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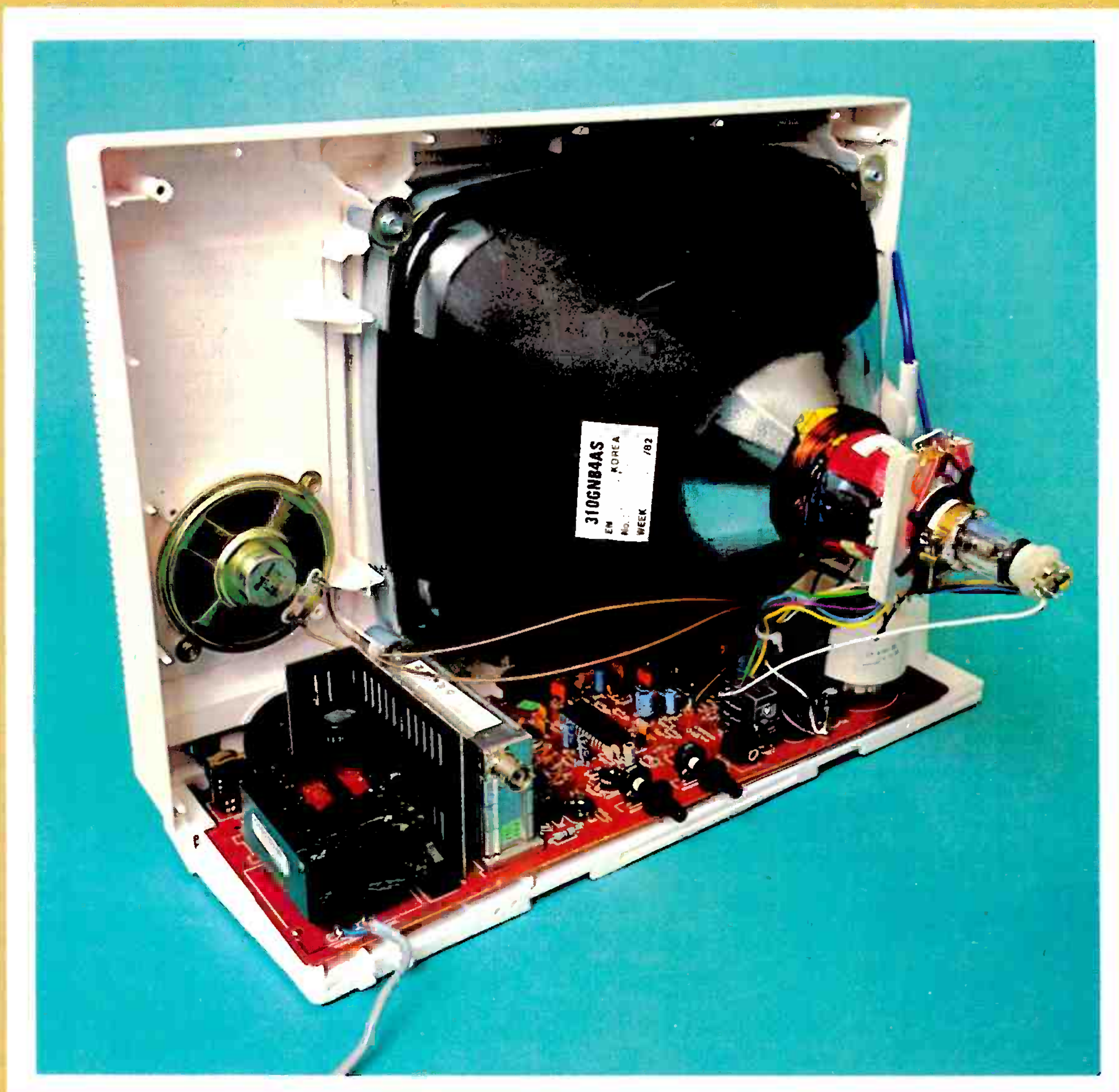
TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



THORN'S NEW 1790 CHASSIS

VINTAGE TV

FAULT REPORTS

SIMPLE VCR SERVICING

QUICK CHECKS: THORN 3000 SERIES

TELEVISION

February 1983
Vol. 33, No. 4
Issue 388

CORRESPONDENCE
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, 25 Lavington Street, London SE1 0PF.

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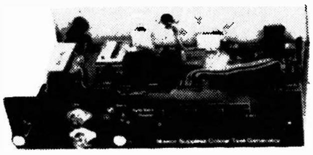
this month

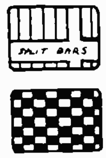
OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 16

MANOR SUPPLIES

NEW MKV CHEQUERBOARD & PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE





- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

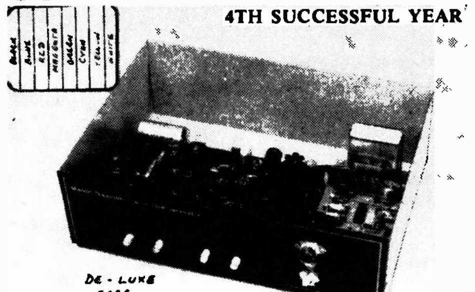
Price of Kit	**£80.50**
Standard Case (10½"×6½"×2½")	**£5.50**
De Luxe Case (10"×6"×2½")	**£8.50**
Optional Sound Module (6MHz or 5.5MHz)	**£4.50**
Built & Tested in De Luxe Case including Sound Module	**£115.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.00.
All above prices include VAT 15%

PAL COLOUR BAR GENERATOR (Mk 4)

4TH SUCCESSFUL YEAR



- ★ 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.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s. on colour bar P.C.B.

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 P&P £1.20. DE-LUXE CASE £8.50. ALUMINIUM CASE £3.30, P&P £1.20, BATT HOLDERS £1.70 P&P 85p, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55 (Combined P&P £1.80).

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

MK 1 (Texas XMII) Cable remote control **£170.20** p.p. £2.80
MK 2 (Philips/Mullard) Infra-red remote control **£227.70** p.p. £2.80.
Further details on request.

Goods available if in stock immediately over shop counter (Mail order between 3 days and 1 week from receipt of order).

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TELEVISION MAGAZINE PROJECT PARTS

NEW COLOUR PORTABLE TV
TV PATTERN GENERATOR — SMALL SCREEN MONITOR
MONO PORTABLE TV — LARGE SCREEN COLOUR TV
PHONE, CALL, OR SEND FOR LISTS
WORKING MODELS & PANEL TEST SERVICE AT
172 WEST END LANE.

SPECIAL OFFER Leading makers Tuner-Timer in De Luxe Case. 12 station touch tune UHF-VHF + IF amp. Video Audio Outputs, Digital Clock etc. Less than half original trade price **£74.75** p-p £3.50.
TV SOUND IF PANELS, FULLY TESTED **£7.82** p.p. £1.00.
SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND tested for T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, AT REDUCED PRICE £57.50 p.p. £1.60.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE £7.80 p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
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. 60p. (ALUM CASE **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.)
ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
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BUSH Z718 BC6100 SERIES IF PANEL £5.75 p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, 100 SERIES, IF, FRAME T.B. £5.75 each p.p. £1.40.
GEC SERIES 1 MONO PANELS **£2.10** p.p. £1.30.
GEC 2110 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2040 DECODER PANEL **£2.88** p.p. £1.60.
GEC 2040 IF PANEL **£3.22** p.p. £1.40.
GEC 2040 (SERIES) CDA PANEL **£2.88** p.p. £1.40.
THORN TX9 PANELS ex factory for small spares. Includes I.C.s & Semiconductors etc. **£5.75** p.p. £2.00
THORN 3000 LINE T.B., POWER PCB **£5.75 each** p.p. £1.30.
THORN 3000 CONVERGENCE PANEL **£5.75** p.p. £1.80.
THORN 3000 VID, IF, DEC, Ex Rental **£3.70 each** p.p. £1.30.
THORN 8800 Varicap channel selector & front control unit **£4.37** p.p. £1.80.
THORN 8000/8500 IF/DECODER PANELS salvaged **£3.70** p.p. £1.80.
THORN 8000/8500 FRAME T.B. PANELS salvaged **£2.88** p.p. £1.40.
THORN 9000 LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £2.00.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
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PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
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BUSH "Touch Tune" Varicap Control Z179, Z718 types **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£7.82** p.p. 85p.
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UHF/625 Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, Mullard 4 position push button **£4.80** p.p. £1.50.
LOPTS NEW & GUAR. P/P Mono **£1.35p,** Colour **£1.45p,** Bobbins **80p.**

BUSH 161 to 186S	**£6.80**	**R.B.M.** A823	**£5.60**
BUSH, MURPHY 774 series	**£9.80**	**R.B.M.** Z179	**£11.30**
BUSH, MURPHY A816 series	**£9.80**	**R.B.M.** T20, T22	**£11.30**
DECCA 20/24, 1700, 2000, 2401	**£8.80**	**R.B.M.** T20, T22 Bobbin	**£6.44**
FERG., HMV, MARCONI, ULTRA 950, 1400, 1500, 1580, 1590, 1591	**£6.80**	**DECCA** Bradford (state Mod No.)	**£10.15**
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GEC 2000 to 2038 series	**£7.80**	**GEC** 2028	**£5.60**
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PHILIPS 19TG 170, 210, 300	**£8.80**	**ITT** CVC25, CVC30 series	**£10.15**
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	**£8.80**	**PYE** 691-697	**£14.80**
		PYE 713, 715, 731 to 741	**£7.85**
		PYE 725 (90°)	**£10.60**
		PHILIPS G8, G9	**£10.15**
SPECIAL OFFER		**PHILIPS** 570	**£7.85**
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PYE 40, 67	**£2.00**	**THORN** 8000/8500/8800	**£14.80**
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TRIPLERS Full range available. Mono & Colour.
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THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED
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MANOR SUPPLIES

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W. Hampstead (Brit. Rail) access from all over Greater London.

Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.
ALL PRICES INCLUDE VAT AT 15%

TRANSISTORS, ETC.

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.56	BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63	BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63	BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.48	BC107*	0.16	BC207*	0..	BC461	0.78	BD238	0.68	BF244*	0.31	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
AC128K	0.55	BC108*	0.16	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BRY39	0.60	MPU131	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	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.54
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.66	BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71	BF257	0.47	BT109	1.99	OC35	1.26	2N916	0.46	2N4126	0.17
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74	BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	0.30	BC213L*	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	BU102	2.85	OC44	0.68	2N1164	10.29	2N4292	0.32
AC153K	0.52	BC119	0.34	BC214L*	0.18	BC557*	0.16	BD520	0.88	BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD599	0.87	BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.17	BD600	1.23	BF271	0.42	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	0.20	BC238*	0.15	BCY10	0.30	BD663BR	0.86	BF273	0.33	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.05	BDX18	1.55	BF274	0.34	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95	BF336	0.63	BU205	2.58	OC81D	0.95	2N1711	0.47	2N5061	0.30
AC187K	0.65	BC136	0.22	BC252*	0.25	BCY34A	1.02	BDY16A	0.63	BF337	0.65	BU206	2.59	OC139	1.30	2N1893	0.52	2N5064	0.63
AC188	0.50	BC137	0.30	BC253*	0.38	BCY72	0.27	BDY18	1.55	BF338	0.68	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
AC188K	0.61	BC138	0.352	BC261A*	0.28	BD115	1.35	BDY20	2.29	BF355	0.72	BU407	1.38	OC170	0.80	2N2217	0.55	2N5087	0.50
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BDY38	1.38	BF362	0.49	C106D	0.80	OC171	0.82	2N2218	0.38	2N5208	0.59
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48	BF363	0.49	C106F	0.43	OC200	3.90	2N2219	0.42	2N5294	0.66
ACY17	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF367	0.29	C111E	0.46	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF451	0.43	D40N1	0.64	OC202	2.40	2N2222A	0.41	2N5298	0.71
ACY28	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF121	0.85	BF457	0.46	E300	0.42	OC205	3.95	2N2369A	0.40	2N5322	1.18
ACY39	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.48	BF458	0.49	E1222	0.47	OCP71	1.98	2N2401	0.80	2N5449	0.18
AD140	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.56	BF459	0.52	E5024	0.19	ON236A	0.94	2N2484	0.35	2N5457	0.46
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51	BF594	0.16	GET872	0.46	R2008B	2.72	2N2570	0.74	2N5458	0.40
AD143	1.78	BC153	0.38	BC297	0.36	BD137	0.40	BF137F	0.78	BF596	0.17	ME0402	0.18	R2010B	2.79	2N2646	0.82	2N5459	0.58
AD149	1.42	BC154	0.41	BC300	0.62	BD138	0.42	BF152	0.19	BF597	0.27	MF0404/02	0.18	R2322	0.75	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25	BFR39	0.30	ME8001	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	BFR40	0.29	ME6002	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	BFR41	0.30	MJ2955	1.30	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	1.32	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84	BFR50	0.29	MJ3000	1.58	TIC44	0.25	2N2905*	0.39	2N6122	0.80
AF115	1.26	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BFR52	0.33	MJE340	0.68	TIC46	0.35	2N2906*	0.36	2N6178	1.07
AF116	1.28	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BFR61	0.29	MJE341	0.72	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	1.32	BC168B	0.14	BC309*	0.18	BD157	0.51	BF166	0.50	BFR62	0.28	MJE370	0.74	TIP29A	0.47	2N2926O	0.14	2N6211	2.74
AF118	0.98	BC169C	0.15	BC317*	0.15	BD158	0.75	BF167	0.36	BFR79	0.30	MJE371	0.79	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
AF121	0.68	BC170*	0.15	BC318*	0.15	BD159	0.68	BF173	0.36	BFR80	0.29	MJE520	0.85	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
AF124	0.38	BC171*	0.15	BC319*	0.19	BD160	2.69	BF177	0.36	BFR81	0.30	MJE521	0.95	TIP31C	0.67	2N3053	0.48	2SC643A	2.28
AF125	0.38	BC172*	0.14	BC320	0.17	BD163	0.67	BF178	0.36	BFR88	0.42	MJE2955	1.20	TIP32A	0.56	2N3054	0.86	2SC930D	1.50
AF126	0.36	BC173*	0.22	BC321A&B	0.18	BD165	0.66	BF179	0.58	BFT41	0.48	MJE3000	1.95	TIP32C	0.72	2N3055	0.72	2SC1061	1.46
AF127	0.86	BC174A & B		BC322	0.28	BD166	0.88	BF180	0.53	BFT43	0.55	MJE3055	1.22	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.56
AF139	0.58		0.26	BC323	1.15	BD175	0.90	BF181	0.53	BFW11	1.02	MPF102	0.40	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	0.22	BD177	0.58	BF182	0.44	BFW30	2.58	MPS3702	0.33	TIP41A	0.72	2N3391A	0.38	3N128	1.00
AF149	0.45	BC177*	0.20	BC328	0.18	BD178	0.92	BF183	0.52	BFW59	0.19	MPS3705	0.30	TIP42A	0.80	2N3633	0.60	40250	0.96
AF178	1.35	BC178*	0.22	BC337	0.17	BD181	1.94	BF184	0.44	BFW60	0.20	MPS6521	0.36	TIP2955	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	2.10	BF185	0.42	BFW90	1.65	MPS6523	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
AF180	1.35	BC182*	0.15	BC340	0.19	BD183	1.34	BF186	0.42	BFX29	0.38	MPS6566	0.44	TIS43	0.44	2N3705	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD184	2.30	BF194*	0.14	BFX84	0.42	MPSA05	0.30	TIS73	1.36	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC348A & B		BD187	1.20	BF195*	0.13	BFY50	0.38	MPSA06	0.32	TIS90	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14		0.17	BD188	1.25	BF196	0.14	BFY51	0.37	MPSA55	0.43	TIS91	0.28	2N3708	0.17	40429	0.85
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15	BFY52	0.35	MPSA56	0.45	ZTX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	3D222	0.91	BF198	0.29	BFY53	0.36	MPSA93	0.56	ZTX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BFY90	1.98	MPSL01	0.33	ZTX213	0.2	2N3772	2.08	40603	1.13
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BPX25	1.82	MPSU01	0.61	ZTX300	0.16	2N3773	2.90	40636	1.25
AL103	2.55	BC187	0.27	BC360	0.59	BD233	0.52	BF218	0.42					ZTX304	0.25	2N3794	0.40	40654	0.89

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Type	Price (£)
CA810QM	2.50
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.18
MC3051P	0.58
MFC400B	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.96
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SL432A	2.52
SL450	5.10
SL901B	4.7[illegible]
SL917B	6.50
SL918A	5.95
SN72440N	2.21
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32

Type	Price (£)
SN76023ND	1.40
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.98
TA7073P	3.51
TAA263	2.20
TAA300	3.8F
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	2.85
TAA621AXI	4.7b
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.76
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
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TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
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TBA240A	3.98
TBA281	2.07
TBA395*	2.56
TBA396	2.40
TBA400	2.20

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TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	4.55
TBA641BX1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.48
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	3.85
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	1.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

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Type	Price (£)	Type	Price (£)
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AA119	0.21	BY118	1.10
AA129	0.28	BY126	0.20
AA143	0.18	BY127	0.21
AAY30	0.28	BY133	0.35
AAZ13	0.42	BY140	1.40
AAZ15	0.35	BY164	0.75
AAZ17	0.28	BY176	2.80
AY102	3.85	BY179	0.83
BA100	0.24	BY182	1.14
BA102	0.36	BY184	0.44
BA104	0.19	BY189	5.30
BA110	0.80	BY190	4.90
BA111	0.70	BY206	0.28
BA115	0.17	BY238	0.25
BA116	0.56	BYX10	0.30
BA121	0.85	BYX38/600	0.70
BA129	0.45	BYX70/500	0.63
BA145	0.19	ITT44	0.08
BA148	0.19	ITT210	0.63
BA154	0.06	ITT827	0.80
BA155	0.17	MCR101	0.48
BA156	0.12	MR854	1.10
BA157	0.25	OA5	0.88
BA158	0.28	OA10	0.58
BA159	0.40	OA47	0.20
BA164	0.14	OA81	0.19
BA182	0.27	OA90	0.13
BA201	0.13	OA91	0.15
BA202	0.14	OA95	0.20
BA203	0.14	OA200	0.13
BA216	0.08	OA202	0.13
BA219	0.11	OA210	0.89
BA243	0.45	TIL209	0.14
BA317	0.06	TIL211	0.18
BA318	0.07	TV20	2.25
BAV10	0.10	IN914	0.06
BAV21	0.18	IN916	0.06
BAW62	0.06	IN4001	0.06
BAX13	0.07	IN4002	0.07
BAX16	0.10	IN4003	0.08
BAX17	0.19	IN4004	0.08
BAY72	0.16	IN4005	0.09
BB104B	0.52	IN4006	0.10
BB105B	0.33	IN4007	0.12
BB105G	0.30	IN5400	0.15
BR100	0.40	IN5401	0.17
BY100	0.35	IN5402	0.20
BY103	0.35	IS920	0.09
		IS921	0.11

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	£1.28 each
2.5W plastic	7.5-75V	87p each
20W stud	7.5-75V	£1.31 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.67
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL519	6.20
PL802	5.60
PY81/P810	0.80

BRIDGES

Rating	Price (£)	Rating	Price (£)
1½A 50V	0.27	2A 100V	0.36
100V	0.28	200V	0.40
200V	0.32	400V	0.47
400V	0.40	600V	0.53
600V	0.50	800V	0.60
800V	0.58	1000V	0.87
3A 100V	0.52	6A 100V	0.66
200V	0.55	200V	0.68
400V	0.61	400V	0.74
600V	0.67	600V	0.80
800V	0.80	800V	0.86
1000V	1.20	1000V	0.95

10A and 25A ranges also stocked.

RESISTORS

Carbon Film (5%)

	Ea	10 of one value	Mixes of a minimum of 10pcs of any value: 50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	96p	£1.40	£5.40
½W 10Ω-10MΩ (E24)	3p	25p	96p	£1.40	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£28.80

Wirewound (5%)

2½W 0.22Ω-270Ω	18p
4W 1.0Ω-10kΩ	22p
7W 0.68Ω-22kΩ	24p
11W 1.0Ω-22kΩ	28p
17W 1.0Ω-22kΩ	33p
Vertical mounting pillars	3p

Presets (†)
0·1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2·2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2·5, 5MΩ all 14p each
0·2W (Vertical and Horizontal)
Values as 0·1W all 14p each

FUSES (all packs of 10)

20mm Time Delay (BEAB)

40mA	5.50
50, 63mA	5.50
100mA	3.50
160, 200, 250mA	3.20
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 3.25

20mm quick-blow (BEAB)

100mA	£1.50
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 70p

2A circuit breakers metal £1.62, plastic £1.48

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4n7F	1500V DC	60p	100nF	1000V DC	46p
10nF	1000V DC	22p	470nF	1000V DC	60p

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1kV	1.5nF	18p
3kV	1.5nF	20p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
	270, 300pF	39p

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30, 120, 270, 470, all at 20p each

VHF to UHF CONVERTER CM6022/RA. "Televerta" for DX-ing or uhf receiver use on relay systems, Eire etc. † £32.77

TELEVISION

TV Pioneer

The death of Vladimir Kosma Zworykin at the age of 92 late last summer seems to have gone largely unannounced. Dr. Zworykin was however very much one of the pioneers of TV – called by some "the father of television". He is perhaps best known for the successful development of the iconoscope tube, one of the first practical electronic camera tubes.

Vladimir Zworykin was born in Mourom, Russia in 1889 and attended the Petrograd Institute of Technology, from which he received a degree in electrical engineering in 1912. He emigrated to the USA in 1917 and obtained a post with the Westinghouse Corporation. His doctorate was obtained from the University of Pittsburgh in 1926. In 1929 he moved to RCA as Director of Engineering at RCA's Camden, New Jersey, Electronic Research Laboratory, where he remained until 1942. He then moved to Princeton University, retiring in 1954.

Zworykin's interest in television started back in Petrograd, where he studied under Professor Boris Rosing, becoming his laboratory assistant. An illustration in this magazine in July 1935 (*Practical Television,* Vol. 1, no. 11) shows the TV system proposed and demonstrated by Boris Rosing in 1907. The video signal was produced by means of mirror drums (for scanning) and a photocell, a cathode-ray tube being used to display the picture at the receiving end. It was A. A. Cambell Swinton who is first on record as proposing the use of electronic scanning for both the camera and the receiver. In a letter to *Nature* in 1908, he proposed a pick-up tube containing a two-dimensional array of minute photocells with a common cathode. The cells would be charged by the scene focused on to them, then discharged in sequence by a scanning beam. The picture would be displayed by being "applied to a Rosing cathode-ray tube" – Rosing had modified the original Braun c.r.t. of 1897 by adding focusing and deflection arrangements.

Zworykin was thus at the heart of TV thinking from the start, and in 1923 he filed a patent application for his iconoscope camera tube (the name came from the Greek eikon, an image, and skopein to see). It's one thing to put proposals forward however, another to achieve a practical device. It seems that Zworykin continued work on his iconoscope tube over a period of several years, building various prototypes and devising improvements each time. Work did not accelerate however till Zworykin joined RCA. One of the earliest preserved iconoscope tubes was built by Zworykin in 1931.

Though Zworykin's original patent application was made at a remarkably early date, it was EMI who were first awarded a patent for such a camera tube – for the Emitron tube in 1932. It's interesting to note the Russian influence on the development of TV – the EMI team was headed by Sir Isaac Schoenberg, who had also studied at St. Petersburg.

The Emitron was very similar to the iconoscope. EMI's jump ahead was probably due to the different tempo of development on the two sides of the Atlantic at the time rather than any technological reason. The Baird company in the UK had been generating considerable pressure to get a TV service started, and EMI, which had only recently been created from various recording companies during a difficult time in the industry, were determined to ensure that the all-electronic TV system then being developed at their Hayes Central Research Laboratories should be the one adopted. The work at Hayes was done in great secrecy – to such an extent that for a time Schoenberg did not disclose to the directors just what he was doing by way of developing a camera tube. The Emitron was a working proposition by 1932 however, and after further development was used at the start of the BBC's high-definition service in 1936. It seems that at the height of the depression in the USA the pressure to get a TV service started there was less than in the UK.

The similarity of the Emitron and the iconoscope has long been something of an historical riddle. There were links between RCA and EMI, though there is nothing on record of any technical co-operation in the TV field. An account of the iconoscope tube in the October 1934 issue of *Practical Television* described in some detail the light-sensitive mosaic on which the scene was focused and which was scanned, from the same side, by the electron beam. To quote: "the 'electric eye' is composed of a large number of tiny globules of silver, which are covered with caesium to render them responsive to light and are deposited as a mosaic on a mica backing plate". An article on early camera tubes in our June 1969 issue described the mosaic used in the Emitron tube in much the same terms, though mentioning that "it was in the construction of the mosaic that the Emitron differed most from the iconoscope." Both developments followed up Cambell Swinton's suggestion of course, using the materials then available, and when one considers the chemical problems and the poor vacuum technology of the time it's amazing that the two tubes were so successful. The basic mosaic arrangement was Zworykin's however.

Dr. Zworykin's interests extended far beyond television. After his retirement, he directed the Medical Electronics Centre at the Rockefeller Institute, New York. He received 27 major awards including, in 1966, the US National Medal of Science "for major contributions to the instruments of science and television, and for stimulation of the application of engineering to medicine."

COVER PHOTO

Our cover photograph this month shows a rear view of the Ferguson Model 38030 monochrome portable with the back cover removed. Models 38030 and 38020 are fitted with the new Thorn 1790 series chassis (see page 183). Apart from the loudspeaker and the tube assembly, everything is mounted on a single PCB. The 28-pin Monomax i.c. can be seen at the centre of the board. Our thanks to THORN EMI FERGUSON Ltd. for the loan of the set.

CORRECTION

R3320 (in series with transistor TR7323) in Fig. 2, page 131 last month was incorrectly shown as R3330.

Long-distance Television

Roger Bunney

FOLLOWING the very active October conditions, which culminated in an excellent tropospheric opening over the weekend of October 29th-31st, November was disappointingly quiet. A few sporadic E signals, even fewer F2 signals, and several auroras comprise the bulk of the loggings. There have been the usual MS (meteor shower) signals on most days, though the mid-month Leonids shower failed to produce any great increase in signal pings. One is left hoping that there'll be the traditional mid-month SpE opening or two during December. The main loggings were as follows:

6/11/82 F2/TE signals on ch. E2 from due south.
8/11/82 Unidentified SpE signal on ch. E2 at 1800.
14/11/82 ORF (Austria) ch. E2a; CST (Czechoslovakia) R1.
16/11/82 RAI (Italy) IA.
18/11/82 ARD (W. Germany) E2.
20/11/82 SR (Sweden) E2; NRK (Norway) E2; SRG-1 (Switzerland) E2.
23/11/82 A very strong aurora from 1900 onwards, with mainly ch. R1 signals (noted in Scotland).
24/11/82 RTVE (Spain) E3, 4. Further auroral activity during the afternoon/evening, with signals throughout Band I.
25/11/82 TSS (USSR) R1 via F2; RTVE E2, 3, 4.
27/11/82 JRT (Yugoslavia) E3.
28/11/82 GBC (Ghana) ch. E2 via F2 at 1320.
1/12/82 A tropospheric opening with Scandinavian/W. German signals in Band III and UK/Dutch signals at u.h.f.
4/12/82 A tropospheric duct between southern UK and central Europe along a warm front, giving signals from CST and DFF (E. Germany) in Band III and at u.h.f.
5/12/82 Unidentified ch. Rl signal.

