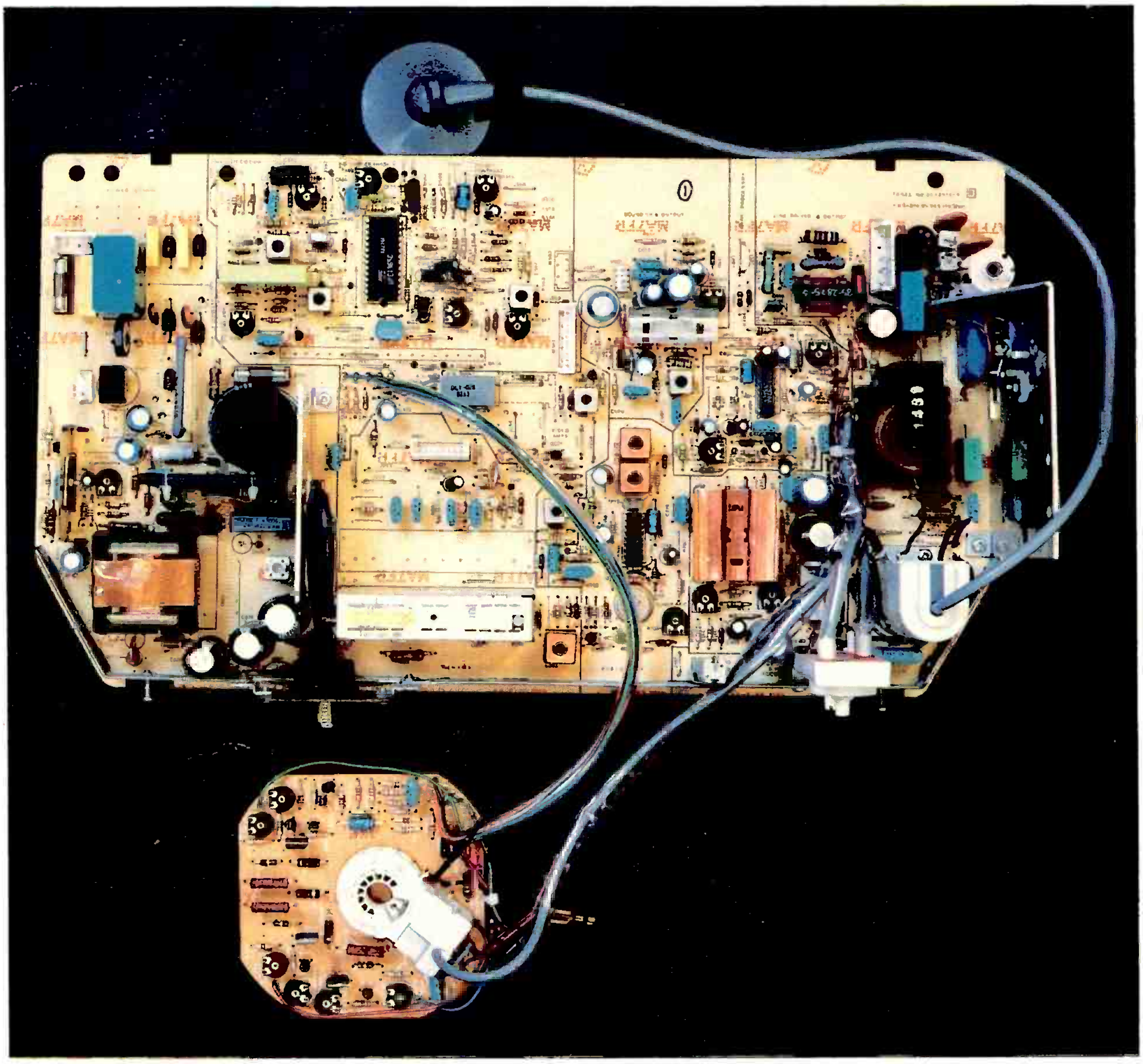
NOVEMBER 1981 70p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



TV RECEIVER DESIGN – THE NEW DECCA COLOUR CHASSIS

DIGITAL SIGNAL PROCESSING

SERVICING LUXOR 110° HYBRID CTVs

VCR TOPICS: TV STANDARDS

TELEVISION

November 1981 **Vol. 32, No. 1 Issue 373**

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, Lavington Street, London SE1 0PF.

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QUERIES
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.
Requests for advice in dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

OUR NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 18

MANOR SUPPLIES

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

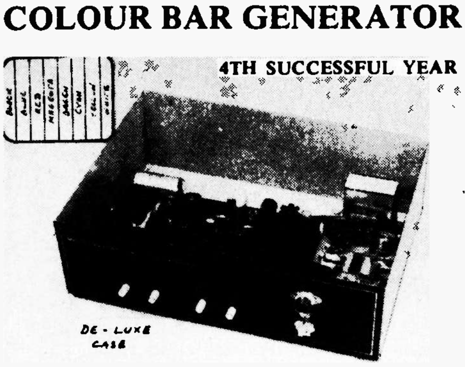
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ 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.

PRICE OF KIT £80.50.
DE LUXE CASE (10"×6¼"×2¼") £8.50
Post/Packing £2.00.

ALL ABOVE PRICE 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 £5.95. 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 (CHI 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

Remote control of stations & teletext.

MK I (Texas XMII) **£170.20.**

Further details on request P/P £2.80.

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"TELEVISION" NEW COLOUR PORTABLE PROJECT (Parts available) **SWITCH MODE POWER SUPPLY KIT £26.00** p.p. £1.60. **SIG BOARD KIT** (Incl. ALT. SAW IF) **£70.00** p.p £1.60. **TIME BASE £44.80** p.p. £1.60. **CRT BASE £2.60** p.p. 60p.
(PHONE, CALL, SEND FOR LIST). FULL TECHNICAL ADVICE & PANEL TEST SERVICE FOR OUR CUSTOMERS,
"TELEVISION" TV PATTERN GEN. PARTS AVAILABLE.
"TELEVISION" MONITOR PARTS AVAILABLE.
"TELEVISION" MONO PORTABLE RECEIVER PARTS AVAILABLE. WORKING MODELS & PANEL TEST SERVICE.
"TELEVISION" COLOUR RECEIVER (LARGE SCREEN) PROJECT ALL PARTS AVAILABLE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE)
NEW 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, LIMITED QUANTITY AT HALF PRICE **£69.00** 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. £1.00.) ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
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CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£28.00** p.p. £2.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
BUSH 161 TIMEBASE PANEL A634 **£3.25** p.p. £1.40.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, SERIES, IF FRAME TB **£7.90 each** p.p. £1.40.
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GEC 2110 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2010 SERIES TIMEBASE PANEL **£1.15** p.p. £1.00.
GEC 2040 (TYPE) CDA PANEL **£2.88** p.p. £1.25.
PYE 713/715 Convergence **£5.75 each** p.p. £1.40.
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THORN 3000 LINE TB PCB **£5.75 each** p.p. 85p.
THORN 3000 VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.30.
THORN 8500 Series channel selector & front control unit **£4.37** p.p. £1.80.
THORN 8000/8500 IF/DECODER PANELS salvaged **£5.52** p.p. £1.60.
THORN 8000/8500 FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
THORN 8000/8500 POWER/SALV. SPARES **£2.88** p.p. 60p.
THORN 9000 LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £1.60.
THORN 9000 **SERIES TOUCH TUNE** REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£8.90** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
PHILIPS G8/G9 IF/DECODER Panels for small spares **£4.80** p.p. £1.30.
G8 IF Panels for small spares **£1.75** p.p. 95p.
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VARICAP, U321, U322, ELC 1043/06 **£7.82,** ELC 1043/05 **£6.35** p.p. 60p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£2.88** p.p. 60p.
BUSH "Touch Tune" and Varicap Control Unit **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£8.60** 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. £1.30.
TRANSISTORISED 625 IF for T.V., sound, tested. **£7.82** p.p. 95p.
MULLARD EP9000 Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
LINE OUTPUT TRANSFORMERS. New guar. p.p. £1.25.

BUSH 145 to 186SS series	**£9.20**
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FERG., HMV, MARCONI, ULTRA 850 to 1580	**£6.80**
THORN 1690, 1691	**£10.15**
GEC 2000 to 2038 series	**£7.80**
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INDESIT 20/24EGB	**£8.80**
ITT/KB VC1 200, 300	**£8.80**
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SPECIAL OFFER

GEC 2114J/FINELINE	**£5.50**
PYE 40, 67	**£5.50**
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KB VC ELEVEN (003)	**£3.25**

COLOUR LOPTS p.p. £1.30
(BOBBINS **80p**)

R.B.M. A823	**£5.60**
R.B.M. Z179	**£6.70**
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DECCA Bradford (state Model No.)	**£10.15**
DECCA 80, 100	**£9.50**
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PYE 731 to 741	**£7.85**
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TRANSDUCTORS Suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
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LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

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BUSH 184	£23.00 each	£20.00	£38.00
THORN 3000 19"	£28.00 each	£25.00	£43.00
THORN 3500 26"	£28.50 each	£25.00	£43.00
DECCA BFD - 30's	£28.00 each	£25.00	£43.00
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100's OF SINGLE/STANDARD MONO - 100% COMPLETE I.E. THORN 1300 - PYE 169 - PHILIPS 300 - GEC FINELINE - BUSH/MURPHY - INDESIT - ITT/KB ETC.
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100's OF COLOUR TV'S 100% COMPLETE AS THEY ARRIVE — IN BATCHES OF TEN
BRIARWOOD SPECIAL CLEARANCE PRICE **£15.00** per set! + VAT

TUNE IN TO THESE BRIARWOOD BARGAINS
ALL SETS IN BATCHES OF FIVE
— ALL GOOD WORKING

5 - 25" 3000 THORN OR
5 - 26" PYE WITH DOORS!
@ £40.00 each + VAT

5 - 25" BUSH WITH DOORS
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@ £40.00 each + VAT

5 - 26" THORN WITH DOORS
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@ £40.00 each + VAT

RING BRADFORD (0274) 306018 FOR DETAILS OF SPECIAL PRICES FOR SINGLE SETS!

BRIARWOOD TELEVISION LIMITED

BTV BRIARWOOD

QUALITY SELECTED EX EQUIPMENT SPARES

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MONO TUNERS
6 button integrated all at £4.00 U.H.F. P/Button D/S £3.50. U.H.F. P/Button S/S £4.00. Rotary £3.00 + £1 P&P

MONO TUBES
(tested)

19" Rimguard	£3.00
23" Rimguard	£4.00
20" Rimguard	£5.00
24" Rimguard	£6.00

+ £5.00 P & P

MONO LOPTS
All D/Standard Lopts at £4.00 + £1 P&P. All S/Standard at £4.00 + £1 P&P.

MONO PANELS
i.e. Philips, Bush, etc. £3.50 + £1 P&P. Quotations for complete S/hand chassis if required. (Diff. prices)

PLEASE ADD 15% V.A.T. TO ALL ITEMS AND OVERSEAS AT COST. CASH WITH ALL ORDERS.

VALVES (MONO & COLOUR)

PCL82	0.10	30C1	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECL80	0.10
PCL83	0.25	30C17	0.10	30C15	0.10	EF184	0.10	6/30L2	0.10	PL509	1.00
PCL84	0.10	PCF802	0.10	30C18	0.25	6BW7	0.10	30PL1	0.25	PY500	1.00
PCL85	0.10	PCF805	0.25	PC97	0.20	EH90	0.10	30PL13/4	0.10	GY501	1.00
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PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
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Please note there is 50p Postage and Packing per order.

BRIARWOOD TV LTD (Export Division)

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COLOUR & MONO TV'S ALWAYS AVAILABLE FOR WORLDWIDE USE

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S/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	VIDEO	CON	POWER	L/TB	F/TB
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GEC Hybrid	6.00	6.50	9.00	—	5.00	—	—	12.00
Philips G6 S/S	9.50	—	10.00	—	5.00	—	—	6.00
Thorn 3000	6.00	6.00	6.00		5.00	15.00	15.00	6.00
Pye 691/693	6.00	6.00	8.00	—	5.00	—	15.00	5.00
Thorn 3500	6.00	6.00	6.00	6.50	12.00	15.00	15.00	6.00

Korting and other foreign panels available on request. Postage & Packing £1.25

COLOUR TUBES

17"	£15.00
18"	£15.00
19"	£15.00
19" A49/192	£18.00
20"	£18.00
22"	£20.00
25"	£15.00
26"	£22.00

Plus P&P £6.00
New rebuilt tubes available on request.

COLOUR TUNERS

Bush	£5.00
GEC	£5.00
Philips G6 S/S	£5.00
Pye 691	£5.00
Thorn 3000	£5.00

Some new tuners in stock, can supply on request. Many Foreign Tuners also available on request. Plus P&P £1.

COLOUR LOPTS
Most Lopts available from £5.00. Both British & Foreign makers. Please ring or write. P&P per Lopt £1.00

MISC.
S/Output transformer from £1.50. F/Output from £1.25. Scancoils from £5.00. P&P £1.00 Other spares available on request.

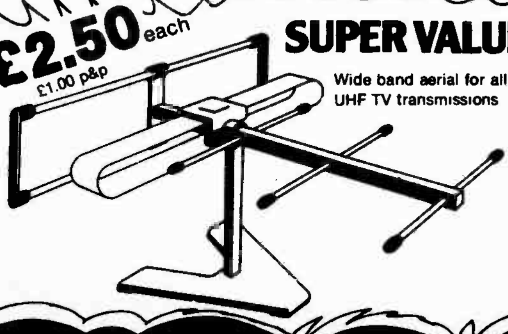
THORN 1500 TUNERS
NEW SPECIAL OFFER AT £8.00
Postage & Packing £1.00

NEW PRODUCTS!

SUPER VALUE - SUPER QUALITY

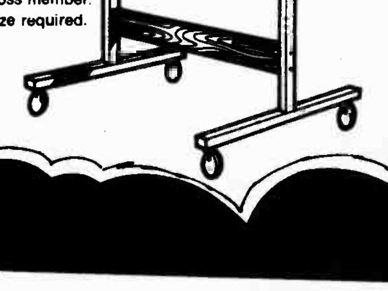
£2.50 each
£1.00 p&p

Wide band aerial for all UHF TV transmissions



£5.95 each
£1.75 p&p

Fits 22"-26" TV's. wood finished cross member. State size required.



TV scores with quality

WHY NOT TRY OUR EXPRESS MAIL ORDER ON ANY OF THE ITEMS LISTED

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TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £
AC107	0.24	AF181	1.00	BC179	0.12	BD137	0.30	BF218	0.12	OC36	0.90
AC113	0.22	AF186	0.90	BC182L	0.09	BD138	0.31	BF219	0.12	OC38	0.90
AC115	0.23	AF239	0.46	BC183L	0.09	BD139	0.40	BF220	0.12	OC42	0.45
AC117	0.30	AU113	1.40	BC183LA	0.10	BD140	0.37	BF221	0.21	OC44	0.60
AC125	0.23	BA130	0.08	BC183LB	0.10	BD144	1.39	BF222	0.12	OC45	0.50
AC126	0.23	BA145	0.14	BC184L	0.09	BD145	0.50	BF224	0.18	OC46	0.39
AC127	0.22	BA148	0.21	BC186	0.21	BD177	0.50	BF256	0.37	OC70	0.39
AC128	0.22	BA155	0.08	BC187	0.21	BD178	0.50	BF258	0.30	OC71	0.39
AC131	0.13	BAX13	0.05	BC209	0.11	BD203	0.40	BF259	0.30	OC72	0.39
AC141	0.24	BAX16	0.08	BC212	0.09	BD204	0.70	BF260	0.25	OC74	0.39
AC142	0.24	BC107	0.11	BC212L	0.09	BD222	0.73	BF262	0.28	OC75	0.39
AC141K	0.31	BC108	0.11	BC213L	0.09	BD233	0.36	BF263	0.25	OC76	0.39
AC142K	0.31	BC109	0.11	BC214L	0.09	BD234	0.34	BF271	0.27	OC77	0.50
AC151	0.21	BC113	0.11	BC237	0.09	BD237	0.44	BF272	0.27	OC78	0.23
AC165	0.21	BC114	0.11	BC238	0.09	BD238	0.44	BF273	0.16	OC81	0.26
AC166	0.21	BC115	0.11	BC240	0.31	BDX22	0.73	BF336	0.30	OC810	0.14
AC168	0.22	BC116	0.11	BC249	0.35	BDX32	1.98	BF337	0.29	OC82	0.26
AC176	0.22	BC117	0.12	BC251	0.22	BDY18	0.80	BF338	0.29	OC820	0.20
AC176K	0.28	BC119	0.24	BC257	0.20	BDY60	0.80	BF479		OC83	0.30
AC178	0.23	BC125	0.15	BC262	0.18	BF115	0.30	BFT	0.27	OC84	0.30
AC186	0.26	BC126	0.15	BC263B	0.20	BF121	0.29	BFT	0.27	OC85	0.28
AC187	0.23	BC136	0.15	BC267	0.19	BF154	0.12	BFX84	0.27	OC123	0.25
AC188	0.23	BC137	0.17	BC281	0.24	BF158	0.19	BFX85	0.27	OC169	1.20
AC187K	0.30	BC137	0.23	BC300	0.27	BF159	0.24	BFX	0.30	OC170	1.20
AC188K	0.30	BC139	0.23	BC301	0.27	BF160	0.23	BFY37	0.22	OC171	0.92
AD130	0.58	BC140	0.24	BC302	0.30	BF163	0.30	BFY50	0.21	OA91	0.07
AD140	0.68	BC141	0.27	BC303	0.27	BF164	0.30	BFY51	0.21	BRC4443	0.65
AD142	0.80	BC142	0.27	BC307	0.11	BF167	0.30	BFY52	0.21	R2008B	1.50
AD143	0.70	BC143	0.27	BC307A	0.11	BF173	0.21	BFY53	0.27	R2009	1.30
AD145	0.70	BC147	0.10	BC308A	0.12	BF177	0.26	BFY55	0.33	R2010B	1.50
AD149	0.64	BC148	0.10	BC309	0.14	BF178	0.24	BFX		R2265	1.50
AD161	0.42	BC149	0.10	BC337	0.12	BF179	0.28	BHA0002	1.90	R2305	0.38
AD162	0.42	BC153	0.12	BC338	0.15	BF180	0.30	BSX20	0.23	R2305	
AD161)		BC154	0.12	BC487	0.20	BF181	0.34	BSX76	0.23	BD222	0.37
AD162)	1.00	BC157	0.12	BC547	0.10	BF182	0.30	BSY84	0.36	R2540	2.50
AF106	0.42	BC158	0.12	BC548	0.11	BF183	0.29	BU105	1.00	S2802	
AF114	0.37	BC159	0.12	BC549	0.11	BF184	0.27	BU105 02	1.50	SCR957	0.65
AF118	0.45	BC160	0.26	BC557	0.12	BF185	0.29	BU105 04	2.00	TIP31A	0.38
AF121	0.37	BC161	0.26	BCX33	0.10	BF186	0.32	BU126	1.40	TIP32A	0.36
AF125	0.30	BC167	0.11	BD112	0.39	BF192		BU205	1.20	TIP3055	0.53
AF126	0.30	BC168	0.11	BD113	0.65	BF194	0.15	BU206	1.60	TIP31B	0.39
AF127	0.30	BC169	0.11	BD115	0.32	BF195	0.13	BU208	1.60	TIS90	0.23
AF139	0.40	BC171	0.10	BD116	0.47	BF196	0.13	OC22	1.10	TIS91	0.25
AF150	0.27	BC171A	0.10	BD124	1.30	BF197	0.13	OC23	1.30	TV106	1.09
AF151	0.30	BC172	0.10	BD131	0.36	BF198	0.12	OC24	1.30	MJE340	0.50
AF170	0.92	BC173	0.12	BD132	0.36	BF199	0.14	OC25	1.00	MJE520	0.45
AF172	1.00	BC177	0.12	BD133	0.37	BF200	0.28	OC26	1.00	2N2219	0.40
AF178	1.00	BC178	0.12	BD135	0.30	BF216	0.12	OC28	1.30	2N2646	0.40
AF180	1.00	BC178A	0.12	BD136	0.30	BF217	0.12	OC35	1.00	2N2926	0.15

TYPE	PRICE £
2N3053	0.21
2N3054	0.60
2N3055	0.60
2N3442	1.00
2N3702	0.15
2N3703	0.12
2N3704	0.18
2N3705	0.18
2N3706	0.14
2N3707	0.14
2N3708	0.14
2N3772	2.00
2N3773	2.50
2N3819	0.30

VALVES

DY87	0.60
DY802	0.64
ECC82	0.60
EF80	0.55
EF183	0.70
EF184	0.70
EH90	0.75
PC86	0.85
PCC89	0.65
PCC189	0.80
PCF80	0.80
PCF86	0.72
PCF801	0.70
PCF802	0.85
PCL82	0.75
PCL84	0.80
PCL86	0.85
PCL805	0.82
PLF200	1.00
PL36	£1.10
PL84	0.80
PL504	£1.30
PL508	1.50
PL509	2.45
PL802	£2.75
PY88	0.75
PY500A	1.60
PY81 800	0.70

All transistors. IC's offered are new and branded. Manufactured by Mullard. I.T.T., Texas. Motorola etc
Please add 15% VAT to all items and overseas at cost
P & P U.K. 50p per order. overseas allow for package and postage. Cash with all orders. All prices subject to alteration without notice.

E.H.T. Trays Colour

TYPE	PRICE £
Pye 691 693	4.50
Pye 715/731/ 735	5.50
Pye 737	5.40
Decca (Large Screen) CS2030/2232/ 2630/2632/2230/ 2233/ 2631	5.00
Decca 80	5.30
Decca 100	5.30
Philips G8 520/540	5.30
Philips G9	5.50
Philips 550	5.30
GEC C2110	5.50
GEC Hybrid CTV	5.10
Thorn 3000/ 3500	5.00
Thorn 800	2.42
Thorn 8500	4.75
Thorn 9000	5.50
GEC TVM25	2.50
ITT KB CVC 5/7/8/9	5.10
ITT KB CVC 20/25 30/32	5.50
Bush CTB25 MK3 Quadrupler	8.00
Bush X179	4.50
RRI (RBM) A823	5.00
Bang & Olufsen 4/5000 Grundig 5010/5011/5012/ 6011/6012/7200/ 2052/2210/2252R Tandberg (radionette) Autovox	6.60
Grundig 3000/3010 Saba 2705/ 3715 Telefunken 709/710/ 717/2000	6.80
Korting	6.80

E.H.T. TRAYS MONO

950 MK2 Single Stick Thorn TV 11, 16K 70V	0.75
TV 20 2 MT	0.75
TV 2016K 18V	0.75
BUSH 718	1.30

MAIL ORDER TV BARGAINS

PYE 691	22"	@ £55.00
PYE 691	26"	@ £55.00
PYE 697	22"	@ £65.00
PYE 697	26"	@ £65.00
BUSH 184	19"	@ £70.00
BUSH 184	22"	@ £70.00
BUSH 184	26"	@ £70.00
GEC 2040	19"	@ £55.00
GEC2040	22"	@ £55.00
GEC 2040	25"	@ £55.00
GEC 2040	26"	@ £65.00
KORTING	22"	@ £70.00
KORTING	26"	@ £80.00
THORN 3000	19"	@ £70.00
THORN 3000	25"	@ £60.00

Good working mono's Pye, GEC, Bush etc.

20" & 24" S/S	£20.00
20" & 24" D/S	£18.00
19" & 23" D/S P/Button	£15.00
19" & 23" D/S Rotary	£12.00

Cheques, P.O. or Cash with orders Please. Please note there is 15% VAT on all the above prices. Plus £10.00 p & p for colour TV. £5.00 for mono. ENGLAND, WALES and SCOTLAND Inland N & S IRELAND £15.00 for colour. £7.00 for mono.

IC's

TYPE	PRICE £
BTT6018	1.00
CA3605	1.20
MC7/c	
MC14016	0.50
SN76003N	1.40
SN76023N	1.20
SN76110N	1.00
SN76226DN	1.50
SN76227N	1.20
SN76532N	1.30
SN76550N	0.30
SN76666N	0.70
TAA570	1.38
TBA120AS	1.00
TBA120S	0.75
TBA120SQ	0.75
TBA395	2.20
TBA341	0.97
TBA520	1.40
TBA520Q	1.10
TBA530Q	1.10
TBA540	1.30
TBA540Q	1.45
TBA550Q	1.40
TBA560C	1.50
TBA560CQ	1.50
TBA570	1.00
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920	2.00
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
TCA270SA	1.45
TCA270Q	—
TCA1327B	1.00
TCA800	2.00
TDA1010	—
TDA1327B	1.00
SBA750	1.75
SC9503P	1.20
SC9504P	1.20
SL901B	5.00
SL917B	7.00

DIODES & THYRISTORS

OA47	0.06
OA81	0.06
OA90	0.06
OA91	0.07
BA130	0.10
BA145	0.16
BA148	0.18
BA154	0.18
BA155	0.10
BAX13	0.08
BAX16	0.10
BY126	0.10
BY127	0.10
BY164	0.40
BY179	0.57
BY226	—
BY227	0.12
BYF206	0.14
1N4001	0.04
1N4002	0.05
1N4003	0.06
1N4004	0.07
1N4005	0.07
1N4006	0.08
1N4007	0.08
1N4148	0.05
1N4751	0.14
1N5401	0.12
1N5403	0.12
1N5404	0.14
1N5405	0.14
1N5406	0.14
1N5408	0.25
BR100	0.22
BR101	0.28
BT106	1.19
BT108	1.23
BT109	1.09
BT116	1.60
BT120	1.60
2N4444	0.90

BRIARWOOD TELEVISION LTD

Briarwood House, Preston Street, Bradford West Yorkshire BD7 1LU
Tel: (0274) 306018

P. V. TUBES

Telephone: Accrington (0254) 36521

38A WATER STREET, ACCRINGTON, LANCS BB5 6PX.

WHOLESALE SUPPLIERS OF TELEVISION COMPONENTS

TRADE COUNTER OPEN MON-FRI 9 a.m.-4.30 p.m. SAT MORN. 9.30 a.m.-12 noon.

INTEGRATED CIRCUITS

MC1307	1.00	ML922	3.29	SN76131N	1.30	TAA350A	80	TBA120B	1.30	TBA570	1.00	TCA800	1.89	TDA2540	3.84
MC1327	1.00	ML926	2.18	SN76226(D)N	1.55	TAA300	58	TBA120SB	1.38	TBA641-B11	2.40	TCA940	1.80	TDA2541	2.85
MC1330P	90	ML928	2.18	SN76227N	1.10	TAA310	2.83	TBA120U	1.00	TBA641 BX1	2.00	TDA440	2.20	TDA2560	1.90
MC1349	1.20	SA5560S	1.80	SN76532N	1.50	TAA320	59	TBA395	2.20	TBA690	1.50	TDA1004A	2.95	TDA2581	2.25
MC1350	96	SA5570S	1.80	SN76533N	1.30	TAA550	28	TBA396	80	TBA673	1.10	TDA2540	3.15	TDA2590	3.25
MC1351	1.00	SA5580S	2.90	SN76033N	1.53	TAA570	1.80	TBA440N/TBA1441	2.75	TBA700	2.12	TDA1170	1.99	TDA2591	2.75
MC1352	1.00	SA5590S	2.90	SN76544N	1.35	TAA630	2.50	TBA440	2.50	TBA720Q	2.12	TDA1190	2.60	TDA2593	2.50
MC1358PO	1.50	SL901B	4.45	SN76650M	89	TAA630S	2.50	TBA480	1.28	TBA750	2.05	TDA1270	3.73	TDA2600.	3.25
MC1495L	1.00	SL917B	6.25	SN76660N	80	TAA621 AX1	3.00	TBA480Q	1.20	TBA800	89	TDA1327	1.00	TDA2611A	1.85
MC14011BCP	42	SL1310	1.80	SN76666N	70	TAA840/S1	1.98	TBA500P	1.58	TBA810AS	1.35	TDA1352B	1.60	TDA2640	2.25
MC14049BCP	43	SL1327Q	1.20	SW153	2.74	TAA700B	1.70	TBA510	3.00	TBA820	1.70	TDA1412	1.20	TDA2690	1.00
ML231B/ETTR6016	2.20	SL76544	2.00	TA7141P	95	TAA700	1.70	TBA520Q	1.20	TBA89D	3.94	TDA2020	4.66	TDA3950	2.36
ML232/ETT6016 CA3065	2.20	SN76003N	1.75	TA7050P	95	TAA661B	1.20	TBA530Q	1.28	TBA920	1.80	TDA2030	2.80	UPC566H	2.95
ML236	5.36	SN76013N	1.50	TA7051P	95	TAA840		TBA530	1.20	TBA920Q	1.80	TDA2521	4.17	UPC575C2	3.40
ML237	1.95	SN76013ND	1.50	TA7171P	1.80	TBA120A	70	TBA540	1.49	TBA950(2X)	2.40	TDA2522	2.40	UPC1025HI	4.50
ML238	4.20	SN76023N	1.45	TA7172P	1.80	TBA12DS	78	TBA550	1.58	TBA990	1.40	TDA2523	2.20		
ML239	2.50	SN76023NO	95	TA7173P	1.45	TBA120SA	70	TBA550Q	1.58	TCA160	1.20	TDA2530	1.95		
ML920	4.12	SN76110N	89	TA7074P	1.00	TBA120AS	70	TBA560Q	1.59	TCA760	2.30	TDA2532	2.45		
		SN76115N	2.27	TA7176P	75					TCA270SQ	1.25	TDA2524	2.25		

SOCKETS IC

8 pin 24 16 pin 20
14 pin 18 14 pin Dil/Quil 28

WE NOW HAVE THESE SPECIAL CB INTEGRATED CIRCUITS

TA7205AP	3.72							
2SC1909	1.41	MSN5807	7.87	PLL02AG	9.89	LC7120	5.87	Please enquire for others
2SC495	1.10	AN7150	3.97	MC1351P	1.00	TA7204P	3.77	
LC7130	5.93	TA7222	4.07	AN2140	3.91	TA7130P	1.93	
AN240	3.84	TA7310P	2.78	LA4031P	3.21	UPC1156H	4.28	

