SEPTEMBER 1979 Australia 95c; Malaysia $2.75; New Zealand 95c 55p

TELEVISION

SERVICING · VIDEO · CONSTRUCTION · DEVELOPMENTS

SERVICING PYE SOLID-STATE COLOUR RECEIVERS

RECEIVING FRENCH TV

NEW TELETEXT SIGNAL PANEL

THE V2000 VCR SYSTEM

PHD COMPONENTS

RADIO & TV COMPONENT DISTRIBUTORS

UNIT 7 CENTENARY ESTATE
JEFFRIES RD ENFIELD MIDDX
MAIL ORDER ONLY 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 0.35p 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	o.16
IN5407	0.33
BR100	0.50
BR101	0.60
BRY39	0.60
TIC116ON	1.50
BT119	2.50
BT120	2.50
BYX/71 600	0.80
2N444	1.50
TV106 2	1.50
BYX88C2V7	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	0.25
BZX61 8V2	0.25
BZX61 9V1	0.25
BZX61 10V	0.25
BZX61 11V	0.25
BZX61 12V	0.25
BZX61 13V	0.25
BZX61 15V	0.25
BZX61 16V	0.25
BZX61 18V	0.25
BZX61 20V	0.25
BZX61 22V	0.25
BZX61 24V	0.25
BZX61 27V	0.25
BZX61 30V	0.25
BZX61 33V	0.25
BZX61 36V	0.25
BZX61 39V	0.25
BZX61 47V	0.25
BZX61 72V	0.25
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
AF114	0.60
AF115	0.60
AF116	0.60
AF117	0.80
AF118	0.60
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
BC138	0.40
BC139	0.40
BC140	0.40
BC142	0.40
BC143	0.40
BC147	0.15
BC148	0.10
BC149	0.15
BC153	0.15
BC154	0.15
BC157	0.15
BC158	0.15
BC159	0.15
BC160	0.40
BC161	0.40
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	0.20
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	0.50
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	2.00
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	0.15
BF195	0.15
BF196	0.15
BF197	0.15
BF198	0.15
BF199	0.15
BF200	0.15
BF224	0.15
BF240	0.15
BF241	0.15
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	3.00
BU326S	1.50
BU406	2.00
BU406D	2.50
BU407	2.00
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
MJE2995	1.50
MJE3005	1.30
MP8113	1.00
MPSU05	1.20
MPSU55	1.20
TIP2955	1.30
TIP3055	1.30
TIS90M	0.60
TIS91M	
2N2904	0.50
2N2905A	0.50
2N2905	0.50
2N3053	0.50
2N3703	0.20
2N3705	0.20
2N3710	0.20
2N3055H	0.75
TAA350	0.80
TAA550	0.60
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
TCA270SA	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
SN76013N0	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
UA7824	0.50
TBA396	2.00
TCA270SO	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

VALVES — ALL VALVES 'MAZDA' BRAND

DY/86/87	1.20
DY802	1.20
ECC82	1.10
ECC84	1.35
ECH83	1.00
ECH84	2.00
ECL80	1.50
ECL82	1.30
ECL86	1.50
EF80	1.20
EF95	0.70
EF183	1.10
EF184	1.10
EL34	3.00
EL84	1.40
GY501	2.40
PC97	1.60
PC900	1.75
PCF80	1.50
PCF802	1.50
PCF806	2.50
PCL82	1.50
PCL84	1.50
PCL85/805	1.50
PCL86	1.50
PD500 510	5.00
PFL200	3.00
PL36	2.00
PL81	1.00
PL504	1.60
PL508	2.40
PL509	3.50
PL519	5.00
PL802	3.20
PY88	1.80
PY500A	2.40
PY800 801	1.40
UCL82	1.50
30FL2 1	1.60
PCF805	1.00
PCF808	1.50

DIRECT REPLACEMENT PARTS

173 Tuner (Repl Elc 1043 05)	8.00
4 443MHZ Crystals	2.00
Cut Out TCE 3500	2.00
Cut Out GEC	2.50
Cut Out TCE 8500	2.00
TV18 Rectifier Stick	2.00
TV20 Rectifier Stick	2.00
VA 1104 Thermister	0.60
Transductor TCE 3000	1.50
AEG Tuner (Repl Elc 1043 06)	9.00
Aeriel Isolator Kit	1.20
Phillips G8 Lopt	12.00
PYE 691 697 Lopt	14.00
Bush A 774 Lopt	18.00
Decoder Panel Autovox 2282	10.00
Degaussing Panel Autovox 2282	2.00
Sounf O P Panel Autovox 2282	4.00
PS Panel Autovox 2282	6.00
Comp Control Unit Autovox 2282	3.00
Field TB Panel Autovox 2282	5.00
IF Tuner Assembly Autovox 2282	7.50
TCE 850 Lopt	1.00
TCE 900 Half Wave	0.50
Delayline SDL 141	0.40
Pye 95 Tuner	1.50
GCE 2110 Degauss Panel	1.50

EHT MULTIPLIERS

TCE950 Doubler	2.00
TCE950 1400 Tripler	4.00
TCE1400 (Piped System Only)	4.00
TCE1500 Doubler	4.00
TCE1500 Tripler	4.50
TCE1600 1 2 Wave	3.00
DECCA CS 1730 1830 Doubler	4.00
DECCA CS 1910 2213 Tripler	6.50
DECCA 30 Series Tripler	6.50
DECCA 80 Series Tripler	6.50
DECCA 100 Series Tripler	6.50
GEC Hybrid 2028 Tripler	6.50
GEC 2110 Tripler PRE JAN77	7.00
GEC 2110 Tripler Post JAN77	6.50
ITT CVC 5/8/9 Tripler	6.50
ITT CVC 20 25 30	6.50
Phillips 520 Tripler	6.50
Phillips 550 Tripler	6.50
Phillips G9 Tripler	6.50
PYE 691 693/697 Tripler	5.50
PYE 731 725 Tripler	6.50
RRI 823 Tripler	7.00
RRI 2179/823	6.50
TCE 3000/3500 Tripler	7.00
TCE 4000 Tripler	8.00
TCE 8000 Doubler	3.00
TCE 8500 Tripler	6.00
TCE 9000 Tripler	7.00
TVK 76 13 Continental Sets	5.00
TVK 52 ITT Replacement	6.50
Korting 90% Tripler	6.50
Autovox Tripler	6.50
Rediffusion MK 1 Tripler	8.00
RRI TV 25 Quadrupler	8.00
Tripler Mounting Kit	1.50
RRI T20	6.50

PHD COMPONENTS

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 1000 2000/35	1.10
GEC Phillips G8 600 250	2.10
GEC/Phillips G8 600/300	2.50
ITT/KB 200 200 75/25/350	3.00
ITT CVC 20 200/400	2.20
Phillips 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 140 128 + 16, 1K7 + 116 + 462, 126	1.10
TCE 1500 350 + 20, 148 1K5, 317	0.90
TCE 1600 18 Thermal Link 320 + 70, 39	1.00
TCE 300/3500 6 1 + 100	0.60
TCE 800 56 + 1K, 47, 12	0.90
Phillips G8 2 2 + 68	0.60
Phillips G8 47	0.50
Phillips 210 30 + 125, 2K85	0.90
Phillips 210 118 + 148 (Link)	0.60
RRI 141 154 + 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 56 + 27	1.00
PYE 11009 60 + 70 + 173 + 26 + 16 + 17 + 19	1.00

CONNECTORS

Sets of AVO Leads	10.00
Plug 13A (Box of 20)	6.50
AL Coax Plugs Pack of 25	4.00
Plug Top 3A (Box of 20)	6.50
6DB Attenuator	0.90
12DB Attenuator	0.90
18DB Attenuator	0.90

SERVICE AIDS & TOOLS

Super Servisol	0.75
Foam Cleanser	0.75
Silicone Grease	0.75
Plastic Seal	0.75
Aeroklene	0.75
Freezit	0.75
Antstatic	0.75
Solder 18 SWG 60 40 0.5KGM	5.50
ORYX 50 TC Soldering Iron	8.90
ORYX 50 TC Iron 24V	9.50
Power Supply Type PSU 24 VAC	17.50
Sponge for PSU 24 VAC	0.18
Replacement Element for ORYX5	3.60
Safety Stand	3.50
Sponges for Stand	0.15
ORYX Super 30 Soldering Iron	3.50
Replacement Element for ORYX 3	2.50
LLSF 16 Iron Coated Longlife Tip	0.90
LLSF 24 Iron Coated Longlife Tip	0.90
LLSF 32 Iron Coated Longlife Tip	0.90
LLSF 48 Iron Coated Longlife Tip	0.90
LLSF 64 Iron Coated Longlife Tip	0.90
LLDF 08 Iron Coated Longlife Tip	0.90
LLDF 16 Iron Coated Longlife Tip	0.90
LLDF 24 Iron Coated Longlife Tip	0.90
LLDF 32 Iron Coated Longlife Tip	0.90
LLDF 48 Iron Coated Longlife Tip	0.90
LLDF 64 Iron Coated Longlife Tip	0.90
LLDF 24 Iron Coated Longlife Tip	1.15
Isotip Quick Charge	18.50
Repl Battery for Isotip	5.50
PC Drill Replacement	10.60
Replacement Drill	0.85
Protective Carrier	1.10
12V Auto Charger	4.50
Replacment Bulb	0.35
Micro Tip Q Charge	2.30
Fine Tip Q Charge	2.30
HD Tip Q Charge	2.30
Regular Tip Q Charge	2.30
Tuner Ext Tip for QC	2.75
SR2 Desoldering Tool	8.50
SR3AS Mini Silver	5.50
SR3A Mini Orange	5.95
Replacement Nozzles	0.65
Replacement Washers	0.17
Bench Vice Model 1B	22.00
Bench Vice and PCB Holder	33.00
PCB Holder Only	11.00
Solda Mop Red Std	0.48
Solda Mop Brown Light	0.48
Ersa Sprint	9.50
Low Voltage Soldering Station	9.95
Side Cutters	2.50
Hex Trim Tool	0.10
TVT 78 Transistor Equivalents Book	5.00

TELEVISION

September 1979

Vol. 29, No. 11
Issue 347

this month

567 **Leader**

568 **Teletopics**
News, comment and developments.

570 **Receiving French TV** *by Hugh Cocks*
In favourable locations along the south and east coasts French TV can be received on a permanent basis. Advice is given on transmitters to try for and the equipment required.

574 **The V2000 VCR System**
Technical features of the new Philips/Grundig VCR system, which could become a new world standard.

576 **No Clock Display** *by Steve Beeching, T.Eng. (C.E.I.)*
Another nasty VCR fault. This time a Sony Betamax VCR which wouldn't give a clock display.

577 **All Slog and No Grog . . .** *by Les Lawry-Johns*
Part of this month's column is set to music. Whatever next? At least the Red Baron hasn't put in an appearance. Not yet.

579 **Next Month in Television**

580 **Restricted Brightness Range** *by George Wilding*
Quite a lot of things can be responsible for restricting the range of operation of a set's brightness control, and these depend on circuit design. A survey of possible causes is provided.

582 **New Teletext Signal Panel** *by Alan Kitching*
This new signal panel has been designed as a direct replacement for the original one in the *Television* teletext decoder, using the same components. The use of an adaptive data slicer circuit gives improved performance under adverse signal conditions. The layout has been improved, and a sound i.f. preamplifier added.

586 **Readers' PCB Service**

587 **Servicing Pye Solid-State Colour Receivers, Part 1** *by Mike Phelan*
Dealing with faults on the Pye 713, 715, 717, 725, 731, 735, 737 and 741 chassis. This part covers the power supply and timebase circuits used in the larger-screen chassis.

592 **Long-Distance Television** *by Roger Bunney*
Reports on DX reception and conditions, and news from abroad. Also the start of a new series giving advice to those thinking of making a start with experimental DX reception.

595 **Tuners for DX Reception** *by Hugh Cocks*
A useful new v.h.f./u.h.f. tuner has become available on the surplus market.

596 **TV Troubles** *by Robin D. Smith*
More notes on fault conditions. Also some of the problems that can arise when customers decide to have a go.

598 **TV Servicing: Beginners Start Here . . . Part 24** *by S. Simon*
Now we really come to grips with colour! The basic colour mixing techniques are described, and things to look for listed when dealing with wrong colours or a poor grey scale on sets with colour-difference drive.

601 **Letters**

602 **Your Problems Solved**

604 **Test Case 201**

OUR NEXT ISSUE DATED OCTOBER WILL BE PUBLISHED ON SEPTEMBER 17

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.

SUBSCRIPTIONS
An annual subscription costs £9.50 in the UK, £10.50 overseas ($21 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

BINDERS AND INDEXES
Binders (£2.85) 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 70p 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 "Your Problems Solved". Send to the address given above (see "correspondence").

THE UNBEATABLE BRIARWOOD SERVICE

EX·EQUIPMENT SPARES

MISC. S/Output Trans. £1 + VAT + £1 P&P F/Output Trans. £1.25 + VAT + £1 P&P. Scancoils £1.50 + VAT + £1 P&P. Other spares available, please write or phone for details.

MONO TUBES
(tested)
19" Rimguard **£3.00**
23" Rimguard **£4.00**
20" Rimguard **£5.00**
24" Rimguard **£6.00**
+ £4.00 P.&P..

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

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

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

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

VALVES (MONO & COLOUR)

PCL82	0.10	PCF802	0.10	PCC86	0.10	EY86/7	0.10	30PL1	0.25	PL509	1.00
PCL83	0.25	PCF805	0.25	PC97	0.20	EY8/7	0.10	30PL13/4	0.10	PY500	1.00
PCL84	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30P12	0.10	GY501	1.00
PCL85	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	30FL1/2	0.25	PL508	0.50
PCL86	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC82	0.10	PCH200	0.50
PFL200	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECC81	0.10	PCF200	0.50
PCF801	0.10	PCC86	0.10	EF184	0.10	PL81	0.10	ECH81	0.10	CEY51	0.15
30C1	0.10	30C15	0.10	6BW7	0.10	6/30L2	0.10	ECL80	0.10		
30C17	0.10	30C18	0.25	ECC85	0.10	U26	0.10	ECL82	0.10		
PL83	0.10	PL84	0.10	EH90	0.10						

Please note there is 25p Postage and Packing per order.

WE DO NOT SELL RUBBISH AT BRIARWOOD TV

D/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	EHT	REG	CON	S/OUTPUT	POWER	L/TB	F/TB
Bush/Murphy	6.50	6.50	6.50	—	—	6.50	1.50	6.50	—	—
GEC/Sobell	6.50	7.50	—	—	—	6.50	—	—	—	7.50
Philips	6.50	9.50	—	—	—	7.50	—	—	—	6.50
Decca	6.50	9.00	9.00	—	—	6.50	2.00 (19" only)	8.00	—	6.00
Thorn 2000	5.00	5.00	5.00	6.50	6.50	6.00	—	6.50	10.00	6.50
Pye	7.50	7.50	9.50	—	—	6.50	—	—	—	7.50
Baird	6.50	8.50	7.00	—	—	6.50	—	—	—	6.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	VIDEO	CON	POWER	L/TB	F/TB
Bush 184	7.50	—	12.00	—	8.00	6.00	12.00	—
GEC Hybrid	7.50	6.50	10.00	—	6.00	—	—	12.00
Philips G6 S/S	9.50	—	10.00	—	6.00	—	—	6.00
Thorn 3000	6.50	6.50	8.00	6.50	6.00	20.00	20.00	6.50
Pye 691/693	6.50	6.50	10.00	—	6.50	—	15.00	6.50
Thorn 3500	6.50	6.50	8.00	6.50	7.50	20.00	20.50	6.50

Korting and other foreign panels available on request.

Postage & Packing £1.25

COLOUR TUBES

19"	£18.00
19" A49, 192	£20.00
20"	£20.00
22"	£22.00
25"	£18.00
26"	£28.00

Plus P&P £4.

NEW
Rebuilt tubes available on request.

COLOUR TUNERS

Bush	£6.00
GEC	£6.00
Philips G6 S/S	£6.00
Thorn 3000	£6.00
Pye 691	£6.00

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

COLOUR LOPTS
Most Lopts available from £7.00. Both British & Foreign makes. Please ring or write.
P&P per Lopt £1.

MISC.
S/Output transformer from £1.50.
F/Output from £1.25.
Scancoils from £5.00.
P&P £1.
Other spares available on request.

G8 PANELS
SPECIAL OFFER
CHROMA £12.00

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

MAIL ORDER T.Vs. IN GOOD WORKING ORDER

COLOUR

Pye	19"	£60.00	22"	£65.00	26"	£75.00
GEC	19"	£60.00	22"	£65.00	26"	£75.00
Bush	19"	£80.00	22"	£80.00	26"	£90.00
Philips	G6	—	22"	£63.00	26"	£70.00

Many other makes & models available.
Please ring or write for information.

PERSONAL CALLERS WELCOME.

MONO

20" & 24" S/S	£16.00	Pye, GEC, Bush etc.
20" & 24" D/S	£14.00	Pye, GEC, Bush etc.
19" & 23" D/S	P/button £12.00	Pye, GEC, Bush etc.
19" & 23" D/S	Rotary £8.00	Pye, GEC, Bush etc.

Please note there is 15% V.A.T. on all the above prices.
Plus £8 P&P. England, Wales & Scotland for colour T.V.'s. Inland N. & S. Ireland P&P £15. P&P £5 for mono T.V.'s to England, Wales & Scotland. Inland N. & S. Ireland £7 per set.

Briarwood T.V. Limited
Britain's Mail Order T.V. Specialists

BRIARWOOD

OTV

THE LARGEST STOCKS OF GENUINE PART-EXCHANGED COLOUR T.V.'s IN THE COUNTRY – UNDER ONE ROOF.

REGULAR LARGE DELIVERIES EVERY WEEK INCLUDE—

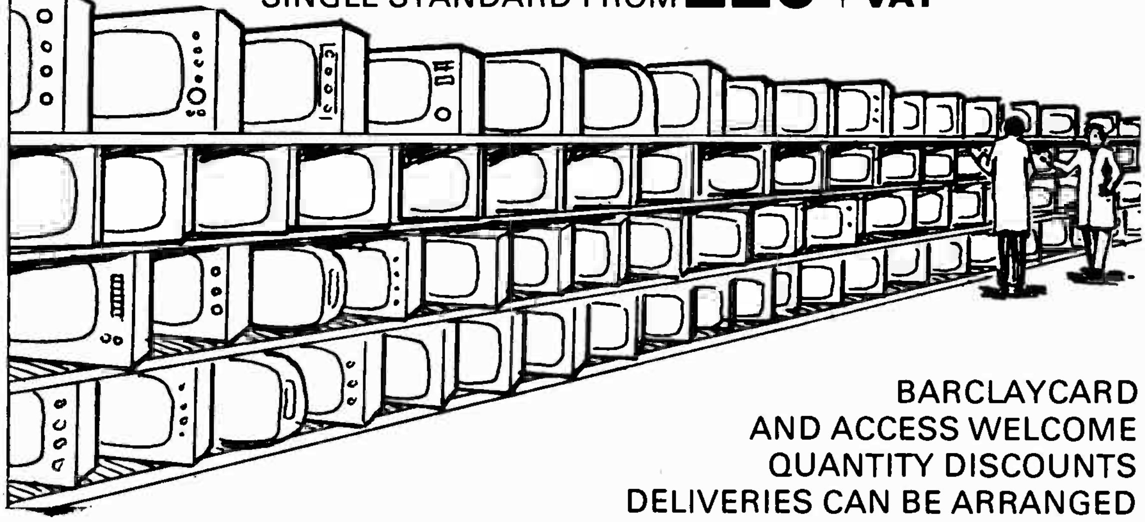
Philips 511/512/G8 etc., Bush, Murphy, Thorn 3000/3500/8000/8500, GEC all models, Pye Varicap, Grundig, Telefunken, Saba, Decca Bradford, Nordmende, B. & O., Emo, Finlux, Luxor, Korting, Hitachi, Sanyo, Toshiba, etc., etc., etc.