The above reception is via SpE unless otherwise indicated.

Anthony Mann, who used to send us reports from Perth, W. Australia, has taken up an appointment in Louisiana, USA, and is now re-equipping for DX reception. He reports the following F2 reception using a Tandy Patrolman 60:

16-21/11/82 US pagers at 35·22 and 35·58MHz, also a UK pager (!) at 31·75MHz.
18-20/11/82 BBC-1 B1 and TDF (France) F2 sound channels with offsets.

He comments that the MUF is well short of the ch. B1 vision at 45MHz, though the levels of the B1 and F2 sound signals are very high, at approximately 1mV!

My thanks to Hugh Cocks (E. Sussex), Cyril Willis (Ely), Iain Menzies (Aberdeen), Paul Barton (Harrogate), Arthur Milliken (Wigan) and Graeme Wilson (Middlesbrough) for their reports.

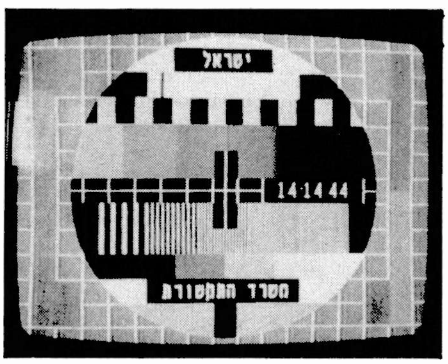
In the November column I mentioned a mystery system M, ch. A2 signal from the south, suspected as being from an AFRTS outlet. Mike Gaskin (Caterham) reports hearing an English language station "SEBC" with the verbal identification "106MHz VHF stereo and TV Channel 2" during a Band II (f.m.) SpE opening. Any ideas?

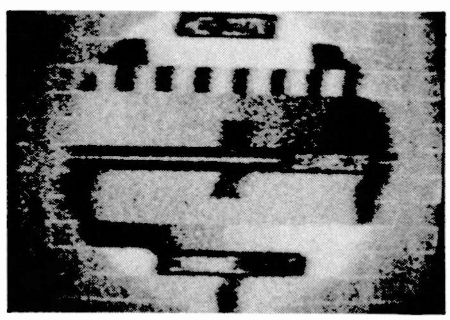
We understand that the FUBK test card from W. Germany with the identification "WDR EK 50" originates from a new ch. E50 transmitter at Ederkopf. It carries the WDR-1 programmes and has an e.r.p. of 50kW.

News Items

France: The French fourth channel, called "Canal Plus", is expected to start operations this December. Existing v.h.f. stations are being re-equipped to give 60% coverage of the population initially, with teletext (Antiope) as well. It seems that the following system L channels, plus u.h.f., will be used: ch. 1 176MHz, ch. 2 184MHz, ch. 3 192MHz, ch. 4 200MHz, ch. 5 208MHz, ch. 6 216MHz. These are the nominal vision carrier frequencies — the sound carrier is at +6.5MHz in each case. On November 4th the Antenne-2 programme "Planète Blue" dealt with the television of tomorrow, and four Canal Plus transmitters carried live programmes from other European countries including Germany, Switzerland, Belgium and the UK (Channel 4). The transmitters were Paris (Eiffel Tower) ch. 6, Paris Pontoise ch. E59, Lyon ch. E66 and St. Etienne ch. E65.

Italy: The largest organisation in the private TV broadcasting field, Canale-5, has obtained effective control over the second largest organisation Italia Uno. There are 22 stations throughout Italy in the Canale-5 network, watched by some nine million viewers daily, while the Italia Uno network consists of 18 stations with seven million viewers. Canale-5 had an estimated advertising income of $70 million in 1982. Estimates of the advertising income for the private and state-run (RAI) TV networks in 1982 are $280 million and $210 million respectively.





Left: The Philips PM5544 test pattern with Israeli identification. Centre: Lady TSS-1 (Russia) announcer received in Malawi by L. Bruzzichesi at 714MHz via the Ekran satellite. Right: Aramco TV PM5544 pattern from Dhahran, Saudi Arabia, received by Esa Nurkka at Lappeenranta, Finland via double-hop SpE.

Sri Lanka Broadcasting Corporation station logo, featuring the Selalhiniya bird.

Luxembourg: The RTL-2 service is expected to be in operation by the time this is read, catering for UK, Dutch and German audiences, with subtitling so that two language groups can be served simultaneously.
Eire: The last 405-line transmitter, Letterkenny (Donegal), closed on November 23rd, almost 21 years after RTE commenced 405-line transmissions. The Letterkenny equipment is to be put on display at RTE's Dublin broadcasting museum.
Greece: The army-controlled Yened TV service has been closed down and replaced with a commercial service (ERT-2).
W. Germany: The Hesse state government at Frankfurt is to open a State Communications Office with the aim of licensing private radio and TV broadcasting organisations. The first private TV station is expected to be in operation later this year.
USA: The Khan a.m. and Harris stereo systems have both received FCC approval. The Khan system uses two a.m. receivers, with the left channel tuned slightly below the carrier frequency and the right channel slightly above. Harris have started a crash programme to develop a decoder chip for their system.
Sri Lanka: C. de Silva has written to us describing the current TV situation in the island. There are two broadcasting organisations, SLBC (Sri Lanka Rupavahini Corporation) and ITN Ltd. (Independent Television Network). SLBC transmit twenty minutes of colour bars (but no test card) prior to the start of programmes. An aerial shot of the studio and a line drawing of a Selalhiniya bird moving across the screen appear just prior to programme commencement. The bird is also featured in the station logo. ITN transmits the logo "TV Sri Lanka" for ten minutes before programme start and colour bars for twenty minutes before that (again no test card). ITN now have a 226ft mast at 100ft a.s.l. – a 100ft mast above the station was previously used.

Low-noise Amplifiers

MCP Electronics have sent details of a new range of TRW integrated TO8 package low-noise amplifiers which are capable of handling very high input signals. All the necessary coupling and decoupling components are contained within the TO8 packs. The LNA1001 covers 10MHz-1GHz with a typical gain of 13dB and a noise

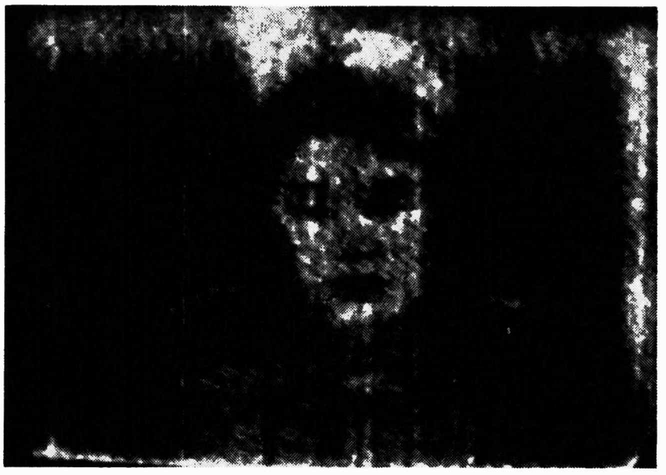
figure of 1·8dB at 200MHz rising to 3·5dB at 1GHz. The cheaper LNA501 has similar characteristics but with a cut-off at 500MHz where the noise figure is 3·2dB. The input/output impedance is 50Ω. We had intended to evaluate one of these, but since the one-off trade prices are £40·72 and £37·58 respectively plus VAT we felt that perhaps few would undertake construction of such an amplifier. Further details can be obtained from MCP, Alperton, Wembley, Middx HA0 4PE.

Cordless Phones

Under new Home Office regulations, cordless extension phones can now be used in Band I within the 47·45-47·55MHz spectrum, the expected range being some 200m. This will last till 1986 when the future of Bands I/III will be determined. Illegal equipment operating at 49MHz is at present being sold – frequencies used are from 49·83MHz in 15kHz steps for five channels. Some of these are known to cover four-five miles! Models with full duplex (i.e. two-channel) working at 49MHz are available.

Books

The *Amateur Television Handbook, Vol. 2* has now been published. It expands on the information provided by the earlier, successful Vol. 1, in particular with additional detail on r.f. (including 10GHz) and f.m. techniques. Highly recommended for ATV enthusiasts at £2 from bookshops or £2.40 by post from BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN. *Build a Personal Earth Station for Worldwide Satellite TV Reception* by Robert Traister, with some 304 pages, is available from Maplin Electronics, PO Box 3, Rayleigh, Essex SS6 8LR. The



Historic DX-TV. BBC-1 received at the RCA Research Station in 1938. Photo taken from a 35mm frame.

book is of US origin and in addition to covering fundamentals offers advice on building your own station. The price is £7·55 – book no. FT1409, order no. WA61R.

Transmitter Guide

The recommended guide to all transmitters in Europe and the near east is that published by the European Broadcasting Union, 32 Avenue Albert Lancaster, Technical Centre, Bruxelles B-1180, Belgium. The 1983 edition, with its six bimonthly supplements, is now available from the above address at 750 Belgian francs. When ordering, quote the "List of Television Stations – European Broadcasting Area, No. 27". The Italian free stations are not listed.

New EBU Listings

Portugal: San Miguel RTP-1 ch. E31 250kW e.r.p. horizontal.

Jordan: A 500kW e.r.p. transmitter is in operation at Ras Munif-Ajlun carrying the Arabic (JTV-1) and English (JTV-2) services on chs. E9/11. Several u.h.f. relays using powers up to 6·6kW have come into operation.

From our Correspondents . . .

Michael Ockenden has written a long article on war-time TV for the February issue of *After the Battle.* The story starts when v.h.f. monitors at Beachy Head picked up 46MHz signals in 1942. When analysed, these proved to be German TV transmissions from the Eiffel Tower, Paris. It was felt that monitoring these transmissions would provide useful information and a group of RAF officers established a 'DX-TV' station. To obtain sufficient signal input for the pre-war TV sets used, two 105ft masts with a curtain of twelve full-wave dipoles, giving a gain of 18dB, were erected. A story well worth reading.

Petri Pöppönen (Lahti, Finland) has sent us a photo of the Aramco TV ch. E3 signal he received from Dhahran (Saudi Arabia) on June 7th, via double-hop SpE. Petri works at the Lahti long-wave station and reports that TV monitoring is a problem there due to the high-level r.f. interference. Both ZTV (Zimbabwe) and GBC (Ghana) ch. E2 were seen at Lahti during September/October, via F2. During a tropospheric opening at the end of October another DXer, Seppo Pirhonen, received Lingen ch. E41 (near the Dutch border) in Finland.

Igor Hajek writes that the identification "ORPS" seen on the USSR electronic test pattern could stand for either "All-Union Radio and TV Transmitting Station" or "Regional Radio and TV Transmitting Station". The latter is more likely as the pattern is of Moscow network origination.

Ryn Muntjewerff (Beemster, Holland) has sent more detailed information on his reception during the October 30/31st tropospheric opening. Apart from many W. German signals, a duct to the ENE produced Russian signals in Band III (Lietuvos ch. R8, Vilnius ch. R9) and at u.h.f. (Klaipeda-1 ch. R29, also ch. R32). Czechoslovakian CST-2 signals were received in pròfusion throughout Band IV, and a new ORF-1 (Austria) transmitter was noted on ch. E38.

Finally, Graeme Wilson has bought a Radioshack/Tandy Patrolman 50 and made various modifications. A sleeve has been fitted to the main tuning knob shaft to remove the sideways movement. A fuse and 0.01μF decoupler have been added in the mains input circuit. A small 12V LES bulb has been fitted to the pointer carrier by filing a groove in the carrier and sticking the bulb in the groove — power is taken from the mains transformer output side via very thin wire and a 68Ω resistor, a silver foil reflector shining the light down the pointer. The phones socket has been replaced with a coaxial type which enables the 10.7MHz i.f. output to be fed to a communications receiver as a tunable i.f. The 0.022μF coupling capacitor C99 has been replaced with a 50kHz Ambit ceramic filter to improve selectivity — this gives minimal loss without the need for a preamplifier stage, and results in a very selective unit (though with distortion on broadcast f.m.).

The Way We Were . . .

Thanks to Harold Stoke (Salisbury) and A. Robinson (Rhos-on-Sea, Clwyd), several very old TV magazines have come my way. They give an interesting insight into pre-war TV. Vol. 1, No. 1 of *Television* (the Royal Television Society's magazine, not the one you're reading) was published in March 1928. The future for TV at that time seemed to rely on the selenium cell and the Nipkow disc. There was a constructional article on how to make a simple disc televisor. Osram type LS5 valves were used in the Baird version as they "provide faithful reproduction of the current variations produced by the 'electric eye'." One had to obtain a constructor's sub-licence, which was current for two years, before making the televisor.

The first (?) DX-TV is reported when Baird transmitted television between London and Glasgow in early 1927. In April 1927 ATT transmitted "images" over the 200 mile NY/Washington circuit.

Progressing ten years on brings us to the *Television and Short Wave Magazine* for April 1939. Here we have the first known photograph of DX-TV reception. It shows announcer Elizabeth Cowell at the BBC ch. B1 Alexandra Palace transmitter received via F2 at the RCA Research Station, Riverhead, Long Island, NY during the autumn of 1938. The quality of the high-definition signal had suffered from the familiar F2 layer distortion. A commentator observed that in NY it looked more like one of Baird's 30-line pictures. Though the BBC's Birmingham transmitter was not opened till the late 40s, the August 1939 issue of this magazine notes that it had already been built by EMI and was "now lying at their works in Hayes". It was designed as a private venture, with the BBC's co-operation.

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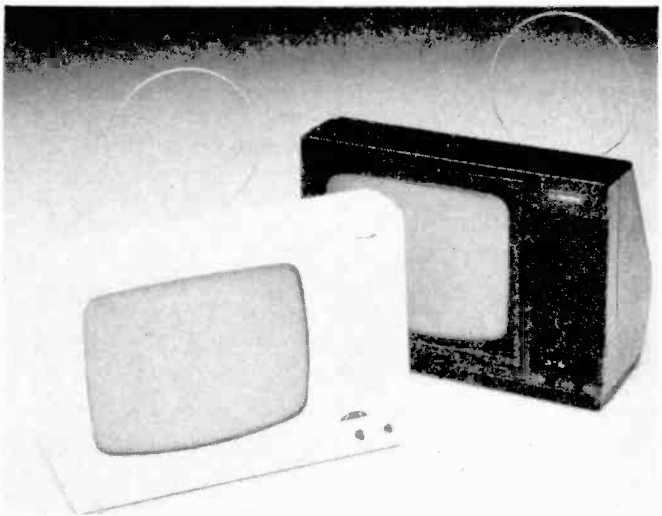
The New Thorn Portables



Model 38030 left, Model 38020 right.

THORN'S new 12in. monochrome portables, Models 38020 and 38030, have been designed to sell at a suggested retail price of just £49.95. They are fitted with a new chassis and are being produced at Thorn's Gosport TV plant. This is good news indeed, since it shows that the UK's TV industry can produce and sell sets in even the most competitive section of the market. To make this possible, the sets have a minimal component count and a mechanical construction of extreme simplicity. They weigh just 13lb and have a consumption of typically 1A. Features include rotary electronic tuning, an earphone socket and a foldaway loop aerial.

The new chassis is the 1790 series which is shown in block diagram form in Fig. 1. There are a few features in common with the previous 1696/1697 series – the same tuner plus SAWF with driver at the front end, a.c. coupled BF391 video output stage, a similar line output stage with BU807 line output transistor, and an 11V series regulator with differential error amplifier. Further simplification whilst maintaining performance is hardly possible in these areas. The main change is the use of the Motorola Monomax i.c. This 28-pin device incorporates the i.f. strip, video processing section, a.g.c. and sync separator circuits along with the field and line generators, and does so with a minimal external component count. It also incorporates an 8V regulator. A TDA1190P i.c. is used as the sound channel, and there's a discrete component field driver/output stage (TR6/7/8). The only stages apart from the items so far mentioned are an amplifier (TR11) between the Monomax i.c. and the line output stage and an amplifier/inverter (TR9) in the flyback pulse feed to the Monomax i.c. There are only three tuned coils in the whole set – tuner coupling, 6MHz trap and sound detector quadrature coil.

There are just two timebase presets – line hold and height. The contrast and brightness controls are both

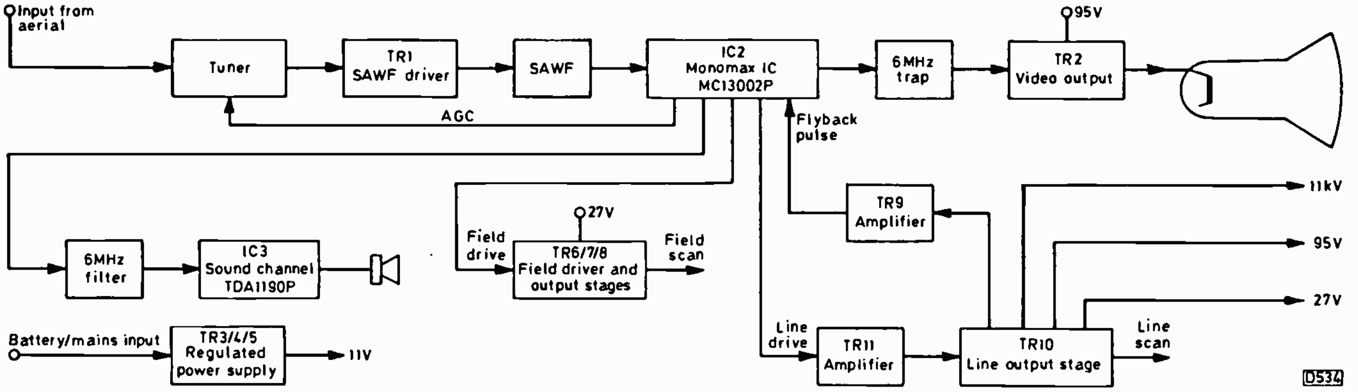


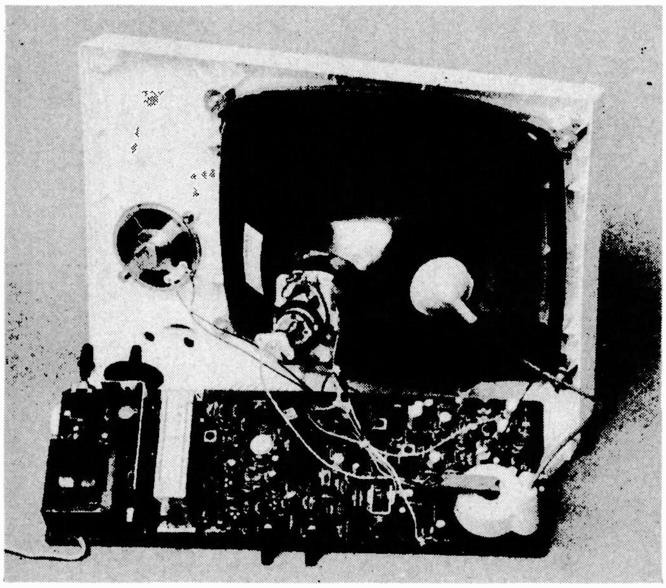
Fig. 1: Block diagram of the Thorn 1790 series chassis. IC1 (not shown) is the ZTK33 tuning voltage stabiliser.

presets, with screwdriver access through the rear of the cabinet. The two front controls are for tuning and volume/on-off. These are also mounted on the single printed panel.

The Monomax IC

The Monomax i.c. is where the novel circuit features are to be found, so most of our article will be devoted to this. The i.c. incorporates 200 linear devices, 200 gates, one million ohms of resistance and 120pF of capacitance on a 12,700 square mil chip. To make this possible and to reduce the dissipation, the i.c. is operated at 8V instead of the usual 11-12V. This enables the area occupied by the minimum size transistor to be reduced by 30 per cent, giving an overall 15 per cent reduction in the chip size. A further key aspect is the inclusion of a nitride step in the process of chip fabrication. This provides reliable junction seals and enables stable capacitors with three times the values possible with normal oxide films to be incorporated. The i.c. dissipates less than 500mW.

A block diagram of the Monomax i.c. is shown in Fig. 2. The differential i.f. input is fed to a four-stage i.f. amplifier whose first two stages are gain controlled. To bias the amplifier, balanced d.c. feedback is decoupled at pins 2 and 6 and applied to pins 3 and 5 via 2.2kΩ resistors. For optimum noise performance, the gain control applied to the first stage is delayed until the gain of the second stage has been reduced by 15dB.



Neat layout within the 38030, with just about everything on the single printed panel.

The following detector stage is the first unusual feature, since there's no external coil. Instead of a synchronous detector, a simple full-wave circuit is employed. To compensate for the non-linearity introduced by this type of detector, a second similar detector is used in a feedback linearising circuit – the idea is shown in Fig. 3. The performance achieved is equal to that provided by a conventional synchronous detector, the advantage being that no adjustment or external filtering is required.

The video processing section provides contrast control, black-level clamping and beam limiting – the latter feature is not used in the 1790 chassis, being unnecessary in view of the a.c. coupling employed in the video output stage. The clamp reservoir capacitor is connected to pin 25, the clamp pulses being derived from phase detector 2 in the line timebase phase-locked loop. A flyback-blanked, low-impedance video output is provided at pin 24.

The video signal is also fed via a noise filtering and gating circuit to the a.g.c. circuit, which is both sync and flyback gated, and to the sync separator. The a.g.c. reservoir capacitor is connected to pin 8. The components connected to pin 7 form an anti-lockout circuit for the gated a.g.c. system. There are two time-constants, C9/R63 and C8/R12, D4 conducting when the field sync pulse arrives to bring C8/R12 into operation.

The line and field generators are controlled by a 31.25kHz oscillator. This uses a novel design, with an on-chip 50pF nitride capacitor, and produces a sawtooth output. The oscillator's output is sliced, divided by two and fed to the two phase detectors in the line frequency phase-locked loop. This part of the circuit follows conventional practice, with the first detector locking the oscillator, via pins 13 and 12, to the line sync pulses whilst the second detector compares the phases of the oscillator's output and the line flyback pulses. The output from the second phase detector controls a pulse-width modulator to get a correctly phased line drive signal. This is divided by two and fed out at pin 17 via a buffer stage.

The most unusual section of the i.c. is the field circuit. Instead of a conventional field oscillator, a ten-stage divide-by-625 counter is used, driven by the sliced output from the 31.25kHz oscillator. This avoids the need for a hold control and close-tolerance timing components. The output from the counter is fed via the window control circuit to the sync gate, which allows the field sync pulse through to control a conventional field generator – the charging components that produce the ramp are connected to pin 20. The field sync pulse also resets the counter via an OR gate. In the absence of a field sync pulse the counter is reset via the window circuit and the OR gate.

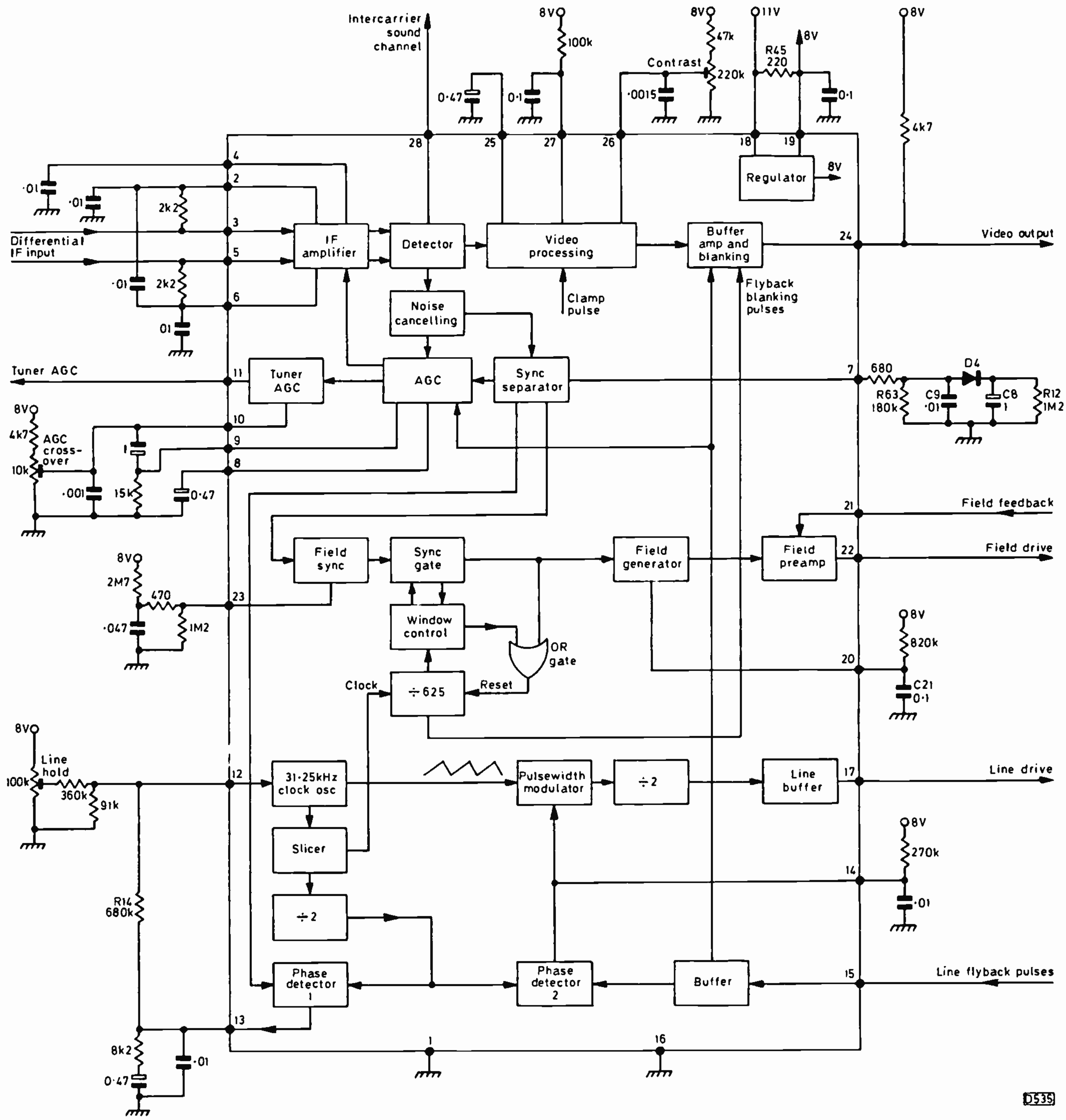


Fig. 2: Block diagram of the Motorola MC13002P Monomax i.c., with external components as used in the Thorn 1790 chassis. The height control acts on the feedback applied to pin 21.