SEMICONDUCTORS

AC126	22	AU110	2.00	BC171	9	BC261B	15	BD138	23	BF115	35	BF259	24	BFY90	75	OC79	20	2N3706	10
AC127	22	AU113	1.40	BC171A	10	BC262A	15	BD139	28	BF117	36	BF262	84	BR100	17	R2008B	1.80	2N3708	17
AC128	20	BC107	20	BC171B	10	BC262B	15	BD140	31	BF125	28	BF263	50	BR101	30	R2010B	1.80	2N2904	30
AC128K	32	BC107A	20	BC172	9	BC300	33	BD144	1.20	BF127	26	BF271	24	BRC4443	80	R2265	1.40	2N5294	48
AC141K	34	BC107B	20	BC172B	10	BC301	28	BD159	65	BF154	12	BF273	12	BRX46	40	R2322	58	2N5296	48
AC142K	30	BC108	20	BC172C	10	BC303	28	BD160	1.30	BF158	18	BF310	30	BRY39	30	R2323	67	2N5298	89
AC176	25	BC108A	20	BC173C	12	BC307	10	BD166	52	BF160	27	BF311	30	BRY56	57	R2461	1.50	2N5496	53
AC176K	32	BC108B	20	BC174A/B	10	BC308A/B	17	BD179	52	BF167	24	BF336	36	BT106	1.00	R2540	2.80	2N6107	75
AC187	26	BC108C	20	BC182	9	BC327	11	BD182	72	BF173	22	BF337	30	BT108	1.24	RCA16334	90	2SC643A	1.50
AC187K	28	BC109	20	BC182LB	10	BC328	9	BD183	75	BF177	35	BF338	34	BT116	1.21	RCA16335	80	2SC1172Y	2.20
AC188	25	BC109B	20	BC183LB	10	BC337	11	BD201	85	BF178	26	BF355	37	BU104	2.00	TIP29C	43		
AC188K	37	BC109C	20	BC184	9	BC338	9	BD202	80	BF179	28	BF362	37	BU105	1.25	TIP30C	43		
AD143	82	BC114	12	BC184	10	BC461	30	BD203	80	BF180	36	BF363	33	BU108	1.80	TIP31C	41		
AD149	79	BC116A	12	BC204	10	BC547	10	BD204	84	BF181	36	BF371	30	BU124	1.30	TIP32C	42		
AD161	42	BC117	20	BC208	13	BC548	10	BD222	46	BF182	30	BF457	35	BU126	1.48	TIP33B	75		
AD161/2	1.15	BC119	24	BC209	10	BC549	8	BD223	56	BF184	30	BF458	28	BU204	1.50	TIP41C	46		
AD162	42	BC140	32	BC212	9	BC550	7	BD225	47	BF185	30	BF459	35	BU205	1.34	TIP42C	47		
AF114	40	BC141	26	BC212L	9	BC557	8	BD232	45	BF194	11	BF639	28	BU206	1.80	TIP47	70		
AF118	62	BC142	21	BC213	9	BC558	9	BD233	35	BF195	11	BFT42	28	BU208	1.60	TIP2955	90		
AF121	56	BC143	24	BC213B	10	BCY72	13	BD234	37	BF196	10	BFT43	28	BU208A	1.95	TIP3055	63		
AF124	34	BC147	9	BC213L	9	BD115	32	BD235	33	BF197	11	BFW10	60	BU208/02	2.10	TIS91	21		
AF125	35	BC148	9	BC214	9	BD116A	65	BD236	40	BF198	11	BFX29	30	BU326A	1.42	TV106/02	1.55		
AF126	34	BC149	10	BC214L	10	BD124P	60	BD237	33	BF199	15	BFX84	27	BU407	1.25	2N696	21		
AF127	32	BC157	11	BC2378	12	BD131	33	BD238	35	BF200	30	BFX85	28	BU500	1.95	2N2905	28		
AF139	42	BC158	10	BC238A/B/C	8	BD132	35	BD410	55	BF241	15	BFX86	30	EI222	28	2N3054	60		
AF239	45	BC159	10	BC251A	12	BD133	40	BD434	55	BF256LC	28	BFX88	25	MJE340	40	2N3055	60		
AL102	2.00	BC160	25	BC252A	12	BD135	26	BD517	60	BF256	28	BFY50	20	MJE520	44	2N3702	11		
AU106	2.50	BC161	28	BC252B	12	BD136	27	BD520	75	BF257	28	BFY51	22	MJ3000	2.38	2N3703	10		
AU107	2.00	BC170B	15	BC261A	18	BD137	26	BDX32	1.50	BF258	25	BFY52	20	DC71	27	2N3705	10		

THERMISTORS

VA1104	75
VA8650	55
VA1039	35
GEC Dual Posistor	1.50
GEC Dual 2040	1.50

CERAMIC FILTERS

6Mhz	74
5.5Mhz	74

CRYSTALS

4.3Mhz	1.30
8.8Mhz	1.30

NEW VALVES

30FL2	1.41	EY500A	1.33	PCL85/805	79
DY802	72	EZ80/1	56	PCL86	81
DY86/7	66	GY501	1.45	PD500	2.93
ECC81	60	GZ34	1.56	PFL200	1.35
ECC82	60	KT66	5.00	PL36	1.15
ECC83	60	KT88	6.00	PL81	94
ECC84	80	PC86	81	PL82	46
ECC85	98	PC88	81	PL83	1.43
ECC88	1.35	PC92	80	PL84	84
ECF80	80	PC97	1.14	PL95	1.00
ECF82	88	PC900	80	PL504	1.32
ECH81	1.04	PCC84	70	PL508	1.43
ECH84	1.13	PCC85	85	PL509	2.60
ECL80	84	PCC88	82	PL519	2.78
ECL82	77	PCC89	79	PL802	2.45
ECL86	84	PCC189	1.02	PY33	61
ECF86	78	PCC805	1.40	PY88	81
EF80	68	PCF80	75	PY500A	1.40
EF85	68	PCF86	1.13	PY800/1	68
EF86	1.19	PCF200	1.23	UCF80	67
EF89	1.43	PCF800	1.38	UCH81	1.43
EF183	68	PCF801	1.13	UCL82	84
EF184	98	PCF802	86	UCL83	94
EH90	1.02	PCF805	1.63	UL84	1.02
EL34	1.63	PCF806	1.30	U26	1.30
EL81	86	PCF808	1.83	U191	95
EL84	68	PCH200	1.45	6F23	85
EL90	82	PCL82	78	UY85	80
EL509	2.22	PCL83	2.00	PL802T	2.50
EY86/7	68	PCL84	81		

All valves are new – boxed – guaranteed.

Please add 15% VAT to **ALL** items.

DIODES

AA119	9	BY210/800	33	IN5401	12
BA102	17	BY298	22	IN5402	14
BA115	13	BY299	22	IN5403	12
BA145	17	BYX10	20	IN5404	12
BA148	17	BYX36/10	30	IN5405	13
BA154	6	BYX36/600	35	IN5406	18
BA155	14	BYX55/600	30	IN5407	18
BA156	15	BYX71/600	90	IN5408	18
BA317	25	OA47	9	ITT44	4
BAX13	4	OA90	5	ITT2002	11
BAX16	8	OA91	8	Y969	89
BB105B	30	OA95	8		
BB105G	30	OA202	11		
BY126	12	IN914	4		
BY127	11	IN4001	4		
BY133	15	IN4002	4		
BY164	45	IN4003	4		
BY176	85	IN4004	5		
BY182	87	IN4005	5		
BY184	55	IN4006	5		
BY223	90	IN4007	6		
BY199	30	IN4148	2		
BY206	14	IN4448	10		

ZENER DIODES

BZX61/BZX85C(1.3W)	**BZY88-(400MW)**
6V2-7V5-8V2-9V1	2V7-3V-3V3-3V6
10V-11V-12V-13V-15V	3V9-4V3-4V7-5V1
16V-18V-20V-22V-24V-	5V6-6V2-6V8-7V5
27V-30V-33V-36V	8V2-9V1-10V-11V
39V-47V-56V-68V	12V-13V-15V-18V
75V	24V-27V.
Price **20p** each	Price **10p** each

ACCESS ACCEPTED

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	3.85
THORN 1500 5 Stick	4.25
THORN 1600	3.45
THORN 2000	8.80
THORN 3000/3500	6.89
THORN 8000	3.55
THORN 8500/8800	5.40
THORN 9000	7.43
DECCA CTV 19/25	5.35
DECCA 1730/1830	3.80
DECCA 1910/2213 Bradford	5.92
DECCA 30	5.92
DECCA 80	6.20
DECCA 100	8.04
UNIVERSAL I T T	5.40
GEC 2040/2028	5.84
GEC 2110 Pre Jan '77	6.95
GEC 2110 Post Jan '77	9.05
PHILIPS G8 Short Focus Lead	6.65
PHILIPS G8 Long Focus 550	5.86
PHILIPS G9	6.33
PYE 691/3	5.13
PYE 713 4 Lead	7.00
PYE 731/25	5.95
R B M. A823 (plug in) AV	5.98
R B.M A823	5.78
KORTING (similar to Siemens TVK1)	8.65
ITT KB CVC5/9	5.35
ITT KB CVC20/25/30 (Mullard Type)	5.35
RRI T20	8.80

RECTIFIER STICKS

TV11	74
TV18	81
TV20	85
TV13	75

TRANSFORMERS

L.O.P.T.

R.B.M A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	19.60
R.B.M T20A	13.95
PHILIPS 210/300 Mono	10.80
PHILIPS G8	10.00
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 691/3	14.50
PYE 697 (Printed)	14.50
PYE 731	10.80
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80	8.50
DECCA 100	8.58
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	9.00
GEC 2040	9.50
ITT CVC 1-9	9.20
ITT CVC 25/30/32	8.00
ITT CVC 20	7.16
THORN 3000 EHT	8.38
THORN 3000 SCAN	6.38
THORN 8000	8.05
THORN 8500	10.00
THORN 9000	10.05
THORN 3000/3500 Mains Trans.	10.00
THORN 1591	8.68
THORN 1591	8.68
THORN 1691	9.68
THORN 9800	1000

PANELS

I.F. Gain Module (Pye, Philips)	9.80
C.D.A. PANEL (Pye, Ecko, Invicta, Dynatron)	20.00
CONVERGENCE PANEL Philips G8	17.85

NEW MONO TUBES

MULLARD A31/510 110° 12"	17.00
MULLARD A34/510 110° 14"	18.50
VEGA A50/120WR .20"	13.50
VEGA A61/120WR 24"	15.00
VEGA 12" 90°	15.00

REBUILT COLOUR TUBES

17"-18"-19"-20"-22"	£30.00
26"-25"	£34.00
26" 110°	£36.00

Glass for Glass exchange
2 year warranty

MULLARD COLOUREX TUBES OR THORN NEW LIFE TUBES

18" A47/342X A47/343X	50.00
19" A49/120X	52.00
20" A51/120X	52.00
22" A56/120X	42.00
25" A63/120X	54.00
26" A66/120X	53.00
26" A67/120X	53.00

Glass for Glass exchange
1 year warranty or 4 year option.

CARRIAGE ON MONO TUBES **£5.50** incl VAT
COLOUR TUBES. Collection from trade counter only. (except) 12", 14" – £4
(£1 extra for N. Ireland).

As our regular customers know orders telephoned in before 4 p.m. will be despatched the same day. Give us a ring – we'll give you service.

P. V. TUBES

Telephone: Accrington (0254) 36521

REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.96
DECCA 80 (400/350V)	3.16
DECCA 100 (800/250V)	3.16
DECCA 1700 (200/200/400/350V)	4.03
PHILIPS G8 (600/300V)	2.21
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	4.50
PYE 691/7 (200/300/350V)	2.39
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.20
(2500/2500/25V)	1.15
RBM A823 (600/300V)	2.30
RBM 2146 (300/300/350V)	3.16
ITT CVC5/9 (200/200/75/25)	2.47
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.04
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.03
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.01
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.40
THORN 3500 (1000/63V)	85
THORN 3500 (1000/70V)	84
THORN 6000/8500 (2500/2500/63V)	1.54
THORN 6000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.58
THORN 9000 (400/400V)	3.05

WIREWOUND RESISTORS

PREFERRED VALUES

		price each
4W/5W	1R-1K5	20
	2K2-3K3	20
	4K7-6K8	20
	10K	25
7W	1R-4K7	21
	5K6-12K	21
	15K-22K	21
11W	1R-8K8	24
	10K-15K	24
	22K	24
17W	1R-10K0	28
	15K-22K	28

RESISTORS

A range of the following at Preferred Values

		Price per 10 pack
0.25W		20p
0.5W	3R3 to 8M2	20p
1W	10R to 10M	30p
2W	10R to 150K	62p
2W	10M	62p

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	7.60
Mullard ELC1043/06	7.80
4 P/B DECCA/GEC/ITT	6.80
6 P/B DECCA/GEC/ITT	7.90
4 P/B PYE	8.00
6 P/B PYE	10.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass. (Square/Early)	13.50
PHILIPS G8 Ass (Sloping/Late)	13.00
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
U321 UHF Tuner	7.50
THORN 8800 SELECTOR	7.50
THORN 9000 SELECTOR	11.40

SUNDRY TUNER ACCESSORIES

RANK Tuner Push Button 1½"×½" dia.	30p
RANK Tuner Push Button 2" long × ½ dia.	30p
RANK Tuner Push Button 2" long × ¼" dia.	30p
GEC Tuner Neons 2110 chassis.	14p
Drive Cams	10p each

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/push	82
Philips G8 Push On/Off Switch.	1.38
4A Double Pole Rotary On/off	82
A1 Beam Switch (THORN 3500)	50
A1 Controls 5m (THORN 3500)	60
GEC 2110 A1 Control IM5 (Red, Blue, Green)	each 50p
GEC 2040 On/Off Switch	each 80p

THERMAL CUT OUT

THORN 3000 2A Metal	1.60
THORN 8500 2.5 Plastic	1.60
GEC 2040 Metal	2.50

SUNDRIES

ANTIFERENCE Super Set Top		8.00
ANTIFERENCE Car antenna		7.00
ANTIFERENCE Xtra Boost UHF Amp.		15.40
ANTIFERENCE SB11 Splitter		2.40
Surface Mounting Aerial Outlets		80
Cable Clips	per 100	1.10
Transductor 90°		2.00
EHT Final Anode Cap		53
Delay Line CTAV 82/DL50/50L141		2.29
EHT Cable 30kV		25p per mtr.
Coax Plugs	pack of 10	1.80
Focus control GEC/THORN		1.83
PVC Tape		35
FM Plugs		25
PL259 Plugs		40
DECCA 30 Series width control		50
DECCA 3.9R Mudulohm		60
Line Connectors		35
6.3V CRT boost trans		4.35
ANTIFERENCE XG8 High Gain Aerial (State Channel)		18.00
Reducers for PL259		10

N.B. We have a full range of aerials and accessories available from the trade counter.

SOLDERING EQUIPMENT

WELLER Iron Kit 15W	3.00
WELLER Iron Kit 25W (inc. tips)	4.89
WELLER Iron 25W	3.80
WELLER 3/16" Single Flat Tips	51
MIN Soldering Iron	5.00
WELLER Heat Gun Kit	14.80
WELLER Heat Gun	11.00
(Pair) Tips for Gun	30
WELLER Cordless Iron	24.70
ANTEX Soldering Iron 25W	4.89
Solder Remover Sucker	8.50
Solda Mop	70
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.50

MIXED DIELECTRIC CAPACITORS

Volts DC		
600V	0.1 mFd	30
1000V	0.01 mFd	20
	0.047 mFd	29
	0.1 mFd	32
	0.22 mFd	40
	0.47 mFd	75
1250V	0.1 mFd	45
1500V	0.0022 mFd	19
	0.0047 mFd	20
	0.022 mFd	24
	0.033 mFd	59

SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

MINIATURE price each 14
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K-100K
220K-470K-1M0

STANDARD price each 14
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K
100K-220K-470K-1M0-2M2-4M7

PYE LABGEAR

CM6040/WB UHF Masthead (ch21-68)	10.06
CM7025 UHF High Gain M.H.A. 24V (specify group A, B or CD)	14.91
CM7061 Power Unit (12V)	10.84
CM7065/WB VHF/UHF M.H.Amp (12V)	12.00
CM7073 VHF/UHF Dist Amp (8+1)	37.00
CM7053 'Behind the set' UHF Amp. (mains)	10.73
CM7043 'Behind the set' 2nd Set Amp. (UHF-2 outputs)	10.06
CM6006 UHF 6 way Passive Splitter	10.72
CM7042 TV Games Combiner	3.31
CM9003 Flush Mount Single Outlet Isolated	1.75
CM9009 Flush TV/FM Diplex Outlet Isolated	3.00
CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF	17.50
CM6038 VHF/UHF 625 TV Patt Generator	87.50
CM6052 UHF/VHF Pal Colour Bar Generator	215.00
7056 TELETEXT ADAPTOR (Converts any set to remote)	200.00
AMPLIFIED CARAVAN AERIAL (All Channels)	10.50

DATA BOOKS NO VAT

Transistor Equivalent	
TVT 80 A-Z only	3.75
TVT 80 2N/2S series only	4.00
TVT 80/80 A-Z and 2N/2S together	7.50
LIN IC Books LIN 1	5.05
LIN 2	5.05

CAPACITORS

AXIAL TYPE

Volt	MF	Price	Volt	MF	Price
10	22	7		4.7	7
	47	7		100	18
	100	8		220	30
	220	11		470	38
	470	18		1000	53
16	1000	20		2200	85
25	10	7	100	10	12
	22	7		22	14
	47	8		47	18
	100	10		100	20
	220	17		220	35
	470	22	300	12	30
	1000	30	450	1	23
	2200	40		4.7	28
	4700	80		10	28
40	22	9		22	56
				33	62
50	500	38			
63	1	7	500V	1	30
	2.2	7			

'MIDGET' CONTROLS

Insulated spindle length 44mm.

LESS SWITCH 30p
Log or Lin.
5K-10K-25K-50K-100K-250K-500K-1M

WITH D.P.S.T. SWITCH
Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M 81p

SERVICE AIDS

SERVISOL Freeze-It	80
SUPER SERVISOL	75
SERVISOL Foam Cleanser	70
SERVISOL Plastic Seal	68
SERVISOL Silicone Grease	70
SERVISOL Tubes Silicone Grease	1.80
SERVISOL Aero Klene	83
SERVISOL Aero Duster	70
SERVISOL Excel Polish	52
Penetrating Fluid	70
Fire Extinguisher 640G	1.08
Heat Sink Compound 25G	1.00
Silicone Rubber Tube 1108	2.00

SLIDER POTENTIOMETERS

Lin or Log

470R	55p	4K7	55p
1K	55p	10K	55p
2K2	55p	47K	55p

FUSES

	Pack of 10
1¼" QUICK BLOW	
100ma	40
250ma-500ma-750ma-1A	40
1.5A-2A-2.5A-3A-5A	40
1¼" ANTISURGE	
250ma, 500ma 600ma, 630ma, 750ma, 850ma, 1A, 1.25A	
1.5A, 2A	1.41
2.5A, 3A, 5A	2.10
20m ANTISURGE	
80ma	3.11
100ma, 160ma, 200ma	2.00
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A	1.97
2.5A, 3.15A	1.43
20mm QUICK BLOW	
100ma	45
250ma, 500ma, 630ma, 800ma,	37
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	37
1" MAINS	
2A, 3A, 5A, 10A, 13A	84

MULTITURN POTENTIOMETERS

100K	
GEC/TCE	55p
PHILIPS G8	55p
DECCA/RANK	55p

ELECTROLUBE PRODUCTS

Electro-Mech lubricant	1.30
Elect. cleaning solvent	1.50
Freezer	1.30
Foam cleanser	1.06
Heat transfer compound	1.07
Silicone compound	1.81
Special contact fluid (Snorkel)	2.07
Permagard	1.43
Elec. mech. lubricant pen	80

THICK FILM RESISTOR NETWORKS

THORN 3500 (5 pin connection)	1.98
PYE 731 (6 pin connection)	2.20
THORN 9000 (Circuit Ref. R704/7)	1.98

DISC CERAMIC CAPACITORS

High Voltage

8KV d.c.-12KV d.c.

39 pF	30	180pF	30
140pF	30	200pF	30
150pF	30	220pF	30
		250pF	30

CONVERGENCE PRE-SET POTS

	each
3 Watt complete with knob	
5R0-6R8-10R-15R-20R	35
50R-100R-200R-500R	35

MAINS DROPPERS

DECCA 20	2.28
R.B.M. A823	77
R.B.M. 161	85
GEC 2000/2018	78
GEC27840	84
PYE 713/15 3R5/15/45R	1.46
PYE 725/31 3R0/56R/27R	84
PYE 725 56R/27R	62
PHILIPS 50501	60
PHILIPS 210/50511/LINK	64
PHILIPS G8/50832	85
PHILIPS G8 47R section	30
THORN 1500	85
THORN 3500	75
THORN 8000	80
THORN 8500	80

METRIC CONVERGENCE POTS

Philips G8
5R-10R-20R-50R 35

TEST EQUIPMENT

Portable Oscilloscope	150.00
Probes × 10	£10.90
TF200 Frequency Metre	155.00
CRT Tester/Rejuvenator	172.00
LABGEAR Colour Bar/Cross Hatch	215.00
LABGEAR Pattern Generator (Pocket Size)	87.50

EAGLE PRODUCTS

Please send large S.A.E. for full EAGLE Catalogue.

Multimeters		
KEW 7N	2,000 opv	5.25
EM5	5,000 opv	8.95
EM10	10,000 opv	11.50
EM50	50,000 opv	18.95
EMC321 Carrying Case for above		2.25
Digital Meter TS1000		44.50
KHP 30N Measuring Probe (30kV) (E.H.T.)		20.95
T1206 2 Station Intercom.		6.05

HOW TO ORDER

Add 15% VAT to all Prices.
Add 75p per order P&P – First Class Mail is used whenever possible.

Goods for U.K. supply only.

For orders of very small odd items, i.e. IC's, Trans, diodes. – Customers need send only 30p.

For Aerosol's please add 30p per can. (These are very heavy!)

Orders over £25 before VAT are Post Free except when the order contains AEROSOLS.

Carriage on Tubes is as stated on list.

ALL ENQUIRIES SAE PLEASE

VAT invoice on request.

We do regret any postal increases but we try our best to give a speedy, and efficient service, at a fair price

Same day dispatch

EAGLE PRODUCTS

SE500 Headphones	3.75
SE540 Headphones with Volume Control	5.50
SE600 Lightweight Headphones	7.95

TRANSISTORS, ETC.

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.68
AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68
AC128	0.46	BC107*	0.16	BC207*	0.39	BC461	0.78	BD238	0.68
AC128K	0.55	BC108*	0.15	BC208*	0.37	BC477	0.30	BD253	1.56
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74
AC152	0.36	BC117	0.30	BC213L*	0.16	BC550	0.24	BD438	0.75
AC153	0.42	BC118	0.24	BC214*	0.18	BC556	0.23	BD519	0.88
AC153K	0.52	BC119	0.34	BC214L*	0.18	BC557*	0.16	BD520	0.88
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD599	0.87
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.17	BD600	1.23
AC178	0.51	BC132	0.20	BC238*	0.15	BCY10	0.30	BD663BR	0.86
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BDX18	1.55
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	BDY16A	0.63
AC188	0.52	BC137	0.30	BC253*	0.38	BCY72	0.27	BDY18	1.55
AC188K	0.61	BC138	0.35	BC261A*	0.28	BD115	1.35	BDY20	2.29
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BDY38	1.38
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48
ACY17	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55
ACY28	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF121	0.85
ACY39	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.48
AD140	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.55
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51
AD143	1.78	BC153	0.38	BC297	0.36	BD137	0.40	BF137F	0.78
AD149	1.42	BC154	0.41	BC300	0.62	BD138	0.42	BF152	0.19
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25
AD161/162	1.22	BC158*	0.12	BC302	0.86	BD140	0.50	BF159	0.27
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20
AF114	1.32	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84
AF115	1.28	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65
AF116	1.28	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95
AF117	1.32	BC168B	0.14	BC309*	0.18	BD157	0.51	BF166	0.50
AF118	0.58	BC169C	0.15	BC317*	0.15	BD158	0.75	BF167	0.38
AF121	0.68	BC170*	0.15	BC318*	0.15	BD159	0.68	BF173	0.35
AF124	0.38	BC171*	0.15	BC319*	0.19	BD160	2.69	BF177	0.36
AF125	0.38	BC172*	0.14	BC320	0.17	BD163	0.67	BF178	0.46
AF126	0.36	BC173*	0.22	BC321A&B	0.18	BD165	0.66	BF179	0.58
AF127	0.86	BC174A & B		BC322	0.28	BD166	0.88	BF180	0.53
AF139	0.58		0.26	BC323	1.15	BD175	0.90	BF181	0.53
AF147	0.52	BC176	0.22	BC327	0.16	BD177	0.58	BF182	0.44
AF149	0.45	BC177*	0.20	BC328	0.18	BD178	0.92	BF183	0.52
AF178	1.35	BC178*	0.22	BC337	0.17	BD181	1.94	BF184	0.44
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	2.10	BF185	0.42
AF180	1.35	BC182*	0.15	BC340	0.19	BD183	1.34	BF186	0.42
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD184	2.30	BF194*	0.14
AF186	1.48	BC183*	0.14	BC348A & B		BD187	1.20	BF195*	0.13
AF202	0.27	BC183L*	0.14		0.17	BD188	1.25	BF196	0.14
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF198	0.29
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25
AL103	1.58	BC187	0.27	BC360	0.59	BD233	0.62	BF218	0.42

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
BF244*	0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.48	2N3906	0.20
BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
BF257	0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
BF262	0.73	BU102	3.38	OC44	0.68	2N1164	10.29	2N4292	0.32
BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
BF271	0.42	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
BF272A	0.80	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
BF273	0.33	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
BF274	0.34	BU205	2.58	OC81D	0.95	2N1711	0.47	2N5061	0.30
BF336	0.63	BU206	2.59	OC139	1.30	2N1893	0.52	2N5064	0.63
BF337	0.65	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
BF338	0.68	BU407	1.38	OC170	0.80	2N2217	0.56	2N5087	0.50
BF355	0.72	BUY77	2.50	OC171	0.82	2N2218	0.38	2N5208	0.59
BF362	0.49	C106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
BF363	0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
BF367	0.29	C111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
BF457	0.46	E300	0.42	OCP71	1.98	2N2401	0.80	2N5449	0.18
BF458	0.49	E1222	0.47	ON236A	0.94	2N2484	0.35	2N5457	0.48
BF459	0.52	E5024	0.19	R2008B	2.72	2N2570	0.74	2N5458	0.40
BF594	0.16	GET872	0.46	R2010B	2.79	2N2646	0.82	2N5459	0.58
BF596	0.17	ME0402	0.18	R2322	0.75	2N2784	1.15	2N5494	0.85
BF597	0.27	MF0404/02	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
BFR39	0.30	ME6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.56
BFR40	0.29	ME6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
BFR41	0.30	MJ2955	1.30	TIC44	0.25	2N2905*	0.39	2N6122	0.60
BFR50	0.29	MJ3000	1.58	TIC46	0.35	2N2906*	0.36	2N6178	1.07
BFR52	0.33	MJE340	0.68	TIC47	0.45	2N2926G	0.15	2N6180	1.39
BFR61	0.29	MJE341	0.72	TIP29A	0.47	2N2926O	0.14	2N6211	2.74
BFR62	0.28	MJE370	0.74	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
BFR79	0.30	MJE371	0.79	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
BFR80	0.29	MJE520	0.85	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
BFR81	0.30	MJE521	0.95	TIP32A	0.56	2N3054	0.66	2SC930D	1.50
BFR88	0.42	MJE2955	1.20	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
BFT41	0.48	MJE3000	1.95	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
BFT43	0.55	MJE3055	1.22	TIP34A	0.84	2N3254	0.58	2SD234	1.48
BFW11	1.02	MPF102	0.40	TIP41A	0.72	2N3391A	0.38	3N128	1.60
BFW30	2.58	MPS3702	0.33	TIP42A	0.80	2N3633	0.60	40250	0.98
BFW59	0.19	MPS3705	0.30	TIP2955	0.77	2N3703	0.17	40251	1.14
BFW60	0.20	MPS6521	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
BFW90	0.65	MPS6523	0.36	TIS43	0.44	2N3705	0.17	40361	0.48
BFX29	0.38	MPS6566	0.44	TIS73	1.36	2N3706	0.16	40362	0.50
BFX84	0.42	MPSA05	0.30	TIS90	0.23	2N3707	0.18	40410	0.94
BFY50	0.38	MPSA06	0.32	TIS91	0.28	2N3708	0.17	40429	0.88
BFY51	0.37	MPSA55	0.43	ZTX108	0.14	2N3715	1.70	40530	0.79
BFY52	0.36	MPSA56	0.45	ZTX109	0.16	2N3771	2.09	40595	1.39
BFY53	0.36	MPSA93	0.56	ZTX213	0.23	2N3772	2.08	40603	1.13
BFY90	1.98	MPSL01	0.33	ZTX300	0.16	2N3773	2.90	40636	1.25
BPX25	1.62	MPSU01	0.61	ZTX304	0.26	2N3794	0.40	40654	0.89

Alternative gain versions available on items marked*. For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)	Type	Price (£)	Type	Price (£)
BRC1330	0.93	SN76003N	3.32	TBA240A	3.98
CA810QM	2.44	SN76013N	2.52	TBA281	2.07
CA3005	1.85	SN76023N	3.02	TBA395*	2.58
CA3012	1.45	SN76023ND	2.52	TBA396	2.40
CA3014	2.23	SN76033N	3.32	TBA400	2.20
CA3018	0.71	SN76023ND	1.40	TBA480Q	1.84
CA3020	1.89	SN76033N	2.20	TBA500*	2.21
CA3028A	0.80	SN76110N	1.20	TBA510*	2.21
CA3028B	1.09	SN76115N	1.62	TBA520*	2.98
CA3045	3.75	SN76116N	1.78	TBA530P	2.24
CA3046	0.70	SN76131N	2.10	TBA540*	2.88
CA3065	1.74	SN76226N	2.60	TBA550*	3.13
CA3068	1.90	SN70227N	1.61	TBA560C*	3.18
CA3130S	1.57	SN76228N	1.80	TBA570*	1.29
FCH161	2.40	SN76502N	1.92	TBA611B	2.68
FCJ101	3.32	SN76530P	0.97	TBA641	2.55
LM309K	1.98	SN76533N	1.38	TBA641A12	2.55
LM380N-14	1.65	SN76544N	1.85	TBA641B11	2.90
LM1303N	1.03	SN76546N	1.85	TBA651	2.42
MC1307P	1.82	SN76570N	1.81	TBA673	2.31
MC1310P*	1.84	SN76620AN	0.99	TBA700*	2.50
MC1312P	2.34	SN76650N	1.48	TBA720AQ	2.38
MC1327P*	1.86	SN76660N	0.84	TBA720Q	2.38
MC1330P	0.83	SN76666N	0.96	TBA750*	2.18
MC1350P	1.22	TA7073P	3.51	TBA800	2.05
MC1351P	1.42	TAA263	2.20	TBA810AS	2.00
MC1352P	1.42	TAA300	3.85	TBA920*	2.80
MC1357P	2.92	TAA320	1.10	TBA940	3.52
MC1358P*	2.30	TAA350A	2.48	TBA950	2.08
MC1458G	1.43	TAA370A	3.18	TBA990*	2.90
MC1496L	1.15	TAA435	1.70	TCA270A*	3.55
MC3051P	0.58	TAA450	3.39	TCA280A	1.43
MFC400B	0.85	TAA521	1.10	TCA290A	3.46
MFC4060A	0.98	TAA522	2.09	TCA420A	2.10
MFC6040	1.11	TAA550	0.35	TCA440	1.67
MFC8020A	1.10	TAA560	1.93	TCA840	4.26
ML231	3.57	TAA570	2.20	TCA650	4.26
ML232	3.57	TAA611A	1.67	TCA660	4.26
NE555	0.72	TAA611B	1.89	TCA730	4.10
NE556	1.34	TAA621AXI	2.33	TCA740	4.04
NE566	1.95	TAA630Q	3.91	TCA750	2.53
SAA1024	5.70	TAA630S	4.18	TCA760	1.52
SAA1025	10.35	TAA661A	2.39	TCA820	3.29
SAS560A	2.01	TAA661B	1.75	TDA440	4.16
SAS570	2.01	TAA700*	2.80	TDA1003	1.68
SC9503P	1.40	TAA840	3.38	TDA1004	2.73
SC9504P	1.38	TAA861A	0.95	TDA1005	3.04
SL414A	1.91	TAA930A	1.43	TDA1022	6.89
SL432A	2.52	TAA930B	1.43	TDA1024	0.97
SL450	5.10	TAA960	3.20	TDA1034	2.98
SL901B	4.20	TAA970	2.81	TDA2610	2.86
SL917B	5.60	TAD100	2.66	TDA2640	2.86
SL918A	5.95			ZN414	1.45
SN72440N	2.21	TBA120A	0.90		
SN76001N	1.67	TBA120S*	0.99		
SN76003N	2.20	TBA120SA	1.02		
		TBA231	1.12		

* Indicates Q version is also available.