SPECIAL LOW SUMMER PRICES

Now in operation

DUAL STANDARD FROM **£5** + **VAT**

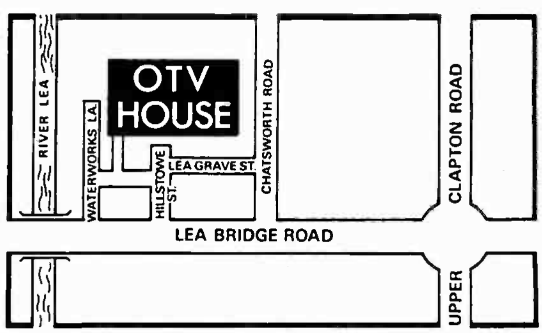
SINGLE STANDARD FROM **£20** + **VAT**



BARCLAYCARD
AND ACCESS WELCOME
QUANTITY DISCOUNTS
DELIVERIES CAN BE ARRANGED

SUPERB TESTING FACILITIES AVAILABLE

OTV TELEVISION LTD,
144A Lea Bridge Rd,
London E5 9RB.
Tel: 01-985 6111/8687



We specialise in Export

Enquiries invited from the Middle East and Third World Countries.

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.46
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.38
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.92
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	0.35
AF115	0.35
AF116	0.41
AF117	0.42
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.38
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.38
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	1.58

Type	Price (£)
AU103	2.40
AU107	2.75
AU110	2.40
AU113	2.80
BC107*	0.16
BC108*	0.15
BC109*	0.16
BC113	†0.22
BC114	†0.22
BC115	†0.24
BC116*	†0.25
BC117	†0.30
BC118	†0.24
BC119	†0.34
BC125*	†0.30
BC126	†0.30
BC132	†0.20
BC134	†0.22
BC135	†0.21
BC136	†0.22
BC137	†0.30
BC138	†0.35
BC140	0.36
BC141	0.44
BC142	0.35
BC143	0.38
BC147*	†0.12
BC148*	†0.12
BC149*	†0.13
BC152	†0.42
BC153	†0.38
BC154	†0.41
BC157*	†0.13
BC158*	†0.12
BC159*	†0.14
BC160	0.52
BC161	†0.58
BC167B	†0.15
BC168B	†0.14
BC169C	†0.15
BC170*	†0.15
BC171*	†0.15
BC172*	†0.14
BC173*	†0.22
BC174A & B	†0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	†0.15
BC182L*	†0.15
BC183*	†0.14
BC183L*	†0.14
BC184*	†0.15
BC184L*	†0.15
BC185	0.36
BC186	0.25
BC187	0.27

Type	Price (£)
BC192	0.56
BC204*	†0.39
BC205*	†0.39
BC206*	†0.37
BC207*	†0.39
BC208*	†0.37
BC209*	†0.39
BC211*	†0.36
BC212*	†0.17
BC212L*	†0.17
BC213*	†0.16
BC213L*	†0.16
BC214*	†0.18
BC214L*	†0.18
BC225	†0.42
BC237*	†0.16
BC238*	†0.15
BC239*	†0.22
BC251*	†0.25
BC252*	†0.26
BC253*	†0.38
BC261A*	†0.28
BC262A*	†0.28
BC263*	†0.26
BC267*	0.20
BC268*	0.28
BC286	0.40
BC287	0.49
BC291	0.27
BC294	†0.37
BC297	0.36
BC300	0.62
BC301	0.38
BC302	0.66
BC303	0.84
BC304	0.44
BC307*	†0.17
BC308*	†0.14
BC309*	†0.18
BC317*	†0.15
BC318*	†0.15
BC319*	†0.19
BC320	†0.17
BC321A&B	†0.18
BC322	†0.28
BC323	1.15
BC327	†0.16
BC328	†0.18
BC337	†0.17
BC338	†0.17
BC340	0.19
BC347*	†0.17
BC348A & B	†0.17
BC349B	†0.17
BC350*	†0.24
BC351*	†0.22
BC352A*	†0.24
BC360	0.59

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	†0.13
BC548*	†0.13
BC549*	†0.15
BC550	†0.24
BC556	†0.23
BC557*	†0.16
BC558*	†0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.06
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	†0.37
BD136	†0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	†0.51
BD155	†0.90
BD157	0.81
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.68
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

Type	Price (£)
BD234	0.68
BD235	0.63
BD236	0.63
BD237	0.66
BD238	0.68
BD253	1.58
BD410	1.65
BD433	0.65
BD435	0.70
BD436	0.71
BD437	0.74
BD438	0.75
BD519	0.88
BD520	0.88
BD599	0.87
BD600	1.23
BD663BR	0.68
BDX18	1.55
BDX32	2.95
BDY16A	0.63
BDY18	1.55
BDY20	2.29
BDY38	1.38
BF115	0.48
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.48
BF125	0.68
BF127	0.51
BF137F	0.78
BF152	†0.19
BF158	†0.25
BF159	†0.27
BF160	†0.20
BF161	0.64
BF163	†0.65
BF164	†0.95
BF166	0.50
BF167	0.36
BF173	0.35
BF177	0.36
BF178	0.48
BF179	0.58
BF180	0.53
BF181	0.53
BF182	0.44
BF183	0.52
BF184	0.44
BF185	0.42
BF186	0.42
BF194*	†0.14
BF195*	†0.13
BF196	†0.14
BF197	†0.15
BF198	†0.29
BF199	†0.29
BF200	†0.26
BF218	†0.42

Type	Price (£)
BF222	†0.51
BF224 & J	†0.22
BF240	†0.32
BF241	†0.31
BF244*	†0.51
BF245*	†0.43
BF254	†0.48
BF255	†0.58
BF256L*	†0.49
BF257	†0.44
BF258	0.52
BF259	†0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.42
BF272A	0.80
BF273	†0.33
BF274	†0.34
BF336	0.63
BF337	0.65
BF338	0.68
BF355	†0.72
BF362	†0.49
BF363	†0.49
BF367	†0.29
BF451	0.43
BF457	0.46
BF458	0.49
BF459	0.52
BF594	†0.16
BF596	†0.17
BF597	†0.27
BFR39	†0.30
BFR40	†0.29
BFR41	†0.30
BFR50	†0.29
BFR52	†0.33
BFR61	†0.29
BFR62	†0.28
BFR79	†0.30
BFR80	†0.29
BFR81	†0.30
BFR88	†0.42
BFT41	0.48
BFT43	0.55
BFW11	1.02
BFW30	2.58
BFW59	†0.19
BFW60	†0.20
BFW90	†0.65
BFX29	0.38
BFX84	0.42
BFY50	0.38
BFY51	0.37
BFY52	0.36
BFY53	0.36
BFY90	1.98
BPX25	1.62

Type	Price (£)
BPX29	1.62
BR101	0.53
BR103	0.64
BR303	1.06
BRC4443	1.78
BRY39	0.80
BRY56	†0.44
BSS27	0.92
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	2.85
BU105	†1.80
BU105/02	†1.95
BU108	†2.98
BU126	†2.91
BU204	†2.50
BU205	†2.78
BU206	†3.09
BU208	†4.88
BU407	†1.38
BUY77	2.50
C106D	0.80
C106F	0.43
C111E	†0.46
D40N1	0.64
E1222	0.47
E5024	†0.19
GET872	0.46
MC140	†0.36
ME0402	†0.18
MF0404/02	†0.18
ME6001	†0.18
ME6002	†0.18
MJ2955	1.30
MJ3000	1.58
MJE340	0.58
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	1.22
MPF102	†0.40
MPS3702	†0.33
MPS3705	†0.30
MPS6521	†0.36
MPS6523	†0.36
MPS6566	†0.44
MPSA05	†0.30
MPSA06	†0.32
MPSA55	†0.43
MPSA56	†0.45
MPSA93	†0.56
MPSL01	†0.33
MPSU01	0.61

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	†0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R2008B	†2.92
R2010B	†2.79
R2322	†0.75
R2323	†0.85
ST2110	0.49
ST6120	0.48
TIC44	†0.25
TIC46	†0.35
TIC47	†0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.51
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	†0.44
TIS73	†1.38
TIS90	†0.23
TIS91	†0.28
ZTX108	†0.14
ZTX109	†0.16
ZTX213	†0.23
ZTX300	†0.16
ZTX304	†0.26

Type	Price (£)
ZTX500	†0.18
ZTX502	†0.22
ZTX504	†0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	8.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	†0.15
2N2926O	†0.14
2N2926Y	†0.14
2N2955	1.12
2N3053	0.48
2N3054	0.66
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	12.70
2N3703	†0.17
2N3704	†0.19
2N3705	†0.17
2N3706	†0.18
2N3707	†0.18
2N3708	†0.17
2N3715	1.70
2N3771	2.39
2N3772	2.58
2N3773	3.90
2N3794	†0.40

Type	Price (£)
2N3819	†0.47
2N3820	0.72
2N3866	1.08
2N3904	†0.20
2N3905	†0.20
2N3906	†0.20
2N4036	0.94
2N4123	†0.17
2N4124	†0.17
2N4126	†0.17
2N4236	2.20
2N4289	†0.32
2N4292	†0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
2N5042	1.65
2N5060	†0.28
2N5061	†0.30
2N5064	†0.63
2N5086	†0.49
2N5087	†0.50
2N5208	†0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.15
2N5449	†0.18
2N5457	†0.46
2N5458	†0.40
2N5459	†0.58
2N5494	0.85
2N5496	1.06
2N6027	0.55
2N6107	0.71
2N6122	0.80
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB337BP	4.26
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.56
2SD234	1.48
3N128	1.60
40250	0.98
40251	1.14
40327	0.67
40361	0.48
40362	0.50
40410	0.94
40429	0.88
40530	0.79
40595	1.39
40603	1.13
40636	1.25
40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
BRC1330	†0.93
CA810QM	2.44
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	†2.40
FCJ101	†3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	3.08
MC1307P	†1.82
MC1310P*	†1.94
MC1312P	2.34
MC1327P*	†1.66
MC1330P	†0.93
MC1350P	†1.22
MC1351P	†1.42
MC1352P	†1.42
MC1357P	†2.92
MC1358P*	†2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4008	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	2.58
ML231	†3.57
ML232	†3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	†5.70
SAA1025	†10.35
SAS560A	†2.[illegible]
SAS570	†2.01
SC9503P	†1.40
SC9504P	†1.38
SL414A	1.91
SL432A	2.82
SL450	5.10
SL901B	†4.20
SL917B	†5.60
SL918A	†5.95
SN72440N	†2.21
SN76001N	†1.67
SN76003N	2.22

Type	Price (£)
SN76008KE	1.56
SN76013N	1.56
SN76013ND	1.40
SN76018KE	1.56
SN76023N	1.56
SN76023ND	1.40
SN76033N	2.22
SN76110N	1.20
SN76115N	†1.82
SN76116N	1.78
SN76131N	†2.10
SN76226N	†2.60
SN70227N	†1.61
SN76228N	†1.80
SN76502N	†1.92
SN76530P	†0.97
SN76533N	†1.38
SN76544N	†1.85
SN76546N	†1.85
SN76570N	†1.81
SN76620AN	†0.99
SN76650N	†1.48
SN76660N	†0.64
SN76666N	†0.96
TA7073P	†3.51
TAA263	†2.20
TAA300	†3.85
TAA320	1.10
TAA350A	†2.48
TAA370A	3.18
TAA435	†1.70
TAA450	†3.39
TAA521	1.10
TAA522	2.09
TAA550	0.45
TAA560	1.93
TAA570	†2.30
TAA611A	1.67
TAA611B	1.89
TAA621AXI	2.33
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	†2.80
TAA840	†3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	†2.25
TAA970	†2.48
TAD100	†2.66
(Filter)	0.98
TBA120A	†0.90
TBA120S*	†0.99
TBA120SA	†1.02
TBA231	1.12

Type	Price (£)
TBA240A	†3.98
TBA281	†2.07
TBA395*	†2.58
TBA396	†2.40
TBA400	†2.20
TBA480Q	†1.64
TBA500*	†2.21
TBA510*	†2.21
TBA520P*	†3.40
TBA530P	†2.24
TBA540*	†2.88
TBA550*	†3.13
TBA560C*	†3.18
TBA570*	†1.29
TBA611B	2.68
TBA641	2.55
TBA641A12	2.58
TBA641B11	2.61
TBA651	†2.12
TBA673	†2.19
TBA700*	†2.50
TBA720AQ	†2.38
TBA720Q	†2.38
TBA750*	†2.18
TBA800	†1.65
TBA810AS	†1.69
TBA920*	†3.80
TBA940	†3.52
TBA950	†2.78
TBA990*	†2.90
TCA270A*	†3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	1.98
TCA440	1.67
TCA640	2.76
TCA650	2.76
TCA660	2.76
TCA730	3.54
TCA740	3.04
TCA750	2.53
TCA760	1.52
TCA820	3.29
TDA440	†4.18
TDA1003	1.52
TDA1004	2.73
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	1.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

* Indicates Q version is also available.

DIODES

Type	Price (£)
AA113	0.17
AA119	0.21
AA129	0.28
AA143	0.18
AAY30	0.28
AAZ13	0.42
AAZ15	0.36
AAZ17	0.28
AY102	3.85
BA100	0.24
BA102	0.38
BA104	0.19
BA110	0.80
BA111	0.70
BA115	0.17
BA116	0.56
BA121	0.85
BA129	0.45
BA145	0.19
BA148	0.19
BA154	0.06
BA155	0.17
BA156	0.12
BA157	0.25
BA158	0.28
BA159	0.40
BA164	0.14
BA170	0.18
BA182	0.27
BA201	0.13
BA202	0.14
BA203	0.14
BA216	0.08
BA219	0.11
BA243	0.45
BA317	0.06
BA318	0.07
BAV10	0.10
BAV21	0.18
BAW62	0.06
BAX13	0.07
BAX16	0.10
BAX17	0.19
BAY72	0.16
BB104B	0.52
BB105B	0.33
BB105G	0.30
BR100	0.40
BY100	0.35
BY103	0.35

Type	Price (£)
BY114	0.60
BY118	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY184	0.44
BY189	5.30
BY190	4.90
BY206	0.26
BY238	0.25
BYX10	0.30
BYX38/600	0.70
BYX70/500	0.53
ITT44	0.08
ITT210	0.63
ITT827	0.80
MCR101	0.43
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

ZENER DIODES

400mW plastic	3.0-33V	14p each
1/1.3W plastic	3.3-180V	18p each
1.5W flange	4.7-75V	£1.28 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	0.46
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	0.66
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/PB10	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	0.88
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	£1.40	£6.40
¼W 10Ω-10MΩ (E24)	3p 25p	95p	£1.40	£6.40
1W 10Ω-10MΩ (E12)	5p 45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p 80p	£3.60	£6.40	£28.80

Wirewound (5%)

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

Presets (†)
0.1W (Vertical and Horizontal) 100, 220, 470Ω, 1, 2.2, 4.7, 10, 22, 47, 100, 220, 470kΩ, 1, 2.5, 5MΩ all 14p each
0.2W (Vertical and Horizontal) Values as 0.1W all 14p each

FUSES (all packs of 10)

20mm Time Delay (BEAB)
40mA £3.68
50, 63mA £2.55
100mA £1.68
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)
COLOURTEXT ADAPTOR 7026
Full facility Colourtext decoder to place between aerial and receiver. All you would expect of a quality ready-made unit. Leaflet on request. †£340.20

COLOUR BAR GENERATOR
CM6052/D8. 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. £182.25

TELEVISION COLOUR RECEIVER MK II

SEMI CONDUCTOR PACK No. 1 (Power Supply)

All Parts as Published £6.45 (inclusive of 51p VAT and p & p)

P. & P. UK: £0.12 per order. **Overseas:** At cost.
Please add VAT at 8% and 12½% on items marked†.
It is only possible to show part of our range here. Our catalogue (30p refundable) shows Service Aids, 7400 series, CMOS, op amps, SCRs etc., hardware, capacitors, special TV items and many more transistors, diodes, i.c.'s and valves.
Giro A/c 23 532 400. *A/c facilities available*

CAPACITORS

Metallised Paper (†)

2n2F	1500V DC	60p	10nF	500V AC	80p
2n2F	600V AC	24p	15nF	300V AC	30p
3n6F	1700V DC	60p	22nF	300V AC	32p
4n7F	1500V DC	60p	100nF	1000V DC	20p
10nF	1000V DC	22p	470nF	1000V DC	60p

H.V. Disc Ceramic (†)

1kV	1.5nF	18p	8kV	250, 270, 300pF	39p
3kV	1.5nF	20p	10kV	1nF	87p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p	18kV	1nF	73p

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

VHF to UHF CONVERTER CM6022/RA. "Televerta" for DX-ing or uhf receiver use on relay systems, Eire etc. †£24.40

EAST CORNWALL COMPONENTS

CALLINGTON – CORNWALL PL17 7DW

TEL: CALLINGTON (05793) 2637. TELEX: 35544 (OFFICE OPEN 9.30-5.00 MON-FRI)

TELEVISION

EDITOR
John A. Reddihough

ASSISTANT EDITOR
Luke Theodossiou

ART EDITOR
Roy Palmer

ADVERTS MANAGER
Roy Smith 01-261 6671

CLASSIFIED ADVERTS
Colin R. Brown 01-261 5762

A decade of the VCR

The 70s have seen the development of the domestic VCR from initial laboratory prototypes to an established consumer product. At the start of the decade, there were numerous intimations that a number of firms had development projects under way. There were also proposals for other domestic video systems, both disc (Teldec) and film (EVR), that subsequently fell by the wayside. The first domestic VCR system to appear, Cartrivision, was introduced in the USA in mid-1972. It was not a success. It appears to have lasted for about a year, by which time Ampex had also decided to drop its proposed Instavideo system. Though RCA continued work on various proposed systems, including discs and a holographic system using cheap plastic film, US firms then seem to have lost interest.

The main development was continued by Philips in Europe and various Japanese firms, in particular JVC and Sony. Philips were first to introduce a successful system in launching the N1500 on the European market in 1973. It gave an hours' recording/playback time. Up-dated versions were introduced in 1975 (N1501) and 1976 (N1502), and the N1700 with its two hours' (later two and a half hours') record/playback time was launched in late 1977. Philips never seen to have been keen to enter the US market with an NTSC version.

The Japanese video manufacturers battled it out over the years 1976-7 in their own and the US markets. Several systems came and went, and at the end of it all Sony's Beta II and JVC's VHS systems had become firmly established. During 1978, PAL versions were launched in the UK, giving three hours' playing time. Improved versions have already appeared, the main items receiving manufacturers' attention being timers with extended operating periods, facilities for locating particular parts of the recorded material quickly and easily, and the provision of pause controls.

There is no doubt that many leading international TV firms regard domestic video as the key to their future. The colour TV markets in the developed world have reached saturation point – the markets are now mainly first-time buyers and replacement ones – while it's likely that countries such as Korea, Taiwan and Singapore will scoop third world TV markets as they open up. So video is an obvious thing for Japanese and European TV firms to go for.

Seeing the growing dominance of the Japanese video firms, Grundig decided to develop a variant on the N1700 system with more sophisticated features such as search-tuning. Its SVR system, giving four hours' playing time, was launched in 1978.

Which brings us close to the end of the decade and the recent announcement of the joint Philips/Grundig V2000 system. You might have thought that there were enough non-compatible VCR systems already. True enough, but if a major technical breakthrough has been achieved then yet another system is justified. All the systems so far use $\frac{1}{2}$in. tape. What Philips and Grundig have succeeded in doing is to get up to eight hours' playing time (with a corresponding reduction in tape costs) from a cassette, by making use of the tape twice over. In fact it's a $\frac{1}{4}$in. recording system on $\frac{1}{2}$in. tape, the arrangement being similar to the standard audio cassette. This involves the use of some sophisticated techniques, in particular dynamic track following, in order to maintain correct head/track alignment. We shall have to wait to see whether the system is accepted in practice however. As they say, the proof of the pudding is in the eating. Philips and Grundig are nevertheless to be congratulated on their successful development of the new system, and it's refreshing to find that the European TV industry is not prepared to play second fiddle to you know who.

The situation is unlikely to end at this point however. Other systems are under development. Funai Electric of Japan for example intends to introduce a system using a $\frac{1}{4}$in.-tape cassette, and there is some emphasis on the development of light-weight portable machines – the present generation of VCRs is hardly acceptable for portable use, being intended mainly as time-shift devices (seeing the programmes when you want to rather than when the broadcasting schedules dictate).