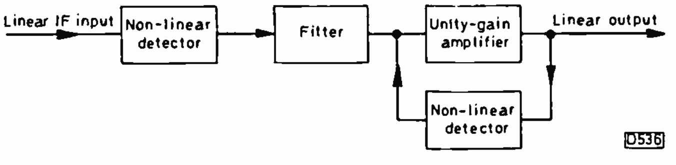


Fig. 3: Principle of using a second non-linear detector in a feedback loop to provide a linear output.

The window circuit controls the time during which the sync gate is open. There are two conditions, narrow and wide, depending on the sync condition. When the circuit is synchronised, the gate is opened during the count 614-626. This is the narrow condition, and provides good noise immunity. A coincidence detector in the window circuit checks the synchronisation. If this detector finds that there is non-coincidence between the gate and sync pulses eight times in succession, the gate is opened during the count 484-644. This is the wide condition, giving rapid field locking. In effect, this is the first digital field oscillator to be used in a UK produced TV chassis.

The single PCB used in the 1790 chassis is a compact 4⅞ × 13½in. It's held in position by runners in the moulded two-piece cabinet. The only components not mounted on the board are the tube with its yoke and the loudspeaker. The tube's graphite coating is taken up to the protection band so that no earthing spring is required, whilst the aerial plug is soldered directly to the tuner. There are just ten screws to hold the whole lot together. It would be difficult to devise a simpler form of construction.

Simple VCR Servicing

Part 1: No Playback

Derek Snelling

THIS article is the first of a short series dealing with common VCR faults. We'll start by assuming that the machine is one of the earlier mechanically controlled ones and that for some reason or other it won't play back a tape. Whilst more obscure causes of the trouble obviously can't be considered in an article of this sort, the information that follows should help you find the cause in fifty to seventy five per cent of such cases. If the machine is one of the more recent "electronic" type VCRs, i.e. one with push-button controls, much of the information will still apply but refer also to the separate section at the end specifically relating to these machines.

No detailed knowledge of VCRs is required to follow the information to be given, but it's assumed that you have a knowledge of normal fault finding procedures. For the repairs you'll need a meter and the relavant service manual. Both VHS and Betamax machines are covered. You will also require a tape with a known good recording on it.

We'll start by going through playing a tape from the moment of switch on to getting a picture on the screen, indicating likely trouble spots at each point along the way.

(1) Plug in – switch mains switch on if one is fitted.

If there is no sign of life, i.e. no clock, check the plug fuse and wiring. If these are o.k., remove the top, bottom and sides of the machine to assist with any repairs. Check the mains fuse (a common failing on the Sanyo VTC9300), the mains wiring to the transformer, and the outputs to the bridge rectifiers.

(2) Switch the VCR on

If the power-on light fails to light up, check the various fuses in the power supply and the power supply itself. Power supplies are usually straightforward, consisting of bridge rectifiers and series regulators. A common failing with the Sanyo VTC9300 is the 12V regulator (see *Television* May 1981, page 373). The bridge rectifiers commonly fail on the Panasonic NV8600.

If the light in the cassette housing (VHS machines) fails to light, check the bulb, the switch operating the bulb and, if fitted, the driver transistor. The bulb itself commonly fails on all VHS machines except for some reason Hitachi models. In some VCRs the bulb lights up at switch on whilst in others a cassette has to be inserted – this pushes a switch down towards the front of the cassette compartment.

(3a) Insert a cassette

If you cannot close the cassette compartment, check the spring (VHS machines) on the right-hand side of the cassette housing. This releases the flap at the front of the cassette. Retension if necessary (see Fig. 1).

To the front of and on the right of the cassette housing (VHS and Betamax machines) there's a metal bar that opens the flap as the cassette is lowered. Check that this is lined up with the slot in the cassette and if necessary adjust with a pair of pliers (see Fig. 2). The bar may be bent if a cassette has been forced in wrongly or, in the case of VHS machines, if the spring mentioned above is weak.

Finally check for foreign objects fouling the housing as it goes down.

(3b) Tape does not thread up on insertion – Betamax machines only

Check the loading switches at the front right of the housing, then check the loading motor (the small motor that drives the large metal loading ring, usually located underneath the main deck) and the drive circuit.

(4) Press the play button

The play button may refuse to stay down or may stay down and then come up again after a few seconds. We'll deal with these conditions separately.

If the play button refuses to stay down, switch off the mains supply and try again. If the button still refuses to stay down there's a mechanical fault with the key assembly. This is usually due to a worn latching bar. Use of a needle file will often enable it to be repaired. To do this however you may have to remove and strip down the key unit, something that shouldn't be attempted unless you've a certain aptitude for mechanics. Replacement of the latching bar or play lever may be necessary.

If the play button stays down with the mains disconnected, the stop solenoid is operating and preventing the key from latching. This can be due to:

(a) The cassette lamp not lighting (VHS, see Fig. 2).
(b) The forward tape end sensor oscillator faulty or incorrectly adjusted (Betamax). Check the adjustment according to the instructions in the manual and that the oscillator is working (a scope if helpful here).
(c) The dew circuit (if fitted) is operating. Check that there's no damp in the machine and that the dew circuit is operating correctly.
(d) A fault in the stop solenoid drive circuit. Check and if necessary repair.

If the play button stays down but comes up again after a few seconds, the machine has either detected a fault or thinks it has. Possible faults are:

(a) Failure of the head drum to rotate. Check the drum motor and the associated drive circuits.
(b) Failure of the capstan motor to rotate. Check the capstan motor and drive circuits.
(c) Failure of the take-up spool to rotate. Check the belts

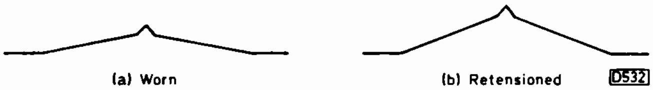


Fig. 1: Cassette flap release spring (VHS machines). Retension if the cassette compartment can't be closed.

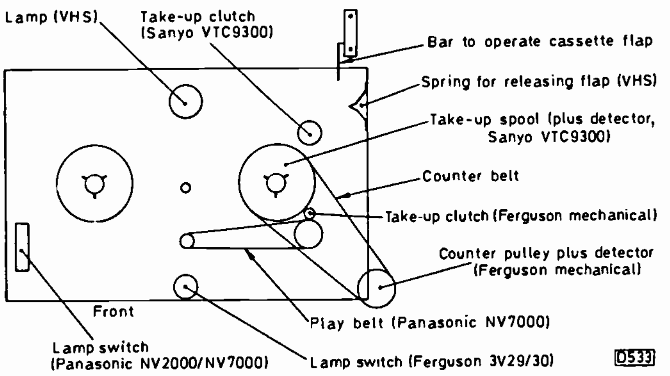


Fig. 2: Top view of the cassette compartment, showing various items that might require attention in different machines.

and replace if loose. Check the take-up clutch and replace if worn. Clean all pulleys and rubber wheels. A broken play belt is common on the Panasonic NV7000.
(d) Failure of the counter to rotate. In some machines (e.g. Ferguson) the rotation of the take-up spool is ascertained by detecting the rotation of the counter drive pulley. Check the pulley and belt.
(e) Failure of the take-up spool rotation detector. This can be one of two types, either a rotating magnet and Hall effect i.c. (e.g. Ferguson), or an infra-red transmitter-receiver (e.g. Sanyo). It may be located near the counter (Ferguson) or under the take-up spool (Sanyo). A scope is useful here to check for the presence of the pulses.
(f) Failure of the head rotation detector. This takes the form of a control head which is mounted under the lower cylinder assembly and detects the passing of two magnets mounted on the flywheel. Incorrect positioning of the head or the flywheel on the shaft (common on Ferguson machines) can result in the pulses being too small. If possible, check the pulses with a scope.

If the tape fails to load when the play button is pressed – this applies to VHS machines only – check the loading motor and drive circuit. Check the loading belt(s) – a stretched belt is common on the Panasonic NV7000. Check that the cassette flap is open and that no foreign objects are fouling the loading arms.

(5) Tape threads and moves normally but there's no picture

It may seem obvious, but has the correct button on the TV set been pressed and is it tuned in? If the machine has a test signal (set-up) switch, use it and check whether the black-and-white stripe appears on the screen. If not or if you don't have a machine with this facility, select another spare button on the TV set and try tuning this to the VCR's output. If you cannot tune it in, the VCR is probably at fault and at least you haven't off-tuned the VCR button. If you can tune in the VCR's output, switch back to the VCR button and tune that in. If you cannot tune the test signal in, the u.h.f. modulator or the aerial terminal board (a common fault on the Panasonic NV2000) may be faulty.

If the TV set can be tuned in to the test signal and the playback sound is about normal but there's still no playback picture, the video heads may be dirty. I would not advise using a head cleaning tape: head cleaning kits can be bought and contain full instrucions. Never clean the heads in an up-down direction, and always use isopropyl alcohol or freon, applying this with the proper soft leather type cleaning sticks, *not* cotton buds. If head cleaning fails to cure the problem, further fault finding which is beyond the scope of the present article will be required, i.e. tracing through the signal path etc.

(6) Picture o.k., no sound

Clean the audio/control head. Clean and spray the record/playback switches (common fault on Ferguson machines). If this doesn't help, the head may be faulty (common with Hitachi machines). Fault finding in the audio department is pretty straightforward, the circuitry being similar to that used in audio recorders.

ELECTRONIC VCRs

With electronically-controlled VCRs there are four differences to note. We'll proceed as previously for mechanically-controlled machines. Where an item has been omitted, this means that the information given earlier applies.

(2) Switch the VCR on

In these electronically-controlled machines the operate (video on) switch usually applies a logic high to a pin on one of the microcomputer i.c.s. If all is well, the microcomputer i.c. then provides a logic high or low output to another pin. The power is then switched on. The point of this is that a logic high applied to the "operate" pin does not necessarily result in an output from the "power on" pin. Whether it does or not depends on the voltages at the other pins of the microcomputer i.c.

The microcomputer i.c. itself is unlikely to be the cause of the failure of the power supplies to switch on. If the microcomputer doesn't switch the power supplies on, it's sometimes useful to try to switch them on by connecting a resistor between an unregulated, unswitched supply and the point where the power supply is switched by the microcomputer. If this fails to get things going, the power supply is probably faulty. If the power supplies then appear to operate normally, one of the inputs to the microcomputer i.c. is probably wrong. The only way to tackle this is to make careful checks, referring to the circuit diagram. Defective zener diodes are a common problem with Hitachi machines.

Many recent machines, particularly portables, use infra-red LEDs rather than bulbs. These can be checked only with a meter. Unlike bulbs however failure is rare. Some machines still use bulbs which are lit only during operation of the machine, being pulsed, i.e. switched on and off every few seconds. Again a meter is the easiest way to check such bulbs.

(4) Press the play button

Failure of anything to happen usually means that the microcomputer i.c. is receiving a fault-present input at one of its pins. Points (a), (b) and (c) given previously (failure of the drum, capstan or take-up spool to rotate) are possibilities, but it's really necessary to check the microcomputer inputs in conjunction with the manual.

If the tape fails to load (VHS machines), the following tips are worth bearing in mind. With the Ferguson 3V29/3V30, check the after loading switch (see *Television*, August 1982). In the Hitachi VT8000/8500 series, check the 2.2Ω resistor R081 on the system control board (see *Television*, May and July 1981 and March 1982).

Teletopics

CABLE GO AHEAD

The government has given the go ahead in principle to the establishment of multi-channel cable networks in the UK – the relevant legislation is expected to follow later this year. Operators who commit themselves to the more expensive switched star networks, which are better suited to two-way operation, will be able to apply for a twenty year franchise. Those opting for the cheaper tree and branch system will be able to apply for a twelve year franchise. The idea is to encourage the installation of switched star networks from the outset – those installing tree and branch networks will have to lay the ducts so that the system can be converted to star operation later. Other requirements will be the provision of a minimum 25-30 channels carrying the present TV services, the proposed DBS services, audio channels, telecommunications facilities and at least one return video channel. A white paper giving a more detailed technical specification is to follow. There will be an independent cable television authority to award the franchises and maintain standards of "taste and decency".

VIDEO GAMES PAST PEAK?

The surprise announcement by Warner Communications of "disappointing" fourth quarter results from its subsidiary Atari led to something of a panic on Wall Street. Shares in Warner Communications fell by just over fifty per cent while Mattel, the main competitor, slumped by forty seven per cent after announcing a loss for the quarter. The reason for the disappointing results could however simply be increased competition – the number of video game cartridge manufacturers has increased from about fifteen to over eighty during the past year.

Whatever the situation in the USA, a MORI survey suggests that the steam has gone out of the sale/rental of games units in the UK. While eight per cent of those in the sample acquired video games in 1982, only three per cent proposed to do so in 1983.

ITT's MOVE

The move of the ITT Service Department from Paddock Wood, Kent to Basildon, Essex has now been completed. All correspondence and spares orders should in future be addressed to ITT Consumer Products Services, Chester Hall Lane, Basildon, Essex SS14 3BW. The telephone number for spares orders only is Basildon (0268) 288818. For other service matters phone Basildon (0268) 3040.

VIDEO MARKETS

Whilst the UK VCR market remains as buoyant as ever, conditions elsewhere are not so bright. In the UK, deliveries rose from one million plus in 1981 to the two million mark in 1982. The previously mentioned MORI survey reports that whilst fifteen per cent of those covered bought or rented a VCR in 1982, twenty five per cent hope to do so in 1983. The percentage of homes with a VCR in the UK is now well ahead of any other country and it's interesting to note that this is also true (on a much smaller scale) of home computers. World-wide however it seems that there is now considerable excess VCR manufacturing capacity – put by a Philips spokesman at 4·4 million machines. There's been price cutting in the slower moving markets, particularly in W. Germany, where both Grundig and Philips have announced redundancies at their V2000 system plants. The EEC is now monitoring imports of Japanese VCRs and has started anti-dumping procedures against Japanese manufacturers: the solution seen by some Japanese firms is to start production in Europe – Matsushita is setting up a joint venture with Bosch to produce VCRs at the Blaupunkt plant in W. Germany, while Akai is to start production at its subsidiary plant in France.

VIDEO DISC DEVELOPMENTS

A particularly interesting announcement, of a video disc on which it's possible to record as well as play back, comes from Sony. It seems that for the present the system is not being considered for the domestic market, the aim instead being to develop it as a data storage medium for business/educational use. Nevertheless, unless there's a cost barrier one can expect something of this sort to reach the domestic market sooner or later, and one can perhaps be forgiven for speculating on whether the postponement of the VHD system is connected with this – Matsushita's UK managing director Andy Imura recently commented that his firm favours "the record/replay system still being perfected".

The Sony system uses a laser to alter the physical condition of a layer within the disc from an amorphous to a crystalline phase. A laser power of 6-7mW is required and it's interesting to compare this with the 1·5mW (average) laser power used for replay in the Philips disc system. Sony are claiming eleven technical patents for their optical disc system, including some still being filed. The main feature of the disc is a highly sensitive recording material with a double-layer structure, consisting of an antimony-selenide metallic film recording layer and a laser heat absorbing bismuth-telluride metallic film layer. These layers are evaporated on to a disc substrate made of polymethyl methacrylate.

The recording layer crystallises when heated to 170°C by the laser, tripling its reflectivity. As the phase transition from amorphous to crystalline occurs over a narrow temperature range – about 20° – the edge of the recorded elements is sharply defined, ensuring a high signal-to-noise ratio over a wide frequency range and making the system equally suited to digital or analogue (element length change) recording. Because of the high recording temperature, the disc is not affected by temperature changes under normal storage conditions, but one disadvantage compared to tape seems to be that a recording can be made only once.

Pioneer, who have now joined Philips in selling LaserVision players and discs in the UK, are planning to introduce 8in. "mini-discs" with a playing time of twenty minutes per side.

References have been made to the "interactive" use of video discs on various occasions. The idea is that the disc is used as a storage device which produces various displays under the control of a computer linked to the disc player. There is the further possibility of mixing signals produced by the disc with those produced by the computer's character generator. All this opens up intriguing prospects for the future development of video technology.

TANDBERG SPARES

Tandberg UK Ltd. have completed an agreement with HRS Electronic Components Ltd., the main UK agents for Loewe Opta television receivers, to handle all future servicing and spares supplies for the Loewe Opta produced Tandberg series CTV4 chassis. Tandberg will continue to provide spares for their earlier CTV1, CTV2 and CTV3 chassis. Tandberg UK Ltd. are at Revie Road, Elland Road, Leeds LS11 8JG; HRS Electronic Components Ltd. at Brasshouse Passage, Birmingham B1 2HR.

THOMSON-GRUNDIG

Our announcement last month of a Thomson-Brandt link up with Grundig followed the signing of an agreement between the two companies. It now seems that problems have arisen due to the requirements of the W. German federal cartels office. Grundig are also having talks with Siemens, Bosch and Philips.

CATALOGUES ETC

Teletronic (North East) Ltd., who recently celebrated their 25th anniversary, now have the technical capability to reprocess over 800 different types of standard delta and in-line gun colour tubes. A catalogue is available from Teletronic at See-Vu works, Strangeford Road, Seaham, Co. Durham, SR7 8QE.

A new catalogue listing their extensive range of aerials and associated equipment has been published by South West Aerial Systems of 10 Old Boundary Road, Shaftesbury, Dorset, SP7 8ND. The catalogue is available at 54p per copy.

The *Electronics Projects Index 1979-80* has been published by the Libraries and Arts Department of the North Tyneside Metropolitan Borough Council. It provides a detailed guide to projects published during 1979 and 1980 in most electronics magazines. The next edition covering 1981-2 is expected to be available later this year. The cost of the 1979-80 Index (No. 3) is £2·50 including post and packing. Available (send cash with order) from EPI Sales, Central Library, Northumberland Square, North Shields, Tyne and Wear NE30 1QU.

Satellite Television Technology (PO Box G, Arcadia, Oklahoma 73007, USA) have published two new books of interest to satellite TV enthusiasts. First is the *International Satellite Television Reception Handbook* by Steve Birkill, who should need no introduction to readers of this magazine. This publication costs $3 (US/Canada/Mexico) or $3·50 (elsewhere) and provides details on setting up a satellite terminal in almost any part of the globe. Secondly comes the *Spherical Antenna Manual* by Mike L. Gustafson ($30 in the US/Canada/Mexico, $35 elsewhere). This provides practical details to enable "the average guy" to build a low-cost, efficient parabolic aerial at a cost of less than $300.

NEW FROM TOSHIBA

Some of the latest additions to the Toshiba range of television receivers are of interest in having a detachable infra-red remote control unit. The unit lifts off and when attached to the set provides the on-board controls.

LATEST ITT CHASSIS

ITT have introduced a new chassis, type CVC1100, for use with thin-neck 14 and 16in. in-line gun colour tubes. The combined tuner/i.f. module is the same as that used in the CVC801 Mini chassis, but most of the rest of the circuitry is different. The power consumption is down to typically 40W under normal operating conditions.

The TDA3561 single-chip decoder is on the main panel, with the class A RGB output stages on the c.r.t. base panel. There are just two other chips on the main panel, TDA1940F which combines the sync and line oscillator functions and a TDA1870 for the field timebase. Unlike the Mini chassis, the line output stage is not driven by the chopper circuit. Instead a separate driver stage, fed from the TDA1940F i.c., is used. The chopper circuit is an interesting variant on the Siemens self-oscillating circuit, but works at line frequency. A very simple arrangement (no thyristor) is used to switch the chopper off at the appropriate time during the cycle to produce a regulated 115V output. There seems to be no end to possible chopper permutations!

LATEST VCRs

Sony's replacement for the top of the range C7 is the sleek new C9, which is fully rackable (a front loader with virtually all the controls accessible at the front) and at 430mm is the same width as a standard audio unit. Features include stereo sound or bilingual sound capability and Beta noise reduction (BNR). The latter operates by recording the sound with the video on the helical tracks and results in an audio signal-to-noise ratio of better than 43dB – the new recorder is compatible with all existing and future Beta machines and tapes. Full function infra-red remote control is included, along with a powered camera socket and the facility to play back or record PCM encoded tapes. The suggested retail price is £699 including VAT.

To complement the C9 Sony have introduced a new range of TV sets featuring stereo sound capability – the XR series. There are initially two models, both made at Sony's Bridgend plant, the KV2052 and KV2056. Both are 20in. models, the latter being equipped for teletext. The KV2052 can be converted for teletext operation by the simple addition of an extra PCB at a cost of £90. The stereo amplifier provides an output of 5W per channel, and synthesized stereo can be selected to enhance a mono signal source.

Grundig have also launched a stereo VCR, Model 2 × 4 Stereo, and are contemplating the introduction of the 2 × 4M on the UK market. The latter is a bottom of the range machine introduced to compete with the low-cost Japanese VCRs.

OBITUARIES

Vladimir Zworykin died last July at the Princeton, New Jersey Medical Centre, aged 92. Zworykin was one of the pioneers of television, being best known for the development of the iconoscope camera tube, which played a major role in getting electronic television started in the USA. Dr. Zworykin was born at Mourom, Russia and attended the Petrograd Institute of Technology. It was here that he came under the influence of Boris Rosing, who proposed the use of the cathode-ray tube for TV purposes as early as 1907.

Jack Dickman, founder, chairman and managing director of Fidelity Radio, has died at the age of 66. He began business in 1946 and successfully steered Fidelity Radio through the many difficult periods experienced by the trade in the post-war era.

Bill Wood, MBE, who retired as head of the BBC's Engineering Information Department in 1978, died on November 14th following a heart attack. He was 69. After war service in the RAF Bill Wood joined the BBC in 1946, working on television in the Research Department.

Fault Report

Notes from Robin D. Smith, Richard Roscoe, R. J. Fox, John Coombes and George Wilding

A Batch of ITTs

On several occasions we've had problems with the infra-red preamplifier i.c. type TEA1009. The usual situation has been that the set works all right using its built-in controls, but can be remotely controlled only when the transmitter is held within a couple of inches of the set.

We've found that removal of R774 (100kΩ) in the Mini series (CVC800 chassis), as suggested by ITT, certainly cures the problem of failure to start from cold. Here's another one on more recent models, this time the 80 series chassis. Black streaking and random channel changing can be caused by the spark gap on the c.r.t. base panel: removing it provides a temporary cure, and on the latest sets the need for it has been eliminated.

We're still experiencing a high failure rate of line output transformers and triplers in the CVC20/25/30 series chassis. This leads me to a problem we had with a CVC20, the fault being field roll and slight tearing of the picture. After a lot of testing and panel swapping it turned out to be the tripler.

The trouble we had with a CVC30 was a very intermittent field linearity error – no amount of heating or cooling would produce the fault for us, so we had to tackle it by a slow process of elimination. One by one we changed the field output transistors, the field timebase board complete, and several other items. Eventually, after three weeks of soak testing, the culprit turned out to be the output stage bias diode D10 (BY133) which was going open-circuit intermittently. Oh yes, and two days later the line output transformer and tripler failed.

If you have a loud whistle that's not caused by any of the line coils in these chassis, change the 4·7μF electrolytic in the power supply – C42 in the CVC25/30/32, C45 in the CVC20.

A CVC30 was sent to us by an engineer who is not familiar with the chassis. He reported that it had been tripping and that replacing the line output transformer and tripler had failed to provide a cure. He's then readjusted the current trip preset R810, after which the set had gone bang and died. We found that the BU126 chopper transistor was short-circuit, so after replacing this we disconnected the line output stage (by removing socket S4/5) and set up the power supply. Everything was all right so we reconnected S4/5 and of course the set tripped again. After eliminating the line output transformer and tripler we eventually found that the 12V supply rectifier D27 (BY206) was short-circuit.

Finally, a no colour fault on a 16in. set fitted with the CVC40 chassis. The customer reported that the problem had initially been intermittent, and that he'd taken the set back to the dealer who'd supplied it several times. The no colour condition was now permanent, and overriding the colour-killer failed to produce any signs of chroma. The decoder panel was actually o.k. – checked on another set – and the only clue we could find was that the voltage at pin 13 of IC501 (TBA560CQ) was low at only some 1·1V instead of around 3·8V. Now this could simply mean that the colour-killer was operating, but we did know that the decoder panel was o.k. Perhaps the pulses from the line timebase were missing or incorrect? I don't mind confessing that we spent some considerable while carrying out tests, though the cause of the trouble turned out to be quite simple – R1003 (2·7kΩ), which is in series with the colour control, had gone open-circuit. The difficulty is that R1003 is mounted on the control panel and is hard to get at. Our conclusion was that the resistor had probably been creeping up in value over a period of time, hence the return visits to the original dealer. **R.D.S.**

Decca Bradford Chassis

You would think that a simple line drive fault in a hybrid colour set with which we are familiar wouldn't cause too much headscratching, but... The fault was that the picture would not always appear at switch-on. Changing the line output valve and boost diode made no difference, so I checked the line drive waveform which was incorrect. Several resistors could be responsible for this, so we started making checks and then started to think about faulty capacitors. After a while my colleague came in and asked whether I'd tried a new PCF802 line oscillator valve? Yes, a replacement put an end to the trouble. **R.D.S.**

Sony KV2000UB

A Sony set with a field fault is quite a rare occurrence. This one was suffering from lack of height however, while the hold control was at one end of its track. The circuit consists of an i.c. oscillator/amplifier followed by a conventional driver and class B output stage, so it seemed reasonable to start at the i.c. end. All the voltages were about right, and in this design there are none of those high-value resistors that can cause trouble in the height circuit. You can never be certain however, so we started by making some cold resistance checks.

It's really useless trying to do this with the component in situ – unless it's a dead short capacitor or something equally obvious, which it rarely is. So we always lift one end of a suspect before checking it. The resistors in this area were all o.k., but the diode (D501, type 1T40) recorded a large reverse leakage. We'd no 1T40, but replacing it with a 1N4148 cured the lack of height and brought the hold control setting back to mid-track. The diode appears to be there to clip one of the feedback waveforms. **R.R.**

Two 18" Skantics

The first went off with a bang recently after four years of trouble free operation. It was one of the 4751/5151/5661 group of models which use the later version of the self-oscillating chopper module, the one covered in the January 1982 issue of *Television*.

We found that the 1A power supply fuse was open-circuit and the BU126 chopper transistor short-circuit, but were loath to investigate further in the house. This was partly because we'd a spare module with us, but mainly because we caught a belt off the mains bridge rectifier's reservoir capacitor – despite being careful. The new module went in after we'd checked the line output transistor in case it was short-circuit, and fortunately everything worked o.k. When we got round to repairing the module we found that in addition to the previously mentioned items the damage caused by this particular bang consisted of the BRY55 trigger thyristor blown apart, the BC557 regulator transistor base-emitter short-circuit, the two 1N4148 diodes short-circuit, coil LN05 (250V rail) open-circuit, plus CN05 (4·7μF) leaky and RN13 (6·8Ω) open-circuit.