DIODES

Type	Price (£)	Type	Price (£)
AA113	0.17	BY114	0.60
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	3.86	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	0.26
BA115	0.17	BY238	0.25
BA116	0.56	BYX10	0.30
BA121	0.85	BYX38/600	0.70
BA129	0.45	BYX70/500	0.53
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	0.48	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	£1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each
75W stud	7.5-75V	£7.95 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
R53	1.75
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	0.68

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.63
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY88/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	2.00
PCL82	0.93
PCL83	1.12
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
PL508	1.85
PL509	3.10
PL519	3.10
PL802	3.25
PY81/P810	0.60

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%) — *10 of one value*; *Mixes of a minimum of 10pcs of any value:*

	Ea	10 of one value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.40	£6.40
¼W 10Ω-10MΩ (E24)	3p	25p	95p	£1.40	£6.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£28.90

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 £3.68
50, 63mA £2.55
100mA £1.86
160, 200, 250mA £1.44
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A all £1.19

20mm quick-blow (BEAB)
100mA 68p
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A all 56p
2A circuit breakers metal £1.52, plastic £1.48

LABGEAR (Details of full range on request)

TELETEXT ADAPTOR 7056. An amazing box which can be used with any UHF Receiver. £213 + £2.25 P&P + VAT. – ask us for a fully descriptive brochure.
VIEWDATA ADAPTOR 7050. Prices and details on request.

COLOUR BAR GENERATOR

CM6052/DB. VHF/UHF gives standard 8 band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster + crosshatch + greyscale stepwedge + colour bar + centre cross + dot pattern + centre dot. **£223.37**

CAPACITORS

Metallised Paper

2n2F	1500V DC	60p	10nF	500V AC	80p
2n2F	600V AC	24p	15nF	300V AC	30p
3n6F	1700V DC	60p	22nF	300V AC	32p
4n7F	1500V DC	60p	100nF	1000V DC	46p
10nF	1000V DC	22p	470nF	1000V DC	60p

H.V. Disc Ceramic (†)

1kV	1.5nF	18p
3kV	1.5nF	20p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
8kV	270, 300pF	39p
10kV	1nF	67p

MULTIMETER
20,000 OPV
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DC Range 0·6-1200
Complete with rechargeable batteries.
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CONVERGENCE POTENTIOMETERS
5, 7, 10, 15, 20, 50, 100, 200, 500Ω †38p each

VHF to UHF CONVERTER CM6022/RA. "Televerta" for DX-ing or uhf receiver use on relay systems, Eire etc. †£28.37

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TELEVISION

COVER PHOTO
Our cover photograph this month shows the printed-circuit boards (main and c.r.t. base) used in the new Decca/Tatung 120 series chassis. Our thanks to Tatung (UK) Ltd. for supplying this.

CORRECTION
The value of the capacitor added across transistor T1535 in the Philips K30 and KT3 chassis (to increase the field flyback blanking period) was given as 15pF instead of the correct 0·015μF on page 409 of our June 1981 issue (see Service Notes from Philips).

LLJ
Les has been inundated with sets that keep going hrrrump bonk. Never fear, he'll be back with us next month.

QUERY SERVICE
We regret the need to increase the charge for replying to readers' servicing queries to £1 (including VAT) from this issue. It's some two years since the charge was last increased, and inflation continues to affect our costs.

Futurology

Maybe I'm getting old, or maybe some real change in human expectations has come about, but whichever it is I find it harder and harder to look into the future and see anything other than more of the same – plus some rather grisly thoughts, such as will all those military rockets and things remain unused? It wasn't always the same. There was a time when you could really see the world changing around you – "modern architecture", the streamlining of cars, trains, household appliances, and so on. The 1939-45 war produced, as wars usually do, major technological breakthroughs, and for those of us then young the prospect seemed to be one of endless scientific innovation. For a time it appeared to be turning out just so. The breaking of the sound barrier; the discovery of the transistor effect and the consequences this had for electronics; the achievement of rocket thrust sufficient to escape gravity; nuclear power; the development of computers both large and small – to name only some obvious items. More recently, men have walked on the moon, rockets have sent pictures back from Saturn, while satellite communications have, in one sense, made the world a smaller place. Yet we don't seem to be all that good at feeding ourselves, keeping the peace, or providing even basic amenities for a large proportion of mankind.

In the past, some prophets have been remarkably perceptive. *Wireless World* last month reprinted Arthur C. Clarke's famed article of October 1945, in which he predicted satellite broadcasting and communications. At that time it was still an open question as to whether rocket propulsion could ever attain the velocity required to achieve an orbital station. Despite that, Arthur Clarke was able to predict a complete system – the orbital positions for geostationary satellites, and transmitter powers and frequencies. He was a bit out in mentioning solar engines "which employ mirrors to concentrate sunlight on the boiler of a low-power steam engine", but did go on to talk of "photo-electric developments (that) may make it possible to utilise the solar energy more directly." In fact he got it about 95% right, which was truly remarkable (he'd certainly done his homework first).

The field of radio/electronics has never been short of prophets – predictions of television, stereo and so forth go back far in time. The only thing that wasn't foreseen was the development of semiconductor technology – the transistor was discovered almost by accident, though once it was understood all manner of developments followed. Right now however one has this feeling that most of what's feasible has already been achieved. Three-dimensional TV is still not a practical proposition; there are those who feel that larger displays with high-definition TV systems are a prospect for the not too distant future; there's all this talk about the information age; and those video discs haven't yet reached the high street shops. Let's look at these briefly.

I remember seeing 3-D TV at an Earl's Court Radio Show in the fifties: very good, but you had to wear special glasses. A cable company in California experimented with 3-D TV some months back, using specially processed tapes, but again the viewer required special glasses. At this Summer's Chicago Consumer Electronics Show, Matsushita demonstrated a system in which left- and right-eye signals from a pair of cameras were displayed on alternate fields – the special glasses this time had shutters that were synchronised with the left- and right-eye fields. No one would be very happy watching for any length of time under these conditions.

A lot of work seems to be going into the development of high-definition TV systems at present – with 1,000 lines or so. Apart from bandwidth, the problems are not all that great, but the fact is that 625 lines provide perfectly adequate definition for viewing under normal domestic conditions. In fact some of the work on high definition TV seems to have more to do with achieving equivalent definition to 35mm film, with the aim of simplifying programme making. As for the information age, the computer has indeed enabled vast stores of information to be easily tapped – but how many people need access to it, and for what purposes? Very few one suspects, and only for specific reasons such as stock control and so on. More important is the way in which the microprocessor has added a new dimension to automation, but that's another matter entirely.

The video disc is already giving rise to second thoughts – because the more versatile VCR has established itself so rapidly. Discs may be cheaper and give superior quality, but once people have become used to cassettes and to recording what they want when they want, will they take to discs as a second source of video material?

One's left with the feeling that apart from shoving a dish aerial on the roof in a few years' time, dual-channel sound, and continuing improvements to existing video/TV hardware, there's not all that much to look forward to. Does it matter? Well, it could be a part of the reason for the advanced economies running out of steam, and if that gets much worse one wonders how the wider problems of poverty, decay and so on can ever be tackled.

Teletopics

PRESTEL CUT-BACK

British Telecom are to close down 14 of the 20 Prestel computers, giving a saving estimated at around £1 million a year. The original computer network seems to have been based on the assumption that by now hundreds of thousands of domestic subscribers would be using the service, something that hasn't happened and doesn't seem likely to. The total number of installations has now passed 13,000, and is increasing at 500 per month – almost entirely business users. Philips/Pye are understood to have around 40% of the market and Thorn 17%. British Telecom emphasise that the computer cut-backs will in no way affect existing users of the service – the six remaining computers will be adequate to serve some 250,000 Prestel installations. Additional services are being introduced – "gateway" to provide access to third-party computers, and "mailbox" to provide an electronic message facility. The latter service will be restricted to the Croydon computer initially, but will become available nationwide in 1983.

VIDEO DISC LATEST

Philips have now officially postponed the UK launch of their LaserVision video disc system – the aim now is for a launch early next year. The reason for the delay is problems with getting an adequate disc yield from the Blackburn disc pressing plant. Though computer-based test equipment has been installed, all discs at present have to be viewed throughout for adequate quality control – new test equipment is being developed at Eindhoven. Philips point out that the technical problems of producing the discs are akin to those of i.c. manufacture, so that teething problems are to be expected. The view is that customers will not buy the players until an adequate catalogue and stock of discs is available.

Meanwhile JVC have clarified the current position of their VHD disc system. Modifications have been introduced to achieve world-wide compatibility – NTSC discs will be playable through PAL/Secam players and vice versa. On 625-line receivers there's some small loss of picture area at the top and bottom of the screen when a 525-line disc is being replayed, but the colour is decoded and the player functions normally in every other respect. Extra signals are being added on the discs to indicate to the player the coding system used – the player then automatically switches to provide correct decoding for the receiver in use. This systems compatibility is a major technical advance, though viewers will normally use discs conforming to their local TV standard.

It seems that the sales of RCA Selectavision video disc players in the USA have not quite been up to expectations – some 40,000 players were sold initially. RCA's director of market planning for the system is placing emphasis on the growing disc catalogue – in a message to dealers, he commented that "there's a positive correlation between the number of titles stocked and players sold."

Sales of LaserVision players in the USA have also now reached 40,000, though this is the total for the first two years following the system's initial launch on a limited market basis. The problem for Philips in Europe is that the vital lead they originally had over the cheaper JVC VHD system is fast disappearing: Philips apparently have some 200,000 players stockpiled ready for the European launch of LaserVision, but players without discs are not a sustainable marketing proposition.

Now if you could record on video discs as well as playing them back, the prospects for discs would be bright indeed. Matsushita (JVC's parent company) seem to be moving in this direction. At the Chicago Consumer Electronics Show this summer they exhibited a still-picture record/playback disc system – the 8in. disc can hold 15,000 frames of information, with access to individual frames in half a second. That number of frames would of course provide inadequate playing time for moving pictures. The recorder/player uses a laser, with different power levels for recording and playing back. On record, the laser alters the optical characteristics (reflectivity) of the groove. Address signals are provided on the disc to control the laser beam's position for stable recording and playback.

FULL CIRCLE

Once upon a time we had valve line output stages, with feedback within the stage to provide width/e.h.t. regulation. Then came the transistor line output stage, which can't regulate itself so that it has to be used with a regulated power supply. Ever since, there's been a tendency for the switch-mode regulated power supply to become more closely integrated with the line output stage – we've had Syclops, Ipsalo and so forth. The latest design emanating from the Philips laboratories brings us full circle – one transistor and one transformer providing both the line scan/e.h.t. and regulation.

The basic circuit is shown in Fig. 1, and as you'll observe takes the basic system used in the Thorn TX10 chassis a step further. As with the TX10, the arrangement uses a chopper transistor, three diodes, a couple of capacitors, a transformer and a coil, but instead of a secondary winding on the transformer driving a separate (though simple) line output stage the winding drives the scan coils directly – via the usual scan-correction capacitor (C4) of course.

Tr1 acts as a parallel chopper with T1 and L1, the transformer also being used to provide mains isolation. Let's briefly consider the basic action. When Tr1 switches on, current flows via L1 and T1, increasing linearly. When Tr1 switches off, the voltage across L1 reverses and C2 charges via D4. C2 is in effect the chopper supply reservoir capacitor, the voltage developed across it depending on the transistor's on/off times. C2 also receives a charge via D3, since D3/C2/T1 form a conventional efficiency diode circuit. Surplus energy is returned via D2 to the mains rectifier's reservoir capacitor C1. C3 tunes the primary winding of T1 to provide the flyback pulse.

By tapping the coil, the circuit conditions enable the

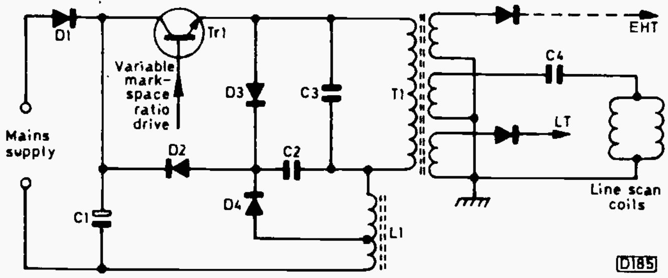


Fig. 1: Parallel chopper circuit which drives the line scan coils directly from a secondary winding on the transformer.

value of the flyback tuning capacitor to be selected so that, without having to increase the transistor's maximum voltage rating, the scan coils can be driven from a secondary winding on the transformer – in the TX10, the "flyback" pulse is used only to provide an input to the diode-split e.h.t. rectifier system.

The new circuit will operate with mains voltages between 165-265V. The source impedance of the e.h.t. system is low (i.e. good e.h.t. regulation), and the overall power consumption is less than 40W. It seems bound to turn up in someone's chassis sooner or later.

TELETEXT RETROFIT KIT

ITT have introduced a simple teletext "retrofit" kit to enable remote control versions of their current 22in. and 26in. Trimline models to be converted for teletext use "in a matter of minutes". The conversion kit has three colour-coded plug-in connectors, and can be held by the dealer in his showroom and used to convert existing stock as required. The idea is to be able to sell "teletext ready" sets to customers who are hesitant about whether or not they want teletext. ITT also report that 35% of all TV sets now being sold feature some form of remote control.

NEW THORN PORTABLES

The latest Thorn portables – the 1696-1697 series – employ a compact, horizontally mounted panel with low component count – five i.c.s, including the 33V stabiliser, and seven transistors. The i.f. strip uses a BF199/SAWF/TDA440 combination, the intercarrier sound/audio channel a TDA3190, the field timebase a TDA1044 and the sync/line generator department a TDA1180. A BC308A is used for a.g.c. inversion, a BF391 for video output and a BU807 as the line output device. The series regulator is a bit unusual for Thorn in employing a differential amplifier as the error detector. Rotary tuning is retained with the varicap tuner, and the tube operates with a 90V first anode supply. Initial models are the 38000 and 38010 (12in.), and the 3870 and 3871 (14in.).

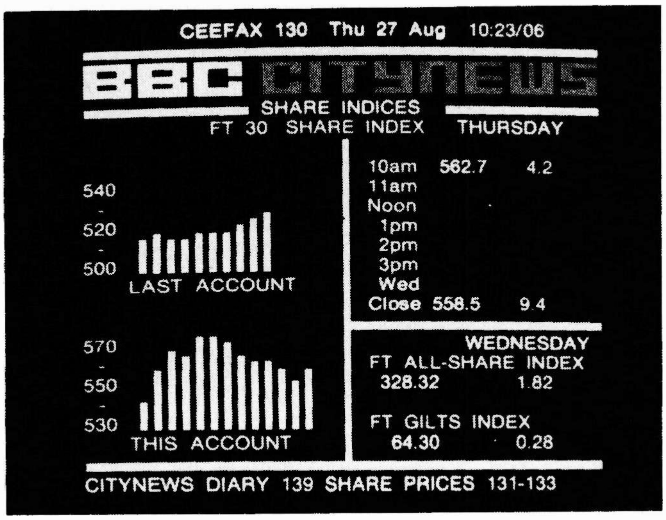
TAKE IT TO SOTHEBY'S

Amongst the things now being handled by the Belgravia, London branch of Sotheby's is vintage TV sets. At a recent auction a set dating from the late forties, with a walnut-veneered cabinet and 13in. viewing mirror in the top, sold for £286. The set also incorporated a radio receiver. Our report didn't mention the make, but it sounds like one of those EMI sets (see for example our October 1980 issue).

ENHANCED TELETEXT

As part of a development programme supported by the Department of Industry, the BBC has produced equipment for use in studying the enhancement of the UK teletext system. One of the initial uses was in the development of an improved teletext decoder using high-quality character generation. When the teletext specification was written five years ago, improvements were anticipated and the shape and style of the characters were left undefined: spare signalling capacity was provided to enable improved character sets to be used. Advances in i.c. technology have now made such character generators, which are compatible with current transmissions, feasible, and it's expected that manufacturers will in due course provide the option of decoders that give higher-quality character displays.

Further use of the equipment will be in investigating coding methods for high-quality graphics, using the redefinable character, alphageometric and alphaphotographic techniques. Demonstrations have already been carried out at the June IEEE Conference in Chicago and at the Berlin Radio Show.



This photograph of the Ceefax Citynews Diary page shows the much improved text quality that can be obtained from recent BBC teletext transmissions.

VIDEO PROGRAMME VENTURE

Thorn EMI Video Programmes and MCA Video Disc have formed a joint venture international video programme production company based in Los Angeles. The aim is to draw on the resources of the two partners and to produce video programmes anywhere in the world, with the emphasis on material for the VHD and LaserVision disc systems (MCA produce the LaserVision discs in the USA). It seems that the movie world is fast moving into video, which brings us to our next item.

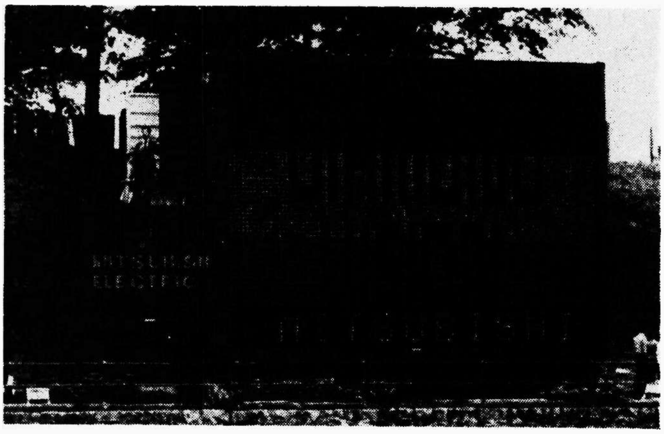
HIGH-DEFINITION TV

Various firms are working on high definition TV systems. Sony recently demonstrated a 1,125-line, 60-field system, and in Europe a 1,250-line system has been proposed. Since the latter is 2 × 625 lines, the idea is that a dual-standard signal source could be provided, with every other line being used for 625-line equipment. The higher-definition signals would be used with large-screen projectors. The Sony system, which uses three 30MHz RGB channels, is aimed at giving picture quality at least equal to that obtained with 35mm. film. The idea is to simplify programme production, with the programme material stored using a new 1in., wideband tape system. It's understood that the system matches up with conventional standards conversion coding arrangements.

NEW VCRs

New "basic" VCRs have been introduced by JVC and Ferguson – Models HR7200 and 3V29 respectively. The machines have similar specifications but differ markedly in styling and control layout. Ferguson have also introduced an up-rated version of the machine, Model 3V30, featuring Dolby noise reduction, a more sophisticated timer unit, and remote control as standard. There is no JVC equivalent to this machine, whose specification was devised by Thorn.

Also new to the Thorn range is the 3V28



The world's "largest portable colour television", the Mitsubishi "Diamond Vision". The picture is produced by a matrix of 192 × 130 2in. colour tubes. Photo by George Egerton.

tuner/timer/mains adaptor/battery charger unit, which is designed for use with the 3V24 portable VCR. The new combination enables eight programmes to be recorded over fourteen days, with serial recording if required. There's also a ten-minute battery back-up facility for clock and programming.

Philips have introduced two new V2000 system machines, the VR2021 which replaces the original VR2020, and the VR2022 which includes the additional features of freeze-frame and fast picture search both forwards and backwards.

CLEANING TAPE FROM SONY

Sony have introduced a cleaning cassette, type L25CL, for use with Betamax VCRs. The cassette is inserted, run for half a minute, then removed without rewinding. If an obvious improvement with a short test recording is not obtained, the machine requires servicing attention. The tape, which should give some 200 cleaning operations, is expected to retail at around £10.

MANOR SUPPLIES TEST GENERATOR

The new Mk. V colour test pattern generator from Manor Supplies certainly has a lot to offer for £90·50 (kit plus de-luxe case, VAT and post/packing). There are 40 different patterns and variations, available at u.h.f. or video, for checking TV sets and VCRs. The kit is easy to build, with only two adjustments – no special test equipment is required. The u.h.f. output is to broadcast standard, fully interlaced and with correct picture blanking.

NEWS FROM GRUNDIG

Grundig have introduced a new range of nine TV sets in the UK, with screen sizes from 14½in. to 26in., using the new Grundig Compact Universal Chassis. The remote control models can be converted for teletext operation simply by fitting an extra PCB.

Looking ahead, Grundig have secured a technical agreement with the Japanese developers of the Funai compact cassette combined video camera/recorder. The Funai "cam-corder" was shown by Sulkin at the May trade shows earlier this year. Grundig's agreement includes PAL system rights.

A few early Grundig 2 × 4 VCRs had lip synchronisation problems when used with cassettes recorded on Philips V2000 series machines – due to the sound heads being mounted in slightly different positions. The machines concerned have serial numbers whose first three digits of the six digit number are 009 or less – the number is on a yellow and orange label at the back. Grundig have now offered to modify these machines free of charge.

MITSUBISHI'S DIAMOND VISION

Heralded as "the largest portable colour television in the world", Mitsubishi's "Diamond Vision" was installed opposite Caernarfon Castle to relay the Royal Wedding live earlier this year. The massive screen, 6 × 8m (i.e. almost 40ft.), consists of a matrix of 24,960 separate 2in. red, green and blue c.r.t.s arranged in RGRGRG and GBGBGB form on alternate rows, i.e. there are twice as many green tubes as blue and red ones. Reader Glyn Dickinson reports that the picture was sharp, even in bright sunlight – and the geometry first class! Sound is provided by horn speakers mounted above the screen, computer techniques being used to form the picture, i.e. generate the drives to the c.r.t.s. Apparently Mitsubishi have four of these displays world wide, the other three being permanently sited in Japan and the USA.

AERIAL EQUIPMENT

Wolsey Electronics have introduced a new range of high-gain aerials with multidirector assemblies. There are two models, the HG20 with eight director assemblies and the HG36 with 16 director assemblies. Gain figures quoted are 15dB and 18dB respectively. The HG36 offers an improved beamwidth (±15°) and front-to-back ratio.

Antiference have introduced a new range of single-stage masthead preamplifiers – Models UP1300/W and UP1300/V for u.h.f. and v.h.f. respectively. There are accompanying power supplies and diplexers.

TRANSMITTER NEWS

The following relay transmitters are now in operation:

Belcoo (Fermanagh) Ulster television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.

Braemar (Scotland) BBC-1 ch. 39, Grampian Television ch. 42, BBC-2 ch. 45, TV4 (future) ch. 49.

Bushmills (Co. Antrim) Ulster Television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.

Cilfrew (Glamorgan) BBC-Wales ch. 39, BBC-2 ch. 45, HTV-Wales ch. 49, Sianel 4 Cymru (future) ch. 52.

Gortnalee (Fermanagh) BBC-1 ch. 21, Ulster Television ch. 24, BBC-2 ch. 27, TV4 (future) ch. 31.

Gulval (Cornwall) Westward Television ch. 23, BBC-2 ch. 26, TV4 (future) ch. 29, BBC-1 ch. 33.

Plymouth (Victoria Park) BBC-1 ch. 40, Westward Television ch. 43, BBC-2 ch. 46, TV4 (future) ch. 50.

Lavington (Wiltshire) BBC-1 ch. 21, HTV-West ch. 24, BBC-2 ch. 27, TV4 (future) ch. 31.

Workington (Cumbria) TV4 (future) ch. 54, BBC-1 ch. 58, Border Television ch. 61, BBC-2 ch. 64.

The above transmissions are all vertically polarised.

The Home Office has approved the use of two extra lines per field for teletext transmissions. The following lines will be used: 15, 16, 17, 18. Under the terms of the IBA's Code for Teletext Transmissions, advertising pages may not exceed 15% of the total number of pages and adverts carried on otherwise editorial pages may not exceed 15% of the page area.

TV Receiver Design: The Decca/Tatung 120 Series

Ray Wilkinson

HANDEL is supposed to have taken only three weeks to produce the "Messiah", but he used material he'd written previously. Looking at my notebook I see that our laboratory at Bradford developed the Decca 120 colour chassis in about a year though, as you'll see, we used some "previous material" in the form of proven circuitry from the preceding 70/90/110 series chassis.

Design Considerations

Before going into the details of the new chassis I'll summarize briefly some of the factors we had to consider in arriving at the final design. This will illustrate why particular electronic and mechanical arrangements were adopted.

First, the range of models. We started off by producing a low-cost 14in. colour portable for the UK market. The early prototypes looked good, so we thought maybe it would drive bigger tubes successfully – say 20in. ones. Then we thought we might be able to adapt it for v.h.f. reception for export. And so, quite soon, the basic requirements expanded to cover the full range of possibilities – driving 14-22in. 90° tubes and 22-26in. 110° tubes, with receivers for the home and export markets. In other words, the chassis had to be capable of working in a sophisticated full-facility large-screen set as well as our original starting point, a bottom of the range portable. This meant a small chassis with very good performance, easily adaptable to different broadcast standards and colour systems and to more sophisticated control and channel selection arrangements. On top of which it had to be inexpensive to produce!

To cater for the variety of control arrangements envisaged, with infra-red remote control one of the options, all the customer controls (colour, brightness, contrast and volume) had to operate with d.c. voltages. In order to drive the 30AX 110° tube on the other hand slightly different timebase circuitry was required: this variant came to be known as the 130 chassis. At least three-quarters of the 120 and 130 series chassis are identical however, reducing considerably the design, manufacturing, testing and servicing problems.

Our other main objectives with the design, compared to our previous chassis, were: cost reduction; as good or better performance, particularly in respect of the picture and sound quality and reception under adverse signal conditions; and as good or better reliability.

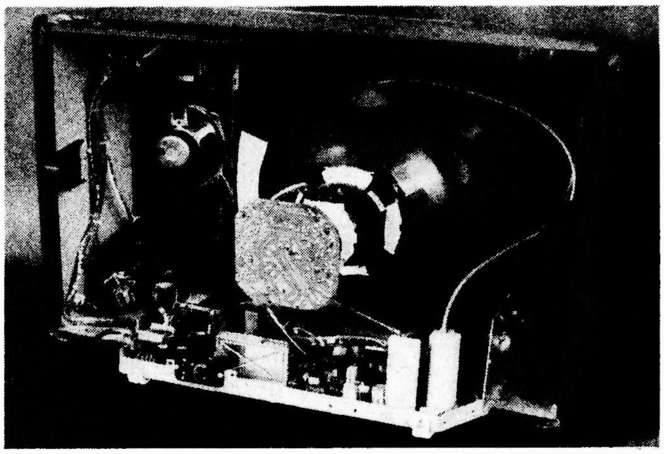
Let's take cost reduction first. It's comparatively easy to reduce costs if performance and/or potential reliability are degraded. This doesn't do your reputation much good however. We went about the problem by reducing the component count (these chassis use the least number of components of any chassis known to us); by reducing the size (and quantity) of printed circuit boards – all the circuitry except that on the c.r.t. base panel is on a single board; and by improvements in production methods – for example a larger percentage of the components are auto-inserted, which provides the bonus of increased consistency with a dramatic reduction in the number of rejects at the test station. The auto-insertion machine determined the maximum size of the main board – two of them can just be accommodated on its table.

The standard of performance achieved is the result of careful attention in the design to each parameter, usually working in close contact with i.c. manufacturers whose recommendations for device usage often require modification and some redesign before they can be used in a practical receiver design that's to go into large-scale production. We've optimised the transient response of the i.f. and video amplifiers for the display of text, and have retained the adaptive sync separator with field sync count-down (as in the 70/90/110 series) to obtain the best sync performance under peculiar signal conditions.

Good reliability is something that comes through close control at each stage of design and manufacture. In designing the chassis we had to ensure that no combination of tolerances can result in any component (particularly semiconductor devices) being overrun due to either excess voltage, current or power, even at the highest or lowest temperatures and humidities in which the sets are likely to be operated (and, believe me, some countries are very hot and wet and some have peculiar leaping-about mains supplies!).

In manufacture, reliability has been ensured by techniques such as goods inwards component checking; sophisticated and rapid automatic testing of all appropriate voltages and currents in the sets, using microprocessor-controlled machines which have been designed and built in-house and allow for operator checks and adjustments as required; giving each receiver a 24-hour soak test before carrying out final checks and boxing; and by quality control checks on samples taken from each batch of receivers.

Even that's not the end of the story. Any faults that show up during the 24-hour soak test are analysed and, if



Interior view of one of the prototype receivers.

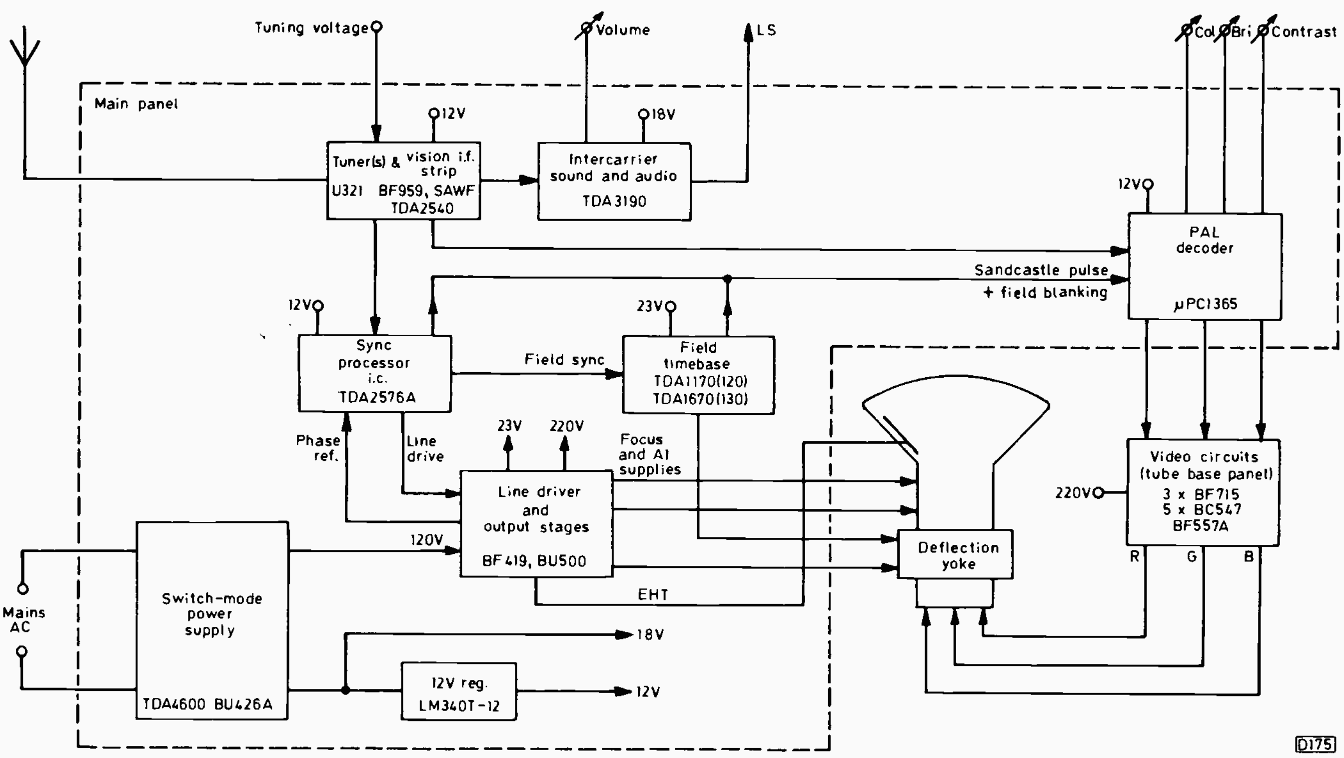


Fig. 1: Simplified block diagram of the 120/130 series chassis.

there's a fault pattern rather than random failure, corrective action is taken – either in the manufacturing process, or with the component supplier, or if necessary by reconsidering the design.

The Sets Themselves

Now let's take a closer look at the sets themselves. We've retained the simple DZUS fastener for fixing the cabinet back. On removing the back however anyone familiar with previous Decca receivers will immediately notice a difference (see the accompanying photograph). With the simpler, smaller chassis (comparable in size to a monochrome set), we've fixed it at the bottom of the set rather than mounting it vertically with the hinge-up servicing position previously provided. A servicing position has not been forgotten however, though we hope it won't be needed: you just loosen two screws and a plastic clip holds the chassis vertically, giving access to both sides.