The intense competition in the video field has given the consumer the benefit of very reasonable VCR prices. Manufacturers can hardly have made much out of their VCR efforts to date. What are the prospects? We still incline towards pessimism. Do people have the time or inclination, even if they have the spare cash, to dabble with yet another piece of domestic technology? It's one thing to pick up the paper or switch on the radio or telly, another to organise yourself so that you can decide what you want to see and when a week or more in advance, and then arrange everything accordingly. And of course the marketing effort will be against a background of forecast deepening world economic recession.

Correction: The value of R9 in the class AB video circuit featured in the monochrome monitor conversion article last month should have been shown as 47kΩ, not 27kΩ.

Teletopics

TELETEXT TROUBLE

Setmakers, through BREMA, have expressed concern over the slow growth of the teletext service and are understood to be seeking government assistance. Production of teletext-equipped sets has failed to reach anything like the expected levels. The industry had originally hoped to sell about 40,000 teletext-equipped receivers by the end of 1977, but to date only some 20,000 sets have been sold. Production potential is said to be around 50,000 sets a year, but only half this number is at present being produced. The industry is blaming the price of teletext-equipped sets – around £700 for a 26in. model. It's felt that the public will begin to buy in large numbers only when teletext sets are available at an extra £60 to £70.

Apparently some i.c. manufacturers have encountered problems in getting the chips to operate at the frequencies involved. The price of sets of teletext i.c.s is certainly appreciable at present, accounting for much of the high price premium of teletext sets. Setmakers feel that a major breakthrough would occur if the price of the sets of chips could be brought down to around £10 to £15. This is one of those awkward chicken and egg problems however. Low production means high prices, and until volume production commences the prices will remain high.

With a saturated TV market, increased public demand for teletext sets will come mainly through replacement sales. Whilst replacement buyers frequently go up market, the present premium seems to be a deterrent to many purchasers.

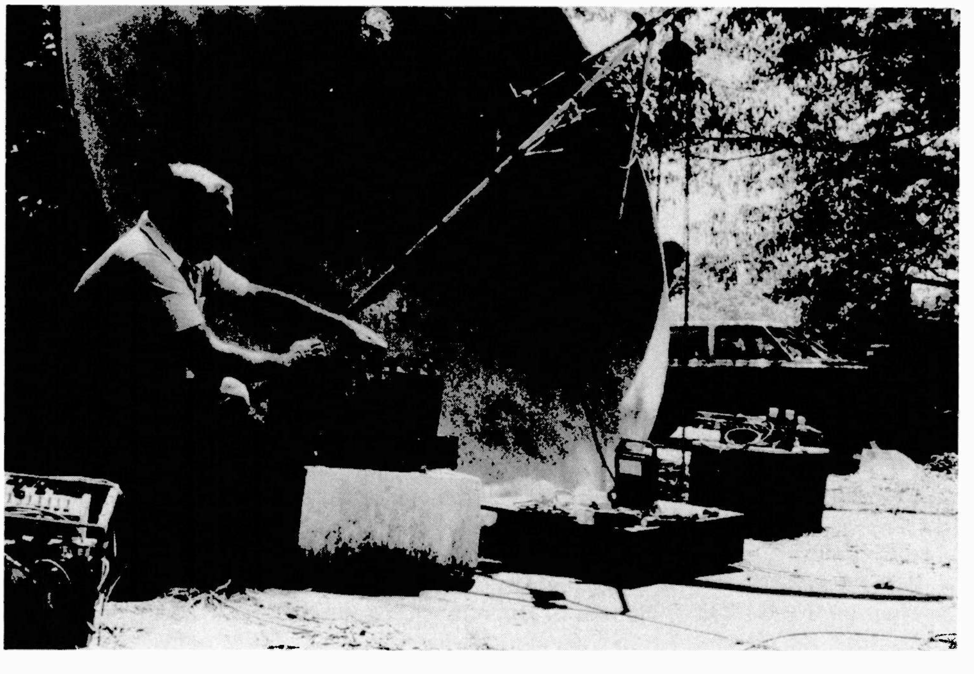
DOMESTIC SATELLITE TV RECEPTION STARTS IN THE US

Satellites have been in use for some time now in the USA for coast-to-coast TV programme distribution, and have in particular benefited cable system operators in enabling them to increase substantially the number of channels available to their subscribers. So why not set up your own backyard terminal, and link yourself to the satellite TV distribution system? Well cost for one thing. Until recently, it seems.

As we go to press with this issue a Satellite Private Terminal Seminar (SPTS-79) is being held in Oklahoma City, co-ordinated by Bob Cooper who is well known for his DX-TV activities and as the former editor-in-chief of the CATJ magazine. Four years ago a satellite receiver terminal would cost you over $100,000. The cost a year ago was $25,000, and has now fallen to under $8,000. If you have the knowledge to build and set up your own terminal however, the cost can be in the region of $500 to $1,000, depending on how much surplus equipment you can obtain to incorporate in the installation. Those attending the seminar were provided with two complete sets of plans for building a satellite terminal – the Coleman Conversion and the Howard Terminal.

EXTENDED PLAY VIDEODISCS

The battle of the VCR systems raged mainly around how many hours' playing time you could get out of the cassette. Now that Philips are test marketing their videodiscs in the USA (in Seattle and Atlanta initially) a similar contest seems to be looming up. The basic Philips videodisc, which we described in some detail in our June 1975 issue, has a playing time of an hour – half an hour per side. This is rather wasteful of disc space however if you think about it. The laser scans the disc from the centre outwards, each rotation of the disc giving a complete picture, i.e. two fields. This means that at the end of the disc (outer edge) a field takes up far more space than at the centre. Much more information could be crammed on the disc if the length of track occupied by a field was kept constant from the centre to the outer edge, with the disc speed being reduced accordingly as the scan proceeds. This is the proposal put



Robert Coleman of South Carolina with his $200 satellite TV receiver terminal. Surplus equipment which Robert obtained over a six-month period enabled the cost to be kept to a minimum. Robert Coleman is believed to be the first individual working privately to design and bring into operation state-of-the-art gallium-arsenide f.e.t. low-noise amplifiers for this service. Coleman's receiver electronics cost him less than $50 to assemble and put together: he was one of the programme instructors at the recent Satellite Private Terminal Seminar held in Oklahoma City.

forward by Philips for their Extended Play videodisc. There would be one complete picture per disc rotation at the centre, as with the Standard Play disc, and three complete pictures per rotation at the outer edge, the speed being progressively decreased from 1,800 r.p.m. at the centre to 600 r.p.m. at the outer edge.

Sony, who have also demonstrated a working optically-scanned videodisc system, have put forward an alternative suggestion – halving the disc speed to double the playing time.

TV4

The Government is to introduce a bill during the next parliamentary session extending the life of the IBA and giving it responsibility, "subject to strict safeguards", for the fourth TV programme. If all goes ahead as at present planned, TV4 is expected to open as a commercial network under IBA control in late 1982 or early 1983. The previous Government had authorised the IBA to commence engineering work for the new network.

MARKET FORECASTS

Mackintosh Consultants have issued a prediction that by 1982 72 per cent of Western European homes will have a colour receiver – this compares with 47 per cent last year. There is considerable variation between countries at present. Whilst the W. German, UK and Swedish markets are virtually saturated for example, only 15 per cent of Spanish homes have a colour receiver. The Spanish market is not likely to provide opportunities for hard-pressed German and UK setmakers however, since the Spanish TV industry enjoys a considerable measure of protection while per capita income is likely to prevent a rapid growth of sales.

As a result of excess production by W. German setmakers over a million sets are now estimated to be held in stock. Prices have fallen by a quarter, and some plants are working on short time.

The total European VCR market last year reached 225,000. BREMA figures suggest that UK imports had risen from 22,000 in 1977 to 95,000 last year. Mackintosh suggest that if the average VCR retail price falls below £600, European sales this year could reach 450,000.

The Henley Centre for Forecasting has also been looking at its crystal ball. Predictions here are that UK VCR sales could reach 150,000 this year, and that the market value of video systems will show an increase of over 1,000 per cent over the period 1978-84.

STATION OPENINGS

The following relay transmitters are now in operation:

Brushford (West Somerset) BBC-1 ch. 21, Westward Television ch. 24, BBC-2 ch. 27. Receiving aerial group A.

Claonaig (Kintyre) BBC-1 ch. 55, Scottish Television ch. 59, BBC-2 ch. 62. Receiving aerial group C/D.

Dowlais (Mid-Glamorgan) BBC-Wales ch. 58, HTV Wales ch. 61, BBC-2 ch. 64. Receiving aerial group C/D.

Faversham (Kent) BBC-1 ch. 22, Southern Television ch. 25, BBC-2 ch. 28. Receiving aerial group A.

Grantown-on-Spey (Highland) Grampian Television ch. 41, BBC-2 ch. 44, BBC-1 ch. 51. Receiving aerial group B.

Ireshopeburn (Co. Durham) BBC-1 ch. 55, Tyne Tees Television ch. 59, BBC-2 ch. 62. Receiving aerial group C/D.

Oban (Strathclyde) Scottish Television ch. 41, BBC-2 ch. 44, BBC-1 ch. 51. Receiving aerial group B.

Walthamstow (London) BBC-1 ch. 45, Thames/London Weekend Television ch. 49, BBC-2 ch. 66. Receiving aerial group E.

All the above transmissions are vertically polarised.

The latest (May, 1979) issue of the IBA's invaluable pocket guide to transmitting stations has now been published. Copies can be obtained from the IBA Engineering Information Service, Crawley Court, Winchester, Hants, S021 2QA.

JAPANESE BUY UK CHIPS

Matsushita has placed an order with Plessey for 200,000 1GHz divide-by-256 CMOS i.c.s for use in a frequency synthesiser tuning system to be incorporated in up-market Panasonic TV receivers. The Plessey chip has been selected because it's the only 1GHz divider that can drive CMOS metal-gate logic directly without the need for low-power Schottky interfacing.

SUPERTITLING

Amongst the systems under development at the IBA's engineering headquarters is a new process called "Supertitles" to help the hard-of-hearing follow TV programmes. The system operates on the same principles as teletext, boxed captions appearing at the bottom of the screen. One problem is the fact that most people speak at a rate of around 160 words per minute, while few typists or machines can handle much over 80 words per minute. Southampton University is collaborating with the IBA on the project.

FLAT-SCREEN TV FROM SINCLAIR?

At a recent press conference Clive Sinclair announced that his company is in the final stages of developing a flat-screen TV receiver. The initial model would be a 3in. portable the size of a small paperback, but the principle can apparently also be used for large-screen models. What exactly the principle is remains something of a mystery, the only fact to emerge being that the screen is 3/8in. thick. Sinclair Radionics is unable to finance the establishment of a production line for the new development however, and is looking for a partner willing to provide the required investment. Meanwhile production of the present Microvision model is being moved from the company's St. Ives factory, where 160 redundancies have been announced, to a new and so far undisclosed location.

THE PYE STORY

A twenty page booklet marking the fiftieth anniversary of the formation of Pye Radio Limited is available to members of the public on application to Pye Ltd., Publications Department, 137 Ditton Walk, Cambridge. This fascinating little publication, entitled *"The Story of Pye Wireless"*, traces the history of Pye receivers from the early twenties (the Pye Unit System of 1922) to the present day. TV sets, from 1936 on, naturally also feature in the story. Many of the early sets are illustrated.

An intriguing part of the story is the creation of Pye village industries throughout East Anglia during the 1939-45 war. The Government had suggested that Pye build a giant shadow factory. Instead however Pye took work to the villages in order to make use of the vast productivity potential of the area. By the end of the war the most complicated electronic equipment was being made in every corner of East Anglia, many people working at home. Pye had over 14,000 employees in village industries at the time.

Receiving French TV

Hugh Cocks

FRENCH TV can be received on a permanent or semi-permanent basis over quite a large area of England (apologies to those in Scotland, N. Ireland and Wales). Signals are present all the time along the entire south coast and a fair way up the east coast, and extend some way inland. During settled weather conditions, very strong signals are present over much of the country. There are three French TV networks, Television Francaise 1, Antenne 2, and France Regions 3. They can provide a refreshing change from our local programmes, especially the late night films! Language is not too great a problem: it's surprising how one tends to pick it up after watching for a while, though fast-spoken French in films can be a problem.

French TV System

As in the UK, all three networks use the same transmitter sites at u.h.f. The old 819-line system, used by TF-1 at v.h.f., is becoming obsolete and dates for the closedown of this service are being suggested, giving way to a new 625-line v.h.f. service (where have we heard that before?!).

The u.h.f. network uses system L. This has positive-going vision modulation, a.m. sound spaced 6·5MHz above the vision carrier, and SECAM colour with the subcarriers (two) at roughly the same frequency as our one subcarrier. Needless to say, a UK system I TV receiver won't think very much of the French transmissions, producing a somewhat jumbled negative picture with mostly buzzing from the loudspeaker. A system I set can be used to line up the aerials in the first place however, before you get too committed with system L receivers.

Which Transmitter?

The first thing to decide is which transmitter to try to receive. The map shown in Fig. 1 indicates the transmitters most favourably received in the UK. Those marked with an asterisk are lower powered ones, but can be well received under good conditions. A problem that has to be taken into account is UK transmitters on the same or adjacent channels. The channel groupings correspond to our own (the channel numbers are exactly the same) with the exception of Boulogne where a wideband aerial will be required.

As a very approximate guide to the "UK service area" of these transmitters, Lille is strongest up the east coast and in inland areas; Boulogne in east Kent and south east Sussex; Caen from mid-Sussex to east Devon; Brest in the south west; and Rennes in the Channel Islands. Obviously the local terrain and UK relay transmitters may make the final selection of a transmitter somewhat different from this rough guide.

Care is required in receiving Caen in central southern England, as the aerial will be pointing more or less at Rowridge, Isle of Wight, which is only one channel away. Extra i.f. and aerial filters may be required therefore in order to get good results – to say nothing of high-gain aerials with a sharp forward pickup lobe. Sideways stacked aerials are recommended, especially in this area, in order to narrow the forward pickup lobe – the problem in most locations will be not so much the strength of the received signal as the level of interference from UK transmitters.

Receivers

As regards receivers, there are several options open to the budding French TV viewer. The obvious one, though expensive, is a quick trip to Boulogne, where a set can be purchased at a price in excess of UK TV prices plus a large dose of French VAT (33%!) to say nothing of UK customs duty. Certain setmakers, notably the German ones, can supply SECAM sets in the UK. It's worth making enquiries.

Perhaps the easiest solution, to start off with anyway, is to convert a UK monochrome TV receiver. Late dual-standard sets are the best, in particular the Bush TV161 series. Modifications are relatively simple with a dual-standard set, as the French system L is a mixture of our 405- and 625-line systems. As a bonus, the set can still be kept dual-standard, switching between the UK and French u.h.f. systems.

Typical Conversion

As an example then we'll take the Bush TV161, though other dual-standard chassis will doubtless serve just as well.

First disconnect the switching linkage between the i.f. and timebase panels, and solder the timebase panel for operation on 625-lines only.

Connect switches 2S1a, b and c on the i.f. panel permanently in the 625-line position. This is best done at the rear of the panel, by breaking the "405" print to the switches and linking the "625" contacts together. To cater for the 6·5MHz spaced French sound, the old 405 sound i.f. needs to be moved from 38·15MHz to 33MHz. This is easily accomplished by increasing the value of C24 in the 2VT2 transistor can from 3·9pF to approximately 5·6pF,

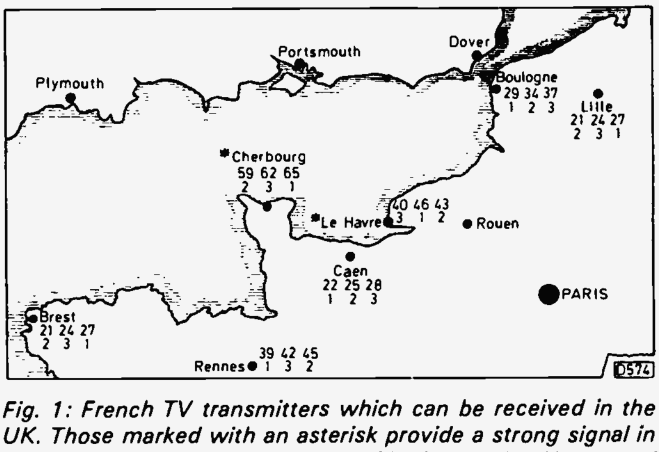


Fig. 1: French TV transmitters which can be received in the UK. Those marked with an asterisk provide a strong signal in good reception conditions only. Cherbourg, Le Havre and Boulogne have an e.r.p. of 100kW, all others an e.r.p. of 1MW. Rouen is also a 1MW transmitter, but the channels are the same as Crystal Palace. The network number is shown beneath the channel number.

increasing the value of C54 in the 2VT5 transistor can from 47pF to 82pF, and increasing the value of C61 in the 2VT6 transistor can from 33pF to 47pF. In the 405-line position the i.f. panel switching now corresponds to the French system, while the 625-line position remains as required for UK reception.

Alignment

When it comes to alignment, no alteration to the UK side of things is required of course. Switch the i.f. strip to the French position, and tune in a French transmission. Sound of sorts should be heard immediately, probably accompanied by buzzing.

Starting with the sound take-off coil L11, adjust for maximum sound and least buzz. Then adjust the first and second sound i.f. coils L26 and L30 for the same results. Go back to L11, and repeat the procedure once or twice. This should produce buzz-free sound. Note that the contrast control (405/French) should not be over advanced, or sound-on-vision and vision-on-sound may result (the old 405-line system complaint!). When satisfied with the sound alignment, tweak L10 (2VT2 can) in the vision channel on test card (yes, the French radiate the PM5544 pattern all afternoon on the third channel!) for optimum frequency response. You should now have a highly sensitive French/UK TV receiver.

Single-standard Sets

Single-standard sets can also be modified, but require a great deal more work – not so much in providing for demodulation of the positive vision signal, but in arranging for the a.m. sound. An approach I've used is to employ the ubiquitous surplus Philips G8 gain and vision selectivity modules (see Fig. 2).

Three modules are required, two selectivity ones and a gain module. Insert one selectivity module immediately after the tuner, diplexing the output from this to the main i.f. strip and to the second selectivity module. The output from the latter goes to the gain module, whose video output pin provides the audio signal. By suitably aligning all the Philips cores, good sound can be obtained.

The correct vision signal sense can be obtained by using a phase-splitter stage in the main i.f. strip, following the vision detector diode. A suitable transistor is often present anyway as an emitter-follower, the simple course then being to take the signal from its collector. Beware of any d.c. coupling. If this is present, a.c. coupling will have to be introduced. You might think that simply reversing the detector diode would do the trick, but this will totally upset the a.g.c. circuit and any d.c. coupling present. No interaction occurs incidentally between the Philips units and the existing i.f. strip.

As it stands of course this results in a single-standard (French) TV receiver. By adding switching (a relay is best) however the sound and vision can be switched back to the UK standard: use the existing 6MHz feed for the sound, and tap the emitter of the phase-splitter transistor for the vision – also cut the supply voltage to the a.m. sound i.f. system.

Colour

The more adventurous reader may ask what scope there is for modifying a UK colour set for SECAM reception. Modifying an existing PAL only board would be a formidable task unfortunately. SECAM is a completely

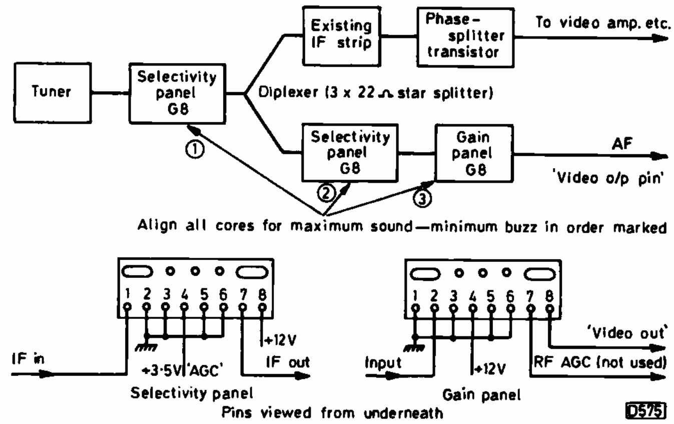


Fig. 2: Block diagram of a single-standard receiver converted for reception of French TV.

different system up to the matrixing of the luminance and colour-difference signals. One or two UK setmakers have produced export versions of their chassis, often with a PAL/SECAM decoder. The latter is a clever one with electronic switching between the two systems. I've seen such a board for the Thorn 3000 chassis. The situation with this is somewhat complicated by the fact that the board was made in Belgium and not by Thorn themselves, who cannot supply it.

