JULY 1981

IR 97P (INC VAT)

70p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

VIDEO EFFECTS GENERATOR

COLOUR PORTABLE TIMEBASE BOARD

SERVICE NOTEBOOK

plus

All THE REGULAR FEATURES

PHD COMPONENTS
RADIO & TV COMPONENT DISTRIBUTORS
UNIT 7 CENTENARY ESTATE
JEFFRIES RD ENFIELD MIDDX
SHOP NOW OPEN TELEX 261295

ALL COMPONENTS OFFERED SUBJECT TO AVAILABILITY. WE RESERVE THE RIGHT TO SUBSTITUTE REPLACEMENTS SHOULD THE ORIGINAL PART BE OUT OF STOCK OR UNAVAILABLE!
PLEASE ADD 50p per parcel post and packing.

SEMICONDUCTORS

AA113	0.16
AA116	0.16
AA117	0.16
AA119	0.16
OA91	0.12
OA95	0.12
OA202	0.18
BA100	0.18
BA102	0.10
BA130	0.15
BA154	0.10
BA155	0.20
BA164	0.12
BAX13	0.16
BAX16	0.08
BAY38	0.16
BY206	0.20
IN4148	0.04
BY126	0.20
BY127	0.15
BY133	0.22
BY164	0.50
SKB2/08	1.00
BY238	0.15
BYX10	0.18
IN4001	0.10
IN4002	0.10
IN4003	0.12
IN4004	0.12
IN4005	0.12
IN4006	0.14
IN4007	0.16
IN5407	0.33
BR100	0.30
BR101	0.60
BRY39	0.60
TIC1160N	1.50
BT119	2.00
BT120	2.00
BYX/71/600	0.80
2N444	1.50
TV106/2	1.50
BYX88 2V7	0.10
BZY88 3VO	0.10
BZY88 3V3	0.10
BZY88 3V6	0.10
BZY88 3V9	0.10
BZY88 4V3	0.10
BZY88 4V7	0.10
BZY88 5V1	0.10
BZY88 5V6	0.10
BZY88 6V2	0.10
BZY88 6V8	0.10
BZY88 7V5	0.10
BZY88 8V2	0.10
BZY88 9V1	0.10
BZY88 10V	0.10
BZY88 11V	0.10
BZY88 12V	0.10
BZY88 13V	0.10
BZY88 15V	0.10
BZY88 18V	0.10
BZY88 20V	0.10
BZY88 22V	0.10
BZY88 27V	0.10
BZY88 33V	0.10
BZX61 7V5	0.20
BZX61 8V2	0.20
BZX61 9V1	0.20
BZX61 10V	0.20
BZX61 11V	0.20
BZX61 12V	0.20
BZX61 13V	0.20
BZX61 15V	0.20
BZX61 16V	0.20
BZX61 18V	0.20
BZX61 20V	0.20
BZX61 22V	0.20
BZX61 24V	0.20
BZX61 27V	0.20
BZX61 30V	0.20
BZX61 33V	0.20
BZX61 36V	0.20
BZX61 39V	0.20
BZX61 47V	0.20
BZX61 72V	0.20
AC107	0.35
AC127	0.50
AC127/01	0.60
AC128	0.60
AC128/01	0.60
AC141	0.50
AC141K	0.60
AC142	0.40
AC142K	0.60
AC176	0.60
AC176/01	0.60
AC186	0.40
AC187	0.40
AC187K	0.60
AC188	0.40
AC188K	0.60
AD140	1.50
AD142	1.50
AD143	1.50
AD145	1.50
AD149	1.00
AD161/2	1.50
AD162	0.70
AD262	1.50
AF121	0.60
AF124	0.60
AF125	0.60
AF126	0.60
AF127	0.60
AF139	0.60
AF239	1.00
AL102	3.00
AU107	3.00
AU110	3.00
AU113	3.00
AL103	3.00
AY102	3.00
BC107	0.20
BC108	0.20
BC109	0.20
BC113	0.15
BC114	0.15
BC115	0.20
BC116	0.20
BC117	0.20
BC118	0.20
BC119	0.50
BC125	0.20
BC126	0.20
BC136	0.20
BC137	0.20
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BC143	0.40
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BC170	0.15
BC171	0.15
BC172	0.20
BC177	0.20
BC178	0.20
BC179	0.20
BC182L	0.15
BC183L	0.15
BC184L	0.15
BC184LC	0.15
BC186	0.30
BC187	0.30
BC203	0.15
BC204	0.15
BC205	0.15
BC206	0.15
BC207	0.15
BC208	0.15
BC209	0.15
BC212L	0.15
BC213L	0.15
BC214L	0.15
BC225	0.40
BC237	0.15
BC238	0.15
BC251A	0.15
BC301	0.40
BC303	0.40
BC307	0.15
BC308	0.15
BC327	0.15
BC328	0.15
BC337	0.15
BC338	0.15
BC547	0.15
BC141-10	0.80
BD115	0.50
BD124	1.80
BD131	0.70
BD132	0.60
BD133	0.70
BD134	0.70
BD144	2.50
BD159	0.80
BD238	0.50
BD380	0.70
BD441	0.70
BD537	0.70
BD538	0.70
BD507	0.70
BD508	0.75
16181	1.20
16182	1.20
BD709	1.00
BD710	1.00
BD442	0.70
BD379	0.50
BF115	0.60
BF118	0.60
BF152	0.40
BF154	0.20
BF157	0.70
BF158	0.40
BF160	0.60
BF163	0.60
BF167	0.50
BF173	0.50
BF177	0.50
BF179	0.50
BF180	0.50
BF181	0.60
BF182	0.50
BF183	0.50
BF184	0.50
BF185	0.50
BF194	0.20
BF195	0.20
BF196	0.20
BF197	0.20
BF198	0.15
BF199	0.15
BF200	0.15
BF224	0.15
BF240	0.45
BF241	0.20
BF256LC	0.50
BF257	0.50
BF258	0.50
BF271	0.60
BF273	0.20
BF274	0.25
BF336	0.50
BF337	0.50
BF338	0.50
BF355	0.80
BF458	1.00
BF459	1.00
BFT43	0.50
BFX29	0.50
BFX84	0.50
BFX88	0.50
BFX89	0.50
BFY50	0.50
BFY51	0.50
BFY52	0.50
BFY90	1.20
BF381	0.50
BFR39	0.30
BFR79	0.30
BFR81	0.30
BFR89	0.50
BF259	0.25
BDX32	2.50
BU206	1.60
BU208/02	2.80
BU326S	1.00
BU406	2.00
BU406D	2.50
BU407	1.70
BU407D	2.50
R2008B	2.50
R2010B	2.50
R2540	3.00
ME0402	0.20
ME0412	0.20
ME4003	0.15
ME6002	0.20
ME8001	0.20
MJE2955	1.50
MJE3005	1.30
MP8113	1.00
MPSU05	1.20
MPSU55	1.20
TIP2955	1.30
TIP3055	1.30
TIS90M	0.30
2N2904	0.50
2N2905A	0.50
2N2905	0.50
2N3053	0.50
2N3703	0.20
2N3075	0.20
2N3710	0.20
2N3055H	0.60
TAA350	0.80
TAA550	0.50
TAA570	1.80
TAA611	1.75
TAA630S	2.50
TAA661B	2.00
SN76540N	1.50
TAD100	2.00
TBA120AS	0.75
TBA231	1.20
TBA480Q	2.20
TBA520Q	2.00
TBA530	2.00
TBA530Q	2.00
TBA540	2.20
TBA540Q	2.20
TBA550	3.00
TBA550Q	3.00
TBA560C	2.20
TBA560CQ	2.20
TBA570	2.50
TBA570Q	2.50
TBA641BX	3.00
TBA641B11	4.00
TBA651	3.00
TBA720A	1.50
TBA730	1.50
TBA750	2.00
TBA750Q	2.00
TBA800	1.00
TBA810S	1.50
TBA820	1.50
TBA920	2.00
TBA920Q	2.00
TBA990	2.00
TBA990Q	2.00
TCA2205A	3.00
TCA900	1.00
TCA940	2.00
TDA1170	2.00
TDA1200	3.00
TDA1270	4.00
TDA1412	1.00
TDA2020	4.00
SN76115N	2.00
SN76227N	1.20
SN76530P	1.00
SN76651N	1.50
SN76003N	3.00
SN76013N	2.00
SN76013NO	2.00
SN76013ND	2.00
SN76023N	2.00
SN76023ND	1.00
SN76033N	2.00
SN76110N	2.00
SN76226DN	2.00
SN76227N	1.20
SN76532N	2.00
SN76533N	2.00
SN76544N	2.00
SN766504	1.00
SN76665N	1.50
SN76666N	1.20
SL901B	6.00
SL917B	8.00
TBA396Q	2.00
TDA440	2.50
SN76001N	1.50
TBA520	2.00
TBA120S	1.00
TBA396	2.00
TCA270SQ	2.00
TDA2030	8.00
TDA2140	6.00
TDA2150	6.00
TDA2160	6.00
TDA1230	3.00
TDA3089	2.00
TDA1054M	2.00
MC1349P	1.50
SAA661	0.60
SAS560S	2.00
SAS570S	2.00
SN7400N	0.40
SN7413N	0.90
SN74122N	1.00
SN74141N	1.00
TBA395	1.80
TBA395Q	1.80
TBA950	4.00
TCA800	4.00
TCA800Q	4.00
TDA1180	3.00
TDA1190	3.30
TDA2002H	3.60
TDA2590Q	5.00
TDA2600	5.00
TDA2640	3.30
TDA3950	3.00
TAA621 AX1	3.30
TBA625X5	2.00
TCA830S	2.00
TDA2020/A2	5.00
TDA2020P	5.00
TDA2030V	3.60
TDA2010/BD2	4.50
TDA2002V	5.00
TCA940E	3.00

We can often supply equivalents to transistors & I.C's not listed. Free list on request with any order.

VALVES

DY/86/87	1.30
DY802	1.80
ECC82	1.40
ECC84	1.20
ECH83	1.10
ECH84	1.10
ECL80	1.10
ECL82	1.10
ECL86	1.10
EF80	1.10
EF95	1.50
EF183	1.70
EF184	1.60
EL34	3.00
EL84	2.00
GY501	3.00
PC97	1.50
PC900	1.50
PCF80	1.74
PCF802	1.60
PCF806	1.10
PCL82	1.70
PCL84	1.80
PCL85/805	1.90
PCL86	1.90
PD500/510	5.00
PFL200	2.60
PL36	2.60
PL81	1.50
PL504	2.50
PL508	2.50
PL509	4.00
PL519	5.00
PL802	3.00
PY88	1.70
PY500A	2.80
PY800/801	1.70
UCL82	1.10
30FL2/1	1.40
PCF805	1.20
PCF808	1.20
PL519 - PY500A	5.00

VALVES NOT SHOWN HERE MAY BE IN STOCK. PLEASE WRITE FOR QUOTE.

DIRECT REPLACEMENT PARTS

Decca 30 Series Lopt	8.00
173 Tuner (Repl Elc 1043/05)	8.00
4.443MHZ Crystals	2.00
Cut Out TCE 3500	2.50
Cut Out GEC	2.50
Cut Out TCE 8500	2.00
TV18 Rectifier Stick	2.00
TV20 Rectifier Stick	2.00
VA 1104 Thermister	0.80
Transductor TCE 3000	1.50
AEG Tuner (Repl Elc 1043/06)	9.00
Aeriel Isolator Kit	1.60
Philips G8 Lopt	12.00
PYE 691/697 Lopt	11.00
Bush A 774 Lopt	18.00
Bush Q823 Lopt	5.00
Pye 731 IF Gain	10.50
A823 Bush Power Panel	20.00
PL 802T Transistorised	4.00

BAHCO TOOLS — Come and see the full range at our shop or send for full catalogue free, on request, with any order.

EHT MULTIPLIERS

TCE950 Doubler	2.00
TCE950/1400 Tripler	5.04
TCE1400 (Piped System Only)	4.56
TCE1500 Doubler	4.16
TCE1500 Tripler	4.64
TCE1600 1/2 Wave	3.95
DECCA CS 1730/1830 Doubler	4.23
DECCA CS 1910/2213 Tripler	6.67
DECCA 30 Series Tripler	6.01
DECCA 80 Series Tripler	6.43
DECCA 100 Series Tripler	6.68
GEC Hybrid 2028 Tripler	6.43
GEC 2110 Tripler Pre JAN77	7.21
GEC 2110 Tripler Post JAN77	6.43
ITT CVC 5/8/9 Tripler	6.51
ITT CVC 20/25/30	6.45
Philips 520 Tripler	6.51
Philips 550 Tripler	6.42
Philips G9 Tripler	6.63
PYE 691/693/697 Tripler	6.68
RRI 823 Tripler	5.48
RRI Z179/823	6.68
TCE 3000/3500 Tripler	5.51
TCE 4000 Tripler	8.00
TCE 8000 Doubler	3.53
TCE 8500 Tripler	5.60
TCE 9000 Tripler	7.28
TVK 76/13 Continental Sets	5.50
TVK 52 ITT Replacement	6.68
Korting 90% Tripler	6.50
Autovox Tripler	6.50
Rediffusion MK 1 Tripler	6.00
RRI TV 25 Quadrupler	4.00
RRI T20	7.04

MULTISECTION CAPACITORS

DECCA 400 400/350	3.72
DECCA 80/100 400/350 + 800/250	4.00
GEC 200 200 150 50/350	3.00
GEC 100 2000/35	1.10
GEC Philips G8 600/250	2.10
GEC Philips G8 600/300	2.50
ITT KB 200 200 75 25/350	3.00
ITT CVC 20 200/400	2.20
Philips G11 470/250	1.90
PYE 691 200 300/350	2.80
PYE 1000 1000/40	0.90
PYE 731 800/250	2.50
RRI 2500 2500/30	1.30
RRI 600/300	2.50
RRI 300 + 300/300	2.50
TCE 950 100 300 100 16	1.00
TCE 1400 150 100 100 100 150	3.70
TCE 1500 150 150 100	2.10
TCE 3000/3500 175/400 + 100 + 100/350	2.70
TCE 3000/3500 600/70	1.00
TCE 3000/3500 220/100	0.70
TCE 8000/8500 2500-2500/63	1.50
TCE 8000/8500 700/200	1.00
TCE 8000/8500 400/350	1.00
TCE 9000 400/400	3.00
TCE 9500 220/400	2.20

MAINS DROPPERS

TCE 140 12R + 16, IK7 + 116 + 462, 126	1.16
TCE 1500 350 + 20, 128, IK5, 317	1.10
TCE 1600 18 Thermal Link 320 + 70, 39	1.10
TCE 3000/3500	0.80
TCE 8000/8000A 56 + 1K, 47, 12 5R + 1R + 100R	1.00
Philips G8 2.2 + 68	0.90
Philips G8 47	0.80
Philips 210 30 + 125, 2K85	0.70
Philips 210 118 + 118 + 148 (Link)	0.65
RRI 154 + 50 + 16.94	0.60
RRI A640 250 + 14 + 156	0.80
GEC 27840 10 + 15 + 19 + 10 + 63 + 188	1.00
GEC 2000	0.80
PYE 731, 735 36 + 27	1.00
PYE 11009 60 + 70 + 173 + 26 + 16 + 17 + 19	1.00
RRI823 56R + 68R	0.80

CONNECTORS

Sets of AVO Leads	10.00
Plug 13A (Box of 20)	8.00
AL Coax Plugs Pack of Ten	1.80
6DB Attenuator	1.00
12DB Attenuator	1.00
18DB Attenuator	1.00
Back to Back Coax	0.40

SERVICE AIDS & TOOLS

Super Servisol	1.20
Foam Cleanser	1.20
Silicone Grease	1.20
Plastic Seal	1.20
Aeroklene	1.20
Freezit	1.20
Antistatic	1.20
Solder 18 SWG 60/40 .5 KGM	10.00
SR2 Desoldering Tool	9.70
SR3AS Mini Silver	7.00
SR3A Mini Orange	6.80
Replacement Nozzles	0.80
Replacement Washers	0.19
Solder Mop Red	0.60
Solder Mop Brown	0.60
Side Cutters ORYX	3.20
TVTY 80/80 Transistor EQV A-Z or 2N	5.00 each
Books PR	9.00 PF

TELEVISION

July 1981

Vol. 31, No. 9
Issue 369

this month

OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 22

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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Binders (£4.40) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

BACK NUMBERS
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at 85p inclusive of postage and packing.

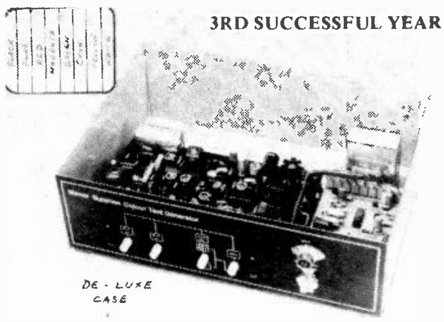
QUERIES
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative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

MANOR SUPPLIES

PAL COLOUR BAR GENERATOR

plus CROSS HATCH KIT (Mk. 4)

3RD 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).

ALSO THE MK3 COLOUR BAR GENERATOR KIT FOR ADDITION TO MANOR SUPPLIES CROSS HATCH UNITS. £28.75 + £1.60 p.p. CASE EXTRA £2.00. BATT. HOLDERS £1.70.

- ★★ Kits include drilled P.C. board, with full circuit data, assembly and setting up instructions.
- ★★ All special parts such as coils and modulator supplied complete and tested, ready for use.
- ★★ Designed to professional standards.
- ★★ Demonstration models at 172 West End Lane, NW6.
- ★★ Every kit fully guaranteed. Technical back-up service.

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

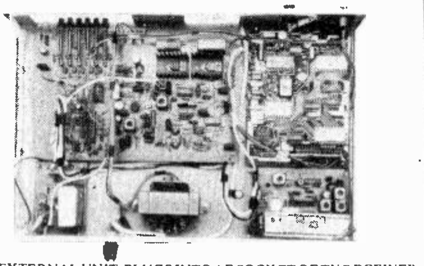
MANOR SUPPLIES

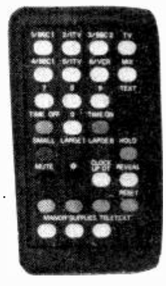
TELETEXT KIT (MK2)

(INCORPORATING MULLARD DECODER 6101VML)

BACKED BY YEARS OF EXPERIENCE

INFRA RED REMOTE CONTROL TEXT & STATIONS





- EXTERNAL UNIT, PLUGS INTO AE SOCKET OF TV RECEIVER.
- LATER SPEC (DOUBLE HEIGHT, BACKGROUND COLOUR ETC).
- INFRA RED REMOTE CONTROL (MULLARD 5000 SYSTEM) STATION SELECTION, TEXT, MIX, TIME, DOUBLE HEIGHT, HOLD, CLOCK, REVEAL RESET ETC, ETC.
- INCLUDES COMPLETE & TESTED 6101 VML (MULLARD) DECODER, SAW FILTER IF PANEL & 32 BUTTON REMOTE CONTROL HANDSET.
- SUITABLE FOR BBC DEAF SUB-TITLE TRANSMISSIONS REMODULATES PICTURE.
- CONVERTS ANY UHF RECEIVER TO STATION SELECTION REMOTE CONTROL AND TELETEXT. (SIMPLIFIED KIT AVAILABLE FOR REMOTE CONTROL ONLY).
- FACILITIES FOR VIDEO OUTPUT, MONITORS, CCTV ETC.
- AUDIO OUTLET FOR EXTERNAL HI-FI AMPLIFIER.
- EVERY KIT EASY TO ASSEMBLE & FULLY GUARANTEED. TECH. BACK UP SERVICE.
- DE-LUXE CASE MEASUREMENTS APPROX. 15¼ × 10¼ × 3¾.
- WORKING MODEL AT 172 WEST END LANE, N.W.6.

FURTHER DETAILS ON REQUEST

ALSO, MANOR SUPPLIES TELETEXT MK1 KIT (TEXAS) NOW WITH REMOTE CONTROL PRICE £181.70 P/P £2.80.

TELEVISION PROJECTS & SERVICE SPARES

"TELEVISION" NEW COLOUR PORTABLE PARTS AVAILABLE (PHONE, CALL, SEND FOR LIST). FULL TECHNICAL ADVICE & PANEL TEST SERVICE FOR OUR CUSTOMERS, BACKED BY YEARS OF EXPERIENCE ON PREVIOUS MAGAZINE TV PROJECTS.
"TELEVISION" NEW MONITOR PARTS AVAILABLE.
"TELEVISION" MONO PORTABLE RECEIVER PARTS AVAILABLE. WORKING MODEL & PANEL TEST SERVICE.
NEW CTV SIGNALS BOARD PARTS NOW AVAILABLE.
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, LIMITED QUANTITY AT HALF PRICE **£69.00** p.p. £1.60.
"TELEVISION" COLOUR RECEIVER (LARGE SCREEN) PROJECT ALL PARTS AVAILABLE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE AVAILABLE).
NEW SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND TESTED FOR T.V. SOUND & VISION **£32.80** p.p. £1.20.
TELETEXT 5V STABILISED MAINS POWER SUPPLY (FOR TEXAS OR MULLARD DECODERS) **£6.70** p.p. £1.00.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£11.30** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
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GEC 2040 (TYPE) CDA PANEL **£2.88** p.p. £1.25.
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THORN 3000 LINE TB PCB **£5.75 each** p.p. 85p.
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PHILIPS 19TG 170, 210, 300	**£8.50**
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GEC 2110 Series	**£12.20**
ITT CVC 5 to 9	**£10.15**
ITT CVC 30 Series	**£10.15**
PYE 691-697 (BOBBINS)	**£7.60**
PYE 713 715	**£7.85**
PHILIPS G8, G9	**£10.15**
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PCL86	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30FL1/2	0.25	PL508	0.50
PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
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GEC Hybrid	6.00	6.50	9.00	—	5.00	—	—	12.00
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Thorn 3000	6.00	6.00	6.00		5.00	20.00	20.00	6.00
Pye 691/693	6.00	6.00	8.00	—	5.00	—	15.00	5.00
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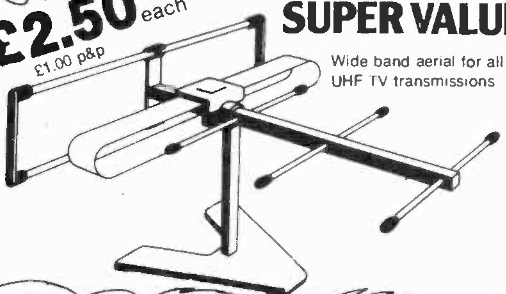

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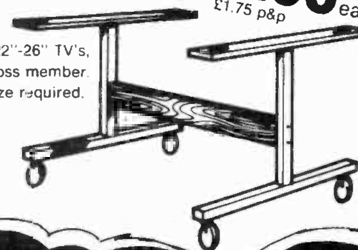

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AC107	0.24	AF181	1.00	BC179	0.12	BD137	0.30	BF218	0.12	OC36	0.90	2N3053	0.21
AC113	0.22	AF186	0.90	BC182L	0.09	BD138	0.31	BF219	0.12	OC38	0.90	2N3054	0.60
AC115	0.23	AF239	0.46	BC183L	0.09	BD139	0.40	BF220	0.12	OC42	0.45	2N3055	0.60
AC117	0.30	AU113	1.40	BC183LA	0.10	BD140	0.37	BF221	0.21	OC44	0.60	2N3442	1.00
AC125	0.23	BA130	0.08	BC183LB	0.10	BD144	1.39	BF222	0.12	OC45	0.50	2N3702	0.15
AC126	0.23	BA145	0.14	BC184L	0.09	BD145	0.50	BF224	0.18	OC46	0.39	2N3703	0.12
AC127	0.22	BA148	0.21	BC186	0.21	BD177	0.50	BF256	0.37	OC70	0.39	2N3704	0.18
AC128	0.22	BA155	0.08	BC187	0.21	BD178	0.50	BF258	0.30	OC71	0.39	2N3705	0.18
AC131	0.13	BAX13	0.05	BC209	0.11	BD203	0.40	BF259	0.30	OC72	0.39	2N3706	0.14
AC141	0.24	BAX16	0.08	BC212	0.09	BD204	0.70	BF260	0.25	OC74	0.39	2N3707	0.14
AC142	0.24	BC107	0.11	BC212L	0.09	BD222	0.73	BF262	0.28	OC75	0.39	2N3708	0.14
AC141K	0.31	BC108	0.11	BC213L	0.09	BD233	0.36	BF263	0.25	OC76	0.39	2N3772	2.00
AC142K	0.31	BC109	0.11	BC214L	0.09	BD234	0.34	BF271	0.27	OC77	0.50	2N3773	2.50
AC151	0.21	BC113	0.11	BC237	0.09	BD237	0.44	BF272	0.27	OC78	0.23	2N3819	0.30
AC165	0.21	BC114	0.11	BC238	0.09	BD238	0.44	BF273	0.16	OC31	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		

VALVES

TYPE	PRICE £
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

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

TYPE	PRICE £
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

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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

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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

TYPE	PRICE £
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.