The 120 chassis is a true single-panel design, with no plug-in or soldered-in subpanels. The mains filtering, degaussing, power supply, timebase, PAL decoder and i.f. circuitry, plus the tuner(s), are all on the one board, with the video circuits on the tube base panel – the best place for them. The metalwork has also been reduced to a minimum: just a simple strengthening bar at the back and a few heatsinks. Dual-standard PAL/Secam sets require an extra plug-in subpanel, allowance for the plug being included on the main panel.

The Electronics

A simplified block diagram of the chassis is shown in Fig. 1: most of the semiconductor devices used in the chassis are indicated.

The tuner(s) and the i.f. section are virtually identical to those employed in the 70/90/110 series chassis, since nothing giving comparable performance at the same cost is available in quantity so far. One change here is the use of a single-transistor preamplifier stage to replace the SL1430 i.c. previously used to make up for the insertion loss of the SAW filter. The sound department employs an SGS TDA3190 combined intercarrier/audio chip – this is basically the same as the TDA1190Z we used previously, the new i.c. having a slightly cheaper package.

The field timebase employs the trusty TDA1170 i.c. from SGS (and others now). We've used this chip since 1975 (I believe we were the first UK setmaker to use it, in the 80 series chassis). The 30AX tube calls for higher scanning power, so the 130 chassis uses a TDA1670 i.c. in the field timebase.

The TDA2576A sync processor i.c. is one we've not used before. I'll return to this later.

The line output stage is traditional, with a line output transformer and a tripler in preference to the use of a diode-split line output transformer. We still don't feel that the latter has significant cost or reliability advantages in comparison with the conventional system, while there can be problems with the breathing performance and radiation into the rest of the receiver. In addition, having to replace the complete transformer because of a faulty diode is expensive! The new line output transformer we've used is quite a bit smaller than previous designs, and the tripler is the new Mullard BG200. We're also using a new thick-film potted resistive unit for both the focus and c.r.t. first anode supplies.

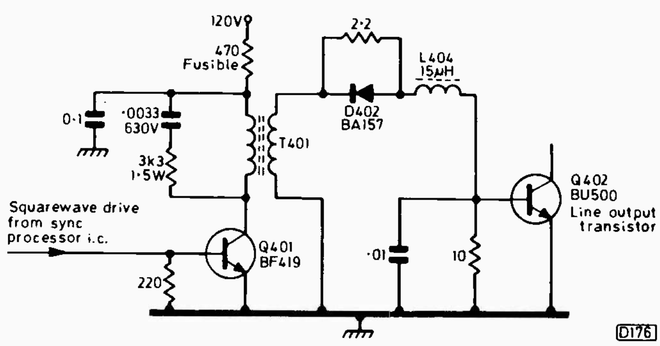


Fig. 2: The line driver stage.

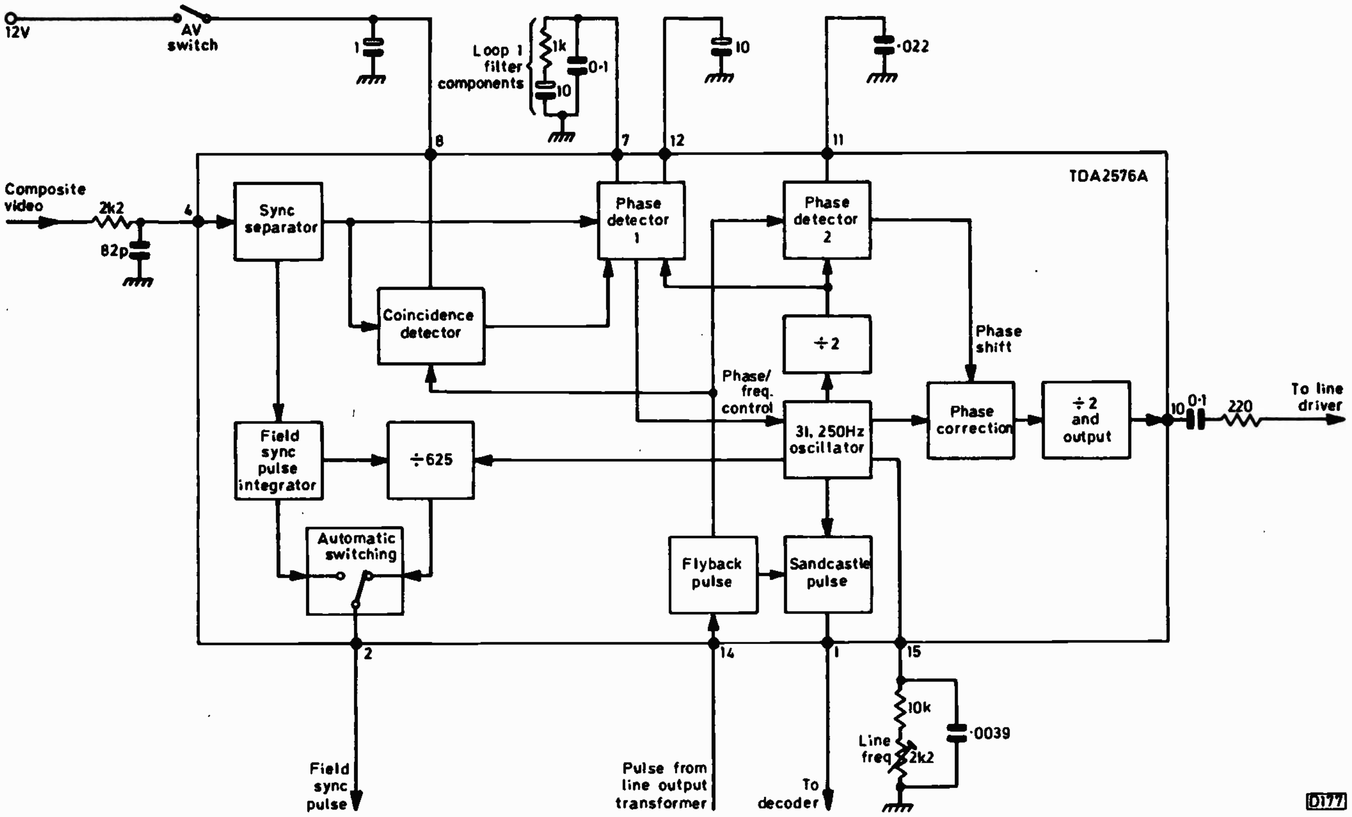


Fig. 3: Simplified block diagram of the TDA2576A sync processor i.c.

The 90° tubes we're using are from a new pincushion-distortion free range produced by Toshiba and Mullard. So we don't need the transductor circuitry used in the 70/90 series chassis. The 110° 30AX tube still requires some EW correction, which is provided on the main board by a simplified diode-modulator with a driver – the circuit is almost identical to that used in the 110 series chassis.

This leaves the PAL decoder, the video circuits and the power supply. These are all new to our receivers and will be dealt with in detail later.

Although quite a bit of previous circuitry has been used in the new chassis, the different chassis concept and the new board layout resulted in a considerable amount of development work. As with previous chassis, the component spacings required for auto-insertion, and the test pads and location holes required for auto-testing, all placed constraints on the layout – while the elimination of pick-up and radiation from high-energy spikes (especially noticeable in Band I) takes ages.

In the 70/90/110 chassis the switch-mode power supply operated at line frequency – in fact it formed a phase-locked loop with the line timebase. The chopper transformer had a winding which provided the drive to the line output transistor, while the line output transformer provided a phase reference pulse which was fed back to the TDA2581 power supply control i.c.

We've reverted to completely independent power supply and line output stage circuits in the new chassis. This means that a separate line driver stage is required – a conventional circuit (see Fig. 2) similar to that employed in the 80 series chassis is used. The independent line output stage also means that a different sync processor i.c. is necessary. The TDA2571A used in the 70/90/110 chassis didn't contain the phase-locked loop required to compare the line output phase reference and the line oscillator signals – this loop was incorporated in the TDA2581 power supply control i.c. The TDA2576A contains this loop (see "phase detector 2", Fig. 3). In the way in which its separate sections are interconnected, the i.c. is similar to the familiar TBA920: the oscillator runs at twice line frequency however, and field sync pulse and sandcastle pulse generators are incorporated. The circuit techniques are much more sophisticated than those used in the TBA920, which dates from the early seventies – much of it is very similar to the TDA2571A.

The sync separator is of the adaptive type, which gives improved performance and is especially effective where noisy, ghosty or cross-modulated signals are all you've got to go on. In this type of circuit (see Fig. 4), a variable gain amplifier ensures that the height of the separated mixed sync pulses is kept constant. A small slice through the centre of each pulse is then amplified, giving a very solid sync signal.

Like the TDA2571A, the TDA2576A has a field countdown chain (divide by 625) whose output is constantly checked with the integrated field sync pulses. This gives a "flywheel" effect to the field sync, with good, solid field lock. If a sync source which doesn't have the correct 625:1 ratio between twice line frequency and the field frequency is used (a video game for example), the circuit automatically reverts to use of the normal integrated field sync pulses.

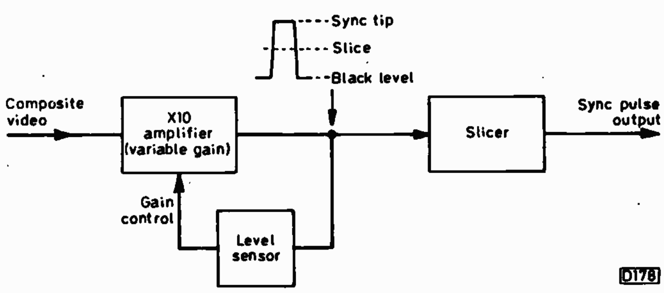


Fig. 4: Principle of the adaptive sync separator.

Fault Report

Steven Knowles

G8 Trouble

I had double trouble recently with a Philips set fitted with the G8 chassis. The original complaint was "no results", and on inspection the 3·15A mains fuse was found to have blown. The first thing I did was to look at the rear of the panel – if the rectifier/regulator thyristor shorts in this chassis it often blows a length of the print off the board. The print was all intact however, and on checking with a meter the thyristor showed no signs of a short. The next likely suspect was the mains filter capacitor, but on looking at this it was obvious that it had been fitted fairly recently. It was not a set I regularly service incidentally. The fuse's blackened appearance definitely suggested that there was a dead short somewhere, but checking from the fuseholder to chassis again drew a blank.

I decided to fit a new fuse therefore and see what happened. The new fuse didn't blow, but apart from the tube heaters lighting up the set remained dead. Check for a.c. at the anode of the thyristor: nothing. Check back to the 2·2Ω surge limiter section of the power resistor: voltage at one end, not the other. Remove panel, replace power resistor, refit panel and switch on. All o.k. Still suspicious of thyristor, so replace it to be on the safe side. Check setting of the h.t. control, replace back and leave set on soak test.

Two Hours Later

Some two hours later, just as I was finishing off a single-standard G6 which had had various problems in its field timebase (two capacitors blown off the board, both drop-off cathode resistors dropped off, and a burnt out linearity control), the G8 suddenly went dead. Suspect that the mains fuse has again blown, but no – the tube heaters were alight. Remove back and find 800mA h.t. fuse on line scan panel blown. Remove flying lead PC1 to isolate the line output stage, replace fuse and switch on. Fuse holds. Switch off, reconnect PC1, switch on again. Fuse blows after approximately two seconds, proving that the fault is in the line output stage. Can't find ammeter, so fit another fuse and disconnect tripler, transductor connection plug and line scan coils plug. Switch on and fuse blows again. Check line output transistors which seem to be o.k., and notice that the flyback tuning capacitors are of the green type which are not normally troublesome. Try replacement line output transformer, which restored normal operation. In fact we're getting more and more G8s in with line output transformer trouble. Thinking back, most Philips sets from the 210 chassis and the earlier Style 70 series onwards seem to have been prone to this sort of trouble.

A Visit to the Barbers

Paid a visit to the local barber, whom I'd not frequented for many years, recently and noticed on a high shelf and displaying an admirable picture an old Ferguson 306T. Memories came flooding back. The 306T (17in.) and 308T (21in.) date from around 1956 and were, in my opinion, one of the most reliable chassis of that era. The components were mounted on a fairly small vertical panel, the massive cabinet being required to house the large 70° tubes. Reliability seemed to decrease after that. I can't recall ever having had to replace the dropper in one of those old sets. Compared with the rate of dropper failure in these days, well...

No One Touched Them

We get all sorts of silly faults to deal with sometimes – like the Thorn 1500 with no results due to a wire coming adrift in the mains plug, and the 1400 with a shorted mains filter capacitor due to someone having fitted a 300V component. Then there was the time I was asked to look at a washing machine (yes, a washing machine!) that insisted on drying the clothes before it washed them! We take all these things in our stride, don't we? But there's one thing that irritates me no end, those (few) people who seem to take you for some sort of fool. Typical example: "the BBC-1 button gets BBC-2 and the ITV button gets BBC-1." You go to look at the set and know damn well that someone's been at the buttons, but will they admit it? Oh no! "We never turn those buttons", or "we never touch those little wheels." "It went like that overnight!" You know they're lying, but what can you do? Personally I like a quiet life and simply grit my teeth whilst viciously resetting the tuning. Maybe I'm too introverted.

Curiosity Won the Day

Had a Bush TV161 in recently with the complaint "sound, no picture". Remove back and see large hole in the print around the PCL805. Question owner. "Yes, it used to keep going into a white line all the time, then it went altogether." Examine print further and see signs of frantic repair work around the PCL805 and dry-joints all over the place. Instinct tells me to refit the back and forget the whole thing, but curiosity won the day.

Resolder all suspect joints and switch on, expecting sound but no picture. No sound either! Make a few tests and replace on-off switch/volume control. Valves now light up, sound appears, but still no raster. Remove line output stage screening cover and notice that the DY802 e.h.t. rectifier is glowing bright blue instead of red. Try another which also glows blue. Remove top cap (anode) and try again. Rectifier now lights up normally, while a healthy spark can be drawn from the top connector. Refit connector: rectifier glows blue again, but notice that the heater is still alight and there's still a spark from the anode cap.

Jump to wrong conclusion and check c.r.t. first anode voltage – o.k. Short together tube's cathode and grid – still no raster! Starting to get annoyed, so make cup of tea. On returning to the fray I did what I should have done in the first place – remove the e.h.t. lead from the tube and try again. The rectifier was still bright blue, while no spark could be drawn from the loose tube connector. Examine line output transformer more closely and notice that the heater winding seems tacky. Snip it off, wind a new turn round with e.h.t. cable and connect up. Normal results at last!

Grundig 5011

A Grundig 5011 came along with the complaint "lack of width, poor focus and foldover at the bottom of the raster". Previous experience with these sets suggests carrying out an inspection of the condition of the printed board and the wound components in and around the line output stage. This time we found that the core of the combi coil 9245-834-21 was cracked in half, with an eighth inch gap between the two halves. We held the two sections together with the set working and the symptoms all cleared. So we ordered and fitted a replacement to complete the repair.

A 24in. Indesit

The next job was an Indesit T24EGB – an early one fitted with a mechanical tuner. The complaint was "weak unstable picture, suspect tube low." The picture was indeed very grey, but whether the tube was low or not was impossible to tell because of the presence of a dirty great black hum bar which travelled up the screen and tripped both timebases each time it reached the top.

The 24V supply for the transistorised sections of the receiver is obtained from the earthy end of the heater chain in this chassis, and it seemed to us that something was wrong with the smoothing here. There's a multiple smoothing filter (C914/R908/C915/R909/C916), and on checking up we noticed that C914 (500µF) is sandwiched at the top of the chassis between the dropping/smoothing resistors and the PCL805 field timebase valve. It's obviously subject to a lot of heat, and was completely dried up. Replacing this restored normal results, with a crisp, well-contrasted picture, but something was amiss with the tuner – the resetting was something terrible.

The resetting accuracy of the buttons on these sets is not particularly good at the best of times, but this was too bad to let pass. We removed the tuner and control panel complete, but couldn't see anything wrong with the operating bar and return spring. So we decided to remove the inspection cover. We could see, on moving the outside linkage, that there was quite a bit of movement not being transmitted to the moving gang. Closer inspection revealed that the moving gang is connected to the outside linkage by two small clips – one at each end. These had loosened slightly over the years, causing a certain amount of play: it was possible to tighten them up to complete the job.

That Fine Ferguson Failed

The phone then rang – it was the barber. "You remember that old Ferguson set you were admiring so much the other week? – it's gone wrong." So down I went, and as usual the shop was full of customers. Now I don't like working in front of an audience, but... Apparently the set would come on all right, then the picture would get darker until it became too dark to see – though it didn't vanish completely. In fact it started to get noticeably darker some four-five minutes after I switched the set on – the width also started to come in at the sides. As I stared at the old set something clicked in the back of my memory. Surely this used to be a stock fault years ago? – the old Ferguson low width fault. Then I remembered – a leaky 0·001µF coupling capacitor between the line oscillator and the line output valve. And so it was that without making any tests I was able to remove the cabinet shell, snip out the faulty capacitor, fit a new one, put everything back together and get a picture that stayed on. In front of an audience too! It's nice to be able to do things like that from time to time...

Up The Garden Path

I've long been convinced that the proverbial "trip up the garden path" starts when you remove the back of a TV set. The one in question was a dual-standard Philips G6 that I'd sold some years previously to friends of mine. It had been fairly trouble free, requiring only the odd adjustment or valve replacement from time to time, but now seemed to have something more serious wrong with it – the symptoms were described as follows: an odd smell was noticed after the set had been on for a couple of hours, and on looking at the screen the picture was observed to have shrunk by about an inch and a half all round. The set had then been switched off and allowed to cool, but on switching on the fault was sound but no raster. The owners were going away on holiday for a month (sigh of relief): they left me the keys so that I could look in when I'd an opportunity.

I called round one evening and found the symptoms as described – no raster, no line output stage activity, no h.t. to the line output stage due to the fusible feed resistor having sprung open. Resolder it and switch on. The sound came through but the line output valve started to glow cherry red. Switch off, replace the PCF802 line oscillator valve and try again. Once more a cherry red line output valve. Decide to replace the PL509 and PY500. No difference. Unhook e.h.t. and focus rectifiers. PL509 still cherry red, and so was my face. What next? Disconnect one end of boost capacitor, PL509 starts to... That left the line output transformer and the d.c. feed choke to the line output valve as suspects. The choke sometimes develops shorted turns, but this is usually quite obvious from its appearance. This one looked quite clean, so I made a note to order a new line output transformer next day.

As I prepared to leave the house, I became vaguely aware of a flashing blue light. Open front door and come face to face with two police officers on the doorstep. What was I doing as the owners were on holiday? My first attempt at an explanation – "I'm doing a job" – resulted in a further twenty minutes of questioning before I was eventually allowed to go home.

Back with the New Transformer

In due course I returned with the new transformer. Fit it, switch on, get sound then... I couldn't believe it – the PL509 was cherry red! Better take the set back to the workshop. With it on the bench I started to check just about everything there was to check – all the capacitors, resistors and valves in the line timebase, change the d.c. feed coil, monitor the line drive waveform, disconnect the transductor and scan coils, but the PL509 continued to glow. Eventually I found myself checking things that couldn't possibly have any bearing on the fault.

Maybe the new transformer...? This seemed unlikely, since new transformers are rarely defective while the likelihood of a new one producing exactly the same symptoms as the old one seemed improbable. And I'd not got another one to try. After long deliberation I returned the transformer with an accompanying letter. A replacement arrived a week later, and was fitted with little optimism. Switch on and wait. Sound, then all of a sudden the generator starts up and the line whistle comes through along with a rustle of e.h.t. Throw – sorry, put – the whole lot back together, check the boost voltage, tweak up the grey scale and the convergence and that's that. What a performance!

The Moral?

The moral (if there is one) for newcomers is to try and remain logical. It's not always easy I know. If you come up against a really sticky fault, it's best to leave it for a while and return to it later. Bye for now...

Digital Signal Processing

Arthur Mole

FOR several years now the use of digital techniques in television has been growing. A considerable impetus came initially from the need for high-quality TV standards conversion. The IBA's DICE (Digital Intercontinental Conversion Equipment) standards converter came into operational use in 1972. It's success demonstrated convincingly the advantages of processing video signals in digital form – digital signals are neither phase nor level dependent. The trend since then has been towards the all-digital studio: digital effects generators have been in use for some time, and digital telecines were announced earlier this year.

An earlier example of the application of digital techniques to television was the BBC's sound-in-syncs system, in which the sound signal is converted to digital form so that it can be added to the video signal for network distribution. The sound-in-syncs system first came into use in 1969, and is now widely employed.

Digital techniques have already appeared on the domestic TV scene. The teletext signals are digital, and require digital processing. In modern remote control systems the commands from the remote control transmitter are in digital form, and require digital decoding and digital-to-analogue conversion in the receiver before the required control action can be put into effect. Allied to this, digital techniques are used for the more sophisticated channel tuning systems. The basic TV receiver itself continues to use analogue techniques however. Are we about to see major changes here?

ITT Semiconductors in W. Germany have been working on the application of digital techniques to basic TV receiver signal processing since 1977, and at the recent Berlin Radio Show presented a set of digital chips for processing the video, audio and deflection signals in a TV receiver. The set consists of a couple of l.s.i. and six v.l.s.i. chips – and by very large scale integration (v.l.s.i.) we're talking about chips that contain some 200,000 transistors.

What are the advantages? For the setmaker, there's reduction in the component count and simpler, automated receiver alignment – alignment data is simply fed into a programmable memory in the receiver, which then adjusts itself. Subsequently, the use of feedback enables the set to maintain its performance as it ages. From the user's viewpoint, the advantages are improved performance and the fact that extra features such as picture-within-a-picture (two pictures on the screen at the same time) and still pictures become relatively simple to incorporate.

The disadvantage of course is the need for a lot of extra circuitry. Since the received signals remain in analogue form, analogue-to-digital conversion is required before signal processing is undertaken. As the c.r.t. requires analogue drive signals, digital-to-analogue conversion is required prior to the RGB output stages – the situation is somewhat different in the timebase and audio departments, since the line drive is basically digital anyway and class D amplifier techniques can be used in the field and audio output stages. In between the A-D conversion and the various output stages, handling the signals in digital form calls for much more elaborate circuitry – hence those chips with 200,000 or so transistors. The extra circuitry is all incorporated within a handful of chips of course, but the big question is if and when the use of these chips will become an economic proposition, taking into account reduced receiver assembly/setting up costs, compared to the use of the present analogue technology – after all, colour receiver component counts are already very low.

With the present digital technology, it's not feasible to convert the signals to digital form at i.f. So conversion takes place following video and sound demodulation. Fig. 1 shows in simple block diagram form the basic video and deflection signal processing arrangement used in the system devised by ITT Semiconductors.

Before going into detail, two basic points have to be considered – the rate at which the incoming analogue signals are sampled for conversion to digital form, and the number of digits required for signal coding.

Consider the example shown in Fig. 2. At both (a) and (b) the signals are sampled at times T1, T2 etc. In (a) the signal is changing at a much faster rate than the sampling rate. So very little of the signal information would be present in the samples. In (b) the rate at which the signal is changing is much slower, and since the sampling rate is the same the samples will contain the signal information accurately. In practice, the sampling rate has to be at least

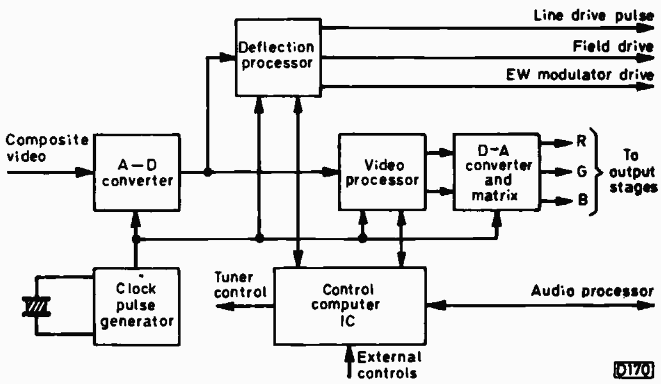


Fig. 1: Block diagram of the digital video and deflection signal processing system devised by ITT Semiconductors. A-D and D-A conversion of the video signals is carried out by a single chip which ITT call the video codec.

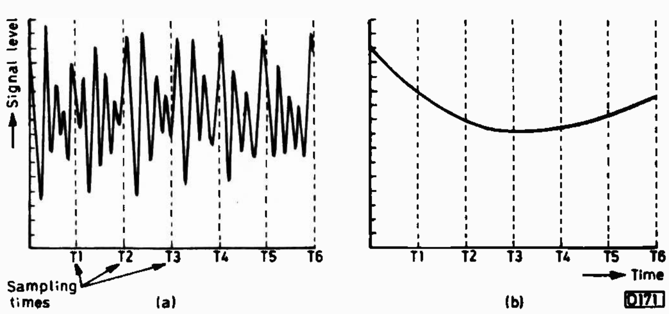


Fig. 2: Principle of signal sampling and conversion to digital form. If the signal is sampled at a much lower frequency than the rate at which it is changing, as at (a), most of the signal information will be lost. Signal resolution, once the signal has been converted to digital form, depends on the number of digits used to represent each signal sample. Voltage comparators are used to sample the signal and convert it to digital form.

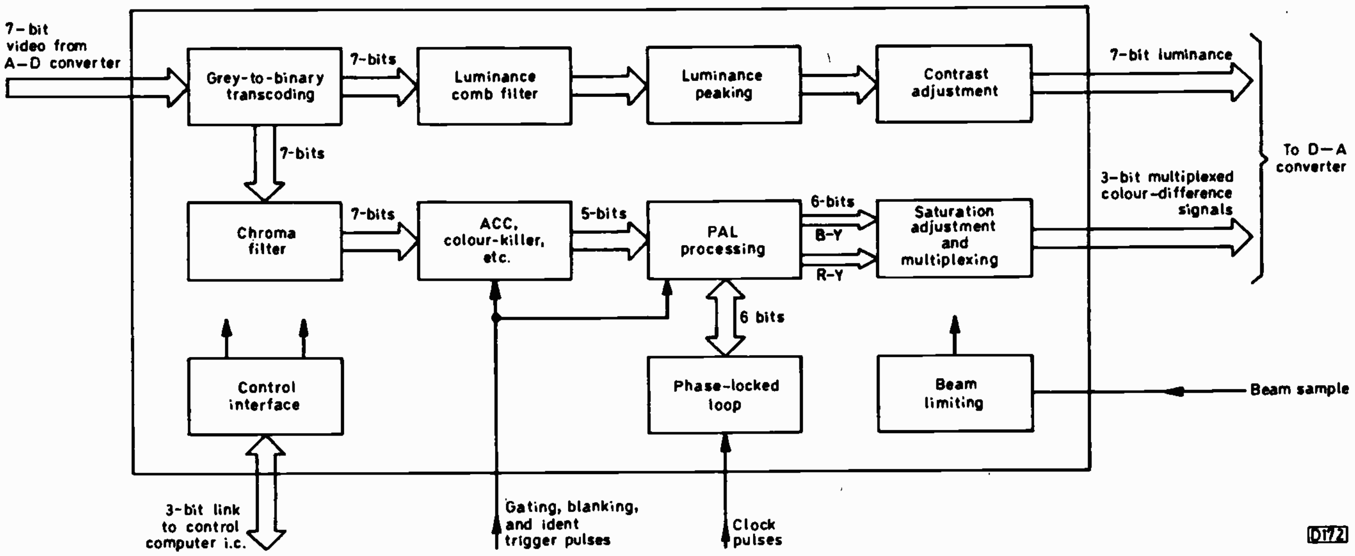


Fig. 3: Simplified block diagram of the video processor i.c.

twice the bandwidth of the signal being sampled.

Once you've got your samples, the next question is how many digits are required for adequate resolution of the signal, i.e. how many steps are required on the vertical (signal level) scale in Fig. 2? The use of a four-digit code, i.e. 0000, 0001 etc., gives 16 possible signal levels. Doubling the number of digits to eight gives 256 signal levels and so on. ITT's experience shows that the luminance signal requires 8 bits (digits), the colour-difference signals require 6 bits, the audio signal requires 12 bits (14 for hi-fi quality) while 13 bits are required for a linear horizontal scan on a 26in. tube. These digital signals are handled as parallel data streams in the subsequent signal processing.

Returning to Fig. 1, the A-D and D-A conversion required in the video channel is carried out by a single chip which ITT call the video codec (coder/decoder). A clock pulse generator i.c. is required to produce the various pulse trains necessary for the digital signal processing, and a control i.c. is used to act as a computer for the whole digital

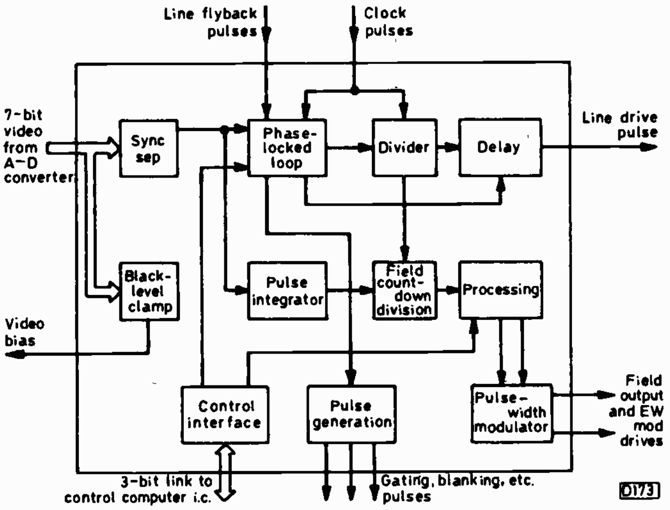


Fig. 4: Simplified block diagram of the deflection processor i.c. The line drive output is conventional. The field and EW modulator outputs consist of pulse-width modulated wave trains. These can be amplified by a class D amplifier and then filtered to provide sawtooth and parabolic field frequency outputs (the principle of this was described in Teletopics, January 1977). The i.c. also contains a black-level clamp whose output is used to clamp the black level of the demodulated video to a fixed voltage to ensure that the A-D converter operates at the optimum level.

system and also to provide interfacing to enable the external controls (brightness, volume, colour etc.) to produce the desired effects. In addition, the control i.c. incorporates the digital channel selection system.

The video codec i.c. uses parallel A-D/D-A conversion, i.e. a string of voltage comparators connected in parallel. This system places a high premium on the number of bits used to code the signal in digital form, so ITT have devised a technique of biasing the converter to achieve 8-bit resolution using only 7 bits (the viewer's eye does some averaging on alternate lines, as with Simple PAL, but this time averaging luminance levels). The A-D comparators provide grey-encoded outputs, so the first stage in the video processor i.c. is a grey-to-binary transcoder.

As Fig. 3 shows, the processes carried out in the video processor i.c. then follow the normal practice, though everything's done in digital form. The key to this processing is the use of digital filters. These are clocked at rates up to 18MHz, and provide delays, addition and multiplication. The glass chroma delay line required for PAL decoding in a conventional analogue decoder consists of blocks of RAM (random-access memory) occupying only three square millimeters of chip area each. As an example of the ingenuity of the ITT design, the digital delay line used for chroma signal averaging/separation in the PAL system is used in the NTSC version of the chip as a luminance/chrominance signal separating comb filter.

Fig. 4 shows the basic processes carried out in the deflection processor i.c. This employs the sorts of techniques we're becoming used to in the latest generation of sync processor i.c.s. Digital video goes in, and the main outputs consist of a horizontal drive pulse plus drives to the field output and EW modulator circuits. The latter are produced by a pulse-width modulator arrangement, i.e. the sort of thing employed with class D output stages. The necessary gating and blanking pulses are also provided.