Results

Providing there's a clear take-off in the French direction, and interfering signals are at a low level, signals of sorts should be seen at up to 150 miles from a 1MW French u.h.f. transmitter. Needless to say, high-gain aerials mounted as high as is practical should be used, particularly the farther inland one is. As mentioned earlier, the main problem will come from UK transmitters on the same or adjacent channels. If several French transmitters seem likely to be received, a wideband aerial on a rotator could be employed. During enhanced tropospheric conditions the signals become very strong indeed – often with stations from the south of France causing co-channel interference.

If you obtain a SECAM colour receiver, you'll obviously need a higher signal level than for monochrome reception. Below a certain signal level, colour noise increases rapidly with the SECAM system, due to the f.m. threshold effect. This happens only at quite low signal levels however, and in practice SECAM can provide a better signal-to-noise ratio than PAL under mediocre signal conditions. Noise tends to appear as long streaks with SECAM and can be irritating.

It would be possible to build a monochrome French to UK system converter. The French signal would have to be demodulated and then remodulated to the UK standard on a spare UK u.h.f. channel. I can somehow envisage a few G8 modules in the French i.f. strip!

One inconvenient point is that you can never be too sure what programmes are being shown on French TV until the day of the transmission. The French TV guide is published well in advance: it can be ordered through large newsagents.

It should be possible to obtain a teletext decoder or modify a UK one to receive the French Antiope system (different again, needless to say!) and have pages of French information in good signal areas.

Finally, my thanks to many friends in the south of the country who have helped with advice on suitable transmitters for different areas. And my apologies to anyone who is well and truly out of range of French TV . . . ■

The V2000 VCR System

THE new V2000 VCR system which has been jointly developed by Philips and Grundig represents a major advance in VCR technology. The compact cassette, roughly 7 × 1 × 4¼in., is capable of providing up to eight hours' playing time. It achieves this by using a quarter-inch video recording system, i.e. there are two sets of video tracks (see Fig. 1) one above the other on the ½in. tape. The arrangement is the same as that used with audio cassettes: when one track length has been used, the cassette is withdrawn, turned over, and the second section of track is used. With each track section providing up to four hours' playing time, the total playing time is a maximum of eight hours.

The greatly extended playing time – and thus tape economy – has been achieved by cramming yet more information on to the tape. The speeds used are much the same as with other current machines, but the track width is the narrowest yet. As a comparison:

System	*Tape Speed*	*Read/write speed**	*Track Width*
N1700	6·56cm/sec	8·1m/sec	84µm
SVR (Grundig)	3·95cm/sec	8·2m/sec	51µm
VHS	2·339cm/sec	4·83m/sec	49µm
Betamax	1·873cm/sec	6·6m/sec	30µm
V2000	2·44cm/sec	5·08m/sec	22·6µm

*Taking head and tape movement into account.

So the increased information packing density has been attained by using quarter-inch recording and very narrow tracks, laid down side by side. This implies the need for great accuracy in the head/track alignment, and for this purpose a new technique has been adopted – dynamic track following (DTF).

The video heads (see Fig. 3) are mounted on small plates of piezoelectric ceramic material which are in turn attached to the upper section of the head drum. Since piezoelectric material bends when a voltage is applied to it, this enables the heads to be moved vertically. The control voltage is obtained from the head as it follows the track, so that the alignment of the head with the track can be continuously maintained. The use of this technique has other advantages: interchangeability of cassettes between machines is guaranteed, while slow-motion, fast-motion and still-frames can be obtained with good picture quality and without interference.

The self-correcting video head system (dynamic track following) operates during both record and playback. The usual control track is dispensed with. As shown in Fig. 1 there are audio tracks at each side of the tape, both capable of stereophonic recording/reproduction, and cue tracks in the centre. These latter are not used in the initial production VCRs, but will be employed in later development of the system. For control purposes, DTF signals are laid down on the track during recording at frequencies below the 625kHz chrominance subcarrier (see Fig. 4). These vary between adjacent tracks, following the sequence (Fig. 5) 102kHz (f1), 117kHz (f2), 164kHz (f4), 149kHz (f3). Frequencies f1 and f4 are recorded by one head (K1), frequencies f2 and f3 by the other (K2).

Dynamic Track Following

During playback, the relevant video head scans the recorded tracks. In addition to the video signal and the track's DTF signal there will also be, due to crosstalk, difference frequencies is compared, to find out in which signal frequencies on adjacent tracks. Say head K1 is scanning a track with a 102kHz DTF signal (f1). Adjacent tracks will carry 117kHz (f2) and 149kHz (f3) signals. The two difference-frequency signals produced will thus be 15kHz and 47 kHz (117 – 102kHz = 15kHz, 149kHz – 102kHz = 47kHz). The relative amplitude of these two difference-frequencies is compared, to find out in which direction the head is tending to move away from the correct track, and as a result a correction signal is obtained for application to the piezoelectric plate. This then pulls the head back into alignment with the track. The difference

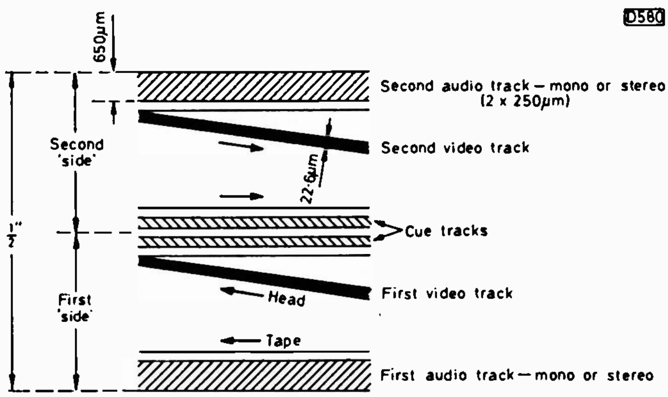


Fig. 1: Arrangement of the tracks on the tape.

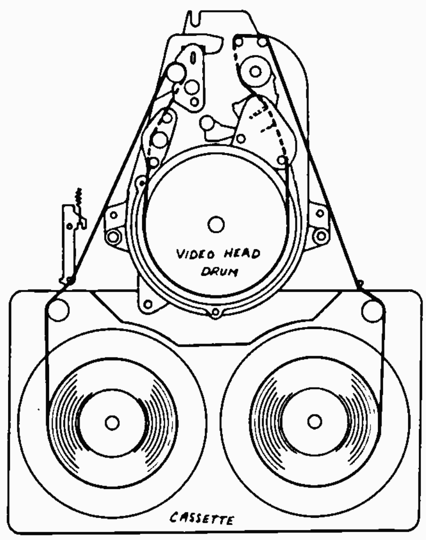


Fig. 2: The M-wrap tape path in the recorder.

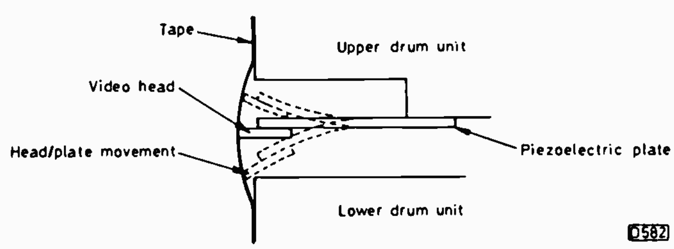


Fig. 3: The heads are mounted on servo-controlled piezoelectric elements to provide dynamic track following.

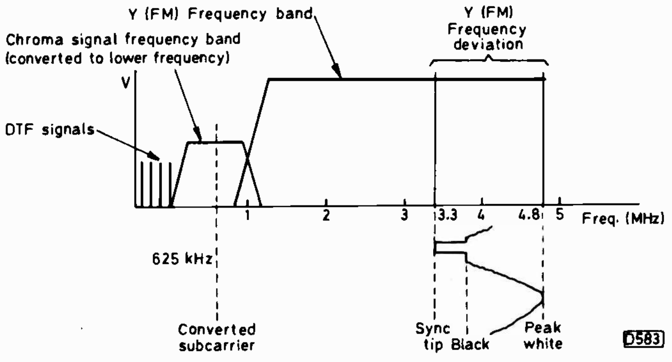


Fig. 4: The signal positions within the bandwidth.

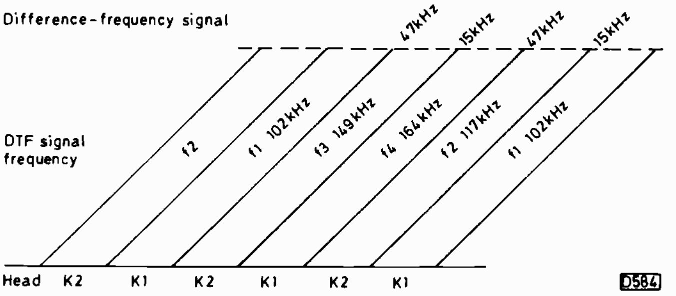


Fig. 5: The sequence of the dynamic track following signals. Read from the right, this is f1, f2, f4, f3.

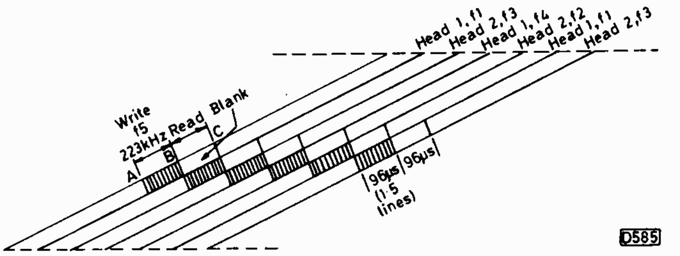


Fig. 6: For dynamic head position correction during recording, a signal is laid down during a 96µsec period while the field flyback is occurring. Recording ceases during the following 96µsec period, the head then reading the crosstalk signal from the previous track. The resultant signal initiates the servo control action.

frequencies are 15kHz and 47kHz whatever the track, as some addition and subtraction exercises will show.

During the period when a video head is not in contact with the tape, i.e. between fields, its piezoelectric carrying plate is restored to the position it had at the commencement of the previous track. When the head returns to contact with the tape therefore it's in the correct starting position.

The head drum is specially heated in order to reduce to a minimum the effect of any mechanical changes during the scanning of the tape. By keeping the drum at a constant temperature, its diameter hardly alters. Wear on the head and frictional losses due to the tape sticking to the drum are thus reduced to a minimum.

If the two heads show an equal deviation in the same direction during playback, the effect is remedied by moving the tape. For this action, the control voltage from the DTF discriminator is fed to the tape servo. The result is that the tape is moved relatively to the heads, restoring the correct alignment. This is termed automatic tracking (see later).

During recording, the heads must be lined up in exactly the correct position with respect to each other, since the video tracks are laid down side by side with no guard band. Due to tolerances however, for example the hysteresis characteristics of the piezoelectric head carrying plates, there is no permanent static condition. This means that dynamic control is necessary during recording as well as during playback.

This is done by placing one head in the nominal position and including the other in a control loop. An additional reference signal, at 223kHz, is recorded on the track for a one and a half line period during the field flyback. During the following one and a half lines, no signal is recorded on the track (see Fig. 6). This enables the signal on the adjacent track to be read in order to provide the required control voltage.

Servo Systems

The tape runs through the recorder at a constant speed of 2·44cm/sec. For this purpose the capstan is directly connected to the capstan motor spindle, on which a 216-pole tachogenerator is mounted. The motor speed is 116·4 r.p.m. Speed control during recording is achieved by comparing the phase of the signal from the tachogenerator with that of a fixed 419·376Hz signal produced by a crystal oscillator. During playback, the previously mentioned automatic tracking system is used to move the tape into the required position instead of using phase comparison.

The head drum is also directly driven, with the motor connected to a 125-pole tachogenerator. The speed of the head drum is 1,500 r.p.m. For phase comparison purposes a phototransistor, coupled to the head drum, produces one pulse per revolution (25 pulses per second). These are compared to a 25Hz reference frequency. During recording the reference frequency is produced by division from the field frequency; during playback it's produced by a crystal oscillator.

The scanning unit, which consists of the microchassis and the integrated head drum motor/video head drum assembly, has been designed so that it can be automatically preadjusted in the factory. The scanning unit can be exchanged without difficulty in either the factory or the service department. The same interchangeability applies to the following parts of the scanning unit: the head drum motor (with or without head drum), the head drum, the audio head, and the erase head.

Signal Handling

As with the N1700 system, the slant-azimuth technique (the two heads are angled at +15° and −15° with respect to each other) is used to avoid luminance crosstalk between adjacent tracks. To avoid crosstalk between the lower frequency chrominance signals, a comb filter consisting of a 128µsec delay line and an adder circuit is used. This of course is a similar idea to the basic PAL arrangement. These techniques are said to ensure good picture quality during playback, while good sound quality is achieved by a new system developed by Philips – "dynamic noise suppression".

Operation

The VCR has been designed for simple, foolproof operation. Search tuning is employed, as in the Grundig SVR system (see *Television*, July). Once the search button has been pressed, the recorder automatically scans all the TV bands. Accurate, automatic tuning occurs immediately a station is found. The tuned-in frequency can then be stored in the memory, by operating the "store" command followed by a channel number chosen by the user. A maximum of 26 channels can be stored in the memory.

The Philips VR2020 VCR has five memory blocks for storing recording instructions. Each block stores the required starting time, stopping time, day of recording and the relevant channel number. Programming can be done up to 16 days in advance. Once the recorder has been programmed in this way, anyone using the recorder in between is warned by the indication "attention timer". The cassette lift opens if there is no cassette or a protected cassette in the machine, drawing the user's attention to the fact that he cannot record under these circumstances.

There's a separate switch, which can be set in either of two positions, for each side. In one position recording is possible: in the other, marked by a red indicator, recording and erasure are not possible. This provides protection against unintentional erasure.

If the auto-rewind button is pressed at the end of the pre-programmed recordings, the recorder automatically winds back to the beginning of the tape.

The VR2020 is equipped with a four-digit electronic tape counter. To go back to a certain tape position quickly, the go-to button is pressed and the required counter number is keyed in on the keyboard. The recorder then winds forward or backwards to the position requested. The counter is automatically set to zero at the beginning of the tape. It can also be set to zero manually if required.

An infra-red remote control system provides remote channel selection and control of all the tape drive functions.

The use of an advanced microprocessor makes operation very simple. If any key is pressed at random, a check is first of all made by the microprocessor's programme to see whether the requested operation is permissible – for example in the case of recording with a protected cassette in the machine. The recorder is completely safeguarded against incorrect operation therefore.

As a result of using microprocessor control, it's possible to switch over directly from wind to play or from off to record for example: all the necessary intermediate steps are automatically carried out by the recorder.

If the electricity supply is interrupted, the channels stored in the memory are retained for about three months. Also, once the supply has been restored any interrupted operation continues.

The recorder contains a wideband aerial amplifier which passes the off-air or VCR signal to the TV set without loss. It's not necessary therefore to switch the recorder over between off-air and playback when the VCR and the TV set are used alongside.■

No Clock Display

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

THE problem with a Sony Betamax SL8000 VCR we had in recently was that on switching on the clock didn't show any digits. The first thing I did of course was to check that the supplies were reaching the timer board – these are 10V, –20V and 2·5V a.c. They all seemed to be o.k., making the checks with my oscilloscope since any further testing would probably require its use to check on the presence or absence of pulse waveforms. So on we went to check the waveforms around the timer i.c. IC3101. There seemed to be a general absence of pulses, except for pins 1 and 42 which had 400kHz pulses and pin 36 which had a 50Hz squarewave – at the correct levels.

There are five enable lines to the display board (four figures plus colon), on pins G1 to G5. Enable is 10V, otherwise the lines are biased to –20V via 100kΩ resistors. Each figure consists of a seven-segment arrangement, a to g, and each part of the colon has its own input. Without any input pulses there's no illumination – the digits are multiplexed, G1 to G5 being strobed in turn and each set of segments altered digit by digit at a fast rate to produce a constant display.

It seemed at the time a good idea to change the timer i.c., no mean feat since it has 42 soldered pins and is a CMOS type at that. So the new one went in with me chained to earth. Switch on and . . . oh dear, no lights! Still no pulses anywhere either. My workshop has dents in the wall that match my forehead after previous VCR nasties, so I added a few more.

A closer look was needed since something had obviously been missed. Check i.c. pin voltages carefully. All correct except for pin 7, the reset pin, which is connected to the collector of Q3001 (see Fig. 1). This transistor should have been turned hard on, with its collector at 0V. Instead, it was at 7·5V. Drastic measures were called for, so I earthed the collector – and got lots of pretty green lights from the display. I then discovered that the 10V line was in fact also 7·5V.

Now Q3001 resets all the timer i.c. functions when the VCR is switched on, or in the event of a mains interruption, thus eliminating any false timer action. At switch on, Q3001 is biased off by the –20V rail. The 10V rail rises slowly, due to the large values of the decouplers and the action of C8104 (see Fig. 2) in the 10V regulator circuit. As the 10V rail rises, the voltage at the collector of Q3001 increases and, at a point just over 8V, the timer i.c. is powered but held reset. At about 8·2V, zener diode D3001 switches on, applying a positive voltage to the base of Q3001 which also switches on. Its collector voltage falls to 0V, thus removing the reset.

So if the 10V rail is lower than 8V, the i.c. is held reset and nothing happens. The fault was clearly in the power supply, and swapping the timer or display boards would have had no effect on the fault. The trouble was in fact due to an open-circuit joint on the 10V supply reservoir capacitor C8106. The effect of the rest of the circuit was to produce a well-smoothed 7·5V supply.

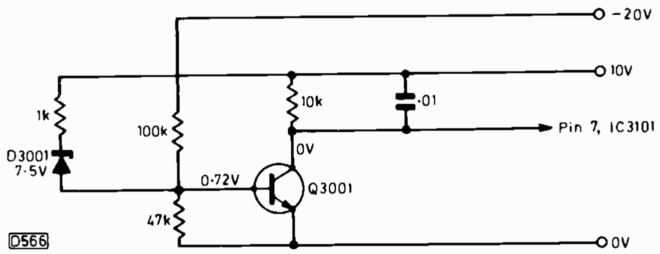


Fig. 1: Timer i.c. reset circuit.

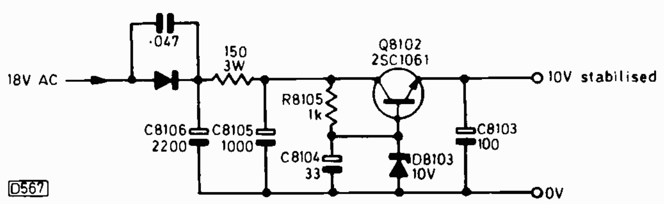


Fig. 2: 10V supply circuit.

All Slog and No Grog . . .

Les Lawry-Johns

THERE'S absolutely no rest for us busy boys lately. Even when we finish you can bet your life some joker will spoil your pint with "I don't want to bother you, but . . .". You escape from that and settle down at home with a bite to eat and a quick glimse of the telly before bedtime and the thing changes channels all on its own. So you give up and go to bed and dream about sets that won't go right or women that won't go wrong or something. Look at yesterday for instance. It started with colourless sets.

First an 8500 (Ferguson) with the complaint that the colour had been intermittent but had now gone beyond recall.

Dealing with Lack of Colour

I suppose we all have our own pet ways of making a start when tackling faults that can have various possible causes. I always like to start on this one by proving the presence of timing pulses from the line output stage. These are applied to connection 3/2 on the decoder panel on the 8000 series chassis, and can be measured at TP9 in the burst gate circuit. Finding little activity here we nipped smartly over to the timebase panel and had a look at TP28, which again was lifeless. It was a short step from here to R404 (33kΩ) which was found to be open-circuit.

Nice going we thought. Keep it up and we might regain some of our lost confidence which has taken a bashing lately due to persistent wrong diagnoses, er diagnostics, er, jumping to the wrong conclusions, with the consequent hours lost plodding toward the right conclusions.