ELECTRONIC TUNERS AND ASSEMBLIES

NSF173 Replaces ELC 1043/05/06 and Thorn	7.20
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	9.00
6 P/B PYE	16.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass (Square/Early)	11.29
PHILIPS G8 Ass (Sloping/Late)	11.63
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

SUNDRY TUNER ACCESSORIES

RANK Tuner Push Button 1½" × ½" dia	30p
RANK Tuner Push Button 2" long × ⅜ dia	30p
RANK Tuner Push Button 2" long × ½" dia	30p
GEC Tuner Neons 2110 chassis	14p
Drive Cams	10p each

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/push	62
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/off	62
A1 Beam Switch (THORN 3500)	50
A1 Controls 5m (THORN 3500)	69

THERMAL CUT OUT

THORN 3000 2A Metal	1.30
THORN 8500 2.5 Plastic	1.30
GEC 2040 Metal	2.24

SOLDERING EQUIPMENT

WELLER Iron Kit 15W	3.80
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	13.00
WELLER Heat Gun	10.50
(Pair) Tips for Gun	36
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	4.89
Solder Remover Sucker	6.50
Solda Mop	70
500G Reel Solder	7.00
DIY Type Solder	43

FUSES

	Pack of 10
1¼" QUICK BLOW	
100ma	48
250ma 500ma 750ma-1A	49
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	2.16
20m ANTISURGE	
80ma	3.11
100ma 160ma 200ma	2.08
315ma 500ma 630ma, 800ma, 1A, 1.25A, 1.6A 2A	1.07
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

DATA BOOKS

Transistor Equivalent	
TVT 80 A Z only	3.25
TVT 80 2N/2S series only	3.50
TVT 80/80 A Z and 2N/2S together	6.50

LINEAR DATA BOOKS

LIN 1 IC	5.50
LIN 2 IC	5.50

SERVICE AIDS

SERVISOL Freeze It	80
SUPER SERVISOL	75
SERVISOL Foam Cleanser	70
SERVISOL Plastic Seal	68
SERVISOL Silicone Grease	78
SERVISOL Tubes Silicone Grease	1.60
SERVISOL Aero Klene	63
SERVISOL Aero Duster	78
SERVISOL Excel Polish	52
Penetrating Fluid	70
Fire Extinguisher 640G	1.88
Heat Sink Compound 25G	1.00
Silicone Rubber Tube	1.98
Electrolube Snorke'	1.80

PYE LABGEAR

CM6001 Power Unit (16V or 24V)	11.75
CM6019/WB UHF Masthead Amp(ch21 68)	8.58
CM6040/WB UHF Masthead (ch21 68)	18.06
CM6020 Power Unit (16V)	10.20
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)	12.80
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	97.50
CM6052 UHF-VHF Pal Colour Bar Generator	210.50
7056 **TELETEXT ADAPTOR** (Converts any set to remote)	206.00

SUNDRIES

ANTIFERENCE Super Set Top	6.80
ANTIFERENCE Car antenna	7.80
ANTIFERENCE Xtra Boost UHF Amp	15.40
ANTIFERENCE SB11 Splitter	2.40
Surface Mounting Aerial Outlets	80
Cable Clips per 100	1.18
Transductor 90°	2.08
EHT Final Anode Cap	53
Delay Line CTAV 82/DL50/50L141	2.20
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 'IR Modulohm	48
KEW Pocket Size 1000 OPV Meter	5.60
Line Connectors	35

NB: We have a full range of aerials and accessories available when collected from the Trade Counter

SOCKETS IC

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

CONVERGENCE PRE-SET POTS

3 Watt complete with knob — each

5R0	35
6R8	35
10R	35
15R	35
20R	35
50R	35
100R	35
200R	35
500R	35

WIREWOUND RESISTORS

PREFERRED VALUES

		price each
4W/5W	1R 1K5	16
	2K2 3K3	18
	4K7 6K8	20
	10K	25
7W	1R 4K7	18
	5K6 12K	21
	15K 22K	20
11W	1R 6K8	18
	10K 15K	21
	22K	24
17W	1R 10K0	27
	15K 22K	28

REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.82
DECCA 80 (400/350V)	3.00
DECCA 100 (800/250V)	3.00
DECCA 1700 (200/200/400/350V)	3.50
PHILIPS G8 (600/300V)	2.11
PHILIPS G9 (600/300V)	2.11
PHILIPS G11 (470/250V)	2.56
PYE 691/7 (200/300/350V)	2.28
PYE 731 (60/300V)	2.20
RBM A823 (2500/2500/30V)	1.20
(2500/2500/25V)	1.10
RBM A823 (600/300V)	2.10
RBM Z146 (300/300/350V)	3.00
ITT CVC5/9 (200/200/75/25)	2.35
ITT CVC 20 (220/400V)	1.92
GEC 2110 (600/250V)	1.85
GEC 2040 (1000/2000/35V)	1.14
GEC 2040 (300/300/150/100/50)	3.90
THORN 950 (100/300/100/16/275V)	1.75
THORN 1400 (150/100/100/100/150/320V)	2.60
THORN 1500 (150/150/100/300V)	1.92
THORN 1500 (12/300V)	30
THORN 3500 (175/100/100/400/350V)	2.34
THORN 3500 (1000/63V)	62
THORN 3500 (1000/70V)	80
THORN 8000/8500 (2500/2500/63V)	1.47
THORN 8000/8500 (700/250V)	2.20
THORN 8000/8500 (400/350V)	2.44
THORN 9000 (400/400V)	2.90

CAPACITORS

AXIAL TYPE

Volt	MF	Price	Volt	MF	Price
10	22	7	63	10	9
	47	7		22	11
	100	8		47	16
	220	11		100	19
	470	18		220	30
				470	38
16	1000	20		1000	53
25	10	7		2200	85
	22	7	100	10	12
	47	9		22	14
	100	10		47	19
	220	17		100	29
	470	22		220	35
	1000	36			
	2200	46	300	12	30
	4700	80	450	1	23
40	22	9		4.7	28
50	500	38		10	28
63	1	7		22	56
	2.2	7		33	62
	4.7	7	500V	1	30

CONVERGENCE CONTROL METRIC (G8)

5R	35
10R	35
20R	35
50R	35

THERMISTORS

VA1104	62
VA8650	55
VA1039	35
GEC Dual Pcsistor	1.50
GEC Dual 2040	1.50

RESISTORS

A range of the following at Preferred Values

		Price 10 Pack
0.5W	3R3 to 8M2	20p
1W	10R to 10M	36p
2W	10R to 150K	62p

Price per 10 mixed values

SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

MINIATURE price each 12p
100R 220R 470R 1K0 2K2 4K7 10K 22K 47K 100K 220K 470K 1M0

STANDARD price each 12p
100R 220R 470R 1K0 2K2 4K7 10K 22K 47K 100K 220K 470K 1M0 2M2 4M7

MULTITURN POTENTIOMETERS

100K	
GEC/TCE	50p
PHILIPS G8	50p
DECCA/RANK	50p

THICK FILM RESISTOR NETWORKS

THORN 3500 (5 pin connection)	1.12
PYE 731 (6 pin connection)	1.45
THORN 9000 (Circuit Ref R704/7)	1.50

MIXED DIELECTRIC CAPACITORS

Volts DC		
600V	0.1 mFd	38
1000V	0.01 mFd	20
	0.047 mFd	29
	0.1 mFd	32
	0.22 mFd	48
	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

DISC CERAMIC CAPACITORS

High Voltage

8KV d.c.	12KV d.c.		
39 pF	22	180pF	22
68pF	22	200pF	22
140pF	22	220pF	22
150pF	22	250pF	22

'MIDGET' CONTROLS

Insulated spindle length 44mm

LESS SWITCH 39p
Log or Lin
5K 10K 25K 50K 100K 250K 500K 1M

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

SLIDER POTENTIOMETERS

Lin or Log			
470R	50p	4K7	50p
1K	50p	10K	50p
2K2	50p	47K	50p

HOW TO ORDER

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

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

For Aerosols please add 30p per can (These are very heavy!)

Orders over £25 P.P. VAT are 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

TRANSISTORS, ETC.

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.68	BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63	BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63	BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.46	BC107*	0.16	BC207*	0.39	BC461	0.78	BD238	0.68	BF244*	0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
AC128K	0.55	BC108*	0.15	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.46	2N3906	0.20
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65	BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65	BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71	BF257	0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74	BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	0.30	BC213L*	0.16	BC550	0.24	BD438	0.75	BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
AC153	0.42	BC118	0.24	BC214*	0.18	BC556	0.23	BD519	0.88	BF262	0.73	BU102	3.35	OC44	0.68	2N1164	10.29	2N4292	0.32
AC153K	0.52	BC119	0.34	BC214L*	0.18	BC557*	0.16	BD520	0.88	BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD599	0.87	BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.17	BD600	1.23	BF271	0.42	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	0.20	BC238*	0.15	BCY10	0.30	BD663BR	0.86	BF272A	0.80	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BDX18	1.55	BF273	0.33	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95	BF274	0.34	BU205	2.68	OC81D	0.95	2N1711	0.47	2N5061	0.30
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	BDY16A	0.63	BF336	0.63	BU206	2.59	OC139	1.30	2N1893	0.52	2N5064	0.63
AC188	0.52	BC137	0.30	BC253*	0.38	BCY72	0.27	BDY18	1.55	BF337	0.65	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
AC188K	0.61	BC138	0.35	BC261A*	0.28	BD115	1.35	BDY20	2.29	BF338	0.68	BU407	1.38	OC170	0.80	2N2217	0.55	2N5087	0.50
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BDY38	1.38	BF355	0.72	BUY77	2.50	OC171	0.82	2N2218	0.38	2N5208	0.59
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48	BF362	0.49	C106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
ACY17	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF363	0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF367	0.29	C111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
ACY28	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF121	0.85	BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
ACY39	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.48	BF457	0.46	E300	0.42	OCP71	1.98	2N2401	0.80	2N5449	0.18
AD140	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.68	BF458	0.49	E1222	0.47	ON236A	0.94	2N2484	0.35	2N5457	0.46
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51	BF459	0.52	E5024	0.19	R2008B	2.72	2N2570	0.74	2N5458	0.40
AD143	1.78	BC153	0.38	BC297	0.36	BD137	0.40	BF137F	0.78	BF594	0.16	GET872	0.46	R2010B	2.79	2N2646	0.82	2N5459	0.58
AD149	1.42	BC154	0.42	BC300	0.62	BD138	0.42	BF152	0.19	BF596	0.17	ME0402	0.18	R2322	0.75	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25	BF597	0.27	MF0404/02	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
AD161/162	1.22	BC158*	0.12	BC302	0.86	BD140	0.50	BF159	0.27	BFR39	0.30	ME6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20	BFR40	0.29	ME6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	1.32	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84	BFR41	0.30	MJ2955	1.30	TIC44	0.25	2N2905*	0.39	2N6122	0.60
AF115	1.26	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BFR50	0.29	MJ3000	1.58	TIC46	0.35	2N2906*	0.36	2N6178	1.07
AF116	1.28	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BFR52	0.33	MJE340	0.68	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	1.32	BC168B	0.14	BC309*	0.18	BD157	0.51	BF166	0.50	BFR61	0.29	MJE341	0.72	TIP29A	0.47	2N29260	0.14	2N6211	2.74
AF118	0.98	BC169C	0.15	BC317*	0.15	BD158	0.75	BF167	0.38	BFR62	0.28	MJE370	0.74	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
AF121	0.68	BC170*	0.15	BC318*	0.15	BD159	0.68	BF173	0.35	BFR79	0.30	MJE371	0.79	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
AF124	0.38	BC171*	0.15	BC319*	0.19	BD160	2.69	BF177	0.36	BFR80	0.29	MJE520	0.85	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
AF125	0.38	BC172*	0.14	BC320	0.17	BD163	0.67	BF178	0.46	BFR81	0.30	MJE521	0.95	TIP32A	0.56	2N3054	0.66	2SC930D	1.50
AF126	0.36	BC173*	0.22	BC321A&B	0.18	BD165	0.66	BF179	0.58	BFR88	0.42	MJE2955	1.20	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
AF127	0.86	BC174A & B		BC322	0.28	BD166	0.88	BF180	0.53	BFT41	0.48	MJE3000	1.95	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
AF139	0.58		0.26	BC323	1.15	BD175	0.90	BF181	0.53	BFT43	0.55	MJE3055	1.22	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	0.16	BD177	0.58	BF182	0.44	BFW11	1.02	MPF102	0.40	TIP41A	0.72	2N3391A	0.38	3N128	1.60
AF149	0.45	BC177*	0.20	BC328	0.18	BD178	0.92	BF183	0.52	BFW30	2.58	MPS3702	0.33	TIP42A	0.80	2N3633	0.60	40250	0.98
AF178	1.35	BC178*	0.22	BC337	0.17	BD181	1.94	BF184	0.44	BFW59	0.19	MPS3705	0.30	TIP2955	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	2.10	BF185	0.42	BFW60	0.20	MPS6521	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
AF180	1.35	BC182*	0.15	BC340	0.19	BD183	1.34	BF186	0.42	BFW90	0.65	MPS6523	0.36	TIS43	0.44	2N3705	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD184	2.30	BF194*	0.14	BFX29	0.38	MPS6566	0.44	TIS73	1.36	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC348A & B		BD187	1.20	BF195*	0.13	BFX84	0.42	MPSA05	0.30	TIS90	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14		0.17	BD188	1.25	BF196	0.14	BFY50	0.38	MPSA06	0.32	TIS91	0.28	2N3708	0.17	40429	0.88
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15	BFY51	0.37	MPSA55	0.43	ZTX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF198	0.29	BFY52	0.36	MPSA56	0.45	ZTX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BFY53	0.36	MPSA93	0.56	ZTX213	0.23	2N3772	2.08	40603	1.13
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BFY90	1.98	MPSL01	0.33	ZTX300	0.16	2N3773	2.90	40636	1.25
AL103	1.58	BC187	0.27	BC360	0.59	BD233	0.62	BF218	0.42	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	SN76008KE	2.56	TBA240A	3.98
CA810QM	2.44	SN76013N	1.56	TBA281	2.07
CA3005	1.85	SN76013ND	1.40	TBA395*	2.58
CA3012	1.45	SN76018KE	2.56	TBA396	2.40
CA3014	2.23	SN76023N	1.66	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	2.35
LM380N-14	1.65	SN76544N	1.85	TBA641B11	2.61
LM1303N	1.03	SN76546N	1.85	TBA651	2.12
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	0.64	TBA720Q	2.38
MC1330P	0.83	SN76666N	0.96	TBA750*	2.18
MC1350P	1.22	TA7073P	3.51	TBA800	1.65
MC1351P	1.42	TAA263	2.20	TBA810AS	1.69
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	TCA640	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	1.1[illegible]		

* 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	3.85	BY179	0.83
BA100	0.24	BY182	1.14
BA102	0.36	BY184	0.44
BA104	0.19	BY189	5.30
BA110	0.30	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	0.45	TIL209	0.14
BA317	0.06	TIL211	0.18
BA318	0.07	TV20	2.25
BAV10	0.10	IN914	0.06
BAV21	0.18	IN916	0.06
BAW62	0.06	IN4001	0.06
BAX13	0.07	IN4002	0.07
BAX16	0.10	IN4003	0.08
BAX17	0.19	IN4004	0.08
BAY72	0.16	IN4005	0.09
BB104B	0.52	IN4006	0.10
BB105B	0.33	IN4007	0.12
BB105G	0.30	IN5400	0.15
BR100	0.35	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	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
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

Mixes of a minimum of 10pcs of any value:

Carbon Film (5%)	10 of one Ea	value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.49	£5.40
½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.49	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£26.90

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**

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Please add VAT at 15%.
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Giro A/c 23 532 4000. *A/c facilities available*

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

CONVERGENCE POTENTIOMETERS
5, 7, 10, 15, 20, 50, 100, 200, 500Ω †38p each

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A Start to Satellite TV?

Following the release of a home office study on satellite broadcasting, the home secretary has announced, in a parliamentary reply, that the government is prepared to consider a direct satellite TV service for the UK. A two-month limit has been imposed for comments on the study, and a service could be started within four years of a decision being made.

Moves towards the start of direct satellite TV transmissions seem to be afoot in most developed countries. In the USA, the Federal Communications Commission recently gave its approval to the start of an "experimental" service, and is to consider an application from the Satellite Television Corporation, a Comsat Corporation subsidiary, to operate this. The US TV broadcasting industry as a whole is strongly opposed to this move however. In continental Europe, the joint French-W. German satellite system is already under way, with the French firms Aerospatiale and Thomson-CSF, the W. German firms MBB and AEG-Telefunken, and the Belgian firm Etca collaborating over the £100m venture. Two satellites are to be launched by Ariane rocket in 1984: each will be equipped to transmit on five channels, though only three will initially be used. The Japanese are proceeding in their usual methodical fashion.

So you could argue that if everyone else is jumping on the satellite bandwagon, the UK should join in as well. There is certainly a case for encouraging UK firms to get going and take a fair slice of a market which is expected to be worth some £2 billion over the next fifteen years. But the fact that a service could be started without too much difficulty does not mean that it would be sensible to go ahead and start it. A lot of money is involved, fingers could be burnt, and understandable enthusiasm in some quarters needs to be tempered with caution.

There are at least two grounds for this. First, are extra channels justifiable in terms of their likely use? And secondly, would viewers be willing to pay for the extra receiving equipment required? Taking the first point, the availability of extra channels doesn't necessarily mean that the viewer would get a worthwhile increase in the choice presented to him. There are already times when with three channels the choice seems to be sport, sport and sport. One can envisage a choice of half a dozen old films that have already been shown several times over. In this connection, the use of a VCR as a time-shift device would seem to do far more in giving the viewer a wider choice of what he wants to see and when.

In fact the video boom places a decided question mark over the need for extra channels via satellite. Not only that, but TV4 has yet to start – it will be interesting to see just what it will eventually have to offer. Nor has breakfast TV got going. In addition to the use of VCRs for time shifting, there's now a considerable range of pre-recorded video programme material, which will quite soon be available on cheap discs as well as cassettes, for rental or purchase. As Thorn's Commercial Director David Hewitt pointed out recently, there's already a lot of competition for the domestic telly's screen time. The video boom has a long way to go yet: the price of VCRs is still falling as production increases, and the same will apply with disc equipment – it's already apparent that there will be a lot of competition between tape and disc systems, with each trying for a larger slice of the domestic video market.

With four transmissions at your disposal and your home video system ready to hand, would you feel tempted to pay another couple of hundred or so pounds for a satellite receiving dish, converter and the necessarily rather specialised installation? There will always be those who have to have something new of course, and the cost will not be all that great, but one nevertheless wonders whether a worthwhile demand will exist and whether people will be willing to put their hands in their pockets.

The cost doesn't stop there. The BBC is proposing that one channel should be used as a subscription service. For a modest £5 a month, you could have new feature films, first runs of special productions, extended sports coverage and so on. But whatever was shown would be likely (assuming that it has more than transient interest) to turn up on the other networks in due course – and with all those VCRs around a certain amount of recording and swapping about would doubtless occur. One way or another, the service would have to be paid for.

Despite these perhaps rather parochial reservations, there's no doubt that a large international satellite market is going to develop. In many parts of the world satellites offer a better solution than a terrestrial network of transmitters. We have in a sense conflicting interests here. The electronics/aerospace industries want to develop and sell the hardware, but the broadcasters see no urgent need to add to the present services. One can't help feeling that, so far as the UK is concerned, the best course would be to defer satellite TV until the time comes to reconsider our TV transmission system as a whole. Satellite TV after all provides the ideal opportunity to introduce new transmission standards, say a high-definition system with digital signal encoding.

COVER PHOTO

This month's cover photograph shows Thorn TX9 colour sets undergoing soak testing at the Thorn Consumer Electronics Gosport TV factory. The sets are on the top tier of a three-tier Hirata soak testing system – one of the most sophisticated available.

Teletopics

PHILIPS BOOST V2000

Philips are spending over £2m on a promotional campaign for the V2000 "Euro-Video" VCR system. It seems that production is now on the increase, the "supply problems" that have held back the VR2020 machine having been overcome. There are certainly signs of increased confidence in the system. ITT have now introduced a machine, Model VR482, using the system, and Körting were showing a V2000 machine at the recent trade shows. B and O have introduced a machine on the Danish market, and this is expected to be released in the UK later this year.

Meanwhile there seems to be some uncertainty about the exact launch date of the LaserVision disc system in the UK – sometime in the autumn seems to be about the closest one can get. The problem appears to be to do with getting an adequate yield from the disc pressing plant – there's obviously little point in introducing the players until an adequate supply of discs is available. Pioneer's LaserVision disc player, Model VP1000, was on display at the trade shows.

BRAND NAMES

Rank have now completed their withdrawal from the radio/TV field. As mentioned previously, J. J. Silber, a GUS subsidiary, have acquired the Murphy brand name. A range of radio/audio/TV equipment, including a VCR, is planned for release shortly. J. J. Silber have also acquired the Dansette brand name, which was once well known for record reproducers (as we used to call them – in the mid-fifties). The Bush brand name has been acquired by Interstate Electronics, which has now changed its name to Bush Radio. Several ex-Rank people have taken up posts with the new Bush Radio.

Rank Radio's Milton Keynes distribution warehouse was sold to Binatone some months back. Now the servicing side, including the RSVP spare parts wholesaling business, has been taken over by Currys Group Service. Currys feel that it will fit in well with their Mastercare operation, which provides a nationwide trade service.

BOOSTING TELETEXT

October is to be "national teletext month", during which there will be a major, government backed initiative to "establish rapid consumer acceptance of teletext". The idea is one outcome of the joint government/industry teletext "committment conference" held last January. The broadcasters will be persuaded to "educate and motivate" TV viewers during peak viewing hours, while a major effort will be made to train retail staff and encourage them to "talk teletext". The objective is to double the sales of teletext sets expected in the absence of this "co-ordinated marketing approach". Targeted sales of teletext sets are 300,000 in 1981, rising to 700,000 in 1982 and 1·1 million in 1983 – sales last year were 75,000 sets plus 5,000 adaptors. Prestel is also to be promoted, though the effort here will be directed at "selected sectors of industry". Targets for Prestel set sales are 50,000 in 1981, rising to 80,000 in 1982 and 140,000 in 1983.

The government has already given teletext a fillip by halving the legal minimum down payments for hire purchase or rental. The minimum deposit now payable under a hire purchase agreement has been reduced from 20% to 10% of the cash price, while the minimum period for which rental must be paid under a hiring agreement has been reduced from 26 to 13 weeks.

JOINT EUROPEAN VIDEO VENTURE

Discussions between Thorn-EMI, JVC, AEG-Telefunken (W. Germany) and Thomson-Brandt (France) with a view to establishing a joint venture to manufacture video and other consumer electronics equipment in Western Europe are officially said to be "well advanced". The parties concerned believe that such a joint venture is the only economically viable means of establishing a European manufacturing base to meet the growing demand for video products. The aim is to make available factories in W. Germany, France and the UK to concentrate on the production of VCRs, video cameras and disc players. Technology would be provided by all partners, with JVC the principal contributor, each party retaining complete freedom on the marketing side.

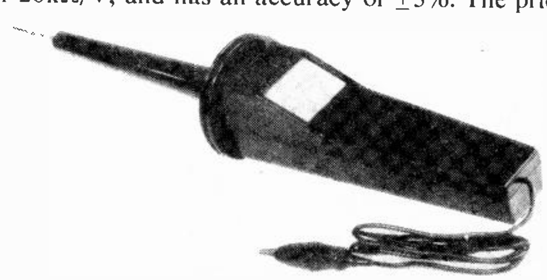
Thorn-EMI have all along hoped to be able to move from simply marketing to manufacturing VCRs. They comment that the market is now large enough to make this possible, though only "on a joint venture basis to be viable". What this seems to mean is that everyone chips in something, which is a sensible enough way of going about things. In world-wide terms, Thorn, Telefunken, Thomson-Brandt and JVC are all quite small as TV setmakers. Points still under discussion appear to relate to component sourcing, production levels and the degree of manufacture/assembly.

SONY'S VELOCITY MODULATION SYSTEM

Sony have announced a substantial increase in the production of their 27in. Model KV2704UB at Bridgend. We originally mentioned this set, with its unique velocity modulation system to give a sharper picture, last February, and have now had an opportunity to take a look at the circuitry involved. The velocity modulation feature is applied to the tube's focus electrode system. There are two focus pins, and in addition to the d.c. focus voltage a differential signal is a.c. coupled to these pins – from a pair of BC237 transistors operated from the h.t. line. The input to the velocity modulation circuit is tapped from the luminance channel via a high-pass filter, so that an input is received only when an h.f. transition occurs. The net result is that the shape of the spot is altered when there's an h.f. transition. A sharpness control, operating via a field effect transistor, enables the effect of the velocity modulation circuit to be adjusted.

EHT PROBE FROM THANDAR

A lightweight, self-contained e.h.t. probe with built-in meter has been introduced by Thandar. The probe, Model LHM80A, measures up to 40kV with an input impedance of 20kΩ/V, and has an accuracy of ±3%. The price is £16



The Thandar LHM80A e.h.t. probe/meter.

plus VAT – further details from Sinclair Electronics Ltd., London Road, St. Ives, Huntingdon.

COMPACT VCR

Funai's compact portable VCR, claimed to be the world's smallest, is now being handled in the UK by Sulkin (UK) Ltd., 73 Grosvenor St., London W1X 9DD. The cassette uses quarter-inch tape and gives up to half an hour's recording time. The machine is sold by Technicolor in the USA, where it's been on the market for some months – a cassette giving an hour's recording time was recently introduced by Technicolor. In Japan, Canon have recently taken up the Funai VCR.

TV TOO RELIABLE?

The high reliability of modern TV sets can be something of a problem to service engineers, since the low failure rate means that faults are less easy to identify and assess. To help tackle this problem, Philips have installed a computer at their Croydon colour TV factory to analyse specially prepared dealers' service cards. The aim is to identify failure patterns on a national basis and to pass the information back via dealers. Philips Video's technical sales manager Noel Cunniffe points out that if action is not taken engineers will inevitably become less effective at fault-finding and carrying out repairs in the field. The use of a computer was necessary since "with the low call rate now experienced there's no other way of effectively measuring breakdown patterns".

SONY'S NEW VCR

Sony's latest VCR, Model C5, has been introduced to compete in the lower price range end of the market. It shares the same basic chassis as the more sophisticated C7, and is very similar in appearance, but is designed to sell at around £200 less.

LIQUID CRYSTAL TV

Various mentions have been made in the past in these columns of the development of liquid crystal display panels for use in TV sets. At this year's London trade shows two prototype sets were being exhibited – one by Hitachi and the other by NEC. The NEC set had a 2in. screen, while Hitachi's set had a 3in. screen measuring 45 × 60mm, with 19,200 picture elements – giving a resolution of 120 × 160 lines. We are able to show a photograph of this latter set, along with a block diagram (see Fig. 1) indicating the basic operation. The demodulated video signal has to be converted to a digital one, and is then fed into a memory that stores a complete line of information. This information is then applied to a pulse-width modulation circuit, and finally to the panel's matrix drive circuit. Another panel matrix circuit provides the scan action. Compactness and low power consumption have been achieved by using LSI CMOS integrated circuits for the digital operations, the display panel itself being of the reflection type.