A further chip provides audio signal processing. One might wonder why the relatively simple audio department calls for this sort of treatment. The W. German networks are already equipping themselves for dual-channel sound however, and the audio processor i.c. contains the circuitry required to sort out the two-carrier sound signals.

These chips represent a major step in digitalizing the domestic TV receiver. It seems likely that some enterprising setmaker will in due course announce a "digital TV set". The interesting point then will be whether the chip yields, and the chip prices as production increases, will eventually make it worthwhile for all setmakers to follow this path. ■

Servicing Luxor 110° Hybrid CTVs

Part 1

Mike Phelan

LUXOR 110° hybrid colour TV sets were imported from Sweden during the 1973–74 colour boom period: the design is fairly sound, and large numbers are still giving good service. They also represent a good prospect for renovation, often being available from disposal outlets at reasonable prices – many rental companies seem to be getting rid of their continental sets, probably because a lot of their technicians are reluctant to get to know about anything that has a foreign sounding name. There are also 90° Luxor hybrid colour receivers around: these were imported by Rediffusion, and will be the subject of a subsequent article in the magazine.

The main 110° model is the 2621. It has an attractive cabinet which houses a 110°, delta-gun 26in. tube – the cabinet was available in rosewood, teak, walnut, mahogany or white. Some of the models had a lockable door covering the front controls, a separate on–off switch being provided on the back cover. Most sets have a 25W bulb at the back to give "background" illumination. The front controls are as follows, from top to bottom: push-push switches for on–off and bass cut; four slider controls for treble, volume, brightness and colour; a rotary contrast control; then seven pushbuttons for channel selection and band switching. A window beside each pushbutton shows a moving ribbon type channel display.

The internal appearance is reminiscent of many early UK produced hybrid sets, but the accessibility is far better. The convergence controls and raster correction panel are contained in a hinged frame which is attached to the top of the cabinet. The main chassis contains five large, non-removable printed boards in a metal frame. Vertically mounted at the left is the audio and l.t. board; below it at the bottom are the power supply, decoder and timebase panels, the sync/line oscillator i.c. being on a small plug-in module attached to the latter; the vertical panel on the right contains the line output stage, while the CDA panel is attached to the rear chassis rail. The i.f. stages are in a screening can mounted above the tuner on the back of the control panel.

To gain access to the CDA panel, slide it horizontally and swing it down through 90°, after removing the latch – if this is still present. Take care to remove the c.r.t. leads from the clip on the convergence board. The whole chassis slides backwards when the springs at either side are eased out: for access to the underside, the chassis can be tilted forwards after the spring-loaded peg near the mains transformer has been pulled out. After slackening the two screws below the line output stage screening can and the two corresponding ones behind, the whole line output section folds down flat. To get at the i.f. stages or the tuner, slide the chassis out, remove the knobs, then the two long screws that hold the control panel/i.f. strip/tuner: the whole assembly can be "hung" on the two hooks on the left-hand vertical chassis member for servicing.

Now to the circuit and the faults to which it is prone.

Power Supply Faults

We'll start with the power supplies (see Fig. 1). The h.t. rails are produced by a bridge rectifier directly from the mains. Another bridge rectifier, fed from the mains transformer, produces a 31V supply. An AD149-type series regulator (Q276) produces a stabilised 24V line from this supply. Three EF184 valves are used in the colour-difference output stages, their heaters being fed from a winding on the mains transformer. The heaters of the five other valves are connected in a series chain across the mains, via dropper resistors. The latter (R605 39Ω and R606 82Ω) cause more than their share of trouble: they are tucked away in the corner near the left rear chassis upright and run very warm. When you find that all the heaters apart from the EF184s are out, tip the chassis up and have a look under R605 and R606. If you are lucky, one or both will be found dry-jointed: if you are not, there will be a hole burnt in the board. The best cure is to replace both resistors with a single 120Ω "polo mint" type bolted to the chassis somewhere.

The other various wirewound resistors on the power supply panel can go open-circuit, particularly R610 (4·7Ω) which feeds the line output stage. When checking around with the Avo, ignore R612 (7·5kΩ) which is connected between the 220V rail and chassis.

Another fault that occurs quite often is a 100Hz hum bar: it will usually be found that every pin on both the large electrolytic cans is dry-jointed. If the hum affects the picture brightness and the sound, the fault is in the l.t. supply, to which we'll return.

If one or both of the mains fuses S601-2 (3·15A anti-surge) has blown, one might suppose that one of the five mains filter capacitors C601-5 has given up. We've never had one of these fail however: the reason for the blown fuse(s) is likely to be one of the diodes D601-4 in the h.t. bridge rectifier circuit or one of the small 0·005μF capacitors C606-9 connected across them. If two of the diodes fail immediately after they've been replaced, fit a new PY500A boost diode – the old one will have a heater-cathode short which will effectively short out one half of the bridge.

The l.t. supply is straightforward and doesn't cause many problems. One rather baffling fault occurs when the error detector transistor Q275 (BC141) goes open-circuit. The symptoms are a blank raster of reduced width with a fold in the centre, and no sound. The line linearity coil L851 and R921 (1·5kΩ) also overheat. The latter component is mounted on the plug at the back of the line output stage. If you are fortunate, you will find that the l.t. rail has fallen to about 8V – but placing a meter prod almost anywhere usually clears the fault. The 24V series stabiliser transistor Q276 (TI3027 or AD149) sometimes goes short-circuit, giving severe hum on sound and picture – this fault can also be caused by the 31V supply reservoir capacitor C285 (2,200μF) drying up.

Signal Circuits

The ELC2000 v.h.f./u.h.f. tuner and its push-button unit cause more trouble than the rest of the set. Drifting is a common problem, and the push-button unit is the most

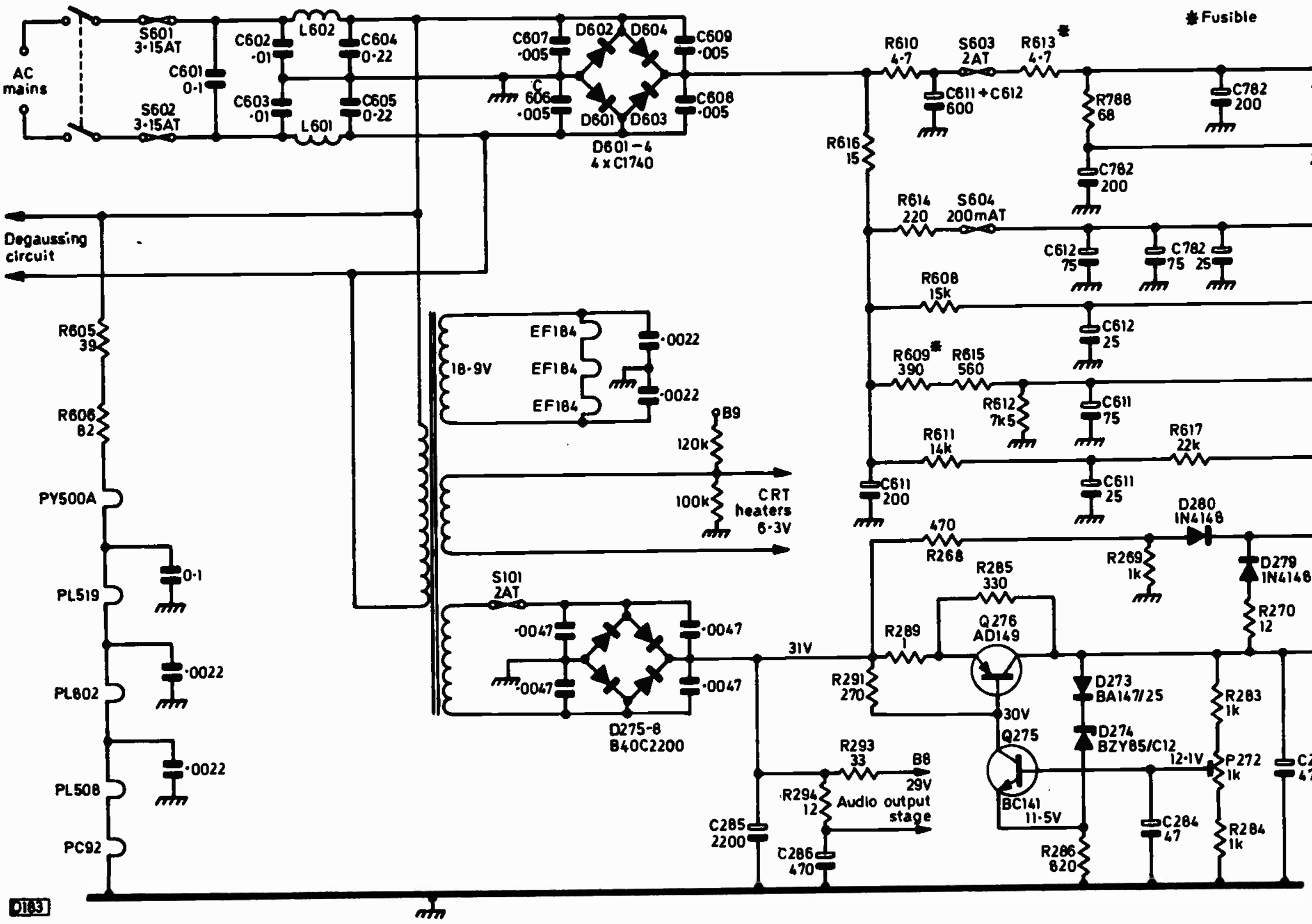


Fig. 1: Power supply circuitry. There's also a 12V regulator, on the i.f. panel.

likely cause. Less often the tuner itself is responsible: only on very rare occasions is the ZTK33/TAA550 33V stabiliser the culprit. The problem with the push-button unit is that the printed potentiometer tracks alter in value: replacement is the only cure, cleaning being a waste of time. Anyone who has worked on other sets (Rank, Kuba, ITT) using the same make of push-button unit will be familiar with the trouble.

The tuner itself can be responsible for patterning and low gain. The latter fault is often caused by the wire-wrap trimmer C67 in the u.h.f. r.f. amplifier stage going short-circuit. This can, with care, be repaired by unwrapping the wire slightly. First however check that the tuner a.g.c. voltage (pink lead) is about 2·5V – sometimes the 8·2V zener diode D232 in the tuner a.g.c. circuit goes open-circuit, giving rise to a grainy picture. This component is to be found in the i.f. can.

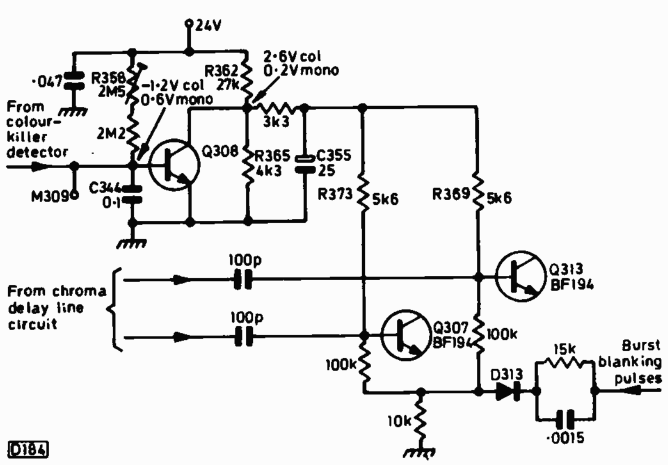


Fig. 2: The colour-killer circuit. The colour-killer detector is a synchronous type driven by the burst phase discriminator transformer – so there'll be no colour on the screen when the reference oscillator is unlocked.

The i.f. strip has two MC1350P (or SN76600P) i.c.s to provide the gain. These are followed by two BF199 (or BF173) transistors, one of which (Q201) drives the 6MHz intercarrier sound detector whilst the other (Q202) drives the video detector. The intercarrier sound goes off to the usual TBA120 chip. The video goes to Q203 (BC147B), which provides a video feed and drives the a.g.c. circuit from its emitter, with a feed to the sync circuit from its collector. The i.f. stages are supplied by a 12V stabiliser circuit which is also inside the i.f. can.

With the exception of the previously mentioned zener diode D232 and the TBA120, the only failures we've had in the i.f. section have been due to Q203 going short-circuit between its emitter and base, giving intermittent loss of sync. The i.f. unit has otherwise proved itself to be extremely reliable.

The same remark applies to the decoder, which rarely gives any trouble. It's conventional apart from the colour-killer arrangement, which is a bit unusual (see Fig. 2). The colour-killer transistor Q308 (BC148C) is driven by a phase detector (D306-7) which is in parallel with the burst detector (D304-5). Whilst the burst detector produces a positive-going output, the colour-killer detector produces a negative-going output (−1·2V at the base of Q308) when the 4·43MHz reference oscillator is locked to the burst. Q308 is thus turned off when a colour signal is present and the reference oscillator is locked correctly. When Q308 switches off, the bases of the R − Y and B − Y preamplifiers Q307 and Q313 receive forward bias via R373 and R369 respectively. To override the colour-killer.

connect point M309 to chassis. On monochrome, the voltage at the base of Q308 is 0·6V.

From time to time we've had to replace either the 4·43MHz crystal, or the 6·8V zener diode D308 which stabilises the oscillator's base bias, to cure complaints of intermittent colour. Very occasionally one or other of the chroma amplifier transistors Q301 (BF195) or Q302 (BF194) fails, giving the same result.

If there's no colour and the voltage at M309 is zero or negative, either the delay line driver transistor Q303 (BC147A) is faulty or the colour control or its connections are. Note that there's a second saturation control ganged with the contrast control. All the sliders on this chassis tend to become noisy – they can be dismantled and cleaned with care.

One strange fault that crops up from time to time concerns the bistable circuit (Q311-2, BC147Bs), which may stop and start erratically. You may find that after replacing both transistors, the ident diode D314 (OA91), and checking the presence of triggering pulses etc. the thing still won't work. Measure the values of the 470Ω load resistors R3101 and R3113: despite their size these two resistors can, and indeed do, increase in value.

That sums up the troubles likely to be experienced with the decoder. Next month we'll continue with the CDA panel and the timebases.

Colour Portable Project

Part 7

Luke Theodossiou

BY this time all the modules are built, visually inspected and ready for connecting up. At this stage, the tube size has to be selected in order to determine the degaussing coil and the cabinet. So far, we have been unable to arrange for a cabinet to be made available to readers, largely due to the number of different sized tubes available. This makes the stocking task somewhat difficult and suppliers are reluctant to commit themselves to stocking the various types. There are several alternatives; readers can purchase a cabinet and back from the spares department of virtually any manufacturer to suit their own personal taste. A cheaper solution is to use the cabinet from an inexpensive non-working ex-rental set, but it may prove difficult to find one for the 14" or 16" tubes. In both instances, the control panel will have to be modified to suit the remote control since there is an absence of the usual sliders on the front panel. Perhaps the best solution is to make a cabinet using either Perspex, veneered chipboard or plywood. With a little effort and dexterity, the result can be very pleasing.

The wire loom details for interconnecting the boards are shown in Fig. 1. We suggest the use of 16/0.2mm wires twisted together for each run. The actual connections are:

Signals Board:

Connector A: Aerial input lead (use coaxial cable) from aerial isolator socket.

Connector B: This connects to the following points on the remote control interface board:

B1 (+33V)	to connector B8
B2 (VCR switch)	to connector B7
B3 (+24V)	to connector B2
B4 (Earth)	solder to 'common' terminal of IC2 on underside of R/C interface board
B5 (Volume)	to connector B5
B6 (Tuning voltage)	to connector B6
B7 (Colour)	to connector B3
B8 (Contrast)	to connector B1
B9 (Brightness)	to connector B4

Connector C: RGB outputs. Connect to the appropriate points on the c.r.t. base socket using separated video type cable.

Connector D: This connects to connector A on the timebase board.

D1 (VCR switch)	to A4
D2 (+24V)	to A6
D3 (+220V)	to A5
D4 (Earth)	to A1
D5 (Sandcastle)	to A3
D6 (Video)	to A2

Connector E: Leads to 16Ω loudspeaker. Do *not* use a speaker with a ferrite magnet due to excessive stray field which will affect colour purity.

Timebase Board:

Connector A: See signals board connector D.

Connector B: This is the power supply input and connects to the switch mode power supply module on connector C.

B1 (+220V)	to C1
B2 (Earth)	to C4
B3 (+24V)	to C2
B4 (+118V)	to C3

Connector C: This carries the heater, A1, grid and earth connections to the appropriate points on the c.r.t. base board.

Connector D: This connects to the line and field deflection coils on the tube. Connect a wire link between D3 and D4.

SMPS Module:

Connector A: Mains input via on-off switch.

Connector B: Use pins B1 and B2 only to connect to degaussing coils.

Connector C: See timebase board connector B.

Remote Control Interface Board:

Connector A: This connects to the R/C preamplifier module.
A1 is +18V
A2 is Earth
A3 is input from preamplifier

Connector B: See signals board connector B.

Connector C: This connects to the solenoid of the mains switch, and to the momentary local channel step-through switch. The latter may be located either on the front or back of the receiver and serves as emergency channel

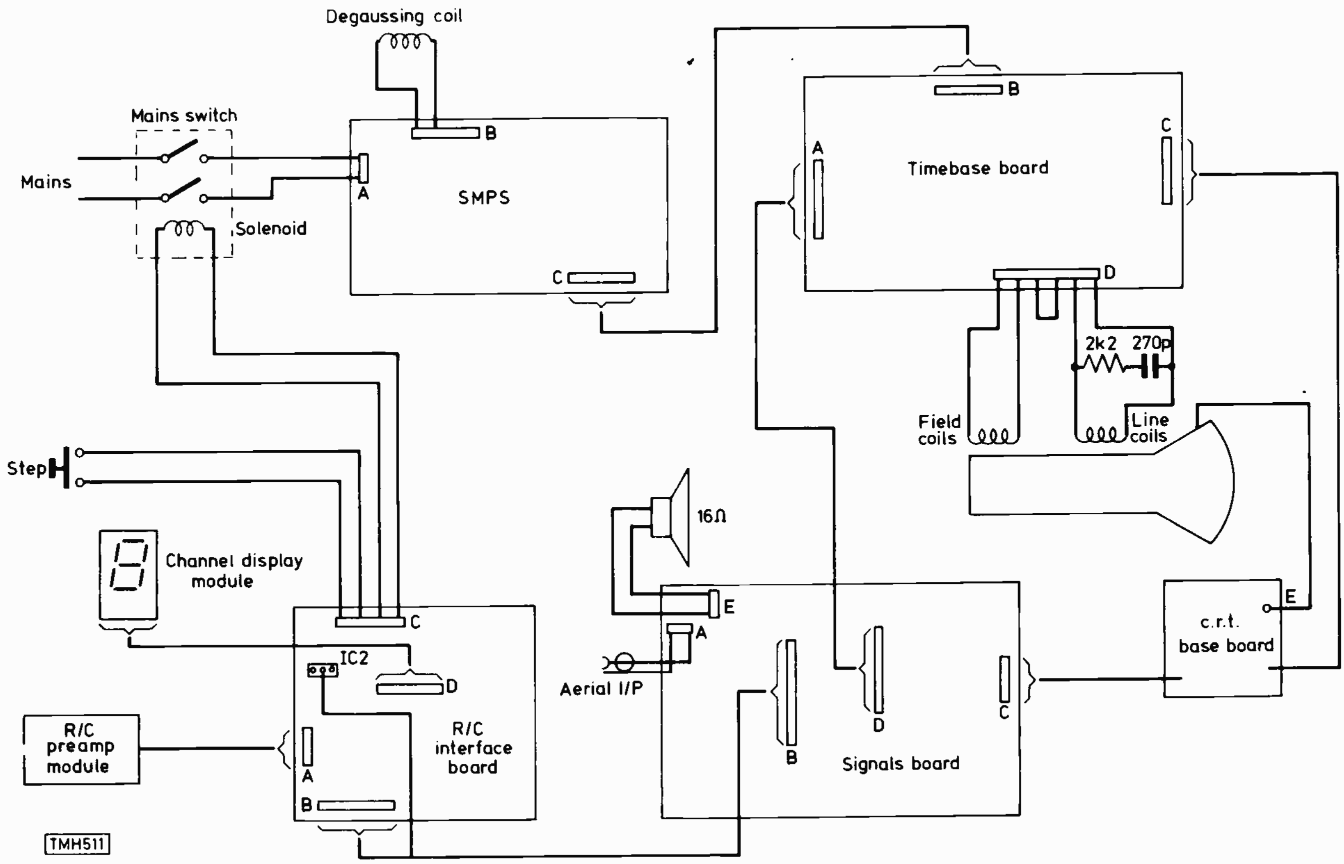


Fig. 1: Board interconnections. See text for details of individual connectors.

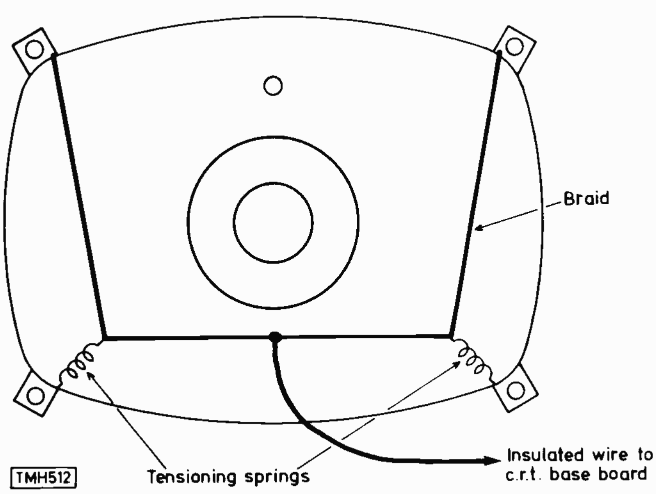


Fig. 2: Tube earthing arrangement.

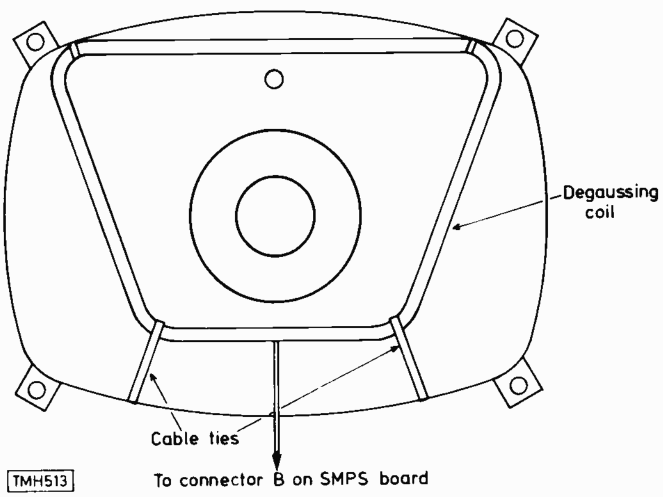


Fig. 3: Mounting the degaussing coil.

change in case of R/C transmitter failure (e.g. low battery).
C1 Earth to solenoid
C2 Earth to step switch
C3 Drive to solenoid
C4 To step switch

Connector D: This connects the channel display module at the appropriate points which are shown in Fig. 11, p. 591 in the September 1981 issue.

The connections to the scan coils on the yoke are made via some solder tags and the safest method of determining the line and field coils is to measure the resistance: the line coils are around 2 ohms, whilst the field coils are about 15Ω. Don't forget to include the *RC* network across the line coils.

The c.r.t. rimband and Aquadag are earthed to the c.r.t. base board. In order to ensure good contact with the graphite surface of the tube, a braided cable is used together with two tensioning springs. The idea is shown in Fig. 2.

In addition, the degaussing coil needs to be attached to the tube and the arrangement is shown in Fig. 3.

It is obviously desirable to keep cable runs as short as possible, and a little thought beforehand will reveal the best arrangement. The use of cable ties or lacing cord is recommended for anchoring cables to the cabinet. Do double check the interconnections using the circuit and overlay diagrams – mistakes in wiring up can prove disastrous.

Manual Control Version

For those constructors who wish to keep building costs to a minimum, omitting the remote control can result in a

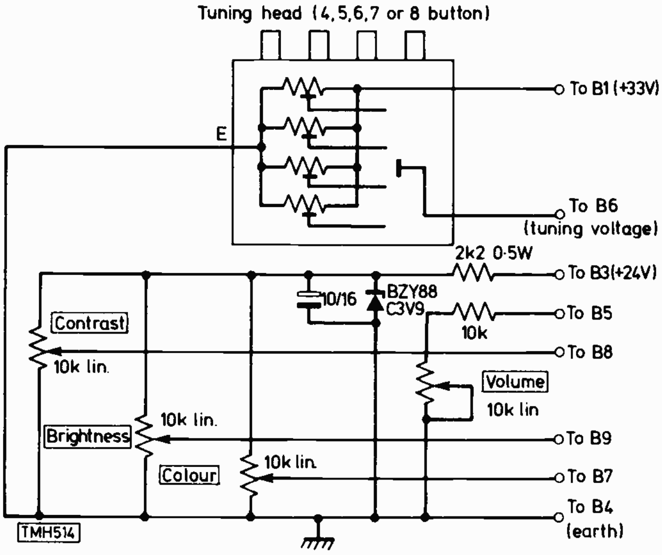


Fig. 4: Front panel control circuit for use when the remote control system is not used.

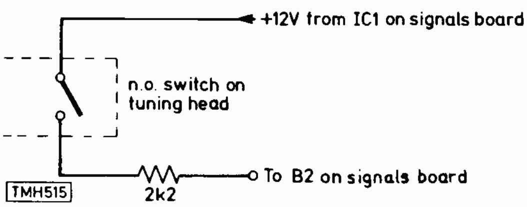


Fig. 5: VCR switching without remote control.

substantial saving. Since there is no provision for driving the channel display module other than by way of the remote control interface board, this will have to be omitted as well as the transmitter, preamplifier and interface board.

The mains switch can now be a standard push-to-make/push-to-break type, rated at 4A. Connector B on the signals board carries all the required connections to the manual front panel controls, i.e. the channel selector and control potentiometers. A suitable circuit for the front panel controls is shown in Fig. 4. Some tuning heads have an additional switch for VCR operation, usually making contact when the last push-button is depressed. In that case the circuit shown in Fig. 5 may be used to provide the facility of optimising the line timebase for VCR operation.

Degaussing Coils

The degaussing coil may be obtained from:
Forgestone Colour Developments Ltd.,
Ketteringham,
Wymondham,
Norfolk NR18 9RY.

The price is £2.65 inclusive of p.&p. and VAT. Don't forget to specify the tube size.

Demonstration Receiver

Manor Supplies have informed us that they have a demonstration model of the receiver using a 20" tube. This may be viewed at their premises at 172 West End Lane, London NW6.

TV Pattern Generator

FIGS. 4 and 5 below show the print track patterns on the top and bottom of the board designed for the TV Pattern Generator project (for further details see last month's issue).

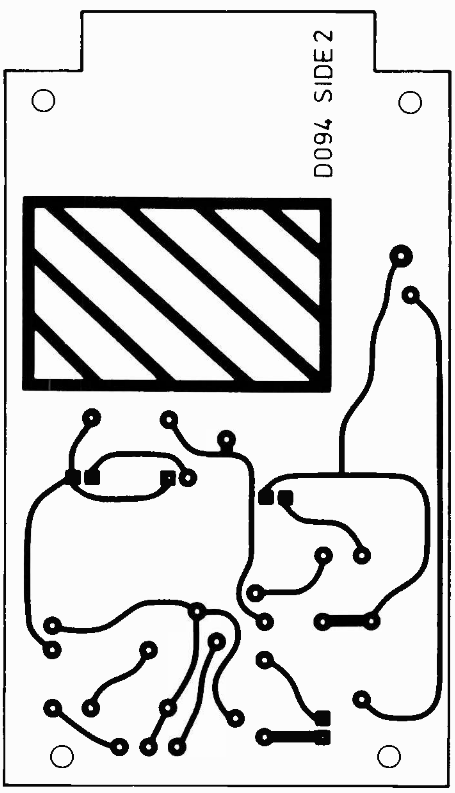


Fig. 4: Top track pattern.

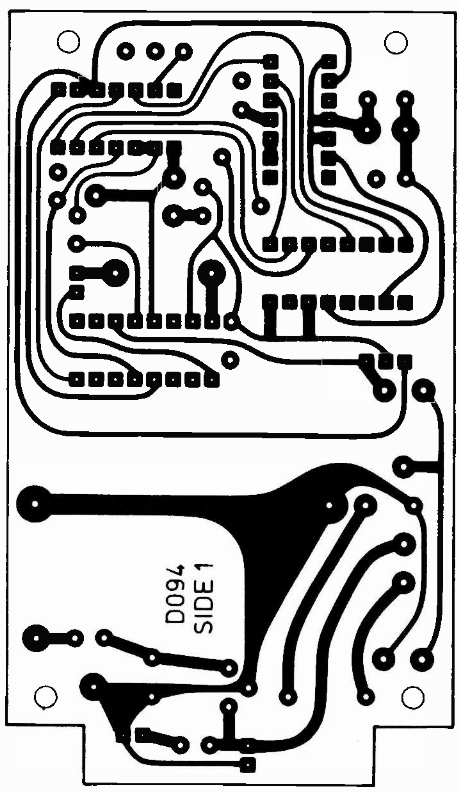


Fig. 5: Bottom track pattern.

Reusing Heads

C. J. Lowdon, B.Eng. (Hons.), C.Eng., M.I.E.E.

A VCR's head drum usually contains two ferrite video record/playback heads. These are wired in series with the primary of a rotary transformer, and scan the tape one at a time as the drum rotates. Obviously if either head fails the machine requires service attention. A cleaning tape can be tried, but if this fails to restore the performance more drastic steps need to be considered. The aim of the present article is to outline the procedures I follow with Philips N1700 machines.

The first thing to suspect is head clogging. Remove the head drum and if possible spin it at speed in a cleaning fluid (ideally isopropyl alcohol). If this is not convenient, it may be possible to clean the faulty head separately.

To identify the faulty head, use a scope to monitor the output from the head preamplifier board. As a head wears out, its upper frequency response falls off. Since the modulation system used is f.m., the effect of wear is streaking on peak white areas of the picture. Two heads in good condition should produce two balanced signal envelopes on the scope's display. Short-circuiting one head will remove the corresponding signal envelope, enabling you to identify which head is which. Don't apply the soldering iron to the head terminals for more than about two seconds. After removing the drum, try cleaning the faulty head with a child's paint brush and cleaning fluid. Do this carefully, and on no account apply any stress to the head vertically nor any pressure to its face.

Head Transplants

If cleaning is unsuccessful, it can be concluded that the particular head is worn out. This leaves only one experimental course of action, one which I've carried out successfully on a number of worn out N1700 head drum assemblies – two faulty head drums are used to produce one working drum. This unlikely refurbishing process consists of using one of the usable heads as a transplant to replace one of the worn out heads.

The two heads in an N1700 head drum differ slightly. Since the machines use the slant-azimuth technique, the two heads in each drum have oppositely slanting head gaps. It's necessary therefore to transfer a head of the right sort – the type can be identified by the colour of the wire wound on it.

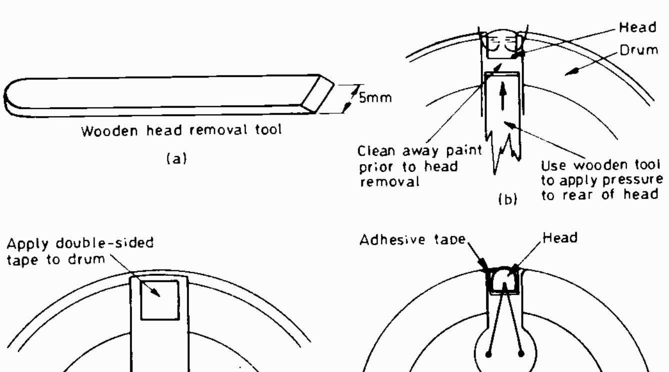


Fig. 1: Head transplant details.

