes.
- Alarm.
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- Back-light.
- Fully adjustable bracelet.

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M8

**SOLAR QUARTZ LCD  
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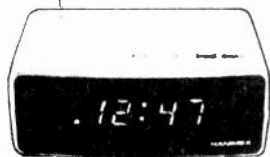
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M14

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# Wideband Hybrid Preamplifier

Luke Theodossiou

OUR latest preamplifier design, described in this article, is of the "blockbuster" type – it can be used as a mast-head or set-back booster, a preamplifier for MATV systems, or a general purpose wideband amplifier. It covers the frequency range from 40-860MHz (i.e. the v.h.f. and u.h.f. bands), features a typical gain of 27dB with a noise figure of only 5.5dB, and requires no external components apart from a 24V supply.

## Circuitry

The unit is designed around the Mullard OM335 thick-film hybrid integrated circuit. Fig. 1 shows the internal circuit. As can be seen, input and output d.c. blocking capacitors are included within the i.c., also supply decoupling, so that connecting the device to a power supply is all that's necessary.

A suitable mains supply circuit is shown in Fig. 2. There's no reason why two or three PP3 batteries connected in series cannot be used (the absolute maximum voltage is 28V). Alternatively a 12V supply could be used, but this will

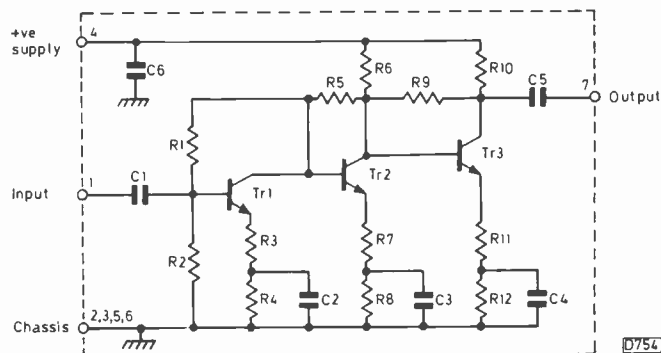


Fig. 1: Internal circuit of the Mullard OM335 thick-film wideband hybrid integrated circuit. The three stages are d.c. coupled, with a.c. coupling at the input and output.

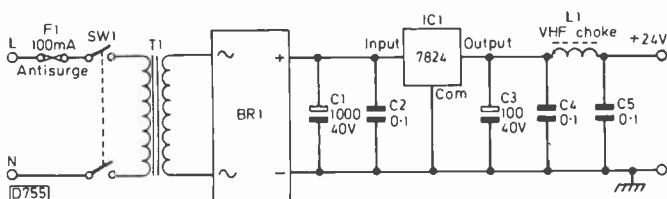
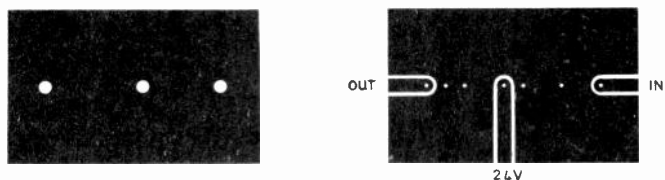


Fig. 2: Suitable 24V power supply for mains operation. The unit can alternatively be supplied by two or three series-connected PP3 batteries.



Figs 3 and 4: The double-sided print pattern for the board on which the thick-film unit is mounted.

reduce the maximum output level and the gain (to around 23dB). The device draws around 35mA with a 24V supply, so an on-off switch is required with batteries to ensure a reasonable service life.

## Construction

A double-sided PCB has been designed, with 75Ω input and output tracks to enable 75Ω coaxial cable to be soldered directly to the board. The board's double-sided copper pattern is shown in Figs. 3 and 4. The coaxial cable used can be either the aerial downlead itself or a link between the signal source and the equipment. If the unit is cased, the coaxial leads can be brought out to u.h.f. connectors mounted on the box.

When soldering the OM335 to the board, ensure that the maximum soldering iron contact time of five seconds (at 260°C) is not exceeded. Note that the black dot identifies pin 1 (input).

A simple method of supporting the PCB is to solder it to a piece of tagstrip which is then bolted to the case. The power supply can also be constructed on tagstrip – it's so simple we didn't consider it necessary to provide a PCB layout.

## Performance

A typical frequency response characteristic is shown in Fig. 5. The device will in fact operate at up to 1.4GHz, but the gain at this frequency falls to just over 13dB. The back attenuation (output to input) is 40dB minimum. The maximum output level with a 24V supply is greater than 80mV. The intermodulation figure quoted is -60dB.■

## Components list

- T1 Mains transformer, secondaries 2 12V 0.25A a.c. connected in series. RS Components 196-303
  - BR1 1A bridge rectifier. RS Components 262-157
  - IC1 7824 1A 24V regulator
  - C1 1000μF 40V electrolytic
  - C2 100n 50V ceramic plate
  - C3 100μF 40V electrolytic
  - C4 100n 50V ceramic plate
  - C5 100n 50V ceramic plate
  - L1 1A v.h.f. choke RS Components 238-255
  - F1 100mA anti-surge fuse
- Hybrid i.c. type OM335. RS Components 308-556.  
Suitable weather-proof box, e.g. RS Components 509-125

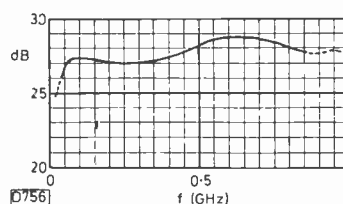


Fig. 5: Typical frequency response for the OM335, showing the wide bandwidth.

# VCR Troubles

Steve Beeching, T.Eng.(C.E.I.)

Just before Christmas a number of VCRs were brought in for repair – and all were wanted in time for the onslaught of transmitted goodies. One client sent along three JVC HR3300s, with the instruction to repair the two that belonged to his customers with spares taken from the third, stock machine. Not unreasonable, considering the problem of getting spares quickly in the pre-Christmas period.

## Rolling Picture (JVC)

Anyway, the first JVC I looked at had the reported fault “no sync”. This meant in practice that the replayed picture rolled. All the i.c.s on the servo board had been changed, and what’s more all the presets had been twiddled. A check with a pre-recorded tape however showed that the loss of sync was due to a tape path fault rather than, as the client’s service staff had thought, a servo fault. So a little time was spent adjusting the tape path almost into alignment before starting on the servos. The problem was that the entry guide was out of adjustment, causing tracking noise where the field sync pulses should be.

Each servo has two adjustments, phase (or sample pulse position) and discriminator gain. The HR3300 service manual gives full instructions for these adjustments, except for discriminator gain which is a little obscure. The basic idea is to define the current through the motor when this is held still, making the adjustment for zero differential input to the discriminator i.c. Fig. 1 applies to both servos (head drum and capstan), since the discriminators are identical. The procedure is as follows. With the machine unpowered, connect a 1.5V battery across the motor drive output. Connect a bleed resistor ( $R_{test}$ ) across the motor to set the voltage applied to the inverting input of the i.c. Then adjust for the same voltage at the non-inverting input. This is done by connecting a meter on the  $50\mu A$  range across the inputs, making the adjustment for zero current with the motor held still by hand.  $R_{111}$  is the head drum adjustment ( $R_{test}$  105.6 $\Omega$ ) and  $R_{76}$  the capstan adjustment ( $R_{test}$  33 $\Omega$ ). The other adjustments are straightforward.

## A JVC that wouldn't Play

The second JVC wouldn't play, that is the play button released itself after tape threading was completed. Now a number of electronic reasons and a couple of mechanical ones could be responsible for this. If one of the safety

circuits had a signal missing, the stop solenoid would operate, releasing all function keys. The procedure I adopt to check for this is to connect the base of X7 on the Mechon board to chassis, inhibiting the stop solenoid. If the keys still release, as the play key did in this particular case, then the problem is a mechanical one.

Two possible causes are wear in the notch of the drive arm assembly (part 106) or wear on the latching notch on the play key. The former involves a total strip down of the threading system (which I've done once), the latter requiring only the use of a needle file – to file the notch on the play key so that the latching bar holds better. What happens you see is that the final clunk after threading, when the guides are locked into place, causes vibration as a result of which the play key jumps and delatches.

For reasons beyond me, the servos on this machine also needed setting up. Obviously the Phantom Twiddler had been at work.

## Tape Counter Fault (JVC)

The third JVC, which was to have been used for spares, had very little wrong with it – once I'd sorted out the tape counter, whose electrical connections had been disconnected. This caused the same symptom as with the previous machine – the play key releasing after tape threading. This time connecting the base of X7 to chassis removed the problem, so that I was able to check and discover that the TUS signal was missing. Oh, and the servos were maladjusted again . . .

## Modulator Needs Adjustment (JVC)

More than a few JVC HR3330s are being unboxed and checked only to find that the modulator needs adjustment. This causes an intermittent random crackle (teletext), due to peak white signals slightly over modulating the video carrier and putting amplitude modulation on the sound carrier. The results obtained depend on the ability of the receiver to provide a.m. limiting during demodulation – in extreme cases it may be necessary to modify the receiver.

To check a VHS recorder for this, insert a cassette, press only the record key, and select an off-air channel (preferably on test card). Then compare the direct TV results with those obtained via the recorder. If the video contrast is higher via the VCR, it needs reducing. The procedure is as follows, and applies to the JVC HR3330 and HR3660 and the Ferguson 3V00 and 3V16.

Remove the bottom panel, then the modulator. Remove the modulator's side panel, then replace the modulator. The preset on the extreme left is the audio carrier frequency, that left of centre is for audio level. Video levels are at the upper and lower right, and Beeching's rule is: whichever preset is in the most clockwise position is the one to be adjusted anticlockwise. This rule applies until I get some service information that covers the modulator as well, though it's proved effective in all cases to date. Back off the preset carefully, while still comparing the direct and via VCR contrast levels, until the via VCR contrast matches that directly off air. If, after reducing the contrast level, a slight

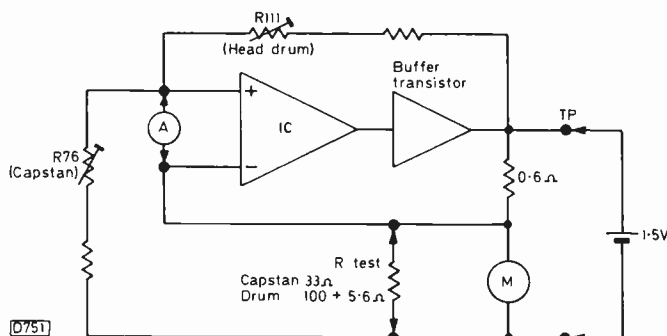


Fig. 1: Test circuit for adjusting the servo discriminator gain in the JVC HR3300 VHS VCR.

crackle is still heard this is acceptable provided it's not recorded. If the crackle is still high, JVC suggest adding a 6MHz ceramic filter across the take-off coil.

### Faulty Capstan Motor (JVC)

Another fault we've had with one of these machines is that the VCR would not respond to key operation after it had run for an hour or so. I ran a three-hour tape through the machine and then stopped it. Pressed the rewind key and it refused to operate. This was traced to a faulty capstan motor, which when hot developed a habit of not restarting once stopped, probably due to a lost segment winding.

### Loss of Colour on Replay (JVC)

Yet another nasty JVC VCR fault came my way – loss of colour on replay after an hour. You can play tapes through for days of course before anything happens, and when it does the fault may clear before you can find what's up. I was fairly lucky however. The first time I managed to discover that the colour killer had operated via the phase detector IC204. On the second occasion I found that the 4.43MHz reference signal to the phase detector was low. The measurement at TP215 was only 200mV when it should have been 1.1V. Ah! I thought, IC208 is faulty. Wrong of course. The trouble was eventually traced to the crystal, Xtal 202, but it took a whole day . . .

### Sony Betamax

Not many Betamax problems lately. One machine was brought in by a customer who was not pleased. Oh no! Not at all pleased. He'd purchased a copy of "The Bitch", and couldn't extract it from the Betamax . . . I found that after he'd watched the film he'd rewound the tape, at the end of which the machine had stopped and refused to release the cassette. This was because at the end of the rewind the stop solenoid had operated, to release the keys, and had shattered the stop solenoid microswitch. This had promptly fallen apart, cutting off all power to the main motor. Joan Collins suffered only minor damage . . .

### Hum Bar on Colour (N1501)

The problem with a Philips N1501 was that it would play back in colour and record in monochrome, but if an attempt was made to record in colour you'd get across the screen a large bar that would move up and down, rather like a hum bar. I've had hum bar problems before, but not in colour only. Anyway, the machine came in and at first nothing untoward happened. Then the hum bar appeared, and sure enough if the colour-killer was operated the bar disappeared, leaving a reasonable monochrome picture. Back to colour, and the bar returned.

A quick look at the 25V line with the scope revealed a bump where there should be a flat line. Reach for the freezer and squirt the BY164 bridge rectifier D151. The bump went, so did the bar across the picture. A new BY164 restored normal operation.

### Record and Tracking Faults (N1500)

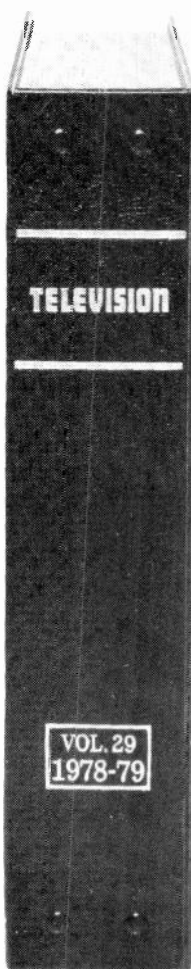
We had an interesting problem recently on a Philips N1500 VCR. It was picked up from a school, and had been to the local shop who'd been unable to repair it. The problems were no record, and no tracking control on

replay. The lack of tracking was soon traced to a wire off the control track head. Isn't it marvellous though the way we engineers will strip down a VCR, drag out the trusty scope, wire everything up and check for the presence or absence of various pulses before we check to see whether there are any loose wires? Why do it the easy way when the hard way will do just as well?!

The other fault, no record, did require the use of the scope – to discover that the record f.m. carrier was missing. I suppose the local shop couldn't check for that with the AVO . . . It didn't take long to find that one of the BSX20 modulator transistors had an emitter-base short. I've had this one before, way back in about 1974: whilst it's not exactly a stock fault it's worth noting since it can easily be mistaken for a video head fault.

### Threading Problems (N1500)

I've had to scrap an N1500 recently – the first one to suffer from the fact that parts for the N1500 are running out or just not available. The problem was that during tape threading and unthreading the threading motor worked o.k. but the head assembly was so stiff that it couldn't be pulled all the way round by the springs and string. Usually a few drops of oil will cure this problem. In this case however I had to strip the lower head assembly down and remove three metal plates. These are shown as part no. 509, or 507 in some versions of the service manual. They're coated with PTFE or some such substance, and this was worn through. As the surface was scored, no amount of lubricant would do any good. Oh well says I, sort out the part number and order some. No way however say Philips Service. So there you are, not available individually or as part of an assembly, at least so far.



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# Teletext the Philips Way

Harold Peters

AN ARTICLE on the Rank teletext receiver in the May 1979 *Television* featured the well established Texas Instruments' Tifax teletext decoder. This proven unit comes as a package to which the setmaker (or enthusiast for that matter) needs only to connect supplies and interface it to the set. For this reason no details of the internal workings of the unit were given nor, for that matter, are they needed.

From the Mullard/Philips stable comes a group of special-purpose i.c.s designed for teletext decoder use. These give greater flexibility, enabling setmakers to build up their own panels to meet their own needs. As well as layout variation, this group of i.c.s permits the optional inclusion of a number of novel features which are described below. Naturally setmakers are not left entirely to their own initiative: Mullard/Philips provide detailed application information and layouts, one such being used in the current range of Pye/Philips teletext receivers. These use the G11 chassis as a foundation. The way in which the interfacing is done will be better understood once a description of the decoder itself has been given.

## Features

A good teletext decoder should not only be capable of presenting the required page without errors and in colour: it should also have the essential facilities for newsflashes, timed pages and for revealing the answers to the puzzle pages. The Mullard/Philips package does all this, as well as character rounding, background colour and, in the interface stages, provides for superimposition of a full coloured page of text on top of the analogue signal (mixed mode).

The extra features available are: "Status", which provides a boxed programme identification at the top left of the screen for ten seconds whenever the channel is changed. "Time", which permits the teletext clock, normally seen to the right of the page header, to appear for ten seconds, boxed and double height, to the right of the analogue signal (the picture to old fogeys like me). The page header changes colour when hunting for a new page, reverting to white when the page is found. While waiting for the selected page to appear, you can watch the picture: when the wanted page has gone into the memory and is ready for display, the page header appears at the top of the picture for ten seconds – as an invitation to change back to text. Page 100 is automatically read into the memory at switch on or after a channel change – so you don't have to call up the index every time you want to go to text. The "time" facility previously mentioned means that some page or other must always be written into the memory, and this kills two birds with one stone. Most versions have a "local" double-height facility, so that a page can be split into its top and bottom halves and each half displayed double height for greater legibility. 22in. teletext sets really do need this in an average room. Incidentally, the characters in a double-height display appear to be thicker as well, but if you measure them you'll find that this isn't so.

A viewdata (Prestel) version of the chassis is also in

production: the extra electronics are currently mounted in a plinth beneath the console floor. It's not intended that teletext only sets should be convertible for viewdata use.

## The Decoder Chips

The teletext decoder itself is based on four special-purpose i.c.s known as the VIP, TIC, TAC and TROM chips. Two remote control chips complete a sextet.

The VIP – Video Input Processor, type SAA5030 – accepts a positive-going video signal straight from the vision detector (see Fig. 1). It ignores the analogue (picture) information, removing the data signal by means of an adaptive slicing technique. This looks at the data exactly halfway between zero and one, regardless of amplitude and baseline variations. The result is optimum teletext eyeheight, in turn providing better legibility (if you want to know more about eyeheight, see the January 1978 issue).

There are two clock signal generators in the VIP. One produces an output at 6.9375MHz, the bit rate of the incoming data, the other operating at 6MHz. The 6.9375MHz clock is derived from the clock run-in at the start of a received data row. This causes a high-Q tuned circuit to ring, and is kept in step with the incoming data by means of a control loop circuit. The 6MHz generator is crystal controlled and locked to the incoming picture sync pulses: its output goes to the TIC chip, where line and field pulses are generated for the control of the data raster.

The VIP's outputs go two ways then: the 6MHz clock to the TIC, and the data and 6.9MHz (for short) clock to the TAC.

The TAC – Teletext Data Acquisition and Control, type SAA5040 – receives the data and 6.9MHz clock signals from the VIP and also instructions from the user via the remote control receiver decoder (which has its own, much slower, clock pulses). The TAC's purpose is to select the required page and pass it to the decoder's memory – it does this via a seven-bit data bus. Also passed on, via a five-bit data bus, is the row address instruction. Part of the TAC's function therefore is to convert the incoming serial data stream into two outgoing parallel data streams.

The TAC has its own small inbuilt memory, in which is stored the control data necessary to select the required page/time, depending on the instruction code passed on from the remote control receiver. The same memory also contains the programme to store page 100 in the absence of any other instruction, and to display the previously mentioned status and time boxes on the screen when required. The programme for top or bottom half of the page at double height is also stored here.

The TIC – Timing Chain, type SAA5020 – uses the 6MHz clock signal from the VIP to produce all the timing pulses required to generate a page of text. Since each text character is a microsecond long, and each dot of the character occupies a sixth of the character's width, you can see the reason for a 6MHz clock – it's running at the dot rate.

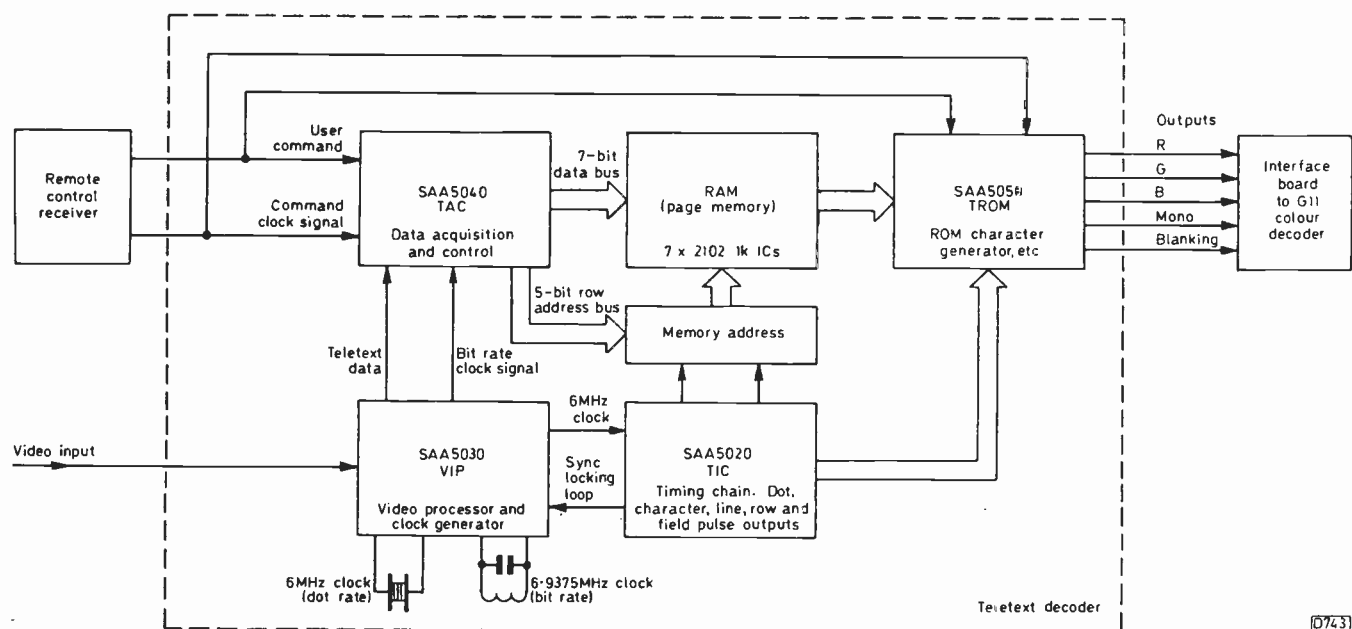


Fig. 1: Block diagram of the teletext decoder used in Pye/Philips teletext receivers.

The TIC divides the dot rate by six to get a 1MHz clock signal (character rate), then by 64 to obtain line-frequency pulses, and again by 625 to get down to the field rate. The line-rate pulses are further divided to produce the rows, and are also fed back to the VIP to lock the clock to the incoming signal.