One other thing we learnt during the course of the repair was that the small RS thyristor type C103YY doesn't work in this circuit. It makes the power supply pulse rapidly.

The other Skantic also led us a merry dance. The symptom was that the width varied with picture content – any bright areas dramatically reduced the width of the picture at that point. When captions rolled up the screen we were left feeling positively seasick!

Our first thought was that something was amiss in the EW correction circuit, though the three presets here all had the correct effect on a blank raster. An hour later we'd tried substituting all the important bits with no improvement, and were desperately checking waveforms. Then we had a stroke of luck – you couldn't do this job without it! The by now hot line output transformer started to whistle quite badly, and when we had a look at it we noticed that the part of the core running through the coils had a distinct crack in it. This was the trouble of course. The reduced core efficiency resulted in it saturating much sooner than it should have done, thus limiting the scan drive. Easy when you know, isn't it? **R.R.**

Plus ça Change . . . .

We tottered back to the workshop the other day having grappled with an old and very grubby Bush colour set (A823 chassis, not even the two-chip version). The problem had been no line sync, but a new pair of flywheel sync diodes (the originals checked o.k. on the meter incidentally) had brought colour back to its screen, not to mention the cheeks of its worried owner. "Thank god" he said. "Thought for a bit I'd have to buy a new one." His euphoria was almost obscene.

"It's still an old set" we said, "and the tube's no better than you'd expect. Think of what'd you'd get with a new set – teletext, remote control, utter reliability – all at a giveaway price."

"I'll think about it" he said, settling down to watch the racing again, quite unaware that in real life Brough Scott doesn't suffer from jaundice.

Waiting for us on the bench was a brand new Hitachi set fresh from its box. As we'd said, teletext, remote control and – no line sync! You need a strong mind at times like this. Fortunately it turned out to be due to nothing more than a loose plug on the teletext panel, the work of a moment to put right, but my nerves were somewhat fragile for quite a time afterwards. **R.R.**

The Nerve of It

Talking about nerves, what do you say to someone who blames you when his aerial falls down, simply because the day before you replaced his tuner? The tuner *was* faulty, but there was little comfort to be gained from this in the face of blind, ignorant certainty! **R.R.**

Renovating a 1500

We've a number of customers who will not countenance a colour set. Often it's the extra cost of the licence or the rental that's the problem, but in the case of one of our customers it's a question of loyalty. Her late husband bought a 24in. Marconiphone set back in 1970 and she won't part with it. So when the tube expired recently she was quite adamant – fix it!

So in went a new tube and, while we had it on the bench, out came all the dust and fluff. We also replaced the hard-working output valves (PL504, PY801, PCL805 and PCL86) and a very dirty contrast control, checked the soldering on the field output transformer and the tuner bar, put in a new mains dropper to be on the safe side, then switched on. The picture came up as good as new, and although the bill was almost as much as a new set would cost the old lady was clearly delighted that we'd been able to get her husband's set going again.

A week later however she was on the phone to say that there was a crackling noise from the speaker. We went along expecting to find that the new PCL86 audio valve was dud, but we were wrong. In all our cleaning and dusting we'd omitted to clean the earthing spring that stretches across the tube's graphite coating. This was sparking across to the spring and producing crackles in the speaker – just like the old spark transmitters. But of course – wasn't the set a Marconi?! **R.R.**

Regulator Troubles

The first fault we had on a Hitachi Model CSP680 we'd installed back in March 1973 was a colour sync problem after about half an hour's operation. I put the set on the soak test bench, with a colour-bar input, whilst attending to a Sony monochrome portable Model TV121UK with a poor picture/sync problem. With any monochrome portable my first check is always on the l.t. rail voltage. This once again saved time since the reading was 15V instead of 11·6V. Adjusting the 11·6V preset made no difference, and a quick check showed that the error detector transistor Q602 was open-circuit. Fitting a BC337 in this position and adjusting the preset produced a complete cure.

The Hitachi set was by now just beginning to loose colour sync, and a finger placed near the 4·43MHz crystal and varicap diode made the colour lock – after nine years a crystal has every right to feel tired. A replacement didn't cure the fault however, and when the set was taken to the workbench and the test card was tuned in it was immediately obvious that the picture was oversize. So we checked the regulated h.t. line and obtained a reading of 155V instead of 120V. Yes, you've got it, replacing the error detector transistor TR43 provided a complete cure! A few adjustments and we had a picture which looked good enough to last another nine years. **R.J.F.**

Rank T24E Chassis

In the event of no sound or raster, check for 112V (output from the series regulator) at test point 91. If missing, check fuse FS803 (3·15A). If this is open-circuit, check the series regulator transistor TR801 and for a short-circuit from TP91 to chassis, indicating trouble in the line output stage. If FS803 is all right, check the mains fuse FS801 (1·6A delay). If this is open-circuit, check the bridge rectifier diodes D801-4 (type 1S1887) and the protection capacitors C802-5 (0·0068μF). If still in trouble, check for an open-circuit mains transformer (T802) or mains filter coil (T801).

Loss of one colour should lead first to a check on the relevant RGB output transistor for being open-circuit. If o.k., suspect the TA7193P decoder i.c. The i.c. has 24 pins which are close together: when replacing, beware of shorts or dry-joints and don't overheat it.

Note that sets fitted with this chassis may be fitted with a Toshiba or a Mullard tube. Because of the different heater current requirements, an extra 5·6Ω resistor is connected in parallel with R920 on the c.r.t. base panel when the Mullard tube is used. It should be stood off the panel using 5mm sleeving. Sets fitted with Toshiba tubes have the letter A in the model number, e.g. BC7200AT, those fitted with Mullard tubes having the letter B, e.g. BC7200BT. **J.C.**

Rank T22 Chassis

The fault we had with a Murphy set fitted with the Rank T22 chassis was flickering between a light and dark display. Our first thoughts were of a possible fault on the signals panel, but on turning the contrast and brightness controls down we noticed slight variations in the grey scale. Then on checking the voltages at the first anode presets we found that these were also varying. A check on 4R42 (150kΩ), which is in series with the presets on the high-voltage side, revealed that it was varying in value — on removal a slight burn mark could be seen beneath it. Replacement restored a normal picture. **J.C.**

GEC Model 3133

There was an interesting fault on this mains/battery portable: though the complaint was simply "no sound or vision", some very faint modulation could be seen on the noise-free raster. This strongly suggested that one or other of the three i.f. transistors was at fault, so as a start we checked the voltages in the second and the final i.f. stages. The a.g.c. is applied to the second i.f. transistor TR101, and the no-signal base and emitter voltages were found to be way out at 6V and 5·4V respectively instead of 3·7V and 3·2V. Clearly the a.g.c. voltage, which forms this transistor's base bias and comes from pin 5 of the TCA270 video demodulator chip via a resistor network, was excessive. There's an a.g.c. delay control in the resistor network – it's usually set fully anticlockwise, but can be advanced to avoid cross-modulation in areas of high signal strength. Fully advancing it restored the sound and vision, but with very bad grain. Since the control was operational, the main suspect was the chip. Replacing this and resetting the control to its normal anticlockwise position restored normal results.

A point worth bearing in mind is that if the control had been set well away from the anticlockwise position, the i.c. fault would have produced symptoms suggesting a defective r.f. amplifier transistor or an aerial fault. **G.W.**

Hitachi CNP190

We've had another case of no colour in one of these sets due to C533 (0·001μF) going open-circuit. This capacitor couples the ripple signal in the burst detector circuit to the two-stage ident amplifier which in turn drives the colour-killer transistor TR28. Overriding the colour killer by connecting a 4·5V battery to point J on the signal panel to forward bias the chroma delay line driver transistor TR32 will restore colour when C533 is open-circuit.

In another of these sets the line output transistor had failed three times within a few months for no apparent reason. On the third occasion we had the set on soak test with the back off and noticed a small but quite strong spark in the line timebase – due, we found, to a dry-joint momentarily opening. Since resoldering this and all other suspect joints no further transistor breakdowns have occurred. **G.W.**

Monostables and Schmitt Triggers

S. George

FOR many years TV sets employed analogue circuitry exclusively: amplifiers amplified and timebases produced ramps. In recent years however digital circuitry has found increasing applications in TV sets, also in VCRs. Two basic building blocks in digital circuitry are the monostable multivibrator and the Schmitt trigger, which we've coupled together since they have some features in common. We'll deal with the monostable multivibrator first.

Astable and Bistable Multivibrators

Multivibrators of the astable type were at one time widely used in TV sets as timebase oscillators. They consist of two *RC* cross-coupled transistors or valves which switch each other on and off continuously at a rate determined by the time-constants of the *RC* cross-coupling components. Add a charging capacitor between the collector or anode of one of the transistors/valves and chassis and you've got a timebase sawtooth generator. The discrete component bistable multivibrator (commonly known as a flip-flop) was used in older colour sets as the PAL switching device. Unlike the astable circuit, the bistable remains in one stable condition, with one transistor/valve conducting and the other cut off, until a trigger pulse comes along to reverse these conditions. A second trigger pulse is required to restore the circuit to its initial condition. As a result, the bistable multivibrator acts as a divide-by-two circuit. Apply two trigger pulses and you get a single output pulse from either collector/anode. The PAL switch thus operates at 7·8kHz when driven by line frequency trigger pulses. The cross-coupling in a bistable multivibrator is primarily resistive (small capacitors may be included to speed up the switching action).

The Monostable Multivibrator

The monostable multivibrator has one stable and one unstable state. When triggered, it undergoes one complete cycle of operation, returning to the original condition. The basic circuit is shown in Fig. 1, and as can be seen there's resistive cross-coupling on one side (R3) and *RC* coupling (R2/C1) on the other side. The time taken to complete the cycle of operation depends on the time-constant of the *RC* coupling network. In the rest condition Tr2 is saturated, its

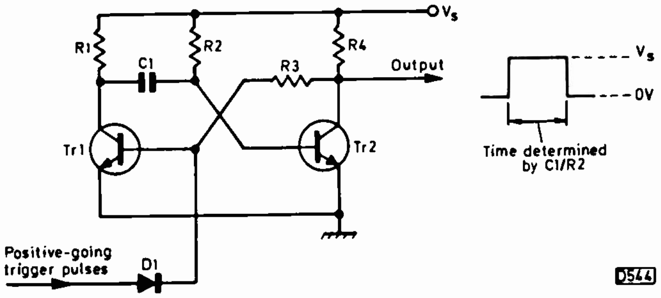


Fig. 1: Basic monostable multivibrator circuit.

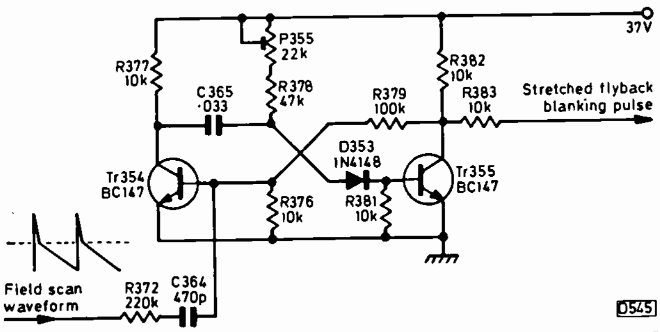


Fig. 2: Monostable multivibrator circuit used in 20AX GEC sets to lengthen the field flyback blanking pulses.

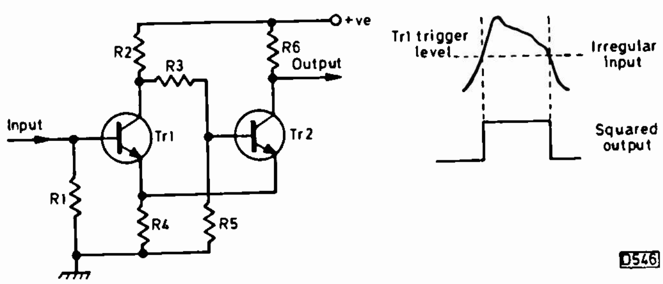


Fig. 3: Basic Schmitt trigger circuit.

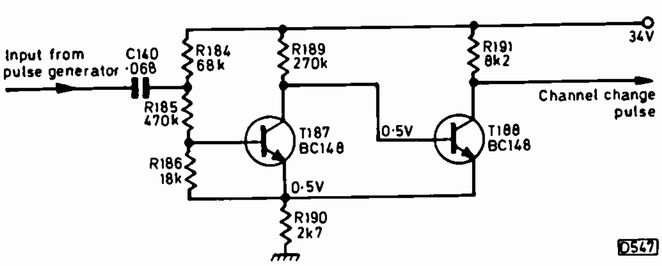


Fig. 4: Schmitt trigger circuit used in remote control versions of the Philips G11 chassis to shape the pulse fed to the channel change i.c.

base being forward biased via R2. The low voltage at the collector of Tr2 appears at the base of Tr1 via R3, so that Tr1 is cut off. Apply a positive-going pulse to the base of Tr1 via D1 and Tr1 conducts, its low collector voltage being applied to the base of Tr2 via C1. Tr2 is thus cut off. C1 now charges via R2, and when the voltage at the base of Tr2 rises sufficiently this transistor switches on once more and the circuit returns to its initial rest condition.

Monostable Multivibrator Uses

The monostable multivibrator is particularly useful since its single *RC* time-constant enables it to be employed for pulse timing purposes. In a VCR for example, using R2 as a tracking control enables the timing of the pulses in one of the servo circuits to be varied so that the tracks recorded on the tape are correctly scanned by the video heads during playback.

Perhaps the best known use of a monostable multivibrator in a TV chassis is as the pulse-width modulator that controls the chopper transistor in the Thorn 3000/3500 chassis. The monostable is triggered by pulses from the line oscillator, the duration of its subsequent cycle of operation being controlled by an ingenious feedback system.

Several TV chassis use a monostable circuit to lengthen the field flyback blanking pulse to ensure complete blacking out of the teletext lines at the top of the picture – examples include the Philips G11 chassis and GEC sets fitted with the 20AX tube. Fig. 2 shows the circuit used in GEC sets. In the rest state, TR355 is held saturated by the bias network P355/R378/D353/R381, its low collector voltage being applied to the base of TR354 via R379. Positive-going flyback pulses from the field output stage are fed to the base of TR354 via R372 and C364. As a result TR354 conducts, TR355 switches off and a positive-going output pulse appears at the collector of TR355. The duration of this pulse depends on the time taken for C365 to charge via R378 and P355, which is the pulse width control. When TR355 switches on again the output pulse is terminated. The *RC* time-constant network has thus stretched the flyback blanking pulse, which is applied via an inverting amplifier to pin 8 of the TBA560C i.c. in the decoder.

The Schmitt Trigger

Like the three types of multivibrator, the Schmitt trigger consists of two transistors cross-coupled so that when one is cut off the other is saturated. In this case however one of the cross-couplings is between the emitters of the two transistors, leaving one base independent to receive the input. Fig. 3 shows the basic circuit.

The circuit is used to produce a clean, square output pulse from an input whose shape is somewhat different. In the rest state, Tr2 is biased on by the network R2/3/5. Its emitter current develops a voltage across the common emitter resistor R4 so that Tr1 is cut off. If a positive-going waveform is applied to the base of Tr1, it will at some point conduct. The combination of its negative-going collector voltage, applied to the base of Tr2 via R3, and the positive-going voltage developed across R4 will switch Tr2 off rapidly. This condition will continue until the input applied to Tr1's base falls to a point where Tr1 switches off. Tr2 will then switch on again.

As a practical example of the use of a Schmitt trigger in a TV set, Fig. 4 shows the pulse squarer circuit used in remote-control versions of the Philips G11 chassis to produce an optimised squarewave for application to the BTT6018 channel selector i.c. It differs from the basic Schmitt configuration in that the first transistor T187 is conductive in the rest state, its base being forward biased by R184/5. So T188 is held cut off by the low voltage at its base and the positive voltage at its emitter, a negative-going input pulse being required to change the state of the circuit. This is applied via C140. The output pulse is also negative-going of course.

Reliability

These monostable multivibrator and Schmitt trigger circuits are very reliable in use since with one transistor off and the other saturated the dissipation in both transistors is minimal.

System L-I Converter

Roger Bunney

DX-TV enthusiasts and those wishing to view French television (you've a good chance if you life along the south/south east coast) come up against the problem that France uses different TV standards to the UK. At u.h.f., France uses system L. This has the same channel bandwidth and vision carrier frequencies as the UK system I, but differs in the following respects: the sound-vision spacing is 6·5MHz, the vision modulation is positive-going, and a.m. is used for the sound signal. This means that the French signals cannot be resolved on a standard UK system I TV set. Whan can you do? You can cross the channel and return from the Calais Hypermarket with a French TV set, or alternatively obtain converted or sets switchable for French TV reception from specialist firms such as Portatel Conversions Ltd. of Sunbury on Thames. The solution I adopted however was to rig up a simple converter. This doesn't deal with the different colour systems, but all I was interested in from a DX point of view was resolving a monochrome signal. Also I wasn't concerned about the accompanying sound signal, though with a little extra circuitry this can also be provided.

Fig. 1 shows in block diagram form the system I'm using for DX reception of French TV signals. The signal from the u.h.f. aerial is first amplified by a Labgear CM7066 wideband masthead amplifier and is then fed to a varicap tuner. The i.f. output from this is passed via a Wolsey VA20 0-20dB attenuator to the system L-I converter. This provides an output at u.h.f. for feeding to a standard system I TV receiver. The advantage of the arrangement is that all signal processing is done prior to the TV set itself, which thus requires no modification.

The converter is housed in a standard RS diecast box for good screening and strength. Fig. 2 shows the circuit. The input from the tuner first passes via a single BFY90 preamplifier to give gain prior to splitting into separate vision and sound sections – as mentioned above I'm not using a sound circuit, though details of what's required will be given later. The vision signal is then passed via a switched narrow/wideband selector to the amplifier/detector module. To narrow the bandwidth, switch S1 applies forward bias to the BA379 pin diode which brings the filter L1 into circuit.

The heart of the unit is the Ambit 94420 amplifier/detector module which comes in kit form. It makes use of the handy TDA4420 i.c., which is able to demodulate either f.m. or a.m. signals, catering for both positive- and negative-going video in the latter case. Fig. 3 shows the circuit of the Ambit module.

The output from the amplifier/detector module is then fed via a gain control to an Astec UM1286 which modulates the signal back to u.h.f., system I, with the output on channel E36. This particular Astec model also accepts an audio input, which can be provided by an additional 94420 module fed from the point marked "audio i.f." in Fig. 2. To ensure that the calibration is accurate, a simple marker oscillator (Astec UM1233) is included. This produces a blip on ch. E36: once this is aligned with the output from the u.h.f. modulator, the receiver itself can always be tuned to the correct channel.

The power supply circuit is conventional – see Fig. 4. For details of the varicap tuning system I'm at present using, see the March 1982 issue, page 236.

The layout within the diecast box is not critical, though lengths of screened feeder should be kept to the minimum length. The BFY90/L1 section was built on a small PCB and bolted to the side of the box. The 94420 module's phono plug i.f. input socket was removed for ease of mounting, a thin coaxial feeder being soldered through the resulting hole with the cable screen soldered to the inside wall of the box. The positive and negative video outputs from R2 and R3 in the module are taken via short lengths of unscreened wire to a miniature RS SPDT toggle switch (317-077). The video gain control could be an internal preset, but for DX use it's best to make it an operator control.

The marker oscillator is mounted in proximity to the output socket. Take a thick gauge wire from the original output connection inside the unit through a convenient polythene access hole and place it in the vicinity of the coverter's output socket. This will provide coupling to the output at a level that gives a visible indication without swamping the receiver's a.g.c. system. Remove the phono plug output sockets from both Astec units, again to save space within the diecast box.

Since the unit as described is intended for DX use, the video output polarity is switchable (S2). Those simply wishing to view French TV can omit this switch, taking the positive output from the 94420 module directly to the video gain control. Holes in the lid of the 94420 module were drilled/enlarged for tuning the cores (T1/2/3).

For reception of French TV sound as well, a second 94420 module will be required. The French audio, spaced at 6·5MHz, will be present within the tuner unit's i.f. output passband. It will be necessary to tune the sound i.f. transformers (T1/2/3) to 6·5MHz below the video i.f. This means increasing the values of C1, C16 and C17 to

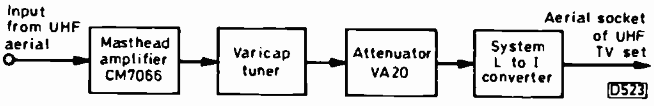
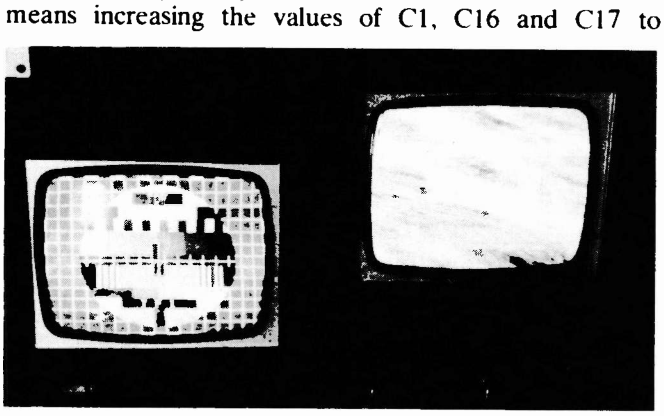


Fig. 1: Block diagram of the system in use for the reception of French DX-TV signals.



Photograph showing a converted signal display (left) and the same signal applied directly to a system I receiver (right).

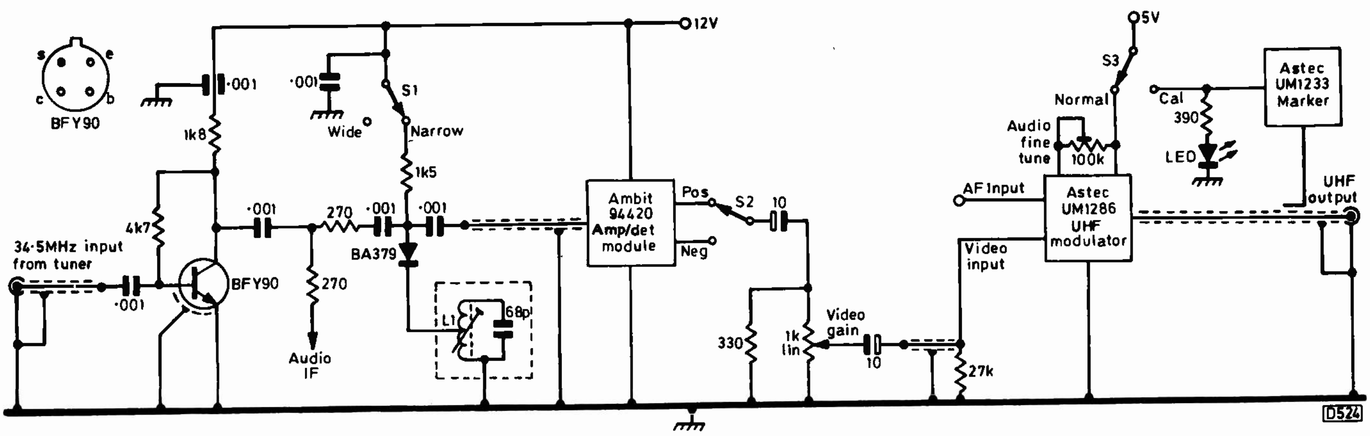


Fig. 2: Circuit diagram of the system L-I converter.

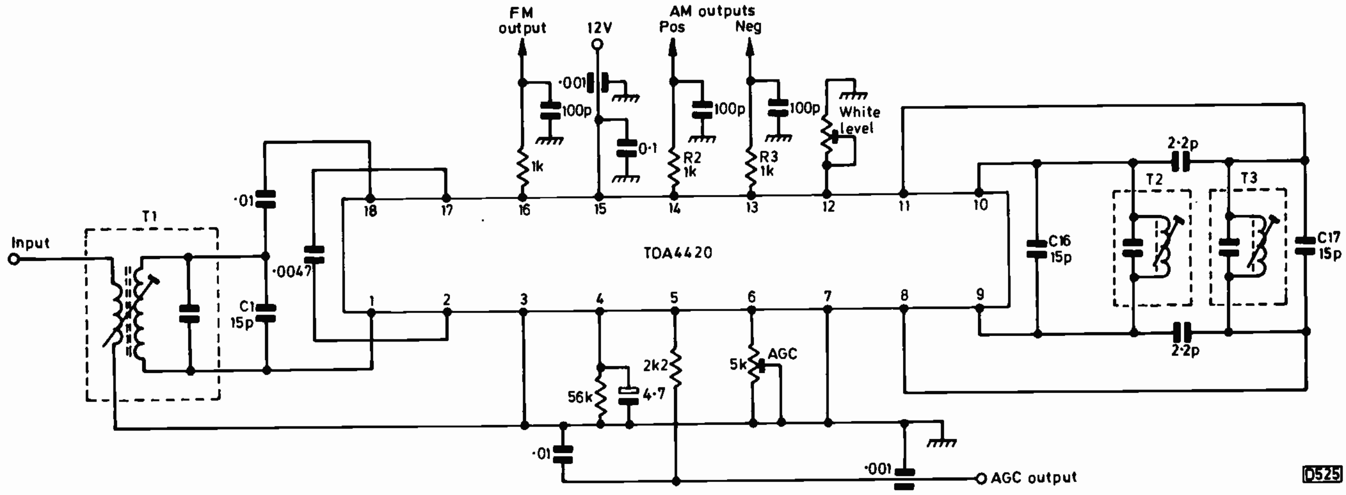


Fig. 3: Circuit of the Ambit 94420 module – 35MHz version.

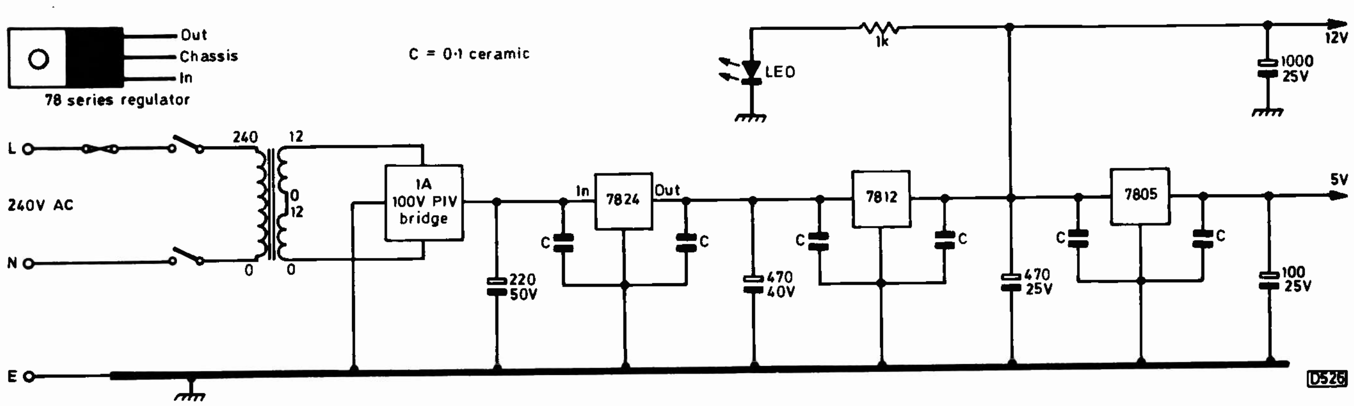


Fig. 4: Power supply circuit.

approximately 20pF. Either add extra 5pF capacitors or fit miniature foil trimmers having a maximum value of 10pF (e.g. RS 2-10pF type 125-648). The trimmers can then be used for tuning.