And the Next Gent Please

Of course the next case just had to be loss of colour again. Apparently Mr. Earlybirth had had a spot of trouble with his Philips G8 of late, and was dissatisfied with the service he had received from the original suppliers of the set. He produced massive repair bills to prove it. Horrific would perhaps be a better word. Since the last one was very recent and was incurred in the quest for lost colour, I suggested that he returned the set to the repairers for their approbation. "I'm too scared" he said. "It'll probably be a hundred quid this time." I couldn't quite see how this could happen, but as he was clearly adamant about not going back with it I didn't press the point further.

"O.K. Mr. Earlybirth, leave your phone number and we'll ring you when it's sorted out."

Clearly this was one to approach with caution. It was one of the separate panel type, and it was obvious that some work had been done on both the signal and the decoder panels.

So we decided to cut across the usual routine and fit a known good decoder panel which we just happened to have lying around. With this in there was still no colour, so we did something daft. We refitted the original panel and then checked for the positive and negative pulses at pins 8 and 1 respectively at the rear edge connector. The negative pulses were there but there was no joy at pin 8 (TP39). So over we went to the timebase (line scan) unit and checked at pin 1 of plug U. Nothing here so follow the track along to R576 (4·7Ω, or 4R7 if you like that better). It didn't look well, and indeed proved to be open-circuit. A replacement of the same small wattage did not overheat, and the positive pulses were now present on my little diode probe.

Sadly however there was still no colour (and I hadn't left the colour control turned down like I did on that one some time ago, chasing all over the place before I realized it).

So out came the decoder panel again and in went the test one. Full colour. Suspecting hanky-panky, we looked with care at the removed panel. The core of the reference oscillator coil looked decidedly out of place, whilst all the other cores were still sealed. So back went the panel and careful adjustment to the suspect core restored almost normal results except that the grey scale was out and the picture was too bright with the brightness right down.

Resetting the blue d.c. level control R297 restored normal brightness, and a touch up on the green and red level controls restored the grey scale to very nearly perfect. All that remained was to converge the set. This was easier said than done, since R1933 on the convergence panel had seen better days. A new 10Ω potentiometer put this right, and we were quite pleased with the result.

"Mr. Earlybirth. Your set's ready. Bring a couple of hundred quid with you, ha, ha."

It was a bit premature really because I suddenly became aware that there was no sound when I turned it up to hear what the tennis scores were (I can't read).

The rear cover had to come off again, and the sound returned on its own. This proved to be nothing more than a poor contact on the audio plug, so we wern't all that upset.

Put the back on again, having wangled the control knobs through, and that was that. We didn't really sting him. He got change from three fivers, and was happy.

Only No Sound

"Not a lot wrong" he said. "Not a lot. Just no sound." As this was an ITT CVC5, it came as no surprise and of course we made straight for the PCL86. Giving it a quick clout with a screwdriver handle restored the sound with a sharp crack. In went a new valve and we waited for the sound to burst forth. It didn't. Applying the voltmeter, we found rather more h.t. than we expected. Not too much voltage you understand, but what there was was in too many places.

As usual, my mind went completely blank. I knew I should have h.t. on pin 6, the output pentode anode, but I couldn't remember what pin the screen grid voltage should be on. So we had 200V on pins 6, 8 and 3, and 100V on pin 9. Looking it up, we should have had 200V on pins 6 and 3, but pin 8 was the control grid. Not to be bothered with niceties, the valve was whipped out and the voltage on pin 8 vanished. Another duff new valve, but what had happened to the cathode bias resistor? Nothing apparently. It still read 120Ω and the 50μF decoupler was also in one piece. Another new valve restored the sound.

"While you're at it" said Mr. Ratchet (christian name I presumed was Paul, as it said P on the job sheet), "you

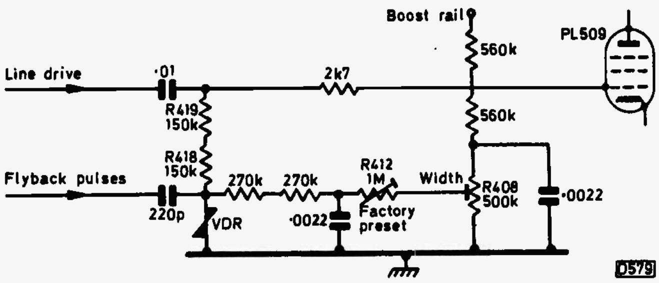


Fig. 1: The width control circuit used in the ITT CVC5 and subsequent hybrid colour chassis. The design is conventional, but care has been taken over its implementation. Pairs of resistors are used to reduce the voltage stress across the individual resistors, and the 0·0022µF decoupling capacitors are included to protect the factory and dealer preset width controls against high pulse voltages.

might have a quick look at the picture as there's a line down the left side." There was indeed. It looked like brushing of some sort, and the width only just made it. Just to put us on the wrong track (tracking?) there was a sharp crack of discharge from inside the line output section.

Off came the screening and we peered suspiciously at the tripler and focus assembly. Nothing seemed out of place, and the discharge did not recur. Bearing in mind Eugene's good advice from earlier in the year, we looked hard at the line output transformer subpanel for signs of dry-joints etc. Everything seemed in order.

Looking again at the picture, the line scan did not seem all that even. We concluded however that once the left side dribble was cured everything else would fall into line as it were. For want of something better to do, we changed the PL509. This made matters a damn sight worse, so we changed the PY500 as well. This didn't alter things at all.

Since the width was only just making it, we reset the "dealer width" control R408 (see Fig. 1) which didn't do anything. Neither did the "factory width" control R412, which seemed most peculiar. A meter applied to the PL509's control grid showed that there was adequate drive, and incidentally shot out the width. "Ah ha" we said (not being able to think of anything better).

So off went the supply and we got down to checking the resistors in the width circuit. All seemed in order until we came to the series resistors R418 and R419. They should have been something like 150kΩ each. R419 read o.k., but R418 didn't read at all. A new resistor in this position enabled us to set up the width correctly, with a nice even line scan and no dribble.

"Took a long time to find that, didn't it?" commented Mr. Ratchet. "My name's not Trundle" I protested (sorry Eugene). "My name is the one over the door and I am a well known ditherer. Always have been and it's a bit late to change now. If I was any good at this job I wouldn't be doing it." Now there's a profound thought. I must think about that.

So the Day Wore On

Just for a change we thought we'd have a go at a Ferguson audio effort. "Won't play the records it won't." This was a relief, as we'd had a bit of trouble of late with the cassette side of one of one of these and didn't relish another bout for a time. BSR deck, funny noise, and dead slow on 45 r.p.m.

Take off the turntable and clean up the centre post and bush. Rough up the idler wheel, and a drop of oil into the top motor bearing. Reassemble and check. Nice, quiet and only slightly fast on the strobe (as usual). Switch to 33. Turntable stops. Do it again. O.K. on 45, stops on 33.

Take off turntable and check on idler wheel. Clunks nicely on to the drive spindle on 45, doesn't want to be pulled across fully on 33. Conclude that there's friction on swing spindle in the 33 position. Oil and try again. No better. Take out unit and check on nylon assembly and notice that swing arm has to come down a shade out of its true position which would make the idler contact the motor spindle. Why? Don't know.

Note that there's movement to spare on the assembly when in the 45 position, but none in the 33 position (determined by a nylon ratchet rotating the cog teeth of the nylon speed selector drum). Think. "If the ratchet is pushing the cog drum too far round, why not move it back one tooth?" Ease out the ratchet and allow the drum to advance one tooth. Instant success. Now plays 33 as well as 45.

Question: how did the ratchet and cog get out of sync in the first place? Never mind, plod on.

Think about calling it a day and cashing up. Not difficult as there is no cash in till other than that wrested from Mr. Earlybirth and Mr. Pawl, sorry Mr. Ratchet. Will have to reduce fluid intake until our monetary affairs improve.

Later

We had only a couple of halves, and that was spoilt by someone wanting to know something I didn't know anything about. And so to bed.

Funny it keeps changing channels like that. I'll have to see if it's the i.c. Never mind. Think about it tomorrow. Wonder what I can chat about in the next article? Twenty five years with the September issue, seems only yesterday.

Thirty years ago: wrestling with old prewar Cossor 1210 with the funny sync separator. Two top caps at 90 degrees, one for line, the other for frame (not field then). Bloody great 15in. tube.

Thirty five years, thirty six or so ... I can still hear the boys singing Lily Marlene.

"There's a desert squadron
Somewhere in the blue,
No one there that matters
To tell 'em what to do.

About nine miles this side of Alexandria, well past the stinking tannery, is a small village called Fayid.

We had an airfield there, right on the Med, only the coast road between. Our main war effort was making sailing dinghies to play with out in the bay on our make and mends (afternoons off). Fleet requirement unit they called us, 775 squadron.

And so to Sleep

There was a panic on. The skipper was going barmy. He called Sub-Lt. Thompson in at the double.

"Listen Thompson. Something's up. Jerries are flying Ju 52s across to Benghazi carrying secret loads of I don't know what, but the army's going mad and the Admiral has been on the blower. He wants 'em shot down. Trouble is they're not ordinary Ju 52s, they're Ju 52Ms. The M is for metal. Bloody great lengths of corrugated iron right the way along 'em.

Machine guns are no good, 20mm. cannon shells are deflected back and shoot down or own Seafires – deflected back by the grooves of the corrugated iron. Only one thing to do. We've had a 70mm. gun mounted on a Hurricane and that'll knock a hole in anything. The recoil when the thing goes off will knock you back a hundred knots, so you must go in at two hundred to avoid stalling.

We know your reputation for missing the target every time Thompson, but this time you mustn't miss. All the other pilots have shot themselves down."

Sub-Lt. Thompson,
Second in command,
Couldn't find the target,
Too much bloody sand.
He dropped all his bombs out in the blue,
Too bloody true, and so would you.
If you had seen Benghazi,
If you had seen B.G.

So off went our hero, out into the blue, flying the Hurricane burdened with the enormous gun.

Approaching Benghazi, he could see the distant speck of the three-engined Ju 52 out over the Med. He could see other flying things as well. Large birds called Shite Hawks, wheeling about the sky, hungry for prey. Peculiar birds. The only ones that fly in herds. Lots of cows and only one big bull. He was so wrapped up in what was before him that he didn't see what was behind. An Italian Macchi 42 was slowly coming up astern.

The Ju 52 came lumbering in over the coast line as our Subby closed in to attack. He could plainly see the corrugated side of the big jerry transport looming large.

Before he could get into the firing position, he saw the transport dropping its secret cargo. Hundreds of cones falling, each with their little parachute. Cornets from the toe of Italy. So that was it. Cornettoes. What a devilish scheme, seeing that allied troops held Benghazi at the moment.

They bomb Benghazi every night,
And when they're not,
They're getting tight.

He fired his mighty gun. Crash it went. Bash came the recoil, and the Hurricane practically stood still. Unfortunately, the Macchi had closed up for the kill and couldn't avoid hitting the Hurricane. Bang, they went.

The impact shot Subby Thompson clean out of his cockpit, and he'd forgotten his parachute. Whizz he went, through the crisp North African air. The big Shite Hawk saw his chance and moved in, grasping Subby firmly in his enormous talons. The 70mm. shell tore into the Ju 52 and down it went. Boom. The tangled mass of the Hurricane and the Macchi spiralled into the sea off the coast. Leaving our hero suspended as usual by Bull Shite.

Footnote to a Previous Epic

Footnote to the saga of Lt-Commander Pragham-Wright who attacked the whole Italian 7th fleet in the Straits of Messina (see July issue).

Nineteen ships were sunk that day by one torpedo. The twentieth ship was rammed by the lone Swordfish, whose pilot was heard to shout just before impact "one more for the pot."

We've had several enquiries, you see.

NEW TELEPART CATALOGUE

The new 152-page Telepart trade catalogue, listing over 5,000 items, is now available from Willow Vale Electronics Ltd., Old Hall Works, Arborfield Road, Shinfield, Reading, Berks. (Telephone: Reading (0734) 884444.)

Restricted Brightness Range

George Wilding

RESTRICTED brightness range, i.e. inability to black out the raster fully or, at the other extreme, to obtain peak white, is a common fault in sets of all types, though it's nowadays most often encountered in hybrid colour sets.

The brightness control arrangements used in monochrome sets are straightforward indeed, as the two examples shown in Fig. 1 bring out. Where d.c. coupling is used between the video output stage and the c.r.t. cathode however, as in Fig. 1(a), value change in quite a number of components can be responsible for the fault. The brightness control circuits used in colour sets vary so widely that again the causes of the trouble can be many and various. Assuming however that the c.r.t. first anode voltages are correct – a common cause of the fault on colour sets – the basic cause of the trouble is always the same, restricted or incorrect voltages between the cathode(s) and control grid(s) of the c.r.t. The c.r.t. gun has to be negatively biased of course, i.e. the grid made negative with respect to the cathode, though both electrodes may be at considerable positive voltages with respect to chassis.

As a typical example of d.c. coupling between the anode of the video output pentode and the c.r.t. cathode, Fig. 1(a) shows the circuit used in the Philips 300 chassis – the basic circuit is common to many earlier chassis from this setmaker. The d.c. voltage at the anode of the video output pentode is 142V, while the brightness control enables the c.r.t.'s control grid to be swung between 40-112V. The effective working c.r.t. bias can thus be varied between –30V, when the screen is at peak brightness, and –102V, which is more than ample to black out the raster.

Since a greater number of components affect the c.r.t.'s cathode voltage than its grid voltage in the circuit shown, there are more opportunities for brightness troubles to have their origin here rather than in the grid circuit. The possibilities are: a low-emission output valve; value change in the output pentode's cathode bias resistor, its screen grid feed resistor (if present) or, again if present, its bias stabilising resistor (between the h.t. line or the screen grid and cathode); leakage in the cathode decoupling capacitor; or value change in the anode load resistor.

If a component value change over biases the video output pentode, thus increasing its anode voltage and therefore the tube's cathode voltage (still assuming d.c. coupling), other faults will arise. The sync pulses and the darker picture tones will be amplified on the more curved portion of the valve's characteristic, i.e. towards valve cut-off. As a result, sync pulse amplification will be markedly reduced, often showing up as impaired field sync, while it will be almost impossible to separate the darkest two or three squares of the test card grey scale.

When a transistor is used to provide the video output, similar effects can occur due to an increased value emitter resistor or inadequate base bias. If the latter is provided by a d.c.-coupled emitter-follower driver stage, it may be necessary to check back to the conditions in that stage.

Where a.c. coupling is used between the video output stage and the c.r.t. cathode, as in most mains/battery portables, the d.c. working conditions of the video output stage are divorced (or should be, unless the coupling capacitor is leaky) from the tube's cathode. The most likely cause of the trouble in this case is a fault in the brightness control circuit. The control is usually connected across the h.t. supply, generally with series resistors between the control and h.t. and the control and chassis to set the range of operation. If a resistor on the h.t. side of the control increases in value, the brightness range will be restricted,

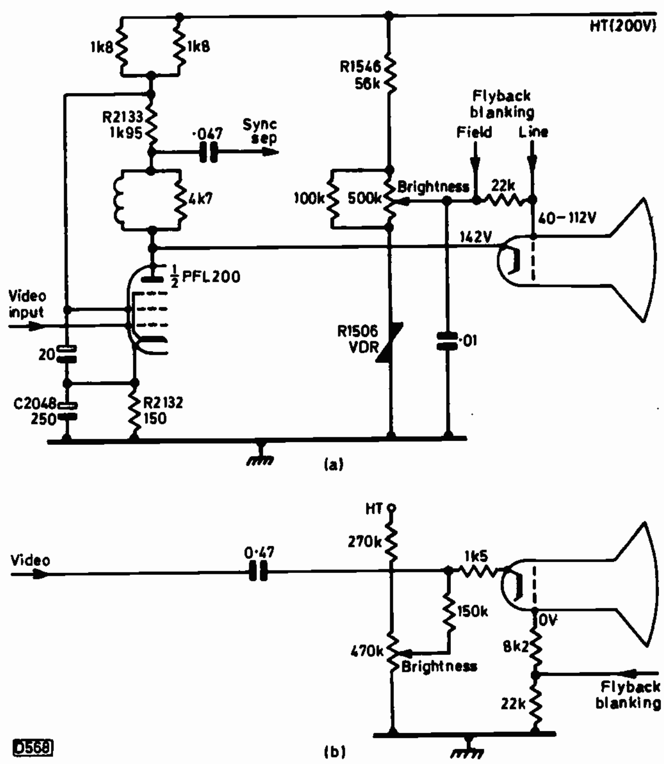


Fig. 1: Contrasting monochrome receiver c.r.t. biasing arrangements. (a) D.C. coupling between the anode of the video output pentode and the c.r.t. cathode, with the brightness control setting the tube's grid voltage. This particular circuit is based on that used in many Philips monochrome receivers. With d.c. coupling, changes in the d.c. conditions in the video output stage will directly affect the tube biasing. Thus changes in the value of quite a number of components, or a low-emission output pentode, will affect the brightness. The VDR R1506 is included to provide switch-off spot protection. When the voltage across a VDR falls, its resistance increases. The effect here is to hold the grid positive with respect to the cathode on switching the set off, thus rapidly discharging the e.h.t. and preventing the appearance of a switch-off spot. (b) A.C. coupling between the output valve/transistor and the cathode of the c.r.t., with the brightness control setting the d.c. voltage at the c.r.t. cathode and the grid returned to chassis. Component values as used in the Thorn 1500 chassis. Provided the coupling capacitor is not leaky, there's little to cause brightness troubles in this type of circuit. The usual cause of such trouble here is change of value of a resistor in series with the brightness control. This type of circuit is very common in transistor portables. Where the resistor between the h.t. rail and the brightness control increases in value, the brightness will increase – because the c.r.t's cathode voltage will be reduced. On some monochrome sets with a.c. coupling the brightness control is included in the c.r.t.'s grid circuit, a fixed potential divider being used to set the c.r.t.'s cathode voltage. Obviously a changed value resistor in the potential divider network will alter the brightness level.

while if a resistor on the chassis side increases in value it may become impossible to black out the screen — assuming that the brightness control is in the c.r.t.'s grid circuit.

Fig. 1(b) shows the brightness control arrangement used, with a.c. video coupling, in the Thorn 1500 chassis. In this example the control grid is taken to chassis and is thus at 0V d.c., serving simply as a suitable point at which to apply the negative-going flyback blanking pulses. The brightness control sets the positive d.c. voltage at the cathode – range from 0 to about 90V. This is equivalent to varying the control grid between 0 and −90V of course.

If in doubt as to whether advancing the setting of the brightness control reduces the tube bias sufficiently, a simple test is to momentarily short the grid and cathode together. This should not significantly increase the brightness of the raster with the brightness control well advanced. If it does, either the c.r.t.'s cathode voltage is too high or its grid voltage too low.

On occasion, you might find that as the brightness control is advanced to increase the c.r.t. grid voltage, so the cathode voltage tends to follow suit. This is a sure indication of grid-cathode leakage in the tube. It can sometimes be cured by flashing techniques, but usually means that a replacement tube will be needed.

Hybrid Colour Sets

When we come to hybrid colour sets using colour-difference drive, we find a very similar situation to monochrome receivers using d.c. coupling. The luminance output pentode is d.c. coupled to the three c.r.t. cathodes, and all the considerations of changed value screen grid and cathode resistors etc. still apply. In addition however it will be found that brightness control is effected by varying the output pentode's negative control grid bias, while this bias may also be affected by the action of the beam limiter circuit. When operating correctly, excessive e.h.t. current will result in the beam limiter increasing the bias on the luminance output pentode. A fault in the beam limiter circuit may change the bias in either direction however. In total therefore many components could be responsible if you find that the luminance output pentode's anode voltage cannot be swung between the normal limits.

An interesting example of such a fault came our way recently, the set being an Ekco one fitted with the Pye hybrid chassis. Although the tube was undoubtedly of low emission, appraisal of the test card showed that all three darkest sections of the grey scale were at about the same darkness level, and couldn't be separated by juggling with the contrast and brightness controls. Probably the most common cause of excessive luminance output pentode anode voltage (lack of brightness) and thus high tube cathode voltage is a low-emission PL802 luminance output valve. A replacement brought no improvement this time however. The beam limiter threshold control RV16 was found to have no effect, while the tube's first anode preset controls were as near maximum as possible consistent with obtaining a relatively untinted raster.