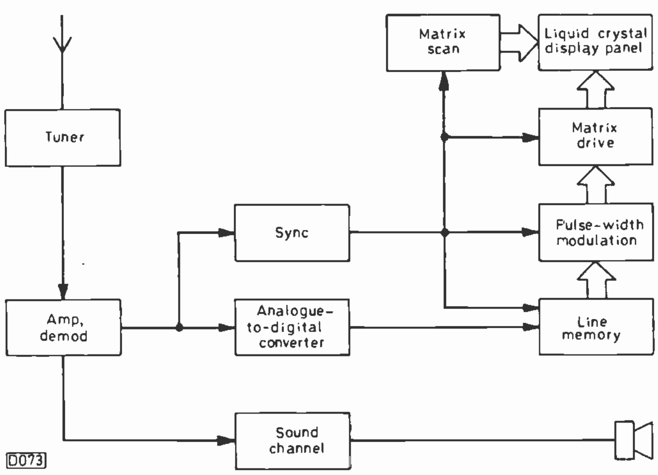
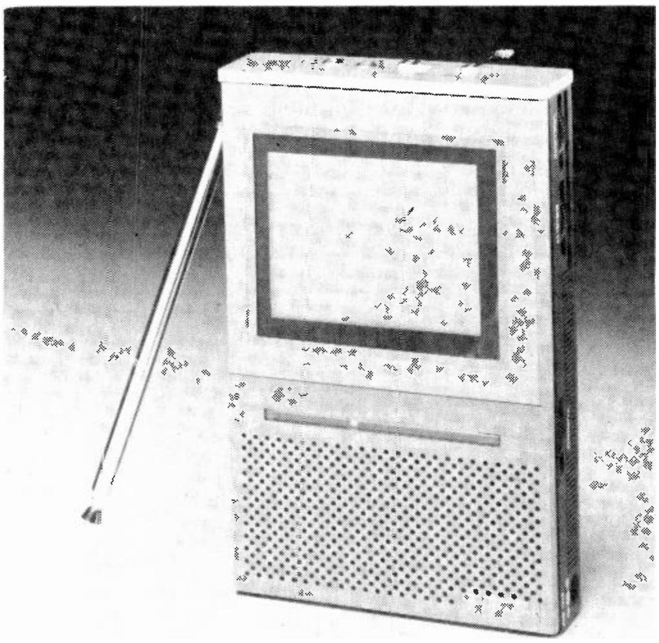


Fig. 1: Block diagram of the prototype Hitachi 3in. monochrome TV set with liquid crystal display panel.


Hitachi's prototype liquid crystal TV set.

ICI's Organics Division, in collaboration with RSRE, Malvern, has developed a range of anisotropic dyes for use with liquid-crystal display devices. The dyes provide a full range of colours, and in LCD use feature high contrast, good viewing angle and long life. The research was initially undertaken with a view to finding a stable material to produce reliable displays for defence applications.

SELECTAVISION A SUCCESS

The evidence so far is that RCA's launch of their CED Selectavision video disc system in the USA — "the biggest product launch in business history" – has been a success. In the first five weeks some 52,000 players were shipped to distributors, and over half appear to have been sold. It was interesting to see the Selectavision player being demonstrated by GEC at the recent trade shows. Hitachi, Sanyo and Toshiba have now introduced Selectavision players in the US, the Hitachi and Sanyo machines featuring two-speed operation in both the forward and reverse modes.

TV MOSAIC

Something new in cable TV. A Dutch operator has managed to put sixteen pictures on the screen simultaneously, each with the appropriate station identification, so that viewers can see at a glance what's on offer. Parts of Holland can receive Belgian, Dutch, French and German stations, plus Luxembourg. Apparently BBC and ITV signals are also distributed.

TRADE SHOW NOTES

There were several interesting things from the TV point of view at the recent trade shows. Decca for example still appear to be going strong, with a new generation of chassis, the 120 to drive 90° tubes in screen sizes up to 22in. and the 130 to drive 22/26in. 110° tubes. The present 70 and 90 series chassis are being phased out. The latest Doric (Rediffusion) sets also incorporate a new chassis, designed to drive the RCA S4 tube. The chassis is mains-isolated, and sets with remote control use frequency-synthesis tuning. Salora too showed a new chassis, type H. We shall be reporting further on these chassis when more details are available. Various continental brands have put in a return appearance. Paul Spring Electronics are now handling the Telefunken range in the UK – Telefunken withdrew from the UK market in January 1979. Tandberg showed a new, advanced range of colour sets. They too withdrew in 1979, but the aim now is to provide sets "for the new era of advanced home applications". There has also been talk of reintroducing the Finlux brand, which with its sister ASA range is produced by the Finnish Lohjans Corporation. Finlux withdrew from the UK in early 1976.

CCD TELECINES

The latest thing to go digital is telecine equipment – both Bosch and Marconi have announced telecine machines that use charge-coupled image sensors in place of the electronic tubes used in previous designs.

The Marconi machine, Model B3410, was shown at the recent Montreux Television Symposium. It operates on the PAL, NTSC or SECAM standards, with RGB or digital outputs. Virtually all the video signal processing is carried out digitally, the three video signals using eleven-bit sampling before gamma correction. A microprocessor control system sets up the gamma, matrix and aperture correction, and also controls the mechanics. The three image sensors used are silicon CCDs, each consisting of an in-line array of 1,024 photosensitive elements with a system of transfer gates and transporting shift registers alongside.

STATION OPENINGS

The following relay stations are now in operation:
Abergwynfi (W. Glamorgan) BBC Wales ch. 21, HTV Wales ch. 24, BBC-2 ch. 27, Sianel 4 Cymru (future) ch. 31.
Dolybont (Dyfed) Sianel 4 Cymru (future) ch. 54, BBC Wales ch. 58, HTV Wales ch. 61, BBC-2 ch. 64.
Llandysul (Dyfed) Sianel 4 Cymru (future) ch. 53, BBC Wales ch. 57, HTV Wales ch. 60, BBC-2 ch. 63.
Salcombe (S. Devon) TV4 ch. 30, BBC-2 ch. 41, Westward Television ch. 44, BBC-1 ch. 51. A wideband (group W) aerial is required for use with this transmitter.
Westward Ho! (N. Devon) BBC-1 ch. 21, Westward Television ch. 24, BBC-2 ch. 27, TV4 ch. 31.

The above transmissions are all vertically polarised.

TOUCH TUNING PROBLEMS

Thorn point out that certain aerosol cleaning and polishing agents can cause problems with touch-pad tuning systems. Problems can also arise when a set is operated under adverse conditions such that moisture forms on the pads. To provide a complete solution with touch-tuned versions of the 9600 and 9800 chassis, Thorn have introduced a light-action channel-change switch assembly which can be used to replace the channel selector pads. The assembly consists of a suitable six-channel switch plate and six-channel PCB, and comes with full fitting instructions.

Overhauling the Rank A823 Chassis

Mick Dutton

The Rank A823 solid-state colour chassis has been around for some years now – since the late 60s in fact – and appears in a large number of the sets I deal with. As a result, I've devised over the years a standard overhaul procedure which may be of interest to other readers.

The first thing of course is the power supply. Remove the panel and check for bad joints around 8R2 and the two thermistors 8TH1/2. If the thermistors are worn, it's best to replace them. Resolder the print areas around the fixing screws, and clean off the metalwork adjacent to the fixing holes. Check that the set h.t./e.h.t. control 8RV1 is not worn: if in doubt, change it. Refit the panel and check that the h.t. is correct – I always set it for 200V at the h.t. fuse 8F3.

The timebase panel is next. First check the height, linearity and set mid-point controls (circuit reference numbers vary between earlier and later panels) for dirty tracks. Again, if they are dirty it's best to change them. Check for dry-joints under the 22Ω damping resistor (5R35/5R54) in the line driver stage. Replace the panel and reset the line hold and the field controls.

The i.f. panel is reliable. It's as well to check the preset colour control 2RV6 (later panel) and that the print is o.k. under the speaker socket.

The decoder is probably the most difficult panel to get working correctly. I've found it best to realign the colour sections completely. This usually cures intermittent colour problems. I also change on sight the 50μF electrolytics 3C2/3C16/3C17/3C23 (two-chip decoder) if they are of the black variety. Check for dry-joints on the luminance delay line, and clean the RGB drive controls. When setting up the two-chip decoder it's quite common to find that the V reference phase coil 3L5 cannot be set for correct overlay without Hanover bars. The cause of this is the chroma delay line having gone out of tolerance, the only cure being replacement. Another fault that's becoming increasingly common on this decoder is 3C30 (15μF) becoming short-circuit: this causes a blank raster.

Dry-joints around the h.t. smoothing/anti-breathing power resistor 8R15/17 can give trouble, and if time permits it's best to remove the chassis from the cabinet and check the conditions of the connections, also the condition of the main reservoir/smoothing electrolytics, the 47kΩ discharge resistors (if they are discoloured, change them), and the security of the earth connection screw at the end of the tagstrip – this can be responsible for an annoying hum bar whose cause is hard to find.

While the chassis is out, check for dry-joints around the pincushion phase coil 6L20 on the scan drive panel – dry-joints here can cause intermittent field collapse.

Check for good connection between the c.r.t. base pins and the panel, and that the focus spark gap has adequate clearance.

The best course of action with the convergence panel is to go through the setting-up procedure, using a crosshatch pattern and changing any controls that are touchy. The usual culprits are the R/G horizontal tilt and amplitude controls 7RV3 and 7RV5.

Going through the above procedure results in better reliability and fewer callbacks, making everybody happier.

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*Axial. All others are Radial.

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Lemon – '81 Style

Chas E. Miller

LONG-TERM readers may recall an article I wrote a good many years ago ("Beware the Lemon") about a certain TV set which, though from a good family, gave me endless trouble. I've been remarkably lucky since those days, and have seldom been confronted with a real, eighteen-carat, twenty-one jewel stinker. Until recently, that is. And when it came, it proved itself a worthy descendant of the original lemon.

The GEC single-standard hybrid colour sets may not be to everyone's taste, but I speak as I find and must say that they've been very good sellers for me over the years. I've sold numerous examples, the majority of which have been so reliable that I've been able to forget them. Frequently, one sale begat another.

So it was that a lady customer who'd owned a 22in. model for some time recommended her friend to buy a similar one from me. And naturally I was happy to oblige. Now I make a practice of testing all second-hand sets for several days, if not weeks, before they are sold. This consistently pays dividends in the low level of call-backs. The set in question was no exception, and had given no indication of incipient trouble whilst on test. Yet it had been in service for no more than a few days before I received a frantic phone message to the effect that smoke had been seen pouring from the back.

On examination I found that the line output transformer had well and truly cooked. In fact it was burnt to a crisp! This surprised and hurt me, since I'd had nothing like this happen for years – it must have been at least six years since I'd had two line output transformers fail in quick succession, and the extra replacements I'd acquired just in case were still on the shelf. So in went a new line output transformer, and with the picture restored the set was returned.

In next to no time it had "gone off". This time the BY127 h.t. rectifier had gone dead short, which was not particularly exceptional nor expensive to put right.

I think I actually got away with a whole week before the next cry for help, which came because the picture had "gone blurred". Having had a few cases of the resistor (R67, 10MΩ) in series with the focus control going high in value, I naturally checked this first. In the event it was perfectly all right, the trouble being due to the e.h.t. series resistor in the c.r.t. anode cap. It was virtually open-circuit.

Replacing this earnt me another few days' respite before another call came. More smoke signals had been observed. This was a classic fault on these GEC sets – a print breakdown around the area behind the height control. The cure is to file away the charred section and replace the missing copper strips with ordinary wire (you got the same trouble near the PL504 in the old Thorn 950 chassis).

Since the set was once more in the workshop I decided I'd forestall any further trouble by changing all the other components that in my experience have been susceptible to failure in these sets. These include the 560kΩ resistor (R526) in series with the height control, the boost reservoir capacitor (C523, 0·47μF), the two resistors (R540, 390kΩ and R541, 120kΩ) in series with the set e.h.t. control, the resistors in the sync separator's collector circuit (R500, 56kΩ and R501, 33kΩ), and the three-legged thermistor TH501/2 in the degaussing/heater circuit. And although there was no evidence to suggest that it had contributed to the earlier failure of the e.h.t. anode cap resistor, I changed the tripler as well. Then back on the test bench for a session.

In all honesty, it lasted no more than ten minutes before the width closed in sharply, with the loss of about two inches at each side. The focus had also deteriorated. I peered in the back, from the line output transformer side, and saw smoke rising. I couldn't locate the source however. It was not until I'd moved to the other side of the set that I was able to spot something I'd never seen before – the focus control itself was glowing red hot from end to end! This held me spell bound for a few moments before my hand flew to the on/off switch. By that time the 10MΩ series resistor had turned to ash and the control's plastic housing had melted around it. By good fortune I happened to have replacements to hand, so it was not too long before I once again had good, sharp pictures of full width. The only snag was that they were now in monochrome! Maybe R416 (18kΩ) which feeds the screen grids of all three PCL84 colour-difference output valves was open-circuit. No.

One soon learns to check and double check the interconnecting leads on GEC sets when something drops out for no apparent reason. To no avail this time however. Not feeling in the mood for a fault-finding session, I changed the decoder panel for a known good one. The pictures were still in black and white. Again check the leads, but find nothing amiss. Replace the original decoder and get colour back – but with no red! The series resistor (R607, 220kΩ) between the red first anode and the slider of the preset had gone open-circuit.

With the red restored it was evident that the purity had gone seriously awry, though it had been perfectly o.k. before the focus control packed up. I thought I'd better check that the degaussing coils were operating before anything else, and sure enough discovered that the VA8650 posistor (TH503) in the degaussing circuit had a leg off. So I went off in search of another. I picked up three, one after the other, and in each case one leg fell off before it could be fitted... Eventually I discovered a complete one which stayed that way long enough for it to be fitted, and was gratified to get a vastly purer red that needed only a little adjustment to get optimum results.

For what followed I've only myself to blame. What I should have done was to say enough is enough and cut my losses by selling the set off at an auction sale while it was still giving what were actually very good results. But refusal to admit that one is beaten is a common enough failing. On the strength of a trouble-free week, with the set on in my house so that it could be left running for fourteen hours a day, I decided to give it another go. It lasted in the customer's house for two days before the raster disappeared.

By now things were getting decidedly embarrassing for all concerned. To give her her due, the owner was acutely concerned about having to call me out so often. She was actually prepared to persist with the set, since the picture pleased her when the set was actually working.

On taking the back off, I immediately spotted that the red button of the line output stage overload cut-out (it's in series with the cathode of the PL509 line output valve) was in its out position. Now as is known, these cut-outs occasionally fail due to ageing, so I gave it an experimental prod. There was an audible "crack" from beneath the chassis, and a small r.f. choke attached to the base of the PY500 boost diode caught fire spectacularly. It continued to blaze merrily after I'd switched off the mains supply, and I had to snuff it out as you would a candle. I can't tell you exactly what caused this conflagration, since I've not had the heart even to try the set again since I brought it back in disgrace, but it's likely that the fifth harmonic tuning capacitor C53 (300pF) is short-circuit – it's well hidden away.

At the end of the original lemon article I asked whether any reader would like to put in a bid for a good used TV, the late property of an old lady with weak eyes. I'm not going to repeat that, since in this case it's no more than the cruel truth. But perhaps someone would like to acquire it as an investment. After all, there can't be much more wrong with it, can there? And I'd accept trading stamps, or cigarette cards, or anything . . . ■

VCR Clinic

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

Compatibility Problem

It came to pass that I sold a couple of JVC HR2200 portable VCRs. With one of them went a Sony HVC2000 camera. The other one was sold to a friend who had made arrangements of his own to buy an HVC3000 camera elsewhere. Now Sony have available an adaptor, Model CMA1010, to enable their cameras to be used with VHS machines. It consists of a small black box, with a 14-pin Betamax K-type connector at one end and a 10-pin VHS J-type connector on a short lead at the other end.

Vince took delivery of his portable VCR, and went away to use it with the HVC3000 camera he'd bought. Back he came to complain that the VCR was faulty: he explained that intermittently the recorder would not operate when using the auto-fade facility – sometimes it wouldn't start, and on other occasions it wouldn't pause. Meanwhile Mansell had taken delivery of his Sony HVC2000 camera, CMA1010 adaptor and JVC HR2200 VCR. Both Andy and I had used this equipment, and had experienced no problems at all. Mansell tried it and reported similar problems to those Vince was experiencing. Apparently he'd used the equipment early one morning on his brother's farm, recording whilst his brother sowed seeds. Well, it was spring! Trying to be helpful, Mansell explained that it may have been the cold weather at the time. Andy decided that if Mansell was daft enough to stand in the middle of a bloody field at some god-forsaken hour in the morning he'd only himself to blame. So much for the customer relations at the Newark Video Centre . . .

Time for yours truly to be called in. Information had to be obtained, and it was discovered that there's a bistable

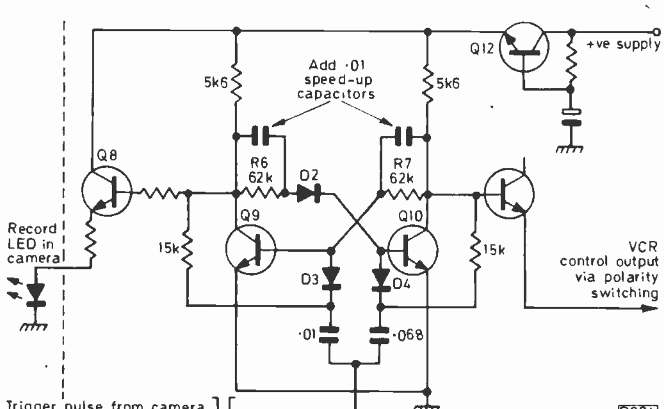


Fig. 1: Interfacing bistable circuit used in the Sony CMA1010 camera/VHS VCR link unit.

inside the CMA1010's little black box. This bistable is triggered by pulses from the camera. So was the trouble due to the camera, the adaptor, or the VCR?

The bistable circuit is shown in Fig. 1. The output from the collector of Q10 goes to the VCR, via the buffer transistor etc., to tell the VCR to record or not. Another output goes from Q8 to illuminate the red "operate" LED in the camera's viewfinder. We found that when the fault occurred, i.e. the recorder failed to start, the operate lamp didn't come on either. The conclusion therefore was either that the cameras weren't producing trigger pulses on occasion (unlikely), or that the bistable was failing to trigger (likely). Much comparison of waveforms on my double-beam scope proved that the trouble was due to intermittent failure of the bistable to trigger.

We phoned Sony Service at Birmingham, who said they'd not come across the problem and suggested we try Central Service at Feltham. They didn't know either, and suggested we send the CMA1010 along for attention.

Well now Beeching's been in the video business long enough to know that what statistically amounts to a 100% failure rate is too much of a coincidence, and that if Sony are being coy about it we might be in for a bit of a wait. We've done a fair amount of design work ourselves, so we decided to have a go at modifying the circuit. What we eventually discovered was that by adding speed-up capacitors – we used tiny 0·01μF 63V ceramic capacitors, soldered to the print – across the cross-coupling resistors R6/7 the problem was solved. Care still has to be taken when using the Sony camera and adaptor, as you can get the system out of sequence and end up stopping the VCR whilst you run the camera and starting the VCR when the camera is not being used. The results can be quite funny . . .

For those interested in the technical details, when the bistable circuit is first powered Q9 conducts, due to the imbalance in the circuit introduced by the presence of diode D2. Q10 is then off of course. When a trigger pulse is received from the camera to give the record command, Q9 switches off and Q10 switches on. The low output at the collector of Q10 tells the VCR to record, while on the other side of the circuit Q8 switches on to provide the LED in the camera's viewfinder with current to light it up. The next trigger pulse from the camera reverses the states of the bistable circuit, Q9 switching on and Q10 switching off – the recorder stops recording and the LED goes out.

So what was the problem? The power supply to the bistable circuit comes via the slow-start transistor Q12. Since there's no decoupling, Q12 loads the circuit, in effect reducing the loop gain. The addition of the speed-up capacitors increases the sensitivity of the bistable switch, thus overcoming the problem.

Another problem has arisen when using the Sony cameras and adaptor with the Ferguson 3V23 and JVC HR7700 mains-operated machines. If you connect the camera via the CMA1010 adaptor, switch the VCR on and then select the camera input button on the front, the LED in the camera lights but the camera doesn't power up. If you unplug the camera from the VCR and then plug it back in however the camera operates – provided "camera" is still selected. Again, why? It's to do with the rate of rise of the power supply voltage.

When the camera is powered via selector switching on these recorders, the 12V supply rises slowly: when the camera is unplugged and then plugged in again, the voltage rise is almost instantaneous. There's a regulator circuit in the Sony cameras, and this requires a fast rise time at power switch on. The switching within the 3V23 and HR7700 machines is too slow for this. We've found that a modification can be carried out on the 3V23/HR7700 to cure the problem, but I'm not sure that it's a good idea to provide details . . .

Tape Trouble – Betas

Finally this month a note on Derek Snelling's last paragraph in the May *VCR Clinic* – on Betamax machines that exhibit blank video replay due to faulty tapes. The cause of the symptoms is lack of control track pulses due to tape edge damage or lack of oxide – the control track is on the bottom edge. As a result of this the servo goes out of lock and the muting circuits operate. A deformed cassette or one that's not seated properly can be a contributory factor when the tape rides high – large-scale misalignment of the tape path will have the same effect.

Derek Snelling reports:

Despite the differences between the Betamax and VHS systems, you get some common faults with the two different types of machines. A couple occur regularly in our area. The first is a trivial one I get at least twice a month, the complaint being that playback is o.k. but the machine won't record. When I get there I usually find that there's a TV/camera switch which is in the camera position. This disconnects the tuner of course, preventing off-air recording. Trying to ask the customer to check this point before you go out is not always easy however.

The second problem concerns the lever which raises the front flap on the cassette when it's inserted into the machine. If the VCR is subject to heavy use, particularly by different people, in clubs say, the lever can become bent. This is usually because the housing has been closed before the cassette has been pushed fully home. The result is either inability to close the cassette housing or inability to eject the tape. Once the top of the machine has been removed and the cassette ejected (if necessary), repair is simply a matter of bending the lever back to the correct position (it's fairly soft). Check by inserting a cassette slowly, seeing that the lever lines up with the slot in the cassette and does not foul anywhere as the housing is lowered. It's a good idea on VHS machines to check the small spring strip in the rear right of the cassette housing, as this should press the button on the right of the cassette, releasing the catch on the front flap. If necessary, retension the strip by bending it slightly, using a pair of long-nosed pliars.

Panasonic NV7000

A problem that seems to be showing up on Panasonic NV7000 machines as they approach a year old is failure to complete the loading sequence. The machine will load up normally until a point just short of the fully loaded position. At this point the motor note changes and it fails to get any farther, with the result that the machine unlaces after a few seconds.

The problem is obviously a mechanical one, and when we first encountered it we decided to contact Panasonic for any advice they could give before we started to strip the machine down – the workings of this model are not the easiest to get at. The problem is apparently a common one, and we were told straight away to remove all the old grease from the loading mechanism and replace it with paraffin oil. This cured the problem on the first machine, but on the next two that came along the larger of the two loading belts had to be changed as well. The loading mechanism seems to operate at the edge of the performance specifications of some of the parts, and recently the loading plate has been changed to give improved reliability. Unfortunately it does not appear to be interchangeable with the earlier plate, and thus can't be used for general replacement purposes.

Latching Mechanism – Ferguson

The latching mechanism on Ferguson machines seems to be a little weak. Three times recently I've had to strip down, reshape and rebuilt this unit on different machines. On the first, the play key would not depress. This was due to the slot in the latching bar being completely closed as a result of the bar being bent. In the second case the record key could not be depressed because the smaller "record" latching bar was bent. In the final case the keys went down o.k. but had a tendency to jump up as the machine clunked at the completion of loading. This was simply the result of latching bar wear: the metal is a bit too soft for the purpose – filing provided a cure. Although the repair to the latching bar was in each case a matter of moments, getting the mechanism out and stripping it down is a tricky job that involves removing eight screws, eight springs and two circlips – after removing the top, the cassette housing, the bottom, bottom board, side and front.

Toshiba V5470

Whilst I agree with Steve Beeching that the Toshiba V5470 is a reliable machine, we've been having a lot of trouble with faulty capstan motors – we've had to change about ten since Christmas. The symptoms are easy enough to spot – varying tape speed, with the obvious effect (wow) on sound, the picture not always being affected. Unfortunately Toshiba seem to have a problem with supplying replacements promptly. Another problem is that Toshiba altered the motor's specification without telling us. This came to light when a replacement motor we'd fitted was found to be running far too fast. At first we thought the motor was faulty, but as a check another one was taken, complete with pulley, from a stock machine. We noticed that the pulley was about 25% smaller, and was marked with a red X. When it was fitted to the replacement motor, the machine worked o.k.

Now the only way to adjust the capstan speed on these machines is by varying the pulley size, and for this purpose we had a full set of pulleys. An X was not mentioned in our manual however, and the pulley was far smaller than the smallest one we had. Because of this we sent two of our pulleys, stamped D and E, for replacement with X pulleys, as we were clearly going to need these with replacement motors. The replacements were marked D and E, but in red instead of in black, and were far smaller than the originals. Obviously Toshiba do a complete range of pulleys similarly numbered to the original range, but smaller to suit the new motors. Life would have been easier if we'd known.

Sanyo VT9300

Since my last report, another fairly common problem with the Sanyo VT9300 VCR has arisen – in fact it's the same problem, though the symptom is different. The complaint is that the keys trip, i.e. come up, at varying intervals on play or record. The machine then stops of course. This habit is particularly annoying with an unattended recording. We first suspected misadjustment of the tape end sensor circuit, causing the oscillator to stop and the machine to think that the end of the tape had been reached. This was not the case however, so the various feedback pulses were next checked. None of them disappeared when the fault occurred – and finding the cause of the problem was made worse because if the machine was operated again even after it had just tripped it would usually work all right.

We eventually contacted Sanyo, and were told that the problem was our old friend the 12V series regulator transistor Q702 going intermittent: the clue to look for is a momentary dimming of the power light before the keys trip. Since the first one, we've had nine further cases of intermittent tripping, and in each case we've changed the regulator transistor without even seeing the fault. The result – 100% success!

Beware – Bodgers at Work!

Just to show that repairs by "the man down the road" are not confined to TV sets, we had a Panasonic NV8600 in for repair last week, the report being that it wouldn't work (very helpful) but that it couldn't be much as it wasn't long out of guarantee. Well, for such a new machine it was in a terrible state – scratched, dirty, the mains lead chopped off just short of the cabinet and another "fitted", and the grommet where it goes through the metal casing missing. Still, it's not for us to criticise how others look after their equipment (once it's paid for and out of guarantee, that is). On to the repair. We soon found that no keys would latch down when the machine was switched on, though they were o.k. when it was switched off. This was soon put down to operation of the stop solenoid, but why?

The cassette housing lamp was lit, but it was noticed that the power light was very dim. Perhaps there was a problem with one of the power supplies? Our checks in this area revealed some points of interest. First, some screws were missing, and the ones that were there were in the wrong places. Secondly, a glance at the rectifier board revealed that several diodes had been replaced, by the look of it with anything that came to hand. Checks here didn't throw any light on the matter however, so we moved on to the regulator and transport board, at the front of the machine – this holds the stop solenoid drive circuitry.

Various circuits can activate the stop solenoid – lamp failure, end sensor, dew sensor – the signals being fed to the drive circuit via diodes D613-7. By disconnecting each of these diodes in turn we were able to determine what was tripping the solenoid. The fault seemed to be around Q625, which operates the power light and senses whether the cassette lamp is functioning. As the lamp was lit, the transistor was suspected. A replacement made no difference however. At this point we for some reason removed the cassette housing: the answer to the problem was then obvious – someone had fitted the wrong cassette lamp. It was larger than the correct one, but the reason it caused all the trouble was that it drew the wrong current and thus confused the lamp failure circuit.