As an optional facility, a stored page can be read after TV hours by allowing this timing chain to free run.

The TROM – Teletext Read Only Memory, type SAA5050 – converts the stored page held in the RAM (Random Access Memory – a group of i.c.s we've not yet mentioned) into the dot matrix pattern of characters comprising the text we see on the screen. The input is in parallel form, but the video output signals must be in serial form. The TROM also carries out character rounding, and the graphics blocks that take the place of text characters on pages such as the weather map are also generated in this chip. There are five outputs from the TROM to the set's video stages – RGB as you'd expect, plus monochrome and blanking. The monochrome signal has a variety of uses other than to provide a signal for black-and-white sets: it can be used to complete the matrix in the unlikely event of the decoder meeting up with a TV chassis employing colour-difference tube drive, and in the Pye/Philips teletext sets it's used to "punch holes" in the analogue signal when the mixed mode is used – so that the coloured text is presented on the screen when the set is used in this picture-plus-text mode. The blanking output provides boxes into which the time, status or newflash text is inserted.

### Page Memory

In addition to the four special-purpose i.c.s we've just mentioned, ten other i.c.s provide a memory in which a whole page of teletext data is stored. This consists of a matrix of seven 1k memory i.c.s, type 2102, though later on special 8k memory i.c.s may replace them.

The teletext format consists of 24 rows of 40, seven-bit characters, but as the 1k RAM i.c.s are organised on a 32 x 32 basis some re-arrangement is required to store a selected page. Three i.c.s (a 74LS83A and two 74LS161s) perform this operation. The memory stores the appropriate page until told not to do so. Three situations will do this, clearing

the memory for the next page: a command from the user's handset; receipt of a newly selected teletext page; and receipt of the clear page command from the broadcaster (as given with a rotating page). The clear page operation is put into effect by arranging for the TAC's data output to consist of the character code for a space: unless followed by further instructions, the TAC will then automatically call up page 100 as previously mentioned.

By now you'll probably be wondering what about switching – how does the memory know when to accept data and when to issue it? In effect, little switching is needed since teletext is basically organised so that the data is coming in at a different time from when it appears on the screen. The data entry window (time when the incoming data is present) is during the field blanking interval, anywhere between lines 6 and 22, though at the moment only lines 17 and 18 are used. The display starts a little way down from the top of the raster, on line 48, and continues to line 288, allowing a clear space of 26 lines between the data's entry time and its display. During this time, on line 40 to be exact, control information from another part of the TAC chip is sent to the page memory, where it's written in to control such functions as channel indication, time, selected page ready and so forth. Some more capital letters: this line is called EDIL (Encoded Data Insertion Line), and is unique to the system being described.

### Ancillary Circuits

When you look in the back of the set, you'll notice that the teletext decoder board is but one of the extra boards not found in an ordinary G11 chassis. The boards adjacent to the teletext decoder board are the remote control receiver plus its own decoder. These bear a superficial resemblance to the system used in the non-teletext G11, but the ultrasonic receiver is the only common feature.

The remote control handset is capable of transmitting 32 different commands, each consisting of a 24-bit signal – typically of 200msec duration. The 24-bit signal is divided into two halves, the first twelve bits being the complement of the second. The idea is that each half must match up before the receiver's decoder accepts the command. Of a 12-bit sequence, the first seven bits are the start code, which is

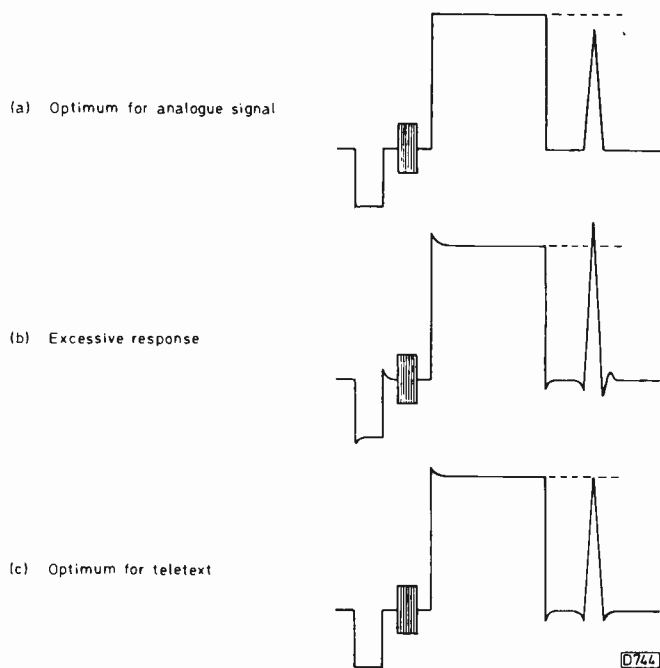


Fig. 2: Use of a pulse and bar signal to achieve optimum data capture: best conditions for teletext reception are when the amplitudes of the bar and the 2T pulse are the same and the lobes at either side of the pulse are symmetrically disposed below the datum line (black level).

identical for every command, and the last five bits the command itself. This arrangement ensures that the set doesn't respond to corrupted or spurious signals. To give the user added confidence, an occulting "message received" lamp at the foot of the cabinet glows while the message is being passed. The same lamp, operating in a steady mode, is used to indicate that the set is in the stand-by condition, i.e. with the TV switched off but the remote control receiver still in operation.

One of the 32 commands is "mode", which permits the majority of the other commands to have a dual function. For example, the buttons for page 123 in the teletext mode will select BBC-1, BBC-2 and ITV respectively in the TV mode, using the same 24-bit words.

Power from the battery in the remote control handset is always drawn by its i.c. even when no command is being made. When not being used to transmit a command however the current drawn by the i.c. is as small as that drawn by a digital watch, so there's little wastage. The i.c.

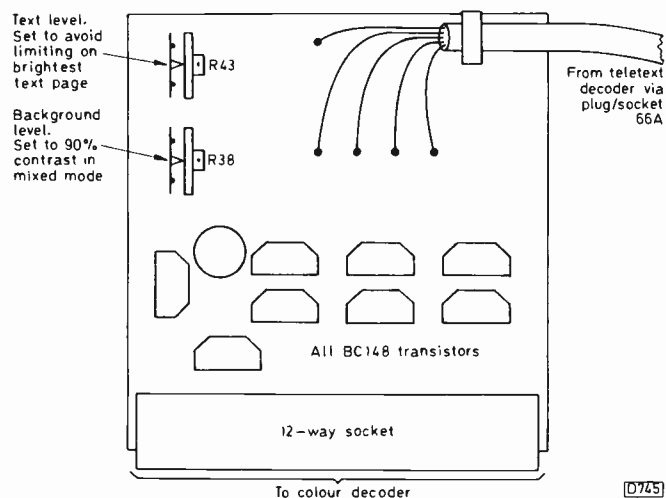


Fig. 3: Layout of the small teletext interface panel used in Pye/Philips teletext receivers (modified G11 chassis).

begins to transmit the command as soon as a button is pressed, continuing until the command has been completed, even if the user's finger has left the button.

There's no provision in the Pye/Philips sets for either a wired-in handset or for selecting text at the cabinet itself.

### Power Supplies

The various supplies for the boards are provided by a unit in the base of the cabinet. This uses a chopper circuit. Later versions derive the power required from the line output stage.

### Interfacing

The teletext decoder's signal input is taken from a standard G11 i.f. strip – at the inverted sync outlet. To ensure best performance, the eyeheight is optimised by using a pulse and bar i.f. signal to adjust the synchronous demodulator precisely. Optimum data capture usually occurs when the lobes (see Fig. 2) at either side of the 2T pulse are symmetrically disposed below the datum line: this condition sets the vision carrier a little below 6dB from peak (the latter is its usual place for analogue reception). Because the i.f. strip's sync outlet is used, the signal is inverted at the input to the teletext decoder. At the same time, the 6MHz intercarrier sound signal is filtered out.

The RGB outputs from the teletext decoder enter the G11 chassis proper at the back end of the chroma/luminance board. The board is modified so that the path of the TV signals is interrupted and at this point a small interface unit is plugged in (see Fig. 3).

There are two preset controls on the interface unit. The one nearest the socket strip is the background control and is normally set, in the mixed mode, to reduce the contrast to 90% of normal. This has been found to give the most acceptable level when pages are superimposed on a programme. The other control, farther from the socket strip – at the corner – is called "text level". It's not set too high during production, to avoid beam limiting occurring on pages with a lot of background colour. Some dealers wind it up a little however to compete with other makes – it's reassuring to know that it can be easily reset for domestic use. The eye, being used to reading black characters on white pages, is easily tired by prolonged exposure to the "negative" teletext display – particularly if there's too much contrast.

### Modifications

Current production Pye/Philips teletext receivers use the Signetics "SAA" range of decoder chips, the panels bearing green labels. To dealers, this is "Phase 1½". Earlier sets, few in number but produced to meet the demand for sets at the start of the service, use chips with preproduction "M" numbers on them. The performance is identical, but there's a degree of board non-interchangeability. "Phase 1" units carry a white label and must be used with Phase 1 handsets and remote control receivers. Phase 1½ units carry a yellow label, and although the handset and remote control receivers are compatible with the green label Phase 1½ ones the decoders are not directly interchangeable. The only difference is a small 6V regulator board which is plugged into the Phase 1½ units and is not required on Phase 1½ units.

At the start of 1980 the six-way ultrasonic remote control system was replaced by an infra-red counterpart. Also, in anticipation of the fourth TV network, the tuning system has gone eight-way – useful to viewers who can receive

from two sets of transmitters. The only change in the teletext decoder is the TAC i.c., which becomes type SAA5040A and contains the extra information to display the two extra channels available. No harm will be done by using an SAA5040A to replace an SAA5040, or vice versa, but in this event the status displayed on the screen will not tie up with what's printed on the control panel.

### Servicing

Unless you are good at working at 50nsec, can gate out a teletext eye, have your own "wallpaper generator" and a scope that looks at pulses, leave the decoder severely alone.

The four special chips are MOS devices and, provided you use the makers' advance replacement schemes, decoder panels will come in the correct conductive plastic bag which can be used to store them safely. Failing this, quickly wrap units in baking foil, handle them only by the edges (as you would an LP), and never handle them in a set connected to the mains or on stand-by. Wait until the replacement arrives before removing the old board, then change the units straight over.

Since the power supply is conventional, this can be safely worked on in the normal manner. When looking for lost voltages here, don't overlook the thermal fuse in the mains transformer. Three supply lines go from the power supply to the teletext units, and combinations of failures of these can produce various symptoms as follows.

*No main 5V supply:* Bright blank raster, flyback lines, set pulsating due to the action of the beam limiter. The message received light still winks during commands.

*No main 5V and 12V supplies to the remote control receiver:* No picture or sound apart from a three second burst at switch on.

*No secondary 5V supply:* Normal picture, weak colour, no handset action.

*All teletext supplies dead:* Picture present, weak colour, no sound, no remote control action.

If the set writes "scribble" in the teletext mode, either the decoder is faulty, the i.f. mistuned or there's aerial trouble (in that order).

To isolate a faulty teletext unit, unplug the white eight-way connector 66A from the decoder. The set then reverts to ordinary TV operation.

To keep the set going with faulty interfacing, remove the interface unit, join pins 5-6, 8-9, 11-12 on the chroma board, and remove plug 66A as above.

A weak battery in the handset may give a short control range or errors before packing up altogether. The type is PP3, and a plastic bag is provided to stop it ruining the handset if it leaks. Remove the battery during long idle spells, and in any event replace it once a year.

The clockcracker engineering test page is the installation engineer's yardstick for checking data capture. If you've handled both the Philips/Mullard type units and the Tifax module you'll know that clockcracker performance doesn't relate directly to page legibility. On a Tifax unit, a corrupted page of news can be seen at the same signal level as a perfect clockcracker page. On the Philips/Pye sets things work the other way round. Here the clockcracker display rows become corrupted (mostly to blank rows) towards the right-hand edge as the signal conditions get worse.

This provides a handy way to get the most out of an installation - if you're patient enough not to make more than one adjustment per clockcracker page read-in. On Pye/Philips sets, a clockcracker page that's more than three-quarters complete will almost certainly mean good legibility on any chosen text page. ■

## next month in

# TELEVISION

### ● MONOCHROME PORTABLE PROJECT

Since the publication of our previous monochrome portable project in 1977, circuit techniques have advanced sufficiently to justify a more up-to-date design, starting next month. Particular attention has been paid to improved performance and easier construction. For instance a SAWF provides the selectivity in the i.f. module, and the tuner a.g.c. is derived from the broadband i.f. signal before any shaping takes place. This provides better a.g.c. performance, which is important in a portable. The video output stage uses a cascode design, giving good h.f. response and excellent black-level stability.

In common with current practice, a single-chip sound channel and a line output transformer with a built-in e.h.t. rectifier are used. We've gone one better in the line output stage, eliminating the usual line driver transistor and transformer through the use of a Darlington line output transistor. A well-tuned stabiliser circuit allows for battery as well as mains operation.

A number of different tubes can be used, so long as they are of the 110°, 20mm. neck variety - the screen size is left to constructors' preference. The circuit is built on two main boards (plus the tube base board) to allow for maximum flexibility when mounting in a case, particularly when a small size tube is used.

### ● VCR COLOUR SYSTEMS

Special colour signal processing techniques are used in many VCR designs to avoid possible interference effects from signals on adjacent tracks. Steve Beeching explains the basic systems used in VHS and Betamax machines.

### ● SERVICING HINTS

Dewi James on recent fault experiences with the Philips G11 and Pye 731 series chassis.

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# TV Faults

Robin D. Smith

You get some odd customers. Take this little story. The set was an ITT CVC9 which was arcing and emitting a cloud of smoke. It didn't take us long to ascertain that the line output transformer had shorting turns. On replacing this we had a correctly sized picture, but with a very noticeable hum bar. Checks around the power supply proved that the fault was not there, and after some time we discovered that the earth bar connecting C299, C300 and R408 in the width circuit to chassis was completely dry-jointed. Actually this was slightly misleading – there were no signs of any original solder. After resetting the width controls and reconverging, the set was working to our satisfaction. We asked the customer about the hum bar and he commented that "he forgot to tell us". About a week later the set came back, with the complaint that the hum bar was still present. Switch it on and we found excessive scan, both height and width, and gross misconvergence. Carry out readjustment and soak test for quite some hours, but no evidence of any hum bar. We came to the conclusion that the customer must have had the back off, got himself into a mess, and brought the set back with a fictitious complaint. So we put a rude note across the convergence controls, warning what we would do if they'd been tampered with again.

The set went back and we didn't mention our conclusions. We hoped that that was that. A week later however back came the set and this time it hadn't been tampered with (had he got the message perhaps?). In view of the series of complaints we decided to keep the set for a few days, providing a loan set in its place. Within a few hours the customer phoned to say that the loan set had the same problem.

Perhaps we should have checked before where the customer lived – in a mobile home he'd wired himself. So we went off to check his supply, which turned out to be only 180V. We don't run an electrical business, so we decided not to look into his wiring fault. While we were there however we noticed a large step-up transformer beside our loan set. What was it for? "Ah, when the mains drops, I connect this up to the set." We think we now know why his line output transformer burnt out: at some time it had received more than 240V. Also why he'd tried to get more width.

We left him to make arrangements to get his electrical supply sorted out. He rang back a short time ago to say that all was now well. I only hope so.

## Thorn 1600 Chassis

The trouble with a 17in. monochrome "transportable" fitted with the Thorn 1600 chassis was field collapse. This was one of the early versions, and the trouble was simply a defective SN76033N field output i.c. (IC4). On replacing this the set worked and we decided to overlook the fact that the picture was over scanned. Two days later however the set came back with the same fault, and remembering the over scanning we decided to check the supply voltage before fitting another i.c. The voltage at pin 10 of IC4 turned out to be 36V instead of 29V, so we next checked back to the supply source. This is the shunt regulator circuit (see Fig. 1)

which is in series with the line output stage and is supplied from a rectifier fed by a winding on the line output transformer. We first checked the voltage between the junction R158/C130 and the cathode of W34 – the test points for setting up the h.t. supply. The voltage here turned out to be 180V instead of 140V, and adjusting the set h.t. control R149 made no difference at all. After making various checks we eventually found that R157 (39Ω), which is part of the mains dropper, was open-circuit.

A replacement dropper and new i.c. were fitted. We switched on and again monitored the h.t. It was now down to about 160V, and the picture was no longer over scanned. R149 still had no effect however, while R157 appeared to be getting excessively hot and was smelling. We assumed therefore that the regulator was not working correctly, and after some exhaustive checking we found the cause of the trouble: the insulating washer that should shroud the bolt securing regulator transistor VT18 was missing, with the result that VT18's collector was connected to chassis and excessive current was passing through R157. On fitting a shroud the set h.t. control R149 operated and we were able to set the voltage at 140V. The picture was now under scanned, but this could be corrected by means of R95 (height) and L23 (width).

Now no work appeared to have been done on the regulator before, so we can only assume that the shroud had been left off during manufacture. One wonders how long the situation could have gone on without further damage.

## Rank T20 Chassis

The problem of spasmodic intermittent black lines on sets fitted with the Rank T20 chassis has been mentioned before

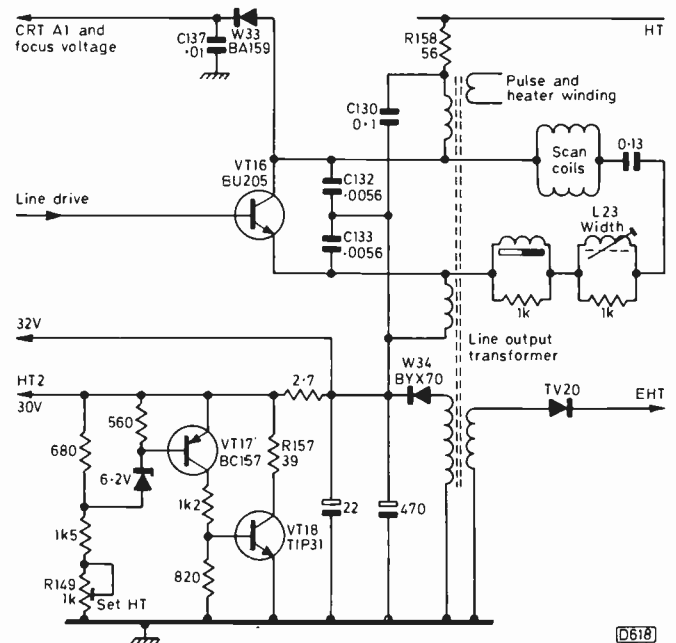


Fig. 1: Simplified circuit diagram showing the basic line output stage configuration and the shunt stabiliser used in the Thorn 1600 and similar chassis.



in these pages, in *Teletopics*. I feel it's worth mentioning again however, as we've had many cases of this problem. Any movement of the chassis may seem to clear the fault, but the symptom usually reappears after a period of time. The fault is due to pin 9 of plug 3Z6, the chassis link between the scan drive and the signal panels, and the best cure is to remove pin 9 completely from the loom and solder it direct to the pin adjacent to R65 on the signal panel.

One of these sets came in with the fault excessive width, the width control 4RV13 being inoperative. The associated transistor 4VT14 (BC148B) was found to be short-circuit, replacement curing the trouble.

What to do when confronted with the "dead set" symptom on a Rank T20 or T22 chassis? These are the chassis with the switch-mode power supply remember. A simple procedure is as follows:

- (1) Switch on and listen for the e.h.t. If this fails to appear, check for h.t. at the collector of the line output transistor 5VT4.
- (2) If you find only 15V, disconnect the power supply (plug 5Z2) and see whether the h.t. (200V) is then present across pins 1 and 2 of 5Z2. If so, the power supply is in order and the line output transistor is suspect.
- (3) If h.t. is present at the collector of the line output transistor, disconnect the driver and output transistors 5VT3 and 5VT4 and carry out d.c. checks on them.
- (4) If they are o.k., disconnect the tripler.
- (5) If this restores normal operation, check 5C17 and then the tripler—5C17 is in the beam limiter circuit.
- (6) If the fault remains, remove the over-voltage trip sub-panel from the main board. It should then be possible to locate the fault by carrying out resistance checks.

We had one of these sets in with tripping and after following the above procedure we still had problems. Disconnect the tripler and the tripping stopped. Check 5C17 which was in order, fit a new tripler, but the problem was still present. It was the line output transformer, with shorting turns in the e.h.t. overwinding. Hence disconnecting the tripler stopped the tripping. A bit misleading, but interesting.

### Thorn 1500 Chassis

The fault condition presented by a Thorn set fitted with the 1500 chassis was a white raster with no sound. A quick check on the supply to the i.f. strip immediately indicated that the fault was in the HT6 line, as the voltage here was over 40V instead of 26V. This, as regular readers will know, is what happens when R79, part of the mains dropper, goes open-circuit (see Fig. 2). This removes the base bias for the video driver/6MHz intercarrier sound amplifier transistor VT8, and thus the signals. The high HT6 voltage unfortunately leads to damaged transistors in the i.f. strip however.

A complete new dropper was fitted, but there was still no sound or vision, accompanied by what I can only describe as pulsing vision. I decided to tackle the sound fault first. This turned out to be a simple matter — the audio circuit h.t.

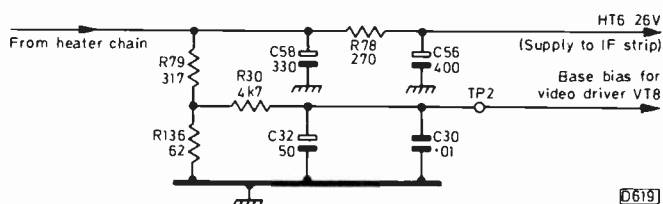


Fig. 2: Derivation of the i.t. supplies in the Thorn 1500 chassis. The voltage at the junction of R78/9 should be 43V.

feed resistor R96 was open-circuit. Replacement restored operation of the audio circuit — checked by injecting a signal at the control grid of the triode section of the PCL82 audio valve — and for some unknown reason stopped the pulsing.

The lack of signals was due to damaged transistors in the i.f. strip of course. VT6, VT7 and VT8 (third and fourth i.f. stages and driver) all had incorrect voltages. Replacing the driver VT8 produced a grainy, unsynchronised picture; next replacing VT7 cured the graininess and improved the sync; and finally replacing VT6 gave us a good, contrasty picture with good field lock but poor line lock. The locking problem was due to the usual 47k $\Omega$  resistor (R44, sync separator screen grid feed resistor) going high in value. During a soak test it was noticed that the field had a tendency to slip, a new PCL805 curing that problem, and by now we had a very good working set.