Vision alignment can be carried out on any signal, either positive- or negative-going. It's best to use a weakish but non-fading signal (or the local signal with heavy attenuation). Feed the output from the tuner to the converter, switch on and tune the TV set to approximately ch. E36. The modulator's output should appear over several channels, and if the external tuner is tuned to a known channel it will be easy to locate the correct output from the modulator.

Now switch S3 to the calibrate position and adjust the brass core (under the Astec label) in the marker unit until the blip coincides with the modulator's output. If narrow/wideband switching is incorporated, set this to wide. Alignment of the Ambit module is simple since there are few adjustments. Assuming that a signal is present and that the TV set is displaying a picture, reduce the input from the tuner and then peak the three transformers T1/2/3, starting from the rear. The a.g.c. preset has little effect, but the white level preset has an obvious effect. Adjust this whilst observing the image on the screen. Now switch to narrow bandwidth, reduce the i.f. input still further and adjust the core in L1. There will be an obvious signal peaking, i.e. with minimising the noise etc.

For audio alignment a French signal will be necessary if equipment is not available. Take the audio from the TDA4420's a.m. output, at the end of R2 or R3 as with the a.m. video. The Astec UM1286 requires an audio fine tuning preset.

If vision only is required, the Astec UM1233 can be used instead of the UM1286. This gives a cost saving. The Ambit 94420 module was used since it provides the required outputs and is convenient. It would be possible to press other units into use, e.g. the famed Philips G8 modules, again reducing the cost, but modification would be necessary for positive-/negative-going outputs.

Ambit provide detailed application notes with these modulators and i.f. units. When ordering the 94420 module, specify the 35MHz version (type 40-94422). The price is £9·34. Ambit sell the UM1233 (40-01233) at £4·25 and the UM1286 (40-01286) at £9·55. Add 15% VAT plus 60p for post and packing. The address is: Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG. Telephone 0277 230909. Delivery is usually ex stock.

The accompanying photograph shows the converter in operation with the French test pattern (left). On the right you can see what a system L signal looks like when fed straight into a system I receiver without conversion. I'd be interested to hear from anyone who uses the unit described in the present article or a similar one – also from anyone who's actually converting decoded system L SECAM to system I PAL!

Servicing Thyristor Line Timebases

Eugene Trundle

IN a recent article in these pages (November 1982) Ted Barrett described the basic operation of thyristor line output stages and offered much useful information on servicing them. As was pointed out, this type of circuit is now obsolete, though large numbers of colour receivers using thyristor line output stages are still in use. Mr. Barrett's article did not cover the type of width/e.h.t. regulator used with later thyristor line timebases, and the main purpose of this supplementary article is to describe the operation of this system and consider some of the fault conditions that can arise.

Earlier thyristor line output stage circuits used a transductor for width/e.h.t. stabilisation. The transductor's load winding was connected across the line output stage input coil, so that the impedance between the line output stage and the h.t. supply could be varied. The transductor's control winding was driven by a transistor whose conduction was determined by the amplitude of the flyback pulses generated by the line output transformer.

Current-dumping Regulator

Greater efficiency at less expense can be obtained by using the so-called current-dumping principle, in which surplus energy from the line timebase circuit is returned to a reservoir, in practice the main smoothing capacitor. Fig. 1 shows the idea. The reservoir capacitor C1 is charged to virtually the full peak mains voltage via rectifier D1. In most designs this is followed by an *RC* network (R1, C2) which provides a reasonably well smoothed supply for the line output stage. This supply is fed to the line output stage via diode D2.

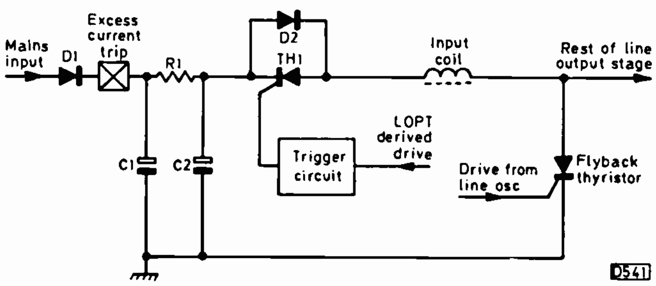


Fig. 1: Energy-dumping principle. When the regulator thyristor TH1 is triggered on, excess energy developed in the line output stage is returned to the smoothing capacitor C2.

When the line output stage is working normally, large voltage spikes, typically 200-300V peak-to-peak at line rate, will appear at the feed end of the input coil. These will reverse bias D2, which thus prevents their passage back to the power supply. If the line timebase was left to itself however excess energy would be developed, with high e.h.t. and horizontal overscanning. Control is provided by adding the regulating thyristor TH1. This is fired at some point during the scanning cycle to prevent excessive energy build-up. C2 is then placed across the input coil/flyback thyristor combination and not only damps the circuit but also collects the excess energy in the form of a "top-up" charge, reducing the current demand on the mains supply.

The regulating thyristor TH1 is fired during the second half of the line scan, before the flyback thyristor initiates the flyback. Thus the timing of the point at which TH1 is triggered determines how much energy is returned to the reservoir – and the line output stage's operating point. The later TH1 is triggered during the scanning cycle, the more power is generated in the line output transformer and the deflection coils.

There are two stages in the production of a trigger pulse for TH1. First, a line output transformer derived pulse is clipped and integrated to form a line-frequency ramp. This is then superimposed on a d.c. voltage which is proportional to the amplitude of the flyback pulse. If this sample d.c. voltage and the ramp are applied to the base of a control transistor, the transistor will switch on at a point on the ramp determined by the d.c. level. As a result, an output pulse whose timing is proportional to the flyback voltage will be generated. This pulse is applied to the gate of the regulating thyristor TH1.

Practical Circuit

Fig. 2 shows a practical circuit – as used in the Rediffusion Mk. III chassis. The 22V zener diode 6D7 clips the line flyback pulses to get constant-amplitude pulses which are then integrated by 6R30 and 6C23 and fed via 6C22 to the base of transistor 6TR2. The d.c. sample is provided by the peak rectifier 6D8 and its reservoir capacitor 6C25, potted down by the set e.h.t. control 6RV2 and its associated resistors. The pulse output produced at the collector of 6TR2 is clipped and

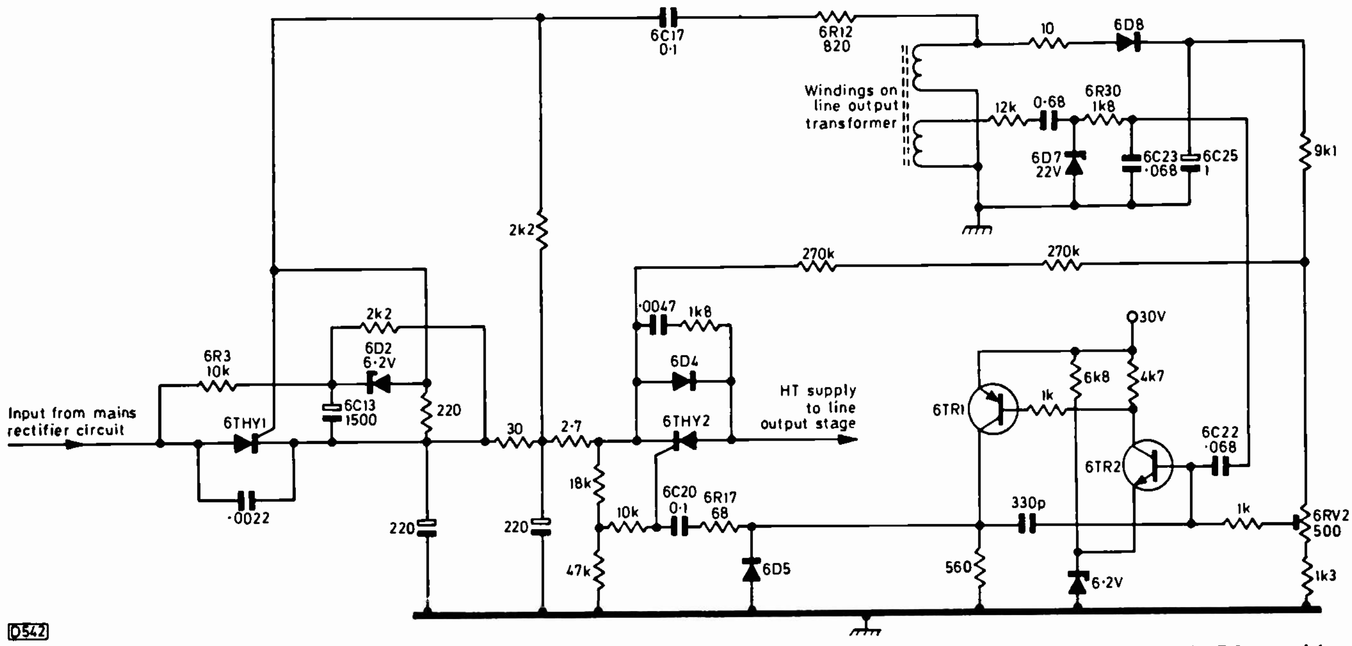


Fig. 2: Regulator, slow-start and electronic trip circuits used in the Rediffusion Mk. III chassis. 6R3, 6C13 and 6D2 provide the slow-start feature. 6THY2 is the regulator thyristor, which is triggered by the pulses produced by 6TR1/2. The electronic trip thyristor switches off in the absence of pulses from the line output stage.

inverted by 6TR1 and then passed to the gate of the regulating thyristor 6THY2.

Servicing Problems

Like many a circuit, the current-dumping thyristor regulator works well enough in practice but gives rise to some problems when a fault occurs. A short-circuit regulator thyristor damps the line output stage excessively and is easy enough to diagnose with an ohmmeter. The real problem is when for some reason the regulator thyristor does not get triggered. Under these circumstances energy quickly builds up in the line output stage and an over-voltage trip will come into operation to call a halt. This situation is characterised by a short burst of line whistle at switch on, followed by a resounding silence. If you can diagnose the cause of the fault in the 500msec or so available, read no further!

For us slowcoaches, help is at hand in the form of a variac, a tool that's becoming indispensible for TV fault diagnosis where power supply or line timebase problems are encountered. Using a variac, one can gradually wind up the mains input whilst watching the ammeter and TV screen.

If the regulator isn't working (which is quite often the case) a perfect picture will be seen at a mains input voltage from the variac of 150V or so (depending on the chassis). This will prove that the line timebase itself is working correctly. When the width and e.h.t. are roughly correct, the effect of adjusting the set e.h.t. control can be tried – it will usually have little or no effect. In the Rediffusion Mk. III chassis, 6R17 (see Fig. 2) will often be found open-circuit due to overheating: less often the zener diode 6D7 is responsible. Whatever the cause, the set is now operational for the purposes of fault-finding and oscilloscope tests should soon establish the cause of the missing, or mistimed, trigger pulses.

Later Thyristor Models

The current-dumping regulator thyristor is found in most of the later chassis that have a thyristor line output stage. All use similar circuits to generate the trigger pulses. Apart from the Rediffusion Mk. III chassis, probably the most common examples are the 14in. Ferguson colour portable Model 3787 and the Körting 55636, also the National Panasonic Model TC361GM. The latter model is sometimes guilty of intermittent mains fuse blowing at random and irregular intervals: this is usually due to one or other of the thyristors used, and in persistent cases we've found it necessary to replace the cutout TR801, regulator TR851 and flyback thyristor TR551 – despite the TR prefixes, these are all thyristors of course.

Circuit Complications

It is general practice in TV chassis to power much of the receiver from line output stage derived supplies, and thyristor designs are no exception. This means that a start-up supply is required for the line oscillator. There can be other complications. In the Rediffusion Mk. III chassis for example thyristor 6THY1 acts as an electronic trip and also forms part of the slow-start system. During normal operation it's held conductive by pulses from the line output transformer. These are applied to its gate via 6R12 and 6C17. So something has to be done to get it started. The slow-start action is provided by 6R3, 6C13 and the zener diode 6D2. 6C13 charges slowly via 6R3: when the voltage across it has risen sufficiently 6D2 conducts, firing 6THY1.

Safety Resistors

When a set is dormant with a dead line output stage, an open-circuit safety resistor may be the first clue you find. In the Mk. III chassis an inactive line output stage will remove the pulse feed to 6THY1. The set will continue to try to start via the slow-start network, but 6R3 is designed to go open-circuit under these conditions. You will have to replace it therefore before getting out the variac and starting to fault-find as previously described.

In the Grundig GSC100 chassis (Models 1514, 4415,

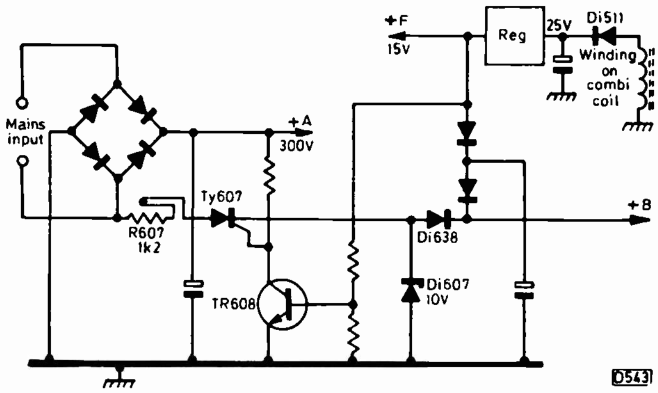


Fig. 3: Start-up circuit used in the Grundig GSC100 chassis. When the line output stage comes into operation the +F supply is developed and TR608 conducts, shorting the gate of the start-up thyristor Ty607 which thus switches off.

6415, etc.) the start-up feed for the line generator comes from the mains bridge rectifier via the fusible resistor R607, the kick-start thyristor Ty607 and Di638 (see Fig. 3). This supplies the +B line until rectifier Di511, which is fed from a tertiary winding on the combi coil, starts working. The isolating diode Di638 is then reverse biased. If R607 is found to have sprung, check Di511 for being either short-circuit *or* open-circuit – either condition will delete the +F supply and cause a sustained current flow in R607.

Intermittent Operation

A word on the nasty habits of some thyristors. We've had several cases of sets with thyristor line output stages shutting down intermittently, accompanied where relevant by the demise of a start-up resistor. It's happened to us several times with the Ferguson 3787 and the Grundig GCS100, and on odd occasions with other similar chassis. In each case the cause of the trouble has been traced to an intermittently open-circuit gate-cathode junction in the flyback thyristor – each time the type involved was encapsulated in a TO220 plastic pack. The fault is easily diagnosed (once you've gathered your wits) by means of an oscilloscope check, which will show the presence of trigger pulses at the gate of the device but no activity whatsoever at its anode, which sits quietly at 300V.

Gate-controlled Switches

At the risk of being accused of wandering off the point a little, we hesitantly bring up the subject of the gate-controlled switch device used in various (mostly 18in.) Sony colour sets a few years ago. These bore several numbers – SG608, SG613, and the current replacement type SG6533. We don't propose to embark on a description of their tendency to go dead short and almost write off the KV1810UB sets in which they were used, but rather to describe a nasty, if less catastrophic, habit that some specimens used in the line output position (Q901) in the KV1820UB develop.

We've on several occasions encountered a situation just like that described above for flyback thyristors – intermittent shut down due to an open-circuit gate-cathode junction. The tell-tale symptoms are the same – high-amplitude gate pulses are present but the device will not switch on. Beware of this – and of the high price of a replacement SG6533!

My Brother's TV

Les Lawry-Johns

ONCE upon a time I was advised never to do jobs for friends or relatives. I now realise the infinite wisdom of that. Since yesterday as a matter of fact.

I'd sold my brother a new Philips G8 some years ago. The tube went soft after three years, and there were a couple of minor incidents some two years back, but apart from that it's done pretty well. Fortunately the tube problem occurred within the four year insurance period and it was replaced, but the replacement tube did leave something to be desired. We've soldiered on however, with the help of the reactivator and one or two bits and pieces.

A Watery Picture

The other day I had a call to say that the picture was watery. Apparently it was rippled, which is a bit unusual for a G8. So I pondered a while about what to stuff into my little boxes. Tuner unit, plenty of capacitors, transistors etc. As soon as I saw the picture I kicked myself for not bringing a tripler. With the sound turned down I could hear a hissing noise, and removing the rear cover seemed to confirm that the tripler was a bit dicky. Probably because my brother smokes too much.

So I nipped back to the shop for a tripler. I say nipped, but in fact I got caught behind a couple of learner drivers. The first one was loath to drive out on to an empty main road, and appeared to be waiting for something to come along for him to be cautious about. The second one had similar qualms at a roundabout. Once I got back I rushed into the shop and promptly got involved in a repair that was required urgently. So it was some time later that I dashed out again, clutching a tripler.

Once again it took a little while to reach my brother's home, and as I pulled up I pondered upon the reason for my total lack of preparation. When did I ever go out to a G8 without a line output transformer for example? Suddenly my blood froze. I'd been back to the shop and hadn't picked up a line output transformer. What if . . .

Shrimps for Tea

Why was I so mixed up in dealing with my eldest brother? Was I still the same small boy with the same inferiority feelings? Perhaps it's because he has three Christian names while I have only one. He had been named after my father, my grandfather (the ferry boat captain, if you remember) and the lodger, Uncle Tom. On top of all this my mum always peeled his shrimps for him at tea time, while I had to peel my own – and very good at it I am too. So I suppose that's how I got myself into this mess.

The tripler was duly installed, and of course made little difference except that the hissing didn't sound so loud. I still had this fixed idea that the trouble was something to do with the e.h.t. feed, so I blamed the line output transformer – who wouldn't with a G8? – and like a fool dashed back to the shop to get one. Hurtled back and fitted it in record time. The picture was an smooth as silk and I offered up a prayer of thanks. Back on with the rear cover and fit the aerial lead. Heard my brother making this nasty comment to his wife, so I popped my head over to look at the screen. Looked smooth enough to me.

"It's still not done" he said flatly. "It rippled like buggery while you were hiding away behind it."

So I looked at it for a long time, but it remained smooth. Then I had this urge to run. Never mind the tripler, never mind the transformer, I just wanted to get back to Honey Bunch to tell her what a horrible time I'd been having.

I prepared to leave, suggesting that they try it for a few days to ensure that it was indeed o.k. The expression on my brother's face told me that he didn't think he needed a two-day evaluation, and that in his opinion the fault had not been cleared, just papered over so that I could get away.

Two Days Later

A couple of days later Joyce (his wife) phoned to say that the set was as bad as ever, and that Albert was ill and in bed. So I nipped over and collected the set before he got up. As it had a stand this had to be removed first, but before you could say knife I had it on the bench and was subjecting it to my cool, icy-calm reasoning.

It's not the tripler, so back goes the old yellowed one. Not the transformer either so back in with the old one. Switch on and there's a hell of a sparking, with the picture doing all sorts of things. I looked at the transformer and could see the overwinding lead arcing to the output nipple where it had broken away. Clean lead and solder it to the base of the nipple. All was now quiet and I couldn't see any ripple at all. Next try a vibration test. This meant that I gave it several sharp blows. The ripple returned for a second or two. Move the e.h.t. lead and it rippled again. I noted however that moving the lead also moved the leads and plug to the top (blue) convergence socket. Move the leads and it hissed at me. This was it then, a simple poor connection at the socket. In no time all was secure and the contacts firm.

All that was left was the fact that the blue gun was a little low on emission. They's said they were going to get a new set within a few weeks, so I thought a slight reactivation would be all that was required to keep them happy. This proved to be a little more difficult than I first supposed, but it finally came up after I remembered to switch on the reactivator.

Funny Colours

Back it went, and I stood it on its end to put on the stand. When I switched on the purity was terrible. I thought that the jolting in the car might have moved the purity rings, so I spent some time getting a pure red raster and then going through the whole convergence procedure. At last it looked good, so after asking about Albert's health I departed.

As soon as I got outside I realised that turning the set up on its end had moved the shadowmask, and that this would revert to its original position within a short time. Instead of adjusting everything to suit the shadowmask's new position, I should have given the cabinet a sharp tap to return it to normal. But I hadn't. I thought of phoning Joyce to tell her that the colours would change and that I'd have to go back yet again, but I didn't want the phone to disturb Albert so I left it for a while and then forgot all about it.

The next day Joyce phoned again to say that the colours had gone funny, and that Albert was better and would be around when I called. He was. I could read his mind as I reset the purity and convergence. "Always knew he was hopeless. Should never have let him loose on the poor old set. How could my young brother be any good at anything?"

However, there it was. A perfect picture. Until the plug on the convergence unit started playing about...

I got through a bottle of scotch that night, saying "good old Stan" and "happy new year Stan" every time I poured a nip into my glass. H.B. said Stan should never have given me the bottle, because when I paid for it myself I never got through more than half a bottle. Next day I'd a dose of the runs, but I was sure it was a touch of the flu and of course I needed scotch to ward it off. She said cold water would be better for it, but I couldn't believe that.

Highland TV

Had a very nice letter from Mr. A.J. Bullock the other day. He lives in a very remote part of the Western Highlands some fifty miles and a ferry from the nearest town. How he can cope with all he's expected to do, including the doctor's E.C.G. machine and building preamps to keep the local (extreme fringe) reception going, completely defeats me. Anyway congratulations A.J., and keep up the good work. Scotch is a great helpmate when the going gets rough. An article on your adventures would make interesting reading.

Letters

ANYONE SEEN OUR DISH?

Even regular contributors to *Television* get bitten by the enthusiasms of others, hence my efforts at present to get deep into satellite TV reception. Unfortunately the night after we'd finally assembled and mounted our two-metre white fibreglass dish, fitted the feedhorn and the low-noise amplifier, they all vanished. Hostile elements had nicked the lot!

We'd naturally like our gear back, and there's a reward, but the main point of this letter is to emphasize the vulnerability of expensive equipment left out at ground level without some form of protection. Apparently the theft of LNAs is commonplace in the USA, but our supplier had never heard of anyone taking the dish as well. Next time we'll have ours bugged from the word go, and I'm sure that how we do it would make interesting reading in these pages – if we were daft enough to tell you!
Harold Peters,
Snelling of Blofield, Norfolk.

MAINS SUPPLY FAULTS

On a number of occasions I've found repeated failure of the TDA2600 field timebase chip and the BU208A line output transistor in the Philips G11 chassis to be caused by arcing in mains plugs, sockets or adaptors – despite the mains transient protective devices (VDRs) fitted in this chassis. On one occasion a customer had only bumped the mains fuse box, but a poor contact on the supply fuse destroyed the TDA2600. I now make the condition of the mains supply a standard check on all service calls, even on other types of chassis. I hope this advice will prove of value to other readers.
David Lisle, The Television Doctor,
Gateshead, Tyne and Wear.

MESSAGE FROM AFAR

I feel I must tell you a strange story that may stretch your credulity to the limit. Whilst engaged in a TV repair the other day, and having got the set into working order, I noticed that the blue register was incorrect. As a result, objects were outlined or smeared. The effect had not been sufficient to result in a specific mention from the customer however. There was no reason to suspect the tube's emission and the fault appeared to be in the blue output stage. At this point the phone rang and my wife hastened to answer it. In a few seconds she became wide eyed and pale faced. She turned to me and said slowly, "it's E.T.!"

Now we'd recently seen this film of a lovable creature from outer space who had been left here alone and, naturally enough, wanted to return home as soon as possible. She turned back to the phone.

"Hallo E.T., this is H.B. speaking. Do you want to phone home?"

"He said ITT" she reported.

Well! The set I was working on was from the ITT stable.

She listened again and the voice said "tell him ITT CVC 560pee". The line then went dead. My dear one was shaken to the core and I was trying to flatten the hairs on the back of my head. Why should a creature from outer space phone to tell us the exact location of the component that was causing the problem in the set I was dealing with? – replacement of the 560pF emitter decoupling/frequency compensating capacitor in the blue output stage solved the problem.

I was grateful to E.T. for coming all those light years from a distant galaxy but still a little alarmed, as was H.B. who was making an untoward noise rattling the coffee cups. So I phoned my friend Ridley the solicitor. He said I was potty and that there must be lots of E.T.s in this world without having to go to any other.

Of course. It must have been dear old Trudge down on the south coast who, amongst other things, is an ITT expert. But . . . How did he know I was in trouble with an ITT CVC9?

Listen Trudge, if it wasn't you – don't tell me!
Les Lawry-Johns,
Gravesend, Kent.

THORN 9800 CHASSIS

Intermittent loss of field scan was mentioned in the December Service Bureau. This is often due to a dry-joint on pin 10 of socket 851 on the line output panel. Here are another two common faults on this chassis. First low e.h.t. with the c.r.t. heaters not alight due to L503 (blue width) on the convergence panel shorting and damping the line output stage. Secondly a dead set because R720 (120kΩ) in the mains thyristor trigger circuit has gone open-circuit.
Peter Creaven, Warrington TV,
Heywood, Lancs.

SAGA OF A SONY KV1810UB

Here's a little tale of how I was forced to become one of those bodgers so often condemned in your pages (I've been a reader since 1971). It relates to my Sony KV1810UB which has given many years of trouble-free service. About two months ago I noticed severe pincushion distortion, so I removed the case and with the aid of a scope began to prod around the pincushion drive transistor Q586. End of probe snaps, hand slips, quick flash and new symptom – dead set.

At this I felt I'd just lost the war single handed. Leave it to the professionals I thought. But only one local firm offered to have a look at it, the others refusing for reasons they wouldn't divulge. Anyway out came an engineer and after one and half hours he'd found out how to remove the back of the set and replace the mains fuse, which blew again at switch on. At this point he decided that the set would have to be taken to their local depot at Penrith.

After about six weeks and many phone calls I decided to take the set back and attempt to deal with it myself. Many excuses had been given, and like the other firms they wouldn't send it back to Sony. As we took the set off my wife made noises about the bill and we were told nothing to pay. As we went through the door we were told that the repair would have cost over £100, which would not have been worthwhile for such an old set.

Anyway, once I'd got the set back I soldered a Vero pin on to my scope probe, removed the case and set to. Working through the troubleshooting chart given on page 7 of the manual I soon established that the chopper and line output gate-controlled switches Q603 and Q510 were both short-circuit. I sent a cheque off to the Sony spares department in Slough and got my replacements in just four days. One of these was open-circuit, but a further GCS was on the mat three days later following a phone call.