Procedure

To remove an old head, carefully unsolder the wires from the head to the solder pins. The wires can then usually be pulled from the sealing paint. If there's some resistance, carefully chip the paint away, working in towards the head to raise the wires from the drum. Once the wires are free, the remaining paint can be chipped out (a fine precision screwdriver is useful for this purpose).

The heads are held in position by means of a small amount of adhesive. Application of gentle heat makes it possible to sheer the head off. I've developed the following technique for doing this. Prepare a small wooden tool – see Fig. 1(a) – for applying smooth surface pressure to the rear edge of the head. Next turn the drum upside down and immerse part of the metallic section of the drum immediately beneath the ferrite head in boiling water for about thirty seconds – take care not to get water on the head itself. Hold the head securely and apply firm pressure to its rear edge – see Fig. 1(b).

When the recovered, usable head and the defective head have been removed, the transplant can be carried out – after removing the remaining adhesive. The recovered head can be glued in place directly, but it's advisable to use double-sided adhesive tape to position the head first – see Fig. 1(c). The tape should be of similar thickness to the original adhesive – I use Scotch "electrical tape".

Stick a small square of tape firmly on the prepared drum as shown in Fig. 1(c). Then mount the head in a position relative to the drum face matching that of the original head. Once the head has been positioned, apply even pressure very carefully to stick the head firmly to the adhesive tape. Then rotate the drum, observing from above the relative overhang of the two heads. If necessary the transplanted head can be coaxed into a more accurate position by applying pressure to the edges – on no account apply pressure to the centre of the head face. The final step is to solder the wires back on to the pins – see Fig. 1(d). The heads are not polarity conscious.

Testing

Replace the head drum in the machine and give it a try – make a trial recording and replay it, observing the playback signal envelopes with the scope as before. If the transplanted head has been reasonably positioned but the result is unsatisfactory, the head has not survived the treatment. If the replay is o.k., try the machine using a test tape recorded by a known good machine. With luck this will also be o.k. If not, a decision has to be taken whether to leave well alone or try adjusting the head's position to obtain an improved response. If there's a tracking error with the test tape, the head is misaligned vertically – possibly because it's not evenly stuck. Loss of colour may be due to angular misalignment. Any head movement should be done with the wires unsoldered, as they are extremely delicate. Finally, a small amount of resin adhesive can be placed around the head to hold it in place – I've not found this strictly necessary however.

Try the procedure outlined above on two known faulty heads before you tackle a working head. A usable head that fails to replay normal N1700 tapes correctly can still be used for making and replaying temporary recordings. The technique described above has not been tried on any other types of video heads. ■

Practical TV Servicing: Replacing the Tube

S. Simon

HAVING decided that a new tube is necessary, we have to face up to the sometimes tedious task of fitting it in the set. There are normally few problems, but on occasions the unexpected happens and a straightforward job then becomes a test of nerves and patience – how that lead become disconnected (when you find it) you'll never know. We're concerned here with tube changing rather than fault finding however, so we'll confine ourselves to routine matters and hope that the unexpected doesn't happen to you. The subject is colour tubes.

Dismantling the Set

The first thing to check is the type of tube fitted in the set – there are some odd ones around, mainly in the less common sets, and this can be confusing when the label is missing. Next survey the cabinet, noting any obstructions that will be left to impede tube removal once the chassis has been withdrawn. This applies particularly to those sets with a vertical main panel, such as the Bush-Murphy A823 series, where there are top and bottom obstructions. It's sometimes easier to remove the fixing screws of any such mountings before withdrawing the chassis, so that they all come out together. Then remove the tube base socket and slacken the clamp of the blue lateral magnet, which is mounted immediately behind the purity rings – we're assuming that the tube is of the older delta-gun type rather than the more recent in-line gun type (PIL, 20AX, 30AX etc.).

Depending on their type, the scanning and convergence assemblies can either be removed together or separately. Also the clamp screw may not be in an obvious position. It's normally recessed between the two units, on the right-hand side. If these assemblies have easily reached plug and socket connections, it's sometimes better to disconnect them and leave the assemblies themselves on the tube neck until the chassis has been removed, rather than having the assemblies dangling around half way through the proceedings.

After you've removed the tube base and the blue lateral magnet, note the position of the purity rings before removing them: try not to disturb them too much, as this can save much time when the new tube is being fitted. If the work bench is wide enough, the chassis can be swung round at an angle so that the tube can be taken out without removing the tuner and the front controls. Note also the positions of the convergence and scan coils, so that they can be put back in near enough the same positions on the neck of the new tube.

There are also connections to the degaussing coils: these may consist of a simple plug and socket, but in some chassis the leads extend back to the tube base socket, together with one or more earthing leads from the degaussing shield – you may find them screwed or soldered to the tube base. Carefully note each lead's position and tag. With more recent tubes there's no separate degaussing shield – the shield is within the tube, the degaussing coils being hung on the tube.

Before the chassis can be withdrawn it will also be necessary to remove the e.h.t. connector, which goes to the top or bottom of the bowl depending on which way up the tube is mounted. Note that in some cases this contact can hold a charge for a considerable period. It's prudent therefore to touch the clip to chassis after disconnecting it, and to discharge the tube's connector to the degaussing shield – this is in contact with the tube's outer coating – using a convenient lead or screwdriver blade.

Tube Removal

With all the leads off, check how the degaussing shield is held in place. This is sometimes done by means of screws or nuts at the four corners, sometimes by means of springs. If nuts are used, remove one of the lower ones to see if it also secures the tube – there are not always two lots of nuts and washers. If the shield and the tube's mounting band are held by the same nuts, care must be taken to support the tube when the shield is removed, i.e. when the nuts fixing the shield have been removed there may be no further tube fixing, so that the tube will be loose.

It's far safer to lay the receiver face down on a soft surface and support the chassis on a stool or box rather than work on a bench. By doing it this way, the tubes can be lifted in and out vertically with less risk of strain. Support the cabinet so that the face of the tube protrudes without touching the surface.

Note also that there is additional earthing between the tube's mounting band and the degaussing shield, via a high-value resistor. Make sure that this resistor is fitted with the new tube, and that it's not open-circuit. Poor earthing accounts for the sometimes strange effects encountered when a new tube has been fitted – instead of the results you hoped for, you may get variations in picture size and general fluctuation etc.

Fitting the New Tube

Having stripped any earthing clips and braiding from the old tube, fit these to the new one in the same positions. Present the new tube to the cabinet, ensuring that the e.h.t. connection is in the same position as before, generally at the top but sometimes at the bottom (particularly with Thorn sets).

The method of fixing the tube's lugs to the cabinet varies from set to set. When the tube and shield have been firmly fitted and the earthing leads have been correctly connected, the scan coils and the convergence assembly can be slid on to the tube's neck and provisionally clamped, observing the note you made of their original positions. Next fit the purity magnets if these are separate from the convergence assembly, then the blue lateral magnet clamp, the tube base and the e.h.t. connector (once the chassis has been replaced to enable this to be done).

Run through the plug and socket connections to ensure that none have been forgotten, and resolder or otherwise reconnect the earthing leads from the degaussing shield and the tube's outer coating to the base panel. Reconnect the degaussing coils, and when you've done all this double check everything again. It's all too easy to overlook a disconnected lead or plug, and the extra trouble taken at this stage can save a lot of heartache later on.

Purity and Convergence

When you switch the set on, the images displayed on the screen may appear a trifle strange. First switch off the blue and green guns to leave what should be a red only display. If it's pure red you're in luck and the other guns can be switched on again and the convergence carried out. If the red raster is impure, i.e. other colours are present with the blue and green guns switched off, you will have to carry out the purity procedure first.

Slacken the wing nuts securing the scan coils and slide the assembly back. Then adjust the purity magnets to obtain a large area of red in the centre of the screen, rotating the rings relative to each other until the central area is free from anything other than red. If difficulty is experienced, degauss the tube manually. When you've got a good central red area, slide the scan coils forward to spread the red area out to the edges of the screen. Some fine adjustment of both the rings and the coils may be necessary. Switch off the red gun and switch on the other two guns in turn to ensure that the blue and green rasters are pure.

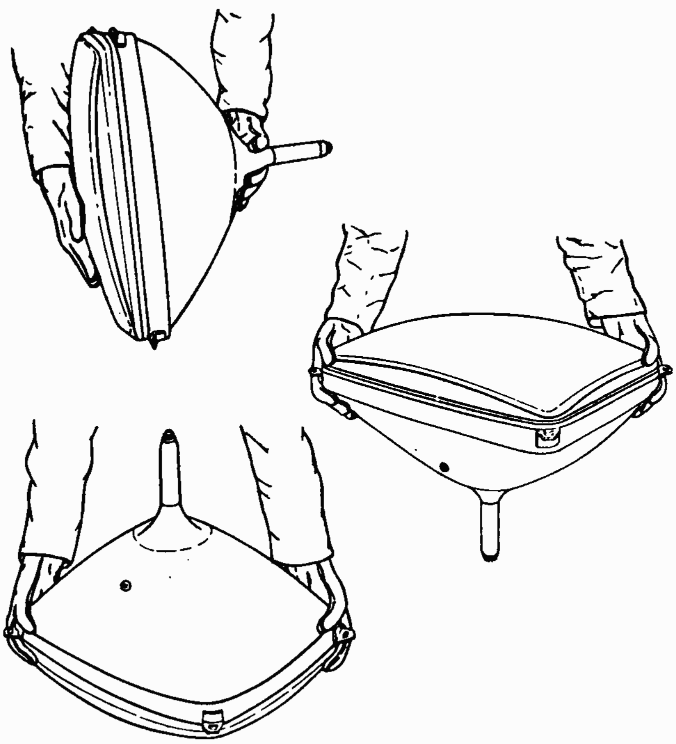


Fig. 1: Handling tubes. Due to their high internal vacuum, tubes are dangerous and should be handled with care. The drawings above show recommended methods, when lifting the tube from the edge-down position (top), when lifting the tube face up (right) and when lifting it face-down (bottom). Under no circumstances should any force be applied to the neck of the tube, its most vulnerable point. If any risk is likely to be encountered, protective clothing, particularly eye shielding, should be worn. The lugs are provided for mounting and should not be subjected to excessive force while handling the tube. Push the scan coils fully forward during the warm-up and preadjustment periods: keep the period during which they are pulled back to the absolute minimum (the average beam current should not exceed 200μA per gun during this time). Illustrations and details courtesy of Mullard Ltd.

Having obtained acceptable purity, one must face the fact that doing this will have had a profound effect on the convergence, so that it will be necessary to go through the convergence procedure. Again we must stress that these notes apply only to delta-gun tubes.

In a delta-gun tube the blue gun occupies a central position at the top or bottom depending on which way up the tube is fitted, the red and green guns being angled to the sides. The static convergence magnets occupy corresponding positions, and are used to move the beam positions accordingly, i.e. blue up and down and the other two diagonally. The idea is to converge the red and green images first, then move the blue one to marry up, using the blue static magnet for vertical movement of the blue display and the blue lateral magnet at the rear of the tube to obtain horizontal registration. This gets things right at the centre of the screen. Some adjustment will also have to be made to the dynamic convergence controls on the convergence panel. We described this in an earlier article (see November 1979). Adjusting the static convergence effects the purity, which will have to be checked again: resetting this will make some static convergence readjustment necessary – carry on until a happy balance is obtained.

Tube Drive

Since the old tube will probably have been set up to obtain a reasonable grey scale with guns whose emission differed, the even emission of the guns in the new tube will probably mean that the c.r.t. first anode controls need adjustment. You'll usually find them on the convergence panel, occasionally elsewhere. Adjust them for nice mid and dark greys (no colour), with the video drives set to obtain light greys and white. Once a happy balance has been achieved, turn up the colour or tune it in. The aim is to get good flesh tones – good colour cannot be achieved unless the grey scale has first been set for a good black-grey-white picture.

Miscellaneous Points

It must in fairness be pointed out that the foregoing is an over-simplified account of tube changing. It has to be, since each different model requires a different drill. If the appropriate manual gives the required information, this should be followed. In the absence of such information, a preliminary examination will generally show what the snags are and whether the construction is such that the main panel or chassis can be removed in one piece to expose the tube.

With chassis such as the Pye 725 series, which has separate vertical panels, the process becomes more tedious due in this case to the multitude of plug and socket connections between the right-hand side power supply panel and the left-centre timebase panel, not to mention the rear centre dropper resistor unit. The left side panel can be left in place, since it doesn't impede tube removal, but removal and replacement of the other two requires a measure of patience and dour determination. Lots of other sets call for dexterity and industry, so that all in all tube replacement is not a job that should be undertaken lightly just because doing it the first couple of times presented few problems.

Remember that PIL tubes have the scan coils etc. permanently fixed, so that the replacement will come with the coils and magnets already fitted and aligned. This is another reason for having the new tube to hand before removing the old one – so that you know what you're dealing with.

Long-distance Television

Roger Bunney

THERE was a slight fall off in propagation conditions during August, but overall and compared to the usual conditions in August it was an extremely active month. It was also (in the UK) a very dry and hot month, which gave improved tropospheric conditions for much of the period. The most unusual phenomenon occurred during the 4th-6th August, when the weather was very hot and humid with intense thunderstorms: several enthusiasts reported that the local u.h.f. signals faded out, suffering from some form of absorption. Here at Romsey the local Rowridge services, which are normally noise-free, were fading into the noise, the picture being subject to co-channel interference. The effect was particularly marked on the 4th. Fortunately Sporadic E propagation has remained very active, the following log of SpE reception being compiled from my own and several other enthusiasts' reception.

2/8/81 RTVE (Spain) chs. E2, 3, 4; RTP (Portugal) E3; RAI (Italy) IA; JRT (Yugoslavia) E3; NTV (Nigeria) E3 – received by Cyril Willis in Cambridge!; plus several unidentified stations and the Italian NCT "free" station which transmits between chs. E3/IA.
5/8/81 MTV (Hungary) R1; DFF (E. Germany) E3; TVP (Poland) R1; JRT E3, 4; TSS (USSR) R1.
6/8/81 CST (Czechoslovakia) R1; TVP R1; JRT E3; Switzerland E3; plus unidentified signals.
7/8/81 RAI IA; RTP E3.
8/8/81 NRK (Norway) E2, 3, 4; YLE (Finland) E4; TSS R1, 2; RTVE E3; JRT E4.
9/8/81 RTVE E2, 3, 4; Switzerland E2; ORF (Austria) E2a; RAI IA; NCT E3/IA; JRT E3, 4; MTV R1, 2.
10/8/81 TSS R1; RAI IA; RTVE E3.
11/8/81 MTV R1, 2; JRT E3, 4; RAI IA; NCT E3/IA; RTVE E2, 3, 4; TVP E3. There was good MS (meteor scatter) reception this day.
12/8/81 TVR (Rumania) R2; NCT E3/IA; RAI IA, B; JRT E3; Switzerland E2, 3; RTVE E2, 3; NRK E2, 3.
13/8/81 TSS R1, 2; SR (Sweden) E2; TVP R2; RAI IA; YLE E3; NRK E2, 3, 4; plus unidentified signals on chs. R1, 2, 3.
14/8/81 TSS R1; YLE E2, 3.
15/8/81 SR E2, 3; RTVE E2, 3, 4; JRT E3. Plus many unidentified signals.
16/8/81 RTVE E2, 3, 4; RAI IA, B; JRT E3, 4; TSS R2; MTV R1; RTS (Albania) IC; plus unidentified signals.
17/8/81 TSS R1, 2; CST R1; TVP R1, 2; RAI IA, B; RTVE E2, 3, 4; RUV (Iceland) E4.
18/8/81 TSS R1, 2, 3; CST R1; RUV E3; NRK E2; MTV R1, 2; TVP R1, 2; JRT E3; plus many unidentified signals.
21/8/81 TSS R1, 2.
22/8/81 RTVE E2; RAI IA.
23/8/81 MTV R1; RAI IA; TSS R1, 2; JRT E4; plus many unidentified signals.
24/8/81 CST R1; TVP R1.
25/8/81 SR E2, 3; NRK E3; TSS R1.

More exotic reception during the month was as follows. On the 14th there were very strong ZTV (Zimbabwe) signals from Gwelo on ch. E2, with clear pictures and sound, including "The Incredible Hulk" followed by "Mixed Blessings" (1800-1830). There was further reception from ZTV on the 14th and 15th, including part of the "Salisbury Show". Hugh Cocks (E. Sussex) logged NTV (Nigeria) on the 2nd and 14th. JTV (Jordan) ch. E3 was logged on the 16th and 17th during the early evening period. The 15th produced Arabic f.m. signals at 95MHz, coinciding with ch. R5 programmes. One continuing mystery has been the repeated reception, again by Hugh, of a system M (525 lines) ch. A2 signal carrying AFRTS programmes, via SpE from the south east. We are awaiting information from AFRTS as to whether the Iraklion (Crete) transmitter is still in operation.

Tropospheric Conditions

Tropospheric propagation during the period was also well above average. Following the excellent opening on July 31st, the first week of August produced enhanced W. German, French, Swiss (chs. E4, 6, 12 and 27) and Irish signals, also the "usual" GDR ch. E6/34 signals. DR (Denmark) was well received on the 6th in the south east. There was another lift on the 12th-14th, when noise-free signals from the Channel Isles were received here at Romsey on chs. 41/54. The 13th produced extremely intense French (TDF) signals in both Band III and at u.h.f. Improved conditions continued throughout the rest of August, peaking on the 17th (with Switzerland at u.h.f.), the 18th, the 19th (with RTVE), the 25th (RTVE again, including ch. E11) and the 27th (with W. German signals). The weather pattern at the time of writing (on the 28th) suggests that there will be further tropospheric activity within the next few days.

In General

It became very evident during the recent enhanced tropospheric conditions that the French are testing their new channel allocations. Hugh Cocks has been receiving 625-line system L signals on ch. 6 on a daily basis and, following a recent visit to Paris, John Tellick confirms that ch. 6 is being tested between 0900-1800 with colour bars and "message bands" advertising French teletext.

TSS have been using a new test pattern on ch. R2. It originates from Tallinn, Estonia, and carries a station identification. Let's hope that this progressive move will extend to the rest of the network!

The most important development this month is unofficial confirmation that Morocco has a ch. E4 transmitter in operation – their first in Band I and currently the only such Band I transmitter in N. Africa. This station has been received daily in the south of France via tropospheric propagation, and also here (unknowingly!) on July 10th at 2300, with local news, and by myself on July 30th at 2030 with a modified EBU bar pattern. We're awaiting further details from RTM as to location, transmitter power, etc.

My thanks to the following who provided various reception reports quoted above: Ray Davies (Norwich), Hugh Cocks, Ryn Muntjewerff (Holland), Martin Reynolds (Nuneaton), Cyril Willis (Cambridge), George North

(Walton), Nicholas Brown and Mark Baldwin (both Rugby) and Keith Hamer (Derby).

News Items

Luxembourg: Following our report last month, we understand that the entire RTL mast structure subsequently collapsed. Hugh Cocks reports (August 26th) that RTL ch. E7 is back on air, at greatly reduced power. It seems that Belgian transmitters may be used to maintain the RTL services.

W. Germany: According to Alexander Wiese (Munich), 27 ZDF transmitters have been modified for dual-sound transmissions. He also reports that the E. German Helpterberg station is now transmitting DFF-1 on ch. E37 (in addition to DFF-2 ch. E22).

Spain: RTVE has been experimenting with the use of solar-powered relay transmitters at five sites throughout Spain. The results have been successful, and a further fifty transmitters, with powers less than 1W, are to be installed. The aim is eventually to use 5W solar-powered relay transmitters.

Eire: A bill has been published to permit the formation of a broadcasting body, similar to the IBA, to issue contracts for commercial broadcasting. RTE, Reception Investigations, Donnybrook, Dublin 4, Eire have published an interesting transmitter and reception folder listing their u.h.f. transmitters and including coverage maps – it's called "Reception of RTE Television Programmes at U.H.F. – What You Should Know", and is highly recommended.

Hungary: The Antiope and UK teletext systems are to be tested during 1982, with a view to starting a teletext service in 1983.

ATV: Blean Video Systems, 4 Mount Pleasant, Blean Common, Canterbury, Kent CT2 9EU have sent us details of their comprehensive range of ATV receiver and transmitter modules. If you want details, send 20p with a foolscap s.a.e.

From Our Correspondents . . .

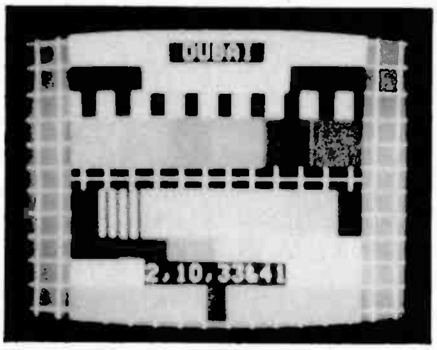
Paul Barnaby (Hull) has modified a Bush TV161 series receiver for operation on systems B/G/L and is using it in conjunction with a WB2 (Band I) and a Colour King (u.h.f.) aerial. He's been very successful with west and east European reception during the past three months – via SpE and tropospheric propagation. Lille chs. 21/24 are weak but regular signals, as are many Dutch and Belgian transmitters. He's had problems with CB interference, but having contacted the operators succeeded in getting low-pass filters fitted.

William Rhodes (Rednal, Birmingham) is another Colour King user. He has to have his aerial in the roof space, but with a low-noise head amplifier reports good reception – during the opening on the 31st, he received many u.h.f. stations including a remarkable catch, the "RS-KH" electronic pattern from Zilina (Czechoslovakia) on ch. R35.

Brian Renforth (Chippenham, Wilts) is using an old Wenvoe (ch. B5) X aerial with an up-converter to feed his rented Baird receiver. During the past SpE season he's been successful in logging signals from most of Europe with this simple installation. During the July 28th-31st opening he achieved quite startling results with a hand-rotated multiple-director u.h.f. array. CB interference is again a problem. I've heard, incidentally, that in the Folkestone area cordless 'phones operating in the 49MHz band – this is within the passband of the Folkestone relay transmitter's B2 receiver from Dover – are being up-converted and transmitted via

Hugh Sculley (BBC Nationwide) received in Cape Town by Paul Johnson.

Moscow ch. R3 (programme-4) received in Holland by Ryn Muntjewerff.



The Dubai square PM5544 pattern (ch. E2). Photo from H. Lloyd-Bennett.

the Folkestone B4 transmitter . . .

John Reed works and lives at Jeddah, Saudi Arabia. His reception, using a variety of aerials, makes envious reading – Syria ch. E4, Dubai E2, Jordan E3, RTVE E2/3 plus other European transmitters, the "local" Aramco TV ch. E3 and suspected NTV (Nigeria) ch. E3, all via SpE, while Sudan TV from Omdurman at 600 miles (ch. E5, 2·4kW) is received daily. On July 28th he logged a ch. E5 signal from the south – a programme called "Watch Mr. Wizard". Excluding the Sudan and Ethiopia, the source is probably one of the two Yemens. The local Saudi Arabian television is listed as ch. 25, but additional unlisted stations are in operation. Those received in Jeddah are on ch. E21 to the south, on chs. E42/3 to the north and chs. E50/1 to the north east. John is currently using a JVC CX610 receiver: he's obtaining a Sony system A receiver in the hope of catching Crystal Palace ch. B1 – we await the results with interest!

The subject of Crystal Palace is also dear to the heart of Paul Johnson (ZS1BR) in Cape Town. He's been receiving the BBC-1 signals for some time – one of our photographs shows Hugh Sculley (BBC "Nationwide" programme) on April 3rd this year. The signals are mainly propagated via early evening trans-equatorial skip, though daytime F2 propagation also occurs. There's evidence of tropospheric enhancement at the receiving end of the signal path. The polarisation seems to be random, and an aerial orientated away from the correct direction will often give enhanced picture quality with reduced multipath distortion/smearing. The receiver being used is a Bush Model TV141U, with a vertically mounted three-element Yagi aerial. The TF-1 (France) ch. F2 sound is also often well received.

Finally, H. Lloyd-Bennett (Dhahran, Saudi Arabia) has sent us several photos showing local TV signals: the ch. E2 Dubai signal is the "square PM5544" often received last winter via F2.

VCR Servicing

Part 3

Mike Phelan

LAST month we discussed the servo systems required in a VCR, with specific reference to the arrangements used in the basic JVC HR3330 machine. If the subject of servos seems a bit on the complicated side, just remember that what happens is much the same as what happens in a TV set's flywheel line sync circuit. In modern VCRs, much of the servo circuitry is incorporated in special-purpose i.c.s, so the servo circuit component count is fairly low.

Let's summarise briefly the minimum requirements of a VCR servo system:

(1) It must ensure that the head drum and the tape-drive capstan rotate at constant speeds, the same on both record and playback.

(2) The positions of the video heads must be referenced to the field sync pulses during recording.

(3) Control pulses derived from the field sync pulses must be recorded on the tape.

(4) On playback, either the head drum or the capstan must be referenced to the recorded control pulses. The item not referenced to the control pulses is speed controlled only.

The fourth requirement ensures that the heads scan the recorded tracks accurately. Clearly it doesn't matter whether the machine is "drum controlled", as with the HR3330 we described last month, or "capstan controlled". The simplest example of the latter approach is probably the Philips N1500/N1700 series, so to round off our introduction to VCR servos we'll take a brief look at the arrangements these use.

Philips Servo System

In the N1500 and N1501 the circuitry is all discrete, while in the N1502, N1700 and N1702 there are a few logic and linear i.c.s involved. The basic principle of operation remains the same however, despite the fact that the N1500 uses a.c. induction motors with eddy current brakes. To go off the track for a minute, the latter fact means that the motors are arranged so that they run slightly fast, the servo system applying a braking effect. An alloy disc on the motor or driven element passes through a polepiece carrying a coil fed from a power transistor, the transistor being the final item in the servo chain – like the motor drive transistor in the arrangements we described last month. The circuit is arranged so that when this transistor is at the centre of its operating curve, the current through the braking coil maintains the correct motor speed.

Fig. 19 shows the N1500's servo system in block diagram form. It's very simple and very effective with, basically, only three things being switched. A 25Hz reference is used on both record and playback. As usual, the field sync pulses provide the record reference, after division by two. On playback the reference signal comes from the power supply, again at 50Hz then divided by two. This division by two is carried out by an astable multivibrator which acts as a voltage-controlled oscillator to the incoming reference signals, providing a 25Hz squarewave output. This output is applied to the control track head on record, meeting requirement (3) above, and is processed to provide ramps for the capstan and head drum servo sample-and-hold circuits, meeting requirement (2). The drum servo compares the ramp with feedback pulses from the head drum on both record and playback. The capstan servo compares the ramp with servo head feedback pulses on record, and with the off-tape control track pulses on playback. Requirements (1) and (4) have thus been met. In connection with the latter, note that the tracking control affects the phasing of the playback sample pulses in the capstan feedback control loop.

Back to the HR3330

We'll return now to the JVC HR3330 machine, to examine the signal sections in more detail, starting with the machine in the record mode. The tuner unit, channel selector and i.f. strip are conventional, and will therefore be left out of our description. The tuner is preceded by an aerial amplifier and splitter (see Fig. 20), the splitter being necessary to divide the signal between the VCR's tuner and the tuner in the associated TV set – otherwise you'd have to change the aerial connections over to watch an off-air transmission with the VCR not in use, or when a different channel was being recorded. If the channel being recorded is also being watched, this can either be done in the normal manner or via the VCR. In the latter case the receiver's

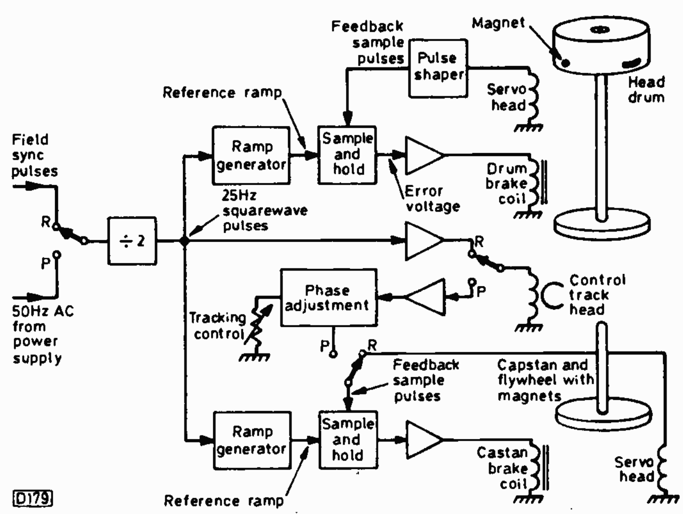


Fig. 19: Servo system used in the Philips N1500 VCR. Note that the control track is at the top edge of the tape in the Philips system.

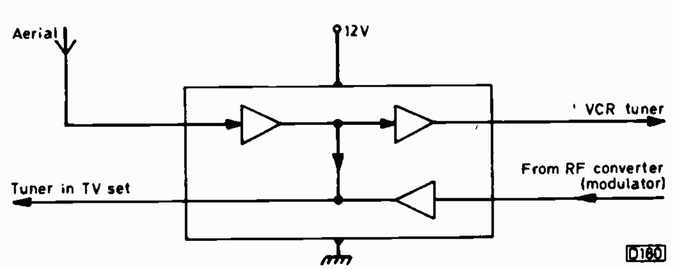


Fig. 20: The signal splitter/preamplifier arrangement used in the JVC HR3330 VCR.

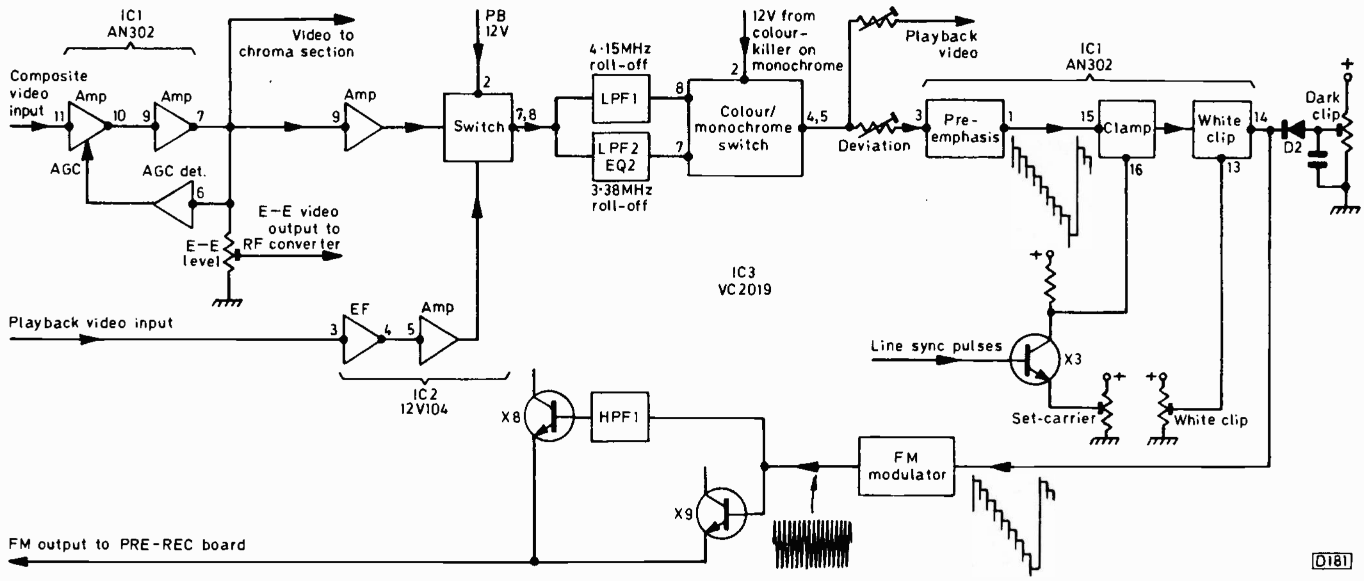


Fig. 21: Block diagram of the luminance signal path on record.