The brightness control circuit used in this chassis is shown in Fig. 2. It acts in conjunction with the d.c. restorer diode D39 which conducts on the tips of the negative-going sync pulse tips. When this happens, C39 is charged to the voltage at the slider of the brightness control, which is connected between 20V and −20V rails via R213, R212 and R202. The brightness control thus sets the d.c. level at the control grid of the PL802 luminance output valve, providing a smooth transition from minimum to maximum brightness. It also provides a means for the beam limiter to act – when the beam limiter transistor VT35 conducts, at

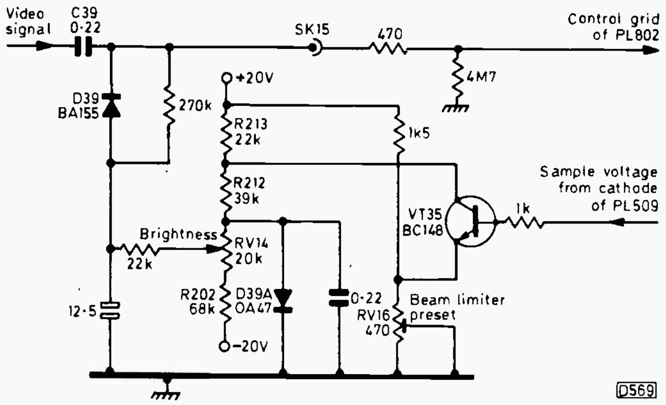


Fig. 2: Brightness control circuit used in Pye hybrid colour receivers. The d.c. restorer diode D39 conducts on the tips of the negative-going sync pulses, returning the coupling capacitor C39 to the d.c. voltage set by the brightness control. The beam limiter also acts on this circuit. With excessive beam current, the line output valve's cathode voltage increases and the beam limiter transistor VT35 switches on. Its collector current, flowing through R213, alters the voltages along the resistive chain R213/R212/RV14/R202. The voltage at the slider of the brightness control is thus pulled back, and the beam current reduced to a safe level.

maximum beam current, the voltage at the junction of R212/R213 is reduced.

Withdrawing the small white plug from socket 15 on the colour-difference amplifier panel removes both the luminance signal feed and the control bias from the control grid of the PL802. When this was done, with the brightness control at maximum, there was an immediate and most pronounced increase in brightness level. Clearly then the brightness control was failing to reduce the bias on the PL802 sufficiently, and on making voltage checks alaong the resistor network R213, R212 etc. R212 was found to be open-circuit. Replacing R212 also restored normal beam limiter action.

Restricted brightness control range on hybrid colour sets using colour-difference tube drive can also of course be caused by incorrect tube control grid voltages. The colour-difference signals are a.c. coupled to the grids, with clamps to establish the correct d.c. conditions. These are usually driven by line-frequency pulses, so absence of the pulses will remove the clamp action. This is quite rare however: more common is drift or variation in the d.c. level from one gun to another due to a component value change. With the Pye hybrid chassis however the tube will be completely or almost completely biased off should either R389 or R393 on the CDA panel go open-circuit. The effect of this is to remove the clamp voltage, so that the voltages at the anodes of the clamp triodes fall to a very low figure instead of the correct 100V or so.

The diversity of brightness control arrangements used in receivers using RGB drive is such that we can't go into them here. Fortunately they don't in practice give much trouble.

Preset Controls

Often the trouble is simply an incorrectly adjusted preset control. Preset brightness controls are to be found in sets of all types, and operate in a variety of ways. In the GEC hybrid chassis there's a background control which sets the colour-difference signal clamping level. In addition you'll often find in a colour set a beam limiter threshold control. It's vital that all controls that affect the brightness level of the picture are correctly set up. This is especially so when the tube is ageing, since wrongly adjusted presets accentuate the effects of low tube emission.■

New Teletext Signal Panel

Alan Kitching

SOMETIME ago I built up the original version of the *Television* teletext decoder. I found however that under certain signal conditions an unusually high number of errors was present on the display. These could usually be eliminated by adjusting the slice level, the tuning and the clock frequency slightly, but the main difficulty seemed to lie in the critical nature of the data recovery section used in the original design. To overcome this problem, a new signal panel was designed. This uses the original i.f. strip along with a new adaptive data recovery section which is able to cope with quite large variations in signal strength and noise levels. Improvements were also made to the i.f. strip earthing arrangements, to overcome certain problems with the original.

The circuit of the new section of the board is shown in Fig. 1. The video input is taken from the positive-going video output of the TDA440 i.c. (pin 12). The new section also includes a 6MHz sound preamplifier as some problems were experienced in the original design at low sound modulation levels.

Buffer Stage

The positive-going video output from pin 12 (which was left disconnected in the original design) of the TDA440, at about 3V peak-to-peak, is a.c. coupled to the base of the emitter-follower Tr1. This provides a low-impedance source to drive the sync and data separator circuits. A parallel tuned

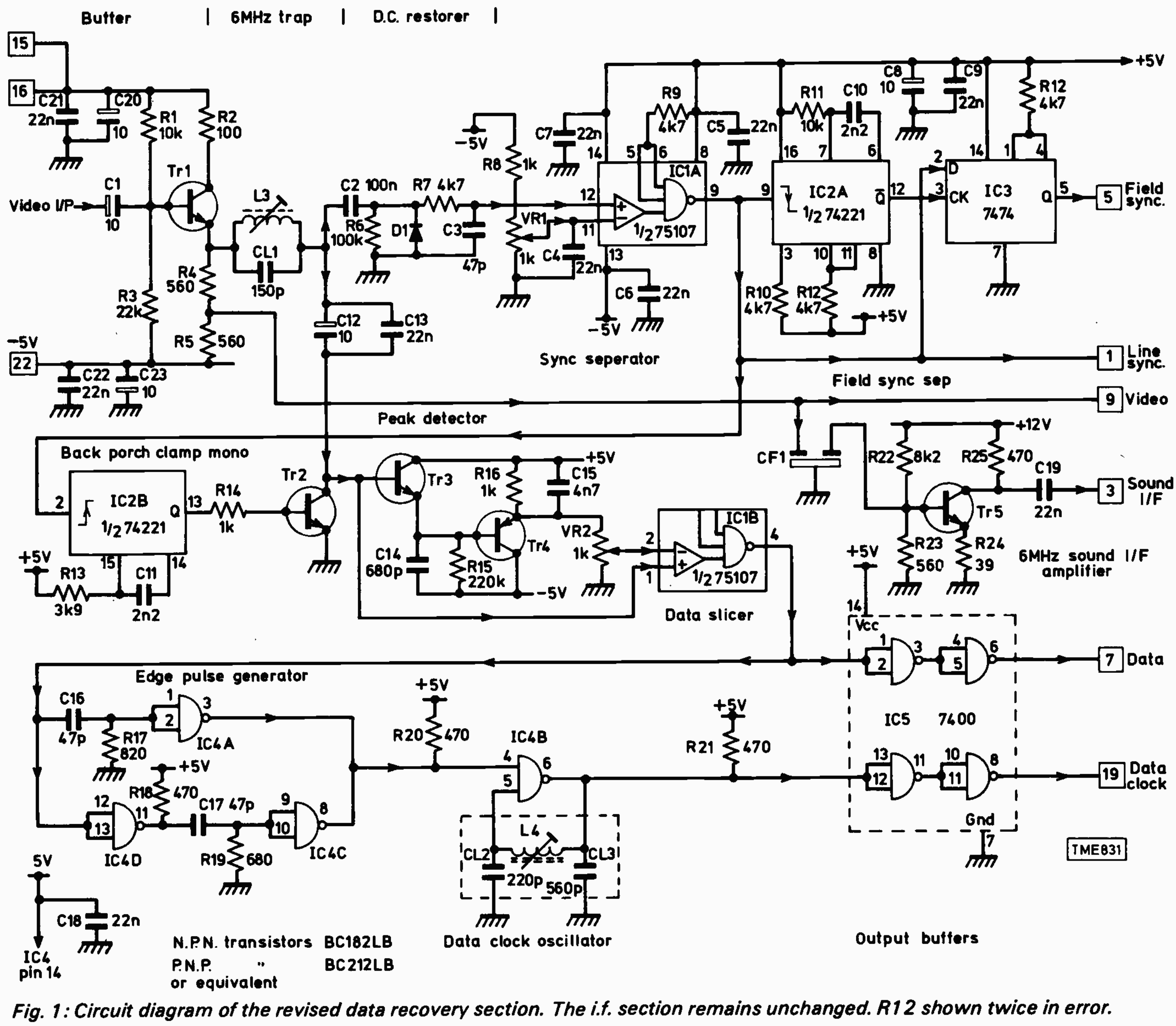


Fig. 1: Circuit diagram of the revised data recovery section. The i.f. section remains unchanged. R12 shown twice in error.

circuit (L3/CL1) removes the 6MHz intercarrier sound signal, which would otherwise upset the operation of the data clock – this is very close to 6MHz.

Tr1 has a split emitter-load resistor (R4/R5), so that a high-amplitude video signal is available to drive the sync and data separators and a low-amplitude video output is available to drive the modulator and the sound i.f. preamplifier Tr5. This split emitter load also provides isolation between the external circuit connected to the video output edge connector pin 9 and the internal data separation circuitry, thus reducing the number of errors caused by locally generated interference.

Sync Separator

We will deal first with the sync separator section of the circuit. The composite video at the emitter of Tr1 is a.c. coupled via C2, with D1 providing d.c. restoration, clamping the sync pulses at about –0·6V. R7 and C3 form an h.f. filter, removing the chroma information and the remaining video signal from the feed to the positive input (pin 12) of the comparator IC1a. The negative input (pin 11) of the comparator is connected to a voltage between –5V and 0V: this sets the level at which the composite video is sliced. The level is set to approximately half-way through the sync pulse portion of the waveform. TTL mixed sync appears at the output pin 9.

The negative-going leading edges of the sync pulses trigger the monostable IC2a, which switches state for 18μsec. The $\bar{Q}$ output then returns to logic 1. This rising edge clocks the D-type flip-flop IC3, the Q output of which takes up the state of the D input which, during the field sync period, is at logic 0. We thus have negative-going field sync pulses at the Q output of IC3. These are taken out to edge connector pin 5, while the line sync pulses are brought out to pin 1, maintaining compatibility with the original board.

Adaptive Data Slicer

Turning now to the data separation section of the circuit, the positive-going trailing edges of the sync pulses trigger monostable IC2b. This produces a short, positive-going pulse of about 2μsec duration during the back porch period. The pulse switches Tr2 on, clamping the black level of the video signal, which is a.c. coupled via C12/C13, at approximately 0V regardless of the average level of the signal. The slice level is set by using a peak detector to detect the data amplitude. The resultant information is used to set the slice level midway between the positive data peaks and black level. Let's see how this operates.

Tr3 and C14 form the positive data peak-detection circuit, with R15 providing the time-constant to set the decay time. The time-constant is fairly long compared to the data bytes, to prevent too much decay during the worst-case condition of fourteen consecutive zeros. Tr4 offsets the base-emitter voltage drop of Tr3, while the shorter time-constant of C15, R16 increases the rise time of the peak-detector circuit to reduce the effect of large noise spikes.

The slice level can be adjusted by means of VR2 over the range from 0V to the positive data-peak level. The voltage from the slider of VR2 is applied to the negative input (pin 2) of the second comparator IC1b, the video signal being fed directly to its positive input (pin 1). The output, at pin 4, is a TTL signal representing the sliced serial data. This is buffered by half the 7400 i.c. IC5.

Data Clock

The serial data from pin 4 of the data slicer i.c. is also fed to the clock generator section. The differentiating network C16, R17 produces a positive-going output to turn on gate IC4a, forcing its output to the low state coincident with the positive-going edge of the data bits. IC4d inverts the serial

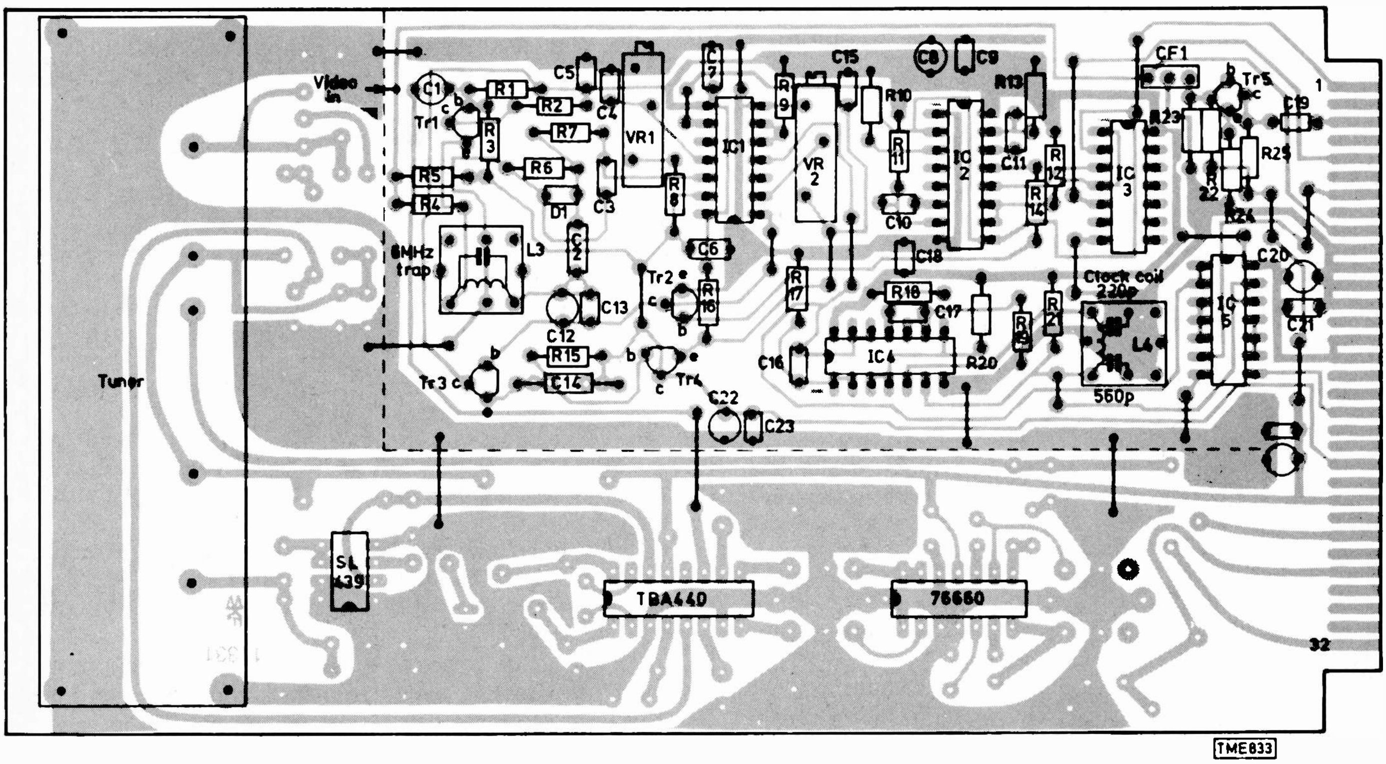


Fig. 2: Component location diagram of the new signal board. The component location diagram for the i.f. section is given in the October 1977 issue.

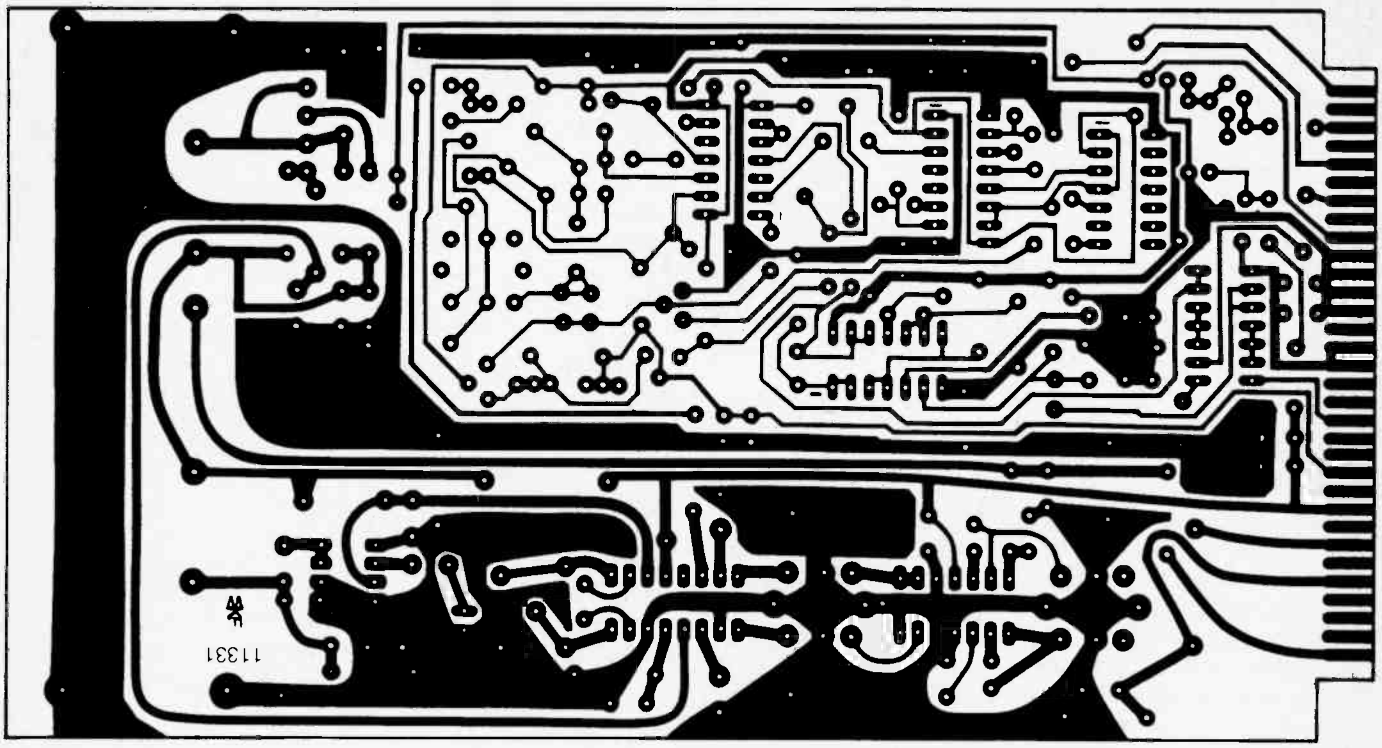


Fig. 3: Copper pattern of the new signal board. The board is available from our Readers PCB Services, reference 11331. Note that the actual size of the board is 386mm × 205mm.

★ components list
(new data recovery section only)

Resistors:		Capacitors:	
R1	10k	C1	10μF 25V
R2	100Ω	C2	100n
R3	22k	C3	47p
R4	560Ω	C4	22n
R5	560Ω	C5	22n
R6	100k	C6	22n
R7	4k7	C7	22n
R8	1k	C8	10μF 10V
R9	4k7	C9	22n
R10	4k7	C10	2n2
R11	10k	C11	2n2
R12	4k7	C12	10μF 10V
R13	3k9	C13	22n
R14	1k	C14	680p
R15	220k	C15	4n7
R16	1k	C16	47p
R17	820Ω	C17	47p
R18	470Ω	C18	22n
R19	680Ω	C19	22n
R20	470Ω	C20	10μF 10V
R21	470Ω	C21	22n
R22	8k2	C22	22n
R23	560Ω	C23	10μF 10V
R24	39Ω	CL1	150p polystyrene
R25	470Ω	CL2	220p polystyrene
All ¼W 5% carbon film		CL3	560p polystyrene
VR1	1k	All electrolytics tantalum bead.	
VR2	1k	All capacitors not otherwise	
¼in. cermet multiturn		specified ceramic plate.	
Semiconductors:			
IC1	75107	Tr3	BC182L
IC2	74221	Tr4	BC212L
IC3	7474	Tr5	BC182L
IC4	7403	Coils etc:	
IC5	7400	L3	25 turns
D1	1N4148	L4	30 turns
Tr1	BC182L	both 36swg, ecw on 4mm formers	
Tr2	BC182L	with cores and screens.	
		CF1 SFE6·0MB Murata	

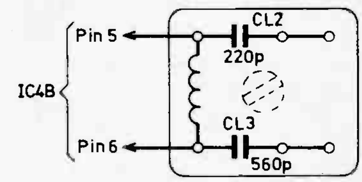


Fig. 4: Constructional details of coil L4.

data and drives another differentiating network C17, R19. This, with IC4c, operates in the same way as IC4a/C16/R17, producing a short negative-going pulse coincident with the negative-going edge of the data bits. The outputs from IC4a and IC4c are connected in the wired-or mode, with R20 forming a common load resistor. Consequently a series of short, negative-going pulses coincident with the positive- and negative-going data transitions is fed into one input of the data clock oscillator formed by IC4b with L4 and the associated tuning capacitors. The pulses serve to lock the oscillator in the correct phase and frequency as the incoming data. The free-running frequency of the oscillator is set by the core in L4 to the data clock frequency (6·9MHz).