### Rank A774 Chassis

A single-standard monochrome set fitted with the Rank A774 chassis gave us a certain amount of trouble recently. To start with there was insufficient width, the line speed was incorrect, and there was line foldover, with a jagged line down the middle. My first suspicion was the line output transformer, which is always going faulty in various ways on this chassis. I was wrong however, so attention was turned to the line oscillator circuit. As a first step 3R51 was disconnected, thus removing the output from the flywheel line sync circuit to the line oscillator. This action resulted in an unsynchronised, correct width picture, so the fault was obviously in the flywheel sync circuit. Check the diodes first of course, and 3D6 was found to be short-circuit.

In went a replacement, but we then found we'd neither line nor field sync. The scope was at hand, so we took a look at the pulses at the collector of the sync separator. They seemed to be all right, but as there were unlikely to be two separate faults in the timebases I decided to concentrate on the sync circuit. Before making any further checks I studied the screen carefully, noting that the screen was darker on one side and lighter at the other, with the symptoms of a poor tube. This indicated what was wrong, as we'd had the trouble before. The a.g.c. reservoir 3C6 (1 $\mu$ F) and smoothing 3C5 (4 $\mu$ F) capacitors were virtually open-circuit, thus upsetting the gain and the sync pulses.

Replacing these capacitors cured the sync fault, while the picture lost its graininess, but I was still left with line tearing. This was the usual earth bar fault, and after resoldering the earth straps a correctly synchronised picture was at last obtained.

### Poor Sound

An OAP customer of ours who is going deaf complained that the sound on her set (a Thorn 1400) was poor. It seemed all right to us when we called, but we decided to bring the set into the workshop for some checks. With the set on the bench the gain at u.h.f. seemed a little low, and the sound was low, but maybe this was just due to the set ageing. We don't have a 405 aerial any more, though we can usually see at least something on our v.h.f. radio aerial. This time there was no sound or vision however. Voltage checks in the i.f. strip revealed that the first vision/sound i.f. amplifier valve V3 had no screen grid voltage. A check with the valve removed revealed correct voltage at the base, so the fault was obviously in the valve. Fitting a new EF183 restored normal u.h.f. sound and produced a much better picture, and the feed resistor didn't seem to have been affected by the defective valve.

# Video Disc Systems

*David K. Matthewson, B.Sc., Ph.D.*

A CASUAL glance through any of the more popular TV journals could lead you to believe that a new dawn in TV is just around the corner – in the form of video discs. Indeed phrases like “early next year”, “cost equal to that of a good television set”, “on-going pilot market trial situation” are bandied about by the PR men with great zeal.

Well, we shall see. I'm old enough however to remember the build up given to the Teldec video disc system some ten years ago, while Baird's video disc system (Phonovision) was first shown in 1928. Both these systems were briefly on sale in the UK, but met with little success. Philips have been pushing VLP – their disc system – for quite a few years (it was first unveiled in 1972), but it has yet to appear on the UK market: 1981 is the latest predicted year for a domestic market launch in the UK.

What is it then that's so far prevented the video disc from making any real impact on the market, and what are the real advantages and possibilities of video disc systems?

The quick answer to the first question is technical problems. To understand what these are and how they can be overcome, let's look at some of the principles of operation that can be used for video disc systems.

## Basic Disc Systems

The first video discs to appear on the market went on sale at Selfridge's Oxford Street store in 1935 – at seven shillings each. They were intended for use with the Baird television system, i.e. the system was a low-definition one, with about six minutes per side from a 78 r.p.m. disc. Because of the very limited bandwidth, conventional disc cutting, pressing and playing techniques could be used – with a thorn needle!

So much for history. Many new video disc techniques have been developed since the 1930s – in fact I've found reference to some forty different systems. The fundamental difference between the systems is the method of recording the video signal. There are four basic techniques, mechanical, capacitive, magnetic and optical. Each has advantages and disadvantages. Let's look briefly at each.

The first, historically, were mechanical arrangements – we've already mentioned Baird's system. By mechanical, we mean that the signal modulation is present in physical form in the disc's groove, and is sensed by a pick-up which is in contact with the disc. Mechanical systems have the advantage of using relatively simple technology, and thus have a low initial cost. The TeD or Teldec system, jointly developed by Decca in the UK and Telefunken in W. Germany, was shown in 1970 as a monochrome system and was up-graded to compatible colour in 1974. It never appeared on the domestic UK market, though it made a brief appearance in W. Germany. Apart from one institutional UK user, it's totally vanished from the scene. The main technical features of the Teldec system were the use of f.m. for the recorded signal and the fact that the pickup remained at a fixed height, the flexible disc being brought up into contact with the pickup head by air pressure from beneath. The disc rotated at 1,500 r.p.m., i.e. 25 revolutions per second = two fields (one picture) per revolution. This provided a playing time of around ten minutes, the real

disadvantage of the system (the picture quality was very good). Attempts at an autochange system to extend the playing time were reported, but never seem to have come to anything.

Capacitive recording is used by the RCA Selectavision system, the JVC Video High Density system and the little known Polish Fonica system. Of these three, only the RCA system seems anywhere near putting in a market appearance. Basically, the sound and vision signals are recorded as capacitance variations along the disc's track. The disc has metal and plastic layers in order to provide the capacitive effect, and the signal is sensed by a capacitive pickup with a diamond and metal stylus. RCA are understood to have pressed several hundred thousand discs for laboratory and field trial use. They've also invested very heavily in developing the system.

Magnetic recording is the only practical method of providing recording and playback on a single unit – the other systems are designed for replay only. Magnetic disc recorders have been used by professional broadcasters for many years, and are a source of sports' stills and action replays. The Ampex HS2000, one of the first disc recorders, continuously records, reads and re-records a magnetic disc. The process takes 45 seconds, so this is the maximum storage time. Fine for penalties and ski jumps, but not much use for general purposes.

Only one magnetic disc system came anywhere near the domestic market – MDR (Magnetic Disc Recorder), produced by a German and French company and first exhibited in 1974. This used a double-sided, 305mm. disc running at 156 r.p.m. to give a playing time of about twenty five minutes per side. Prices suggested in 1976 were £375 for the player and £5 per disc. The system never materialised however and seems to have vanished.

The final technique is to scan the disc optically, i.e. by means of a light beam. The signals are recorded in a form that modulates the light beam. This is the technique used by the only disc system to have been sold in fair quantity, the Philips/MCA VLP (Video Long Play) system, which uses a low-power helium-neon laser to scan the disc. The signals are recorded in the form of a series of very small pits which vary in length. The laser interprets this as a form of pulse position modulation. The pits are arranged in the form of a spiral track, with no mechanical contact between the disc and the laser. The laser head traverses the disc, and to ensure that it remains aligned with the recorded track an elaborate servo system is used. In fact there are three laser beams, two to provide the servo signals that keep the third, signal sensing beam correctly aligned with the track.

An optical scanning system developed by Hitachi employs a 305mm. disc rotating at 6 r.p.m. This enables 54,000 frames of picture information (NTSC colour) to be stored, and is apparently intended as a stills store system. The sound, luminance and chrominance signals are recorded on the disc in the form of 1mm. diameter holograms (a hologram is an interference pattern, produced by merging both halves of a laser beam, one direct from the laser and the other after reflection from the object). On playback, a low-power laser is used to scan these holograms

from three angles.

Laser systems have the potential to provide a record/playback system for the user, though little work on this seems to have been done.

So much for the basic ways of putting video information on to a disc. Let's now look in greater detail at some of the technical problems and the ways in which various firms have tackled them.

## Markets

There are two basic video disc markets – domestic and business/educational. Each has its own requirements and thus technical problems. The domestic market is primarily based on the supply of feature movies. With this type of use you require a long playing time and stereo sound, but probably not a very great disc life – how often would you watch MCA Discovision number P10-521, "Saturday Night Fever", even at \$15.95?! What's probably not required is still frame, slow and fast motion, search, frame by frame advance, etc. For business use however the disc would need to be employed as a rapid information retrieval system, and with each of the 50,000 odd frames storing a still or text page you require a very robust disc, with still frame, rapid access to any stored frame, frame by frame advance and slow and fast search facilities.

At first sight it might appear that these two markets, with their different requirements, would lead to the emergence of two incompatible disc systems. Some manufacturers in fact have opted for one market or the other, and have built suitable hardware. This however is a costly approach, and means you can aim at only part of the total market. The approach adopted by Philips/MCA is to aim at satisfying both types of user.

To get a still picture without using a digital frame store – something too expensive for domestic use, at least for the present – the disc player has to be able to read the same picture frame continuously. It can do this only if each revolution of the disc plays back a single frame of picture. This occurs with a constant rotational speed of 1,500 r.p.m., as we've already seen, but is wasteful of disc space since the information is packed more densely at the centre of the disc and less densely at the outer edge. As a consequence, a playing time of only about thirty five minutes per side is possible. The arrangement also gives noiseless slow and fast motion however, by repeating or skipping individual frames.

## Extended Play

Instead of packing the information on the disc in this rather wasteful way it can be packed at maximum density, i.e. each frame occupies the same track length at any point across the disc: this gives a playing time of fifty-five minutes per side (the Philips Extended Play system). It means however that the disc's speed of rotation has to alter as the laser traverses the disc. We get a longer playing time, but we lose the still frame and fast/slow motion facilities since each revolution towards the outer edge of the disc (the laser scans from the centre outwards incidentally) will contain several frames instead of just one. But do you really need these facilities for home movies, i.e. domestic use?

Philips have in effect developed two systems, one ideally suited to domestic use and the other for information retrieval. Cleverly however a single player meets both needs, playing either type of disc. It automatically checks which type of disc has been inserted, and then functions accordingly. For information retrieval, each frame is individually "numbered" and can be called up by keying the

## CHRONOLOGY OF VIDEO DEVELOPMENTS

- 1928 Baird Phonovision system demonstrated.
- 1935 Baird Radiovision discs on sale.
- 1970 Teldec demonstrated, 5 mins monochrome.
- 1972 EVR (electronic video recording – a TV set playback system using film storage) abandoned. Philips VCR launched.
- 1972 Philips VLP announced.
- 1973 Teldec demonstrated, 10 mins colour.
- 1974 Teldec launched on German market, with cross licencing agreement with Sanyo and King Records of Japan.
- 1974 Philips VLP "hope to market this year", and mass produce "within a few years".
- 1975 MCA laser "Discovision" system abandoned in favour of joint development with Philips VLP.
- 1975 Teldec renamed TeD: stereo sound added.
- 1977 RCA presses 200,000 Selectavision test discs.
- 1978 VLP/Discovision on trial sale in Atlanta, USA, player at £350, discs at £3 to £8.
- 1979 Cross-patent agreement between Philips and other European, US and Japanese manufacturers concerning video discs.

appropriate frame number into a remote control unit. The average access time for any one frame is about three and a half seconds.

## RCA's Selectavision System

RCA, with their Selectavision system, have gone the other way, opting for a relatively low-technology approach aimed at the domestic movie audience. Their investigations into video disc systems began in the 50s, and by 1978 had reached the stage where the player and disc specifications had been finalised and several hundred thousand test discs produced. The system's launch on the US market is expected to be in early 1981. The system uses 300mm. discs running at 450 r.p.m., giving sixty minutes playing time per side. The colour signal, with stereo sound, is stored on the disc in the form of capacitance variations – transverse slots of varying width and periodicity impressed in the bottom of the spiral groove. The tip of the metal/diamond electrode stylus serves as a capacitance probe to recover the signal. The conductive surface of the disc acts as the other plate of the capacitor. The stylus tracks across the disc in the spiral groove as with a conventional audio LP. As the stylus is in contact with the disc, a layer of lubricant is added to reduce friction and extend both the disc and stylus life. The finished disc is packed in a cassette to provide protection – the player automatically removes the disc from its pack once this is posted into the player. Since no still or fast/slow motion is possible with the system, it's not suitable for information retrieval.

## Japanese Developments

The Japanese manufacturers have not been inactive in this field of course, and several systems have been announced at various times. The situation seems to have settled down somewhat recently however, with Sony joining forces with Philips to produce a common optical system and Matsushita and JVC agreeing to adopt JVC's VHD disc system as a joint standard. This presumably means that Matsushita's groove-guided conventional stylus system has now been scrapped.

JVC's grooveless, capacitance system is certainly the

more sophisticated of the two. The smooth discs allow the pickup head to move freely across the surface, making still frame, fast and slow motion etc. facilities possible. The technical details are as yet somewhat obscure – even to JVC in the UK! It's known however that each frame can be individually located, as with the Philips VLP system, and that stereo sound is available. The disc itself has been refined, and now lives in a caddy which is posted into the player. JVC claim that conventional disc pressing techniques can be used to produce the discs, and this should help to keep the cost down. No date for a UK launch has so far been set, nor has any price been suggested.

### Summary

The present position then seems to be that Philips are ahead with their high-technology VLP system, and having joined forces with Grundig and Sony could see their system adopted as an international standard. I recently had an opportunity to examine a Philips/MCA player purchased in the US, and was interested to note that many of the components are marked "made in Holland". It seems that

Magnavox (Philips' US subsidiary) are assembling the players from kits of parts shipped in from Holland. It's rumoured incidentally that the relatively expensive helium-neon laser may in future VLP players be replaced by a solid-state version. This would help in bringing the price down and make the player more robust.

No definite date for the launch of the Philips system in the UK has been decided upon, but Philips are considering the use of the Mullard Blackburn factory as a disc pressing plant – it's expected to be brought into operation later this year. So VLP could well be in the shops here late next year.

Selectavision is scheduled for nationwide distribution in the USA next year, and RCA hope to sell around 200,000 players at about £250 each during the first year. An impressive number of deals with software houses have already been signed, including Disney, 20th Century Fox, MGM, Rank and Paramount. No date for a UK launch has been suggested, and there are no plans yet for a PAL version of the player.

Detailed accounts of the Teldec and VLP systems appeared in the December 1971 and June 1974 issues of *Television* respectively. ■

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# The Gypsy's Warning

Les Lawry-Johns

SOME years ago we were at the seaside. I think it was Margate, but then again it could have been Ramsgate. Since it was drizzling with rain or something, we couldn't stay on the beach. So we went into the amusement arcade, where we rolled pennies down pieces of wood on to a flat surface where they were collected by a nice lady who smiled. She seemed to collect a lot more pennies than she handed back, so I suppose that's why she smiled.

### A Visit to Madame Martine

Having lost all our pennies we ambled around until we came to a hut which had a big notice outside reading: "Clairvoyant. Madame Martine can look into your past and foretell your future." Amazing. Why live in doubt?

Well, I was only forty or so at the time but I seemed to have been in doubt for most of my life and what with all the funny things that were happening it seemed likely that I would remain so. Funny things like dual-standard TVs and radio sets that didn't need to warm up. Things that took a lot of thinking about. So I thought it was time I got myself straightened out by an expert. I'd tried self hypnosis, but every time I told myself to relax I went to sleep. So that was no good.

It wasn't easy to enter the dim interior of the hut and face a woman who not only knew all about my past but also knew what I was going to get up to in the future. But I did, and there she was sitting at a small table which had some playing cards and a piece of round glass on it. I suppose she played patience while waiting for uncertain people like me to pluck up courage and come in. She had a scarf round her head, so presumably she'd just washed her hair – but there was plenty of it hanging down and it looked dry enough. She fixed me with a piercing look from her black eyes. Perhaps she'd told someone something they didn't want to hear.

"Sit down my dear. You have a lucky face so you'll want

the full reading which is an extra two and six pence. It'll be well worth your while hearing about all the nice things that are going to happen to you."

"Do you know the lady on the penny roll stall?" I asked cautiously.

"Of course I do my dear. But do you want the full reading?"

"Not really. Don't bother about my past. Just give me a quick look into the future."

She didn't look very pleased to give me only the basic reading, and grabbed my left hand, opening it out and tracing lines upon it. Suddenly her eyes widened and she looked confused.

"What is it?" I asked in fear and trepidation.

"You're not sure of yourself, are you? In fact you're nervous of what might come." This was hardly astounding, since my hand was shaking like a jellyfish.

"What's to come?" I quavered. "Is it bad?"

"I can't reveal all" said the secretive bitch. "But beware."

"Beware?" I whispered. "Beware of what?"

"Beware the blue tants" she said mysteriously. "And that's all."

### Years Later

Bob was an insurance broker whom I'd known for years. A very conservative type, rarely ready to make any sort of change to his well ordered life. Until last week that is. He came into the shop and gave one of his rare smiles.

"Leslie" he said firmly. "I've decided to bring a bit of colour into my life. To make the golf more interesting, you see."

The upshot was that we unpacked a nice new Ultra 22in. colour set, fitted with the Thorn 9600 chassis, checked it and delivered it to Bob that same evening.

Now we've sold lots of these sets, and have rarely had cause to complain. Of course it had to be the one that

played about a bit we took out to Bob, and of course he had to live way out in the country up a dark lane and it had to be raining.

We found our way up the drive and installed the set which then worked perfectly. As it happened, and much to Bob's delight, golf was in progress. So we had a couple of glasses and dallied a while. It was as well we did, because after about fifteen minutes the colour gently faded out to leave a beautiful black and white picture with admirable grey scale. Believe it or not, Bob didn't even notice. His hero was in a bunker.

"Look at that" he said. "No trouble at all. I wish I could get out of trouble that easy."

"So do I" I concurred, with conviction, having lost all interest in golf.

I couldn't do anything until Bob had seen his fill. I then found that switching off, waiting for a few moments and then switching on again produced normal colour for a very short period.

Access is really good on these models. The left side i.f. panel can be swung up, allowing the decoder panel to be swung out. The print is beautifully marked (other makers please copy), and components can be located and identified without hesitation.

The decoder panel is a direct descendant of the one used in the 8000, 8500 and 9000 series, so we were on familiar ground. A quick check on voltages showed that the 8.8V which should have been present at pin 2 (supply pin) of the TBA395 reference oscillator i.c. (IC5) quickly fell to 3V or so, thus directing suspicion to the decoupling capacitor C186 (6.8 $\mu$ F). Unhooking one end immediately restored the correct voltage and the colour (thus proving that its value is hardly critical). The nearest value we had was 10 $\mu$ F, so in this went and harmony was restored.

"Part of the installation procedure" I explained.

Checked on a meter C186 gave no sign of leakage, but it was most definitely at fault. Oh yes: it was a blue tant.

We also found a blue tantalum responsible for low tuner selector voltages on another model, causing the programme numbers to flicker from one to another like a demented MOSFET i.c. would.

So remember, when you're up a dark lane and it's raining, beware the blue tant.

### Socket to me Baby

This chappie came in to buy a radio. After a bit of humming and hating he decided upon one. Mains and battery.

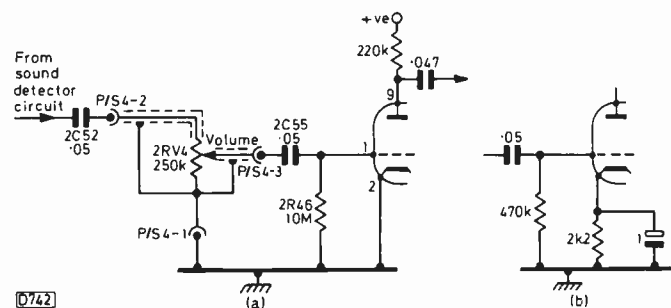


Fig. 1: Triode audio amplifier stage used in the Rank A774 chassis (a). A difficult case of hum on sound could be cured by decoupling the triode's control grid (pin 1). The only workable cure we could find was to introduce selective negative feedback in the triode's cathode circuit (b). The 1 $\mu$ F cathode bypass capacitor provides negligible decoupling at 50Hz. Introducing the 2.2k $\Omega$  cathode bias resistor makes it necessary to reduce the value of the grid leak resistor to about 470k $\Omega$ .

"Would you like me to put a plug on the lead for you sir?"

"No no, we've plenty of plugs in the house, but please put a socket on it for me."

So we put a plug on and away he went quite happily.

### It's Gorn Again

When the 24in. Bush monochrome set came in (A774 chassis) we thought it would be another line output transformer job. It wasn't. The tube was flat – just a dim grey, with silver highlights.

"Is it the picture valve?"

"No. It's the tube and that costs a little more."

"Can you put one in?" So we did, and the picture was lovely. Until the next day that is.

"It's gorn again. That new tube couldn't have been much good."

A new PL504 line output valve restored normal conditions and better relations. Until two days later.

About a year earlier we'd fitted a new line output transformer. This had now chosen to develop shorted turns. Fit new transformer. Nice picture. "Hope it lasts a bit longer this time."

It didn't. Back it came with overloaded video. A.G.C. checked, and suspect preset control plus suspect i.f. amplifier transistor replaced.

"I'm fed up with carting this thing down every few days. Will you come up to us if it gives any more trouble?"

"Certainly. But I shouldn't think it'll play around any more." It did, and I went. Nasty hum on the sound.

Change PCL86 audio valve. No difference. Check electrolytics as hum worse with the volume turned down. Electrolytics not at fault. Hum vanishes when triode's grid is shunted to earth. Check volume control, wiring, screening, plug and socket, valveholder, and finally suspect panel insulation. Cut away here and there but hum remains. Desperate. Fit 2.2k $\Omega$  resistor in series with triode cathode, shunted by small electrolytic, and reduce value of grid leak resistor from 10M $\Omega$  to 470k $\Omega$  (see Fig. 1). Hum now faint buzz, hardly discernible, but I know it's there and I don't know why. Could it be panel leakage, or is there a more subtle reason for the hum (and instability)?

Anyway, there've been no more complaints regarding the sound. Two days later however there was a call because it didn't work at all. Back again to find the on/off switch inoperative. Replace this and cross fingers, legs and eyes – because that was only a couple of days ago.

### Overheard in the Pub

The chap who was talking was getting on a bit and had been interested in radio years ago. The couple listening were of much the same age and greatly impressed.

"Take my last telly for instance. Kept having trouble with the bottom of the picture coming up, leaving a black band at the bottom. If they came once they came a dozen times. Each time they just put a new picture valve in and pushed off. So next time I knew what to do myself. Had to keep on though. Eventually the socket became so loose the valve wouldn't stay in. Got round that one! Glued it in firm. Lasted all right for a time, then the pins went all funny. Set had had it by then though."

"It just shows you, doesn't it?" said the lady. "They don't know their job properly. Take our set. Keeps getting twinkling dots across the top, right at the top they are."

The adhesives man gave his diagnosis. "It's the picture valve's grid that's loose. You just tell them to fit a new one."

# Servicing Zanussi Colour Receivers

## Part 2

Mike Phelan

UNFORTUNATELY, most of the faults on this chassis occur in the line output stage. Yet more unfortunately, most of them cause the destruction of either or both thyristors at switch on or soon after. A variac is a useful tool here, but a knowledge of the stock faults is a good substitute.