Fitting the correct lamp cured the problem. It then remained only to clean last week's dinner out of the mechanics, replace the diodes on the rectifier board with the correct ones, fit a new mains lead and grommet, and hope that the bill would persuade the customer not to let "the man down the road" mess about with it next time.

Hitachi 8000/8500 Series

Further to the problem of the 2·2Ω resistor R081 on the Hitachi 8000/8500 series VCRs burning up, the latest theory is that static charges are upsetting the microprocessor IC901, with the result that there's sometimes an output from both the loading and unloading pins, Q901/2 then both turning on at the same time to produce a virtual short across the loading motor supply. To combat this possibility, the following modification has been made to the reset circuit: instead of ZD901 being fed direct from the 18V rail, it's fed from R081, the theory being that if the fault occurs the voltage from R081 will approach zero, causing a reset to be applied to the i.c. This removes the load and unload outputs, presumably before R081 burns up.

An interesting fault we had with an 8000 was failure to eject when the machine was switched on, and occasional slack tape when the tape was ejected with the machine switched off. We soon found that the main brake was being held in the off position, and that in this position an interlock prevents the eject button from operating. The reason it operated with the machine switched off is because applying power to the main brake solenoid holds the brake off, the brake being on under no power conditions (thus preventing slack in tapes left in the machine whilst it's switched off). The fault was traced to the solenoid drive transistor Q54.

TV Receiver Modifications

Most modern TV sets have a VCR position, but this is not always the case with sets that are more than three-four years old. The modification introduced when the VCR position is selected usually alters the time-constant of the flywheel line sync circuit, to enable this to cope with the off-tape sync pulses. The modification can be switched out to avoid problems during off-air reception, particularly in weak signal areas. Some recent sets, in particular ITT chassis, also suffer from field problems, for which modifications have been introduced.

The following list of modifications for VCR use may be of help to readers. They relate to the various chassis we deal with and have been supplied by the manufacturers concerned. We've tried most of them, though not all. It's also worth pointing out that just because a modification has been suggested for a chassis it doesn't mean that it has to be carried out – a lot depends on the VCR being used, i.e. on whether the heads are worn, whether the tape was recorded on the machine being used, and so on. If any of the following symptoms are experienced – picture shake, pulling at the top of the picture (often worse on still frame), picture bounce or roll (often intermittent), or colour drop out (usually in conjunction with pulling at the top) – the suggested modifications should be tried.

Decca 10 and 30 series: Change R434 to 680kΩ, C419 to 2·2μF and C421 to 0·047μF.

Decca 80/88/100 chassis: Models with touch buttons require no modifications. With others, short pin 10 of IC301 (TBA920) to chassis. If problems are experienced with normal reception after carrying out this modification, a button unit can be obtained from Decca with a microswitch fitted to button 6 so that the modification comes into operation only when this button is operated.

ITT CVC5/8/9 chassis: Change C288 to 680pF, C290 to 0·1μF and R395 to 47kΩ.

ITT CVC20 series chassis: Change R702 to 2·2MΩ, R708 to 82kΩ and C710 to 0·068μF.

ITT CVC25/30/32 chassis: Carry out modifications as for the CVC20 chassis. Also remove wire link adjacent to L35 and replace with a 100μH choke. In cases where field bounce is experienced in models fitted with the CMS30 sync/line oscillator module, change R713 to 3·3kΩ, add an 0·01μF capacitor in the position marked C714, remove wire link WL3 and replace it with an 0·1μF capacitor, and add a 100kΩ resistor in the position marked R714.

Philips G8 chassis: Remove C4496 and C4498 from the timebase panel. Fit a 15Ω ½W resistor in series with a 10μF capacitor in place of C4496. Fit a 10kΩ ½W resistor across pins 3 and 5 of IC2001 on the i.f. panel.

Philips G11 chassis: Where field bounce is experienced, change C2039 on the timebase panel to 0·0039μF 100V.

Rank A823 chassis: Change 5C13 to 680pF and 5C12 to 0·01μF (A803 scan drive panel).

Rank A823A chassis: Change 5C10 to 1·5μF, 5R15 to 47kΩ and 5C15 to 0·068μF (Z504 scan drive panel).

Rank A823B chassis: Uses Z968 scan drive panel. Modifications as for A823A chassis.

Rank Z179 chassis: Short pin 10 of 4SIC1 (TBA920) to chassis. A kit is available to do this automatically on touch tuner models with or without remote control.

Rank Z718 chassis: Connect pin 8 of 4SIC1 (TBA950) to the 12V rail and short pins 1 and 2 of plug 3Z9 together. Kits are available to enable this to be done automatically (quote model number).

Tandberg: A modified sync panel is available for the CTV1 chassis. No modifications to the CTV2 and CTV3 chassis are required.

Thorn 2000 chassis: Change C7 on the line timebase module to 4·7μF.

Thorn 9000 chassis: Change C419 to 3·3μF and C421 to 1μF.

Various imported sets using the TBA920 sync/line oscillator i.c., e.g. the Kuba Florence and Zanussi BR1026, can be modified by linking pin 10 of the i.c. to chassis, via a switch if necessary to preserve good off-air sync.

Pin Diode Aerial Switching

Roger Bunney

DURING a period of good Sporadic E reception, the long-distance TV enthusiast may want to be able to select the inputs from several aerials in rapid succession. This can be done by using a standard multi-contact rotary switch to select the signals from different coaxial downleads, but means that each aerial must have its own cable, with untidy arrangements at the receiver end. The arrangement described here enables the switching to be done remotely at the aerial end, with a single coaxial downlead used in conjunction with a multi-core cable to convey a switching bias supply to the masthead. There are two units: the power supply/selector switch unit, and a remote unit which uses pin diode switching. In addition, a wideband amplifier can be incorporated in the remote switching unit.

Basic Circuit

Fig. 1 shows the basic circuit, for a system to select the signals from three aerials. The input from each aerial is fed via an identical pin diode arrangement which requires an 8·5V bias supply to switch on and pass the signal. Switch SW1 at the receiver end switches the bias to the appropriate pin diode circuit. The latter consists of a TDA1061 pin diode block, followed by a further BA379 pin diode. In the first unit I built, only the diode block was used. After some experimentation however it was decided that a higher degree of isolation was required than the 40dB provided by the block. The problem that arose with inadequate isolation was unwanted phase addition/subtraction when all three aerials were connected to the unit. The solution was to add the BA379 pin diode stage, which resulted in 65dB isolation at the expense of a higher insertion loss – this was measured as a 4dB voltage loss. Fortunately such a loss can easily be made good by means of amplification, either at the remote end or at the receiver end. The isolation was measured by injecting a 10mV 55MHz signal at one input and then checking the residual output (unterminated) obtained with one of the other inputs selected.

Power Supply

The power supply unit is conventional, providing 8·5V which in the prototype is switched to any of three outputs. These are fed to the head unit via a standard DIN socket. The fifth pin of the socket is at chassis potential: the fourth pin is available to feed say a 24V supply to a masthead amplifier, e.g. an RS OM355 hybrid i.c. This supply could alternatively (see Figs. 2 and 4) be fed up to the masthead via the coaxial downlead should switching of a fourth aerial be required. Fig. 3 shows a suitable power supply giving regulated 24V and 8·5V outputs.

Construction and Use

Construction is simple, but care must be taken – even at Band I frequencies – to keep lead lengths to a minimum. Assuming that no mistakes have been made, the unit should work immediately, no alignment being necessary.

The arrangement will operate at Band III, but in view of the insertion loss amplification will be essential. The main idea of the system is for use in Band I, particularly during

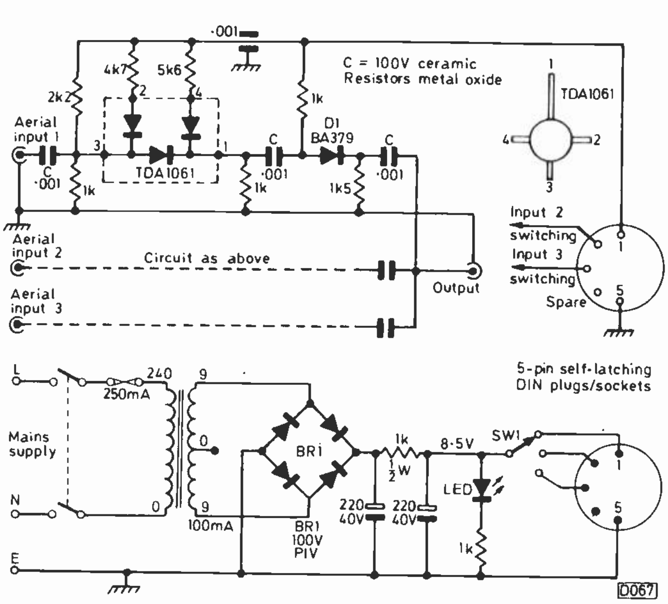


Fig. 1: Circuit diagram of the pin diode aerial switching system, for selecting the signals from three aerials.

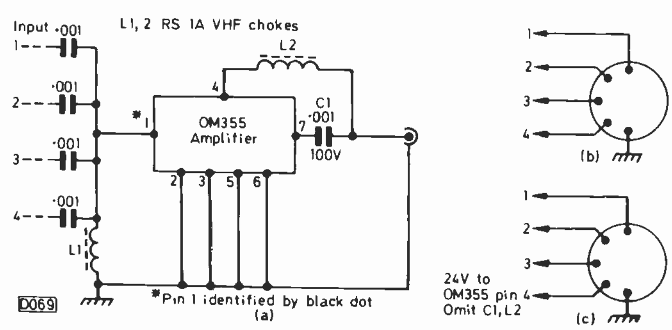


Fig. 2: (a) Adding amplification, with the 24V supply to the OM355 hybrid amplifier i.c. fed via the centre conductor of the coaxial downlead. (b) Five-pin DIN plug/socket wired for switching between four aerial inputs. (c) Five-pin DIN plug/socket wired for switching between three aerial inputs, with the fourth pin used to feed the 24V supply to the OM355 i.c. – C1 and L2 in (a) are not required when this arrangement is used.

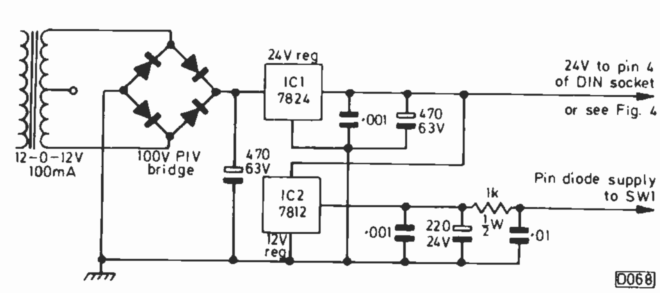


Fig. 3: suggested circuit for providing 24V and 8·5V supplies.

The power supply/selector switch unit (top) and the remote aerial switching unit (bottom), with interconnecting pin diode bias supply cable. Note the arrangement of the coaxial sockets on the switching unit, with the output socket at the centre and the input sockets around it, thus minimising the lead lengths within the unit.

SpE openings when the signal levels will be relatively high. If you intend to use the system as a remote u.h.f. switcher, extreme care with construction will be necessary and the second, BA379 stage should be omitted.

In view of the present cost of low-loss coaxial cable, the project is certainly worthwhile. A single three-core mains cable could be employed, with the outer of the coaxial downlead used as the chassis link and the inner used to feed 24V up to an amplifier. It's advisable, in the interests of screening etc., to use diecast boxes for both the remote and power units. Arrange the input sockets around the output socket in the remote unit to minimise lead lengths.

Since the prototype was intended for domestic use, adjacent to the DX installation, latching screened DIN plug/socket connectors were employed. These prevent the plugs falling out and, though more expensive, were felt to be worthwhile. Four core cable (with individual screens) can be obtained, along with the plugs/sockets, from Maplin. The pin diodes are available from Ambit.

The arrangement adds greatly to efficient operation when SpE conditions are very active, and as an additional bonus reduces wear on coaxial sockets and amplifier input sockets.

Bi-directional System

A further use could be with the improved omni-directional array featured in the August 1980 issue, so that the output from either of the two dipoles could be selected to give bi-directional coverage. For this purpose, omit the second pin diode stage, reducing the isolation level to 40dB. ■

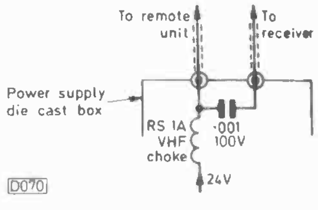


Fig. 4: Method of feeding the 24V supply to the masthead unit via the centre conductor of the aerial downlead – connections at the power supply end.

The End is Nigh

Les Lawry-Johns

I can't help feeling that the end is near. For years I've been kidding people that I know my job and have some sort of crystal ball I look into and immediately know what's wrong with every piece of equipment that comes in, be it a telly, radio, cassette, record deck, depth sounder, automatic pilot, diathermy unit (flesh cutter with a high-frequency probe I think) or what have you. Now I don't seem to be able to get anything right, be it a bread and butter TV set or the decoder in the Mitsubishi CT200. As for these switch-mode power supplies that shut down at the drop of a hat, what's wrong with fuses for heaven's sake? They're not wholly electronic I suppose.

Say for example that an e.h.t. tripler plays up. Once upon a time a fuse in the supply would fail. So you unhooked the tripler, checked the h.t. current with a meter to ensure that it was normal, fitted a new tripler and went to bed. Now when a tripler plays up the power supply senses the overload, shuts down, starts up and shuts down a couple of times and then lapses into sullen silence. In the meantime this huffing and puffing deals the bloody line output transformer a mortal blow, and if it continues to function for the present it'll certainly fail next week, with more huffing and puffing from the power supply. They even shut down when there's nothing wrong, adding chaos to the mayhem.

No, it's all too much for me. Human Rights have been a great benefit to suffering humanity. We never get a second thought. Even when you're having a quiet kip on a Bank Holiday afternoon, the editor rings up and says "don't just sit there, do something". (May Day wasn't intended for the rich owners of department stores – one department for the customers, one for the stock and another for the staff, including cat and dog – editor.)

So I'm busy carving my headstone. I don't trust these stonemasons. So far I've managed to chip out:

Here lies the body of LLJ,
He twisted and turned but couldn't get away.

The Thorn 8500

All this is leading up to the saga (amongst others) of Mr. Piddlewell and his Thorn 8500 colour set. He plonked it down and said it didn't go except for a faint buzz when it was first switched on. "It must be the on-off switch" he informed me. "Rubbish" I replied, "if it was the on-off switch it wouldn't even buzz. Hang on and I'll take a quick look."

With the back off, we could clearly hear the degaussing coils doing their bit when we switched on. There was precious little else however. Unfortunately it wasn't an 8000A, which has a 12Ω dropper instead of a mains input choke. That would have been easy, as the fault would probably have simply been an open-circuit dropper. Anyway, in addition to the choke there's a thermistor (usually), so a quick check was made to ensure that it was intact. We next moved the probe to the thyristor's anode – and the set immediately sprang to life, frightening Mr. Piddlewell out of his senses. He jumped back like a scalded cat. "Don't do that when I'm not ready!"

"Sorry" I said. "I didn't know the prod was going to prod it into action. Let's try it again." So we switched off, waited a while, then switched on again. Nothing happened apart from the buzz. "We've got to creep up on it" I told Mr. Piddlewell.

"You creep up on it" he said. "I'm standing well back this time."

So we tried to be methodical. We first checked for the presence of the mains-derived 25V regulated supply, since this provides the power for the thyristor's triggering circuit. The 25V was present and correct, but it was difficult to make sense of the other voltages because the h.t. voltage hadn't been established. So we checked for voltage at the anode of the thyristor, and the whole thing immediately sprang to life again. In fact anything metal touching the thyristor's heatsink or the diode in series with the thyristor on the input side started the damn thing up. So for want of anything better to do, we changed the diode and the thyristor. The thing then started up without any prodding. We hastily put the back on and started to prepare Mr. Piddlewell's bill.

"It's gorn off" he said.

I stopped writing, closed my eyes, gritted my teeth and rocked back and forth slowly. Off came the back and the testing (me or the set?) started again. Nothing made sense till we touched the input to the thyristor. All services were then restored.

"It's a loose wire" said Mr. Piddlewell helpfully.

"*******" I replied.

I then started mumbling to myself about trigger pulses arriving too late or not at all, and again removed the panel. I changed the three transistors in the trigger circuit, all suspect resistors, the relevant capacitors and the two diodes. The set then worked faultlessly, and off went Mr. Piddlewell without his bill – just in case. The next day he came back.

"It went off half way through the football" he gritted. "Leave it with me for a few hours" I sobbed.

Alone again, I crept up on it. The 25V line was o.k., and any attempt to check on the a.c. side restored the set to life. Out came the panel and, with it suspended by the wiring, I tried to take some readings without touching any point that would prod it back to life. Unfortunately I was stupid enough to allow the 25V regulator's heatsink to touch one of the a.c. mains tags on the input choke. There was a flash and the fuse blew.

With a heavy heart, I checked the 25V regulator transistor. It was short-circuit of course. I replaced it, but there was obviously some sort of short somewhere along the line as the 51Ω resistor in series with the transistor was overheating. Disconnect the 25V output plug 10/5 to the decoder/i.f. panel and the short clears. So we set about the tedious task of checking for shorts on this panel, and finally found it on the small a.f.c. subpanel, where a disc capacitor had gone short-circuit.

This was replaced, and on refitting the plug the BBC World Service commenced to read us the news. I'd met this one before and immediately accused the small eight-pin chip (MC1330 or equivalent, video detector) of playing about. Replacing it rewarded us with more normal sound, but not a sign of a picture as the MC1327 chroma demodulator/matrixing i.c. had also been dealt a mortal blow. With this replaced we had a picture and everything seemed to be in order. It then dawned on me that the power supply still had an intermittent fault, and sure enough the next time we tried to start it nothing happened until we touched the input to the thyristor.

At this I lost my cool. I took out the 4443 thyristor, replaced it with a 4444, and shorted out the series diode so that the full a.c. was applied to the thyristor. "If you need a prod" I said, "have one!" No further trouble has been experienced since then, and if the trigger circuit really was at fault it hasn't said so. Mr. Piddlewell has his set back, and will pay (I hope) when it has worked for a week without fault. So sorry you've been inconvenienced sir.

More Black Comedy

Following that I'd have liked to have had a nervous breakdown. There wasn't time however. An ITT CVC32 came in with the power unit tripping.

Removing the line oscillator panel stopped the tripping, so we checked everything in the line output stage, noticing that a new tripler had recently been fitted (not by us). Now if all the diodes are o.k., together with the line output transistor and the scan-correction capacitor etc., one has to look askance at the line output transformer. Upon fitting a new one normal operation was restored. The moral here seems to be that if the tripler fails the transformer is also suspect, which pleases the customer no end.

When the second CVC32 came along therefore you could say I'd been brainwashed. When it was switched on it tripped a few times and then went quiet. So I took out the oscillator panel and the set stayed on with a whistle to say that it was unloaded. I checked the line output stage – transistor, diodes, etc. – having already unhooked the tripler to no avail. "The transformer's gone" I thought.

So I fitted another and left the tripler disconnected. The set behaved exactly as before. A couple of humps, then back to silence. It then occurred to me that I hadn't checked the overvoltage preset (the bottom one). A slight touch on this restored the supply line and enabled us to set the thing up according to the book. Caught again. Back went the old transformer (sorry to have bothered you), on went the tripler (sorry to have suspected you), and the set was left on test for some hours just to be sure.

In passing, the model had full remote control. This functioned very well, but the off button didn't seem to be very positive in its action on the switch relay, or rather the relay seemed to be sluggish in its action upon the on-off switch. We didn't pursue this as something else was occupying our innermost thoughts – the previously mentioned Mitsubishi set.

Decoding a Decoder

Surely for sheer complexity the decoder used in the Mitsubishi CT200 must take the cake. Not, I hasten to explain, that I'm an expert on decoders, and I rarely tackle any kind of imported colour sets apart from those we've sold ourselves. The reasons for our reluctance to become involved with all the Sonys and other far eastern solid-state colour sets around are first because we don't feel inclined to stock up with spares which we may or may not need to use, and secondly because I'm a coward and hesitate to tackle anything I'm not familiar with.

A friend had had a great deal of trouble trying to get his CT200 fixed however, and had been without it for months. So in a weak moment I said I'd have a go at it, as nothing should take that long to sort out. The complaint was simply no colour. We looked up the circuit and received our first shock – all those f.e.t.s and other transistors dotted all over the place, in addition to one i.c. and two crystals . . .

Since the chroma demodulator i.c. drives the three colour-difference output transistors, this seemed a logical place to start. Injecting signals at its outputs got the output transistors going and produced pretty coloured patterns, but it was hardly surprising to find that this was as far as we got since there was no voltage supply to the i.c. The rectifier (D605) which provides this was open-circuit – it's right over on the far side of the panel. Replacing this restored correct voltages around the i.c., but precious little else. So we plodded backwards and found that the final chroma amplifier Q607 was open-circuit. Replacing this didn't help much either, so we went back and found (cutting a very long story short) several bipolar transistors and one f.e.t. defective.

Rotating the colour-killer control now gave us some bars of colour which couldn't be locked. This was not surprising, because there were hardly any burst gating pulses reaching the two reference oscillator control loops (it's one of those non-PAL decoders). They were present at the input to the decoder panel, but got lost on the way to the gating transistors. We finally found that the choke (L608) across which they are supposed to be developed apparently had shorting turns – it never gave the same reading twice. Replacing this with a coil (complete with core and shunt capacitor) from another decoder sent gating pulses where they should go, and we had colour which locked once we had realigned the coils (these had been disturbed, along with every preset on the board).

We could now rotate the colour-killer control to its proper setting, and decided to change channels to see whether lock was maintained. The button we pressed had not been set to a channel, so we got only a hiss on the sound and no picture. There was also another hiss apparent however, coming from the vicinity of the tripler. Before we could switch off there was a loud splash, and something appeared to be aflame somewhere down in a covered section.

Once the immediate panic was over, we found that there's a 200MΩ bleed resistor housed in a long vertical tube of heavy insulating material at the e.h.t. tripler's output. The insulation had broken down, and there'd been arcing across to the nearest earthed point. There was also a mound of silicone "putty" around the top of the tripler, so it would seem that a discharge had occurred earlier in the set's history. Perhaps this was the reason for the multi-faulted decoder board.

With the discharge problem overcome, we turned to the tuner again and tuned it in. Sound o.k., picture o.k., no colour. Gating pulses were still getting through, and we then found yet another 2SC710 transistor open-circuit, making four of this type we'd replaced. Is there something about this type of transistor that makes them hypersensitive? We fit BC108s and get no more trouble.

We again had colour, but it still seemed to lock weakly on channel change. After that brief second of hesitation however it couldn't be faulted so we called it a day.

Many, many hours had been spent on this hideous decoder, much of the time finding our way around it and trying to understand the meaning of some of the terms used. With thirty odd transistors including the colour-difference output ones, four f.e.t.s, an i.c. plus another half a dozen transistors on the same board for the luminance channel etc., this must be something of a record. Mind you, time could have been saved if I hadn't inadvertently consulted the CP140 decoder circuit instead of the CT200 half way through the proceedings.

If I worked for anyone other than myself, I'd be sacked on the first day.

Video Effects Generator

Malcolm Burrell

ALTHOUGH electrically separate, the video effects generator described here was designed and built as an integral part of the video mixer that was featured in the February issue earlier this year. It shares the same power supply and ZNA134J sync/drive pulse generator, and the output goes to the video mixer's effects input. Sync pulses are not added to the output, as this is done by the mixer. The combination of different effects that can be produced can be quite complicated however, so it was decided to incorporate a preview output. This enables the user to check exactly what the effects will be before say recording them on videotape as part of a programme. The preview output requires sync pulses of course, and these are added in a very basic fashion.

Effects Provided

The effects generator is similar to Andrew Parr's design published in the April 1976 issue of *Television,* but to simplify matters most of the transistors are contained within a couple of transistor array i.c.s – a third such i.c. array is used in the title/key unit, which is an optional extra. The generator itself produces ten different effects in the form of wipes – vertical wipe from left to right or vice versa, likewise from top to bottom, vertical and horizontal split screen wipes, T wipe, three corner wipes, centre rectangle wipe and centre cross from all four corners.

A-B mixing is used, with two rows of buttons to select the video sources (as with the video mixer – the input sockets are common to the two). This enables direct cuts to be made. In addition, a row of ten buttons selects the mating waveform required. For convenience, wipes are achieved using a single slider control consisting of two mechanically coupled dual-track slider potentiometers.

Since the entire system is for monochrome use only, it's comparatively easy to incorporate a simple means of superimposing titles and keying. This tricky operation can be carried out with care, provided the subject to be superimposed is evenly lit and is photographed against a dark background. There are two switches in the keying circuit, one to switch it in and out of operation (see circuit, Fig. 4) and the other to invert the key waveform – in effect reversing the positions of the A and B inputs to the mixer. A variable control (VR7) provides fine adjustment of the key level. The input is preselected by plugging into either of the four looped-through camera inputs to the mixer. Operating the invert switch inverts the key signal, resulting in the key and background being reversed – it does not enable lettering to be inverted from black to white, unless channel A is set to the black level position. For this reason, if black lettering is to be superimposed the caption should consist of black lettering on a white card, while if white lettering is required a black card should be used. With the simple circuitry used here, the lettering should be bold and well spaced, otherwise it will not be clearly resolved.

For keying, the background can be a normal camera input but the key subject must be against a black background, evenly lit and with preferably no really dark contrasty areas which might be interpreted as black, resulting in the background showing through. Obtaining a satisfactory balance is not easy, but various types of effect can be achieved.

To key in the subject, select the same camera input as the one fed to the keying circuit – if a different input is selected, this will be displayed within the area defined by the key shape. By selecting the background information on channel A for example and the caption on channel B, it's possible to wipe the caption away by moving the fader control from B to A.

All in all then the complete unit, mixer plus video effects, provides a full range of facilities in one cabinet (see February cover photo). Independent sections can be omitted as desired.

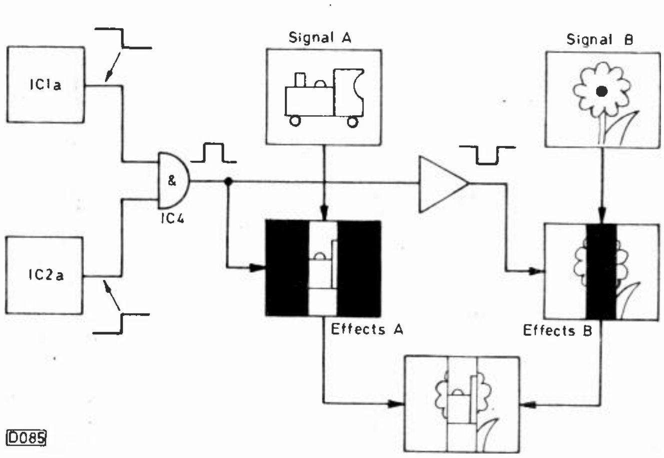


Fig. 1: Principle of the effects generator.