"VCR channel" is selected, the signal going through the VCR's tuner and i.f. strip, then back out via the r.f. converter where it's remodulated on to a u.h.f. carrier, round about channel 37. The r.f. converter's output can be adjusted up or down a few channels – there would otherwise be severe patterning if one of the local channels was close to the VCR's output channel. Using the machine in this manner is known as the E-to-E mode. Direct off-air viewing will give better results of course, as the signal goes through only one tuner and i.f. strip. The amplifier in the "mix booster" (as it's called) makes up for the insertion losses introduced by the splitter.

The audio signal produced by the sound detector passes via an equalizing amplifier to a push-pull oscillator which adds an h.f. bias signal of 70-80V peak-to-peak prior to the signal being recorded on the top edge of the tape by the audio head. The h.f. oscillator also feeds the erase head, the latter erasing the full width of the tape. On VHS machines there's an "audio dub" facility, enabling the audio track only to be erased and re-recorded without affecting the picture. This necessitates an extra slide switch and an extra erase head that covers only the audio track – the latter is part of the same assembly as the audio/control head.

Luminance Signal Path

The video signal from the i.f. strip, or from the video input socket if the mode switch is in the "camera" position, enters IC1 on the Y-C (luminance-chrominance) board – see Fig. 21. It goes through two stages of amplification in IC1, the first being gain-controlled because the luminance signal must be of constant amplitude before conversion to f.m.

The signal leaving pin 7 of IC1 is split three ways. The first branch goes to the chroma processing circuit via a 4·43MHz bandpass filter. The second branch goes to the r.f. converter via the E-to-E level preset, to be remodulated on to a u.h.f. carrier so that the recording can if necessary be monitored. The final branch goes to a further stage of amplification, in IC2, and then to an electronic switch, operated by the PB 12V supply, in the same i.c. This switch is included so that some of the recording circuit can also be used on playback.

The signal path then splits again, via two filters giving 3·38MHz and 4·15MHz roll-offs. The following i.c. (IC3) is switched by the colour-killer. This is done so that the signal with the higher frequency roll-off can be used on monochrome, the 3·38MHz roll-off removing the colour from the luminance channel on a colour recording. If the colour signal was still present when the luminance was converted to f.m., there'd be some very strange effects indeed. In later versions of the machine only the 3·38MHz filter is incorporated, LPF1 being removed and IC3 being replaced by an emitter-follower, the response then being the same on both colour and monochrome.

The luminance signal, with the chroma now removed, then returns to IC1 for pre-emphasis. The preset marked "deviation" adjusts its amplitude – we'll see why in a moment. A sync-pulse driven clamp, consisting of transistor X3 and yet another part of IC1, then restores the signal's d.c. level, the "set carrier" control adjusting the clamping level. This is followed by white and dark clipping to remove the spikes produced by the pre-emphasis (where they exceed a certain level). The white clip circuit is again within IC1, the dark clip circuit consisting of a simple, adjustable diode clipper.

The signal has now been prepared for f.m. modulation. The circuit of the f.m. modulator, which consists of a

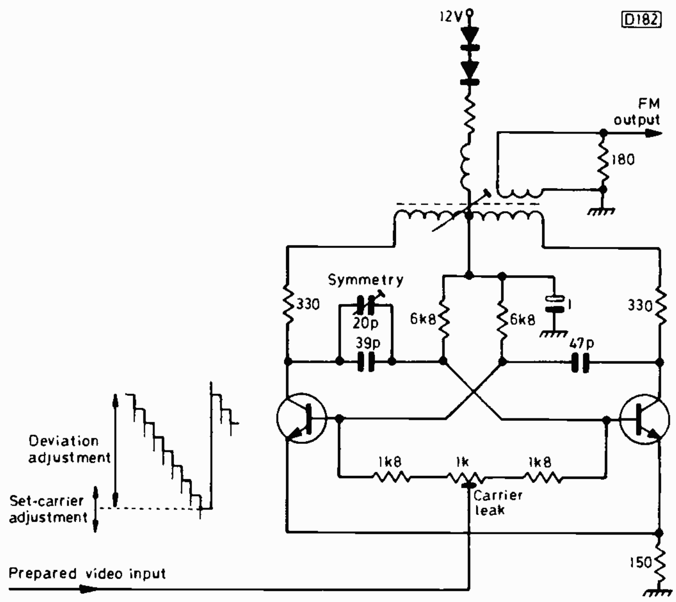


Fig. 22: The f.m. modulator circuit used in the JVC HR3330 VCR. Later machines use an i.c.

voltage-controlled multivibrator (a Kalitron to be exact), is shown in Fig. 22. The higher the voltage fed into the video input, the higher the output frequency. As we mentioned in an earlier instalment, a swing of 3·8MHz for the sync tips to 4·8MHz for peak white is used in the VHS system.

The reason for the set-carrier and deviation controls shown in Fig. 21 should now be apparent. As the sync tips are clamped, the set-carrier control is adjusted so that an input at the same d.c. level as the sync tips produces a 3·8MHz output (to put it another way, we're adjusting the overall d.c. level of the signal so that the oscillator's output is at 3·8MHz during the sync period). The deviation control adjusts the signal amplitude and thus the output frequency at all levels above the sync tips (the adjustment is for peak white at 4·8MHz). Don't attack the nearest VCR with your trimmers – we'll give the correct method of adjusting these two controls later. They need adjustment only if replacements have been carried out in this part of the circuit – or if the "phantom twiddler" got there first . . .

The f.m. modulator in the HR3330 is contained in a screened box and uses discrete circuitry – in later models an i.c. is used. The two controls within the modulator adjust the mark-space ratio without modulation (symmetry) and when fully modulated (carrier leak).

Back to Fig. 21. The resultant f.m. carrier is then split, one side going to X9 and the other to X8 via HPF1. This filter removes the lower f.m. sidebands to leave room for the down-converted chroma signal. X9 is switched on with a monochrome signal, bypassing the filter. The signal then leaves the Y-C board to go to the pre-rec board where the chroma signal is added. After that it passes to the rotary head transformer.

TV Standards

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

I HEARD a sad story the other day of a chap who had purchased a Sony VCR whilst on a business trip to the USA, intending to use it on his return to the UK. He'd been attracted by the very low price of $600 (about £280 at the time). The machine was an SL5700, the US equivalent of the C7 Betamax VCR. When our business man returned, he called upon the local TV shop to set the machine up and was rather taken aback when the engineer informed him that no way would his VCR work, as it was designed for the US TV system. The owner protested that the American salesman had sold him a transformer to make the machine work in the UK, for which he'd paid an extra $34 ... The last I heard was that the gent concerned was seeking an export market for his brand new but useless VCR, without much luck.

This little tale is typical of the confusion that has always surrounded the various TV systems in use and their compatibility. The situation is likely to get worse, since video equipment seems to be cheaper in many foreign markets. One can imagine TV games cartridges, video discs and other software being bought whilst on holiday with little thought being given to the technical parameters concerned. Let's consider the problems then, and some possible ways in which they can be avoided.

If we take for example a colour TV set, the following factors would need to be taken into consideration: mains supply (voltage/frequency); line standard (mainly 625 and 525 lines); colour system (NTSC/PAL/Secam); the channel bandwidth and vision/sound signal spacing; the polarity of the vision modulation (positive- or negative-going); and the sound modulation (a.m. or f.m.).

TV Systems

Table 1 shows the main characteristics of the principal TV systems in use world wide. Within particular geographical regions, the problems are not so great. For instance, with a monochrome portable receiver in W. Europe the main problem will be the different vision/sound signal spacing, plus in the case of France the different vision modulation and sound modulation systems.

Another difference is that whereas v.h.f. is being phased out for TV use in the UK, in other areas v.h.f. is still very much alive. In most European, American and African countries a multiband tuner will be required.

The three main colour systems NTSC, PAL and Secam – there are variants, particularly of the latter – are totally incompatible. The problem with PAL/Secam operation has become less with modern i.c. decoder designs, since some sets of chips will automatically switch between these two systems.

Though the 405- and 819-line systems still linger on, there are basically only two line standards to be reckoned with today – 625 lines (50 fields) and 525 lines (60 fields). The use of 525 lines and the NTSC colour system go together, i.e. the USA, Japan and various countries in the Americas. The use of 625 lines is linked with the PAL and Secam colour systems. It's possible to display a monochrome 525-line picture on a 625-line receiver and vice versa, but the picture geometry will be incorrect. Adjusting the controls will alleviate this problem. It's not possible unfortunately to record a 625-line picture on a 525-line VCR or vice versa, a problem that's plagued broadcasters for years (see Table 2).

Multi-standard Equipment

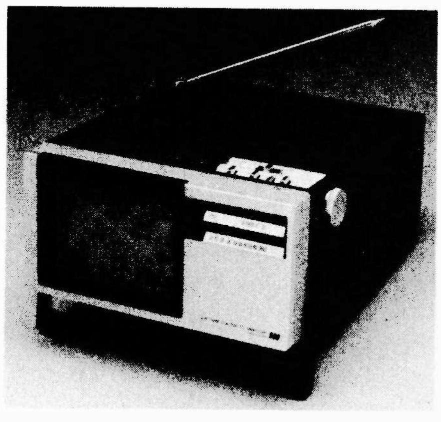
Having considered the main differences between the various TV standards, let's consider some ways in which the problems can be alleviated.

Multi-standard receivers to operate on the various different standards used in W. Europe have been available for some years – the Belgian Barco company produce such sets for example, though their price has tended to restrict

Table 1: Characteristics of TV Systems.

System	*Lines*	*Channel bandwidth (MHz)*	*Vision bandwidth (MHz)*	*Sound/vision spacing (MHz)*	*Vision modulation*	*Sound modulation*
A	405	5	3	− 3·5	Positive	a.m.
B	625	7	5	+ 5·5	Negative	f.m.
C	625	7	5	+ 5·5	Positive	a.m.
D/K	625	8	6	+ 6·5	Negative	f.m.
E	819	14	10	±11·15	Positive	a.m.
G/H	625	8	5	+ 5·5	Negative	f.m.
I	625	8	5·5	+ 6	Negative	f.m.
L	625	8	6	+ 6·5	Positive	a.m.
M	525	6	4·2	+ 4·5	Negative	f.m.
N	625	6	4·2	+ 4·5	Negative	f.m.

Notes: The UK uses system I at u.h.f. Most of W. Europe uses system G at u.h.f. System H has a wider vestigial vision sideband than system G. System K1 has a wider vestigial vision sideband than system K. System D is used in E. Europe. France uses systems E and L – system K is used in French overseas territories.



The JVC Model CX610GB. This 6in. colour receiver/monitor has a v.h.f./u.h.f. tuner and can be used to receive system B, G, D, K, K1 and I transmissions, with either PAL or Secam colour. For monitor use, video and audio input and output sockets are provided.

Table 2: Replaying videotapes.

VCR	Cassette	TV set operating on: PAL	NTSC	Secam
PAL	PAL	Colour	Mono	Mono
	NTSC	—	—	—
	Secam	Mono	Mono	Colour*
NTSC	PAL	—	—	—
	NTSC	Mono	Colour	Mono
	Secam	—	—	—
Secam	PAL	Colour	Mono	Mono
	NTSC	—	—	—
	Secam	Mono	Mono	Colour

**Note:* VHS Secam tapes are recorded using different standards depending on whether they are intended for the French or Middle Eastern markets. Thus a French Secam tape played on a Middle Eastern market VCR such as the Portatel VHS conversion will produce a monochrome picture. French Secam tapes played back on a PAL VCR will appear in monochrome, whereas Middle Eastern tapes will usually produce a colour picture.

them to professional use. A cheaper solution is now available in the form of the JVC Model CX610GB, a small portable colour set capable of receiving 625-line programmes on systems B, G, D, K, K1 and I, in either PAL or Secam colour. It's also possible to obtain sets capable of 525/625-line operation. Some of these sets will automatically switch to the correct line standard. The Sony Model PVM1850PS is capable of receiving both PAL and Secam off-air transmissions, and will display modified NTSC pictures replayed via a suitable VCR.

VCR Problems

When it comes to using VCRs in different countries, the problems become more complex. A 625-line UK TV set will display a 525-line picture without much trouble as the range of timebase adjustment is quite wide – often a small adjustment to the field hold control is all that's needed, though the picture geometry will not be quite right. Standard VCRs are not so tolerant, and are designed to cope with either 50Hz or 60Hz field pictures, not both. If you attempt to record UK TV on an NTSC machine it just won't work, as much of the timing circuitry is controlled by the received sync pulses. The servo system will try to divide 50 by two and expect 30, and when it gets 25 instead it gets confused! Conversely a 625-line VCR won't record US transmissions.

The broadcasters get around these problems by using standards converters – but even optical units cost in excess of £100,000. The low-cost solution was pioneered by Sony: when they introduced their semi-professional U-matic range of VCRs in the UK, they designed them to be capable of playing back NTSC tapes recorded on NTSC machines in the USA or Japan. The signal provided by these machines is not to the PAL standard when an NTSC tape is being played back but, interestingly, neither is it to the NTSC standard! Instead, a special standard called NTSC 4·43MHz is used, with 525 lines, a 60Hz field frequency and a 4·43MHz colour subcarrier. This enables a relatively conventional type of PAL monitor to be used to view the tapes. The system has since been adopted by other manufacturers, and has been applied to domestic VCR systems, including VHS and Betamax. ■

Focusing Systems

Richard Blenheim

A RECENT article in the Practical TV Servicing series drew attention to the focus circuits used in colour receivers. The emphasis was on older models and their tubes, since these are the ones most likely to require servicing. There have been some developments in tube focusing systems in recent years however, and it's worth summarizing them. Apart from the technical interest, it's as well to be aware of the features of different types of tube to ensure that replacements are of the correct type.

The vast majority of colour tubes in use are of the bipotential variety, which means that the first anodes are operated at around 500V whilst the focus electrodes are operated at some 4·5kV. The main exception amongst older tubes is the unipotential type, such as the Mullard 18in. A47-342X tube, which is operated with much the same voltages on the first anodes and the focus electrodes. The trend in recent times has been to obtain improved focus performance by operating tubes with a higher voltage on the focus electrodes. Both the 30AX and modern 90° tubes operate with a focus voltage of about 7kV, which is around 28% of the e.h.t. instead of the 20% used with bipotential tubes. Mullard use the term hibi (high bipotential focus) to describe the new type of electron gun used in their latest 90° narrow-neck tubes. Chassis that use this type of tube include the Thorn TX9 and the new Decca/Tatung 120 series.

The Hibi Gun

Fig. 1 compares the conventional bipotential gun with the newer hibi type. The main beam focusing action occurs between the focus electrode and the final anode: the reason for increasing the focus voltage is to reduce the beam magnification, and thus the spherical spot distortion, in the main lens. Reducing the main lens magnification means that the focus electrode has to be lengthened in order to maintain the correct spacing between the beam crossover point and the main lens. This in turn means that prefocusing is required to prevent the beam becoming too wide. Prefocusing is achieved by modifying the first anode structure as shown. Corner resolution is improved by making the initial part of the focus electrode of a magnetic material such as NiFe 42.

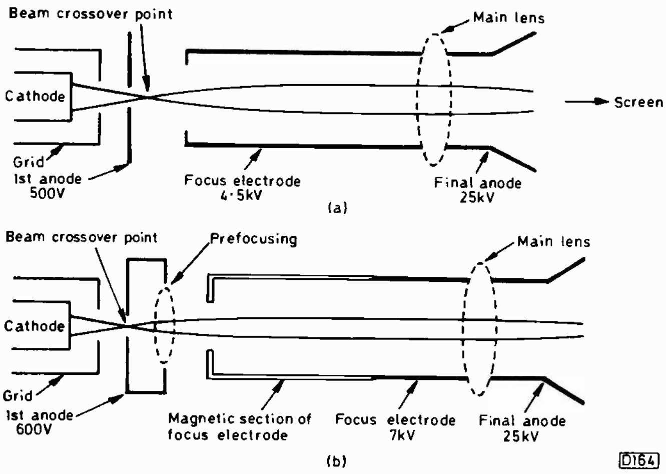


Fig. 1: Comparison between the conventional bipotential tube gun (a) and the newer hibi type (b).

In comparison with the conventional bipotential gun, the spot size with the hibi gun is reduced by 20% at the centre of the screen. At the corners the spot width is reduced by 15% and the spot height by 30%. The overall result is greatly improved resolution, which is of particular importance for text displays.

The hibi gun has an increased cut-off voltage (about 140V), which means that the first anode voltage should be somewhat higher – about 600V. Since the first anode voltage determines the prefocusing effect, any marked change will adversely affect the focusing. The hibi gun also calls for a different focus spark gap and tube base socket (the focus pin has to be more heavily insulated). A suitable base is the JEDEC type B10/277. Printed spark gaps are not suitable at 7kV. The printed type used with bipotential tubes allows slight leakage across the board. This is not serious, even with high humidity. At 7kV however, the leakage can be sufficient to cause the focus voltage to vary, so that a spark gap physically separate from the board is necessary.

Some Other Techniques

An alternative approach to obtaining improved focus

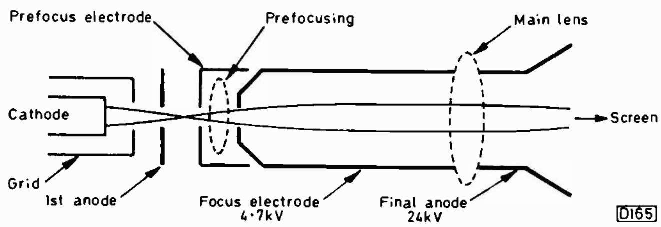


Fig. 2: Additional electrode used in the National Panasonic Quintrix tube to provide prefocusing and thus improved overall focus performance.

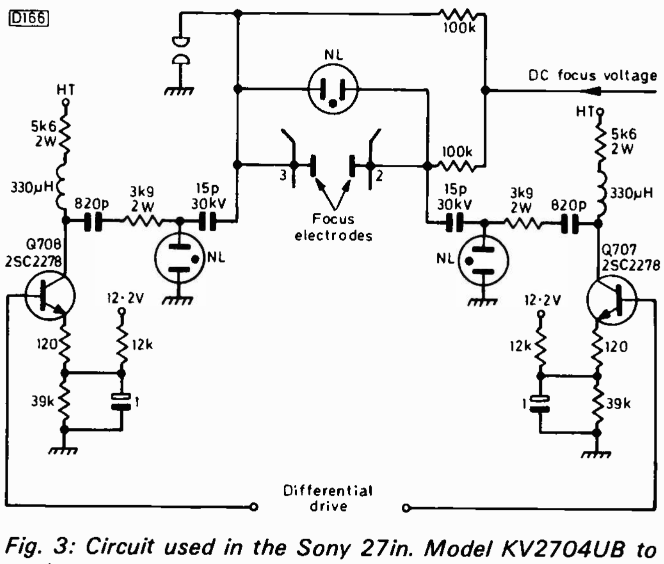


Fig. 3: Circuit used in the Sony 27in. Model KV2704UB to apply a.c. and d.c. voltages to the focus electrodes. Sony call this the "Turbo Trinitron" system.

performance is used in the National Panasonic Quintrix tube, which employs an additional electrode between the first anode and the focus electrode to provide prefocusing. The arrangement is shown in Fig. 2, the additional electrode being operated at a lower voltage than the first anode. National Panasonic have been using this type of tube since 1975.

Something quite different is used by Sony in their Model KV2704UB. This set has a 114° 27in. tube, and to achieve improved focus performance uses a split focus electrode system (pins 2 and 3) with both d.c. and a.c. voltages applied to the focus electrodes. The a.c. drive is differential (see Fig. 3), and is used to alter the spot shape on picture transients. For this purpose a signal is tapped from the luminance channel via a high-pass filter and fed via a phase-splitter to separate driver and output stages. ■

Letters

As far as heat and solid-state circuitry are concerned I must confess to being rather paranoid, my efforts to detect and eliminate "hot spots" in the various pieces of equipment that appear on my workbench often bordering on the frantic. The worst problem is intermittent faults in circuitry that's apparently working within specification. I've now come across a useful dodge that often provides a cure however. The clue as to what's wrong is provided when an "educated" finger tip detects an untoward temperature rise in an otherwise well behaved chip.

When I first came across this problem I thrashed around for a solution and, as I usually do when all else fails, stared moodily into the junk box. There, staring back at me, were several stone dead SN76023N type devices complete with beautiful five-fin heatsinks. So I carefully dug the corpse of the dead device out of one of the heatsinks and glued it, using a touch of super glue, to the offending though working device in the problem set. Some hours later my good lady, who is also the chief soak tester, informed me that the set had worked faultlessly all day – with the back on at that. Since then I've used this dodge to good effect on many occasions – in fact I'm now looking for a source of supply of five-fin 45mm wide heatsinks that doesn't depend on customers extending their speaker leads!

The dodge is worth a try and, in this era of house-coded special devices with any number of pins you can think of besides 14 and 16, can save a lot of time – some of these devices take ages to turn up and often fail to cure the problem when they do. It also saves the customer a bunch of notes.

In closing, keep it up Les! It does my heart good to read you once a month. Hearing of other sufferers' problems is better than Valium any day!

Anthony Beddow,
Minions, Cornwall.

ITT CVC32 CHASSIS

The intermittent loss of field scan at the top of the screen, mentioned in the September *Service Bureau,* is a common fault with the ITT CVC32 chassis. The cause is a dry-jointed connection where the emitter of the lower field output transistor T9 is returned to chassis.

J. Tayler,
Arbroath.

USE OF SOLDERING FLUX

While browsing through a local hardware shop recently I noticed some small, flat round tins which had a dark green label and seemed vaguely familiar. Bringing one of them into the focus range of my ageing bifocals, I noticed that they were something I'd not seen for a very long time, not since the advent of resin cored solder – they were tins of fluxite. Now whether due to some unaccountable impulse or simply nostalgia I'll never know, but I added one of these tins to my other purchases, took it home – and promptly forgot about it.

Some weeks later I came across the tin and decided to see whether its contents had a place in this modern world. I was pleasantly surprised to find that a small amount of flux applied to such items as transistors, i.c.s and other printed panel mounted components made removal much more easy. Indeed where additional solder is applied to aid removal, a saving can be made in view of the present cost of a reel of solder. Other uses include tinning leads, component ends and heavy-duty soldering. Excessive flux can lead to tracking, so any surplus should be removed.

A tin of sticky brown paste may perhaps be an unwelcome item on a busy work bench, but if the tin is kept covered when not in use it can be a very useful friend. After cleaning the tip of the soldering iron with a file, a quick dab into the flux not only produces a perfect tool for modern soldering techniques but also brings back memories with the familiar brief hiss. Perhaps the only thing missing is the blue/green flame when the iron was returned to the gas ring for reheating! Are there many of us left?

A. S. Foster,
Brixham, Devon.

SOLDERING-IRON STAND

I've recently made a simple, folding soldering-iron stand which is not only very stable but, as it folds up, occupies the minimum amount of space, making it ideal for outside work. The whole thing can be made from reasonably thick mild steel wire – I used 3mm wire. Fig. 1 shows the details – (a) in use and (b) when folded. To fold the stand, swing the holder backwards. Make the "U-turns" at the ends of the holder after passing the wire through the "eyes" in the base – the eyes should be just wide enough for the ends of the holder to pass through. The four thick rubber sleevings are optional, but avoid slipping when the stand in on a smooth surface. It's as well to incorporate them – before the eyes are formed of course.

Victor Rizzo,
Msida, Malta.

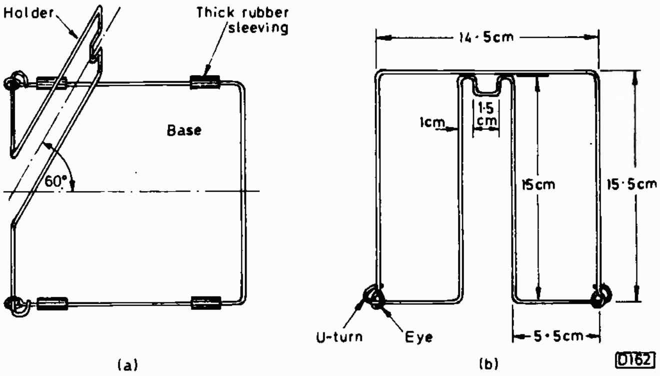


Fig. 1: Details of the folding soldering-iron stand devised by reader Victor Rizzo. (a) In use. (b) Folded.

VCR Clinic

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

We've had a couple of cases this month of machines that played back all right but refused to record correctly. The first one made recordings that were covered with black streaks and noise – it was a Ferguson 3V00 (JVC HR3330). We connected a scope to TP1 on the pre/record board to take a look at the f.m. output to the heads, and found that the waveform had a brightening effect at the centre – see Fig. 1(a). When we expanded the trace to show individual cycles of the waveform these were found to be nothing like sinewaves – in fact the effect looked like crossover distortion in an audio amplifier – see Fig. 1(b). This gave us our clue. The record output amplifier circuit is shown in Fig. 1(c). The waveform was o.k. up to the bases of the driver transistors X4/5, but the voltages at the output transistors X6/7 were incorrect. In fact bias diode D2 was short-circuit, giving us what was indeed crossover distortion. We find it a good rule to say that if a luminance fault does not seem to be like any of those encountered in a TV set, the cause is probably in the f.m. sections of the machine.

The recordings made by the next machine looked very similar, but this time we had more of a chase before tracking down the cause of the trouble. The waveform at TP1 was perfect. On playing the tape back however we had a picture that was discernible but covered with white dots, just as if one head was giving no or a low output. We connected the scope to TP7 on the same board to check the off-tape f.m. signal and found that this was very low on every other field. So we switched to record and connected the scope directly to the head connections (42 and 52, see Fig. 2). There was about 2V of f.m. at both points. We next checked the connections to the rotary transformer, but these were o.k. Clutching at straws we changed the head drum. The problem remained as before, and we became resigned to the idea of changing the lower drum assembly, which is not a very pleasant job. Inspiration then suddenly came – we made scope checks at the earthy ends of the connections (41 and 51) of the rotary transformer. Connection 41 was o.k. (no signal), but connection 51 had 2V peak-to-peak signal, the same as at 52! This was simply due to the fact that X11, which earths point 51 on record, was not being switched on. R30 in series with its base was dry-jointed. Notice that opposite ends of the transformer are used on record and playback, the earthy ends being connected to chassis via switching transistors.

No Colour

After resoldering R30 we gave the machine a test and found that the colour suddenly disappeared on playback. Checking with a prerecorded tape showed that the fault was in the machine's playback system.

In cases of no colour the things we check first are the presence of sync pulses at TP213 on the luminance/chrominance board, of a 4·433619MHz signal at TP215 and a 5·06MHz carrier at TP219. These were all present. The colour/monochrome switch at the rear of the machine was then tried, but there was still no trace of any colour. The next step should be to check through the signal path with the scope. TP202 and TP203 (see Fig. 3) both had good 626·9kHz signals and, proving that frequency conversion was taking place, there was a 4·43MHz signal at pin 7 of IC202. So even if the frequency of the colour signal had been wrong there should have been some trace

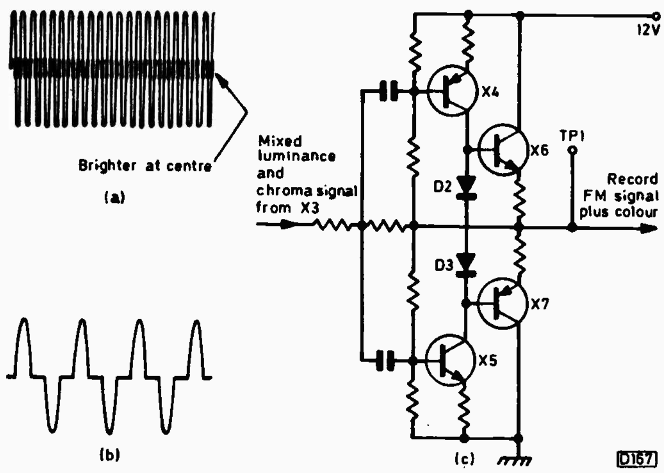


Fig. 1: (a) Faulty luminance signal at TP1. (b) Expanded trace of the signal at TP1. (c) Record driver and output stage circuit (simplified).

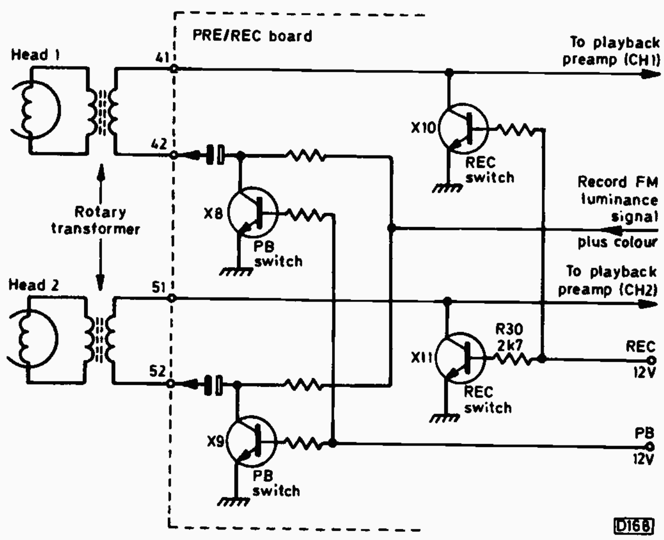


Fig. 2: Record/playback switching at the heads – simplified circuit. X8/9 are switched on during playback. When recording, X10/11 are switched on.

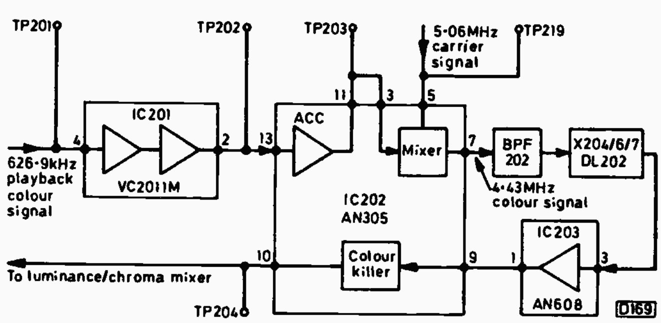


Fig. 3: Block diagram of the colour signal path on replay.

of colour on the screen with the killer overridden. The signal was still present at pin 3 of IC203, but nothing was coming out at pin 1. A replacement AN608 i.c. (it looks like a four-legged transistor) put matters right. **M.P.**

A Delivery of Toshiba VCRs

Another delivery of Toshiba VCRs came in recently. Most were up to specification, but two failed our stringent testing procedure. The first one had a buzz on audio: it could be heard during recording and was in fact being recorded on the tape. There was no buzz when a known good tape was replayed, nor when recording was tried from an external line input. With the scope we traced the buzz back towards the sound demodulator in the i.f. section, and eventually discovered that on the rear connector panel the cables lie near the servo output circuits – the buzz was interference being picked up from the power servo stages.

The next problem was worse. Andy had noticed that the machine produced Micky Mouse audio in the cue and review modes, when the audio should be muted. Furthermore the audio was at a very low level when the machine was in the record mode. Again we checked around with the scope, and found that two record muting transistors were being turned on by a small voltage which came from the Play-12V line. It took some time to check around this supply line, but I eventually traced the cause of the trouble to a Sony CX141 i.c. on the servo panel. The Play-12V supply switches one of its inputs, and the relevant output was at 3V when it should have been at 0V. **S.B.**

Service Notebook

George Wilding

"One Channel" Faults

Two sets came to our attention recently with faults on one channel only. The first was an ITT hybrid monochrome set (VC200 chassis) with the complaint that the sound on BBC-2 had got progressively more distorted, though the quality on the other channels was excellent. Slight readjustment of the cores in the sound discriminator transformer cured that, and whilst their positions were found to be fairly critical on BBC-2 the conditions on BBC-1 and ITV were normal.