### Line Output Stage Faults

Assuming that the set is tripping, short the gate of the flyback thyristor Th2 to earth. If the tripping continues Th2, or less often D38, is short-circuit. Note that while a BT119 and BY189 can replace a BT120 and BY190 respectively, the converse is not true. Repeated failure of either of these components can be caused by short-circuit turns in the commutating transformer TR4 or a dry-joint on R323.

Any fault which causes excessive width will give a high mortality rate of thyristors (and triplers). Too much width that does not respond to adjustment will mean trouble in the stabilising circuit. The first thing to do is to fit a shorting

link in position S12. This should give minimum width – if it doesn't then TR6's primary winding is probably open or TR6 is dry-jointed. If fitting the link works, then the trouble must be in the stages T57 and T58. Dry-joints are very common on the three large inductors in this area, and it's a good idea to completely resolder TR4, TR6 and L40 to avoid future faults.

When the tripping ceases on removing the gate signal from Th2, the latter may be still faulty, only breaking down under the high peak voltage which occurs when the stage is running. This is unlikely however. What is likely is that if link S11 is removed (near the chassis edge) the tripping will stop and field collapse will be displayed. As S11 is in the 32V supply derived from TR4, this would suggest that there's a short in the field timebase. While this is sometimes true – both 2N3055s going short – it's more common for the 32V rectifier to be short-circuit. A suitable replacement for D40 is a BY189, BY190, BY198, Y723 or any fast-acting diode of high current rating.

No e.h.t., no tripping and no voltage on the anode of Th3

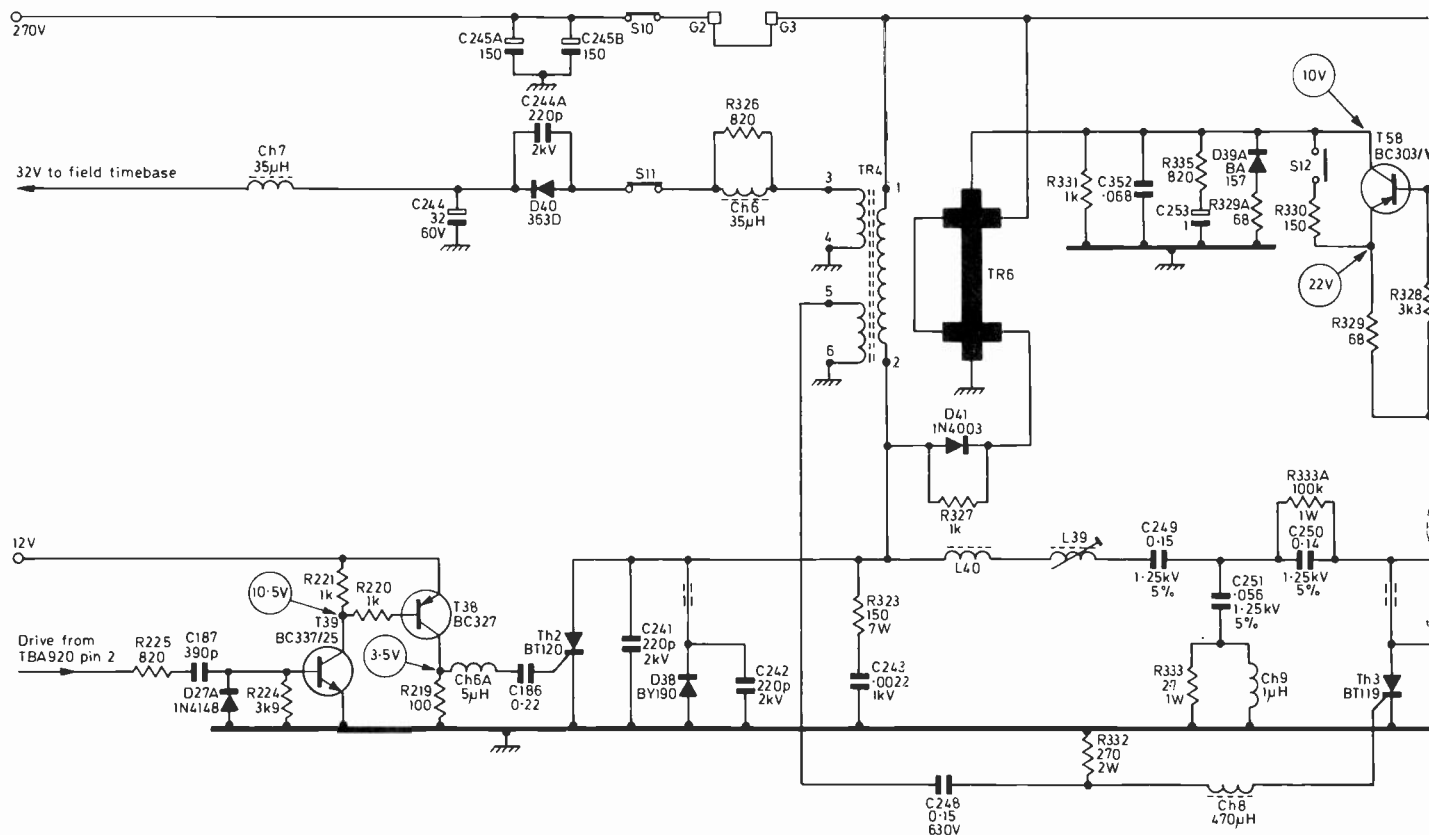


Fig. 6: Circuit of the line driver and thyristor line output stage used in the Zanussi Model BR1026. The beam current/e.h.t. tracking arrangement is interesting (see also Fig. 4 last month). At low beam current, below about 150µA, the beam current flows to chassis via D49, which shorts R319/P30. At normal beam current levels – between 150µA and 1.5mA – D49 is cut off. As the beam current rises, an increasing negative voltage appears at the slider of the e.h.t. tracking control P30, and thus at the base of T57 in the e.h.t./width stabilising circuit (T57/T58/TR6). P30 is adjusted so that the e.h.t. remains constant throughout the range of normal beam current. When the beam current reaches 1.5mA, the beam limiter transistor T18 (see Fig. 4) switches on to provide the beam limiting action.

generally means that the latter or its shunt diode D43 has gone short-circuit, or alternatively that C266 (0.68 $\mu$ F) has. If Th3 is faulty there is often a reason. If you have a variac, now is the time to use it. If you haven't, a different approach is called for.

Examine C258 (1.8 $\mu$ F) closely: if it's cracked, replace it. Also look at the resistor in the c.r.t.'s final anode cap, as a faulty tripler can see off BT119s. When no cause has been found, it's reasonably safe to switch on, but be ready to switch off if the rustle of e.h.t. is absent or the width is excessive. C249, C250 and C251, which form the commutating capacitance, can burn up in a spectacular manner and must be replaced with the correct type. Other potential Th3 destroyers are the diodes in the shift (D46/47) and static convergence (D67/68) supplies, and the EW pincushion transducer TR7. Dry-joints on the wound components remain the most common fault, and give rise to various symptoms, as has already been mentioned.

A fault peculiar to this set is line foldover on scene changes, or when the brightness is advanced suddenly. This is because D41 has gone leaky.

When fault-finding in this part of the set, a useful tip to know is that the scanning circuit can be disabled by fitting link S13. The first part of the circuit should still work, with almost the same waveform on Th2 anode. This looks like a squarewave with rounded tops, and if present, together with the 32V field timebase supply slightly low, will point to the trouble being in that part of the circuit to the right of Th3 in Fig. 6. The transformer is a reliable component, and rarely fails (weak spark at the tripler input).

Setting up the line timebase is simple. Adjust P31 for

24.5kV e.h.t. at low brightness, and P30 for the same at maximum brightness. Don't touch the core of L39.

## Tuner Troubles

The tuner suffers from the normal varicap tuner troubles, i.e. drift and low gain. The latter is usually due to an open-circuit r.f. amplifier transistor. An AF239 is a suitable replacement.

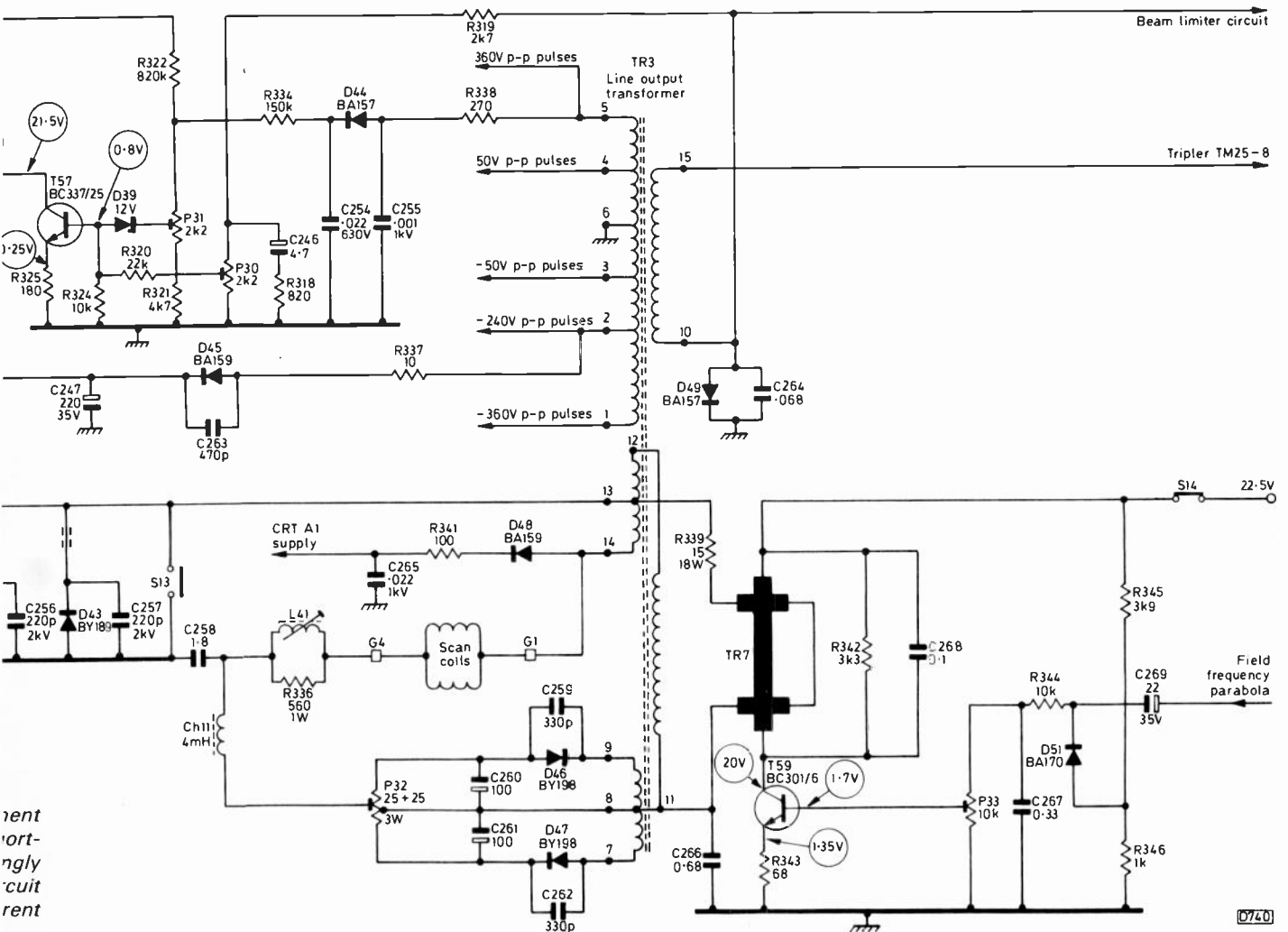
When drift is encountered, the first thing to do is to tune in a station. Then press another button in just far enough to release the first one. If tuning is immediately lost, disconnect C401 (0.47 $\mu$ F) and repeat test – this capacitor goes leaky quite often. If C401 is all right, one of the varicap diodes in the tuner will probably have a leak: they can be checked after disconnecting the 18k $\Omega$  series resistors. This necessitates opening up the tuner: the innards come out after unsoldering the end cover. Another cause of tuning drift is the ZTK33B stabiliser i.c.

## Signal Faults

The i.f. stages are quite trouble free, as is the a.g.c. system. What can appear to be a.g.c. lockout, with a clean raster and no sound, will be found to be nothing more than the preset contrast control P2 being open-circuit.

No raster and no collector volts on T13 will be the result of a short-circuit luminance delay line. This component can also be responsible for multiple ringing.

Intermittent or no sound may be either of the two i.c.s in that department: a simple hum test will show which.



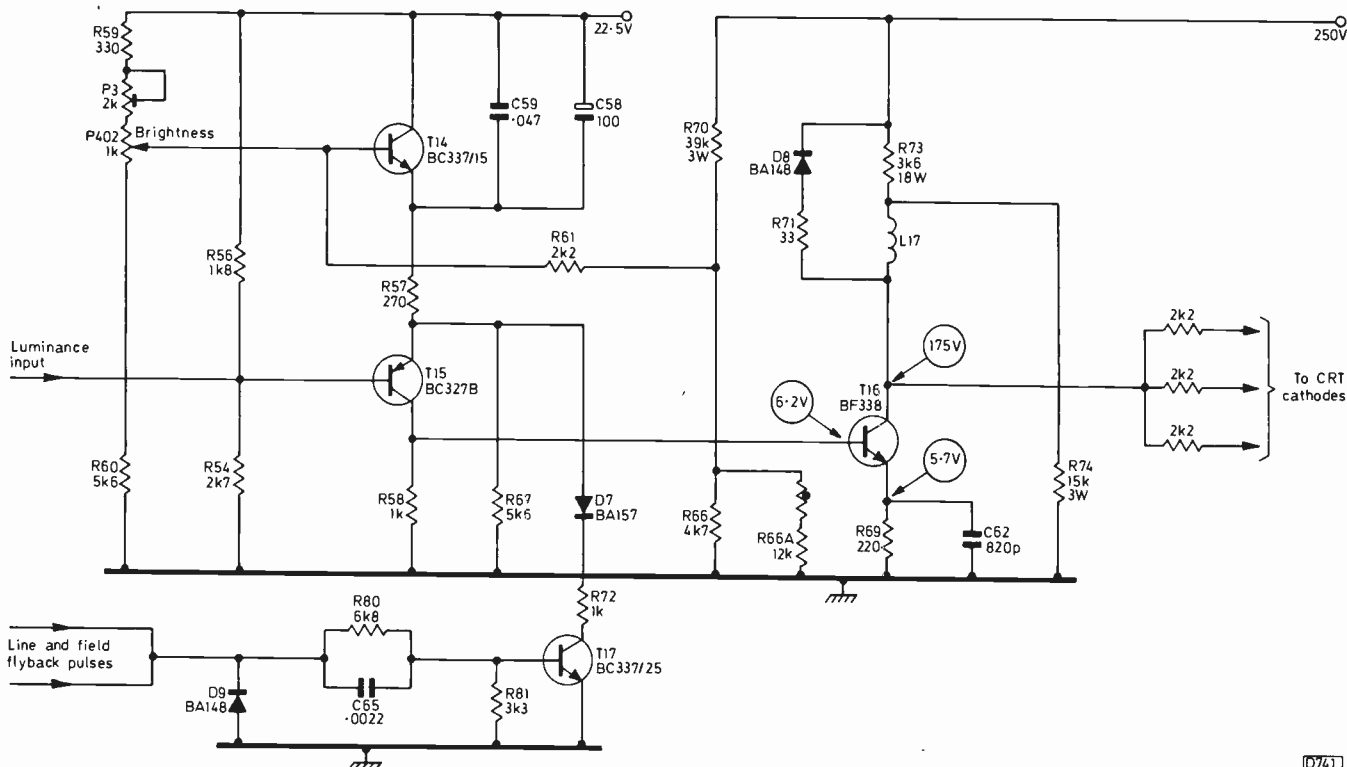


Fig. 7: The brightness, flyback blanking and luminance output circuits. The brightness control sets the voltage at the base of T14, which is in series with the luminance driver transistor T15. Negative-going line and field flyback blanking pulses are applied to the emitter of T15 to switch it off during the flyback periods.

The decoder is also fairly reliable, but a few things can happen to it, including that worst enemy of all decoders, the chap with a trimming tool and no knowledge! To override the killer, fit a link to S7, which is in the larger of the two screened compartments. An unlockable reference oscillator

will almost certainly be caused by a defective crystal, but first check that the decoder panel is plugged in properly.

If faulty, the TAA630 can cause poor matrixing, severe blinds, or loss of one colour-difference signal.

### Decoder Alignment

To align the decoder, assuming no faults are present, proceed as follows. Disable the killer, trim M13 for maximum subcarrier at TP19, using a scope or a diode probe. Remove link S6 and adjust P9 for zero beat of the reference oscillator, then replace link. Short out R162 to give simple PAL, then trim M12 for minimum blinds on R-Y. This is best achieved with a scope at the red c.r.t. grid, with a colour bar signal, but fair results can be obtained on a test card if the B-Y signal is removed by earthing the base of the B-Y output transistor T35. Repeat the procedure for B-Y with P12. Remove the short on R162 and adjust P11 for minimum blinds overall. If you are a perfectionist, misadjust P12 before doing this, to introduce a phase error, remove the R-Y signal as before, trim P11, then go back to simple PAL and reset P12.

### Open-Circuit CDA Load Resistor

Loss of one colour-difference signal, with slight shading across the screen, is produced if one of the load resistors in the colour-difference output stages is open-circuit (R179/187/197). Loss of B-Y is more often than not caused by P14 (1kΩ) being open-circuit – this is the B-Y gain control.

### Defective Tube

Excess of one primary colour occurs when one gun of the c.r.t. develops leakage between its first anode and grid. To check this, note the grid voltage, then unplug the tube base

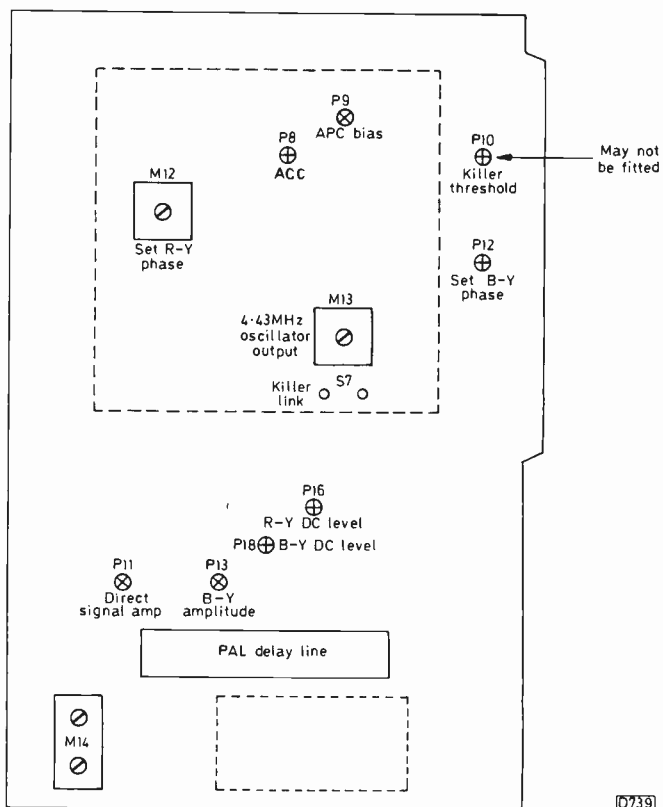


Fig. 8: Decoder panel adjustments (viewed from the component side). P4 which we labelled colour-killer threshold in Fig. 3 last month is used to set the 4.43MHz trap switching.



and measure again: a lower reading means that the tube is leaky.

### Miscellaneous Faults

The convergence panel is not too troublesome, but the diodes D67 and D68 and the electrolytics C284 and C285 occasionally go short-circuit. These components are in the supplies for the static convergence.

A rather bewildering symptom appears when the scan coils develop a short between the field and line windings. The display consists of a narrow vertical band at one side of

the screen with a pattern that looks like one of these thread pictures so popular nowadays at the top or bottom. The toroidally wound coils interleave at the ends, and the turns short together. The offending turns can be separated and insulated, carefully, to save the cost of a new yoke.

The front slider controls are prone to becoming noisy. Don't spray with switch cleaner. Remove and dismantle the control, cleaning it with metal polish. In fact it's better to clean the lot while you've got them out.

So there we are. It's quite a ruggedly constructed set, with most headaches caused by the line output department. ■

# Test Report: Intracast Colour Bar Generator

*Eugene Trundle*

THERE are several small crosshatch/colour bar generators on the market at present, all available in kit form and intended for field or bench servicing of colour TV receivers. The Intracast instrument is the latest of these, and was designed from the outset to provide standard colour bars along with the usual monochrome patterns.

The N7118 is small and light, and uses eleven CMOS chips, one standard 4.43MHz crystal and two transistors. All these are mounted, along with the pattern selector switchbank, on a fibreglass PCB. Power is provided by an internal rechargeable 8.4V Ni-Cad battery, which provides up to ten hours mobile use before recharging with the external mains power unit supplied. Five patterns are available: peak white raster; stepped grey-scale bars; crosshatch; red raster; and 75% saturated, 100% amplitude standard colour bars. The selected pattern is modulated on to a standard u.h.f. carrier (channel 45) for direct connection to the TV set's aerial socket. For bench use the power pack/charger is left permanently on, the instrument then being mains-powered.

### Assembly and Setting-up

The kit comes complete with all the necessary parts, and apart from simple tools only a miniature soldering iron is needed. The precautions necessary when working with CMOS devices are clearly set out in the assembly instructions: there's little risk of damage to these devices, especially as all the i.c.s are pluggable.

Testing and alignment is quite simple, the setting-up procedure involving no more than the adjustment of a couple of trimmer capacitors, though it's important that these are done carefully if tests on TV receivers are going to be valid! The subcarrier frequency is adjusted by reference to a broadcast signal, using a multimeter and an ordinary colour TV set – preferably of the older type with a discrete decoder. The quadrature trimmer is set up in a similar fashion, but calls for the use of an oscilloscope in conjunction with the TV set. There are several ways in which these two adjustments can be accurately carried out, and no doubt the knowledgeable engineer will devise his own method of so doing! No adjustment to the u.h.f. modulator

is necessary or provided, as the u.h.f. department consists of a one transistor oscillator whose r.f. output is modulated by a diode attenuator fed with the pattern signal.

### In Service

The N7118 was substituted for our Philips PM5509 and used for some weeks on all bench repair jobs. It worked well, providing over a millivolt of u.h.f. signal without any sign of modulator or receiver overload (we've known some other instruments require many dBs of attenuation to tame them!). Oscilloscope checks proved that the amplitude and saturation levels of the colour bars were within 5% of the specification, which is quite adequate.