Mating Waveform Generator

The mating waveform generator circuit is shown in Fig. 2. The use of counters was initially contemplated, but this would have been too complex an arrangement for our simple TV studio system. Instead, monostables (timer i.c.s) are used. They have the disadvantage of being a little difficult to set up, and have a tendency to go unstable (acting rather like bistables) when a wipe approaches the edge of the screen. The latter problem has been counteracted by using integrating circuits (R5/C11 and R6/C12) to delay the line and field drive waveforms slightly.

The 556 dual timer i.c. IC2a/b provides the main horizontal and vertical wipe patterns: VR2a/b consists of parallel tracks on a single dual-slider potentiometer. The presets VR5/6 adjust the duration of the pulses over the range of the controls. IC1a/b is identical but produces complementary waveforms, using the dual-slider potentiometer VR1 which is bolted to VR2 and connected in the opposite sense (see Fig. 6).

The control logic is very simple, using inverter and AND gate i.c.s. As an example of the operation, take the vertical split screen wipe (switchbank C in position 2). Waveforms from IC1a and IC2a are fed to the AND gate IC4a, the output from IC1a being inverted by IC6a so that there are two logic one pulses moving in opposite directions as the slider control is operated. Since the AND gate gives a logic one output only when both its inputs are high (one) at the same time, there's no output until both input pulses overlap.

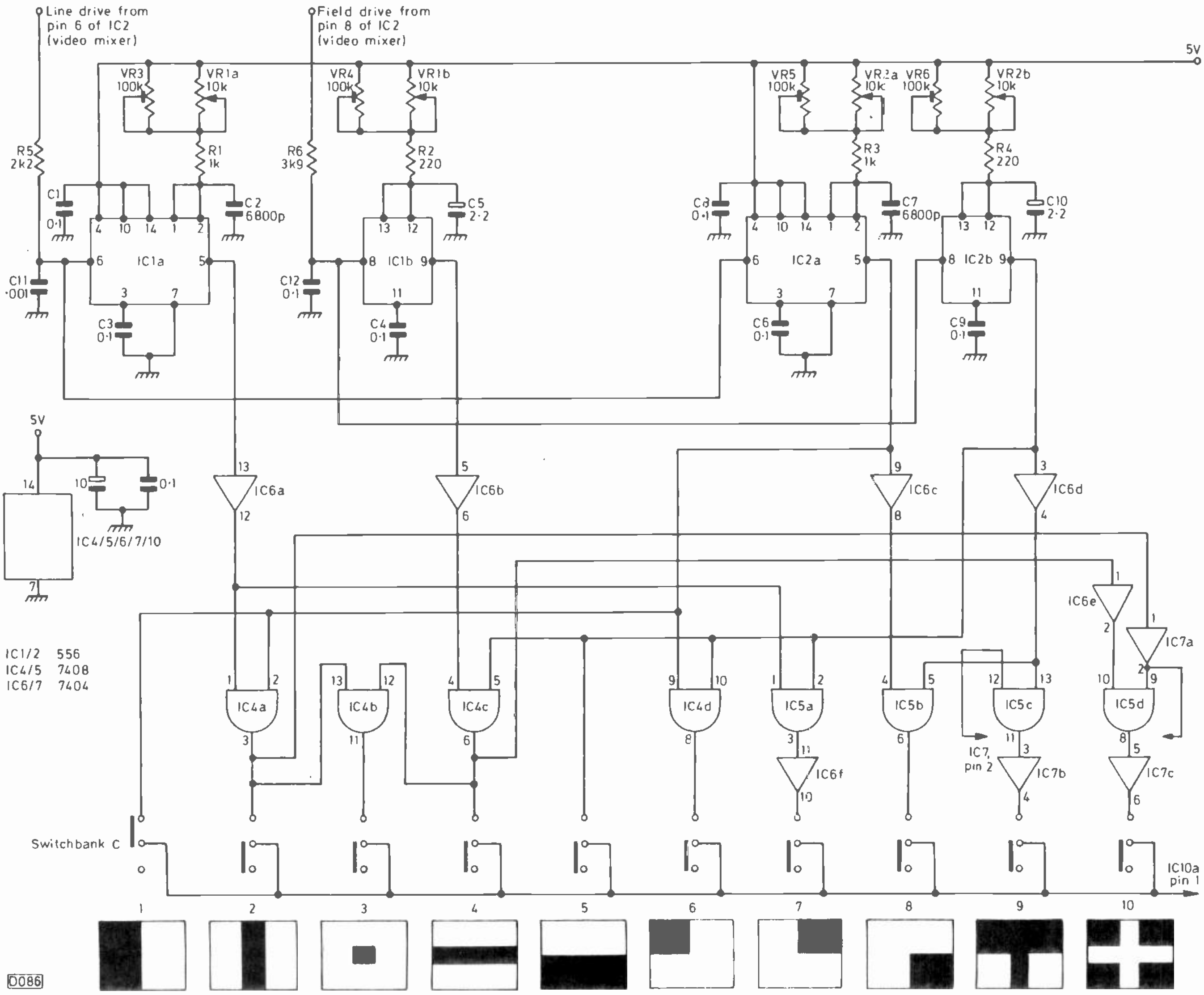
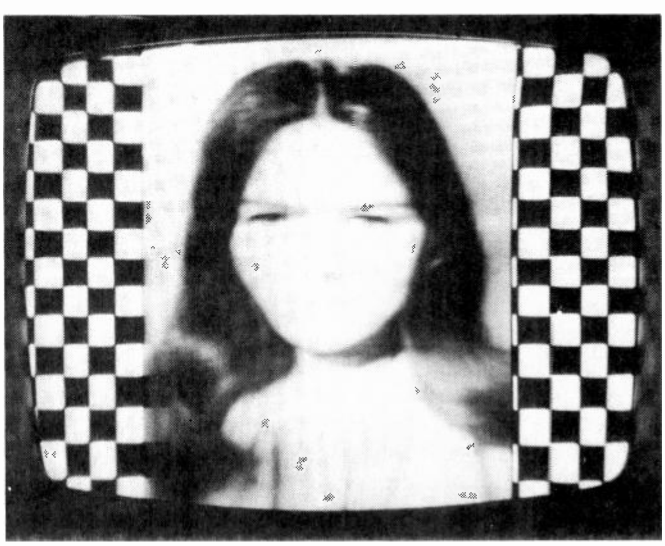


Fig. 2: Mating waveform generator circuit. C2 and C7 are polystyrene capacitors.

As the overlap increases, the output from pin 3 of IC4a will provide a widening pulse outwards from the centre of the screen.

A similar arrangement gives the horizontal centre wipe (switchbank position 4), various combinations of the outputs from the timer i.c.s giving the corner wipes (switchbank positions 6, 7 and 8). After selection by the switchbank, the output mating waveform is fed to IC10a (Fig. 3) where it's inverted and used to switch video channel A. The mating waveform is again inverted by IC10b for switching video channel B. IC10a also receives an input from the key/titling circuit (Fig. 4) when this is incorporated.



Vertical split-screen wipe.

Signal Switching Circuit

Switchbanks A and B at the input to the signal switching circuit (see Fig. 3) are similar to the video mixer switchbanks, and share the same video input sockets. The basic circuit is similar to that shown in the April 1976 issue, but most of the transistors are contained within two transistor array i.c.s (IC8/9). This results in a more compact design and reduces the problems associated with the manufacturing tolerance spreads of individual components. The CA3046 transistor array i.c. has been adopted whenever possible in these designs to simplify matters and because it's readily available.

The video input selected by switchbank A is a.c. coupled by C2 to an emitter-follower stage. The output from this is again a.c. coupled to a second emitter-follower Tr1, with d.c. restoration by D2/R6. From Tr1 the signal passes to D3, which forms part of a two-diode OR gate whose output is the lower of the two signals presented to the circuit. This is where the switching occurs. The mating signal passes from IC10a via R15/C6 to a switching transistor within the i.c. Its output is applied to the second diode D4 of the OR gate. D4 is thus switched on and off by the mating signal. When D4 switches on, pin 9 of the i.c. is effectively earthed and the channel A signal is thus shorted out.

A similar arrangement is used in channel B. The OR gate here (D8/9) is switched by an inverted mating waveform coming via IC10b etc. Thus when channel A is shorted out, the channel B signal appears across R11 and is fed via D6 to the output stage in IC8. When D4 is off and D9 is switched on, the channel A output developed across R10 is fed via D5 to the output stage. The two video signals are thus combined like a jigsaw. The output is developed across R13 and fed via C5 to the effects switch position on the video mixer switchbanks.

If the circuit is used without the video mixer, then provided the input signals are composite (video plus syncs) the output will also be composite. Difficulties might arise if the sync pulse amplitude or duration varies from one video signal to another, which is why the output is routed via the mixer circuit, where the original sync pulses are removed and pulses from the ZNA134J i.c. are inserted instead.

A separate composite video output is provided for preview purposes. The preview output appears across R22 and is fed via C10 to the output socket. Rather large amplitude sync pulses are added to this output via IC10c/d/R23. These swamp most incorrectly timed pulses or, if the video inputs are non-composite, enable a standard TV monitor/receiver to be used without the provision of a separate video/sync input. The preview facility is quite useful when setting up complex key/title effects.

Title/key Circuit

To use a video signal to drive gate IC10a in the switching circuit, the input should be about 2·4V at peak white. Since this gate is either on or off, the use of a processed video signal to drive it will result in outputs corresponding to the black or white portions of the signal. This of course is ideal for keying and titling effects. The title/key circuit (Fig. 4) uses the transistors in IC11 to amplify the video signal sufficiently for this purpose.

The input to the title/key circuit is preselected by removing the termination from the appropriate video input socket and looping the signal (see Fig. 5) through to the title/key input, terminating the signal at this point (with R2). To avoid too much loading on the video source – this would reduce the black level – a low value capacitor (C1) is used at the input to the title/key circuit, D1 providing some d.c. restoration and bias for the input stage.

The output provided by our vidicon camera (see October 1980) is not very even. It's possible that there may be false triggering of the circuit therefore, even at black level, so that when viewing white lettering on a black background some blobs will also be seen. Similarly black lettering on a light background can suffer. Some adjustment and compensation is required, and for this purpose the l.f. response is adjusted by using a 100μF coupling capacitor (C2) with a series potentiometer (VR7) – the latter provides fine adjustment. For light captions less l.f. response is needed, so VR7 is rotated anticlockwise to its maximum resistance position, at which point the switch to open-circuit R7 also operates. A rotary linear potentiometer with an on/off switch is satisfactory for this purpose.

The video signal is then amplified to the point of black/white crushing. In theory a Schmitt trigger should be used, but driving the TTL inverters IC7d/e directly gives us the necessary switching signal for feeding to IC10a.

Even if comparatively small lettering can be resolved, if the camera's response is only to about 3MHz much of this information will consist of slowly rising and falling shades of grey and will not be recognised by the circuit until a voltage swing of 2·4V is reached. For this reason, small lettering will be either absent or uneven with blobs at the intersections of lines.

It's possible to produce both black and white captions superimposed on a given background, depending on the format of the caption. For white lettering coming via camera 2 for example and a background from camera 1, select the camera 1 signal on channel A and the camera 2 signal on channel B. The white parts of the lettering are the video from camera 2, the title circuit simply providing the keying or blanking signal to black out a suitable area from the camera 1 signal.

A further alternative is provided. By operating the invert switch, the caption forms a mask through which the camera 1 signal is visible. This could be employed to put a background outside a window for example. Similarly, with the invert switch in its former position the signal from camera 3 or 4 can be selected on channel B to fill in the area defined by the caption with another pattern or image.

It's necessary to adjust the camera outputs carefully for optimum results, then set VR7 for best results, with a final tweak to the camera's target bias control. Getting good results is tricky, and the fact that black is the key can cause trouble when using contrasty subjects as a key. A toy rabbit with painted black and white eyes would, in close up, have the background visible in the black pupils. In long shot however the relatively poor response of the system will fill these areas in. If a close up is wanted, one could juggle a little by placing on the background a black mask in the approximate position of the eyes.

Although the circuit is simple, provided the limitations are recognised the experimenter can create quite spectacular illusions at low cost, such as appearing on the screen against an exotic background, dancing with a teddy bear or being knocked down by a model train!

Apart from the adjustment already described, no setting up is required in this part of the circuit. If any difficulty is experienced, the value of R3 can be altered a little.

Setting Up

The only setting up needed in the rest of the circuit is the slightly tricky business of adjusting the monostables IC1/2. With different video inputs fed to both channels, select mating pattern 5 and check that a complete vertical wipe is possible up or down the screen. Adjust VR6 to ensure that the wipe just meets the bottom of the screen and goes no farther – otherwise the picture will flicker, rapidly switching between channels A and B. Next select pattern 1 and adjust VR5 similarly on the horizontal wipe. Once these two controls have been set up for satisfactory results, select pattern 3 and adjust VR3 and VR4 for the best compromise at various settings of the user control – the aim is to get a reasonably symmetrical central rectangular shape.

Conclusion

So far we've described a very basic studio system – camera, video mixer and effects generator – which is capable of giving reasonable results at low cost. Due to its lack of sophistication, the system won't give broadcast quality results: but its cost will be a fraction of what you'd have to pay for professional or semiprofessional equipment. Further items are under consideration.

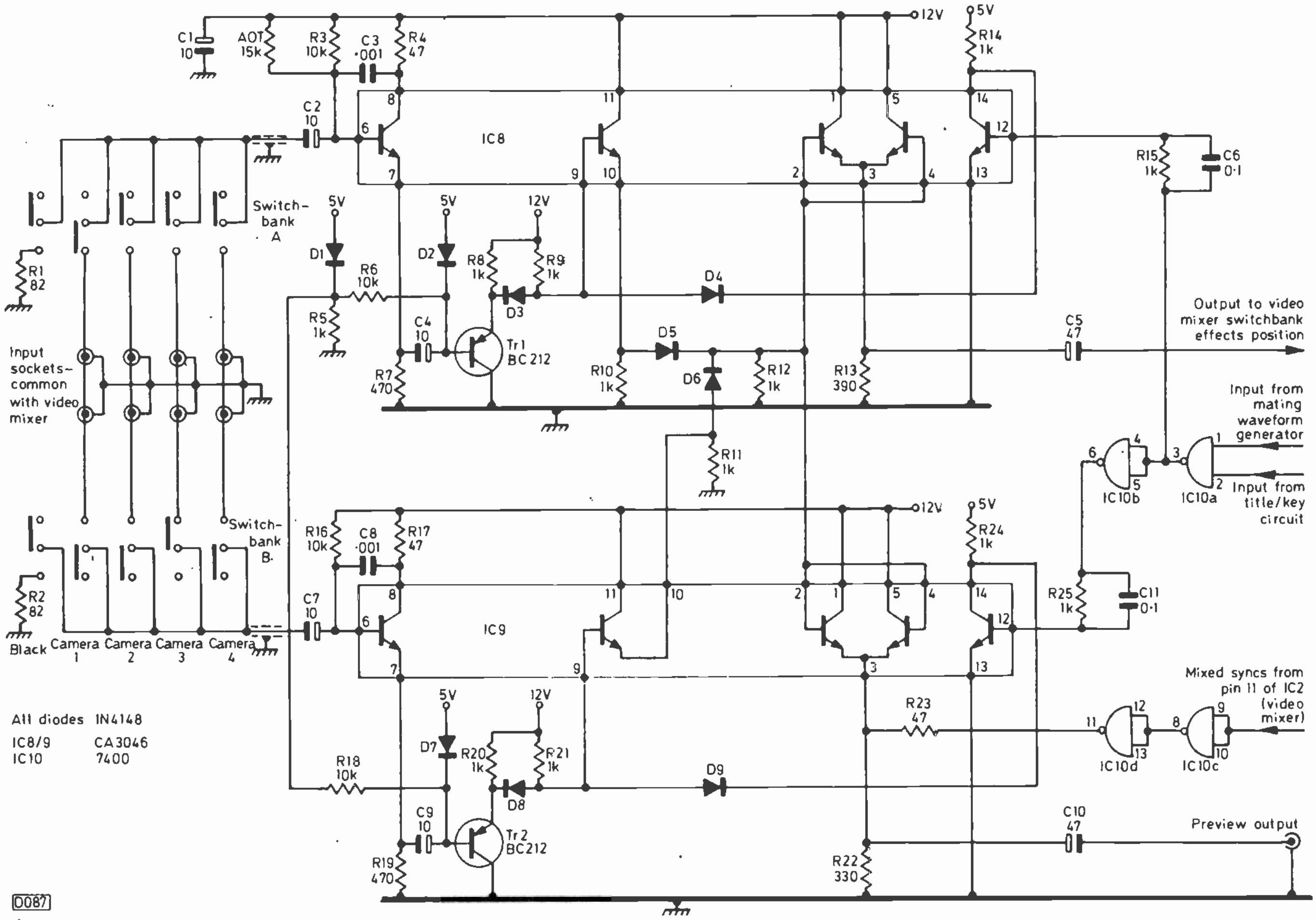


Fig. 3: Signal switching circuit.

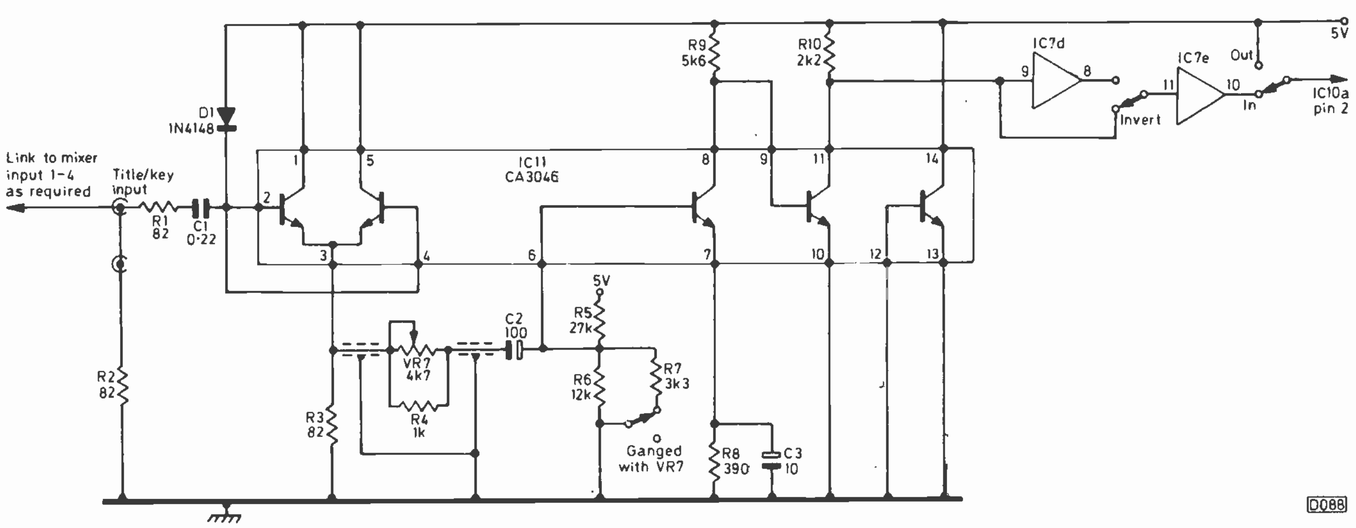


Fig. 4: Title/key circuit.

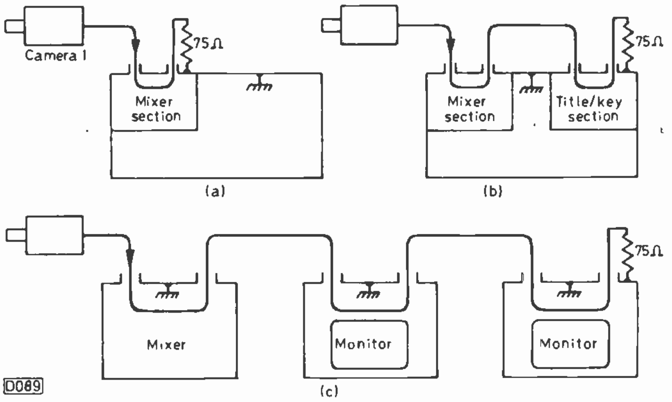


Fig. 5 (left): (a) Principle of looping-through termination; (b) looping-through to the title/key circuit; (c) principle of looping-through video signals.

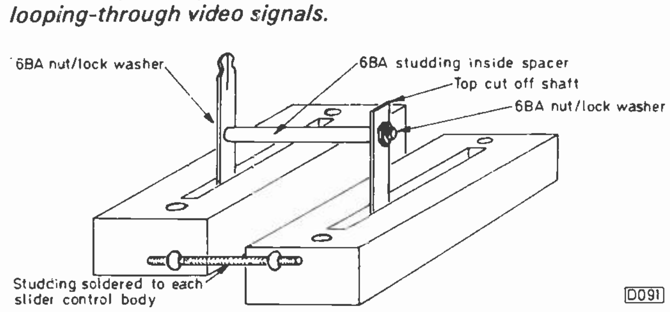


Fig. 6: Linking two dual-slider controls.

Service Notebook

George Wilding

Tackling Unfamiliar Sets

Quite often, even with an unfamiliar set, you can cure a fault quickly by checking for voltages at relevant wirewound power resistors and/or high-voltage capacitors – these components after all cause a high percentage of breakdowns. As an example, take the Decca 22CV0602 we came across recently, with the fault sound normal but no raster. This is a solid-state set, but is not fitted with the well-known 80 and 100 chassis and has a delta-gun tube. Anyway, on removing the back we found that the line output transistor was in a convenient position at the right-hand side. E.H.T. was present, and an arc could be drawn from the transistor's collector, though it seemed rather less than what could reasonably be expected. The tripler was also in a convenient position, so we fingered it in case there was a warm spot. It seemed o.k., and as there was ample h.t. at the large power resistor we next checked at the c.r.t. base for the presence of first anode voltages.

These were totally absent, so along with the small pulse output at the collector of the line output transistor there was almost certainly a short-circuit in a capacitor used as a reservoir or smoother for the first anode supply. It would be rated at some 1kV at least, and a quick glance around revealed a familiar looking blue and white cased capacitor with a high voltage rating and a value of 0·01μF mounted not far from the first anode presents. There was a dead short to chassis from both leadout wires, and on replacing it the picture was restored. Such capacitors are usually either short-circuit or o.k., and being in high-impedance circuits you'll get only a very small or negligible meter reading when testing them in circuit on the low and medium resistance ranges.

Delayed Sound

The fault on a hybrid ITT colour set was rather unusual – the picture appeared in the normal time after switching on, but it took five-ten minutes before the sound appeared. Even then it remained at a low level. Our first suspect was the PCL86 audio valve, possibly with a partial short across its heater, but on inspection the valve was glowing normally while there was absolute silence from the speaker. A replacement made no difference, so the next step was voltage checks.

When pin 1 (triode grid) was contacted, strong sound was obtained, giving the impression that hand capacitance was feeding the audio signal to this very high impedance point (see Fig. 1). On connecting the test prod to the volume control side of the coupling capacitor C75 however there was no sound output. So either C75 was open-circuit, or the hand capacitance idea was wrong. At this point we noticed that the volume level was gradually falling, and that contacting the triode grid restored the original level.

This clarified the cause of the trouble: the valve was obviously being biased off, the meter resistance removing this bias. The 10MΩ grid bias resistor R75 was checked and found to be in order, the only thing left being the rather unusual muting arrangement used in these sets – D57 and the associated components. The idea here is that D57 initially develops a negative bias on C298 by rectifying the signal applied to its anode from the line oscillator. This holds the audio circuit off until the line output stage comes into operation. Once the boost voltage appears, D57 receives a positive, forward bias at its anode via R413 and R409, and the audio circuit comes to life. The trouble was simply that R409 was dry-jointed.

Line Output Transistor Trouble

The fault on an 18in. Pye colour set (713 chassis) was no results, due to the 500mA fuse in the feed to the line output stage being shattered. As expected, the line output transistor was suffering from "punch-through". The transistor is mounted on a plate heatsink which forms part of the line output stage screening cover, replacement being easy enough after unsoldering the three leads to the transistor and undoing the plate's securing screws. When the set was switched on however we found that the picture was split into two vertical sections by an inch wide blanking bar towards the right-hand edge of the picture, while a bright, half inch vertical bar was present near screen centre. Without the bright vertical bar one would have diagnosed false line lock, but it was obvious that adjusting the line hold control would not affect the bright bar.

It was difficult to see what could cause these two defects simultaneously, but after some conjecture I realised what had happened – the transistor had been correctly mounted on its heatsink plate, but the latter had been reversed on fitting. As a result, the transistor's base and emitter connections had been transposed, reversing the phase of the drive waveform. The blanking bar was the result of incorrect timing, while the bright vertical bar was the result of incorrect drive pulse transition from negative to positive. Doubtless similar results would be obtained with other sets, a point that's worth bearing in mind.

Degaussing Circuit Fault

No results on a set we were called to recently – one fitted with with the Philips G8 chassis – was found to be due to a blown mains fuse. This immediately threw suspicion on the mains filter capacitor and the h.t. rectifier/regulator thyristor, but both these components proved to be in order. There was no short across the h.t. rail so, as all the other fuses were intact, the only thing we could do was to replace the mains fuse and switch on, keeping a close watch on the components in the power supply.

Normal sound developed immediately, but we noticed that tiny sparks were present under the paint coding of R1364. This 680Ω carbon resistor links the posistor in the degaussing circuit to chassis (see Fig. 2). On isolating it the value was found to be only 50Ω, while on removing it completely we found that it had gone open-circuit.

A resistor in this position is subject to a high current when the set is switched on from cold, and is best replaced by a higher wattage wirewound type. When open-circuit, or

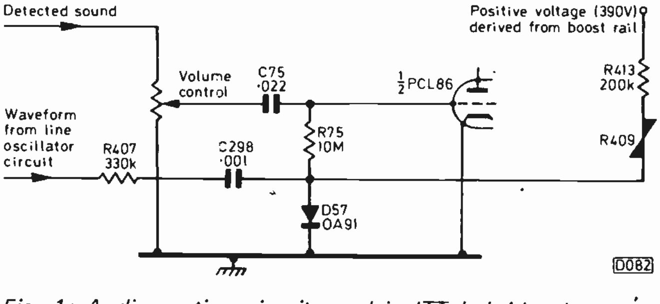


Fig. 1: Audio muting circuit used in ITT hybrid colour sets (CVC5-CVC9 series).

intermittently open-circuit as we assume the faulty resistor was, the degaussing current will not fall to its normal negligible value following the initial switch-on surge.