The data clock output is buffered by half the 7400 i.c. IC5 and is then brought out to edge connector pin 19.

Construction

If the new signals board is to be constructed using components from the original board, these can be transferred on a one-to-one basis – the component layout is identical. If the circuit is to be built from scratch however the constructional details given in the October 1977 issue should be followed and alignment carried out as described in the November 1977 issue.

Construction of the new section of the board is straightforward, following the component layout shown in Fig. 2. The only component requiring any special consideration is the clock coil L4, which differs slightly from the original. It can be wound on the same former however after removing the old winding (see details in components list). Take care to

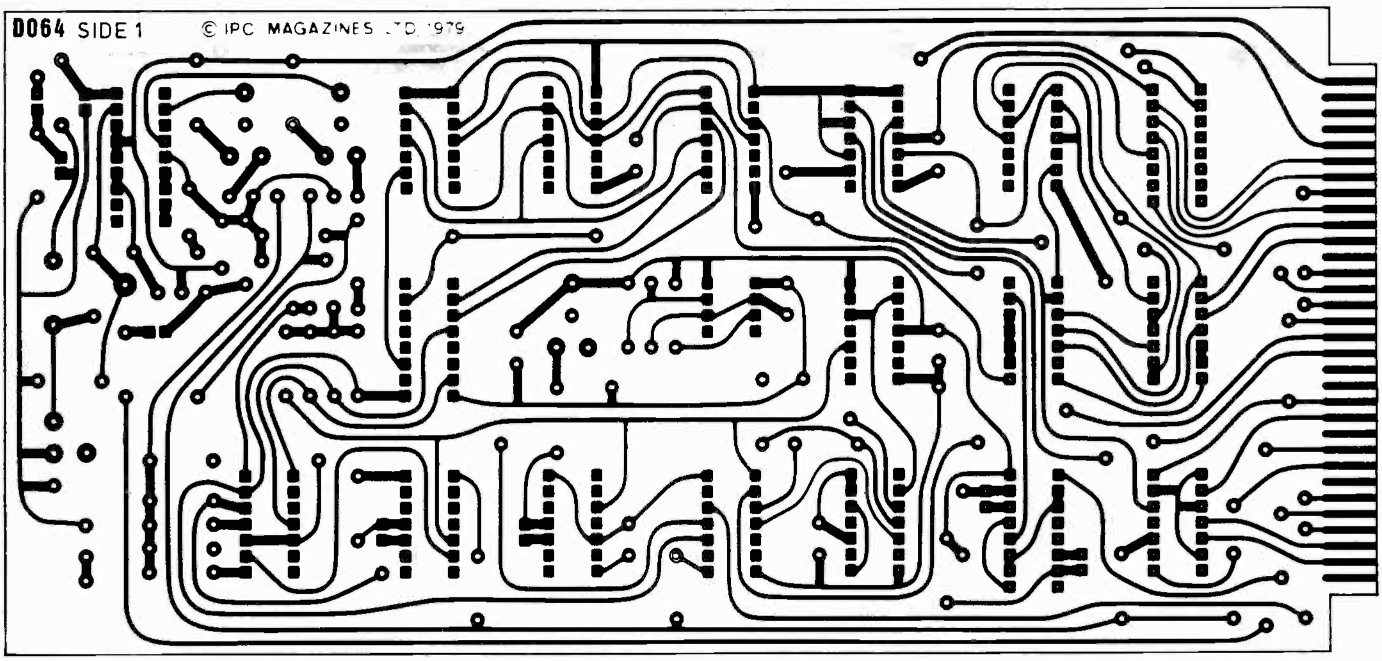


Fig. 5: Underside copper pattern for the teletext options card (see last month), ref. D064.

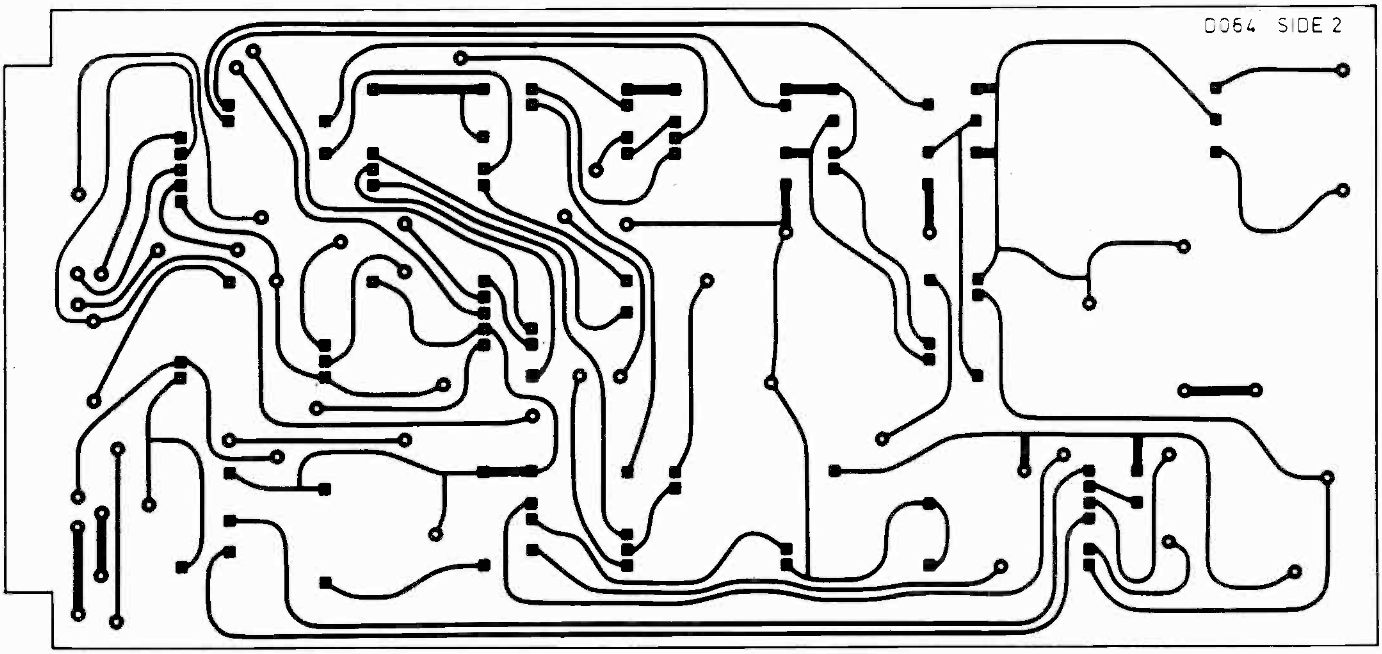


Fig. 6: Topside copper track of the options card D064. Note that the actual board size is 438mm × 205mm.

connect the decoupling electrolytics on the negative supply rail the correct way round, i.e. positive to chassis.

Alignment

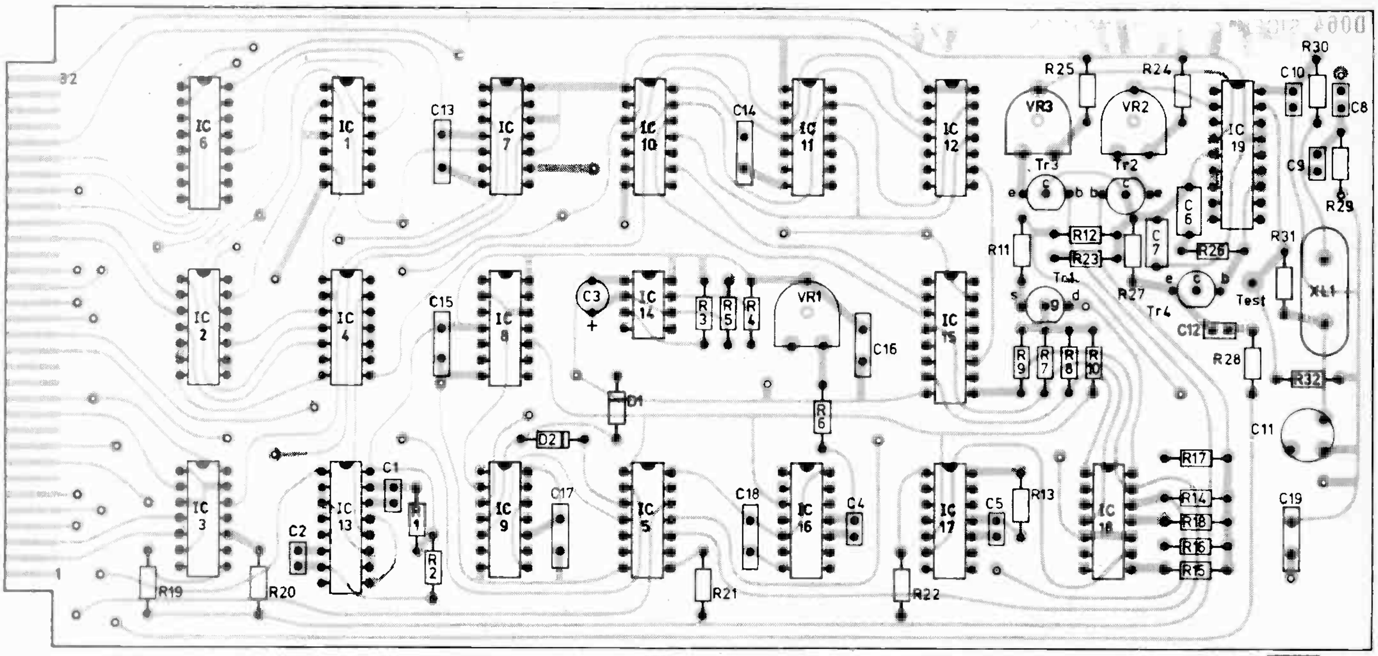
Assuming that the alignment and the 6MHz sound trap have been set up in accordance with the instructions given in the November 1977 issue, and that a good picture which includes a teletext transmission is being received, the new data recovery section should be set up as follows. Switch to the text mode and connect a scope to pin 9 of IC1a. Adjust VR1 to produce TTL composite sync at this point. Check that TTL field sync pulses are present at pin 5 of IC3: if not, check the timing components and connections around IC2a and IC3.

Select the page roll mode and whilst watching the screen adjust VR2 for the most rapidly changing display of characters. When this point has been reached, adjust L2 slowly until the text is as free of errors as possible and complete pages are seen to roll through. Repeat these last two steps if necessary.

Finally switch off page roll and select the clock-cracker page. Adjust L4 a quarter of a turn at a time until complete pages of error-free text are produced. Check on all the other channels.■

MONOCHROME MONITOR CONVERSION

One of the fundamental requirements for a monitor is that it is isolated from the mains. We neglected to mention this point in our article last month, and it's important that constructors incorporate a mains isolating transformer adequately rated for the set being converted. A suitable transformer is the RS Components type 207-469 which is rated at 500VA. Where the power consumption does not exceed about 150W, the 200VA type 207-021 can be used.



oDenotes wire link through board

TME791

Fig. 7: Component location diagram for the options board.

Servicing Pye Solid-State Colour Receivers

The 713, 715, 717, 725, 731, 735, 737 and 741 Chassis

Part 1 **Mike Phelan**

THIS series of articles will cover all the Pye solid-state colour chassis produced up to, but excluding, those sets using the G11 chassis. First we shall deal with the large-screen models. The 18 and 20in. sets used a chassis with certain similarities but a completely different layout: these (the 713, 715 and 717) will be discussed later.

Chassis Numbering

Now to sort out the confusing mixture of chassis numbers. The original was the 731 chassis, using a 26in. tube and an SN76544 combined line and field oscillator i.c. To make the sets VCR compatible, the i.c. was altered to a TBA920 with the field oscillator redesigned using discrete components: the chassis number became 737. Putting the tuning controls in a drawer separate from the push-buttons changed the number to 735! Later models using an A66-410X quick-heat tube had their chassis designated 741; and a "pruned" version fitted with a 20 or 22in. 90° tube was numbered 725.

Despite this complicated system of numbering, most of the panels are interchangeable; the exceptions of course are the line timebase and convergence panels, which differ for 90° and 110° models; the field timebase panel (which can be changed if three components are altered); the c.r.t. base panel; and finally power supplies coded 4A4 cannot be changed for different types.

Accessibility and Layout

Accessibility is quite good, most of the panels being held in three vertical plastic frames which slide on runners, two on the left of the c.r.t. looking from the back and one on the right. The latter holds the convergence, power supply and field timebase panels; for access, lift the plastic latch at the bottom rear corner, draw the panel to the rear until it clicks, then swing it out and lock it in position with the plastic peg at the top. In this position, the convergence controls are accessible from the front of the set. For greater access push the panel, while it's still at an angle, back into the cabinet to free it from the runners. The top runner can be freed from its guide with a strong pull, allowing the panel to be laid on its back.

The extreme left-hand frame carries the chroma panel (top) and a bottom panel containing the tuner, i.f. module, vision detector and sound stages. This frame can be pulled along its runners after the top and bottom latches have been released. When in the nearmost position, the panels swing out to the left. The frame on the left nearest the c.r.t. contains one large board with the line timebase and raster correction circuitry on it, and is attached to the cabinet in the same way as the right hand frame – it's necessary to swing out the chroma/i.f. panel however before removing or turning the line timebase. The plastic moulding on the large i.f. can is to prevent shorts to the line timebase print when both panels are out, but beware of the i.f. panel shorting against a metal aerial plug (I found this out the hard way!).

Power Supply Circuit

Starting with the power supply, a blown mains fuse will in most cases mean either that the mains rectifier thyristor D888 is short-circuit or that the mains filter capacitor C915 (0·22μF) is short-circuit. If C915 has shorted it will usually have blown one of its ends off. It should be replaced by a component rated at 1kV working. Early power supplies used a 16472 thyristor, later ones a 2N4444 or BT106. Beware of devices coded TV106 – an OT112 seems to be about the most reliable replacement.

The thyristor can suffer from leakage as an alternative to going completely short-circuit: this causes the h.t. flutter familiar to most of us (though this symptom can have other causes as well). First try setting up the h.t. Adjust RV916 (h.t. fine) to mid-position, and RV917 (h.t. coarse) fully anti-clockwise. With the meter on the dropper tag marked "185V", adjust RV917 for 195V, then adjust RV879 (overvolts) until the picture *just* starts to pulsate. Finally adjust RV917 for 185V.

Another cause of h.t. flutter is a faulty diac, particularly if of the black plastic D3202Y type. A BR100 is a suitable replacement, but in an emergency reversing the diac sometimes works. Often this device will go open-circuit, sometimes intermittently, but an intermittent diac can usually be persuaded to give up the ghost altogether when sprayed with freezer.

Early panels had a diac/thyristor arrangement for overvoltage protection: this was later altered to a more conventional circuit using a transistor – similar to that in the Philips G8 chassis. As mentioned before, the earlier and later panels are interchangeable – unless the board is a very early one coded 4A4.

A fairly common fault on this set, as in the G8 chassis, is a dry-joint on the mains filter choke L909. Those of us used to the G8 may think that a quick clean-up and re-solder will get the set going again within minutes. But no – the beast will usually be found to be very dead on switching on again. The reason is that the tag on the choke burns quite a hole in the print before the receiver packs up altogether, and the heat produced destroys D884 (7·5V zener) in the overvoltage circuit.

Measuring the voltages on the diac can be revealing in cases where a.c. is reaching the thyristor but nothing is coming out. First however make sure nothing *is* on the cathode: a very low a.c. reading means that the power supply is working but R978 (3·3Ω) is open-circuit. Confusing, but quite logical – if the thyristor's cathode is not connected to the rest of the set, it will follow the gate via R885, and the gating pulse must be between gate and cathode.

Back to the diac: there should be 11·5V positive on one

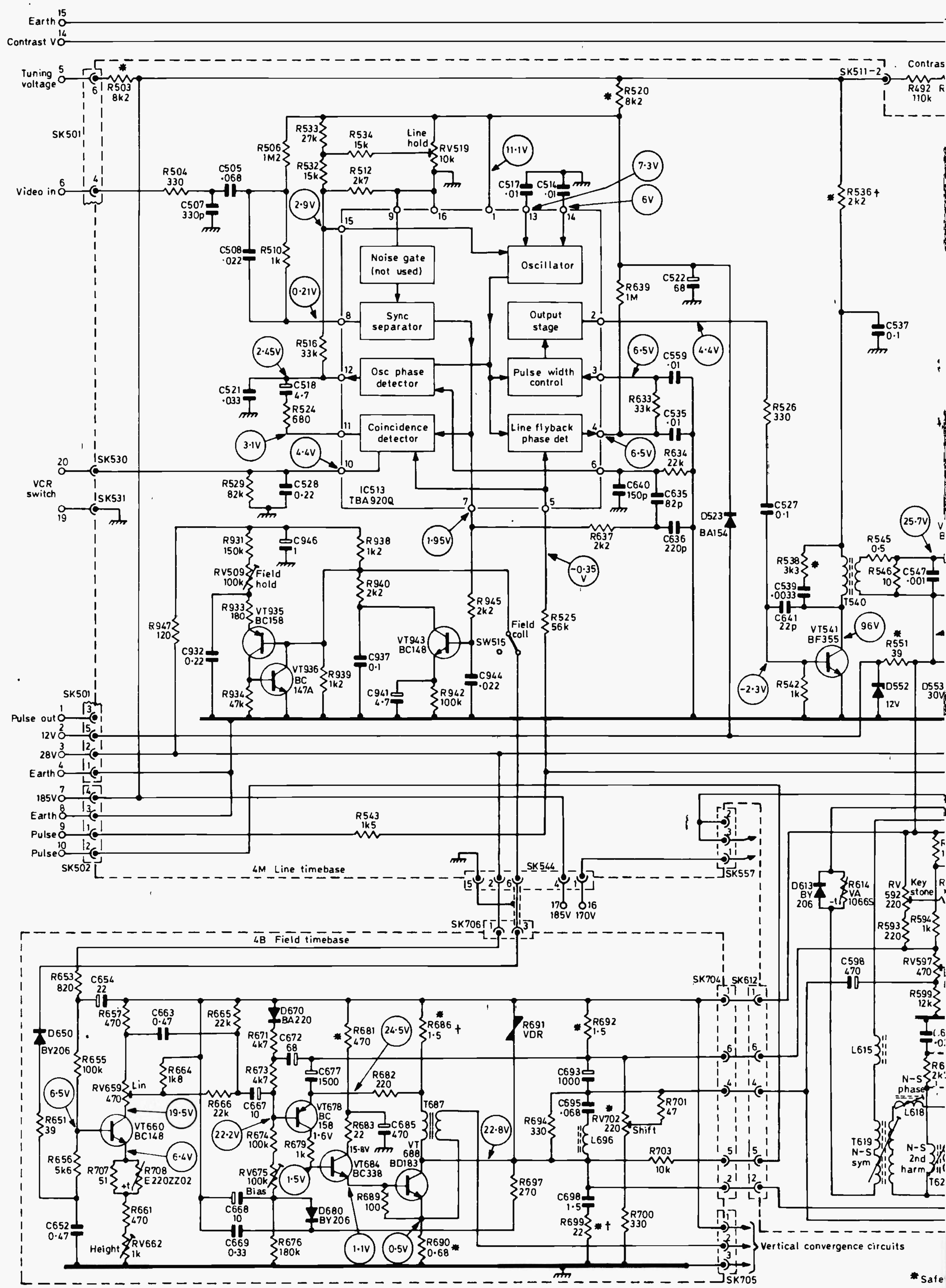
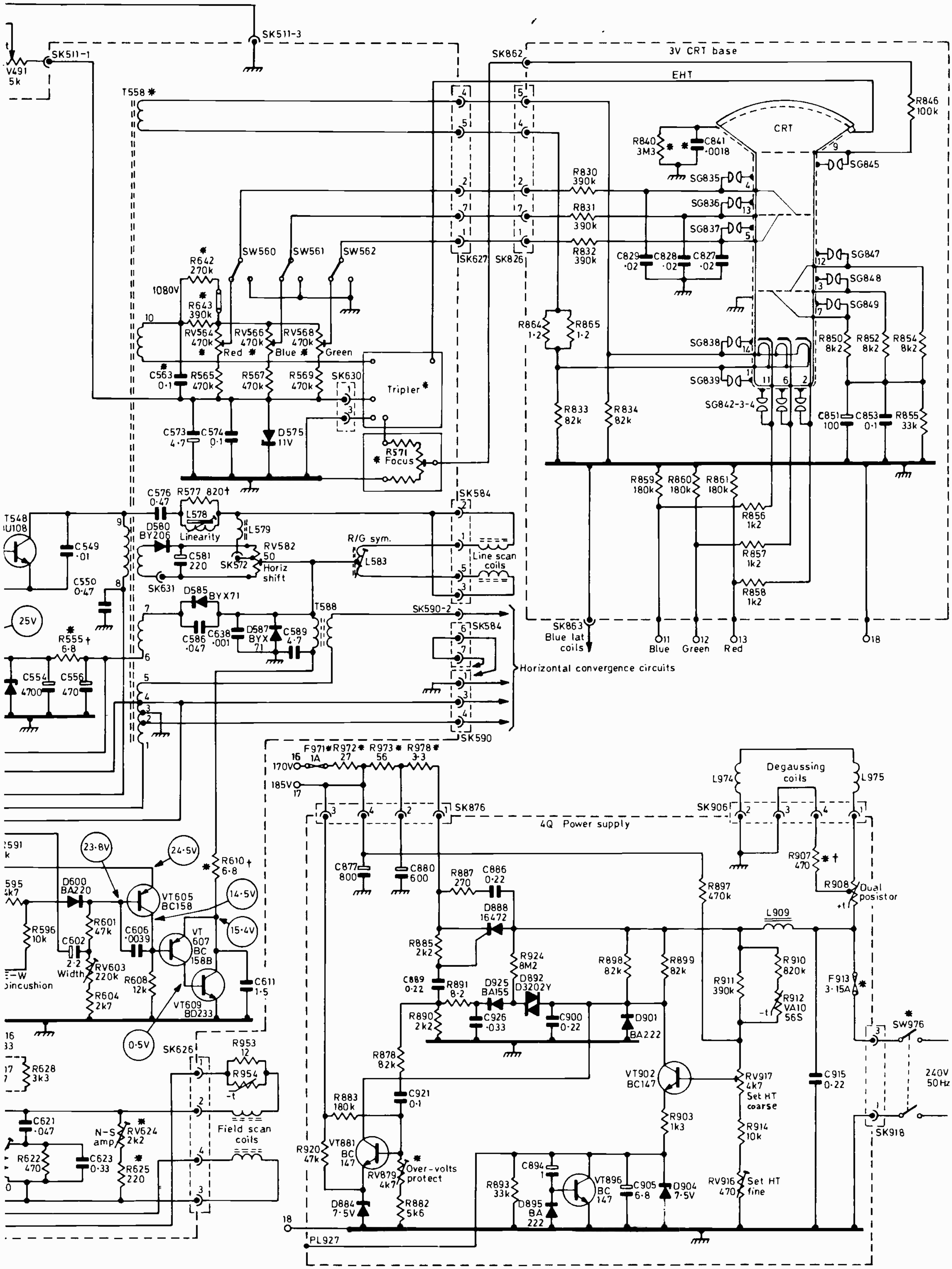