We noticed that the field sync pulse, while admittedly 2:1 interlaced, is of simple form, lasting for the duration of the field blanking period. This sometimes gave rise to odd effects at the top of the picture, the form taken varying from a twitch to slight stretching of the scanning lines, depending on the design and vintage of the receiver under test. This did not detract from the instrument's usefulness however.

This bar generator really came into its own in field servicing. The ten-hour capability of the internal battery lasts for many weeks of field servicing, and the small lightweight instrument, being plastic cased, is easily perched almost anywhere on (or in!) the receiver being set up. The plastic case is quite tough, and being a standard off-the-shelf item is easily replaceable in the unlikely event of breakage. The weight is only 500g (1.1 lb).

### Verdict

The N7118 is slightly more expensive than superficially similar instruments from other sources. On the other hand it uses very up-to-date technology to produce the most important five test patterns needed in TV servicing, and (apart from the field sync pulse!) these are in standard form, giving rise to "text-book" oscillograms as shown in service manuals etc. This, and the "best of both worlds" Ni-Cad/mains pack power supply arrangement, amply justify the kit price of £59.50.

Available from Intracast Electronics Ltd, 203 Picton Road, Liverpool L15 4LG (telephone 051-733-3042).

# Long-distance Television

Roger Bunney

THERE was a considerable slackening off in long-distance reception conditions during January, though there were periods of reception via each of the usual modes of propagation. The most startling opening was perhaps the F2 one on January 7th, when Ian Beckett viewed, from 1305-1327, two different North American system M signals on ch. A2. Both signals were relatively clear, the first being a news programme and the second an Indian Head test card. I'm eagerly awaiting photographs to see whether any identification can be established. On the following day ch. A2 was just visible via F2 during the afternoon – and that really was the F2 story for January, apart from the brief appearance of a Russian ch. R1 signal on the 17th. The Quadrantids meteor shower on the 4th produced intense signal pings – Mike Allmark did well, with numerous Band III pings. Significantly (see below), there was an excellent Sporadic E opening on the 5th, with strong signals for much of the day from most parts of Europe. Scandinavian, Russian and Polish signals predominated during the morning and late afternoon – other enthusiasts have reported Italy as well. Tropospheric propagation also improved, especially around the 12-14th with Band III and u.h.f. signals from the Low Countries and W. Germany being received at favourable locations in the UK.

## SpE Explained?

The interesting point about the SpE opening on the 5th was the fact that it was predicted some 24 hours earlier. I received a phone call recently from Jeff Brown (GJ41CD) in Jersey: he and his colleagues have been working on the cause of SpE, and it looks as if the reason may at last have come to light. Full details have yet to be announced, but the cause seems to be associated with certain types of meteorite that arrive in the F2 layer and are subject to ionisation from the Sun's radiation, the patches of ionisation then drifting downwards eventually to produce intense E layer patches with SpE signal reflection. It seems that these effects are

produced by meteorites made of a particular substance. Anyway, retrospective checks over the last ten years have proved a positive correlation between SpE openings and the presence of such meteorites. I hope to be able to go into the theory of this once further information is available.

## Feedback

There's been feedback, fortunately, from several readers on the various mystery signals received via F2 during the past three months. John Cowan (Ayr) reports that the identification on the mystery ch. E3 PM5544 test pattern has been resolved as Amman. This is surprising, considering that the distance between Jordan and the UK is less than 3,000 miles and that the MUF required is 55MHz. This suggests a very shallow skip angle. Any comments?

The very clear Arabic PM5544 test card I received on December 12th on ch. E2 and announced as being from Dubai now seems not to have come from there – Allan Latham comments that the Dubai test pattern has a square central area instead of the usual circular pattern, and suggests (fortunately the photograph came out clearly) that the pattern must have come from Iran.

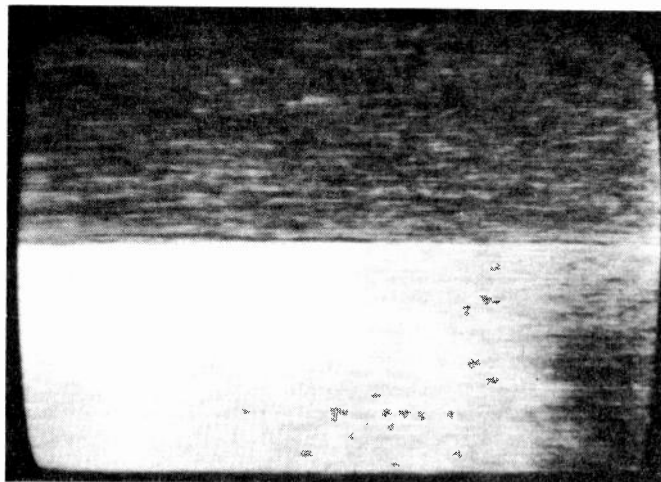
Brian Fitch (Scarborough) reports that DFF (East German) signals have been seen in Band I, with the Russian type electronic pattern.

## 1980 Meteor Shower Dates

Lyrids	April 20-22nd, peaking on the 21st.
May Aquarids	May 1-8th, peaking on the 5th.
Delta Aquarids	July 15th-August 15th, peaking on July 25th.
Perseids	July 27th-August 17th, peaking on August 12th.
Orionids	October 15-25th, peaking on the 20th.
Taurids	October 26th-November 16th, peaking on November 8th.
Leonids	November 15-19th, peaking on the 17th.
Geminids	December 9-14th, peaking on the 14th.
Ursids	December 17-24th, peaking on the 22nd.

## WARC

Various decisions on the frequencies to be used for TV transmissions were made at the World Administrative Radio Conference held in Geneva late last year. The main points are as follows. From January 1st, 1987 the 41-47MHz spectrum will be transferred to fixed mobile use, with a second option to the remaining Band I spectrum if the broadcasters discard its use. This tends to confirm the view, reported here last month, that the UK's 405-line service will come to an end in about 1985. Other countries have indicated their interest in the use of Band I for mobile communications. Band III is to be extended to 230MHz, giving two extra 8MHz channels. This could provide the UK with a national 625-line v.h.f. service without the use of Band I. To give extra channel space, the u.h.f. TV allocation



The BBC ch. B1 test pattern received by Anthony Mann in Perth, Western Australia at 0850 GMT on November 29th, 1979.

is to be extended to 862MHz. Band II (f.m.) will eventually be extended to 108MHz but, following further discussions, the present emergency services now using this spectrum can continue to do so until 1990.

### A Visit to China

As mentioned last month, John Tellick recently visited China. He reports as follows on the TV situation there.

There are three studios in Peking, a large one for plays, a small talks studio and a news announcer (presentation) studio. Modern Philips cameras are used in conjunction with very basic Chinese-made vision mixing desks. There's a stereo desk in one radio studio, and stereo experiments are being carried out. There's Rank Cintel, Fernseh and locally made telecine equipment, while VTRs include three Ampex and three Sony machines (the latter not used for transmission purposes). There are Marconi monitors, Pye OB vans, and locally made equipment racks with certain foreign components incorporated.

Peking has three TV channels – two China Central and a Peking "municipal" one. A similar arrangement is found in other large towns. Transmitter powers are generally 10kW for Central and 1kW for the municipal service. There's extensive microwave linking, with two-way traffic along the central line to the main regional studio centres. PAL colour transmissions started in 1973, but colour receivers are few and far between.

A typical 19in. colour set costs £600. There's no plan at present to start u.h.f. transmissions, though a satellite broadcasting service is under discussion. There are no daytime test transmissions, though the test card or colour bars are transmitted for half an hour before the start of programmes. The main diet seems to be educational programmes, with timings 0830-1200, 1400-1700 and evening programmes starting at around 1930.

### Book Recommendation

SGS-ATES have just published a 300-page book entitled *RF Transistors and Hybrid Circuits*, with transistor specifications, detailed amplifier circuits, information on hybrid amplifier modules – and even an electronic u.h.f. aerial combiner for masthead use with a gain of 23dB! This is truly excellent value at £2.00 and recommended for the weak signal enthusiast who can turn his hand to practical construction. Available from Data Services, SGS-ATES (UK) Ltd., Planar House, Walton Street, Aylesbury, Bucks – make cheques payable to SGS-ATES (UK) Ltd.

### From Our Correspondents . . .

Allan Latham (Abu Dahabi) has sent information on the Band I transmitters at present operating in the Persian Gulf. Dubai operates on ch. E2, with a test card resembling the PM5544 but with a square central portion. Identification is sometimes inserted, with "Dubai" at the top and channel numbers at the bottom – either "2 10 41" or "2 10 33 41". Transmissions start between 1200-1230, 1100 on Fridays. Programmes commence with a reading of extracts from the Koran by an Arab with head-dress. An alternative test pattern consists of colour bars with an extended red bar beneath. Frequency bars and the pulse and bar pattern are occasionally seen. Jordan TV operates on ch. E3, from Amman with the PM5544 test pattern and identification – "JTV" at the top, "AMMAN" at the bottom. Colour bars are sometimes used, with "Jordan Television" in Arabic script in yellow at the bottom. The other ch. E3 station is

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the HZ22 Aramco outlet in Saudi Arabia. Only colour bars have been seen, conventional or the Dubai version, later with a superimposed clock (all white markings). Programmes start at around 1100 daily, with the Saudi flag, then the Koran, then American programmes. The only Arabic ch. E4 station is Bahrain, which uses colour bars for test transmissions.

Arthur Milliken (Wigan) received SpE signals on the 4th, 5th and 6th, and the American ch. A2 signal via F2 on the 7th. He comments that this signal just faded at 1415, as though the transmitter had been switched off.

Roger Hazelden (Bishop's Stortford) has a comprehensive installation including an Antiference MH308 wideband Band I/III aerial and a wideband back-fire array for u.h.f. reception. Using an ELC2060 tuner from Sendz, he received ch. R1 via F2 on each day from the 13-19th December! He's also logged the ch. A2 525-line signals, and a fair selection of Band III/u.h.f. signals from the nearer Continental stations via tropospheric propagation.

Trevor Rose has written from Lowestoft, which seems to be a popular DX-TV location. He's had remarkable success with tropospheric reception. Recently when NOS (Holland) on ch. E27 closed down he viewed RTL (Luxembourg) on the same channel – a rare catch. The German and Italian language Swiss TV services, DFF (East Germany), DR (Denmark) and various West German v.h.f./u.h.f. outlets have all been received.

Petri Pöppönen (Lahti, Finland) has added two U800 selectivity modules (Philips G8 chassis) in series between his receiver's tuner and i.f. strip. As a result of the reduced vision i.f. bandwidth he's been able to resolve very poor signals (previously at noise level) with relative clarity. A further advantage has been the ending of i.f. spread from his local ch. E9 station to adjacent channels. He's received various signals such as RTVE (Spain) and RTP (Portugal) via F2 during the daytime – though I'd suspect that this is more likely to be the F2 backscatter mode mentioned here on several occasions recently. On December 18th he had definite reception of Chinese TV, with gymnastics. The 5th January produced 405-line UK signals via SpE – including North Hessary Tor ch. B2 with the "BBC-1 South West" identification.

### **FAI Propagation**

It seems that we must reconsider the frequencies we normally associate with F2/TE type propagation. During the past twelve months, signals from South African beacon stations have been heard in southern Europe, while Greek amateur radio signals have been heard in South Africa. The startling point is that the frequencies lie within the 2 metre and 70cm. amateur bands (144MHz and 432MHz). The bandwidths used for these amateur radio signals are of course vastly smaller than those used for conventional sound and television broadcasting, while the system gain at the receiver end can be made very high. Nevertheless the fact is that u.h.f. signals are being received (at times) at distances of perhaps 4,000 miles.

In 1979 the WTFDA (PO Box 202, Whiting, Indiana 46394, USA) featured in its bulletin an article entitled "A New VHF-UHF Propagation Mode: FAI". This went in some detail into the causes of distant v.h.f./u.h.f. propagation.

The whole thing started with several reports of record 2 metre contacts between parts of South America – at distances of 2-4,000 miles. Since reception was over conventional trans-equatorial (TE) paths, it was initially

thought that the cause of the propagation was some variation of the usual TE/F2 mechanism. TE tends to be enhanced during the equinoxes (March-May, September-November), and with maximum sunspot activity can, during such times, give daily openings reaching as high as 75MHz (one and a half times the peak daytime maximum usable frequency). If a 144MHz amateur signal is received over such a path, the inference is that the daytime MUF had reached almost 100MHz. This however has never happened.

In February 1978 a Venezuelan radio amateur heard (weakly) signals from an Argentinian amateur at 432MHz – over a distance of some 3,000 miles! The land path ruled out any possibility of the cause being tropospheric ducting or any other such method of propagation enhancement. Three days later, on the 16th, another Venezuelan amateur heard the same Argentinian amateur station. During the same period, a Puerto Rican amateur made contact with an Argentinian amateur, this time on 2 metres at a distance of 4,000 miles. In April 1978 there were successful contacts between Rhodesia and Greece/Cyprus. Contact between northern Australia and southern Japanese amateurs was established in February 1978, at 2 metres.

Research by Joseph Reiser and Gene Pfeffer (see *QST*, October 1978) had established a new mode of propagation – field aligned irregularities (FAI). It's similar to TE/F2 propagation in that there's signal scattering. The "irregularities" that produce the scattering consist of high-density electron bubbles, of an elongated shape and aligned within the Earth's geomagnetic field (i.e. on a north/south path, similar to the normal compass needle). Since the elongated bubbles are north-south aligned, it follows that signals reflected by this mechanism will travel along a north-south path. As the geomagnetic equator tends to criss-cross the geographical one instead of running parallel however, signal scattering may be along paths other than a strictly north-south one. In fact in July 1977 a scatter path was noted between Brazil and West Africa, suggesting that signals can at times be received along the equator.

The bubbles of high-density electrons occur over the equatorial regions, at heights within and above the F2 layer (from 375 to over 500 miles), which explains the v.h.f. and u.h.f. propagation distances. FAI tends to be an evening phenomenon therefore (as with F2 propagation), and is associated with high solar activity. There's a definite peak in the activity: the article suggests that this varies in different parts of the world – October-May favours an African-Mediterranean path, October-March the Americas and June-July East Asia, though at this stage shortage of reports make generalisation difficult.

Since this propagation mode is confined to some  $\pm 2,000$  miles of the Equator, the chances of reception in the UK are minimal to say the least. There have been isolated reports of African F2 signals reaching southern Italy and then arriving in the UK via SpE or MS propagation, but this is rare.

The characteristic FAI signal is weak and fluttery, with some multiple imaging to make identification difficult. A disadvantage in the UK and Europe of course is the lack of African signal sources – in recent times African signals at 30MHz or above have been minimal despite high-level F2 activity.

In conclusion then, FAI does present us with a new method of signal propagation to consider, but whether any enthusiast in Western Europe is successful with reception remains to be seen. A high-gain receiving installation will be necessary with this demanding mode of propagation and whether any such signals will be as easy to resolve as weak tropospheric ones is open to speculation.

# Some Thorny Problems

Nick Lyons

I'VE always had a sort of love-hate relationship with the Thorn 1500 chassis. Never liked the pictures they produce – no black level clamp etc. On the other hand I respect them for the fact that they are quite reliable and when they do fail the fault is usually one of classic simplicity – open-circuit mains droppers and so on.

## Amongst the 1500s

You can have too much of a good thing however and I was somewhat out-faced by the inordinate number of the species calling for attention recently. I had better mention to start with that one or two of our customers live in somewhat squalid conditions to say the least – in fact a fumigating candle is a standard item of equipment when one is called out to see some of the local 1500s. One such customer had a mechanical tuning fault on his 1500, so the report said. Simple as this job was likely to be, it was not exactly relished. Carbolite in hand I strode bravely into the house and on removing the set's back observed that the metal bar against which the buttons press had become disengaged from the metal forks on which it pivots. It transpired that the customer was accustomed to lounging in an armchair and changing channels with his foot, thus administering an excess of mechanical welly (forgive the pun) to the tuner, bringing about its demise. The bar is easily resoldered back in place with a hefty iron of 65W or so, and after doing so I made a hasty if itchy retreat.

"I won't stop the set from rolling about" the next anguished customer told me. I assumed a loose leg was not the fault, and gathered that the picture was. Total loss of sync was the fault on examination. As usual it was R44 (47k $\Omega$ ), which feeds the screen grid of the sync separator, open-circuit. Many of our 1500s have suffered from this fault, and indeed a couple of days later the same thing required attention on another set. Fit a more robust (1W) replacement. The other very common fault seems to be the 2.2k $\Omega$  dropper resistor R96 which feeds the audio circuit going open-circuit: I wish I'd a pound for every one I've replaced.

The next 1500 had, quote, "a line across the middle". Now I know it never makes any difference, but who can resist changing the PCL805 field timebase valve? No change of course: put original bottle back. Next I discovered a very large voltage (60V) at the cathode of the output pentode section of the valve, due to the cathode bias resistor R103 being open-circuit. Now you may be wondering why, with R103 open-circuit, the associated decoupling electrolytic C79 hadn't gone bang, considering that the customer had been indulging in "sound only" entertainment. Well obviously the same trouble had occurred before, because someone had fitted a 40 $\mu$ F, 100V type in place of the 160 $\mu$ F, 25V one. Replacement cathode components of the correct type restored the set to glory, and I bade the customer farewell. But not for long.

We next return to the scene of the broken tuner. This time the report is "the bottom of the picture's half way up the screen". Grab the Dettol and we're away. Replaced the PCL805, no change: why do I do it? Look flustered. Customer waves brown stained and chipped cup which she

has just taken out of a sink which looks (and smells) like a malarial swamp and says "want a cuppa?" Kind invitation declined. I decided that the gross lack of linearity had to be C79 again, not because this was logical (which it is) but because lightning never strikes once in the same place. Replacement cured as they say.

We now move back to the scene of the 1500 which had previously suffered from field collapse, because it was doing it again. Rather disturbed by the shuttle service I was running between these two sets, I yet again tried changing the PCL805. You'll never guess: it worked! The first time in months that changing the PCL805 has cured a field fault. Mopping the brow, I retreated.

## Valve Quality

The next 1500 raises a question which seems to be gaining in importance, the rather questionable quality of some valves today. First however the set itself. Apparently the picture had been getting worse for months, but the main cause of the call out was loud cracking noises from the innards. On switching on, all was revealed. I hesitate to say the tube was going, because it looked more as if it had gone. It barely lit up, and produced a picture like a line drawing on mid-grey card. The cracking noise was due to the PY801 boost diode occasionally arcing with great gusto. A session with the rejuvenator had no effect on the tube, but fitting a booster transformer produced a bearable picture. So attention was turned to the valves. Replace the PY801 along with the PL504 in case this had been damaged by the violent arcing in the PY801, then departed. Within a week I was called back, this time because there was no raster at all. The cause: the new PL504 had cracked. I replaced it with another new one which glowed blue enough to be mistaken for a thyratron – nevertheless it held up. The fact is that during the last six months quite a number of valves have been faulty from new. The quality of some valves was epitomised when I pulled out a faulty EF80 the other day: on it was printed MADE IN HUNGARY. . .

## Blank Raster

Anyway, back to the 1500s. The next one had another common fault, lack of video, the set displaying a blank raster. Pounce on R41 (5.1k $\Omega$ ) in the video output transistor's collector circuit. Very high of course. The transistor's collector load consists of R41 and R40 (2.2k $\Omega$ ) in series. When one of these goes I usually fit a pair of 3.9k $\Omega$  resistors. Why Thorn use two resistors instead of one I'm not sure – the precise value is not all that critical.

This concludes the case for the 1500s.

## A 980 Surfaces

Now back to days of old when valves were bold, and in particular the Thorn 980 chassis. To be truthful I thought that all of this species in my patch had long since died off. Someone had been secreting one in the midst however, the problem it presented being edges only showing on a very pale picture with very weak sync. A video circuit fault of

course, and a common enough problem here is when the EF80 video output valve's bias stabilising resistor R26 changes value. On this occasion however the i.f. filter coil L10 between the detector and the output pentode was open-circuit: the small amount of capacitance across it had been sufficient to couple just the h.f. components of the picture. Shorting out this coil with a wire link produced a low-contrast picture, with the contrast control having no effect. You guessed it, the high-value (5.6M $\Omega$ ) resistor from the slider of the contrast control to the a.g.c. circuit was the culprit. The BY124 a.g.c. line clamp diode W1 has also been known to cause contrast and/or a.g.c. problems on this chassis, but not this time. Anyway, the set put on a brave face for its age and considering the amount of service work it seemed to have received, and we returned it to a thankful customer.

### **The 1400 Chassis**

Enter the Thorn 1400 with no h.t. due to the 16 $\Omega$  surge limiter resistor R125 having gone open-circuit. Another classic fault. On clearing this I noticed what I should have noticed to start with: the heaters were very bright, due to the diode dropper (W10) in the heater chain being short-circuit. If you fail to spot this on the 1400 chassis of course the effect on the field scan is unmistakable – severe bottom foldover, because the output pentode obtains its bias (applied to the control grid) from the heater line via a filter network. Replacing the diode cured the trouble, but on cold test the original one showed o.k. The diode was breaking down only when a high reverse voltage was applied to it, the AVO's test voltage not being high enough. If you're not sure of the normal heater brightness, it's as well to check the voltage across the tube's heater. With a half-wave rectifier in series with the heater chain and a 6.3V heater, a mean reading of 4–4.1V should be obtained on a meter such as an AVO. It's also advisable to check the 0.001 $\mu$ F protection capacitor C88 across W10 in case it's short-circuit. In the final version of this chassis, an 0.01 $\mu$ F 2.5kV pulse type capacitor was used in this position.

Whilst on the subject of 1400s, the following points are worth noting. The h.t. voltage supply to the field timebase can be responsible for cramping problems. If the h.t. feed resistor R135 is 1.5k $\Omega$ , change it to 1.8k $\Omega$ . If the top field linearity control has insufficient range, change R115 from 470k $\Omega$  to 820k $\Omega$ . Sound buzz is often a problem on these sets. In this case change the video output pentode's screen grid feed resistor R36 to a higher value, up to 10k $\Omega$ , and if the set is used on 625 lines only remove W4.