Now to the repair. I fitted the two GCSs and, following the advice given by E. Trundle in his articles on switch-mode power supplies in the July and September 1977 issues, I powered the 19V line externally and made some checks. All seemed well, so I borrowed a variac and applied a slowly increasing mains voltage, constantly checking the power supply and line output stage waveforms. At about 90V a dim picture appeared. With 130V we had a full colour picture, albeit with pincushion distortion. Increasing the input voltage above this level started to alter the mark-space ratio drive to the chopper GCS, maintaining a constant 130V h.t. supply. Connect directly to the mains, switch on and all o.k.

Finally to the pincushion distortion. The field frequency correction waveform is fed to the base of Q586 via C585. A check revealed a waveform at one side of this capacitor, nothing at the other side. Replace the capacitor using a suitable type (4·7μF electrolytic, 100V) and there's a waveform at both sides. Tickle the pincushion amplitude control VR585 and we've a perfect picture.

I wonder what the professionals suspected to be wrong to justify such a high estimate, and why they didn't really seem to want to know?

Clive Caleman,
Whitehaven, Cumbria.

SIMPLE TRANSISTOR GAIN CHECK

Most readers will by now be familiar with the method of testing transistors for continuity and leakage using a meter. A test for gain is sometimes useful however: I've used the following procedure for some time now with success. For an npn transistor, connect the meter's black lead to the collector and the red lead to the emitter. Use the meter on the 200kΩ range (usually the meter's middle resistance range) – don't use the high or low ranges. Lick the end of a finger and place it across the transistor's base and collector. This effectively biases the transistor on, and the meter should show a reading of between approximately 20kΩ and 5kΩ. The lower the resistance reading recorded, the higher the gain of the transistor being tested.

This test doesn't give an accurate gain figure but does show that the device is capable of providing gain (or sometimes not capable of doing so). It also demonstrates d.c. gain only. In my experience however a transistor that passes this test always works in circuit.

It's also possible with this test to prove by deduction the configuration of an unknown transistor. Small silicon transistors (both pnp and npn) respond well but power types and germanium transistors, being of lower gain, don't always respond. I hope this may prove of use to other readers.

Paul Hardy,
Reading, Berks.

ADDING A ZENER TEST

I was very interested in Victor Rizzo's simple zener diode checker (Letters October 1982) and decided to see whether such a test could be added to my capacitor tester (Letters, same issue). This has proved possible and the extra circuitry is shown in Fig. 1 (refer also to Fig. 1, page 640, October 1982). When S3 and S4 are both closed the voltage across R7 is 30V. With S4 open the voltage across R6/7 is 100V. S4 is a normally-closed pushbutton switch. The values of R2, R6 and R7 may have to be altered to get the correct voltage (100V) across probes A and B.

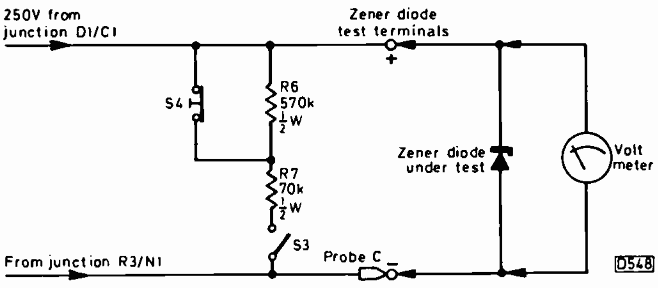


Fig. 1: Adding a zener diode test to Walter Spencer's capacitor tester (see also Letters October 1982).

Leave S3 open when making the tests previously described. To test a zener diode, connect it as shown with a meter (20kΩ/V or better) in parallel and close switch S3. The meter should show the zener voltage (zener diodes rated at up to 33V can be tested) when probe C is connected to the negative terminal. Press S4 and with a good zener diode there should be little if any change in the reading. I tested a number of zener diodes as a check and found that a small increase in voltage – below 5V – was normal. In no case was there an increase above 6V. The zener voltage and the meter reading may differ depending on the accuracy of the meter. If you are going to use a particular meter you can test some known good zener diodes and note the results. For example, with a known good 11V zener diode my meter reads 10V on the 50V scale.

Walter Spencer,
Brisbane, Australia.

CORRECTION

I would like to draw your attention to an error that occurred in the TV Sound Receiver article in the March, May and June issues last year (1982). This is that the quadrature coil L2 should be rotated through 180° on the PCB track drawings. After building my own receiver I eventually discovered that L2 was not in circuit. My findings were subsequently confirmed by Manor Supplies who stock the PCBs and Philips coils.

It's essential to have a really strong signal to drive this circuit. I can get only just sufficient signal from an eleven-element Yagi in the loft, seven miles from Crystal Palace.

Keith Orchards, T.Eng. (CEI), G3TTC,
Chessington, Surrey.

GETTING AT AWKWARD BOLTS

It's sometimes necessary to unscrew a slot-headed bolt from underneath a board inside a chassis or machine so that a transformer or other bolt-secured component can be removed. You can dismantle the whole thing to get at the bolt, but it helps if this can be avoided. An easy way out is to have available three screwdrivers with the shafts bent at the ends. Bend the end of one shaft through 90° and the ends of the others through 45° in both directions. To do this, use steel (not mild steel) screwdrivers: heat the blade ends to a dull red to make the bends, holding the plastic handle and part of the shaft with a wet cloth to avoid damage to the handle.

Victor Rizzo,
Msida, Malta.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.) and Mike Phelan

Sony C7

The first thing to check when faced with a VCR that has a colour fault is whether it's present in the record or replay modes or both. Playing a known good tape on the faulty machine and one of the faulty machine's recordings on a good machine will soon sort that out. In most cases you'll find that the fault is present in both modes. I prefer to use a known good tape with a colour test card or bars for replay purposes whilst fault-finding. The problem on this occasion concerned a Sony SLC7: the replay was basically in monochrome but with a few blue and red flashes thrown in for good luck. Where to start?

On playback, the off-tape colour subcarrier is at 685kHz and 689kHz on alternate tracks (fields) in the Betamax system – this is done for colour crosstalk cancelling purposes – and has to be frequency converted to the standard 4.43MHz. For this purpose, carriers at 5.119MHz and 5.123MHz are required on alternate fields. These are produced by a mixer (see Fig. 1) which receives a 4.43MHz input from a phase-controlled variable crystal oscillator (VXO) and 685/689kHz signals on alternate fields from a voltage-controlled oscillator (VCO). The VXO circuit is phase-controlled by the colour bursts. Its operation varies in the record and replay modes – two crystal oscillators are involved on playback. The VCO circuit is frequency-controlled by the line sync pulses and operates in the same way on both record and playback.

The VCO with its a.f.c. loop is the heart of the whole colour processing system. If this fails, all the other colour circuit operations will fall apart. The main items involved are the VCO itself, a phase detector, and some counters. The VCO operates at 5.48MHz and 5.51MHz on alternate fields. There are two counter chains. A divide-by-eight counter produces the 685/689kHz output for the mixer. The other counter chain, which is switched, is within the a.f.c. loop and produces a line frequency signal that the phase detector can compare with the line sync pulses – in practice the line sync pulses are first processed, after which they are called the pilot burst flag pulses.

Because the second counter chain is switched at 25Hz, frequency measurement is not on in this area. The switched, counted-down output from the VCO is converted to a positive-going ramp before being applied to the phase detector. The flag pulse sits on this ramp – as you'll see by connecting your scope to TP19. There are two pots to twiddle. RV21 sets the pulse half way up the ramp with the machine in the stop mode. When the machine is running, the position of the pulse on the ramp varies at 25Hz, i.e. on a head-by-head basis. RV22 is adjusted to even out the 25Hz ripple. See the waveforms in Fig. 1. Twiddle RV22 to even the 25Hz offset and then if necessary readjust RV21 to centre the ripple half way between the upper and lower edges of the waveform. Intermittent colour on older machines, including the Sony SL8000 and Toshiba V5250, is often due to a.f.c. drift as these potentiometers age.

The count in the a.f.c. loop is 351 for a 685kHz output (head A) and 353 for a 689kHz output (head B). The counter chain is switched to add a count for one head and subtract a count for the other.

Back to our faulty SLC7. When we checked the a.f.c. circuit we found that the operation was erratic, i.e. the sample pulse did not sit on the ramp. Also the colour killer was operating. We next found that the 685/689kHz output was reducing in level. A squirt of freezer on the SN74LS93 divide-by-eight counter IC7 increased the output again, so it was fair to assume that this i.c. was faulty.

This involved us in a certain amount of difficulty, because the counter is on a subpanel mounted and screened in a manner that makes it impossible to work on it. We removed the panel, took off the screening, and mounted it on the print side of the mother board. We decided to use a standard SN74LS93 replacement, but this gave no 685/689kHz output at all. So we tried another, to no avail. A week or two later a replacement i.c. arrived

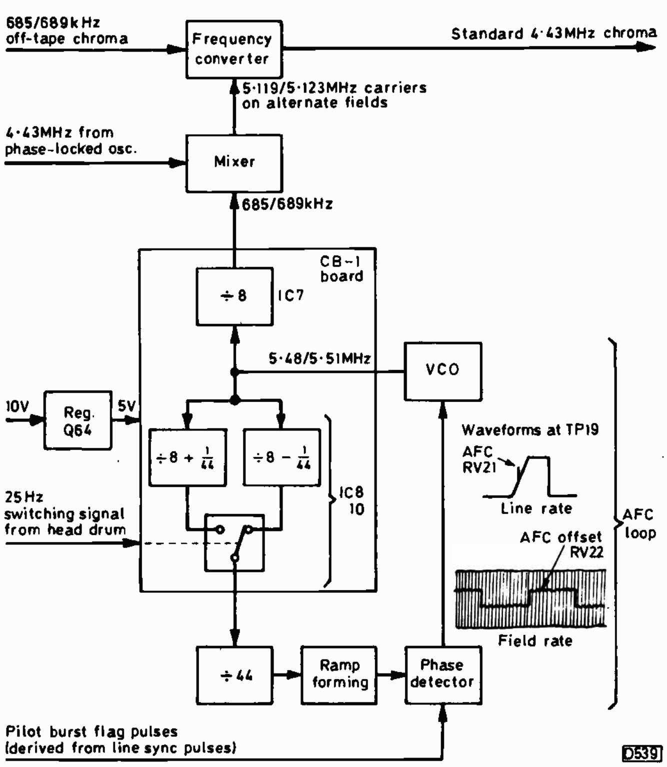


Fig. 1: Colour system a.f.c. loop, Sony Model C7.

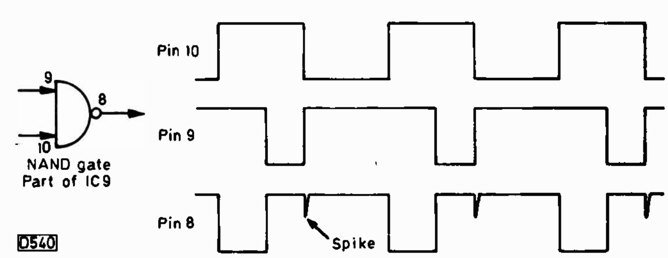


Fig. 2: Waveforms found at one of the gates in IC9.

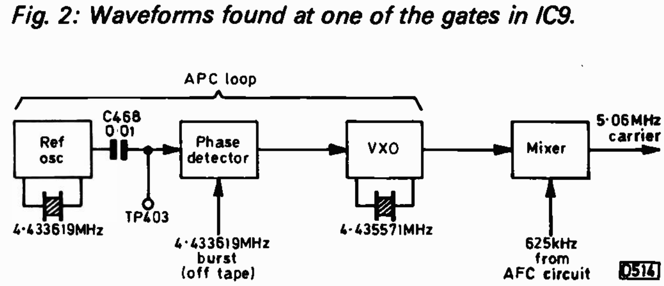


Fig. 3: Colour system a.p.c. loop, Ferguson 3V29.

from Sony. This worked, but there was still no colour.

A check at TP19 revealed that the ramp and the flag pulse were both present, indicating that the a.f.c. loop was locking correctly. So, with the machine running, we switched the scope to watch the waveform at TP19 at field rate, in order to monitor the a.f.c. offset. This couldn't be seen however. The ripple for head A was present, but during the head B period the signal was scrambled. So the a.f.c. loop was locking for only one head. It took some considerable time to find out why – time that shouldn't have been wasted.

Fig. 2 shows the operation of one of the gates – a NAND gate in IC9 – used in the circuit that carries out the 25Hz switching. The inputs are applied to pins 9 and 10. The conditions shown apply to a head A count. For a head B count pin 9 remains high and the output at pin 8 is an inverted version of the input at pin 10. What we discovered was that during a head A count there was a stray spike which interfered with the count on the output at pin 8. Our conclusion, natural enough, was that IC9 was faulty. Not so!

A point to note here is that the counter can be held in either the 351 or the 353 mode. The 25Hz switching signal goes to the counter via transistor Q71 – for the head A condition connect its collector to chassis, for the head B condition connect its base to chassis.

When using an oscilloscope for monitoring with a complex fault condition it's all too easy to ignore the more obvious clues – such as IC7 failing in the first place or why IC9 was suffering from this spike breakthrough. The main supply line in the SLC7 is at 10V, so it was reasonable for us to assume that the counter is run off this supply. It isn't.

In fact the basic problem was due to the regulator transistor Q64. It had been badly mounted in the first place on the mother board, with two of its legs touching. As a result, the counter was being operated at 10V instead of 5V. This was the cause of IC7 overheating and failing. Why the fault took some months to show up is something I can't explain. **S.B.**

Ferguson 3V29

The complaint with a Ferguson 3V29 was poor colour. Indeed when we played back a test tape the colour kept going into horizontal bars then off altogether. This suggested that the fault lay in the part of the circuit that generates the 5·06MHz carrier for frequency conversion, as either the phase or the frequency seemed to be changing.

The first thing to do in a case like this is to make a recording on the faulty machine and play it back on a good machine. If the recording proves to be all right, the fault must be in the a.p.c. loop since this is not used on record. This was the case so we checked at TP403 for 0·72V of 4·433619MHz. This is the output from the crystal reference oscillator used in the a.p.c. loop (see Fig. 3). The signal was absent and we seemed to be loosing it across the 0·01μF coupling capacitor C468. It's one of those tubular ceramics that look like 10kΩ resistors. Replacement solved the problem. **M.P.**

Toshiba V8600

No colour on a Toshiba V8600 was found to be due to the absence of the 5·12MHz carrier used for frequency conversion. It's produced by IC207 (CX832), appearing at pin 15. L215 associated with this pin was found to have short-circuit turns. **M.P.**

Vintage TV: The Decca Story

Chas E. Miller

MOST of the setmakers active in the early fifties have long since departed from the TV scene. One notable exception is Decca, though the TV side of the firm is now owned by Tatung. Our subject this time is early Decca TV sets.

The name Decca is in fact older than the radio and TV industry, the firm having been involved with gramophones since early this century. The manager of a shop for which I did trade work in the late fifties had started his career by repairing Decca gramophones in World War 1 – they were known as "troop comforts" – and had graduated through radio sets and radiograms to television receivers. In the early fifties Decca and RGD were rivals in the luxury end of the market. The "BeauDecca" was a direct competitor to RGD's huge 1949 model for example, both in its size and the quality of reproduction. But unlike RGD, Decca did not feel that they were bound to this end of the market alone. They were not afraid to produce, concurrently with the dignified BeauDecca, a jaunty mains/battery portable known as the Double Decca. Perhaps it's this versatility that's ensured their survival.

Projection TV

In 1950 the largest direct-viewing c.r.t. available in the UK for television had a 15in. diameter round screen and, with a deflection angle of only 55°, a prodigious overall length. When Decca entered the TV field they went for projection sets as a way of obtaining large pictures from a small and thus economically priced and proportioned c.r.t. Model 121 was intended for domestic use and provided a picture of 12 × 16in. on a flat screen built into the front of the console cabinet. The equivalent sized picture would have required a 20in. diagonal direct-view tube, since the tubes of the period had round faces. For use in really large houses, clubs or small halls Decca produced the front-projection Model 1000. This produced a picture of 4 × 3ft on a special aluminium-sprayed screen which was placed about 8ft 6in. in front of the receiver unit. The 1000 contained no fewer than 28 valves, including three EL38 line output pentodes! The reason for this will be explained later.

Projection TV was not itself novel. It had been demonstrated prior to World War 2, and contemporary descriptions indicate that much of the design of the apparatus was similar to that employed by Decca. The optical units were actually produced by Mullard, who supplied them to all the manufacturers of projection receivers. Previous articles in the series have described the system – see Vivian Capel's articles in the June and August 1980 issues. Here's a brief résumé of how it worked (see Fig. 1).

The small projection tube had a 2½in. screen and was operated at 25kV. It was mounted with its face passing through a central hole in a mirror which was at an angle of 45° to the tube's centre line. A second mirror of shallow spherical section was mounted in front of the tube, a short distance away. This gathered the light, i.e. the picture, from the tube, reflecting it back to the angled mirror which in turn reflected it up through an optical correction lens to yet another mirror mounted at an angle. This third mirror was separate from the optical unit and reflected the picture on to the viewing screen, either in the cabinet or remote from it. At each stage as it passed from mirror to mirror and thence to the screen the picture size increased. The purpose of the correction lens was to ensure that an even focus was maintained over the entire screen area.

The mirrors were all of the surface-silvered type, i.e. the reflective material was deposited on the face of the glass instead of the rear surface, as with a conventional looking glass, in order to prevent the double image effects that would otherwise have occurred. The mirrors within the optical unit, and the c.r.t., were protected from dust by sealing all the joints etc. with felt. The final mirror needed cleaning occasionally, and this had to be done with extreme care in order to prevent damage to its surface.

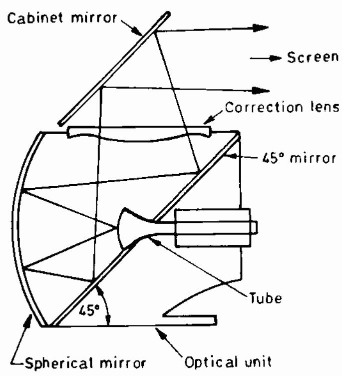
The reason for the high e.h.t. of 25kV was to produce a bright enough picture for successful magnification through the optical mirror/lens/screen combination. A Mullard produced unit was employed to generate the e.h.t. The version used in the Decca 121 and 1000 had an EBC33 as a blocking oscillator driving an EL38 output pentode (the first of those EL38s we mentioned!). The pentode was transformer coupled to a voltage tripler that was completely different from those with which the engineers of today are familiar. It used three EY51 thermionic diodes, each with its own heater winding on the transformer. The whole lot – transformer, diodes and high-voltage capacitors – was sealed in a can of oil to prevent flashovers. The use of such a high voltage on such a small tube meant that the prospect of X-ray radiation was very real. Mullard stated that there was no danger to viewers or engineers provided the c.r.t. was not operated outside the optical unit. E.H.T. regulation was achieved by using the diodes in the EBC33 valve to rectify the "flyback" pulses, thereby producing a voltage proportional to the output to bias the grid of the output pentode.

The Decca Model 1000

The vision and sound receiver sections of the 1000 were conventional for the period. The standard r.f. chassis was tunable over the five Band I channels, using vestigial-sideband operation, or an alternative double-sideband version was available for use in the London area only.

The timebase section was extraordinarily complex. There were no fewer than five valve sections in the sync separator department. This started with an EB91 double diode which was the sync separator itself. A 6F14 pentode sync pulse amplifier followed this. There was then a 6L18 triode limiter and finally an EB91 diode was used as a field interlace filter. T41 thyratrons were employed in the line and field oscillator stages, and the output valves – Pen45 field, EL38 line – were transformer coupled to the scan coils using simple two-winding output transformers.

We now come to the really unusual bit. In addition to the EL38 line output pentode the line output stage incorporated a second EL38 (making three in all) which was referred to as the left-form valve. There was also a triode (half an ECC34) which was referred to as the right-form valve. The purpose of these two valves, which were driven by field-frequency waveforms, was to distort the



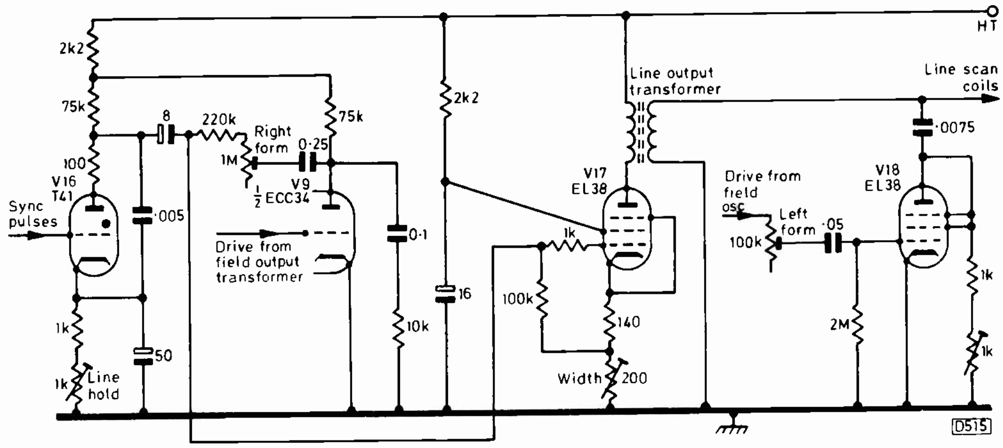


Fig. 1 (left): The Mullard optical unit for use in projection receivers. Fig. 2 (right): The line timebase circuit used in the Decca Model 1000, with left and right form correction stages to compensate for the distortion introduced by the optical system.

raster deliberately (trapezium adjustment) to compensate for the distortion introduced by the fact that the cabinet mirror was mounted at an angle to the viewing screen. The circuit is shown in Fig. 2. The left-form pentode V18 received a drive at its control grid from the field oscillator circuit: it damped the line scan on the left-hand side by an amount proportional to the field scan. The right-form valve V9 received its drive from the field output transformer and was used to adjust the waveform produced by the line oscillator.

Three more triodes were used to protect the c.r.t. should either one or both timebases fail whilst it was in operation. As might be imagined, a stationary spot or single line with an e.h.t. of 25kV would have burnt its image on the screen in seconds had precautions not been taken. Voltages tapped from both timebases were used to bias two of the triodes which in turn controlled the third. The latter controlled the c.r.t. bias. Any fault in the timebases upset the balance of the three triodes, immediately blanking out the raster. Yet another triode worked in conjunction with the manual brightness control to prevent over-modulation effects during periods when peak-white picture information was present.

The Decca 1000 suffered the drawbacks common to all projection receivers. Apart from the elaborate circuitry, which made servicing difficult, the low overall brightness of the magnified picture made it essential to view in darkness – total darkness in the case of very large screen models such as the 1000. The front-view 121 used similar circuitry but didn't require the left-/right-form circuitry.

Later Deccas

What with all this complication and the advent of larger, wide-angled direct viewing tubes, it's not surprising that projection TV sets vanished from the scene in the early fifties. Before long engineers were stripping the expensive e.h.t. units to recover the EY51 valves, which were then very pricey. By 1953 Decca had changed over to marketing conventional TV sets that incorporated the simple and reliable Plessey five-channel chassis. This kept them going until the DM series went into production. These were 13-channel models with, in many cases, provision for v.h.f./f.m. radio reception. Some were combined with radiograms. All used conventional circuitry and gave long, trouble-free service. The cabinets were necessarily bulky in the case of models fitted with 70° and 90° tubes: the chassis were large, flat and easy to get at through the bottom trap doors.

When 110° tubes came along, vertical chassis took over for a while before being replaced with a two-deck assembly similar to that used in the Thorn 850 series. These later models hardly qualify (as yet!) as vintage, but it's worth mentioning that Decca were soon producing hybrid chassis incorporating i.c.s – the MS series. These had such a small chassis that you almost had to look twice to see it in the 24in. version!

Good wishes to Decca under their new ownership, and finally an acknowledgement to the ever efficient service department. The engineers there have always been most helpful with advice on problems – sometimes well beyond the strict call of duty – and the spares service has been first rate.

Routine TV Receiver Tests: Thorn 3000/3500 Series Chassis

S. Simon

MOVING along alphabetically in this series on quick tests on faulty CTVs we come next to Thorn. We don't propose to deal with the original dual-standard 2000 series chassis in view of its rarity: we'll content ourselves with the observation that it was the first fully solid-state colour chassis. The following 3000 series chassis, our subject this month, was also a first in having a switch-mode power supply. So when we moan and groan over more recent switch-mode power supplies it's worth remembering that we've been coping with this sort of thing for a goodly number of years now.

Chassis Recognition

You can't recognise a set fitted with the 3000 or 3500 chassis from the front because of the huge number of variations. Ferguson, HMV, Marconiphone and Ultra sets, quite a few models from the Alba stable and a lot of others were fitted with the chassis. It's at the rear that a positive identification can be made. The aerial socket is at the left-hand side, with above this the red button cut-out (all except a few early models) and above this again the contrast control. Apart from the station selectors on later versions there were no other external controls at the rear. Once the back cover has been removed a strip of presets can be seen down the right-hand side. These are the field hold, height, and the two field linearity controls. Just into the board from the lowest preset there's the smaller "sit-up" control which sets the conditions at the start of the field scan and thus has a profound effect on the overall linearity.

No Results

In the event of no results, the first thing to bear in mind is that the c.r.t.'s heaters are fed from a winding on the mains transformer. So we have our first check: if the tube heaters are glowing, the mains supply is reaching the transformer and there are likely to be some points alive at 240V a.c. and d.c. at the top of the upper left side power supply panel. Incidentally, the 6·3V heater supply can be boosted to help an ailing tube by employing the unused tag on the transformer — this will increase the heater voltage by some 20 per cent. To return however to a non-working set.

If the tube heaters are not glowing, it's likely that the red button cut-out has operated. Push it back in but don't hold it. If there's a noise and the button pops out again, with perhaps a whisp of smoke from the rear centre resistor, switch the set off and check for shorts, starting with the front four rectifier diodes, particularly the right-hand two. One of them is likely to be short-circuit.

If the red button pops out without any signs of overloading, it could just be that the cut-out itself is faulty and in need of replacement.

If there are signs of distress but the diodes read correctly, suspect the R2010 chopper transistor VT604 on the front left side and check it for shorts. Since this will involve removal of the power supply module, a general check on possible suspects can be carried out. For example, the h.t. electrolytics, which are housed under the front of the unit, may show signs of advanced deterioration. This is most objectionable since any leakage of fluid will fall on the front of the lower video panel and play havoc with the brightness (set porch bias) circuitry. The condition of the main electrolytic can be checked without taking the panel out by holding a small mirror in front of it.