Compatible Units?

The main difference between earlier and later versions of the Pye hybrid colour chassis is that in the former the line timebase/power supply circuitry is built on a metal chassis whereas in the latter it's arranged on a large printed panel. We recently found ourselves with one of the later sets that required a new line output transformer and tripler, and one of the separate chassis modules, in unblemished condition, from an earlier type set we'd scrapped. So as both units are connected via five edge connectors plus earthing leads, and are electrically equivalent, we decided to see whether we could use the chassis unit in the set requiring the new transformer and tripler – it's not worth spending a lot on replacement parts for such old sets if this can be avoided.

Our efforts did not meet with success unfortunately, due to the fact that the contacts on the chassis type unit seem to be slightly thicker than those on the PCB type. We're left wondering whether this was an isolated case, or whether other engineers have come across the same problem?

Faint Pictures

We've had two similar faults recently on ITT hybrid colour sets fitted with the CVC8 chassis. In the first the sound was normal but only the vaguest of pictures could be discerned on the not too bright raster, i.e. there was hardly any luminance or chrominance information. This narrowed the field down to the luminance/chrominance detector diode and the following cascode amplifier stage (see Fig. 3). Since the detector diode seldom if ever breaks down, we made a start by checking the voltage at the collector of T21. There was very little voltage at this point, though the 20V rail itself was present and correct. We next contacted the input and output tags of the luminance delay line L60, and found no d.c. voltage at either point. There was clearly a short-circuit to chassis, either in the delay line itself or, far less likely, in C134 which with L59 forms a trap circuit tuned to 4·43MHz. The easiest way to check the delay line was simply to remove the screw that secures the earth connection to the top of the metal casing of the chrominance delay line. This resulted in correct voltages and a picture of sorts, and on fitting a replacement delay line normal picture definition was restored.

The symptoms on the second set were normal sound with only the faintest suggestion of any modulation on the white raster. We again started by making voltage checks in the cascode stage, and discovered that the base of T21 was at about 0·4V instead of 6·2V, whilst its emitter voltage was zero. Clearly T21 was not conducting, and since the resistors in its base bias network had unblemished exteriors we decided to check C131 by unsoldering one lead. This produced correct voltages, and on fitting a replacement normal vision was restored.

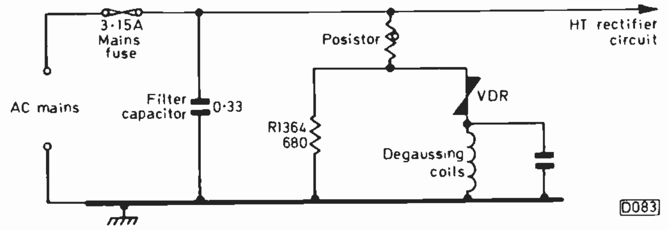


Fig. 2: Degaussing circuit, Philips G8 chassis.

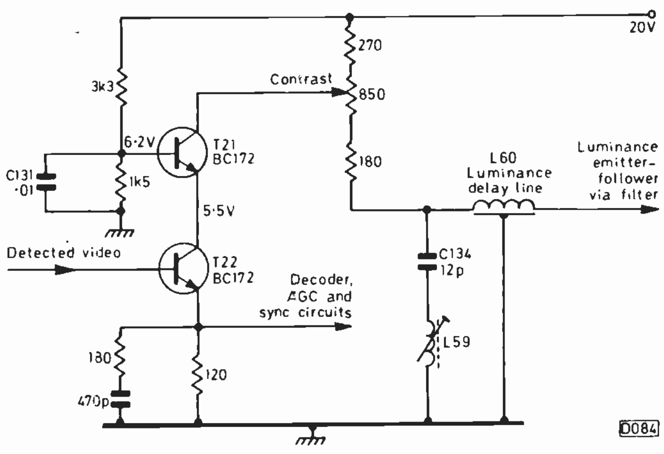


Fig. 3: Cascode distribution amplifier stage used in the ITT CVC5-CVC9 hybrid colour chassis.

In another of these sets a severe hum bar slowly traversed the screen. This can be due to the negative earthing lug of the right-hand multiple electrolytic capacitor developing a high resistance connection to chassis. The soldering was perfect on this occasion however. We next operated the service switch, and obtained a blank raster with no hum bar – so it was the l.t. rather than the h.t. supply that was inadequately smoothed. The bridge rectifier and the reservoir/smoothing electrolytics were checked, but the trouble eventually proved to be due to the AD161 20V series regulator transistor T46 which was short-circuit collector-to-emitter.

Missing Supply

The fault with a Pye hybrid colour set was no sound or raster. Peering through the back, we noticed that the heaters were all alight, while a faint corona discharge around the e.h.t. cap showed that e.h.t. was present. It seemed therefore that the line output stage was working and that the trouble was due to the loss of an l.t. supply – there are several in this chassis.

The question was, where to start checking? L.T. supplies of both polarity are developed on the power supply/line timebase panel, so the obvious first step was to check whether these supplies were being developed and fed to the rest of the set via the various plug-in connectors. We know from experience however that the supply to the tuner and some of the front controls comes via plugs on the i.f. panel, where there are two smoothing electrolytics just waiting to be tested. C43 (640μF) smooths the 30V input to the panel, while the other (C42, 250μF) smooths the 20V supply obtained on the panel via the dropper resistor R40 (39Ω). Normal l.t. was present at C43, but there was nothing at C42, due to R40 being dry-jointed – in fact just pressing one end of it with the test prod restored the sound and picture. When tracking down loss of l.t. in any receiver, especially where there is more than one interconnecting plug and socket, it's a good idea to check for the presence of supplies on any electrolytic smoothers or decouplers as a first step, rather than chasing round checking at the various plugs and sockets: having found an electrolytic without a supply to it, it's usually easy to pinpoint the circuit break.

Our problems with this set were not yet over however. We left it running whilst awaiting the test card so that the set could be adjusted. Suddenly a mild hum bar appeared and, as it travelled upwards, the verticals curved. There were one or two yellow streaks in the centre of the hum bar, and when it reached the top of the picture the field slipped. Quite an array of symptoms, though all suggestive of impaired decoupling somewhere in the signal circuitry. This being so, our first move was to parallel a 100μF electrolytic across the two electrolytics previously mentioned on the i.f. panel. The culprit turned out to be C42.

Smoothing Troubles

"Picture rolls" was the complaint from the owner of an ITT hybrid colour set (CVC8 chassis). This is a fairly common fault on these sets, usually due to the PCL805 field timebase valve or the OA91 field sync diode. Inspection showed that there was line wavering and a mild hum bar as well however, so the basic fault was obviously impaired h.t. or l.t. smoothing.

We've known a hum bar plus field roll to be due to a badly soldered joint at the common negative connection of the multiple electrolytic can on these sets – so much so in fact that a couple of volts could be read between this point and chassis. The soldering was perfect this time however, so in view of the fact that the hum was affecting both the line and the field sync we tried shunting a medium-sized electrolytic across each individual smoothing capacitor – you don't have to use a test capacitor of equal value to the suspect, since one of 25% or so of the suspect's value will immediately show whether the original has lost capacitance. First charge the test capacitor by connecting it across a smoothing capacitor in the set before switching on – subsequent tests from capacitor to capacitor then won't cause current surges and sparks. I personally use a 32μF high-voltage type for testing, linked via crocodile clips on a pair of meter leads.

No fault could be found with the h.t. smoothers, so attention was turned to the l.t. smoothers. Some improvement was obtained by shunting the 500μF reservoir capacitor, a much more marked improvement being obtained when we connected the test capacitor across the main l.t. rail, i.e. at the emitter of the regulator transistor. Now the only smoothing capacitors here are 8μF types, so a further test was made using an 8μF electrolytic. This gave only a slight improvement in the fault condition, so the trouble was almost certainly due to the l.t. bridge rectifier rather than the electrolytics – an open-circuit diode in the bridge rectifier circuit will result in a half-wave instead of a full-wave output. Now testing a discrete bridge rectifer circuit is a fiddly job since some unsoldering is necessary – as far as an ohmmeter is concerned, the two diodes feeding the reservoir capacitor are in parallel, as are the pair that return the transformer's secondary winding to chassis, so that one of each pair must be disconnected. Anyway, one diode was found to be open-circuit, and replacing this produced firm field lock, no line wavering and no suggestion of a hum bar.

Connecting the 32μF test capacitor across the l.t. line had masked the true fault – 50Hz instead of 100Hz ripple.

Vintage TV: Cossor 916 Series

Vivian Capel

COSSOR was once a familiar name in the radio and television field, the firm having started up in the early days of radio – many an older enthusiast will no doubt remember building primitive receivers using Cossor 2V valves. In addition to their valves and radio sets, Cossor were well known for test equipment, particularly oscilloscopes. They entered the TV field right at the start, in 1936. Thus when television transmissions restarted after the war, Cossor had plenty of experience to draw upon. The first sets they introduced were revamped versions of the immediate pre-war ones, and used t.r.f. receiver circuitry. The first truly post-war Cossor sets were the 916-923 series, which employed a superhet receiver circuit and were released between September 1949 and September 1950 – at prices ranging from £42-0-3d to £66-17s-6d (excluding purchase tax). They comprised a range of 10in. and 12in. models, some in table and others in console cabinets, and some with a radio receiver section as well.

Signal Circuits

By adopting a superhet circuit that could be tuned over the five BBC channels, the popularity of the sets was assured – there were certainly large numbers of them in use. Actually the initial versions of the 916 and 917 were not tunable, but the five-channel version was introduced soon after. This was at a time when many other setmakers were producing dual-channel models that created problems for their owners if they moved to other parts of the country. Channel changing was accomplished by retuning the two r.f. coils and the oscillator coil: these were situated right down at the front of the chassis, on the left-hand side beneath the tube bowl, adjustment being by means of knurled knobs on the tops of the cans after first releasing the locknuts. Screwing the cores farther in raised the frequency.

Otherwise the signal side of the chassis was fairly conventional, with two vision and two sound i.f. stages followed by double diodes for detection and interference limiting. The valves were Cossor 6AM6 pentodes and 6AL5 double diodes – the equivalent of the Mullard EF91 and EB91 respectively. Contrast control was effected by varying the cathode bias applied to both the r.f. amplifier and the first vision i.f. amplifier valve. The sound i.f. channel incorporated a.g.c., with a little metal rectifier that acted as a clamp to prevent the a.g.c. line going positive with respect to chassis.

The video output stage (see Fig. 1) employed a peaking coil, with the output d.c. coupled to the cathode of the c.r.t. The usual diode interference limiter, or spotter as it was then often known, was present in the output pentode's anode circuit: an unusual feature however was that the earthy end of the spotter preset control was connected to the slider of the brightness control. The limiting action thus varied with the setting of the brightness control – the higher the brightness, the greater the limiting.

Power Supply

Turning now to the power supply, a transformer was used to provide the various heater supplies, with taps for mains adjustment. The highest tapping, 240V, fed the anode of the half-wave h.t. rectifier directly, but the lower 210V and 230V tappings were more often used as these were the more common mains supply voltages in those days. Three secondaries powered the heaters: one was used for the c.r.t., one for the h.t. rectifier, and one for the 185BT line output valve with a 6V tap for the rest of the valve complement.

The 27SU h.t. rectifier was not in my experience very reliable. There were many cases of intermittent fuse blowing for which no measureable cause could be found, a replacement rectifier generally providing a cure. Sometimes it would fail after a few weeks or months, and in some cases a fine display of pyrotechnics in the rectifier left no doubt as to the cause of the trouble.

The 916 and 917 employed energised loudspeakers, the field coil doubling as the h.t. smoothing choke, a technique that was common with radio sets of the period. The later models had permanent magnet speakers and separate smoothing chokes. Also included in the h.t. line (except for the feeds to the timebases and the audio circuits) was a focus coil with a shunt focus potentiometer and bypass capacitor.

Timebases

Both the line and field oscillator stages were of the blocking oscillator variety, using the two sections of a 6SN7 double-triode valve. The sync separator consisted of a conventional pentode stage, but an interesting point was that the valve's suppressor grid was connected to the field oscillator's timing circuit. When the oscillator fired, a negative pulse was produced and fed to the suppressor grid, ensuring that the valve remained cut off for a short period. The idea was to improve the field sync stability in the presence of noise.

The field and sound output stages both used 7C5 beam tetrode valves. This sometimes enabled one to cure poor field linearity or lack of height by swapping the valves over. Unfortunately the sound output valve was often in a worse condition then the field output valve however.

The field output stage circuit used in the 10in. models was straightforward. The arrangement used in the 12in. models was somewhat more elaborate however, to obtain better linearity. The output valve's screen grid was connected to a tap on the output transformer's primary winding: this dodge introduced a degree of negative feedback, and was later to be called "ultra-linear" when applied to high fidelity audio amplifier circuits. In addition, a tertiary winding was added to feed the linearity circuit. There were also extra resistors in the blocking oscillator circuit.

Line Output Stage

The line output stage (see Fig. 2) used the physically large 185BT tetrode output valve, which seemed to be quite durable. The transformer was mounted in a metal can with

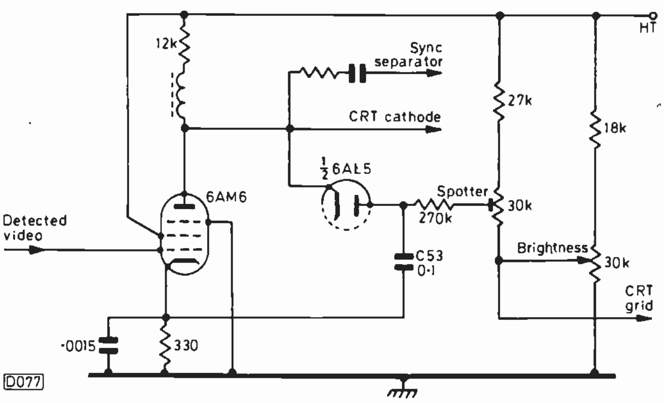


Fig. 1: Video output stage, with interference limiter, used in the Cossor 916 series.

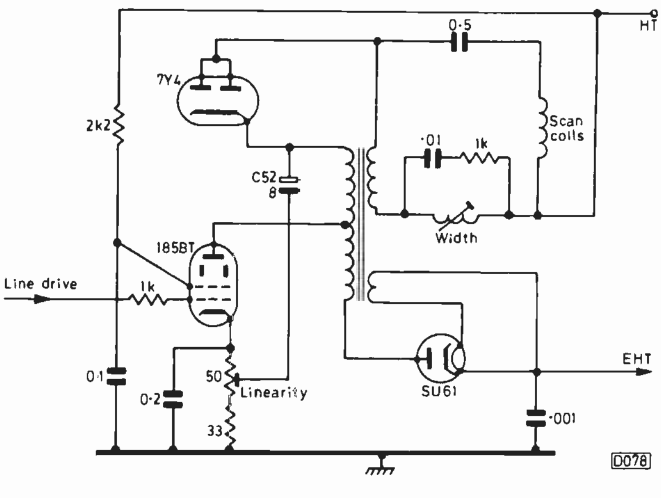


Fig. 2: The line output stage circuit.

a close fitting lid and was sealed in pitch: the pitch block was encased in a sponge rubber jacket, which enabled it to be pulled out of the can.

The circuit followed the basic pattern that was to become general, with a boost diode and an e.h.t. rectifier fed from an overwinding on the transformer. The SU61 (equivalent to an EY51) e.h.t. rectifier was mounted along the paxolin terminal strip that protruded above the pitch, and could be replaced without trouble. The boost diode was a 7Y4, with its two anodes strapped together. The boost voltage produced across its reservoir capacitor C52 was 265V, which was not a great deal more than the h.t. voltage itself. In models from the 918 onwards, a rather novel linearity control was added. The single 82Ω cathode bias resistor originally used was replaced by a 33Ω resistor and a 50Ω potentiometer, whose slider was linked to the earthy end of the boost reservoir capacitor. At the same time the 25μF decoupling electrolytic originally used was replaced with an 0·2μF capacitor.

The 12in. tube fitted in the larger-screen models was a tetrode type, which required a first anode supply of around 400V. This was obtained by using a Metrosil (an early type of non-linear resistor), in conjunction with a 120pF reservoir capacitor, to rectify the flyback pulses in the scan circuit.

The Radio Section

The radio receiver section used in some models was a conventional superhet unit covering the short, medium and long wavebands. It employed a 7S7 frequency changer, 7B7 i.f. amplifier and 7C6 detector/audio amplifier.

The a.f. output from either the radio or TV sound detector was switched to the volume control, which was in the grid circuit of the 7C6 valve. This meant that the triode's gain was also used on TV. The output transformer was different from the TV-only models, with a tertiary feedback winding which was connected in series with the cathode of the 7C6 double-diode-triode. So optimum sound quality was achieved on TV as well. There was also an extra winding which smoothed the supply to the radio section: it was connected in series with the primary winding, and since the current flowed in the opposite direction to the output valve's current a degree of hum cancellation was achieved – as well as reducing the possibility of core saturation. This technique was used in a number of radio sets of the time.

Several later models from Cossor employed much the same circuitry, the main difference being the use of a 6AB8 audio valve in place of the 7C5.

Colour Portable Project

Luke Theodossiou

Part 3: The Timebase Board

This month we are dealing with the timebase section of the receiver, which is probably the most interesting in terms of new circuitry employed. The circuit diagram is shown in Fig. 2.

The absence of pincushion distortion correction circuitry reduces the component count and the number of preset controls, and results in an exceptionally simple circuit which is virtually indistinguishable from that used for a large screen monochrome set. The sync separation and line oscillator functions are performed by a TDA9503, whilst a TDA1170S takes care of field deflection. The reliability of diode-split line output transformers has now been widely established and we are therefore using one in our design in order to reduce the component count as much as possible. The unit we've chosen includes the focus potentiometer and a rectifier which provides the tube's A1 voltage. More about these sections later.

The GCS

The line driver and output stages are, as far as we are aware, unique, and we shall therefore concentrate on describing these in some detail. The line output stage uses a special thyristor as the switching element and from now on we shall refer to it as a gate controlled switch (GCS). It is a fast three-terminal four-layer *pnpn* device similar in construction to the conventional thyristor, and combines the advantages of the thyristor with those of the high voltage switching transistor. Like the thyristor it can be turned on by positive gate drive, and like the transistor it can also be turned off by negative gate drive. It offers the high blocking voltage and high overcurrent capability of the thyristor with the ease of drive and fast switching associated with the transistor.

Like the thyristor, the GCS can be considered in terms of a two transistor model shown in Fig. 1. When positive gate drive is applied to the base of the *npn* transistor, the transistor is switched on, and its collector, which is also the base of the *pnp* transistor, is driven low. The *pnp* transistor then turns on and its collector current flows into the base of the *npn* transistor, setting up regenerative conditions. If the current flowing through the device is sufficient, the device will latch – i.e. remain on. In the case of the GCS, the gain of the *npn* transistor is made large and that of the *pnp* transistor small. The overall gain of the device is also controlled, since very high gain will make gate turn-off difficult. Although the principles have been known for a long time, it is only recently that production techniques have advanced sufficiently to allow the economic manufacture of such devices with repeatable characteristics.

Fig. 1: Circuit symbol for the gate controlled switch (a), equivalent transistor circuit (b).

To turn the device on, a positive current is injected into the gate. Although the duration of this pulse need only be 0·5μs to ensure latching, switching losses are minimised by making the drive pulse of equal duration to the required on-time of the device. Turn-off is achieved by drawing from the gate a current pulse of between 20 and 100% of the anode current for about 0·5μs. This is done by applying a negative voltage to the gate with respect to the cathode, of between −5 and −10V. If the impedence of the gate turn-off circuit is sufficiently low, unity turn-off gain is achieved. Under these conditions, all the anode current is diverted into the gate, turning off the cathode before the anode voltage has started to rise, thus reducing dissipation.

Line Driver Stage

The driver circuit operates in class AB and, in conjunction with the drive requirements of the GCS, eliminates the usual driver transformer. The output stage of the TDA9503 is an open collector transistor, with R10 forming its load. Let's assume that the output transistor in IC1 is on, thus switching Tr2 off. Under this condition, Tr1 is biased on by R12 and acts as an emitter follower with current flowing from the gate of the GCS through the zener diode D4 (which is now on), through Tr1 and the current limiting resistor R14 to the +15V rail established from the +24V rail by R13 and D2. The GCS is therefore switched on. When the output from IC1 changes state, Tr2 is biased on via R10. This turns Tr1 off (since its base is now grounded and its emitter at a higher potential) and removes the current path which switched on the GCS. At the same time D3 is turned on and connects the positive end of C13 to ground, thus establishing a negative voltage of −10V (set by the zener diode) between the gate and cathode of the GCS, which turns the device off. If the driver stage was simplified to class A operation by substituting a 22Ω resistor as the collector load for Tr2 (thus eliminating Tr1, R12 and D3), the circuit would consume substantially more power: the 22Ω resistor would have to be rated at 7W and a heatsink would be required for Tr2.

Line Output Stage

The remainder of the line output stage is conventional. Diode D5 is the efficiency diode with C14 determining the flyback time. C15 is the S-correction capacitor, whilst R15 eliminates ringing from the line linearity control L1. Width is made adjustable with L2. Anti-breathing and flashover protection are provided by R16, which is decoupled by C16.

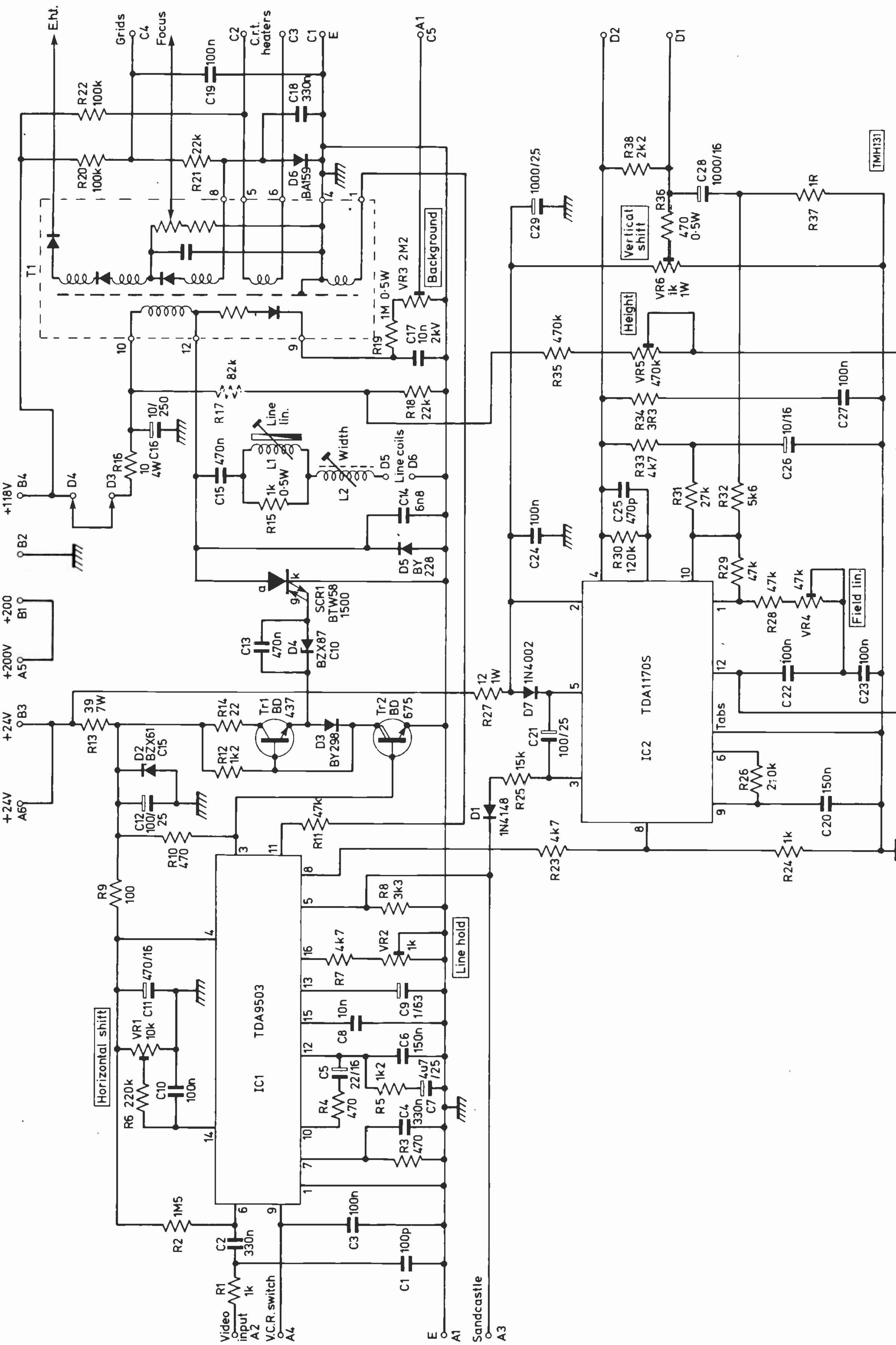


Fig. 2: Circuit diagram of the timebase board.

A flyback rectifier diode and series current limiting resistor are incorporated in the line output transformer to provide the tube's A1 supply. Capacitor C17 acts as the reservoir and the potential divider formed by R19 and VR3 sets the voltage according to the setting up instructions which will be given in a subsequent article.

The heater supply is also derived from the line output transformer across the winding 5-6. In order to maximise tube life, the heaters are not grounded but held at a potential of around +118V above chassis, which minimises the voltage stress betwen the cathodes and heaters.

Beam current limiting is achieved by returning the earthy end of the e.h.t. overwind to chassis via D6 which is forward biased from the l.t. rail by R20 and R21. The junction of the two resistors feeds the c.r.t. grids. At normal beam current requirements this voltage is around +22V. The beam current also flows through D6, but in the opposite direction, thereby opposing the forward bias on the diode. When the beam current is equal to or greater than the forward bias current, D6 is switched off and a negative voltage, proportional to the beam current, appears across C18. This is fed to the c.r.t. grids via R21, thereby reducing the picture brightness and hence the beam current. This protects the tube from the damaging effects of operation at excessive beam currents and is remarkably simple but very effective.

The only other noteworthy feature of the line output transformer is the incorporation of the focus control as part of the assembly, which is more convenient and safer.

Line Processor

The line processor i.c. TDA9503 (IC1) receives a negative-going composite video signal from the signals board and separates out the sync pulses. Field sync pulses are then integrated by the network R3 and C4 on pin 7 and fed to an amplifier whose output appears on pin 8. The line sync pulses are processed by the i.c. and appear at pin 3 as line drive pulses. The i.c. also provides a sandcastle pulse, a noise suppression circuit, undervoltage protection, and a coincidence switching stage which may be disabled by a positive current on pin 9 to optimise the characteristics for

★ Timebase Board Components List

Resistors: all ±5%, 0.25W carbon film except where stated.