### **Portables**

I've always had a soft spot for the 1590/1591 portables, at least from the repair point of view. Usually the fault is a defective AD143/AD149 or whatever regulator transistor, or failure of one of the diodes in the power supply. We were rather intrigued therefore when a chap walked in with one in kit form. Now it had not been bought like that. No, "there'd been an accident". Apparently, rather than fit a longer mains cord the owner had put up with having the lead stretched above floor level from the set on a table to the socket on the other side of the door to the kitchen. This daft state of affairs had persisted, the customer not watching much TV anyway, unplugging the set when not in use and taking care to step over the wire when going into the kitchen when it was. Everything was great until – guess what happened when the milk on the stove boiled over while a programme was being watched . . . He darts towards the kitchen, trips over the set lead, and flies headlong into the kitchen hotly pursued by the 1591. The tuner was pushed back completely into the set, the chassis members were bent, and the case broken in three places and cracked and chipped elsewhere. The printed board didn't seem to be badly damaged however, so I plugged the set in. It worked. After adjusting the field hold and tuning it in, the set produced normal results. There was nothing for it but to straighten out the chassis members, apply generous quantities of Araldite, clamp the case together and, a few days later, return a working set to a very happy customer. Who says British sets don't undergo rigorous testing?■

# **Vintage TV: The Philips 1100U**

**Vivian Capel**

READERS in the London area may be considering a visit to the exhibition at the Science Museum, in Kensington, commemorating fifty years of television. The exhibits are divided broadly into four groups, the first of which covers the pre-war era, including some original 30-line equipment. Fascinating: to think that this is where our modern large-screen, high-definition colour TV service got its start!

The second group deals with the TV of the 50s – when TV for the majority first became more than a curiosity, starting its relentless invasion of the living rooms of the land. It's the sets of this era, most of which have long since disappeared, that are our principal interest as likely collector's items.

The Philips Model 1100U was originally released in August 1951 – at a price of £49 19s 10d (plus purchase tax). It proved to be something of a classic – a popular set that continued to give excellent service long after most of its contemporaries had given up the ghost. The picture quality

was superior to that of most sets of the period, being bright and sharply focused. A contributory factor was no doubt the 9kV e.h.t., which was higher than normal for a 12in. tube. This also had a bearing on the tube's longevity – the tubes seemed to go on for years without any sign of deterioration. Sets with a low e.h.t. of about 7kV seemed to need replacement tubes quite soon.

The 1100U used the same chassis as the 1238U and the console version, Model 1229U. There was also a Stella equivalent, Model 1500U. The chassis was actually in two sections, one for the r.f., video and sound circuits, and one for the timebases and power supply. They lay side-by-side on the wooden base board, which had the customary inspection apertures. Interconnection was by means of large plugs into sockets at the sides of the chassis.

A feature of the construction was the lift-off cabinet. The back screws also secured the cabinet shell, consisting of the sides and top, to a frame of metal struts fixed to the base.

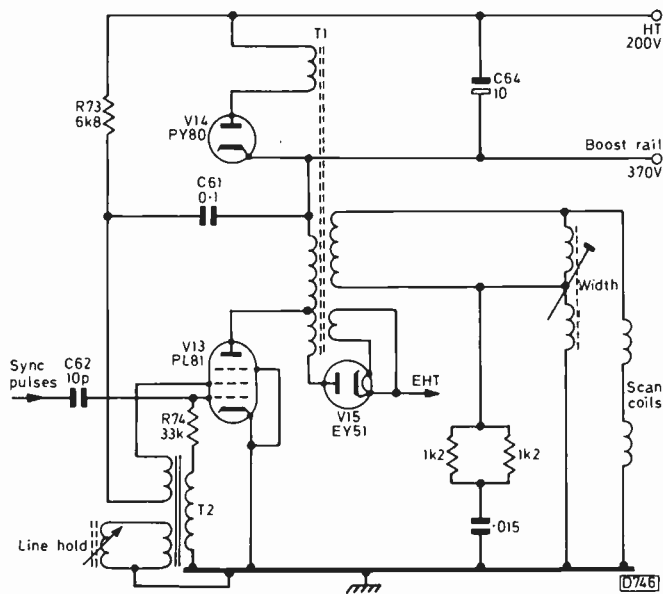


Fig. 1: The self-oscillating line timebase circuit. Feedback between the control and screen grids of the line output valve sustained oscillation.

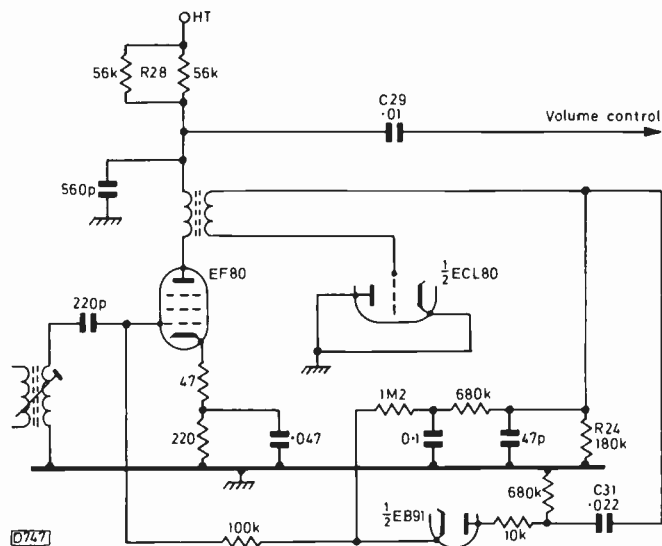


Fig. 2: The single sound i.f. valve also acted as a reflex a.f. amplifier, the detected audio signal being fed back to its control grid via C31 and the series sound interference limiter diode. The audio signal was developed across R28 and fed via C29 to the volume control. Detection was by means of the triode section of an ECL80, strapped as a diode! The detector load resistor is R24, the detected signal being filtered and used to forward bias the cathode of the interference limiter diode. A negative-going interference spike appearing at the diode's anode would switch it off therefore and fail to appear at the EF80's control grid.

Thus when the back was removed the shell could be lifted away, leaving all parts accessible for service. It was felt that this was a notable change of heart on the part of Philips, whose radios had up until then not been renowned for their serviceability!

The shell slotted into the cabinet front, which remained to support the tube and the loudspeaker. This also carried the four user controls: volume, contrast, brilliance and focus. The latter was rather unusual. Most focus controls of the time consisted of a lever protruding through a slot in the back so that the focus magnet on the tube's neck could be

rotated. Here the magnets were rotated by a pair of Bowden cables operated from the control at the front (how Philips loved Bowden cables!). This would occasionally give trouble – the system became stiff and dry, so that the control would then turn in one direction but not the other, and once turned beyond the optimum focus point could not be returned. Running oil down the cables often did the trick.

There were also four preset controls reached through holes in the front of the cabinet by means of a special screwdriver supplied with the set (and usually lost). The height and field hold presented no problems because they were straightforward potentiometers with a slotted end. It was the width and line hold controls that caused troubles. These were coils with cores that were screwed in or out, and the slotted ends were frequently chewed up by clumsy customers using the wrong screwdriver. Sometimes they would jam, and any attempt at rotation would simply break the coils free and turn them, snapping the lead-out wires in the process.

### The Line Timebase

The 1100U was intended as an "economy" set, for use in good service areas. Several stages were combined, and the sync clippers used in other Philips models were omitted. The line oscillator and line output stages were combined, a transformer (T2, see Fig. 1) being used to couple the PL81's control and screen grid circuits. The operation is briefly as follows. To start with the PL81 is without bias and thus begins to conduct. Feedback between the screen and control grids then drives the valve on harder. When the transformer saturates, the drive ceases and the PL81 cuts off to produce the flyback. The line hold control sets the transformer's saturation point, negative-going sync pulses being fed to the control grid to ensure that the PL81 cuts off at the correct time.

### Reflex IF/Audio stage

The sound circuits were rather curious. A reflex arrangement was employed whereby the sound i.f. valve was also used as an a.f. amplifier (see Fig. 2). This arrangement was occasionally found in economy radio sets, but was rarely seen in TV receivers. After detection and i.f. filtering the a.f. signal was fed back to the control grid of the i.f. valve via a series limiter diode. An a.f. load resistor (R28) was connected in series with the anode i.f. coil. The amplified a.f. was then taken via C29 to the volume control.

The oddest feature was that detection was carried out by the triode section of an ECL80, which could have been used as a conventional a.f. amplifier with the detection left to a germanium diode.

Actually trouble was often experienced here as the triode,

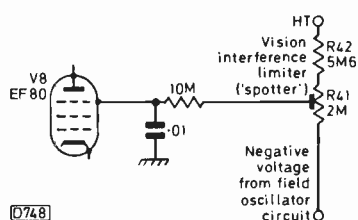


Fig. 3: Vision interference limiting by applying a negative voltage to the suppressor grid of the video output valve. The "spotter" control was set so that the valve ran into saturation in the presence of an interference pulse above peak white. Philips continued to use this arrangement in subsequent models.

which was strapped as a diode, was in the same envelope as the sync separator. Buzz-on-sound was not infrequently encountered due to slight leakage between the sections. A new replacement valve would sometimes produce the same effect. I used to fit a germanium diode in place of the triode – this left the sound completely clear. A sync and sound detector valve in the same envelope is indeed a strange combination!

### Common Faults

A common fault was inability to lock the field scan. This was due to a  $2.2\text{M}\Omega$  resistor in series with the field-hold control going high. The field blocking oscillator transformer was another offender, though not so frequently. If faulty there would usually be a measurable deviation from the correct resistance readings of the windings,  $200\Omega$  for the primary and  $160\Omega$  for the secondary.

Another fault that cropped up from time to time was a flat picture lacking highlights. This was due to the interference limiter circuit (see Fig. 3). A negative voltage

from the field oscillator was applied to the suppressor grid of the video output valve. The feed was via the spotter control, and was returned to an h.t. point via a  $5.6\text{M}\Omega$  resistor (R42) to provide a positive backing off voltage. This resistor was usually the culprit. The idea was that when an interference pulse was present the valve would saturate.

### The Front End

The plug-in coils were used to tune the receiver to the required BBC channel, and the sensitivity was controlled by means of a five-position carousel giving 10dB steps. This attenuation was carried out in the r.f. amplifier valve's cathode circuit.

The aerial was connected by means of a rather large metal-shrouded, two-pin plug with earthing contact. Aerial connectors were in fact one of the service engineer's headaches at the time: there were several different types, so when a set came in for service the workshop aerial outlet had to be fitted with an appropriate adaptor (which always seemed to be in use already).

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# A Look at Capacitors

George Wilding

CAPACITORS are such common components that we don't always fully appreciate what they do nor the incredible range of values in use. In TV sets for example values from as low as  $2.2\text{pF}$  to  $4,700\mu\text{F}$  or more are commonly found, a ratio of 2,136,000,000:1 – translated into linear terms, a thousandth of an inch compared to 33.7 miles!

It's conventional to think of capacitors as "passing a.c. but blocking d.c." The former part of the statement is quite wrong however, since only leakage current actually passes through a capacitor. What appears to be a flow of a.c. through a capacitor is of course a repeated charge and discharge of the capacitor. Whether a capacitor is used as a reservoir, smoother, d.c. block, coupler, decoupler, tuner, diode protector or what have you, it functions in one way and one way only, by accepting and returning an electrical charge. The capacitor may charge quickly and discharge slowly or vice versa, may charge and discharge at exactly the same rate, or may store part or all of its charge for long periods. The effect of this charge/discharge action in any circuit depends on the capacitor's value, the frequencies being handled, and the associated components/circuitry.

A good demonstration of the charge/discharge capability of capacitors can be given by connecting a largish, non-electrolytic capacitor in series with an ammeter across the a.c. mains. Say we use an  $8\mu\text{F}$  capacitor. Its reactance ( $X_c$ ) at 50Hz is  $398\Omega$ . A reading of about 0.6A will be indicated, but unlike the reading obtained if we connect an equivalent resistor in place of the capacitor, the current consumption will be "wattless" and won't be recorded on the supply board's meter. This is because the capacitor accepts a charge from the mains whilst the voltage is rising, and then returns its charge to the supply as the mains voltage falls – less the very, very small proportion of the charge dissipated as a resistive loss. During the following mains half cycle the charge/discharge pattern is repeated, but in the opposite polarity.

A consequence of this is that whilst the charge ( $Q$ ) on the capacitor is in phase with the voltage waveform, the capacitive voltage and current are displaced by  $90^\circ$  with respect to each other – at maximum voltage the charge/discharge current is zero and vice versa.

When a resistor is connected across an a.c. supply the current passing through it is in phase with the voltage of course. Connect a low-value resistor in series with our test capacitor and it will warm up, apparently contradicting our statement that capacitive current is "wattless". This arises however since we are no longer dealing with a pure or nearly pure capacitance but with an RC combination which has an impedance (resistance plus reactance) instead of just a reactance. The voltage and current will be in phase across the resistor but in quadrature ( $90^\circ$  phase shift) across the capacitor, while the common supply current will have a phase angle with respect to the voltage depending on the values of the resistor and capacitor used.

This latter point can be demonstrated by measuring the voltages across a series-connected RC combination. If for example we round up the reactance value of our  $8\mu\text{F}$  capacitor, calling it  $400\Omega$ , and connect it in series with a  $400\Omega$  resistor across the 240V mains supply, the voltage across each will not be 120V. There would be 120V in the case of two capacitors or resistors of equal value, but with an RC combination the resistance and reactance are in quadrature (see Fig. 1). The impedance ( $Z$ ) of such a combination is given by:

$$Z = \sqrt{R^2 + X_c^2},$$

and in this case works out to about 565 $\Omega$ . Following Ohm's Law, the current flowing will be  $240/565$ , or 0.424A, while the voltage across both components will be  $0.424 \times 400$  or 169V.



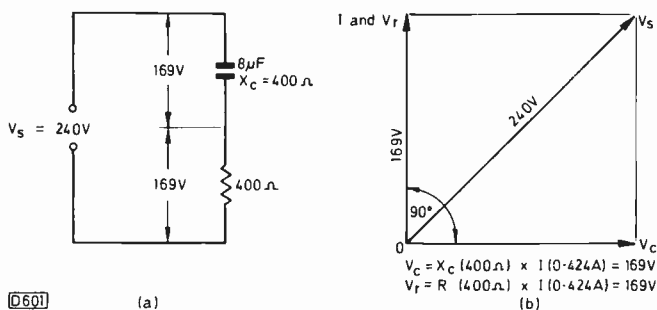


Fig. 1: (a) An  $8\mu\text{F}$  capacitor (reactance at  $50\text{Hz}$   $400\Omega$ ) and a  $400\Omega$  resistor connected in series across the  $240\text{V}$  a.c. mains supply. Due to the quadrature relationship between capacitive reactance and resistance, the voltage across each component will be  $169\text{V}$ . If both components were resistors or capacitors, the voltage across each would be  $120\text{V}$ . (b) Diagrammatic representation showing the voltages developed across the capacitive reactance and resistance.

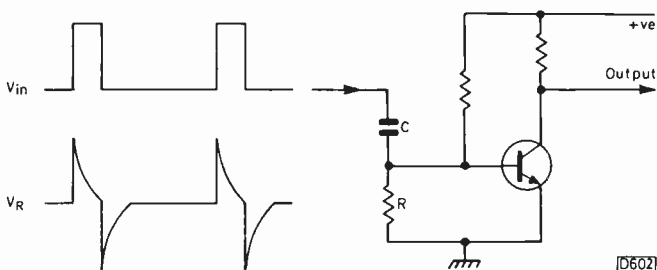


Fig. 2: By taking the output from across the resistor in an RC differentiating circuit, the spiked waveform shown is obtained. To start with, the voltage across the resistor is the full amplitude of the applied pulse input, then falling exponentially as the capacitor charges. At the end of the pulse, the capacitor discharges in the opposite direction.

If you've never delved into electrical fundamentals, these facts may seem surprising. Series or parallel combinations of capacitance, inductance and resistance can be very much more surprising however.

Turning to practical circuitry, when you couple a signal or pulse waveform via a coupling capacitor to a resistor connected between the grid and cathode of a valve or the base and emitter or a transistor, it's the charge/discharge currents flowing through the resistor that provide the drive for the active component concerned. The current flowing will increase or decrease the transistor's fixed forward bias, and for a valve will produce the required control voltage by normal  $IR$  action, i.e.  $V = IR$ .

Especially in the case of step and pulse waveforms however this charge/discharge current is never a facsimile of the input voltage waveform. Apart from all other considerations, the voltage difference between the applied voltage  $V_{in}$  and the voltage  $V_c$  across the capacitor constantly changes to vary the charge/discharge current. At the instant that the step or pulse is applied, the full voltage

will be developed across the resistor, with zero voltage across the capacitor. In fact at this instant the capacitor could be regarded as a short-circuit, the initial surge current being equal to  $V/R$ . No wonder therefore that surge limiting resistors have to be used with mains rectifiers in TV sets.

As the current flowing charges the capacitor, the voltage across it increases exponentially (see Fig. 2) while that across the series resistor decreases similarly – the combined voltage across the two components being equal to the applied (input) voltage at all times. The shorter the time-constant (charging time  $t = R \times C$ ) of the capacitor and resistor, the more steeply and quickly the  $V_c$  curve will rise and the  $V_r$  curve will fall. A rectangular input pulse will therefore produce across the resistor for amplification by the valve or transistor the waveform shown in Fig. 2.

While we would ideally prefer to have the rectangular pulse waveform across the resistor, the differentiated waveform we get, with its full amplitude leading edge, is preferable to the rounded leading edge we'd get if we integrated the waveform instead, i.e. interchanged the positions of the capacitor and resistor in Fig. 2. In practice, circuit time-constants are chosen for minimum step or pulse distortion.

In the same way that a coupling capacitor is charged and discharged by the applied signal, so a decoupling capacitor takes on a charge when an unwanted a.c. variation occurs – charging when the d.c. supply rises and discharging when it falls, thus providing a stabilising action.

Apart from the degree of decoupling required, the main factors determining the value of a decoupling capacitor are the frequency of the unwanted voltage variations and the circuit impedance. The former factor arises because the lower the frequency, i.e. the longer the duration of each periodic cycle, the greater the charge the capacitor must be able to accept without its terminal voltage rising significantly. To smooth out mains, field, line and most audio frequency variations, an electrolytic capacitor is usually necessary: to filter out h.f. and i.f. voltage variations the decoupling capacitor need be no more than  $0.001\mu\text{F}$  at most. Where a high-value electrolytic capacitor is being used to smooth out the mains ripple on a supply rail, a small decoupling capacitor may be found in parallel with it. This is included because the electrolytic has a certain amount of self-inductance which impairs the h.f. decoupling – we want the supply voltage to be constant at all frequencies of course.

Reservoir capacitors in power supply circuits need to be of particularly high value, especially where a half-wave rectifier is used. This is because the rectifier is held reverse biased (non-conductive) except when the voltage at its anode exceeds the voltage across the reservoir capacitor at its cathode. The duration of the time when the rectifier's anode is positive with respect to its cathode may be only about a sixth of the periodic time of the a.c. waveform, so the reservoir capacitor will have to be able to charge to about six times the constant current demand of the circuitry being supplied, rising to a peak of about twelve times this figure.

The voltage across a capacitor equals  $Q/C$ , where  $Q$  is the quantity (of electrons) in Coulombs, numerically  $6.28 \times 10^{18}$ , or one ampere flowing for one second. As  $Q = CV$ , it's interesting to note that in any series chain of capacitors (see Fig. 3) the charge on each capacitor, irrespective of its value, is the same as that on each of the others and in total. The voltage across each therefore will be in inverse proportion, with the individual voltages equal to the total applied voltage. ■

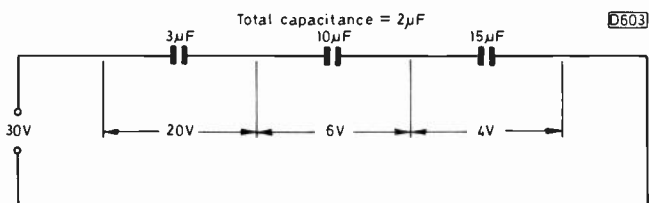


Fig. 3: Irrespective of their values, the capacitors in a series chain all acquire the same charge, which is also that of the total effective capacitance: the voltages across each capacitor are in inverse proportion to their value therefore.

# TV Servicing: Beginners Start Here . . .

## Part 31

S. Simon

It had been our intention to concentrate on the theme of power supplies that refused to work, and indeed we intend to get back to this enthralling subject in due course. First however, having spent some time last month examining the switch-mode power supply used in the Thorn 3000/3500 series, we feel it would be as well to dally a little longer with these sets. Since the circuit should be fresh in our minds, it would be a shame to rush off on to other power supplies in other sets before taking the opportunity to consider some other aspects of the 3000/3500 chassis. These Thorn sets were extremely popular, and it'll be your lot to encounter examples as soon as you start serious servicing.

Our starting point this month is the fact that line output stage faults are the usual cause of a blown h.t. fuse, and are often the cause of the cut-out operating. The line timebase unit is at the top right and, after the power supply unit, is the source of the majority of troubles experienced with these sets.

Early models boasted only one fuse on the top of the power unit (F603, the h.t. fuse), with perhaps another 2A anti-surge fuse on the left side of the main frame if the red button cut-out was not fitted. Later models have several fuses on the power unit, two of which are for the protection of the mains transformer in the event of one or other of the 30V supply rectifiers going short-circuit. We are most concerned here however with F603 and the red button cut-out.

### Excessive HT Current

Whilst it's more common to find that the latter has popped out, it's certainly not uncommon to find that F603 has blown. If F603 has not blown, one can initially view the power supply with suspicion and then if necessary move on to the line timebase section. If F603 has blown, the power supply is much less likely to be at fault and before proceeding further it would be as well to take one simple precaution. This is to remove the e.h.t. tripler clip from its connecting point on the e.h.t. transformer (an unusual aspect of the 3000/3500 chassis is that the line output transistor – two of them on very early 3000s – drives two transformers, one of which drives the scan circuitry and the other the e.h.t. tripler). In addition, it's a simple matter to connect your ohmmeter across the line output transistor(s), black prod to the collector (body of the transistor), red to the base or emitter. If a low reading is obtained, the transistor(s) should be more thoroughly checked out of circuit. Obviously if the red prod is applied to the collector with the black prod to the base the meter will read low anyway – or it should do if the device is working.

If no obvious shorts are found, switch the meter to the d.c. current range and connect it in series with a new 2.5A quick-blow fuse in the F603 position. This is done by clipping the fuse in the holder at one end, leaving the other up-ended for connection to the meter. The necessity for this depends upon the meter's built-in protection (whether it has a good, fast cut-out facility in the event of an overload). A

normal meter reading is between 1.5 and 2A. If this is exceeded by a large margin, there's obviously a short somewhere and individual feeds should be disconnected and tested in turn.