In most cases however the tube heaters will be glowing but there will be no 60V h.t. supply at the rear centre (of the panel) 2·5A h.t. fuse F603. If this is the case it's essential to carry out a few tests which will indicate where the trouble may be. Note the large power resistor (dropper) assembly at the rear of the panel. The right-hand section of this is a handy check point. The tag at the right end should record some 12V and the second one along some 45V. This section is R607 and has a value of 100Ω. If the 45V tag reads more like 30-35V, suspect the front 1,000μF, 63V reservoir electrolytic C607. If this is open-circuit, as it often is, the 45V feed to the 30V regulator will be low and the circuit will not start up. If the voltage is 45V at both tags, instead of 12V at the right side tag, the 30V supply fuse F602 (500mA) beneath the power panel has probaby failed. If the 45V is present but the right side tag records a very low voltage, the chopper driver transistor VT605 (type E1222) could well be short-circuit or incorrectly driven (there should be 1V at its base and 0·75V at its emitter). VT605 is under the left side of the power panel and wears a heatsink.

The 30V Regulator

The 30V regulator transistor VT601 plays a key role in the operation of the whole set. It's an npn power transistor and is bolted to the right side of the power unit. It has a white plastic cover — if this is still in place. The type is SP8385 although others, such as the BD203, can be used. The input to it is the 45V supply previously mentioned and the output at its emitter should be 30V. Its base is biased from the 240V supply via R608 (12kΩ), stabilised by the 30V zener diode W605. This zener diode is just behind the associated 400μF smoothing electrolytic C609 at the front right corner and a dead set can often be due to this zener diode going open-circuit. There should be 30V on its left-hand side and 0·7V on its right-hand side, which is returned to chassis via the base-emitter junction of the delay switch transistor VT602. This transistor switches on the chopper drive circuit, so with no 0·7V at its base there's no chopper drive and no 60V h.t. supply.

Start-up Sequence

The sequence of events when the set is switched on is as follows. The 30V regulator is started up by the 240V and

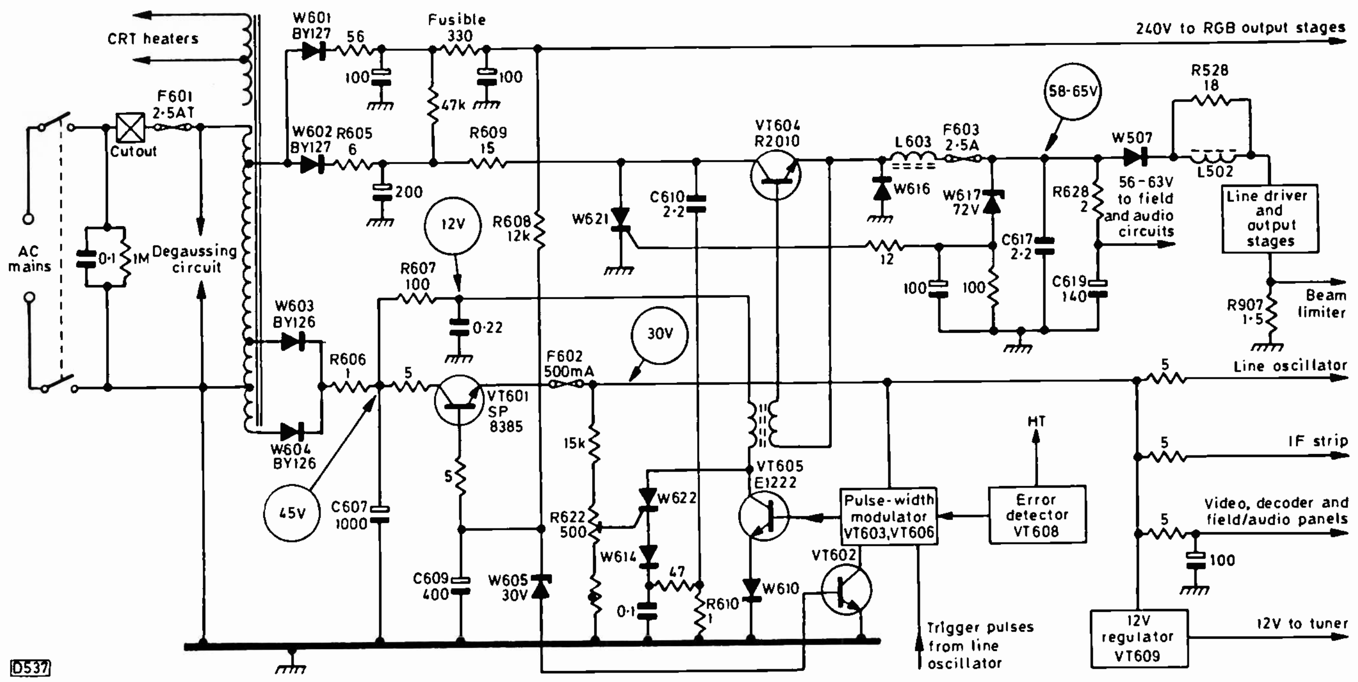


Fig. 1: The power supply arrangements used in the Thorn 3000/3500 chassis – simplified circuit. W621 is the over-voltage trip and W622 the excess current trip. F601 omitted in later production chassis.

45V supplies. The 30V line supplies the line oscillator on the right-hand panel at the top of the chassis, and this in turn provides a pulse to trigger the chopper drive circuit which then comes into operation (at 15kHz of course) to produce the 60V supply for the line output stage, also the field output stage and the audio panel. There's a lot more to the operation of the power supply of course, but this bald outline serves to show the interdependence of various sections of the chassis.

Check Summary

So to check this lot out, if there's no 60V supply at the h.t. fuse F603, first check the voltages at R607: you want 45V at the high side and 12V at the other end. Absence of the 12V supply indicates overloading if the resistor is hot. If it's cool, check it for being open-circuit. If the conditions here are correct, check the front zener diode W605 to establish whether there's 30V at the inner end and 0·7V a the outer end.

There is little doubt that the most common cause of non-operation is failure of the 1,000μF 45V supply reservoir capacitor C607 at the front of the power unit. This state of affairs is immediately indicated by low voltage at R607, i.e. less than 45V at one end, due to C607 having lost capacitance. Merely stabbing a test capacitor across C607 may not produce the expected result: switch the set off and connect the test capacitor across the tags of C607.

There are many other possible causes of non-operation, and you may for example have to spend some time checking various items in the power supply. We can't consider every possibility in an article on general handling. In some cases you may experience a good deal of head scratching and exasperation. Best wishes!

The Line Timebase

The line timebase board is on the right-hand side at the top. Like the power supply panel, it's a swing-up type. Early versions of the 3000 series chassis employed two R2009 line output transistors. Later versions and all 3500 chassis have a single R2008 line output transistor in a simplified circuit.

A separate panel at the top carries the preset brightness and beam limiter circuitry. This is another key section of the 3000/3500 series chassis, the important item on this small panel being the 1·5Ω wirewound resistor R907. This resistor is in series with the line ouput stage and thus carries the total line ouput stage current. The voltage developed across it is used to control the beam limiter. Under no-load conditions, this voltage should be 1·3V. It's a handy check point since a high voltage indicates an overload in the line output stage while no voltage indicates an open-circuit. This assumes that the resistor is intact and hasn't changed value. A voltage of say 3V may not mean that there's an overload: it may indicate that the resistor has gone high in value. This is quite common and accounts for the complaint that "the picture got darker and darker" — because the beam limiter was reducing the brightness.

Lifting this small panel enables the 60V supply to the line output stage, via L502, to be checked for dry-joints etc. It's quite common for the ends of this coil to become dry-jointed and for the associated 18Ω damping resistor R528 to become decomposed. It's also common for the core to fall out of L502 and find a resting place on the decoder panel at the bottom. If the picture is severely corrugated (rippled verticals) with an accompanying twittering noise, check the presence or absence of this core before looking for the cause of the trouble on the power supply panel where there are several items that can cause similar symptoms, including a couple of 0·01μF capacitors (C631 and C616) and the h.t. smoothing capacitor C619 (140μF — it's worth increasing the value of this to 220μF). If the core has fallen out, replace it and seal the end of the coil former to ensure that it doesn't fall out again. This condition should not be confused with the effect caused by a misadjusted dynamic trip preset (R622). The symptom in this event is serrated verticals on bright scenes, the effect stopping when the contrast is reduced. One thus sees that there can be many similar and confusing symptoms: a careful preliminary examination of the exact

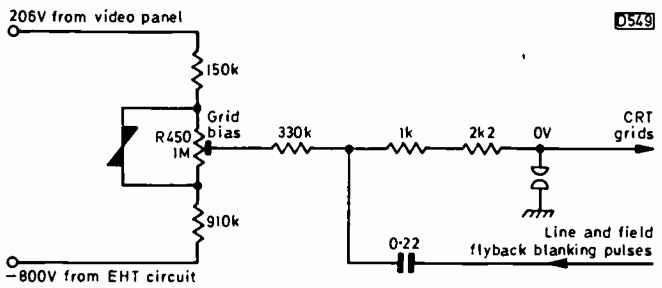


Fig. 2: C.R.T. grid bias/blanking circuit.

effects can save much time. Wild geese are easy to chase but not so easy to catch.

If the reading across R907 is high and there's no raster, disconnect the e.h.t. tripler from the e.h.t. transformer. Even if the tripler is proved faulty the reading may remain high, as shorted turns in the transformer could have accompanied the tripler failure. The result is an expensive repair.

There are not many fault conditions that can give one a nasty turn. One that does so is when the e.h.t. rises to a dangerous level. The symptoms are a small picture with loud discharges around the e.h.t. cap and perhaps from the body of the tripler unit. The item to replace in this event is the line flyback tuning capacitor C518 (0·028μF) — in the earlier two-transistor line output stage circuit there are two capacitors, C517 and C518 (both 0·056μF), connected in series. The capacitor(s) are of the special high-voltage type.

Another capacitor in this area, C520 (7,500pF), can cause trouble. When it goes short-circuit the symptom is no colour since the decoder is then deprived of burst gate pulses.

Most of the other line timebase troubles are fairly straightforward. The most common is line sync problems due to failure of C506 or C511 (both 22μF).

No Colour

We've just mentioned one cause of no colour. Something else to check before delving into the lower right side decoder panel is the first chroma amplifier transistor VT110 which is mounted on the i.f. panel — on the lower rear edge. Check the transistor itself (BF224) and its voltages. Its base is forward biased by the a.c.c. potential which comes from the decoder panel: you should find 0·7V at the base of VT110 and 2V at pin 6 of socket 12 on the decoder panel.

We can't go into detail on the decoder side. If you're going to service a lot of these sets, a workship manual will prove of immense value. We would however mention that if you have a strip of green down either side of an otherwise correctly coloured picture, adjust the core of the ident coil L303 (front right) to shift the strip without bringing it in on the other side. Don't try haphazard twiddling of the presets on the panel or you'll soon be in trouble.

Video Panel

The video panel is on the lower left side, the red, green and blue cathode drive leads plugging into it. There are three BF179 video output transistors with heatsinks to identify them. A suitable replacement is the BF337. Earlier models have separate 12kΩ wirewound load resistors but the later versions have a combined thick-film unit which tends to be more troublesome (as thick-film units are). Faults here can usually be tracked down by comparing the voltages in the three output stages and their drivers.

Lack of Colour

A very common fault is sudden loss of one of the primary colours. Don't rush to the video output stages for the solution. Check the tube base voltages first, ensuring that all three first anodes are at approximately the same voltage. All too often one will be found low compared to the others. This should lead you to the convergence panel, where the presets are mounted. You will see that each control has a switch beneath it, and it's these switches that are usually to blame, due to internal leakage. Remove the switch and fit a replacement or, if the correct switch is not to hand, remove it and join the centre to the upper contacts with a wire link. The other alternative, which is often adopted out in the field, is to cut through the earthing track to the lower contacts of the switch, thus allowing the switch to go on leaking but with nowhere to leak to. Other first anode supply troubles can be caused by shorted decoupling capacitors or changed value resistors (especially if the voltages are too high): these items are all on the convergence panel.

Grid Bias

The term grid bias takes you back a bit, doesn't it? Never mind! The tube's three grids are connected together and taken to the flyback blanking/bias circuit. The bias preset R450 forms part of a resistor chain which is connected between a 206V supply that comes from the video panel and a −800V supply which is obtained from the clipper diode in the tripler. The correct setting for R450, which is at the top rear of the field timebase/audio board (vertical, right side), is normally for zero volts d.c. at the tube's grids. When the tube shows signs of wear however — flaring etc. — a considerable improvement can be achieved by using R221 (set porch bias) at the front left of the video panel to decrease the video drive in order to reduce the flaring, then increasing the setting of R450 to restore the brightness level. This, coupled with an increased tube heater supply (by using the boost tapping on the mains transformer), will lead to a considerable increase in the useful life of the tube.

Summary

Troubles on the i.f. panel are generally of the run-of-the-mill type and can usually be resolved by checking the transistors and the a.g.c. capacitors. The electrolytics are suspect in the field timebase — mainly the black-and-silver types which regularly dry up to cause loss of height etc.

Later models have a varicap tuner which can cause loss of gain due to dry-joints. The problem may be intermittent, and a spare ELC1043/05 tuner is an invaluable item to have around. Little need be said about the earlier tuner, which is usually of the type used in the 1500 monochrome chassis and is well known, or may be of the alternative type with cross-shaped castings which tend to break off and render the relevant button inoperative.

We've left out a lot of detail, as is necessary in this series. For further hints refer to the article by Andy Denham in the September 1978 issue.

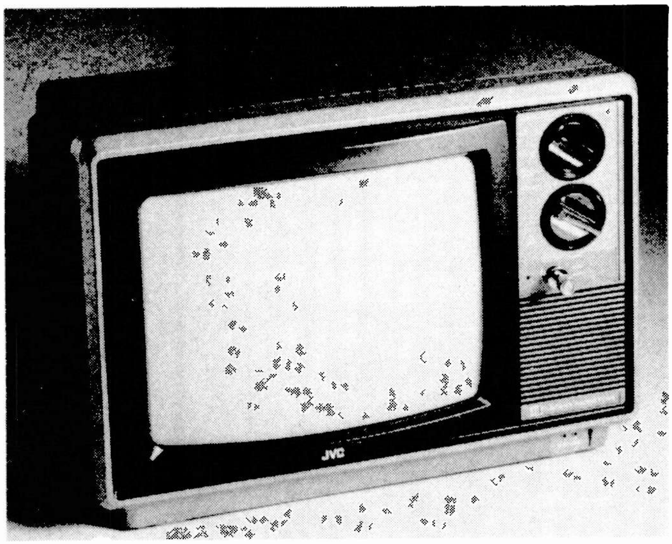
The JVC VM14PSN Multi-standard Video Monitor

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

A FEW years ago the only multi-standard video monitors or receiver-monitors available were designed for the professional user and were sold at the sorts of prices you'd expect in that market. Things have changed, what with the JVC CX610GB 5in. receiver-monitor we reviewed last March and the more recent JVC VM14PSN, a multi-standard monitor which is unique in its class.

The VM14PSN reveals all in its model number – it's a video monitor (not a receiver-monitor) with a 14in. tube and is capable of handling PAL, SECAM and NTSC signals. In fact it will display almost any signal, though PAL(M), the 525-line, 60Hz, 3·58MHz system used in some South American countries, might confuse it. On the SECAM side it will decode signals with the colour sync in the vertical or horizontal blanking intervals, while the NTSC circuitry will handle signals with a 3·58MHz or 4·43MHz colour subcarrier. The NTSC-4·43MHz system is employed by various VTR manufacturers to enable American NTSC tapes to be viewed on modified PAL monitors: it consists of a 525-line, 60Hz field system with the colour subcarrier shifted to 4·43MHz by the VTR during replay. Feed this into a PAL monitor or TV set, disable the phase reversal, alter the vertical scan and linearity and you have a reasonable picture.

The VM14PSN is quite light and has a convenient carrying handle built into the back. Mounted at the rear of the set are two PL259 input connectors for video A and B, with complementary RCA phono audio sockets, and an EIAJ eight-pin connector that can be used with many professional VTRs. The usual "looping" facility is not provided, a single PL259 video socket marked "switched" giving a looped output from either the video A or B sockets or the EIAJ connector depending on the setting of the relevant front control switch. This socket also has a complementary RCA audio connector.



The JVC VM14PSN multi-standard video monitor. The two large switches on the right-hand side are for standard selection (five positions, auto/PAL/SECAM/NTSC-4·43/NTSC, top) and for input selection (three positions, A/B/VTR, below).

The front panel controls are pull-on/volume, input selector switch (A/B/VTR), and system selector switch. The latter has five positions, auto, PAL, SECAM, NTSC and NTSC-4·43. In the auto position the monitor switches the decoding and scanning automatically. This setting is suitable for most situations, but where a very noisy tape is being replayed it's best to switch to the correct colour system manually. Under a flap on the right-hand side there are presets for colour, brightness, contrast, field hold and NTSC tint – the latter to adjust for good flesh tones with an NTSC signal.

The sound output is quoted as 1·5W at 10 per cent distortion. This is quite satisfactory though a little lacking in treble for my taste – maybe this is deliberate to reduce tape hiss on playback. The picture quality is also perfectly adequate: not up to the standard of a semi-professional Barco set, but then that costs twice as much. The geometry of the review set was a little out but was easy to correct.

System switching in the auto mode worked quite well, even with noisy multiple-generation video tapes, though it did get confused by fully saturated PAL and NTSC backgrounds – for example the football results board, which appeared in the wrong colours. Manually selecting the correct system overcame this problem.

In addition to the colour system the manual switching also adjusts for 525/60 and 625/50 scanning – this involves adjusting the field hold, height and field linearity. The auto switching circuit works on a two-level priority basis: the line standard is first determined, then the colour system. To determine the line standard, the set checks the field frequency. The timebases are then switched to match. If the set has found that a 525-line signal has been applied, the next operation is to check the subcarrier frequency – or failing this to switch to monochrome. This check is done by detecting the outputs from 4·43MHz and 3·58MHz filters. The NTSC decoder chip then selects a 4·43MHz or 3·58MHz crystal to provide the reference. If the set has found that a 625-line signal is being applied, it then has to check for SECAM, PAL or monochrome. The SECAM chip carries out this detection and the appropriate switching.

Multi-standard colour sets tend to be rather horrific inside, since they usually consist of a single-standard chassis to which various bits and pieces have been added. Not so the VM14PSN, which was designed from the start as a multi-standard set, with extensive use of i.c.s – the latter make the multi-standard decoding arrangements compact and straightforward. It's easy to get at all the innards if need be.

The power supply is of interest since it's designed for use with 50/60Hz, 110/240V a.c. supplies, with automatic switching. The 150V h.t. line is provided by a bridge rectifier and switch-mode regulator which also provides mains isolation.

In conclusion, if you want a simple PAL only, medium-size video monitor the VM14PSN is worth investigating at around £350. If you want multi-standard capabilities at an affordable price, I can't think of a better buy.

VCR Servicing

Part 15

Mike Phelan

LAST month we saw that it is not too difficult to produce a "random" stop frame. We also looked at the circuitry used in the Ferguson 3V16 to produce a definite tape stopping point for minimum noise. This month we'll consider a few alternative ways of doing this. The 3V16 used a purpose-designed i.c., type BA841. The Toshiba V5470 Betamax machine on the other hand uses an entirely different approach, employing mainly 4000 series CMOS logic i.c.s (see Fig. 66).

The Toshiba Approach

The circuit is brought into operation when the pause key is depressed, the normal servo control over the capstan motor then being disabled. Transistors QH24 and QH25 with ICH11 form a circuit which produces an output when the video f.m. falls to zero, but with a time-constant so that the circuit doesn't respond to tape drop-outs etc., only to the noise bar produced by the change in writing angle when the capstan is stopped.

The two monostables that follow the head switching pulse inverter produce pulses which coincide with the field flyback blanking interval, the ideal place to put the noise bar. The head switching pulses are also divided by two and then converted by a further monostable into a narrow (5msec) pulse which is used to inch the capstan motor along via the 4011 NAND gate.

When the pause key is pressed, drive pulses pass through the NAND gate whose second input is high. The noise bar is then moved down the screen, until it's in the field flyback blanking interval. At this point the two inputs to the phase comparator coincide and its output goes low. This closes the NAND gate, stopping the motor. Pressing "frame advance" produces a pulse which is fed to the comparator so that its output goes high momentarily. Motor drive pulses are again produced, until the noise bar is once more at the bottom.

An almost identical system is used on the GEC 4000 (Hitachi) VHS machine, pulsing the motor at 12·5Hz until the noise bar is at the bottom of the picture.

The Toshiba V8600 gives a superb freeze frame with hardly any discernible noise. This is mainly due to the fact that four video heads are employed instead of the usual two. The two "normal" heads have slanted azimuth gaps, following standard practice. We'll call these heads A and B. The gaps of the third and fourth heads are slanted in the same direction as head B. They are positioned between heads A and B, the four heads being 90° apart. On record and normal playback, heads A and B are used in the normal manner. For still frame, the two extra heads B' and B" only are used. The tape is stopped so that both heads can play back a B track, using a circuit which steps the capstan motor three times, stopping it at a predetermined time after the last off-tape control pulse — as with the 3V16. As both heads scan the same track there's very little noise.

There's another advantage which might not be immediately apparent. On a conventional machine, the A and B heads play alternate video tracks in the still frame mode. So if anything is moving in the picture, i.e. if the two fields differ, that part of the picture will flicker on still frame. On the Toshiba V8600 however the still frame is always just that, as the B' and B" heads play back the same field. Some vertical definition is lost of course, but this is hardly noticeable.

Ferguson 3V23

Next month we'll go on to look at the "top of the range" Ferguson 3V23. This is a rather complex machine with full microprocessor control and front loading. There are six microprocessors in the machine. One controls all the mechanical functions, one calculates the tape remaining from the relative spool speeds, two operate the sweep tuning and clock display, the remaining two decoding this information into a suitable form to drive the fluorescent display. The latter operates in a similar

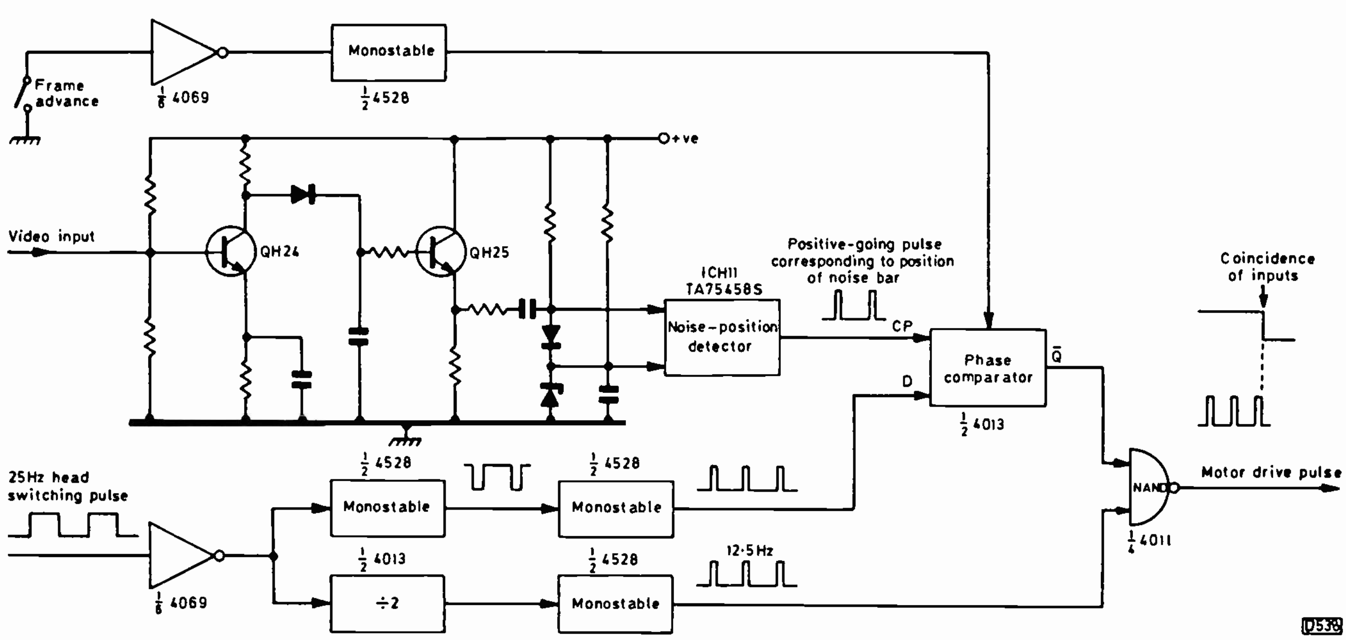
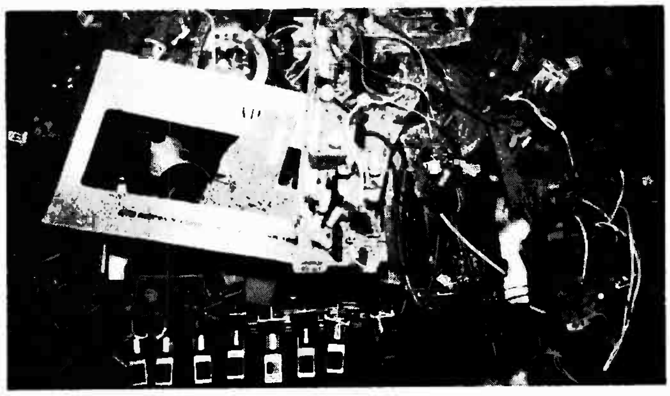


Fig. 66: Freeze-frame circuit used in the Toshiba V5470.

manner to a valve.

There are five motors and two solenoids that control all the deck functions. One motor loads/ejects the cassette, one operates the loading arms, one drives the reels, and then of course we have the capstan and drum motors. The latter is a brushless, direct-drive type, using Hall effect i.c.s. The 3V23 has Dolby noise reduction on sound, freeze frame, frame advance, variable slow motion and double speed. In the latter mode the audio is not muted: instead it's shifted down an octave, using a charge-coupled ("bucket-brigade") device. There are also fast search and assembly edit.

To start off with we'll look at the power supply and mechanism control system.



The editor's first go at VCR servicing?

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 213 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

GEC C2110 SERIES

This set was obtained with the line output transistor and the 47V protection zener diode short-circuit. These were replaced but failed immediately on applying the mains supply. After fitting further replacements I tried the set via a variac. At about 120V there's a small, square bright picture in the centre, the brightness control has no effect and the e.h.t. can be heard hissing violently with occasional arcs from the focus spark gap.

These conditions suggest that the line flyback tuning is incorrect. Replace the tuning capacitor (C52, 0·0052μF) and ensure that it has good electrical contact with the collector and emitter of the line output transistor.

RIGONDA VL100M

The initial fault was a burnt out resistor in series with the primary winding of the mains transformer. Replacing this restored the picture and sound, but a hum bar travels from the top to the bottom of the picture, sometimes quite rapidly. I've replaced the reservoir capacitor and checked the other high-value electrolytics, and the set works perfectly from a battery.

The mains transformer drives a bridge rectifier and it's almost certain that one of the diodes here is open-circuit. Check the bridge and replace as necessary.