R1	1k	
R2	1M5	
R3	470R	
R4	470R	
R5	1k2	
R6	220k	
R7	4k7	
R8	3k3	
R9	100R	
R10	470R	
R11	47K	
R12	1k2	
R13	39R	7W wirewound
R14	22R	
R15	1k	0.5W
R16	10R	4W wirewound
R17	82k	
R18	22k	
R19	1M	0.5W
R20	100k	
R21	22k	
R22	100k	
R23	4k7	
R24	1k	
R25	15k	
R26	210k	±2% metal film
R27	12R	1W
R28	47k	
R29	47k	
R30	120k	
R31	27k	
R32	5k6	
R33	4k7	
R34	3R3	
R35	470k	
R36	470R	0.5W
R37	1R	±2% metal film
R38	2k2	
VR1	10k	standard vertical mounting skeleton presets
VR2	1k	standard vertical mounting skeleton presets
VR3	2M2	standard vertical mounting skeleton presets
VR4	47k	standard vertical mounting skeleton presets
VR5	470k	standard vertical mounting skeleton presets
VR6	1k	1W cermet trimmer RS 186-154

Capacitors:

C1	100p	100V	±2%	Mullard 642 34101
C2	330n	100V	±5%	Siemens B32560
C3	100n	100V	±5%	Siemens B32560
C4	330n	100V	±5%	Siemens B32560
C5	22μF	16V	Electrolytic	Dubilier CEB2216
C6	150n	100V	±5%	Siemens B32560
C7	4μ7	25V	Electrolytic	Dubilier CEB 4R725
C8	10n	63V	±1%	Mullard 424 41003
C9	1μF	63V	Electrolytic	Dubilier CEB163
C10	100n	100V	±5%	Siemens B32560
C11	470μF	16V	Electrolytic	Dubilier CEB47016
C12	100μF	25V	Electrolytic	Dubilier CEB10025
C13	470n	100V	±5%	Siemens B32560
C14	6n8	1500V	±5%	Suflex SK795
C15	470n	250V	±5%	Ero MKP 1841
C16	10μF	250V	Electrolytic	Europe Chemi-Con
C17	10n	2000V	+50%-20%	ceramic disc
C18	330n	400V	±5%	Siemens B32562
C19	100n	400V	±20%	Mullard 352 54104
C20	150n	100V	±5%	Siemens B32560
C21	100μF	25V	Electrolytic	Dubilier CEB10025
C22	100n	100V	±5%	Siemens B32560
C23	100n	100V	±5%	Siemens B32560
C24	100n	30V	+80%-20%	Erie ceramic disc
C25	470p	100V	±10%	Mullard 630 06471
C26	10μF	16V	Electrolytic	Dubilier CEB1016
C27	100n	100V	±5%	Siemens B32560
C28	1000μF	16V	Electrolytic	Dubilier CEB100016
C29	1000μF	25V	Electrolytic	Dubilier CEB100025

Semiconductors:

D1	1N4148	D7	1N4002
D2	BZX61 C15	SCR1	BTW58-1500R
D3	BY298	IC1	TDA9503
D4	BZX87 C10	IC2	TDA1170S
D5	BY228	Tr1	BD437
D6	BA159	Tr2	BD675

Miscellaneous:

T1 Orega 3584-00
L1 Orega 55378
L2 JLC ND 1018
Heatsink for SCR1: 50mm length of RS 401-497
Heatsink for IC1: Staver V8-800
P.c.b. reference no. D091
Connectors: Molex 0.2″ pitch
P.c.b. pillars

VCR operation. The i.c. has been described in more detail in previous issues of *Television* (see February 1979 issue).

Field Timebase

The field timebase uses the well-known TDA1170S i.c. This differs from the earlier TDA1170 in having a better sync circuit and specified tolerance on the free-running frequency of the oscillator. The latter feature allows us to dispense with the field hold control so long as the tolerance of the frequency determining network C20, R26 is adhered to.

The output stage incorporates a flyback generator and the full amplitude flyback pulse (around 22V pk-pk) is available at pin 3. This is potted down by R25 in conjunction with R8 and superimposed on the sandcastle pulse to provide field flyback blanking.

Height compensation with respect to beam current is provided by deriving the voltage for the height control from the h.t. rail via R17 and R18. Vertical centring is provided by sinking or sourcing current through the scan coils via R36 and VR6. Negative feedback via R32 assures a stable deflection current at all times.

Construction

Construction when using the printed circuit board is very simple. Start by inserting all the low profile components first, and gradually progress to the bulkier items. The component packing density is fairly high and it is highly desirable to use only the component types specified – this becomes essential for most components in the high voltage sections. Component substitution usually ends up as false economy so it's not worth risking.

Do check for the obvious – dry joints, solder bridges and polarity of capacitors and semiconductors.

Next month we shall take a closer look at the c.r.t., its base board, degaussing coil, etc. and also provide the component location diagram and copper print pattern for the timebase board.

Test Report: The Trio CS1352 15MHz Oscilloscope

Eugene Trundle

THE Japanese company Trio is well known and respected as a manufacturer of hi-fi audio equipment and communications receivers, but it was only recently that I came across their test equipment. The comprehensive catalogue I received from them embraced fourteen oscilloscopes and all manner of generators, multimeters and so on. From it I selected for test a "middle of the road" oscilloscope – the CS1352, a 15MHz, 2mV dual-trace model with a 3in. c.r.t.

Features

The scope is designed for general purpose use, with TV servicing very much in mind. As with all modern oscilloscopes, the full sensitivity (in this case 2mV/division) is available over the whole 15MHz bandwidth (3dB down). On the X axis there are nineteen sweep speeds, with a five times magnification facility. The formation of the dual traces is set automatically by the timebase speed switch – it's chop-mode up to 1msec/division and alternate sweep from 500µsec/division upwards. Triggering can be from internal or external sources, working on either positive- or negative-going slopes. There's also a TV sync separator, with field or line sync being selected automatically in accordance with the setting of the sweep timebase switch. With this switch set fully clockwise, the X-Y facility is selected: this useful feature offers X-axis operation via the Y channel two amplifier, at the same sensitivity as the Y axis but with a 1MHz bandwidth.

The two d.c. coupled Y amplifiers have twelve fixed gain settings between 2mV and 10V/division, with a vernier control so that the gain is infinitely variable. A mode selector switch gives channel 1, channel 2 and dual-trace operation, with a fourth position labelled "add". In this position, the Y1 and Y2 input signals are added algebraically – or subtracted if the channel 2 invert switch is operated. More on this later!

A 1V, 1kHz calibration waveform is provided, also a Z-axis input (for beam intensity modulation). The e.h.t. is 1·5kV, and each graticule division is 6mm square.

Like many modern test instruments, the CS1352 is very versatile in its power supply arrangements. It can be operated from a.c. mains supplies at 100/120/220/240V, 50 or 60Hz, from an internal 12V battery system offering over two hours' operation, or an external 12V power source, e.g. a car battery, the consumption then being less than 2A (20W). The internal battery system consists of two 6V lead-acid sealed batteries (optional extras), for which a charging facility is provided.

Bench Test

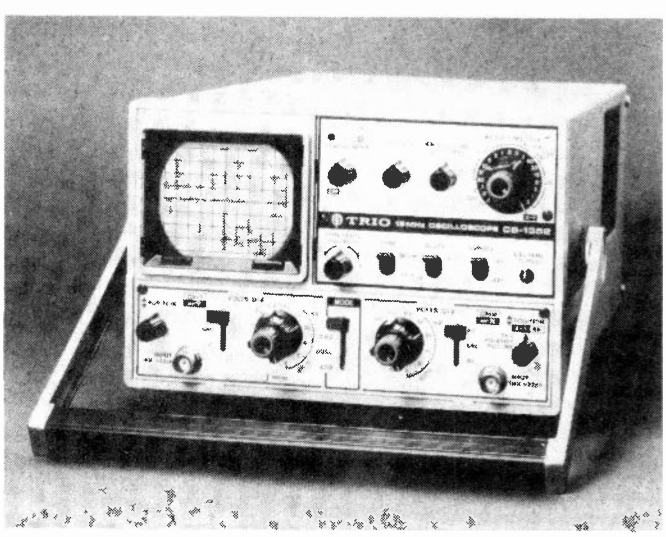
We found this scope very easy to live with. A bright, sharply defined trace was displayed in all the conventional operating modes, with good e.h.t. regulation and focus even at full brightness. With a small sweep duty cycle, and with the sweep magnification facility in operation, the trace left a little to be desired in terms of brightness and focus, due to the rather low e.h.t.

The trend to miniaturisation means that, as with many modern scopes, the graticule divisions are fairly small. This was really brought home to me when the review model was running alongside our old Telequipment D54A.

The absence of alternate/chop and field/line sync selector switches made for convenience in use, though this feature results in a little loss of versatility. An example arose when I wanted to look at the teletext signals and VITS waveforms transmitted during the field blanking interval. For a clear display, it's necessary to trigger the sweep from the field sync pulses, using a line rate sweep. Because the internal trigger selector synchronises the sweep timebase to the line sync pulses above 50µsec/division, I had to resort to external triggering, using the set's field flyback pulse. This produced a good, steady display, and due to the alternate sweep when in dual-beam operation the odd and even field displays can be produced simultaneously with both probes connected to the same signal point.

The Y amplifiers' extra sensitivity and bandwidth are very useful – especially the former for VCR servicing. It's hard to realise that the two extra click stops on the Y gain switch represent an amplifier sensitivity *five times greater* than with most servicing scopes. At the other end of the scale, the minimum gain setting of 10V/division is just acceptable, offering a f.s.d. of 800V with a conventional 10:1 probe. This is just about the safe input voltage limit for most ordinary 10:1 probes anyway, and to examine line flyback and similar waveforms a 100:1 probe is necessary.

When the "add" mode is selected, the sum of the channel 1 and 2 waveforms is displayed. With the same settings, and the channel 2 signal inverted by operating a panel-mounted switch, signals common to both channels are cancelled, leaving only spurious noise and distortion components on the display. This is intriguing, and I had great fun finding lots of unsuspected shortcomings in various types of



The Trio CS1352 15MHz oscilloscope.

equipment. Along with the 15MHz bandwidth, this facility lends itself to the investigation of both analogue and digital delay devices, though I would have appreciated a faster maximum sweep speed than the (unmagnified) 500nsec/division for this purpose. There are applications for this facility in the audio and design fields too.

In X-Y operation there's the advantage of identical X and Y sensitivity and switching arrangements. This makes for easy phase measurements, Lissajous figure displays and vectorscope use. X-Y work at the colour subcarrier frequency is not possible however, due to the curtailed overall frequency response of the Y channel.

The trigger facilities are comprehensive and good so far as general applications and TV servicing are concerned. External trigger signals enter conveniently via a standard side-mounted BNC socket, so that a third probe, a direct lead to a TV pattern generator or whatever can be used. The internal triggering is from the channel 1 signal only, which is mildly inconvenient in some applications.

The instrument comes complete with a comprehensive instruction manual and a service manual. From the latter I discovered that a switch-mode power supply is used, plus some pretty complex circuitry. Also supplied as standard are a viewing hood, mains lead and battery plug. Optional extras consist of probes, shoulder bag and a rechargeable battery pack.

Conclusion

In conclusion, this is a good scope. It's versatile and will appeal to a wide range of technicians involved in both fixed and mobile work. Its specification and go-anywhere features make it worth the price tag of around £300 plus VAT (battery pack £26 plus VAT). The CS1352 is available from Lawtronics Ltd., 139 High Street, Edenbridge, Kent TN8 5AX (0732 865191), and we understand that this distributor offers a fourteen day "sale or return" evaluation service.

Practical TV Servicing: Solid-state Field Timebases

S. Simon

THE field timebase is responsible for driving the scanning spot from the top of the screen to the bottom, after which it returns relatively quickly (the flyback) to the top of the screen. For this purpose, a linearly increasing current has to be driven through the field scan coils, the current reversing quickly at the end of the scan to give the flyback. The usual scheme adopted in field timebases is to generate a sawtooth voltage waveform which is used to drive an output stage that provides current amplification. With a valve field timebase, the sawtooth voltage waveform is applied to the control grid of the output pentode, which is transformer coupled to the scan coils. Any unevenness in the current's rise is corrected by means of negative feedback and/or drive waveform shaping, the linearity control(s) adjusting the feedback/shaping to get the required linear scan. In any type of field timebase, the basic sawtooth voltage waveform is generated by charging a capacitor via a resistor, the field oscillator circuit discharging the capacitor at regular intervals to initiate the flyback. The general scheme is shown in Fig. 1. The height control usually forms part of the resistance via which the field charging capacitor charges. Our theme this month is solid-state field timebases, and some of the more common faults that occur from time to time.

Monochrome and Colour Sets

In a solid-state field timebase used in a monochrome receiver, the field scan coils are generally coupled to the field output stage by means of a large electrolytic capacitor, while on the earthy side they are returned to chassis via a small-value resistor which generates a waveform that can be used for linearity correction purposes – in the form of negative feedback. In a colour set matters are complicated by the fact that the vertical convergence circuits have to be driven by the field output stage, while there is also likely to be raster correction circuitry of some sort. Where a transistor field output stage is used, the raster correction (i.e. pincushion distortion correction) and the convergence circuitry are generally connected in series with the field scan coils. This means that the route via which the field scan current travels from the output stage to chassis can be quite complex, and that the appropriate circuit diagram is almost essential if you're not familiar with the particular set and don't want to get lost along the way. Further complication is added by the fact that d.c. is also usually fed to the field scan coils so that the picture can be moved up and down (vertical shift). It's as well to bear in mind these complications with colour sets, since a good proportion of cases of field collapse in colour sets (a single white line across the screen, or perhaps three single colours but you know what we mean) are due to faults that are not in the field timebase itself, e.g. an open-circuit coil or control somewhere along the line or a break in a printed circuit track.

Tracing the Signal

Now there's one thing that helps when it comes to checking on whether the field timebase is operating. Since it runs at 50Hz, you can hear it. To remove any doubt, you can use a hearing aid in the form of a pair of headphones with a capacitor in series to block the d.c. – preferably a high-resistance pair, with no stereo nonsense. Alternatively a signal tracer consisting of a small amplifier and loudspeaker can be used.

In this way the 50Hz signal can be traced from the oscillator stage forwards. Provided, that is, that this action doesn't stall the oscillator, which can lead to the demise of the output transistors. To avoid unnecessary risks, do it the other way round, checking first at the output. If the buzz here is loud and clear, there's no need to go back to the more sensitive stages. Instead, soldier on towards the scan coils, then along through the minefield of the convergence circuitry (assuming a colour set). This is not too difficult if you've got the circuit diagram. Particularly look for mines in the vicinity of horizontally mounted coils, where a tag may not be making proper contact with the print (a dry- or a loose joint), for open-circuit wirewound controls where perhaps only a touch may be sufficient to restore the scan, and for fine cracks across the print. Such cracks are likely to occur in slightly discoloured areas of the board – discoloured because the heat from a power handling component has caused deterioration of the panel material, often far away from the field timebase itself but on the way perhaps to the field shift control.

The scan coils themselves are not often at fault. The coils (the two halves) may be connected in parallel or in series. If they are in series, a break in one set of windings will stop the current flowing in the other set, except for that flowing via any shunt resistors present. Just a point of minor interest.

If the field timebase stops, or the field scan coils are disconnected, a horizontal line appears across the centre of the screen. We said at the start that the timebase deflects the spot from the top of the screen to the bottom. How does the spot get to the top of the screen if the centre of the screen is the point at which the field scan current is zero? The point to be appreciated here is that the scan current flows through the coils in both directions during the scanning cycle. It builds up to a maximum in one direction, driving the spot say from the centre of the screen to the bottom. The output stage is then cut off and, due to the inductance of the coils and the associated capacitance, an oscillatory action occurs, driving the spot back to the centre and then to the top of the screen. At this point the output stage switches on again to complete the scan, driving the spot back to the centre of the screen. The undeflected spot is always at the centre, being driven upwards and downwards and from side to side.

Still No Scan

To return to our search for the cause of no field deflection, if the 50Hz buzz is audible at the output of the timebase there must be a break in the circuit to the coils or from the coils to chassis (or sometimes to the supply rail instead of chassis). Identify the return lead from the coils and follow it through, using an ohmmeter if necessary to establish the continuity of the circuit. If the circuit is to hand this can be done in seconds. If the circuit is not to hand, and you're confronted with a colour set with a lot of convergence/raster correction circuitry on various panels linked by plugs and sockets, heartache may be the result. In Pye hybrid colour sets for example (691-697 chassis) the edge connectors should receive attention, as should the tracks leading down from the connectors in the case of the 697 chassis, since these wend their way past heat affected parts of the panel. If the field buzz is not audible on the other hand, or there's doubt, as there can be, the first thing to do is to check the supply voltages. Clearly one must have some idea about what to expect.

Voltage Readings

Most solid-state field timebases operate from a clearly defined supply, of around 30-40V. This may be obtained from a rectifier fed from a winding on the line output transformer, or from a suitable point in the power supply. If a valve field timebase is used, it will be supplied from the h.t. line, probably via a separate decoupling resistor which is therefore suspect. In the case of the Pye hybrid chassis however, the solid-state field timebase operates with positive and negative 20V supplies – there's also a separate, zener diode stabilised 20V supply to the height control. The absence of the latter supply does not mean that there will be total lack of field scan with no timebase operation at all: the symptom is lack of height, the culprit almost certainly being the zener diode, which is on the main line timebase/power supply module (or it may be the associated electrolytic capacitor). Measure the voltage at the input to the timebase panel, or at the 22kΩ resistor in series with the height control – not at the height control itself, as the reading obtained here can be misleading.

The Pye field timebase is unusual in this respect, which is why we've mentioned it. Most solid-state field timebases operate with a positive supply of say 40V, with a couple of transistors in the output stage connected between this and chassis. Assuming the use of npn transistors, the upper one will have its collector connected to the 40V line (maybe via a diode) and the lower one will have its emitter connected to chassis. The emitter of the upper transistor will be connected to the collector of the lower one, and provided that both transistors are conductive the midpoint will be at some 20V – this is an average reading recorded by the meter, since the transistors will be being driven from almost fully on to fully off.

Now let's return to Fig. 1. There are often two stages in a transistor field timebase between the charging circuit and the output stage (there may be more, or there may be just a driver stage). So there are several possibilities in the event of non-operation of the field timebase (no 50Hz buzz at the output). The charging capacitor may not be charging and discharging, due say to its loss of ability to hold a charge. It can do this, but it's not a very common occurrence. We mention it simply because the capacitor itself (there are often two of them connected in series, with the linearity feedback fed to their common point) is often overlooked. The charging capacitor may charge on the other hand, but may not be discharged due to failure of the oscillator to oscillate. This stage could consist of a transistor blocking oscillator, as in the Pye hybrid colour sets, a two-transistor oscillator (there are various types of circuit in use), or a silicon controlled switch such as the BR101 or BRY39. Then again the linearity stage may not be working, the driver may not be driving, and the output stage may not be operating. So where do you start?

Short Cuts

Heat means energy being dissipated, and energy being dissipated means that whatever is doing it is doing some hard work. So this is probably where the fault will be found, i.e. in the output stage. Things to look for are open-circuit or short-circuit transistors, open-circuit diodes, dry-joints and other improper connections. Lightly tapping around may quickly reveal a poor connection, while meter readings should indicate what is and what is not happening. A finger applied to the transistors will show whether they are working hard or not at all. If they are not working at all, assuming that the output stage uses two transistors as is generally the case, either one or both is/are defective or they are not being driven by the driver. With the set switched off, the relevant transistors can be roughly checked with an ohmmeter, using the low ohms range.

Depending on the circuit, if the driver is not itself being turned on the current through the output pair of transistors could have been excessive, as a result of which these could have been damaged. Look at Fig. 1 again and assume that both the linearity and driver stages use a single npn transistor connected in the common-emitter mode, with d.c. coupling between the stages. If the oscillator is not working, the charging capacitor will charge up and the linearity transistor will saturate. The driver in turn will be switched off, so that its collector voltage will remain at the supply line voltage. The output transistors will thus be hard on (class A output stage with two transistors, for the technically minded). The thing about all this is that a new pair of output transistors could suffer the same fate as the original pair if the true cause of the trouble is not discovered and put right. There are no hard and fast rules here, since everything depends on the particular circuit arrangement used in the timebase. The fact that d.c. coupling is often used from the oscillator right through to the field scan coupling capacitor can make fault tracing difficult, since if for example a transistor in an early stage is defective the voltages in all the following stages will be wrong. In this event, to isolate the source of the trouble check backwards until you come to a correct voltage reading.

In all probability however there will be no contributory fault that's caused the demise of the output transistors, and a new pair will restore normal operation. But as those of us who've been in the game for any length of time know all too well, these multiple faults can and do occur and can be most annoying. So before a new output pair is fitted, check that the driver is working and that it's receiving an input from the preceding circuitry – meter checks backed by a scope or headphone check.

If a silicon controlled switch oscillator device such as the BRY39 is ued, don't attempt to read its anode voltage with a meter: this will stall it, turn off the driver, turn the output transistors fully on and, if a new pair has been fitted, finish them off (see how easily it can happen!).

Lack of Height

We've already mentioned one cause of lack of height, particular to the Pye hybrid colour chassis. There are many others of course. Sometimes the cause is simply a dud spot on the height control itself, but things are not usually as simple as this.

If the loss of height is even at the top and bottom, it's usually a matter of finding out where the voltage is lower than it should be, but the effect of faulty electrolytics should not be overlooked. A dried up bootstrap capacitor (the one wired between the output from the timebase and the base circuit of the upper transistor in a two-transistor output stage, usually with a value of some 250μF) can cause havoc with the operation of the output stage. We can also get the paradox of a capacitor losing its capacitance and causing excessive height – when it's back in the timing or linearity network. So be patient and check carefully: it doesn't have to be done very often.

Linearity Troubles

Non-linear timebase operation, with either the top or the bottom of the scan compressed, is a very common complaint. In valve circuits we check the output valve and its cathode bias components. If the cathode bias resistor rises in value, there's top compression (but check the linearity presets first): if it falls in value, there's bottom compression. The cathode decoupling electrolytic can dry up, introducing negative feedback which shows up as loss of height, particularly in the lower part of the screen (where most power is required to complete the scan) – the familiar "short legs" effect.

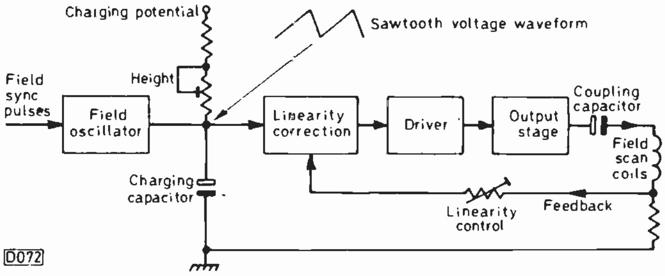


Fig. 1: Block diagram showing the basic arrangement used in a solid-state field timebase. Note that the linearity and driver arrangements used vary considerably. Complications arise with colour sets due to the need, in all but the most recent models, for convergence and raster correction circuitry: following the path to and from the scan coils may take you along a devious route therefore.

In solid-state field timebases, suspicion should be directed first upon the output transistors. Try adjusting the midpoint or bias preset, setting this up or attempting to do so in accordance with the instructions in the manual – to obtain say 22V at the midpoint of a two-transistor output stage operated with a supply of about +40V. If this cannot be done, a new pair of output transistors will often work wonders, even though the originals read all right when checked with an ohmmeter. We may have given the impression that the output pair always consist of two npn transistors: in a large number of sets however a complementary pnp/npn pair is used.

Similar Audio Problems

The field output stage often bears a strong resemblance to an audio output stage: thus tricks learnt with one can help when dealing with the other. The distortion with an audio circuit is scan non-linearity with a field output circuit. Whereas the loudspeaker is the driven member in the former case, the scan coils are the end product as it were in the TV timebase. The method of coupling the coils or the speaker to the timebase or amplifier is also the same – a transformer in valve (high impedance) equipment, a large capacitor in transistor (low impedance) equipment. Whilst it's seldom at fault, this item should not escape attention. The transformer can develop an open-circuit primary winding: this is fairly obvious, since little (or maybe no) h.t. will reach the anode of the output valve. It can also develop shorted turns in the primary winding, drastically reducing the field scan (or the sound output). In transistor (also i.c.) circuits, the coupling capacitor can loose its capacitance – either over a period or suddenly. This is roughly equivalent to shorted turns in a transformer's primary winding. Alternatively it can become leaky, pulling down the output stage midpoint voltage and causing lots of fun.

And hereby hangs a tale. The voltage rating of the output coupling capacitor should be equal to or greater than that of the output stage supply voltage, because circumstances arise where the mipoint voltage rises to the supply line voltage. Obvious you say? Quite so. But it wasn't obvious to the designers of a well known stereo music centre, which has 25V capacitors specified for speaker coupling. The result of this was (and is) that if a fault earlier in the circuit leaves one of the output stages without drive, the voltage on the capacitor is more like 36V. The capacitor explodes with an almighty bang, scattering its innards all over and at the same time causing the output transistors to go short-circuit. The unwary repairer fits new transistors and, copying the other channel, fits a 25V output coupling capacitor. Guess what happens . . .

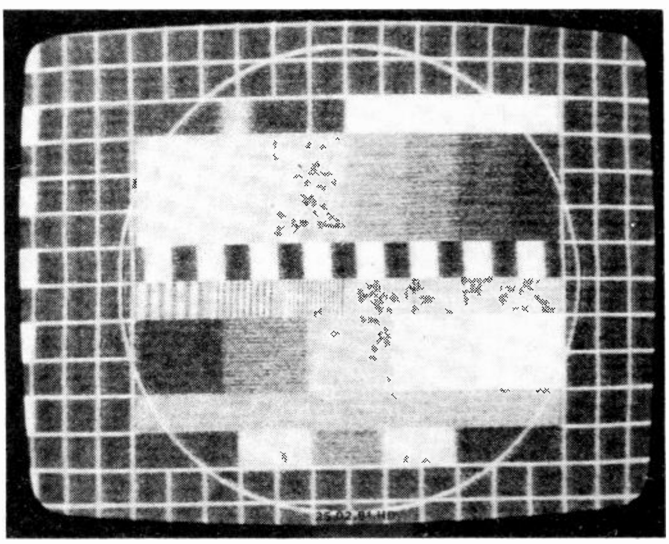
Long-distance Television

Roger Bunney

BY the end of April there was increasing evidence of Sporadic E activity – by the time this issue reaches the newstands, the SpE season should be well under way. The first sustained SpE opening occurred on April 1st, with nearly four hours of signals from eastern Europe – TSS (USSR) chs. R1/2/3, TVP (Poland) ch. R2 and several unidentified signals. Reports of these signals came from several parts of the UK, the level on ch. R1 at times being very strong. A small SpE opening was noted here at Romsey on April 10th, at 0900, again with TSS chs. R1/2, while on the 20th there was a sustained opening with strong signals from MTV (Hungary) chs. R1/2 plus unidentified signals – possibly ORF (Austria) ch. E2a/R1. There have been an increasing number of short duration (up to one minute) signals in the Band I channels, arriving mainly from north easterly and easterly directions, i.e. from Scandinavia/Russia.