The second receiver was a Pye hybrid colour set which had a marked ripple on the BBC-1 picture, suggesting inadequate smoothing of the supply to the line oscillator. The BBC-2 and ITV pictures were quite free from the effect however. The set was being used with a mains-powered aerial amplifier, and on switching this off the ripple immediately disappeared while the contrast fell as the amplifier transistors used up the supply from the reservoir capacitor. As it happened we didn't need to service the amplifier's power supply – a local relay had come into operation since the original installation of the set and its aerial. Greatly improved results were obtained by removing the amplifier, repositioning the aerial and retuning the set.

We often come across sets being operated with an aerial amplifier in order to pick up the signal from a distant transmitter, the owners being unaware that local transmitters have since come into operation. If the local channel frequencies are not too far from those of the distant transmitter you may be able to use the same aerial, but where the transmitters operate at the other ends of the bands, as in my area, a new aerial is a must. Sometimes an owner will simply retune to the new transmitter without bothering about the aerial, not even changing its direction. The result is usually some ringing and evidence of mismatching, and there can be a wide disparity in the signal strengths obtained on the three local channels. It's quite astonishing the poor picture standards that some people will accept, especially when the impairment has been gradual.

Decca 30 Series

Lack of width was the problem with a Decca hybrid colour set (30 series chassis) – the picture was about an inch short on both sides. Pushing the slider of the width control to one extreme produced a big improvement, but there was still a slight gap at each side, while normally these sets produce full width with the slider of the width control midway. New valves failed to make any significant improvement, so the resistors in the width circuit came under suspicion. All relevant resistors were found to be within their tolerance limits however. Fortunately we'd another 30 series set in the workshop, so before delving into other possibilities we swapped over the timebase panels. The problem remained, so obviously the fault was due to something not on the panel – the possibilities were low h.t., the line output transformer or one of the capacitors mounted on it, or the tripler.

The h.t. was right up to the mark, but the 8kV fifth harmonic tuning capacitor C435 was somewhat blackened. As a quick first move, this was replaced. No improvement! The tripler wasn't running warm as far as it was possible to judge, but since changing the line output transformer is such a time consuming job on these Decca sets another tripler was tried. Needless to say after all this the transformer turned out to be the culprit. This was unusual however: usually, when the line output transformer in a colour set breaks down the symptoms are much more decisive.

In another of these sets the h.t. fuse had blown. The first step to take is to check for a short by connecting the meter on a medium resistance range between the PL509 line output valve's top cap (anode) and chassis. A "short" reading here usually indicates that the boost capacitor C436 has succumbed. Another possibility is a heater-cathode short in the PY500 boost diode – disconnecting its top cap (cathode) will isolate that. These items proved to be o.k. however, the short remaining. On inspection the harmonic tuning capacitor C435 was found to be blackened at one point on its edge, where an arc had jumped across to the earthed core of the line output transformer. Replacing this capacitor and the fuse restored normal operation.

Loss of Colour – ITT Hybrids

Loss of colour with ITT hybrid sets can be difficult to deal with since many stages, scattered all over a very large printed panel, are involved. The first thing to do is to check the voltage across the colour-killer reservoir capacitor C162 (4·7μF): it should be 0·1V on monochrome, rising to about 7·8V on colour. If the voltage is absent, you can override the colour-killer by connecting a 12kΩ resistor from the positive side of C162 to the 20V rail. Since C162 is normally charged from the PAL switch bistable, the resultant colour will suffer from blinds. Nevertheless this action will prove whether the chrominance signal path is intact and whether the reference oscillator is working.

I find it quicker however to start by checking the voltage across C218 (also 4·7μF). This voltage is provided by rectifier diode D37 when the 7·8kHz ident stage is working. The voltage at this point on monochrome is 4·7V, rising to about 11V on colour. In most cases of no colour you'll find that the voltage is low, due to failure of the ident stage, the burst gate/amplifier stage, the reference oscillator or one of the first two chroma stages. Voltage checks will then indicate where the fault lies.

In a recent case we found that there was no voltage at the emitter of the second chroma amplifier transistor T28 (BF241) instead of the scheduled 1·8V. A check on the transistor revealed that its base-emitter junction was open-circuit, a replacement restoring normal colour.

Loss of colour on these sets is usually due to a faulty transistor in the decoder. It can also occur should the output from the ident stage be inadequate, due to drift or misalignment of its output coil L75.

Video Review: Toshiba V8600 VCR

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

It came to pass that we were delivered of some Toshiba V8600 VCRs – the new ones with four video heads to give improved still pictures and slow-speed playback. The styling is sleek and compact (see photo), with a slope on the push-button assembly. It's smaller than its predecessor, except in depth, and is slightly heavier – by a couple of pounds.

The controls along the front are standard – eject, rewind, stop, fast forward, pause, audio dub, record, review, play and cue. The tuner and timer controls are hidden away under flaps on the top of the machine. The tuning assembly consists of potentiometers instead of digital storage, though the latter was not a source of agitation: an a.f.c. on/off switch is also provided for preset tuning. Timer setting has now turned to microprocessor techniques, and is similar to that used on the JVC HR7700 machine. There are three time slots over seven days – these are called programme memories 1-3. Two buttons only set the timer: the "enter" button allows you to select any portion of the programme (indicated by the digits flashing), the "set" button enabling you to set the selected digits to the required value. Setting up progresses from selecting the day and start times, then the recording length in minutes, tens of minutes and hours. Finally the channel is set and the programme ends. The programme must be finished by entering "end" or it won't memorise. Programmes can be set to record every day of a week: programme 3 will record during the first week and then if left will repeat in the second week. If two programme times overlap the second one will be cancelled.

There's a noise reduction system: BNR (Beta Noise Reduction system, what else?). This is switched in and out on the front. A tape recorded without noise reduction and then played back with it will loose treble.

Useful and on the front are the tracking control, TV/line switch and the remote control socket. The least useful features on the front are the video and audio input sockets: the complementary outputs are at the rear – not a good point in my opinion. Whilst in a critical vein, the machine has a VTR-TV/VTR switch. In the TV/VTR position there are normal TV and VTR playback outputs. To see the V8600's tuner input however you have to move the switch to the VTR position, when you loose the TV throughput. Why a simple u.h.f. mixer system was not used to make this switch redundant defeats me.

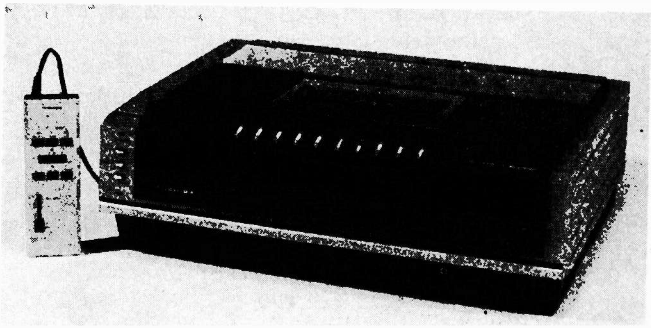
On the good side there's the counter search mode, using the counter to stop the recorder during rewind. In addition to the counter memory there's the PQS (Picture Quick Search) option. When this is "on" the recorder will stop at the beginning of a recording during fast forward or rewind, triggered by a pulse put on the tape whenever the record button is pressed.

The remote control unit has play, cue and review on the top row of buttons, stop in the centre, and slow motion, still and double speed on the bottom row. Also on this unit are a slow motion speed control and a slow motion tracking control (the latter is on the side). Later this year an infra-red remote control system will become available – the present cable connected remote control system comes with the machine as a standard item.

The performance is excellent – Toshiba after all did invent the helical-scan VTR system, a point which doesn't seem to be too well known. Record and audio dub are single touch switches, i.e. you don't have to press play as well: they are inset to prevent accidental operation. The extra facilities provided by the new machine are still frame, fast cue and review, very fast cue and review, and slow motion with variable speed.

Cue or review can be selected in the play mode. When either button is pressed and then released the recorder will work at seven times the normal speed. If the buttons are held down, the recorder operates at 25 times the normal speed. After using other recorders you can very easily be caught out and miss the bit you wanted to stop at, because cue and review lock in at seven times normal speed and you have to press stop or play. So there you are merrily whizzing through at 25 times normal speed and up comes the bit you want: you release the button but the recorder doesn't stop, it just drops to seven times normal speed. Then there's a panic whilst you scrabble to find the stop button and then move to cue or review again to get back to the bit you overshot. Don't say I didn't warn you!

Toshiba have gone to a lot of trouble with this machine to produce what must be the best ever slow motion and still pictures with a Betamax machine. The V8600 uses a technique (four heads) that some reviewers will doubtless say is new (but remember the Sanyo time-lapse monochrome reel-to-reel machine of about 1975), just like they said that the wobbling heads used with the



The Toshiba V8600 VCR.

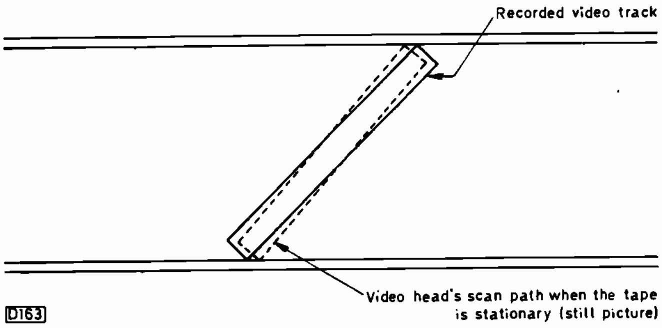


Fig. 1: The still picture problem with a VCR. Normally the tape and the heads move. If the tape is stopped to get a still picture, the heads will no longer scan the tracks correctly. Toshiba solve the problem by using separate, wider heads for stills and slow motion. The heads both scan the B head tracks, avoiding the picture jitter that occurs when a still is formed from an A and a B head track.

Philips/Grundig V2000 system were new (Ampex were using the technique back in 1972). The technique is to use two extra video heads to ensure that the recorded track is fully replayed without bits missing – this is what causes the noise band in so many machines (see Fig. 1). The four heads are mounted around the drum at the 90° points.

The two extra heads are referred to as B1 and B2 (they both replay the B head's tracks) and are thicker than the normal (A and B) heads: or, put another way, they are wider than the recorded tracks. The extra width allows the heads to maintain contact with the recorded track in replay throughout the length of the track so that there are no noise bars. The fact that the heads are B track heads eliminates the field jitter that's so obvious on fast-moving scenes with other systems. Vertical resolution is reduced because you see only one 312-line field. So what? the still pictures and slow motion are excellent – surpassed only by Grundig's V2000 still frames with jitter.

Top Machines

To sum up, the V8600 is a good machine. Nothing in this world is perfect, but at around £600 the V8600 certainly represents good value for money and, in my book, places it in the top three. What are these? The JVC HR7700, the Grundig 2 × 4 Super and the Toshiba V8600: each machine is without much doubt tops in its particular system (VHS, V2000 and Beta respectively). ■

New Tuner for DX Use

Hugh Cocks

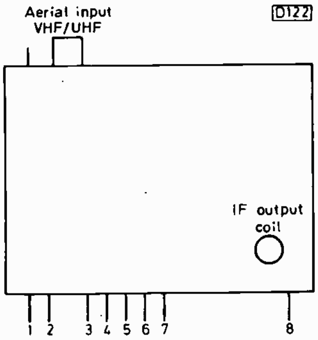
FOR some years now DXers have used varicap tuners to cover the TV bands, both v.h.f. and u.h.f., the ease of operation being much better than with the old turret/rotary mechanical tuners. Unfortunately what all varicap tuners suffer from, more so at u.h.f. than at v.h.f., is cross-modulation/intermodulation affecting the channels adjacent to strong local ones. This makes weak signals on these channels well nigh impossible to see, and the problem will be all the worse when the TV4 service comes into operation. A tuner that solves a great deal of this problem has now appeared on the market however – the ET021 mosfet v.h.f./u.h.f. tuner made by NSF.

Mosfet v.h.f. tuners that cover Bands I and III have been around for many years. Some v.h.f./u.h.f. versions employ a bipolar transistor u.h.f. section that often seems to overload more easily than "all bipolar" tuners! The ET021 covers a very wide range – 41-105MHz, 100-300MHz and 438-870MHz. Virtually every earthbound TV frequency is thus covered, and with slight adjustment it should cover the amateur TV channels (this should be done only by experienced enthusiasts however, as much tighter r.f. coupling is used with mosfets). Physically the ET021 is identical to earlier NSF v.h.f./u.h.f. tuners it will directly replace them.

Tuning across the u.h.f. bands with this new tuner is a delight! Signals that were previously lost in cross-modulation in the group C/D channels appear with ease, even when a bipolar transistor preamplifier is used. The tuner has a lower noise figure than more conventional types, and will produce a weak signal on ch. 59 when this is just not visible using an ELC2000 tuner. There is also a slight increase in v.h.f. sensitivity, which may help to reduce the 27MHz CB interference on Band I for those now plagued by this new problem.

One thing one has to get used to is the exact point in the 100-300MHz coverage where Band III appears – approximately 6-12V tuning potential will cover this band. A.G.C. action is very smooth compared with all the previous types of tuner I've encountered. Mosfet tuners in general produce less noise on the screen than bipolar transistor tuners, due to their low noise figure: this can be a little off putting at first sight, though one soon gets used to it.

Inside, the tuner is a complex beast, containing no less than six transistors – the only bipolar device employed is an AF379 u.h.f. oscillator/mixer. The v.h.f. department has two r.f. amplifier transistors side by side – possibly one for each of the v.h.f. ranges, though no circuit information is available at present.



Pin connections:
1 I.F. output
2 12V for low v.h.f.
3 Tuning voltage
4 12V for u.h.f.
5 12V supply
6 No connection
7 12V for high v.h.f.
8 A.G.C. About 8V maximum, 3V minimum

Fig. 1: Connections to the ET021 tuner unit.

The image channel rejection at u.h.f. is vastly improved, which helps with the problem of local Group B and C signals appearing at twice the i.f. below their proper tuning point – indeed with a 6mV input from a local Group C channel the image is very weak (some early varicap tuners were very poor in this respect).

The tuner costs a little more than a bipolar type, but the improvement is certainly worthwhile. It's available from Sendz Components at £10 plus VAT and 50p postage. ■

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 45 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.

DECCA 30 SERIES CHASSIS

The problem with this set is low e.h.t. with slightly too much width. A known good e.h.t. probe produces a reading of 18kV, and by trying other e.h.t. tapping points on the line output transformer I can't get more than 20kV on a blacked out screen. A new PL509 line output valve has been tried and the width circuit checked, but the problem persists. Otherwise, despite the low e.h.t., the brightness, contrast, focus and colour are good.

These symptoms usually mean that either the line output transformer is faulty or the harmonic tuning of the transformer is incorrect. Ensure that the white flying lead is present on TP402 (pulse feedback to the width circuit), then check that the fifth harmonic tuning capacitor C435 and the damping capacitor C433 (both mounted on the transformer) are present and correct. If so, it's likely that the line output transformer has failed.

THORN 3000 CHASSIS

I've a tricky power supply fault on this set. Several components have been replaced and a thorough check has been carried out for dry-joints, but the following problem remains – 30V supply o.k., but the 60V h.t. appears only about one in five times after switching on, with erratic shifting of the picture after a few minutes. When the set fails to start up, a scope check reveals a correct drive waveform, though of reduced amplitude, at the collector of the chopper driver transistor VT605.

The TRC100P diode W609, in series with the emitter of the chopper transistor, can be responsible for this sort of thing. Replace it with two 1N4002 diodes connected in parallel. If this fails to cure the problem, suspect internal trouble in the chopper driver transformer T602 – but check R616/R650/C636 in the drive circuit first.

ITT CVC5 CHASSIS

There's excessive brightness which cannot be reduced by turning the brightness control to minimum – also the contrast control has little effect.

First check the voltage at the c.r.t.'s grid pins (3, 7, 12). If this is in excess of 32V, check the VDR R409 and D57 – these components are connected between the boost line and chassis (the tint control, which acts on the c.r.t. grids, is fed from the boost line). Next check the first anode voltages. If in excess of 500V, check whether R266 which returns the first anode presets to chassis is open-circuit (it's in the convergence box). Finally, check the c.r.t.'s cathode voltages if necessary. If these are below 120V, check the brightness clamp diode D17 (BA157), R100 (8·2kΩ) which is in series with it, and the other components in the brightness control network.

THORN 1600 CHASSIS

There seems to be an overload in this set, as the fusible surge limiter resistor in the h.t. supply circuit has opened. The mains fuse is o.k. however, and there are no signs of any overheating anywhere.

First check whether the h.t. rectifier diode W24 (BY127) is short-circuit. If this is o.k., the fault is probably in the line output stage. Check the line output transistor VT16 (BU205), the e.h.t. rectifier stick W35 (by disconnection), and the two rectifier diodes fed from the line output transformer – W34 (BYX70) and W33 (BA159).

GRUNDIG MODEL 6011

There are momentary flashes across the whole screen, sometimes in magenta, sometimes green. There's also a general lack of redness, i.e. the reds tend to be brown/orange, though this occasionally corrects itself after one of the flashes. Do you consider the tube to be suspect?

The tube could be defective, but it's more likely that the fault is in the colour-difference amplifier module: replacing the three BF459G output transistors and cleaning drive controls R573/R583/R593 may well solve the problem. Then set up the grey scale.

THORN 3500 CHASSIS

After about an hour, the screen will blank out and then try to come back again. The brightness control has no effect when this happens, and a vertical bar, about ¾in. wide with movement inside, can be seen on the left-hand side of the screen. The bar is coloured dark green on the left and bluish-brown to the right.

This sort of thing is usually caused by poor connections in the long plug/socket that connects the power supply panel to the wiring harness, or by components on the back of the line timebase panel touching the chassis as a result of the panel not being properly clipped to the frame at the back. Tapping and probing with the fault present should lead to the source of the trouble.

TOSHIBA C400B

The fault is a bright raster with some white lines and no sound. Unfortunately the fault is intermittent, the set often working normally for a week or so. When the fault is present, the 15V supply near the video transistors on the main board is at zero volts: on attempting to carry out tests however the set comes on normally. The problem doesn't appear to be due to a dry-joint, because tapping doesn't affect it.

The fault probably is due to a dry-joint however – one associated with the double-sided print on the main panel. The fact that tapping has no effect is normal with this type of dry-joint on these Toshiba sets. Check the voltage at the 15V supply smoothing choke L404 (to the rear, right of the panel) when the fault is present. If the 15V supply is absent, the fault lies in L404, F401 (loose in holder?), the 15V rectifier D408, its surge limiting resistor R448 or the connection from pin 2 on the main panel to the line output transformer. If 15V is present at L404, check the voltage at both sides of R210, which is near the video transistors. If the voltage is low at both sides, there's a faulty connection between L404 and R210 – this involves connections through the board and a track across the component side. If 15V is present at one side of R210 but not the other, the third video transistor Q203 is being turned hard on. In this case, check the base voltages of Q201, Q202 and Q203 (should be 3·8V, 4·5V and 2·4V respectively). If Q201's base voltage is incorrect, the problem is probably in the i.f. module. Otherwise, check around the video amplifier stages. It would be best to resolder all joints concerned with the 15V supply before doing anything else however.

GRUNDIG 1500GB

The problem is tuning drift, though the set often works perfectly for two-three hours before acting up. Checks reveal that the voltage at the 33V stabiliser remains rock steady at all times, but the voltage at the junction of the channel selector/tuner unit varies when the fault occurs.

The trouble could be in the channel selector bank, but on this model the tuner is almost always to blame. The cause is usually leakage in the tuning voltage feedthrough capacitor C24 – it can be replaced using a beefy soldering iron.

RANK A816 CHASSIS

There's sound but no e.h.t., with the HT1 supply to the line output stage low at only 75V instead of 170V – the HT2 supply is o.k.

The low HT1 reading indicates that this supply is heavily loaded. The trouble could be caused by short-circuit turns in the line output transformer but is more likely to be due to the e.h.t. stick rectifier 3D13 (TV20 – remove it from circuit to check), one of the two rectifier diodes 3D11/12 fed from the transformer or a faulty BU105-01 line output transistor.

BEOVISION 3400 CHASSIS

The set went faulty whilst in operation. Inspection showed that the fusible resistor 9R13 which feeds the screen grid of one of the two PL509 line output valves had opened. As a check it was resoldered and the set switched on. The result was normal sound but a picture only eight inches (horizontally) by six inches (vertically) – with misconvergence.

This chassis is unusual in having in effect two line output stages, the main one which produces the e.h.t. and half the horizontal deflection power and the auxiliary one which provides the rest of the deflection power. The symptom described is the result of failure of the auxiliary generator. Check the lower 400mA fuse and the lower PL509, PY88 etc. If the PL509 is cold, your fusible resistor might be open-circuit.

ITT CVC8 CHASSIS

The trouble is unlocked colour, sometimes affecting one colour only, though the fault is not discernible on transmitted colour bars. The effect was first noticed after work had been done in the reference oscillator circuit and its control loop to cure an intermittent colour fault – that was traced to a defective reference signal output transistor (T39).

There's little doubt as to where the fault lies, but an oscilloscope is almost essential to check and rectify it. Either the timing of the burst gating pulse is incorrect, or it's misshapen. As a result, the reference oscillator synchronisation is being upset by the presence of the chroma signal at the beginning of each line. The first of the transmitted colour bars is colourless, which is why the fault doesn't show up on colour bars. Check the burst pulse coupling components C201 (680pF) and R277 (39kΩ) for a start.

THORN 2000 CHASSIS

The trouble is that the first anode supply is way down at only about 370V instead of 900V. All the waveforms in the line timebase up to and including the driver stage are o.k., and I've checked the components in the line output stage as best I can – the flyback tuning capacitors C21/2 have been replaced, also the first anode supply rectifier W5. Unfortunately I've no data on the R1039 output transistors VT4/5 – are there any substitutes?

It could well be that one of the output transistors is defective, though they usually go short-circuit which would show up with simple resistance checks. Thorn transistor types R2008 and R2009 (as used in the 3000 series) work successfully in these positions. The alternative possibility is that something is loading down the line output stage. Apart from W5 and its reservoir capacitor C23 (0·047μF), the suspects are the shift choke L5, the shift rectifier diodes W6/7 and the shunt efficiency diode W7. L5 can be checked by disconnecting it and running the set with it out of circuit.

RANK Z718 CHASSIS

There's a no colour fault on this set. The TBA540 reference oscillator i.c. has been replaced twice, on both occasions restoring colour for two-three weeks. The colour would then start coming and going, disappearing completely a few days later. Colour was on one occasion restored by mistuning, but the picture was very grainy and the colour lasted for only a few minutes.

The small electrolytic capacitors can cause misleading symptoms in this type of decoder. We suggest you replace 3C22, 3C24 (both 10μF), 3C27 (2·2μF) and 3C37 (15μF), then set up the decoder as per the manual. If unlocked colour is obtained with the colour killer disabled (link 3LK2 open-circuit) and cannot be set up with 3C35, the 4·43MHz crystal is suspect.

THORN 3500 CHASSIS

The problem is no results, with the 30V line low at approximately 15V. The voltage at the base of the 30V regulator transistor VT601 was also found to be 15V. The transistor and the components in its base circuit are o.k., and if the 30V supply fuse is removed the voltage at the emitter of VT601 rises to 30V. Any ideas?

This puzzling symptom is quite common, and is almost always due to failure of the 30V supply reservoir capacitor C607 (1,000μF, 70V) – it's at the input (collector) side of VT601. Replacing this component should restore the 30V line and get the set working normally.

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Available until 18th November, 1981. One coupon, plus a £1·00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 44.

TELEVISION NOV. 1981

GEC C2110 SERIES

There's a good black and white picture but no colour. The reference oscillator and demodulator/RGB output panels have been tried out in another set and found to be o.k., so the fault appears to be on the chroma/luminance panel. Disconnecting the colour killer link produces no trace of colour however, while replacing the TBA560CQ i.c. and the set burst potentiometer P203 has made no difference.

The electrolytic capacitors associated with the TBA560CQ i.c. sometimes play up – the ones to go for are C216 (4·7μF), C217 (10μF) and C218 (10μF), at pins 14, 13 and 12 respectively. Also check the continuity and jointing of the set burst phase control L206.

RANK A816 CHASSIS

The set went dead after running only very briefly. On inspection I found that the thermal cut-out wire had broken away from one end of the 6·2Ω h.t. surge limiter resistor 3R119. The link was resoldered, but 3R119 then got very hot whilst smoke came from the line output cage.

If the 6·2Ω surge limiting resistor is overheating whilst the higher value h.t. smoothing resistors 3R117 (302Ω) and 3R116 (560Ω) are not being distressed it's likely that the fault is confined to the power supply. We suggest you replace the h.t. rectifier diode 3D14 and check the h.t. reservoir capacitor 3C69 and rectifier protection capacitor 3C70 for leaks.

TEST CASE

227

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.

Of the many hybrid colour receiver designs produced in the early and mid-seventies, some are best forgotten about (and have been, except by those who still have to service them!). Others were good designs, the sets well outlasting the nominal seven years that seems to be the expected life of a TV set. Many of them continue to bang on into the eighties – even being offered in showrooms as cheap rentals for the less affluent (like myself!) who can't afford to rent or buy the latest boxes of tricks.

What we are leading up to is a certain Decca colour set, Model 2230, which had been refurbished and repolished and was sitting amongst the shiny new Fergusons and Sonys awaiting a "no deposit, £6·50 a month" customer. At least it boasts a real wood cabinet, something which none of its flashy companions can.

"Red convergence out" said the salesman, proud of his ability to display a little technical knowledge. The service engineer looked at the set with a jaundiced eye – after all, he'd called only to pick up some repairs ... Summoning a little enthusiasm and a crosshatch generator, he attempted to set up the convergence on the spot – with no success whatsoever. Switching off blue and green, and trying to forget that he was parked on a yellow line, he studied the red crosshatch and found that it was a little indistinct – defocused almost. Curiously, only the verticals were affected, the horizontal lines being quite sharp. "Astigmatism" said the helpful salesman. But careful adjustment of the focus control failed to improve the fuzzy verticals, and the engineer began to suspect that the tube was faulty – he'd known slight heater-cathode leakage to be the cause of this sort of thing.

To prove the point, he swapped over the red and blue tube cathode leads at the top of the decoder board. The red crosshatch pattern, now coming from the blue output transistor TR215, came up crystal clear, while the output from the red department, now displayed in blue, showed the same fault previously displayed in red – smeary verticals and sharp horizontals. Seeing a traffic warden hovering, the harassed engineer hastily fitted a spare decoder panel he happened to have with him, clearing the fault. He then made his way back to the service department, where the board was left with a colleague who repaired the fault by replacing a single component – this feat was accomplished purely on the basis of the outside engineer's description of the fault! What was the faulty component, and how did it cause this defocusing effect on one axis only? Answer next month, along with another test case item.

ANSWER TO TEST CASE 226
– page 662 last month –

The tale recounted last month concerned a Philips G8 whose line output stage drew excessive h.t. current. There was some uproar in the service department when the suspected line output transformer turned out to be innocent! We left the technician muttering in the corner of the workshop, between trips to the stores for fuses – the line drive, the loading on the transformer's secondary windings, the tripler, the line output transistors and the flyback tuning capacitors had been checked previously.

The technician concerned sets great store on measuring the flyback period as an aid to diagnosis when confronted with an ailing line output stage. In this case he found that the flyback time was way out – in so far as it could be measured. All was revealed when he removed the two line output transistors to measure them for reverse leakage. The insulating washer used in the G8 chassis is a large, rectangular one made of a mica-like material. Under the upper transistor (TR5531) there was a large, irregular burn hole with blackened edges. The washer had been breaking down when the transistor was operational, due to the high peak voltage then present – this was the reason for the crackling noise that emanated from the area.

Bounce? The set's not been back again – as yet!

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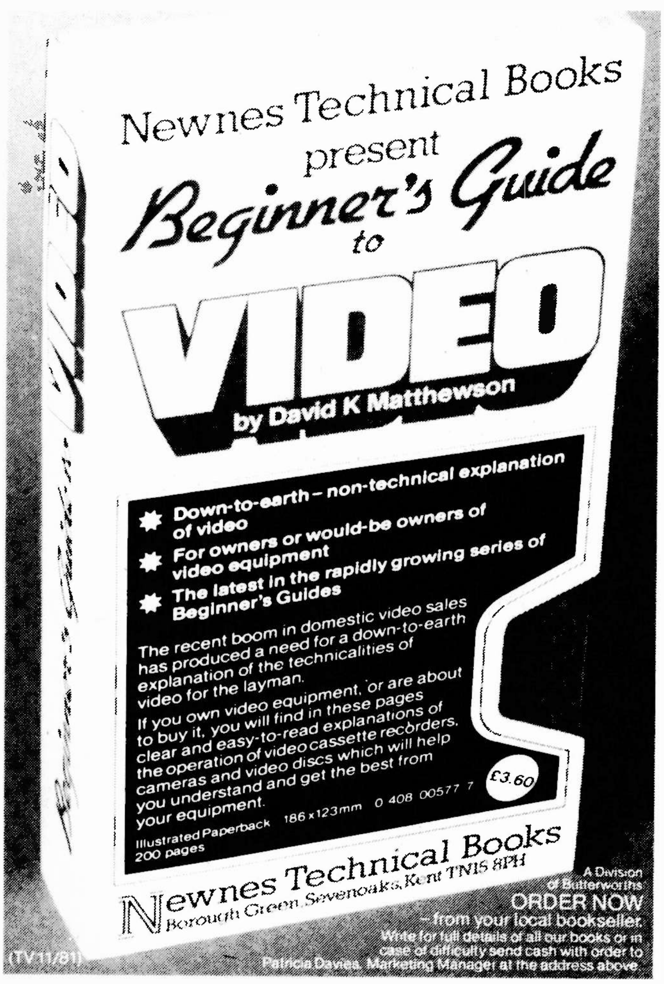

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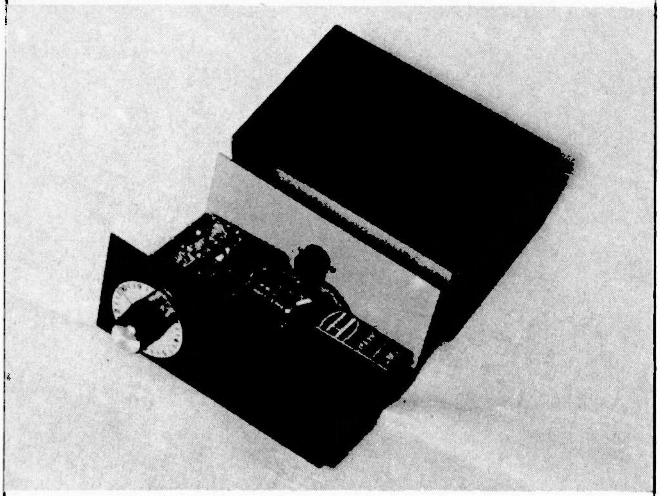

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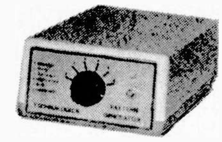

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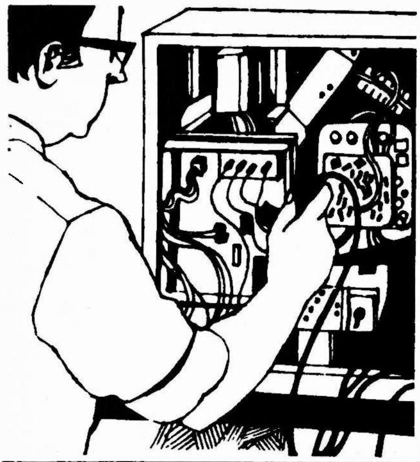

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