Removing the plug from under the power supply unit proves very little, since this also disconnects the line oscillator's 30V supply: without the oscillator functioning the chopper cannot work (no trigger pulses to C613) and there'll be no current flow at all. It's better to disconnect the 60V supply lead to W507 (see Fig. 1) on the line timebase board (in fact W507 may not be fitted, a wire link being connected in its place, but the board is marked W507 so there shouldn't be any confusion). The W507 position is about half way along the left edge of the board. Lift the beam limiter subpanel to gain access to the print and swing the whole unit up to show the lead.

If the current is still excessive, the line output stage is not suspect and the field timebase/sound output sections are suspect together with C617 and C619 on the power supply board. We do not want to dwell upon this (which plugs to remove to isolate which circuit) as it's simply a matter of consulting the circuit and following the normal checking routines. In fact the current will normally be very low with the line output stage disconnected, and the fault will therefore reside somewhere on the upper right side. Shorted capacitors or transistors are the type of thing one will normally find.

Things become more complicated when the current is only marginally high – perhaps not enough to cause the new fuse to fail. In this case, remove the meter and switch to the low volts range. Then, with the fuse fitted properly, measure the voltage across the wirewound resistor R907 on the beam limiter panel (Fig. 2). The line output stage current flows to chassis through this resistor, and since it should have a value of  $1.5\Omega$  it needs no mathematician to calculate that 1A flowing would produce 1.5V. With no beam current flowing (you have disconnected the tripler) the line output stage current should be less than this and 1.3V is more the expected voltage figure. If you find much more than this, there's trouble in the line output stage and it's likely that if the tripler is reconnected the current will increase a lot more to indicate that the tripler is faulty.

With a new tripler fitted we may still be in trouble due (probably) to the e.h.t. transformer T503 having suffered from the excess current passed by the old tripler. So there may be no alternative to replacing this item as well. A faulty tripler can often result in shorted turns in the transformer that supplies it, and one must be prepared for this eventuality. The line output transformer T504 is seldom at fault, and one is rarely wrong to replace the e.h.t. transformer if the tripler has been proved defective and the line output stage current (checked by measuring the voltage across R907) is still excessive with the tripler disconnected.

It must not be assumed that triplers always behave so nastily when faulty. In fact the only indication that all is not well with a tripler may be the inability to focus the picture properly, with the focus adjustment at the end of its travel.

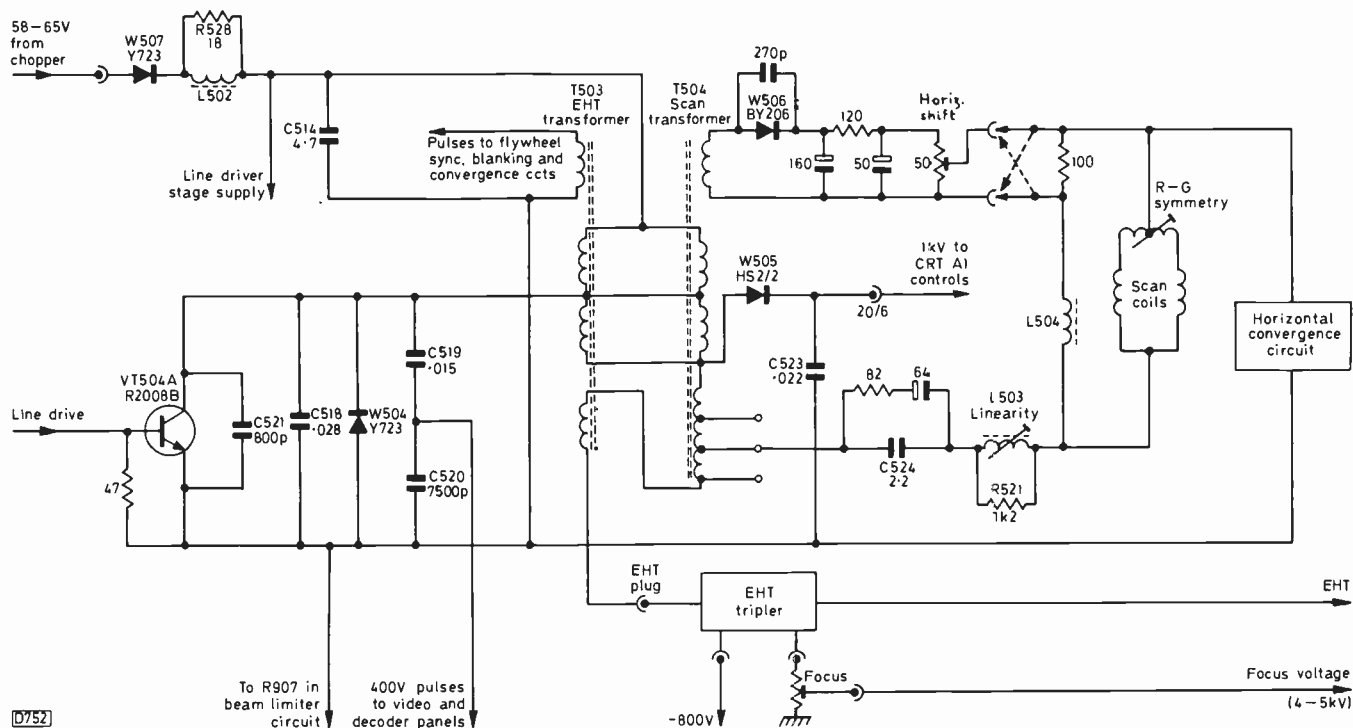


Fig. 1: Circuit of the line output stage used in the Thorn 3000/3500 chassis. In some early versions of the 3000 chassis there are two line output transistors, type R2009. Note that the line output stage earth line is returned to the main receiver earth line via R907 on the beam limiter board (see Fig. 2).

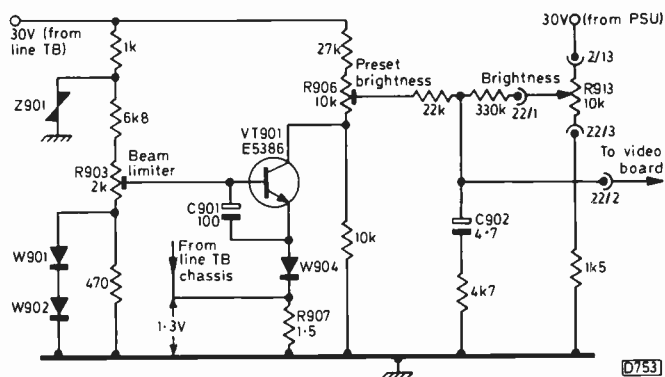


Fig. 2: The beam limiter circuit. With excessive c.r.t. beam current, excessive current will flow in the line output stage. This current returns to the main chassis earth via R907, which biases the emitter of the beam limiter transistor VT901. With no beam current, the voltage across R907 should be 1.3V. A higher voltage suggests a fault in the line output stage – or maybe that R907 has increased in value. When the beam current exceeds the permitted maximum, the voltage across R907 rises, biasing VT901 off. Its collector voltage rises therefore. This increased voltage is used to increase the base bias applied to VT205 on the video panel.

Whilst in many sets this could be due to one of several reasons (resistors changing value or the focus unit itself having internal trouble), it's a fact that a new tripler will restore normal focus in these Thorn models – in the majority of cases. This is another example of how the same symptoms can be caused by different defects in different receivers. For instance, poor focus in say an ITT CVC5-CVC9 hybrid colour receiver will very rarely be due to the tripler: one would this time head immediately for the 2.2MΩ resistor on the tube base, then for the 4.7MΩ resistor feeding the focus stick top connection – unless the focus voltage is too high, in which case one would head for the lower resistor (to chassis) and accuse it of going high in value.

Excessive current drawn by the line output stage in the

3000/3500 chassis is often accompanied by an unpleasant smell which is not due to the tripler. It (the smell) may well issue from the small stick rectifier W505 which overheats when its associated reservoir capacitor C523 (0.022μF) shorts. This is the c.r.t. first anode supply, at 1kV, so a replacement capacitor should be rated at 1.5kV for reliable operation.

### Other Common Faults

Another capacitor which seems to short regularly is C520 (0.0075μF). This produces the obvious symptoms of no colour and excessive brightness, since the clamping pulses (to the chroma and video sections) are lost. This capacitor is at the front of the line timebase panel which must be removed to gain access.

Two small electrolytics in the line sync and line oscillator stages are worth mentioning. Line hold troubles should immediately call attention to these 25 or 22μF capacitors (C506 and C511).

No effort to restore colour on these sets should be made until the line oscillator is functioning and locking correctly and reliably.

### The Beam Limiter

We've made the point that the line output stage current flows through R907. When the tube is asked to pass excessive current (increased e.h.t. and therefore line output stage current), the voltage across R907 increases, thus raising the emitter voltage of VT901 and decreasing the current flowing through this transistor. Less current through the transistor means that its collector voltage rises, which in turn alters the brightness by raising the voltage supplied by the panel to the video board. Reduced brightness means reduced beam current of course. To put it another way, in order to increase the brightness the output from the beam limiter-brightness board must be made negative going at 22/2.

To set up the beam limiter control R903 correctly, first identify the preset (to avoid confusing it with the preset brightness control R906). Turn R903 fully anticlockwise. Set the front panel brightness control midway, turn off the colour and contrast and note the reading at pin 6 (green cathode) of the tube's base socket (with the meter set to the 250V or 300V scale), having also operated the "set white" switch on the bottom left video board. Return the switch to normal and adjust R906 until the reading is the same.

Then turn the colour, contrast and brightness to minimum. Switch the meter to its 2.5V or 3V range, and note the reading across R907 (this assumes there's no fault in the set). Reset the controls for maximum brightness and contrast, with the colour normal, and adjust R903 to obtain a reading 0.5V above the previous reading. Note that we've not specified exactly what this reading should be. We did earlier on, if you remember. It was 1.3V with the tube taking no current, i.e. the first anode switches on the convergence panel off – or of course with the tripler disconnected. This is with no fault in the set.

Now the point arises. What if the brightness is at maximum and the picture is still too dark, which implies that the voltage at pin 6 or the other c.r.t. cathode pins is too high? A check across R907 may reveal a voltage in excess of 1.5V, which you might assume means that the line output stage current is too high, causing the beam limiter to operate.

This could indeed be the case, but before making this assumption it's as well to remember Ohm's Law: the voltage across a resistor depends on the current flowing through it and the resistor's value. The value specified for R907 is 1.5Ω. After a period of use however it may well be found that the resistor's value is higher than 1.5Ω, and this may be the simple explanation of the higher voltage and the decreased brightness, with no fault in the line timebase at all.

The voltage will of course vary with normal aerial input and the first anode switches on.

### **Absence of One Colour**

It is extremely common with these receivers to find that one colour is missing. The customer's complaint may be that the picture is "pink". This implies that although the red and blue guns are working, the green one isn't. This could mean that the voltage at pin 6 of the c.r.t. (green cathode) is high and that the green output transistor is not operating. It might well be so. Quite often however all three cathodes may be found to be at the same voltage but a check on the c.r.t.'s first anode voltages may prove that one is low (in this case green, at pin 5). This leads us hot foot to the convergence board, where we may well find that the voltage is being lost due to a leak. Normally one would suspect a capacitor for this sort of thing, and indeed this could well be the case here (C707/8/9 or C765/6/7, 3000/3500 respectively), but it's a fact that on this series of models leakage occurs across the switch contacts to chassis and it may be necessary to cut through the chassis return print until a new switch can be fitted (and to prove the point).

If on the other hand the first anode voltages are in order, and it's found that one cathode voltage is high, thus explaining the missing colour, attention must be directed to the video board and initially to the relevant output section: first to the appropriate output transistor (one of three with heatsinks), which should be tested in the usual way, then if necessary to the preceding stages. The three colour output transistors have their bases linked together, so the fault would not be here. Failure of one of the clamp diodes

W206/7/8 will result in a low c.h.t. cathode voltage (excessive red/green/blue).

The output transistors' load resistors (R250, R264, R277, 12kΩ) can change value or become open-circuit, particularly when they are contained in a single thick-film unit, as in all late models. The earlier wirewound resistors were not as prone to failure, but should nevertheless be included in preliminary checks when the grey scale is seriously affected.

### **Hum and Hum Bars**

Now let's return to the power supply.

We mentioned last month the trouble caused by deterioration of the main electrolytic block: less drastic effects can be caused by other capacitors in the power supply deteriorating. We also stressed the importance of C607 (1000μF 63V, front centre of power unit). Failure of this capacitor can cause total non-operation of the set because the chopper can't function until the 30V line has been fully established. In many cases however the 30V is present and the set functions, but with a distinct audio hum and a nasty distortion of the picture. C607 is often responsible for this condition, and in this case bridging the suspect with a known good electrolytic will bring an immediate improvement.

Bridging other suspect electrolytics is not recommended, as this can reduce the voltage at the point of bridging and cause a severe overload elsewhere in the circuit. Suspects should be tested separately, or better still replaced.

### **Different Versions**

Lastly this month, the differences between early and later versions of these sets – we don't propose to itemise all the differences, because these are fairly obvious upon inspection and anyone considering serious servicing will take the trouble to obtain the relevant manuals which point these out.

The most obvious difference is in the design and layout of the convergence board. The earlier 3000 models used a fairly small board on the left side, whilst the later 3500 chassis features a larger unit measuring some 35cm in width, occupying the whole width of the rear frame. Items to note on both boards include the two wirewound resistors. On the 3000 series these are both 10Ω (R707/8) whilst on the 3500 one is 10Ω (R751) and the other 18Ω (R752). They are most important to the life of the smaller components (diodes and resistors etc.) since if one becomes open-circuit the smaller components will be asked to carry the heavy current which the wirewounds normally shunt away from them. Thus if resistors are found burnt out and diodes shorted or open-circuit, these large resistors are the first items to check.

Other obvious differences include the use of a single line output transistor in the later versions, replacing the pair of line output transistors used in the earlier version of the 3000 chassis, also the type of tuner unit employed. When the mechanical tuner used in the original sets (similar to that used in the 1500 monochrome chassis) was replaced by varicap types, an extra board carrying the selectors and supplies as well as the tuner itself was fitted on the rear left side of the cabinet. This is removable in one piece, and is easy to separate and service when the occasion (usually caused by dry-joints) arises.

From a general servicing point of view however the versions are much alike and are in fact likeable once one becomes accustomed to their habits, which all in all are pretty predictable.

# Workshop Safety

Robin D. Smith

Back in 1978 I raised the question of the dangers of servicing some of the latest "live chassis" TV sets and asked for readers' views. Now at last the Radio, Electrical and Television Retailers' Association (RETRA, 57-61 Newington Causeway, London SE1 6BZ) has published a booklet entitled *Safety in Electrical Testing* which describes the precautions to be observed whilst servicing TV sets.

One point the report stresses is *common sense*. If you're standing on a metal floor holding a live chassis you're asking for trouble. Workshops should be "earth free" therefore, i.e. with wooden floors and workbenches, and no metal radiators or trunking near the bench. All mains points should have switches.

The subject of isolating transformers has sometimes caused debate in the past. A 500W 1:1 transformer is essential for servicing live chassis however. All test gear should be earthed at the mains or, more desirable, the equipment should incorporate a double-wound mains transformer, eliminating the need for an earth lead.

If care is taken, it seems that it is considered safe to connect an oscilloscope fed with raw mains to a TV set that's connected to the mains via an isolating transformer. Fig. 1 shows a unit under test (UUT) being used with a scope and with only the TV set isolated. The 0V signal line from the UUT chassis is referred to the scope's case, which in effect forms an extension of the UUT chassis. Shock risk always exists of course between a live terminal within a TV

set and a conventional scope, whether earthed or not. When the scope is earthed, shock risk also exists between a live terminal in the UUT and any other external earth. For this reason, it's recommended that the work area should be earth free.

If the workshop area is not earth free, all equipment should be connected via separate isolating transformers.

Another important point is that no other equipment should be connected to an isolating transformer feeding a TV set.

When field servicing, always carry an isolating transformer – and don't try servicing a set leaning against a radiator. It's better to bring the set into the workshop than risk a fatal shock.

I strongly recommend readers to obtain this booklet from the RETRA and to study it carefully. It's written in simple language, and several diagrams showing how to wire workbenches are included.

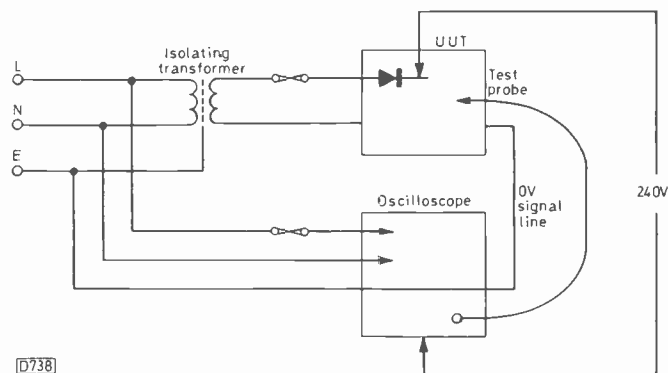
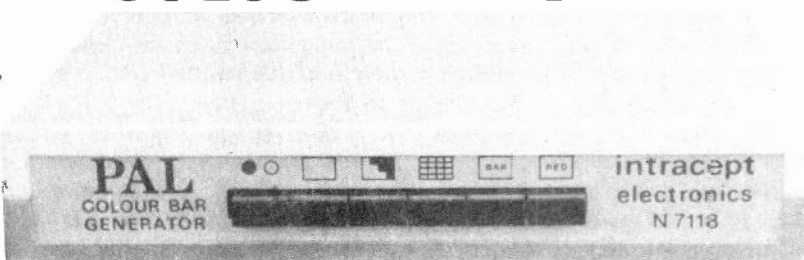


Fig. 1: Using an oscilloscope with a unit under test.

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## **PYE 697 CHASSIS**

The trouble with this set was severe loss of width, with a distorted picture but normal sound. On examination I discovered that the shift choke (L39) had been overheating – so badly that there had been arcing and the wire had burnt through. The break was repaired, but on testing the choke overheated and there was no picture. Disconnecting the shift choke restored the picture – the set seems to work quite satisfactorily without it.

It seems that the shift choke has developed shorting turns deep down in the winding. This would absorb most of the line output stage energy and produce the overheating you describe. With care, the choke can be rewound – fit cheeks to the ends and use an acetate bonding wire.

## **SONY KV1800UB**

There's a quarter inch wide green band at each side of the screen on this set. The purity and grey scale have been set up, but the green bands remain.

If the purity adjustment was successful, and the green bars have sharply defined edges and occur only on colour pictures, it would seem that the timing of the bistable (Q161/2) switching is incorrect. Check the steering diodes D151/2 and associated components, the supply decoupler C179 (4.7 $\mu$ F) and the cross-coupling capacitors C174 and C176. An oscilloscope is likely to be essential in tracing this fault: start with waveform 22.

## **DECCA 10 SERIES**

I'm having difficulty clearing a line timebase fault on this set. The screen is blank, and the sound goes off about a minute after switching on, by which time the PL509 line output valve is red hot. Removing the PL509 or PY500 top caps or disconnecting the PL509's screen grid stops the PL509 overheating. The line timebase valves have been checked by substitution, and the boost capacitor seems to be in order. Disconnecting the tripler makes no difference, and the only clue is that the voltage at the PL509's control grid is only –40V instead of –70V.

From the drive voltage figure you give, it's difficult to decide whether the trouble is due to low drive or a heavily damped line output transformer. If the drive comes up to about –70V when the PL509's screen grid is disconnected, the drive is probably in order – suspects here are R444 and R453 for going low in value (should be 33k $\Omega$  and 330k $\Omega$  respectively), and if necessary check C430 (line drive coupling) and C431 (pulse feedback to width circuit) for leakage. If the fault persists, disconnect the shift rectifier

D404, the blocking choke L402 and the scan coils in turn. If the overheating continues, the line output transformer is suspect for shorting turns.

## **RANK A823A CHASSIS**

There's a good colour picture, but occasionally when there's a camera change, e.g. during adverts, the picture goes to black-and-white with the flesh tones having a green hue. Normal colour is sometimes restored at the next camera change. Otherwise colour has to be restored by channel changing.

It seems that the identity control 3RV4 on the decoder panel is slightly misadjusted. First set up the line hold control on the scan drive panel, following the instructions given in the manual. Then readjust 3RV4 slightly until the effect is removed.

## **TELEFUNKEN 710B CHASSIS**

The trouble started some months ago, with slight picture jitter. It's gradually become worse, to the point where the setting of the field hold control is very critical.

The field sync pulses can be distorted due to the luminance amplifier being overloaded, in turn due to inadequate a.g.c. action in the early i.f. stages. The a.g.c. voltage is applied to pin 3 of the i.f. unit, and the voltage here should be around 22V with a normal signal. If the voltage is incorrect, check the a.g.c. output transistor T172 (BC237A) for base-collector punch through, also the i.f. a.g.c. threshold diode Gr172 which sometimes goes open-circuit to cause problems.

## **RANK Z718 CHASSIS**

The problem with this set is that the overload protection circuit comes into operation about a second after switching on. There's a bit of history: to start with the set would shut down after half an hour, then after switching it back on five minutes later it would remain on for about ten minutes. I replaced the two line output transistors, and the fault is now as above.

The overload protection circuit operates when the line output transformer is heavily damped. Disconnect the input to the e.h.t. stick, insulate it and switch on. If the line timebase now comes to life, replace the stick. If not, the following are suspect: rectifier diodes 5D2 and 5D3, the EW modulator diodes 5D5/6, the reservoir capacitors 5C12 (0.47 $\mu$ F) and 5C19 (0.01 $\mu$ F), the scan coils, and the line output transformer – in that order.

## **PYE 725 CHASSIS**

When the brightness or contrast control is advanced the picture bounces and jitters erratically – at the same time the picture is broken into four-five frames, and black and white lines flash across the screen. The sound remains perfect however. The instability usually follows a consistent pattern, i.e. varying with increased brightness or contrast, but the set may on occasion settle down, leaving a perfect picture. With the brightness and contrast turned down to give a darker than normal picture the fault doesn't occur.

The symptoms suggest that the over-voltage circuit is coming into operation too early. Check by measuring the h.t. at the red plug at the top of the chroma panel where you should read 185V. If the voltage is high, readjust the set h.t. control RV917 on the power supply panel. Alternatively, the BT116 regulator thyristor D888 could be going into the diode mode when overloaded.

### PHILIPS G8 CHASSIS

The picture has slowly moved over to the left. The picture quality is still excellent, but there's loss of information on the left-hand side.