GEC HYBRID COLOUR CHASSIS

With the set correctly tuned the display is in monochrome. Overriding the colour killer makes no difference, and it seems that something is amiss in the reference oscillator control loop – there appears to be an unmodulated 4·43MHz signal at the base of the d.c. amplifier transistor TR327. Detuning the set produces a noisy colour picture, and the signal at the base of the d.c. amplifier is then a 4·43MHz component modulated at 7·8kHz. Adjusting the burst detector coil L306 only makes matters worse, and the detector diodes D307/8 check out o.k. on a multimeter.

The filter capacitor C341 (0·047μF) should remove any 4·43MHz component at the base of TR327 and it could well be that this capacitor is defective. If necessary check C319 (0·0015μF) in the filter circuit following the d.c. amplifier and the burst detector diodes by substitution.

THORN 3000 CHASSIS

The problem in the line scan department is a two-inch foldover to the right of centre. Whist checking I found that the two electrolytics in the line shift circuit were open-circuit, but after replacing them C530 (64μF) in the scan coupling network exploded. This was replaced but the foldover remains. There's also a fault in the power supply. This started with no 30V line due to the l.t. reservoir capacitor C607 having dried up. Replacing this restored correct voltages, but there's a sort of line pairing and picture smearing. Fitting a replacement power supply panel cleared these faults, but I'd like to repair the original one.

The foldover problem is probably due to failure of the scan-correction capacitor C524 (2·2μF). If necessary, check the shift coil L504, resistors R707/8 (10Ω) on the convergence panel and finally the line scan output transformer T504. The original power supply panel will probably work all right if you replace the h.t. smoothing electrolytic C619, using a 220μF 100V capacitor, fit a new 30V smoothing electroytic (C624, 100μF) and check the 12V stabilised output at the emitter of VT609.

SONY KV2000UB

The line output transformer and gate-controlled switch have been replaced, also the efficiency diode and flyback tuning capacitor. After doing this the set was switched on but gave a short whistle and "died". When the horizontal size plug was removed normal operation was obtained, though with no line scan of course. The voltages on the line output gate-controlled switch are quite wrong – they are all negative. Replacing the width plug tripped the set again, and when it was tried in one of the other positions the gate-controlled switch blew.

Removing the width plug disconnects the line scan coils. With these connected, a heavy load is obviously being imposed on the line output stage. Whilst the yoke could be responsible, it's more likely that the scan correction capacitor C808 (0·47μF), the shift choke L802 or either L801 or C801 (0·15μF) in the dynamic convergence network is responsible. L802 can be checked by disconnecting it.

BUSH RANGER-2

We're having difficulty with one of these portables, the fault being an intermittent dead set with no fuses blown. Any attempt at voltage checking on the panel brings the set to life again. The fault occurs about once a week. There's also a half-inch black margin down the left-hand side of the screen. This clears after an hour.

If the 11V line is present when the set goes dead, the base-emitter junction of the BU407 line output transistor may well be intermittently open-circuit. If the 11V line is not present, check for dry-joints on the mains transformer. We've known the black vertical margin to be due to a defective scan coil coupling capacitor (C40, 2·2μF). Check also for dry-joints around the line output transformer.

LUXOR 90° HYBRID CHASSIS

The picture is all right for about an hour after switching on. It then breaks up – first pulling into horizontal lines, then loosing sync. When this happens the line output stage valves get very hot. A new PCF802 line oscillator valve has not improved matters.

As both the line sync and drive are affected, the fault is likely to be in the line oscillator stage. The main suspects are the cathode coupling electrolytic C749 (2·2μF) and the feedback coupling capacitor C752 (820pF). Less likely causes are the two 27kΩ pulse feedback/integrating resistors R741/R744 in the flywheel sync circuit and the 25μF section of C608 (h.t. smoothing).

PYE 697 CHASSIS

A hum bar moves up the screen and on certain pictures the line pulls quite badly. The smoothing electrolytics in the power supply and on the i.f. panel have been replaced but the problem persists.

A frequent cause of this trouble is hum getting on to the varicap tuning line via the a.f.c. feed. This can be cured by screening the lead from the tuner to PL6B/D on the i.f. panel. As a check, if you grasp the lead it ought to make things worse.

TEST CASE

242

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.

THERE can be few service engineers who've yet to come to grips with the technicalities of VCRs. It's probably true to say that most TV-orientated people are happy enough with the luminance side of things, rather confused by many chrominance fault symptoms and quite baffled by the workings of some of the microprocessor i.c.s used in more recent models. Certainly this is true of most of the people we've talked to. The VCR is a prolific source of misleading symptoms in all departments, and thereby hangs this month's tale.

The machine was a Ferguson 3V24, a recent battery-operated portable model that was still under guarantee. It was brought into the workshop with the complaint of poor colour. Now this is a rather vague fault description, so we started by inserting a known good prerecorded cassette and watched the playback carefully. The colour reproduction was very good. We went on to make a recording on a nice new cassette. To save rigging up the tuner-timer unit we fed the video output from a colour-bar generator into the machine. The replay was again very good. The tuner-timer was then connected and an off-air recording made. No problem with the colour on replay, so the machine went straight back to the customer! Perhaps his camera was faulty, or maybe he had a noisy off-air signal?

Two days later the machine was back on the bench, with a curt note to say that the symptoms were still present. This time there was a cassette inside to prove the point – and the reproduction was terrible! Colours flowing in all directions, unlocked and fluctuating, sometimes reverting momentarily to normal. The luminance and sound were apparently normal, and we were given to understand that prerecorded tapes from the library down the road could be replayed perfectly satisfactorily. Since the problem seemed to be occurring in the record mode only, we made another test recording on a known good workshop tape. It played back with messy chrominance.

As it was not possible to analyse the fault by looking at replayed pictures, we dismantled the machine so that we could make scope checks inside. On record the chrominance signal at pin 3 of IC2 and the down-converted chrominance at connector 15 of the pre-rec panel looked perfectly o.k. There seemed little point in getting involved in the phase-locked loop and the mixer operations in the chroma i.c.s IC2 and IC3 as these were working perfectly in the playback mode.

After some thought an idea began to dawn. We found an unused section of the test tape and recorded on it ten minutes of colour bars. We then rewound the tape and examined the result, which was o.k. We next rewound the tape to the same point and, while drinking a cup of tea, recorded a plain red raster. Examination of the picture from this second recording made it quite plain where the trouble lay, and armed with the clues we now had we went straight to it! What was happening? Watch this space. . .

ANSWER TO TEST CASE 241
— page 155 last month —

Our puzzle last month concerned a TV game/VCR combination, the problem being r.f. patterning whenever an attempt was made to record the output from an Atari games console on a Sanyo VCR. Since there's no access to the video signal in the Atari machine, recording has to be done via its u.h.f. modulator, with the VCR tuned to its output – on channel 36.

Now the VCR's output is also on ch. 36, and was active during record so that the game could be monitored on the TV set. So the VCR was both receiving and supplying signals on ch. 36. Not good at all! The Atari console's u.h.f. modulator is a non-adjustable Astec one, so we wound up the trimmer in the Sanyo VCR's u.h.f. modulator to obtain an output on about ch. 38. The patterning then disappeared.

This patterning effect can occur whenever two pieces of equipment with r.f. modulators are used together, and is worth bearing in mind. The u.h.f. modulators used in domestic electronic products sold in the UK are designed to provide an output on ch. 36 or thereabouts as this falls in the middle of the gap between the broadcast Bands IV and V.

QUERY COUPON

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TELEVISION FEBRUARY 1983

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12R 9W	20p	1K2 9W Thorn 3K/4K	18p
15R 5W fusible	25p	1K2 11W fusible	25p
15R 7W	16p	2K2 5W fusible	25p
15R 11W Thorn 3K	30p	2K2 7W	16p
15R 17W	23p	2K2 7W fusible	25p
22R 4W	15p	2K2 9W fusible	25p
22R 9W fusible	25p	2K3 5W	15p
27R 7W	16p	2K7 9W fusible	25p
27R 7W fusible	25p	3K9 5W fusible	25p
36R 17W	23p	3K3 4W	15p
82R 4W	15p	4K7 7W fusible	25p
82R 9W fusible	25p	5K1 7W	16p
100R 5W fusible	25p	8K2 7W	15p
220R 7W Korting fusible	30p	8K2 9W 8K Thorn	23p
220R 17W	23p	10K 7W	15p
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182PF	63V	.02MF	200V
250PF	2000V	.02MF	250V
330PF	63V	.022MF	250V
330PF	160V	.047MF	400V
330PF	8KV	.1MF	250V
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560PF	63V	.22MF	400V
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15MF 63V	20/£1	330MF 35V	10/£1
22MF 10V	20/£1	330MF 63V	10/£1
22MF 40V	20/£1	470MF 6.3V	20/£1
22MF 63V	20/£1	470MF 10V	10/£1
22MF 160V	10/£1	470MF 25V	10/£1
32MF 275V	10/£1	470MF 40V	10/£1
33MF 40V	20/£1	640MF 10V	20/£1
33MF 50V	20/£1	680MF 16V	20/£1
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ZF 11	10p
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ZF 47	10p
ZF 82	10p
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ZPY 43	10p
ZPY 47	10p
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ZTX 33	10p
ZTX 33a	10p
ZTX 102c	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 550	10p
ZW 27	10p
ZW 43	10p
ZW 310	10p
ZY 47	10p
ZY 72	10p
AA 112	10p
AA 143	10p
AA 144	10p
BA 102c	10p
BA 157	8p
BA 158	8p
BA 159	8p
BA 173	8p
BA 182	8p
BA 201	8p
BA 202	8p
BA 248	8p
BA 316	8p
BAV 10	10p
BAV 21	10p
BAW 21	10p
BB 103	10p
BB 105	10p
BB 121a	10p
BZX 61c110	6p
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BZX 70c33	8p
BZX 79c4v7	8p
BZX 79c5v6	8p
BZX 79c6v2	8p
BZX 79c6v8	8p
BZX 79c8v2	8p
BZX 79c12	8p
BZX 79c22	8p
BZX 79c30	8p
BZX 79c43	8p
BZX 79c47	8p
BZX 83c4v3	10p
BZX 83c7v5	10p
BZX 83b12	10p
BZX 83c13	10p
BZX 83c20	10p
BZX 83c27	10p
BZX 83c33	10p
BZX 84c6v8	30p
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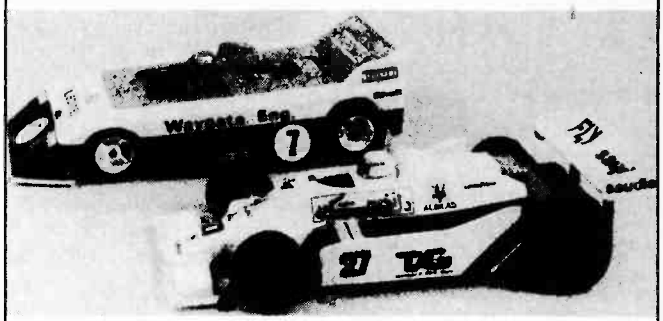
TIP 29C/A	20p
TIP 30	30p
TIP 31A/B	40p
TIP 32	25p
TIP 33	50p
TIP 34	50p
TIP 35	50p
TIP 36	50p
TIP 41	30p
TIP 41c	40p
TIP 42	30p
TIP 47	40p
TIP 49	30p
TIP 100	30p
TIP 120	30p
TIP 130	30p
TIP 131	30p
TIP 136	30p
TIP 2955	40p
2N3055	30p
2N3566	7p
2SB566	10p
F247	10p
MJE 1300S	30p
MJE 2955C3	30p
MV 2209	10p
SP 8385	25p
UA 79M08CKC	30p
TIS 90	

Integrated circuits

SAA 5012	£2.50
SAA 5020	£2.50
SAA 5030	£2.50
SAA 5050	£2.50
TAA 611	£1.50
TAA 641	£1.50
TDA 2575a	£2
U 14727	15p
U 3832	15p
U 3845	15p
MR 856	10p
MR 508	10p
MR 501	10p

BYF 1202	10p
BYF 1204	10p
BYF 3123	40p
BYF 3126	40p
BYF 3214	40p
BYX 36/600	50p
BYX 38/300	25p
BYX 38/600	50p
BYX 55/350	10p
BYX 71/350	20p
BYX 71/600	30p
BYX 72/300	20p
BYV 95	8p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BUW 94	30p
BFY 50	15p
BFY 90	20p
BYW 56 2A/1000v	8p
BF 960	30p
BFR 81	15p
1.52 diode	10p
XK 3123	50p
BZY 93	50p
BZV 15/12	30p
BZV 15/30	30p
BZW 70c6v2	10p
1A/1600v diode	10p
A1 diode	10p
TDA 2532	£1
TDA 1010	£1
Mitsumi tape motor	75p
Sankyo tape motor	75p
20 mixed led red/yellow/green	£1.25
Infra red led LD57CA	15p
Mono scan coil	£3
G 8 transductor	£1
Thorn 4000 tube base	£4
A1 pots Thorn 3500	50p



MARDAVE MODEL RACING CARS

Nickel Cadmium Battery driven
Please send for details

Various Tools and Accessories

Sellotape PVC Black 25mm × 20M **50p** 50mm × 20M	70p
Telescopic aerials (radio)	£1
Xcelite pliers	£3.90
Xcelite cutters	£3.90
Phillips de-solder pumps	£5
VU meter	45p
Pull up large aerial	75p
Portable TV aerial	75p
Neon screwdriver	50p
Phillips snips	£2
2 way baby alarm/intercom with long leads	£5
Phillips universal battery tester/charger, fuse/bulb tester	£5
Volt/ohm test meters 1000 ohm/volt	£5
Regulated power supply 9v/200MA	£1
Tripler D22-C18-74 for PYE 18″ colour portable	£4
Remo 51.1 ¾″ × ½″ microphone/speaker	50p

GEC remote panel, Main transformer 3/ic SAA 1025/SN 74141/TBA 231	£6
Mullard tripler LP 1194/43 for G8/GEC/ITT	£3.50
Hitachi portable Chassis complete	£12
AT 2076/55 GEC split diode transformer	£10
AT 2048/11 LOPTI Mullard	£2.50
75v W/W 25 watt	25p
TV Sound Tuner Kit, ideal for Hi-Fi, TV sound	£9.50
Front End Music Center. VHF/MW/LW 13″×3½″	£5
Output Stage for music center	£5
Both items	£9 circuit supplied (as previous ad)
ITT PANEL – CMC 45 mains panel, lead & filter	£1.50

SENDZ COMPONENTS

63 Bishopsteignton, Shoeburyness, ESSEX SS3 8AF
Tel. 0702/332992
Registered office only. Callers by appointment.
Add 15% VAT then 50p P&P.
All items subject to availability.
Same day service. Add postage for Overseas.
NO CREDIT CARDS TAKEN.

SENDZ COMPONENTS

D. Whitworth,
63 Bishopsteignton, Shoeburyness,
Essex SS3 8AF.
Telephone: 0702 332992
ADD VAT 15%, 50p Post.
Goods despatched on receipt of order.

Transducer Hand Set insert, crystal, tranducer, 11C SAA 1124 & lead **£3.50**

ECL2060 on panel. New **£5**

Rank SPCIT TFB3035D diode trans. **£8**

4.000 Thorn thick film.
00S1 012 E004 **£1.00**
00S1 012 E002 **£1.00**
00S1 012 010B **£1.00**

4 Push button unit preh **£1.00**

6 Push button VHF/UHF for v/cap. GEC-Decca type **£4.00**

7 Push button for CVC5 ITT **£7.00**

6 Push button unit for GEC 2040 and ELC 1043/05 **£6.00**

Mains Droppers

Pye 731 3+56+27R **50p**
Thorn 50-40R-1K5 **50p**
Aerial Socket and Lead **35p**
Pye, Thorn, ITT, Thyristor, Philips G11 122 **60p**
Rank Toshiba Tube Bases **30p**

Speakers

6×4G11	25 ohm	**£1.00**
5½×2½	3 ohm	**£1.00**
5×3	80 ohm	**70p**
5×3	50 ohm	**50p**
5×3	35 ohm	**70p**
5×3	15 ohm	**80p**
6×4	15 ohm	**£1.00**
7×3	70 ohm	**£1.00**
5×3	8 ohm	**70p**
7×3	16 ohm	**£1.00**
8×5	16 ohm	**£1.50**

Diodes

NBY 127	**10p**
BY 133	**10p**
BY 134	**10p**
BY 164	**30p**
BY 176 type	**25p**
BY 184	**25p**
BY 187	**10p**
BY 190	**40p**
BY 194	**30p**
BY 204/4	**8p**
BY 206	**8p**
BY 210/400	**5p**
BY 210/600	**8p**
BY 210/800	**10p**
BY 223	**35p**
BY 226	**15p**
BY 227	**15p**
BY 229/400	**30p**
BY 237	**5p**
BY 254	**10p**
BY 255	**10p**
BY 296	**10p**
BY 298	**10p**
BY 299	**10p**

Line Transformers

G8 Trans. Philips **£7.50**
G11 Split Diode **£12.00**
CVC820 Split Diode ITT **£10.00**
CVC40 Split Diode ITT **£10.00**
CVC32 ITT **£7.50**
EHT Split Diode Leads **£1.00**

Triplers

11 TEZ Rank	**£3.00**
9000 Thorn	**£5.00**
KT3	**£4.00**
CVC-20-25-30	**£4.00**
G9 Philips	**£4.00**
GEC 2110	**£4.00**
9500 Thorn	**£4.50**
2040 GEC	**£3.50**
G8 Philips	**£4.50**
Decca 80 100	**£4.50**
LP1194 Pye 731	**£3.50**
Grundig TVK 52	**£2.50**
11TBQ	**£3.00**
11THY	**£4.00**

New Philips Infra Red Transmitter 9ch & Vol. & brightness change **£7.00**

THORN Tuner Panel. 6 Slider pots, Knobs, touch button. Ultrasonic transductor, ICs, components & mains switch **£3.75**

2040 GEC Line Trans. **£4.00**
2110 GEC Line Trans. **£7.00**
GEC Portable Line Trans. **£3.00**

Philips Infra-Red (full remote transmitter)
Philips KT3 16C928/20C934
Pye KT3 7228/7324 K12 26C 797/1ST 66K 1826 **£12**

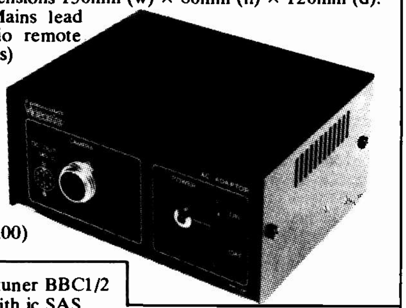
3500 Triplers **£3.50**
G11 Tuner Units **£6.00**
G11 6 Button Key Switch **£2.00**
G11 E/W Transformer **50p**
G11 Line OSE Tran. **50p**
G11 Transient Suppressors 245V **10 for £1.00**
G11 Scan Coils **£5.00**
KT3 AE Sockets **25p**
ELC1043/05 NEW on Panel **£5.00**
4000 Thorn Frame Panel **£5.00**
4000 Thorn Power Supply **£3.00**
4000 Thorn Line OP Panel **£20.00**
NPN PNP 80V 6 Amp TO66 O.P. Trans. **pair 25p**
GEC IC CBF16848. SN16861. SN1682 **each 50p**
Thorn 3500 IF Panel NEW **£3.00**
Thorn Tuner Panel 6-100K Pots & Components NEW No Tuner ELC1043/05 **£2.00**

International Rectifier EHT Diodes G770/HV34 6KV **3 for 8p**

6A/600V Stud Diodes **20p**
6A/1000V Stud Diodes **20p**
SKE 1/02 **20p**

EHT Rectifier wire ends 16Kv **10p**
25A473 PNP C/P **10p**
BU326 **£1.00**
BU526 **75p**

Mains in 110-120-220-240V A.C. 50Hz Adaptor. For black and white camera. Power consumption: 12V A. Output voltage: 14V D.C. Dimensions 150mm (w) × 80mm (h) × 120mm (d). Accessories: Mains lead and video/audio remote cable (2 metres)



£4.60 (post £1.00)

5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T **£7.00**
Control panel 5 sliders + mains lead **£1.50**
Tube base + focus unit for 820 Euro chassis **£4.00**
CVC 9 IF panel and decoder **£7.00**

CVC 20/25/30/32/40 decoder panel **£10.00**
CVC 20/25/30/32/40 decoder panel untested **£5.00**
CVC 40/45 IF panel **£5.00**
Mains panel with switch and lead **£1.00**

GEC Line O/P Trans. & Rec Stick for Portable **£3.00**
Thorn 3500 6 push button unit & cable form **£1.50**

Rank Toshiba
Tube Base **25p**

Rec & Trans

G11 Ultrasonic t/text transmitter G26C 674/02 G22 C66/02 **£19**
Infra Red (full remote transmitter) Dynatron TV CTV 62, 63, 64 **£19**
40K Transducer **50p**
PHILIPS NE511N **£1.20**
GEC 2040 Line OP Transformer **£5.00**
LD57CA Infra Red L.E.D. **15p**
LM337M Reg. **30p**
PYE Line OP Trans. Mono **£3.00**
2SD180 TO3 80V 6A **15p**
2 SB407 Sanyo TO3 **10p**
Thorn T605 1V NPN TO66 80V 6A **10p**
20 GEC Black Spark Gaps **£1.00**
Mono Rank Line Trans T704A **£3.50**
4000 Thorn Mains Dropper **35p**
G11 Line Driver Transformer **35p**
2 SD350A BU208A **£1.00**
G11 IF Detector **£3.00**
G11 Teletext Transmitter **£19.00**
KT3 LOPT **£3.00**
BG200/43 Tripler **£3.00**
DECCA IF 80-100 **£3.50**

Bridge Rec
Wire Leads KBP04 **15p**

G11 Time Base Panel **£12.00**
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 **£3.00**
Thorn 900 Sound OP Panel NEW **£1.00**
U321 T/Unit on Panel Cum 40 ITT **£6.00**

Z714 RANK IF Panels 6MHz 1 I.C. SL437F **£3.00**
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q **£2.50**
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+ SC9503P **£1.50**
Tuner Unit VHF Sylvania GTR Videon MTS900 BIP VHF **£2.50**
Universal Focus. Fits Pye, Thorn and Decca Units.
Large Type **75p**
Decca Small **75p**
ITT Small for use with Split Diode **50p**
Thorne 3500 Focus Unit **£1.50**

TV11	**50p**
Remo TV12SP	**50p**
TV13	**50p**
TV14	**50p**
TV18	**60p**
TV20	**£1.00**
TV30	**£1.00**

Condensers

1500/16	**20p**
3300/16	**20p**
10000/16	**25p**
3300/18	**20p**
470/25	**5p**
680/25	**5p**
2200/25	**10p**
3300/25	**20p**
4700/25	**25p**
1500/30	**20p**
1500/35	**10p**
2200/35	**25p**
220/40	**5p**
400/40	**25p**
680/40	**5p**
1250/40	**20p**
1500/40	**20p**
200/40	**25p**
2200/40	**25p**
2500/40	**25p**
3300/40	**25p**
6800/40	**35p**
750/50	**10p**
1000/50	**20p**
1250/50	**25p**
2000/50	**20p**
3000/50	**25p**
15/63	**5p**
2200/63	**50p**
140/100	**25p**
470/100	**20p**

Infra Red and Ultrasonic G11 Teletext Decoder Panel **£30**
RANK & ITT Mains Remote On-Off Switch (720R) **£1.50**
Mains Dropper PYE 3R5+15R+45R **50p**
Thyristor 600/4 amp C106/2 **24p**
9500 THORN Tripler **£4.50**
G11 Preh Red LED P/Button for C.H. Change **20p**
2SC2073 on Heat Sink 150 NPN 1.5 Amps **7p**
RANK TOSHIBA Transductors TPC-2011 **50p**
Remote unit THORN 11 I.C. Mains Transformers Relay & 5 volt Reg & Component Unit **£1.00** (post £1.50)

800/160	**50p**
G11 0.91/210 scan coil correction	**25p**
G11 0.47/250	**10p**
4n7/250 tested 5KV	**25p**
22/250	**15p**
47/250	**10p**
100/250	**20p**
500/250	**50p**
GEC600/250	**60p**
800/250	**40p**
8/300	**8p**
4/350	**5p**
8/350	**8p**
12/300	**10p**
50/350	**10p**
220/350	**30p**
700/350	**50p**
22/375	**15p**
330/385 CVC 820HT	**60p**
0.1/400	
8/400	**15p**
33/400	**20p**
220/400	**50p**
440/400	**40p**
33/450	**15p**
220/450	**40p**
0.1/600	**15p**
0.1/800	**15p**
0.047/1000	**10p**
0.01/1000	**10p**
0.1/1000	**10p**
0.0047/1500	**10p**
1n8/1500	**15p**
2n2/1500	**15p**
9n1/1500	**15p**
G11.11000/1500	**15p**
G11.8200/2KV	**15p**
0.1/2KV	**20p**
0.0015/2KV	**10p**
4n7/2KV	**15p**
8n2/2KV	**15p**
0.0082/2500	**15p**
1800/4KV	**5p**
4.7nf/5KV	**10p**
180/8KV	**10p**
270/8KV	**10p**
1000/10KV	**10p**
1200/12KV	**10p**

Multi-Caps

Thorn 3500

175/100/100/350v	**£2.00**
KT3/200/25/25/385v	**£1.00**
47/220/350v	**60p**
2500/2500/63v	**50p**
470/470/250v	**50p**
150/200/200/300v	**70p**
100/200/325v	**40p**
400/200/200/350v	**£1.50**
200/200/100/300v	**60p**
200/200/100/32/350v	**£1.50**
200/47/350v	**60p**
100/300/200/100/16/350v	**£2.00**
200/100/100/375v	**£2.00**

ITT Panels

CMA 10	**£2.00**
CMA 11	**£2.00**
CMA 30	**£2.00**
CMA 40	**£1.50**
CMC 10/2	**£5.00**
CMC 15	**£10.00**
CMC 16	**£4.00**
CMC 54	**£10.00**
CMC 56	**£5.00**
CMC 58	**£8.00**
CMC 59	**£8.00**
CMC 67	**£3.75**
CMC 67/2	**£4.00**
CMD 40	**£2.00**
CMF 40	**£2.00**
CMH 10	**£1.50**
CMH 31	**£1.50**
CMP 10	**£2.00**
CMP 11	**£2.00**
CMP 30	**£2.00**
CMP 40	**£2.00**
CMS 11	**£2.00**
CMS 30	**£1.50**
CMS 40	**£2.00**
CMU 14	**£8.00**
CMU 30	**£7.00**
CMU 40	**£7.00**
CMU 45	**£5.00**

Mains in 110-120-220-240V A.C. 50Hz Adaptor. For black and white camera. Power consumption: 12V A. Output voltage: 14V D.C. Dimensions 150mm (w) × 80mm (h) × 120mm (d). Accessories: Mains lead and video/audio remote cable (2 metres) **£4.60** (post £1.00)