Meteor scatter reception has been average. Mark Baldwin (Rugby) reports an active Lyrids meteor shower (April 21-3), with TVP (Poland) ch. R1 the most dominant signal.

There were two periods of enhanced tropospheric reception, end-March and mid-April. During the first opening the nearer W. German v.h.f./u.h.f. transmitters were received in the UK. The opening faded out on April 4th, stronger signals in eastern parts of the UK returning on the 10-13th: Brian Fitch (Scarborough) did particularly well, with many German u.h.f. signals. The high-pressure system over the UK continued, and after a lull further tropospheric signals appeared, from the 15th, Cyril Willis (Cambridge) receiving Denmark chs. E7/10 and NRK (Norway) ch. E6. Strong easterly winds then intervened, and for several days the signals hovered at W. German distances and not much farther. This latter period seemed to peak on the 21st, when Brian Fitch logged E. Germany (DFF-2 ch. E31) and many W. German u.h.f. transmitters. The heavy snow during the weekend of the 25/26th put an end to the opening, as low pressure moved in from the west. Perhaps the most startling tropospheric reception of the period was when Hugh Cocks noted SR-2 (Sweden) ch. E30 from Goteborg, and Jim Cook (Newcastle) logged Sweden ch. E8 and W. Germany ch. E10 using only a wideband Band I aerial!



The new NDR-1 (W. Germany) electronic test card – photograph courtesy of Henny Demming.

Contrary to my expectations, there have been numerous ionospheric signals from Africa in Band I, via both daytime F2 and early evening TE propagation. ZTV (Zimbabwe) and GBC (Ghana) have been seen on many days during the month, and there has also been weak evidence of possibly Kenya/Nigeria/Zambia. Hugh Cocks, monitoring ch. E2 at Hastings, reports that ZTV was present almost daily during the first week of April. It then mysteriously disappeared, though the general conditions suggested that it should have been present. Signals were received again on the 24th, and we subsequently learnt that Gwelo had been off the air for a couple of weeks – it's expected that the ch. E2 transmitter will eventually be closed down, transmissions moving to Band III. During the evening TE period on the 24th signals from Ghana were competing with Gwelo, which was present until 2100, with both sound and vision. At 1745 there was a second co-channel signal, a very weak test grid, Ghana coming on-air at 1800 to obliterate the grid. Late evening signals from Gwelo were received here again on the 25th and 26th, both sound and vision. Ghana was particularly strong on the 25th. Hugh Cocks also reports receiving these signals.

All in all then a rewarding month!

Reports from Abroad

An interesting report covering March and early April has come in from Henny Demming (Holland). He had TE reception from Ghana on four days and ZTV on no less than eleven days in one month! The mystery signal I received on January 29th, with a new test card, has now been explained. Henny reports that it's NDR-1 (W. Germany) – see photo.

One can't help envying Anthony Mann (Perth, Australia) who reports, in a letter dated April 5th, continuous F2/TE/SpE reception. Signals were being received almost daily from Russia (ch. R1) and China (ch. C1). Other signals were received from New Zealand (chs. 1/2), from Australian east coast transmitters (chs. 0/1), also Malaysia (ch. E2) with the PM5544 test pattern (no identification). Several of the Australian ch. 0 signals were received via F2 back scatter, while according to Robert Copeman and Tod Emslie Vladivostok ch. R1 was received in Sydney.

In a letter dated the 13th Anthony Mann describes similar reception, plus communications signals from Central America at up to 44·5MHz, also S. African signals from the west. His letter of the 22nd contained the most dramatic news however. At times the F2 m.u.f. reached 53MHz, with W. Malaysian ch. E2 sound and the P29SIX beacon (52·010MHz). By the 18th he was logging several 50MHz beacons in the southern hemisphere, also local amateurs on six metres. The 19th produced more 50MHz beacons, including S. Africa, but the highest peak so far in the present sunspot cycle occurred on the 20th: Anthony heard two 52·1MHz amateurs (H44PT and H44DX) in the Solomon Islands, and at 0900GMT Mexican two-way communications signals at 49·4MHz. It's almost good enough to emigrate!

In the USA, Jerry Pulice (Staten Island, NY) has at last logged vision signals from Australia and new Zealand – NZ ch. 1 on 45·25MHz, with additional signals offset at ± 10kHz, and (just) Australia ch. 0 on 46·26MHz, using a single dipole array at that!

News Items

New transmitters: A pirate TV transmitter is being constructed on a ship in international waters off Greece, to broadcast uncensored news and films. Test transmissions from the religious "Star of Hope" transmitter in S. Lebanon have started: the transmitter is run by a US evangelical organisation to broadcast programmes to Syria, the Lebanon, Jordan and possibly Egypt from Bint Jubayl (channel not known).
Africa: Morocco is to start a second channel, in colour. Mozambique is carrying out test transmissions on a regular basis several days a week. S. Africa will start a second "non-white" channel in January 1982.
Yemen: New equipment for the start of colour transmissions is being installed in Aden.
Belgium: Experimental teletext services now accompany both the Flemish and French language transmissions. BRT uses 100 pages, based on the UK system; RTBF uses the French Antiope system, again with 100 pages.

French VHF TV Re-engineering

Gosta van der Linden has sent us details of the v.h.f. channel allocations that will be adopted in France when the 819-line transmissions (system E) cease, probably towards the end of this year. System L will be used, with positive vision modulation, a.m. sound and 6·5MHz sound/vision spacing, i.e. the same as used for the French u.h.f. transmissions. The channel details are as follows:

Band I			Band III		
Channel	*Sound (MHz)*	*Vision (MHz)*	*Channel*	*Vision (MHz)*	*Sound (MHz)*
A	41·25	47·75	1	176	182·5
B	49·25	55·75	2	184	190·5
C	58·25	64·75	3	192	198·5
C'	57·25	63·75	4	200	206·5
			5	208	214·5
			6	216	222·5

Channel C' is the allocation for the Besancon-Lomont transmitter.

Television Test Card Book

The second edition of Keith Hamer and Garry Smith's book *"Guide to World-Wide TV Test Cards"* has now been published. It's been extensively revised since the first edition, and features greatly improved photographic reproduction. There are some 240 monochrome photographs, covering Europe and most of the rest of the world – with either "official" or good off-air photos. A selection of Italian "free" station identification cards is also included. The book is highly recommended, particularly for beginners to the hobby of DX-TV. There are 52 pages and the price is £2·85, including surface postage world wide or extra for air mail (e.g. an additional £1 to Australia) – from HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR. Overseas readers should send either sterling or drafts paid on a London bank – no Eire POs please!

From our Correspondents . . .

Wenlock Burton (Melbourne) reports that a u.h.f. station (ch. 28) is under construction at Hobart, Tasmania. He's just purchased the equivalent of an Antiference TC13 group A aerial (marketed by Hills in Australia) and has received three amateur TV stations, including a beacon.

Richard Turcsany (Shelton, Connecticut, USA) reports having received BBC ch. B1 via triple-hop SpE on July 17th last year. The signal was very weak. My own 1980 ch. A2 triple-hop SpE reception was a few days earlier, on July 11th! July it seems is a good month for triple-hop transatlantic reception: since late July 1978, four DXers have reported reception of ch. A2 (two of them noted ch. A3 signals as well).

Ray Davies (Norwich) received many u.h.f. signals during the April openings, including SR (Sweden) chs. 30, 42 and 48 and DFF (E. Germany) chs. 29 and 34. Ray is now using a Fuba XC391 array (chs. 21-48, group K) for u.h.f. reception, with a Polytron 30dB head amplifier. He comments that ZDF (the W. German second network) can be received daily with this new combination.

Another east coast enthusiast, Hugh Chapman (Hull), is installing new Band III aerials and head amplifiers: I look forward to his reception reports.

Letters

FAULTY TAPES

I was extremely interested in Derek Snelling's mention of faulty video tapes in the May *VCR Clinic*. Since the boom, which started about a year ago, in the sales of VCRs, we've found that the percentage of tape faults has been on the increase. This is certainly so with one major brand of tape we've sold. The two most common faults we've experienced with these tapes have been creasing and oxide shedding on the first 50ft. of tape. Since changing to a brand of tape that retails at a slightly higher price, we've had no more trouble and our many customers are happy. It would be interesting to hear from other dealers.

George Le Page,
St. Peter Port,
Guernsey.

IN-SITU TRANSISTOR TESTER

May I thank Mike Phelan for his excellent article (March issue) describing the simple in-situ transistor tester he devised? Not having one of the little transformers he employed, I found that one from an electronic flash gun was just right, with a new primary winding consisting of 20 plus 20 turns substituted round the ferrite core. The tester has proved to be very useful.

C. M. Lindars,
Wallington, Surrey.

HYGIENIC HEATERS

Much, including a comprehensive article by Andy Denham in the September 1977 issue, has been written in your columns on the subject of servicing the Pye hybrid colour chassis, and in particular on the infamous CDA panel with its snags and shortcomings. As is by now well known, there are even solid-state replacement panels which do indeed solve most, if not all, the shortcomings – at a price. I'd like to draw attention however to a point that seems to have been overlooked in the fight to "tame" the panel and the troubles that arise from its operation.

Older readers will no doubt recall, with a shudder, the days when several mono and later stereo record players used what was euphemistically called "a.c./d.c." circuitry, with some quite long series-connected heater chains voltage-wise. These were as often as not overrun, or certainly generously run so far as the heater voltages were concerned. The result was acute audio distortion after about an hour's use. A quick look "under the bonnet" would then reveal output valves with cherry red anodes, and on checking at the control grids a positive voltage would be discovered. This would lead to the coupling capacitors being whipped out – 0·05μF/500V capacitors sold in bagfulls in those days! Pretty soon afterwards however, with the equipment on soak test, the snag would again rear its ugly head, the bottles once more glowing. Positive volts on the grids again, and by this time it was usual to whack in new output valves – UCL83s were a favourite, and at one time I never had less than a dozen of these in stock. Eventually the penny would drop, and we'd realise that instead of being cherry red the heaters were well on the way to being incandescent! So whack some more Ohms in the heater line to get the heaters nearer the right colour. This would get rid of the secondary emission problem (the cause of the positive control grid voltage), and with the heaters being hygienically run everything would settle down. The gear would play for days and days without a burble – miracle cure!

One day, while trying so hard it hurt to set up a CDA panel for healthy pink skin tones that lasted for longer than half an hour, I once again found myself staring stupidly at the four in-line bottles on the panel, each trying hard to be a light bulb. Just for the hell of it, I switched off and put some more Ohms into the wattless dropper gismo heater line. The result was almost too good to believe. After setting the high and low white nicely and the colour bars as prescribed, the set just sat there and performed on and on – just like a monitor. I'd never seen a 697 perform so well for so long. Almost sweating with disbelief, I checked up on what I'd done – increased the value of the watty 22Ω resistor (R303) in the heater chain to a similarly watty 150Ω. So I did the job nicely and installed the resistor properly, to obviate any problems such as the resistor getting hot, dropping off and by Sod's Law falling through a hole in the cabinet on to a priceless shag carpet. Since then I've done this quick little mod to every Pye of the genre that's come my way. To a man they've soldiered on with none of the previous problems that plague this otherwise jolly fine set.

Anthony Beddow,
Minions, Cornwall.

SERVICE BUREAU

I see that line hold trouble with the Pye 169 chassis is mentioned in the May *Service Bureau*. On several occasions I've cured this fault by replacing C49 (16μF), which smooths the h.t. supply to the line oscillator stage – the fault can be exasperating to deal with when the line oscillator stage checks out o.k.

M. G. Cox,
Glossop, Derbyshire.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 493 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.

ITT CVC5 CHASSIS

There's intermittent lack of height on this set, but every time I try to tackle it with the meter the fault clears. A new PCL805 field timebase valve has been fitted, and the height control and its series resistor (R335, 1MΩ) have been replaced. The output stage cathode bias components have also been changed. After doing all this the height again reduced. It could be corrected by adjusting the height control, but on switching on next day there was again a loss of about two inches at the top and bottom of the screen.

R335 is fed from the junction of R417 and C302, which should be checked. There's also a shunt path to chassis via R413, the VDR R409 (E299DD/P344) and D57, so these components may also have to be checked.

GRUNDIG 5010

The set works for about a quarter of an hour, then the mains cut-out trips. This is accompanied by a flashover on the line output stage combi coil – which is a replacement, the original one having shorted turns. There's a heavy current through the h.t. resistors R608/R611, which burn out, but there's no detectable short between the h.t. line and chassis.

Check thoroughly for dry-joints on the heavy wound components in the line output stage. This is common enough advice, but dry-joints here are a constant source of trouble. If the search is fruitless, suspect the line drive coupling coil L501 of being intermittently open-circuit, or alternatively leakage in Di504, which sets the width transductor biasing, or Di502 in the protection circuit.

THORN 3000 CHASSIS

The set goes off and on intermittently – the fault is similar to the excess current trip operating. There's no excess current demand however. The trip thyristor W622 has been changed and the associated components checked, but this has made no difference. A replacement power supply panel has now cleared the fault – any idea what's wrong on the original panel?

The two main possibilities are the l.t. reservoir capacitor C607 (1,000µF), and diode W609 which is in series with the chopper transistor (use two 1N4002 diodes in parallel as a replacement).

SABA G CHASSIS

This set came in as a non-worker, and on removing the back I found that the mains fuse had blown. It's a very complicated receiver however, with the power section right down in the bowels of the set and extra complexity in the form of remote control, so I'd appreciate any guidance you can provide.

If there's a dead short from the mains fuse to chassis, the mains filter capacitor C616 (0·22µF) is probably short-circuit. Next check whether there's a short to chassis at the 1A h.t. fuse Si601. If so, the h.t. smoothing capacitor C604 (470µF) is probably responsible – it breaks down quite often. A voltage-doubling h.t. rectifier circuit is used in this chassis, and if the first capacitor (C607, 470µF) in this circuit breaks down, the mains fuse blows instantly – the capacitor tends to arc over inside with a tremendous crack, like an e.h.t. discharge. The second rectifying element in this circuit is a thyristor, Thy606. This can go short-circuit, causing a hum bar with occasional fuse blowing.

THORN 1400 CHASSIS

The picture is perfect apart from the fact that it suddenly turned to a battleship grey. The contrast and brightness controls both work, and the video output and vision i.f. valves have been replaced.

The probability is that the video output stage is working under incorrect conditions, due to a changed value resistor. Check the values of the anode load resistors (R40 3·3kΩ and R41 2·7kΩ), the screen grid feed resistor R36 (8·2kΩ), the cathode bias resistor R39 (110Ω), and in particular the bias stabilising resistor R38 (39kΩ). Other things that might need to be checked are the first i.f. valve's screen grid feed resistor (R14, 39kΩ) and the high-value resistors (R4/7) connected in series with the sliders of the contrast controls.

GRUNDIG 2210

The symptom is that the set switches itself on and off rapidly, the sound being interrupted and the raster collapsing. If the set is switched off for a minute or so and then switched on again, it will behave normally and the fault may not recur for a week or more.

There's an electronic cut-out on a separate subpanel (module 29301-038.01) in these sets. It consists of a thyristor in series with the h.t. supply, with a circuit that senses excess current flow and in this event switches the thyristor off. The symptoms suggest that the cut-out is tripping intermittently. The main suspects are the 10V zener diode Di619 on the subpanel and the two resistors R608 (9·1Ω, 7W) and R611 (9·1Ω, 11W) on the main panel – the cut-out senses the voltage developed across these resistors.

ITT CVC5 CHASSIS

The picture may come on o.k., but is soon intermittently streaked by bands of white lines, generally in the lower middle of the picture. This sometimes leads to loss of colour, or to break up and loss of sync or a negative picture. When the latter occurs between adverts on ITV, the screen goes black with a green and red diagonal flash or bar. At other times the picture remains normal except for the occasional bands of white lines. Retuning sometimes clears the fault, while at other times it clears for the rest of the evening. The sound also gets a bit mushy when the fault is present.

Your problems will probably be resolved by cleaning and resoldering the four tags which earth the frame of the line output transformer to its subpanel. If the fault persists, concentrate on the a.g.c. circuit, particularly the gating diode D45 (BA145), the transistor T41 (BC174B) and the a.g.c. smoothing capacitor C114 (50µF).

SANYO CTP5101

There are two faults on this set. First, field flyback lines are always visible. Secondly, the picture collapses intermittently, with two horizontal white lines an inch apart and the picture cramped in between – the picture is restored as soon as you touch the chassis.

Replacing R608 (330kΩ) will cure the first problem – it's mounted on the tube base panel and forms the chassis return section of the potential divider network feeding the c.r.t. first anodes. The second problem, intermittent field collapse, must be due to a dry-joint somewhere in the field output stage – probably on the field output transistors (Q905/6) themselves. Resolder these joints and any others that look dry in this section of the set.

THORN 2000 CHASSIS

There's no colour at the extreme right-hand edge of the picture – about two inches are missing. Also, when there's a close up the picture is "contrasty", as if the contrast has suddenly been turned up, with lots of snow on the picture. Another point is that the picture expands when the brightness is turned up slightly, the focus also being affected.

This problem is caused by an incompatible video board, and usually occurs when either the video or the line timebase board has been replaced. The modification required is to fit a 150kΩ, 10%, $\frac{1}{4}$W resistor across C18 in the pulse tap-off circuit on the line timebase panel.

ITT CVC2 CHASSIS

There's a very bright picture on this set, the brightness control having hardly any effect. Also the PL509 line output valve's cathode resistor gets hot.

Ensure that the PL509's cathode resistor (Rh49, 10Ω) has not increased in value, and that its decoupling capacitor Ch29 and the screen grid decoupler Ch24 are intact. If so, replace the PL509. A common cause of excessive brightness on this chassis is failure of R24 (470kΩ) which links the earthy ends of the c.r.t. first anode presets to chassis. Further possibilities are the d.c. restorer transistor TXk13 (BC118) in the luminance channel, diode Dk7 (AA132) which is in series with the base of this transistor, and TXh2 (BC118) in the beam limiter circuit.

RANK A823A CHASSIS

After the set has been on for about half an hour a fault appears at the top of the screen – the top two or three inches of the picture become compressed. The fault is heat sensitive, clearing for a time if the set is switched off and allowed to cool down.

The following components can cause this problem – use an aerosol freezer and hairdryer to isolate the culprit: the field driver and output transistors 5VT7/9/10, the flyback diodes 5D8/10, the field charging capacitors 5C24/25, the bootstrap capcitor 5C35, and the field coupling capacitor 7C5. The latter is on the convergence panel.

THORN 1591 CHASSIS

When the contrast control's setting is advanced, the picture goes negative. When the setting is reduced however the picture is too dark – even with the brightness control at maximum.

If the picture becomes defocused when the image turns negative, the c.r.t. could be responsible. Other things to check however are the first anode supply reservoir capacitor C110 (10μF), the focus control R134, the video output transistor VT9 and the value of its collector load resistor R51 (6·8kΩ). Ensure that the regulated supply line is correct, at 11·6V across C87. Important c.r.t. voltages to check are the cathode (45V) and the first anode (300V), at pins 2 and 6 respectively – a high-impedance meter is required to check these voltages.

TELETON ANEX TA12

The trouble with this portable is line scan collapse – to a vertical line down the centre of the screen.

Failure of the line scan coupling capacitor C416 is a common cause of this fault on these sets. Its value is 3·3μF, and a 50V polyester type should be used – don't replace it with an electrolytic. The other thing to check is that the connections between the line output stage and the deflection coils are o.k.

THORN 8000 CHASSIS

The trouble with this set is top foldover, the teletext lines sometimes appearing $\frac{3}{4}$in. down the screen. The foldover can be removed by reducing the setting of the height control, but there's then quite a gap at the top and bottom of the screen.

This effect is usually caused by leakage in one or both of the field output transistors VT410/VT411, though the driver transistor VT409 is not above suspicion. More remote possibilities are the flyback clamp diode W414, the bootstrap capacitor C438, the field scan coupling capacitor C439 and the scan coils.

PYE 725 CHASSIS

The excellent picture on this set is marred by flyback lines at about half inch intervals down the screen – they are more noticeable on dark scenes.

It's possible that the black level is too high – try readjusting RV404. If this fails to correct the fault, the TBA560C chroma/luminance i.c. is suspect. Also check the c.r.t.'s first anode supply network.

KUBA FLORENCE

This set gives an excellent picture, but has always required careful tuning to obtain colour, even with a good aerial correctly orientated. In recent months all four push-buttons have had to be continually retuned to keep good colour. Now the set goes off tune (loud hissing noise from the speaker), occasionally returning to a good picture and/or another station. Resetting the push-buttons will bring back the picture, sometimes for as long as an hour. The a.f.c. switch no longer has any effect (it used to), though the switch itself and the wiring are o.k.

Tuning drift on these sets is often caused by the potentiometer tracks in the tuning head changing value – the same problem occurs with other sets that use this make (PREH) of tuning head. To check, temporarily substitute a single 100kΩ multi-turn potentiometer or another type of tuning head. Even if the a.f.c. is completely inoperative, the tuning should only drift slowly however. There could be a fault in the tuner causing both faults therefore. With this type of a.f.c. arrangement, where the a.f.c. discriminator acts in series with the tuning voltage, any leakage from the tuning line will affect the a.f.c. action. The TAA550 stabilising i.c. is worth a try, though this would cause problems with the 24V supply if defective. The tuner is a special type (GAF) and is not easy to replace with an alternative type as it has an i.f. preamplifier built into it.

THORN 1500 CHASSIS

The problem is an intermittent streaky line across the picture, making the picture roll. When this happens, streaks of blue light can be seen behind the scan coils, running up the bulb of the tube. Thinking that there might be shorting turns in the scan coils, I changed them. The effect is still present however. On the odd occasion you can switch the set on and everything works normally.

The action to take is to discharge the e.h.t., then thoroughly clean the c.r.t. bowl and flare with methylated spirit. Dry, and lightly smear the area with silicone grease. It would also be worth checking for any dry-joints or bad connections in the line timebase, particularly around the scan-correction capacitor C90 and the line output transformer.

THORN 1690 CHASSIS

There's an odd fault here – the e.h.t. collapses after about 45 minutes, leaving the sound only, though at reduced volume and slightly distorted. Switch off for a couple of hours, then switch on again, and the picture's back, though for only 10-15 minutes. The fuses are of the correct type and have never blown. I've checked the line driver and output transistors, and the electrolytics in this area. When the picture goes, the series regulator transistor really starts to heat up its heatsink, though there are no other signs of components under stress.

On the occasions we've encountered this situation the fault has been due to either the shunt efficiency diode W13 (type F099) or, worse, the line output transformer/e.h.t. rectifier assembly.

TEST CASE

223

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.

Intermittent faults are one of the biggest headaches in TV servicing, and we seem to have had an epidemic of them recently. A particularly shy fault occurred with a Bush colour set, Model BC6248 – a nice little 20in. receiver, with the T20A chassis, remote control and touch tuning.

Our advice was sought on the problem of intermittent channel changing. The owner explained to our field engineer that the set would sometimes revert to channel one without any prompting from the remote control system or the touch pad. This would sometimes happen twice during an evening, though at other times the set would behave itself for several days. Our engineer, having met this sort of thing before on ITT and other touch-tune models, thoroughly cleaned the touch pads with surgical spirit and, seeing a couple of lively children, suggested that their mother keep her eye on the remote control unit! A few days later the engineer was again summoned, as the set was still occasionally jumping back to channel one. Suspicious eyes were cast on the family dog. Did he tend to jump up near the set? Did he have a jingling collar and disc? No . . .

Our engineer studied the circuit of the touch-tune system (customer control unit type T513A) and decided to replace the SAS580 touch-tune i.c. This is the i.c. that selects channels 1-4, and is thus the one most likely to be responsible for the effect. In went a new chip, along with a replacement 9C16 (the capacitor in the network which ensures that channel one is selected at switch on) in case this was leaky or jittery. Away went the engineer, leaving the invoice. Within a week however it was clear that the fault was still present.

The set was brought in and given a long soak test in the workshop on channel three – we had to remove the old 15A plug in order to test the set. The fault failed to put in an appearance however, so the set went back home, with the dog and the devil first and second on the suspect list. Ten days passed, and we dared to hope that the trouble had finally been put to rest. Then our customer, by now a sad and sorry lady, rang up to give us the bad news. Two concrete proposals were put forward in the workshop, to shoot the dog and to order a new touch-panel assembly – by the field and bench engineers respectively.

The upshot was that a third man drove to the house, spent fifteen minutes there, and cured the fault once and for all. We can afford a clue this month – the dog is still around.

ANSWER TO TEST CASE 222
– page 436 last month –

The trouble last month was weak, noisy sound on a large-screen monochrome set fitted with the Philips E2 chassis. The two chips in the sound channel had been virtually eliminated from the chase, and we'd found that the quadrature coil in the detector circuit had little effect on the symptoms when adjusted. It should have done! Tank coils in sound and vision quadrature detector circuits usually tune very sharply indeed. Ours must have been a mile off resonance, because the associated tuning capacitor C403 (820pF) was completely open-circuit. It was a polystyrene type – and poly's a bad girl!

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TELEVISION JULY 1981

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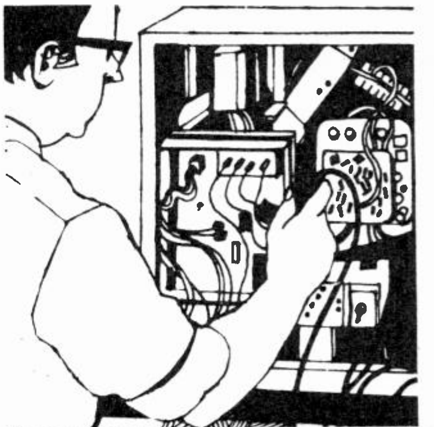

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Pye 69+161. **40p**
Pye 147+260r. **40p**
(731) 3+56+27r. **50p**

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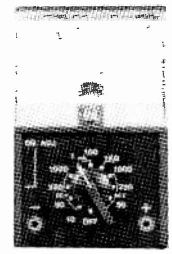

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BC154	7p
BC157	7p
BC158	7p
BC171	7p
BC171B	7p
BC173	7p
BC173C	7p
BC174	7p
BC182L	7p
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BC207	7p
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BC213LA	7p
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220/63	10p
1000/63	15p
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800/250	30p
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