It seems to us that the line hold has drifted off. There are two adjustments, one (line discriminator balance) associated with the TAA700 jungle i.c. on the i.f. panel, the other the oscillator coil on the timebase panel. Tune to a test card and adjust the controls for a normal picture. Then connect a d.c. voltmeter between TP9 (towards the rear of the i.f. panel) and chassis, and adjust R2177 for 6.4V. Next connect the voltmeter to the adjacent test point TP8 and adjust L4501 (rear of the timebase panel) for 6.9V. Finally adjust the horizontal shift control R5555 (centre of the scan panel) for a centred test card.

### THORN 8000 CHASSIS

The trouble with this set is loss of colour. The picture was all right until a short extract from an old black and white film was shown, but when the programme returned to colour the picture remained in monochrome. The situation is the same on all channels, and adjusting the controls makes no difference to the fault.

First override the colour killer by shorting the base-emitter junction of the colour-killer transistor VT113. If this restores colour, check VT113 and the associated rectifier diode W109 and if necessary the ident stage. If there's still no colour, check the voltages around the two chroma amplifier transistors VT115 and VT117. If these are in order, suspect a stalled reference oscillator – the transistor (VT111) and crystal (XTL101) are likely suspects here. If overriding the colour killer results in rainbow hues running up or down the screen (unlocked colour) suspect the d.c. amplifier transistor (VT110) in the reference oscillator control loop, the burst discriminator diodes W106/7 or the crystal. When you've found the culprit, adjusting R163 should restore colour lock. Adjust it as set out in the manual.

### BEOVISION 1400

The fault with this set is that after about two hours the picture goes black. This is with normal contrast and brightness control settings. If these controls are advanced, a very faint picture is visible. The picture returns to normal if the set is switched off and left for five minutes or so.

This trouble is commonly due to reduced c.r.t. first anode voltage. Replacing the feed resistor R320 (22M $\Omega$ ) and its decoupling capacitor C325 (0.1 $\mu$ F 630V) usually cures the problem. A less frequent cause is failure of either the video emitter-follower transistor T171 (BC147B) or the video output transistor T176 (BF110 – a suitable replacement is type BF178). If the transistors are the cause of the fault the voltage at pin 7 (cathode) of the c.r.t. will be well above the normal 100V.

### THORN 1612 CHASSIS

The trouble with this portable is very weak line sync – to obtain a stable picture, adjustment of the line hold control is very touchy.

The line oscillator and sync separator are in the SN76544N i.c. (IC5). The input to the sync separator is at pin 9, where bias is applied via R75. Check that this resistor is intact and of the correct value (220k $\Omega$ ). If so, check the two 47k $\Omega$  resistors R88/9 via which the reference signals are fed back to the flywheel sync circuit in the i.c. If all these resistors are in order, IC5 is suspect.

### RANK Z718 CHASSIS

The trouble on this set is EW pincushion distortion – bowing in at both sides of the screen. The width control 4RV15 has no effect, whilst the width modulator driver transistor 4VT19 is running warm. Adjusting the width control does not vary the voltages in the width modulator circuit.

We suspect that the trouble is due to leakage in 4VT19 or alternatively its driver 4VT18. If both prove ok on test or by substitution, check the capacitors in the width modulator circuit – 5C17, 5C16 and 5C32 – and the modulator diodes 5D5/6. The capacitors should be checked by substitution.

### SANYO 10-T120U/ALBA T10

The picture pulls to the right of the screen – sometimes it takes on an S shape. Adjusting the line hold control pulls the picture back almost into lock, then it starts pulling again. There's also field slip, though this is not as critical as the line locking.

If the pulling occurs in a regular manner, it's probable that the mains bridge rectifier is "half-waving", i.e. one section (diode) is open-circuit. Only one of the four diodes in the bridge needs to be defective for this condition to arise. Check the diodes and their reservoir capacitor C701 (2,200 $\mu$ F).

### RANK A823A CHASSIS

When the set's switched on from cold there's about one and a quarter inches of field foldover at the bottom of the screen. After the set has been on for about twenty minutes, a full raster is obtained.

This problem is usually cured by replacing the field charging capacitors 5C24/25 and the field driver transistor 5VT7. If the 40V supply to the field timebase is low during the fault condition however 5C39 (750 $\mu$ F) is suspect. A further though less likely possibility is that one of the output transistors 5VT11/12 is defective. Use of a hairdryer and freezer aerosol should speed diagnosis.

### ITT CVC32 CHASSIS

The fault on this set is a thin, stationary vertical line (watery) just to the left of the centre of the screen. The trouble started after servicing the power supply to restore picture and sound. The set has also had a high frequency buzzing sound almost from new.

It's important that the correct diodes are used in the power supply to prevent radiation, and that the ferrite beads fitted in production are not discarded. Check these points, and ensure that C44 (–320V line decoupling) and C47A (across the chopper transistor) are present and correct. The buzz is probably coming from the NS raster correction transducer L32/4, but the line output or driver transformer could be responsible.

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## TELEVISION APRIL 1980

## PYE 697 CHASSIS

There's very poor picture geometry on this set, in particular bowing at the top of the screen. Light striations across the top led to the replacement of the N-S amplitude potentiometer RV41, but the problem remains and the N-S phase coil L61 seems to have little effect over its range of adjustment.

A frequent cause of the problem is loss of inductance in L61 with heat. A quick check can be made by holding a soldering iron close to it during a test run. Otherwise we suspect defective scan coils.

# TEST CASE

## 208

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.

A Finnish hybrid colour receiver (ASA Model CT5003) had been working well for several years, requiring no attention until the field lock started to play up, with the symptoms of intermittent rolling and random changes in picture height. These things would usually happen after the set had been in operation for some hours and had thus become thoroughly warm. The complaint was first investigated by the field technician, who discovered that stable field timebase operation could be achieved by readjusting the field hold and height controls after rotating them over their ranges for a minute or so. The impression gained therefore was that the resistance between the sliders and tracks of these controls had become a little unpredictable due to lack of use.

The following day however a somewhat irate customer

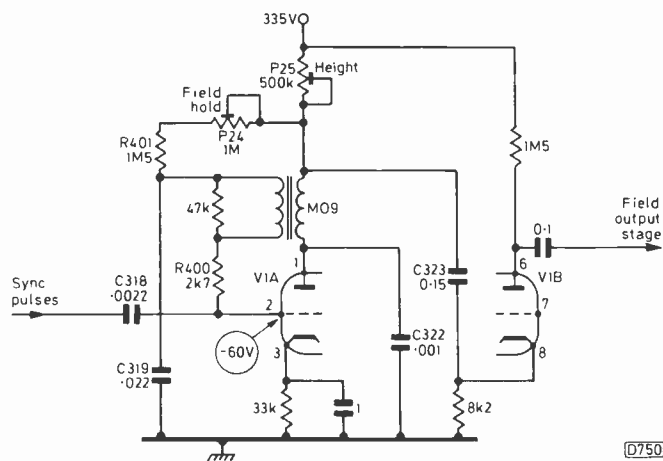


Fig. 1: Simplified circuit of the field oscillator and driver stages used in ASA hybrid colour receivers. V1 is an ECC81.

phoned to say that there was now no picture at all, just a bright line across the screen. So a loan set was promptly despatched and the ASA brought into the workshop.

The bench technician thought he was on to an easy one, and that replacing the two presets would cure the trouble. Sadly, this was not to be. The field collapse remained, despite changing the valves and preset controls.

The field timebase used in these sets has some unusual features. The PL508 field output valve is preceded by an ECC81 double triode (see Fig. 1). The first triode is employed as a blocking oscillator, the second being a driver stage and also involved in field linearity control (the rather complex linearity arrangement is not shown in Fig. 1). Quite a lot to go wrong in fact!

As a first step, voltage checks were made. During the course of this exercise it was discovered that a fairly substantial vertical displacement of the horizontal line occurred whenever the meter probe was touched on the PL508's control grid connection. This suggested that the output stage was operating normally, so attention was turned to the ECC81.

When the meter probe was applied to the control grid (pin 2) of the blocking oscillator section of the valve, the horizontal line expanded to give an almost complete though unsynchronised raster. As you can see, the secondary winding of the blocking oscillator transformer M09 is linked to the grid via R400, the other end of the winding being connected to the timing network C319/R401/P24. Sync pulses from a transistor amplifier stage (T44, BC147) are fed to the control grid via C318.

Without further ado the technician snipped out one component and after measuring it flung it into the bin! After fitting a replacement, a perfect raster which required only slight readjustment of the presets for optimum locking and height was obtained. What conclusions do you think the technician came to, and which component did he replace? See next month for the solution and another item in the series.

## SOLUTION TO TEST CASE 207

— page 267 last month —

Last month's trouble with a Thorn 2000 chassis was an intermittent picture — generally, the e.h.t. would fail to appear after switching the set on. You will recall that the e.h.t. regulator transistor VT6, which is in series with the supply to the e.h.t. generator stage, was failing to conduct when the fault was present, plenty of e.h.t. being obtained by shorting VT6 out. Since VT6 and its driver stages were in order, attention was turned to the control circuitry.

A 3.9V zener diode (W2) is included in the circuit to provide excess current protection. This diode samples the regulator's drive conditions, and is normally non-conductive. Should excessive drive be called for, i.e. excessive e.h.t. current demand, W2 will switch on and limit the regulator drive.

After some preliminary tests had been carried out, it was decided to focus attention on W2. It seemed to test o.k. out of circuit, but when in circuit it had an intermittent tendency to provide a high reverse leakage path, shutting the e.h.t. circuit down. A replacement completely cured the trouble.

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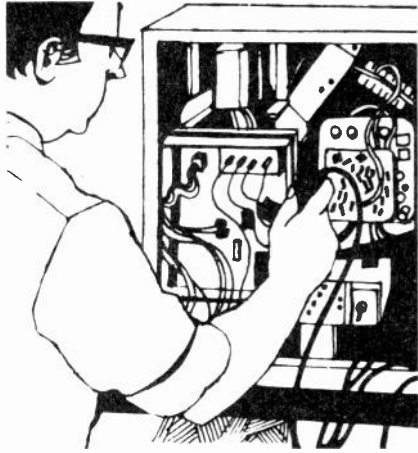
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 See our *NEW Catalogue* for details.

Hundreds of correct spares listed.

Send stamp for free copy.  
 New 1590 or 1591 speakers **£4.90**

*Prices include 15% VAT*

Package/Posting 40p per order but Transformers and Panels £1.

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11 Leeds Road, Hipperholme,  
 HALIFAX (0422) 202979  
 Callers Phone first. Exit 26 M62

**ORDER FORM PLEASE WRITE IN BLOCK CAPITALS**

Please insert the advertisement below in the next available issue of Television for ..... insertions. I enclose Cheque/P.O. for £ .....  
 (Cheques and Postal Orders should be crossed Lloyds Bank Ltd and made payable to Television)


NAME .....

ADDRESS .....

Send to: Classified Advertisement Manager.  
**TELEVISION**  
 GMG, Classified Advertisement Dept., Rm. 2337,  
 King's Reach Tower, Stamford Street,  
 London SE1 9LS. Telephone 01-261 5846.  
 Rate  
 21p per word, minimum 12 word. Box No. 60p extra.

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# TELEVISION TUBE SHOP

NEW TUBES AT CUT PRICES

## EUROPEAN TYPE Nos.

	Price £	VAT £
A28-14W.....	18.95	2.84
A31-19W/20W.....	19.95	2.99
A31-120W/300W.....	17.95	2.69
A31-410W/510W.....	17.95	2.69
A34-100W.....	18.50	2.77
A38-160W.....	17.50	2.63
A44-120W.....	18.75	2.81
A50-120W.....	17.95	2.69
A59-23W.....	18.95	2.84
A61-120W.....	18.95	2.84

## U.S.A./JAP. TYPE Nos.

9AGP4.....	19.50	2.92
190AB4/C4.....	17.50	2.62
230ADB4.....	28.50	4.28
230DB4/CT468.....	24.00	3.60
240AB4A.....	17.95	2.69
CT507 equiv.....	18.95	2.84
CT512.....	27.50	4.12
310DGB4/DMB4.....	23.00	3.45
310EUB4.....	19.95	2.99
310EYB4.....	18.75	2.81
310FDB4.....	19.95	2.99
310FXB4.....	17.50	2.62
310GNB4A.....	23.50	3.52
310HCB4.....	23.50	3.52
340AB4.....	19.50	2.92
340AYB4.....	25.25	3.79
340Rb4/CB4.....	24.50	3.68
340AHB4.....	24.50	3.68

Some Rebuilt Japanese  
& European Types  
Available at  
**£14.00 + VAT £1.75**

## COLOUR TUBES (New & Colourex)

12VARP22.....	62.50	9.37
330AB22.....	67.50	10.12
470FUB22B.....	97.50	14.63
A44-271X.....	65.00	9.75
A47-342X.....	69.50	10.42
A47-343X.....	69.50	10.42
A49-191X.....	59.50	8.92
A51-161X.....	59.00	8.85
A51-220X.....	64.00	9.60
A56-120X.....	58.50	8.77
A63-120X.....	69.50	10.42
A66-120X.....	65.00	9.75
A66-140X/410X.....	70.50	10.57
A67-120X.....	65.00	9.75
A67-140X/200X.....	69.50	10.42
A67-150X.....	75.00	11.25

ALL TUBES TESTED BEFORE  
DESPATCH & GUARANTEED  
FOR 12 MONTHS! 4 YEAR  
GUARANTEES AVAILABLE ON  
MOST TYPES

### CARRIAGE

Mono £3.00 Colour £4.00

Mainland only. Overseas Rates on  
Application.

**TELEVISION TUBE SHOP LTD.**  
52 BATTERSEA BRIDGE RD.,  
LONDON, SW11.  
Tel. 228 6859/223 5088

# ELECTRONIC MAILORDER LTD.

## VALVE BARGAINS

Any 5-80p, 10-£1.50, 50-£6.00 Your  
choice from the list below.

ECC82, EF80, EF183, EF184, EH90, PCF80,  
PCF802, PCL82, PCL84, PCL85, PCL805,  
PL504, PY81/800, PY88, 30PL14, 6F28,  
PFL200.

Colour Valves - PL508, PL509, PL519,  
PY500/A. All tested, 65p each.

Aerial Splitters: - 2 way, 75 OHMS, Inside  
Type, £2.50

## AERIAL BOOSTERS

Aerial boosters can produce remarkable  
improvements on the picture and sound, in  
fringe or difficult areas.

B11 - For the stereo and standard VHF/FM  
radio.

B12 - For the older VHF television - Please  
state channel numbers.

B45 - For Mono or colour this covers the  
complete UHF Television band.

All boosters are complete with Co-ax plugs &  
sockets. Next to the set fitting.

Price £5.70 each.

## SIGNAL INJECTOR

AF/RF, which emits signals up to the UHF  
band. Price £4.70

ALL PRICES INCLUDE VAT, P&P 30p PER ORDER.  
EXPORTS WELCOME AT COST. SAE FOR LEAFLETS.

62 BRIDGE STREET, RAMSBOTTOM,  
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TEL: RAMS (070 682) 3036.

# BIRMINGHAM AND DISTRICT DEALERS/ENGINEERS

## NEWS FLASH

HIGH VACUUM  
QUALITY  
REBUILT TELEVISION  
PICTURE TUBES

COMPETITIVE PRICES

CONTRACT TERMS  
AVAILABLE

2 YEAR GUARANTEE

E.G.	
17" 18" 19"	£29.50 + VAT £4.43
20"	£32.50 + VAT £4.86
22"	£34.00 + VAT £5.10
25"	£37.00 + VAT £5.55
26"	£40.00 + VAT £6.00

### PIL Tubes our speciality.

All Prices For Tubes available on  
a Sound "Glass for Glass" basis  
otherwise £20 surcharge

C.W.O. Carr./Ins. £6.50  
"Old Glass Purchased"

## TUBESURE LTD.

Unit 111, Middlemore Industrial Estate,  
Middlemore Road, Smethwick,  
West Midlands. Telephone: 021-558 7777.

# DISPLAY ELECTRONICS

## REGUNNED COLOUR TUBES 2 YEAR GUARANTEE

Up to 19".....	£29.50
20".....	£31.50
22".....	£33.50
25".....	£35.50
26".....	£37.50

The above prices are for standard  
38mm Delta Gun Types. Prices on  
application for P.I.L. Tubes etc. Some  
types available without pre-supply of  
glass at extra cost.

Carriage/Packing £5 up to 75 miles  
from works. £6.50 over. Please add  
15% VAT

## REGUNNED MONO TUBES 2 YEAR GUARANTEE

20".....	£11.00
24".....	£13.00

Carriage/Packing £4.00 up to 75  
miles from works. £5.00 over. Please  
add 15% VAT.

## CALLERS WELCOME

Late night Thursdays until 8pm  
Saturdays until midday.

N.B. Customers intending to collect  
orders are requested to telephone in  
advance:— even popular types may  
be out of stock for short periods.

## V.D.U./RADAR TUBES

We have supplied British and Foreign  
Airlines with rebuilt V.D.U. Tubes for  
several years and also have Radar  
Display Tubes operating on British  
Airfields.

Home and export enquiries for Radar  
Display Tubes manufactured from  
new (with phosphors to specification)  
are invited.

**WATERLOO ROAD,  
UXBRIDGE,  
MIDDLESEX**

Telephone: Uxbridge 55800

CONDENSER SALE PRICE						
2.7/63V	220/10V	4700/10V	4700/40V	30p	33/350V	6p
4.7/63V	220/16V	1/250V	1000/50V	10p	2000+2000/35V	30p
10/250V	470/25V	10/40V	220/63V	8p	.01/1000V	8p
22/40V	680/40V	330/63V	1500/40V	8p	.047/1000V	8p
160/25V	680/25V	.47/160V	470/63V	8p	.47/1000V	30p
1/63V	33/100V	8/300V	106/350V	20p	.1/800V	8p
100/100V	33/63V	.47/250V	100/450V	40p	.1/400V	5p
2.2/160V	33/35V	.01/100V	220/450V	40p	.0047/1,500V	8p
100/16V	100/63V	.005/1,500V	470/40V	8p	2N2/1,500V	8p
330/25V	22/160V	.01/600V	8/350V	6p	1N8/1,500V	8p
3.3/250V	100/40V		10/500V	10p	.1/2000V	15p
330/10V	47/40V		33/500V	10p	2500+2500	50p
5p each	47/63V	5p each	4700/25V	25p	B9A Print	5p
			4700/30V	25p	V/holders PYE 697 (Long)	
			22/350V	6p		15p

PRE-AMP PAWLE  
4 Pots Transistor etc.  
Plugs & Sockets  
I.F. Pawle  
20 watt O/P stage

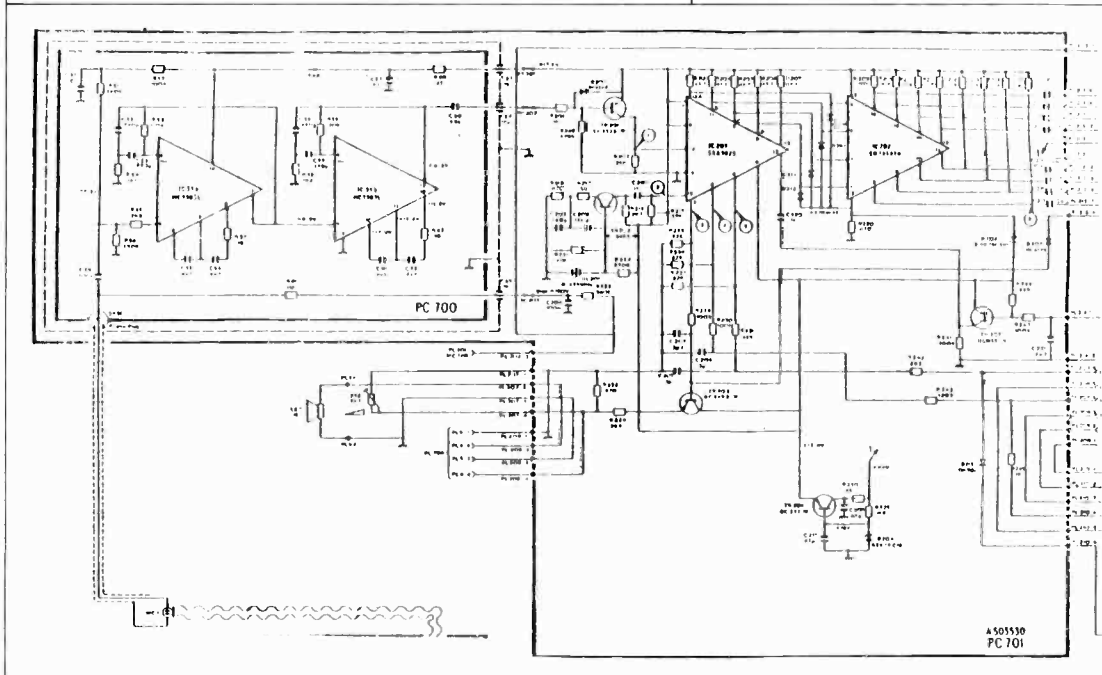
£1.00  
£1.00  
£1.00

ITT PT26 3W12 (Thermistor Degauseing) Fits Most Sets 15p

Thermistors mixed 2N3055 5 for 50p 25p each

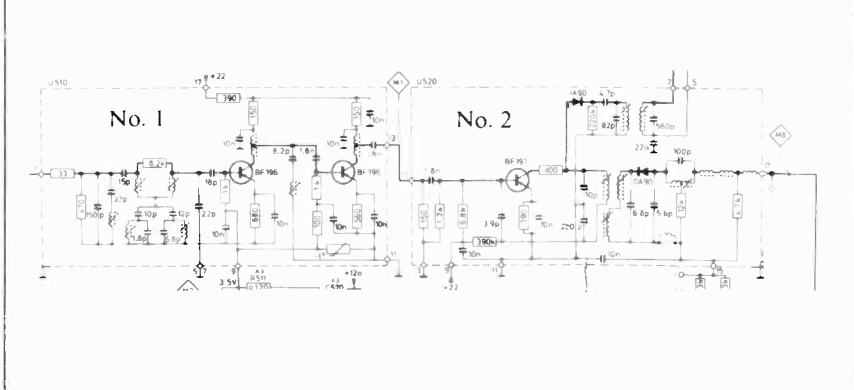
I.C. SOCKETS 14 PIN Q 5p

PHILIPS SNIPS CUT MOST THINGS £2.00



ULTRASONIC AIR BEAM RECEIVER  
Mains power supply  
Print Pawle with all components  
I.C. etc.  
£10.00

T/V I.F. 5.5 Mc/s Cans No. 1 No. 2 PHILIPS £1.50 each



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2 WOODGRANGE CLOSE,  
THORPE BAY, ESSEX  
Reg. Office Only.  
Callers by appointment only.  
Add 15% VAT.  
Add 30p P. & P.  
Add postage for all overseas parcels.