Fig. 1: The timebase, c.r.t. and power supply circuitry used in the 737 chassis. In earlier versions a gating pulse at pin 3 of SK501 is obtai



ty component to be replaced only by same type or manufacturers approved alternative. † Fusible

ned from pin 2 of the line output transformer, via an 18kΩ resistor (R632), and is used for a.g.c. gating in the TCA270Q i.c. in the i.f. strip.

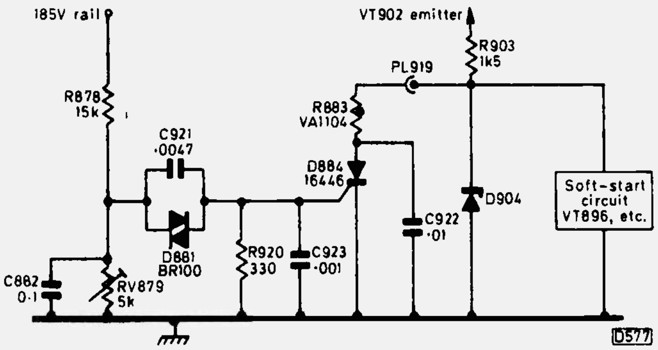


Fig. 2: The over-voltage protection circuit used in early models. On very early versions, PL919 is taken to the cathode of the mains rectifier thyristor: this gives a crowbar action, blowing the mains fuse in the event of excessive h.t. voltage.

side and 8V negative on the other – no positive voltage means either a fault in the overvoltage protection circuit or D901 (BA222) short-circuit; a very low voltage means VT896 (BC147), VT902 (BC147) or D904 (7·5V zener) short-circuit, or possibly C905 defective (can result in a very low h.t. rail if leaky). VT881 and VT896 can be temporarily removed just to check, but remove the h.t. fuse first (situated bottom centre). Lack of negative voltage normally means a defective diac.

Up to now the dropper has behaved itself, apart from the aforementioned R978, which may either be part of the dropper or a separate resistor mounted above. If of the latter type, the correct replacement must be used otherwise mysterious hum bars may be produced. Dry-joints on C880 and C877 (h.t. reservoir/smoothing) can also be the cause of hum bars. As yet we haven't had to replace either of these capacitors, but sooner or later they will begin drying up to cause low h.t.

R911 can change value to cause low h.t. As with other solid-state chassis, it's advisable to check that the h.t. is correctly adjusted whenever one of these sets is serviced.

The Line Timebase

The line timebase is fairly conventional, using a BU108 output transistor. A feature to note is the method of deriving the boost voltage for the tube first anodes. The e.h.t. tripler contains the now usual clipper diode to remove the rings on the input pulse and improve the e.h.t. regulation. If the overwinding is not connected to anything else d.c.-wise, it assumes a potential of about 1kV above chassis. The "bottom" end is decoupled by C563 (0·1μF), and supplies the first anodes. C563 in fact is the bête noire of this chassis. When it goes short-circuit it gives the symptoms of a faulty tripler – disconnect the tripler, and the line timebase starts up. Later sets use an 0·22μF, 1·25kV working capacitor. If the set is left on in this condition, the demise of the tripler, sometimes followed by the BU108 and the line output transformer, can result before the h.t. fuse blows. Where the h.t. fuse F971 has blown, C563 should be the first check therefore. C563 should also be checked whenever the tripler fails.

The 90° and 110° transformers are not interchangeable, the 90° one having more tags. Also, later replacement transformers from the manufacturer have the shift winding incorporated in the primary bobbin instead of being wound externally on to the core: a slight modification is needed on fitting, but full details are supplied with each transformer – a 2·7Ω resistor is required in series with the cathode of D580.

The next most common fault must be failure of C514, the line oscillator timing capacitor (with the TBA920 i.c.). The result is a dead set, which often springs to life if any voltage measurements are taken round the line driver stage, leaving doubt as to the cause of the fault. If the set manages to stay off, it will be found that the collector of the driver transistor VT541 is at h.t., with no negative voltage at its base. Another prod with the AVO shows that the voltage at pin 2 of the TBA920 is approximately correct – so we jump to the wrong conclusion and replace the BF355. After this disturbance the set may work, but sooner or later will fail again when C514 goes open-circuit and the line oscillator tries to run at about 3MHz. Replace with a polyester – *not* ceramic – type. Twice we have replaced C514 and the fault recurred a few weeks later due to the driver transistor developing an open-circuit base-emitter junction. The policy therefore is to replace both components at the same time.

C586 in the EW modulator circuit can be responsible for lack of width. Again a polyester type must be used. The focus unit can go up in smoke, but that's an obvious one.

The c.r.t. first anode preset controls used in these sets are prone to alteration in value, giving changes in grey scale. The series resistors R565, R567 and R569 (470kΩ) are also suspect for this. What seems to happen is that the presets fall in value while the series resistors go high, until a situation is reached where it is impossible to turn the presets down sufficiently. Sometimes it's necessary to replace R642 (270kΩ) and R643 (390kΩ) which feed the first anode potentiometers from the boost rail. They tend to go high resistance, causing a dark picture, though they can also fall in value, giving excessive brightness. The grey-scale setting up procedure will be given later, as it's necessary to adjust the d.c. levels on the decoder first.

The rest of the line timebase has proved quite reliable. One fault we've encountered once or twice on the 110° chassis has been intermittent droop at the top of the raster, caused by a bad spot on the track of RV624 (NS amplitude). The early 110° panel with the SN76544 has the latter and its associated components mounted on a small subpanel.

The Field Timebase

The field timebase uses a single-ended class A output stage with choke loading, similar to the Thorn 3500 chassis. The field oscillator, except on the early 731 chassis which uses part of the SN76544 for the purpose, employs a complementary pair of transistors on the line timebase panel. These are connected as a silicon controlled switch which gives an output consisting of negative-going pulses that forward bias D650 to produce the flyback. This discharges the field charging capacitor C652, which during the forward scan charges from the unstabilised 28V rail via R653, R655 and R656. VT660 amplifies the waveform produced by C652, its gain being variable for control of height by varying the emitter resistor's value. VT660's collector waveform is integrated by C663 and R665, R664, R666 and the linearity control RV659. The remainder of the timebase consists of three d.c.-coupled transistors, VT678, VT684 and VT688, the latter being mounted on a large heatsink. The choke load T687 is actually a transformer, but the secondary supplies a convergence waveform only.

This panel seems to be reasonably reliable, most cases of intermittent field collapse being due to faulty plugs and sockets – either SK704 near the output choke, or one of the plugs at the top of the line timebase. Attention should be directed to these when the field timebase has been proved working – either by a measurable a.c. voltage on the output transistor's collector or an audible buzz from T687.

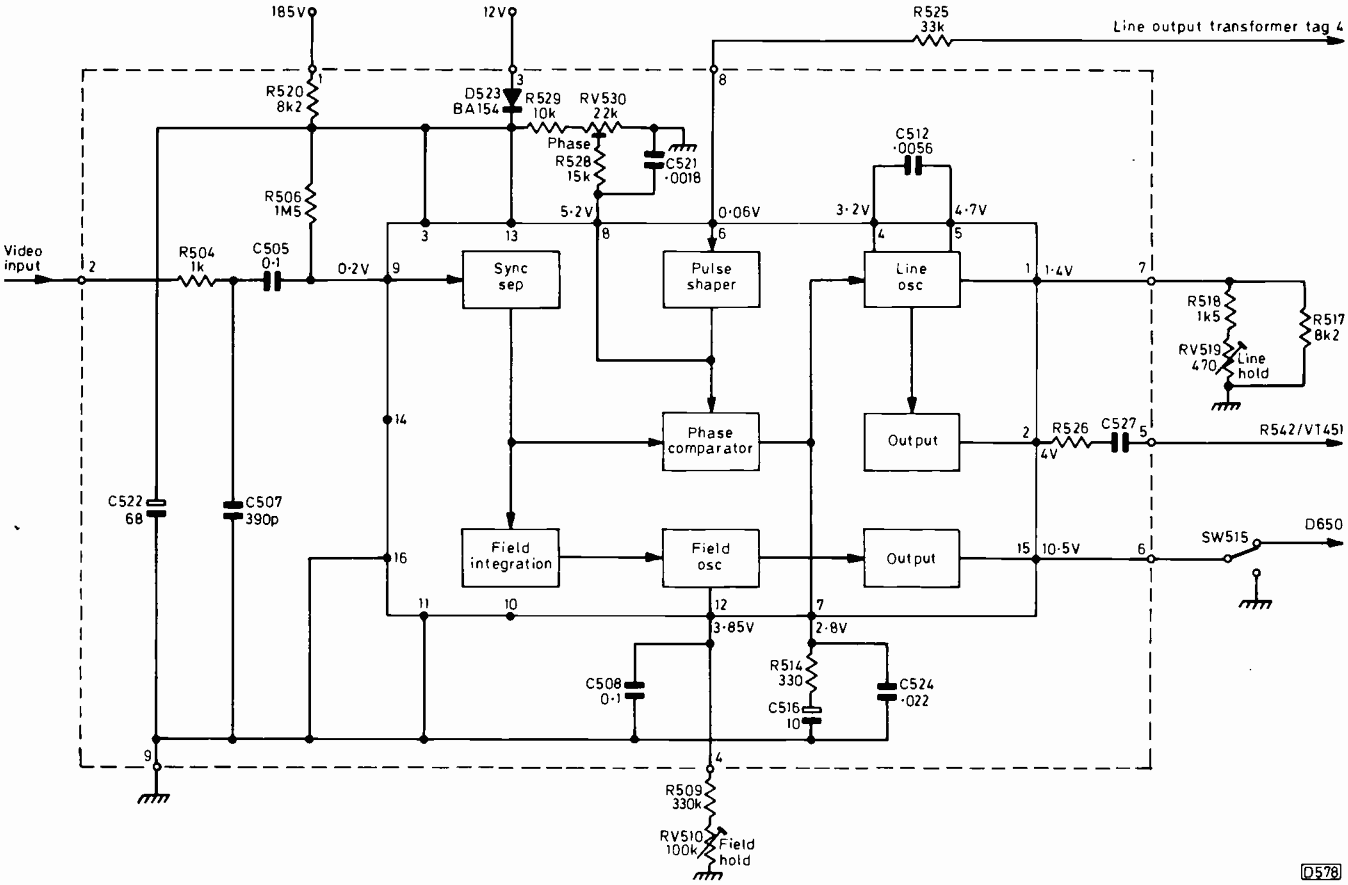


Fig. 3: The 731 chassis uses an SN76544N07 i.c. as the sync separator and line and field oscillator. It's mounted, along with certain associated components, on a subpanel, as shown above. R526 and C527 values as in Fig. 1.

A 3in. high scan with no video has nothing to do with the timebases but is caused by R555 (25V supply filter resistor) springing open. Why did it spring open? H.T. too high, probably because the thyristor in the power supply was leaky.

Both VT678 and VT684 (BC158 and BC338 respectively) can be responsible for field collapse, sometimes intermittent. The output transistor VT688 can be replaced by a 2N3055. It doesn't fail often, but can go leaky causing a progressive reduction in height as it warms up. Always check the setting of RV675 (bias) after any replacements in the field timebase. Start with the control fully clockwise, and turn anticlockwise until the slight compression about a third of the way down the raster disappears and VT688's emitter voltage is no more than 0·5V.

The various electrolytics in the field timebase cause different fault symptoms. Up to now most failures have been due to leakage, but no doubt as these sets age more of the electrolytics will have to be replaced because they've dried up. By far the most common electrolytic to give trouble is C672, in which slight leakage gives reduction of height, but still with a linear scan. C668 gives lack of height, with a band of compression at the centre of scan. We have had to replace a dried up C693 (1,000μF) once or twice, as it was giving severe lack of height with cramping at centre and bottom of the scan. Leakage in C941 causes weak field sync, which can also be caused by C194 (tuner a.g.c. smoothing) on the signals panel.

The 90° and 110° panels are interchangeable, provided three components are changed in value as follows: R661 is 1kΩ for 90°, 470Ω for 110°; R703 is 1·5kΩ for 90°, 10kΩ for 110°; C663 is 0·68μF for 90°, 0·47μF for 110°. Failure to carry out these changes will result in excessive height if a panel from a 110° set is fitted to a 90° chassis. The converse applies if the field timebase from a 725 chassis is fitted to a 110° set.

Convergence Circuitry

The convergence circuitry in both the 90° and 110° chassis has been quite free of trouble. This is in no small measure due to the good design, avoiding controls with low values and high dissipation (which inevitably become noisy and intermittent). The field convergence circuit is driven from the aforementioned secondary winding on the output transformer T687, and is of the active variety, using four transistors in a waveform amplifying and shaping circuit. These occasionally go faulty, usually with open-circuit emitter-base junctions – maybe intermittently. The result depends on which transistor is faulty, but you'll usually find gross convergence errors, the static convergence being so far out that purity is also affected. As a quick check, pull the plugs off the convergence yoke and switch on: though there will obviously be no dynamic convergence, the static convergence should be reasonable.

Other convergence faults have been few and far between, and mostly of the type that respond to tapping – for example an intermittent contact on one of the plugs, or a coil leadout wire dry-jointed.

When adjusting the convergence on the 110° sets, don't forget that there are two three-position switches which can be adjusted in conjunction with the R/G tilt and blue tilt controls. The centre positions give nil correction. As well as this, the blue lateral coil has four tappings on to which the flying lead can be plugged.

CONTINUED NEXT MONTH

Long-distance Television

Roger Bunney

THE Sporadic E season continued into June, with signals at fair levels, and many enthusiasts have remarked on the quite dramatic signals received from Scandinavia — Norway (NRK) in particular. Since NRK includes the transmitter identification on the PM5544 test pattern, establishing the exact transmitter received when the signal is clear enough is relatively easy. With conditions as they have been however, at least two NRK patterns may be received simultaneously on each channel, making identification difficult. Iceland has also been received at good strength on chs. E3 and E4: following recent advice, one DXer tried RUV reception very late – and succeeded in noting system M signals from the NW. These must obviously have originated from somewhere in the Americas!

My own log for the month has been pretty full, though there was no really dramatic reception. The following loggings were all via SpE.

2/6/79 TSS (USSR) chs. R1, 2; NRK E2, 3 and 4 (two on each channel); SR (Sweden) E2, 4. This developed into an all-day opening that jammed Band I.
3/6/79 NRK E3, 4; SR E3; DR (Denmark) E3, 4; also unidentified signals.
4/6/79 RAI (Ialy) IA (twice), IB; TVP (Poland) R1; CST (Czechoslovakia) R1; MTV (Hungary) R1; TSS R1, 2.
5/6/79 DFF (East Germany) E4.
6/6/79 SR E2, 3; RAI IA; plus many unidentified R1, 2 signals.
8/6/79 TSS R1, 2.
10/6/79 TSS R1.
16/6/79 NRK E2, 3; unidentified R1, 2 signals.
17/6/79 TSS R1 twice; RAI IA.
19/6/79 TSS R1, 2; RAI IA.
21/6/79 RAI IA; TSS R1, 2; unidentified R1, 2, 3 signals; plus a mystery signal at 0800 consisting of a pulse and bar pattern followed by a non-identified FUBK test card, weak from the SE, *between* the E2, R1 carriers.
22/6/79 SR E2, 3, 4; CST R1, 2; TSS R2; unidentified signals.
25/6/79 TVP R1, 2; unidentified R1, 2 signals.
26/6/79 RAI IB; RTP (Portugal) E2.

One point is clear: signals from RTVE (Spain) have been lacking this season. There was an improvement in tropospheric reception during the 18-20th – even W. Germany at u.h.f. was noted!

Hugh Cocks (E. Sussex) reports reception of "JTV AMMAN" (identification on PM5544 test pattern) on Sunday the 10th at 1620. There have been several reports that the RAI PM5544 pattern has been seen with the identification "RAY 1" instead of the usual "RAI 1". Mike Allmark (Leeds) received the Tele Oristano (Sardinia) ch. IB electronic test pattern on the 1st – it resembles the W. German circular type pattern of the late 1960s, with the identification "Teleor Can B UHF". Kevin Jackson (Leeds) and Hugh Cocks report reception of another ch. E3 Italian "free" station early in the period, with the "NCT" caption. Gwelo, Rhodesia ch. E2 was received at good strength on May 29th. Geoff Perrin (Dubai) also reports good SpE conditions – he received Pakistan ch. E4 using the PM5544 pattern with the identification "Pakistan" at the top and "Television" at the bottom.

During the early hours of June 12th, Cyril Willis (Cambridge) attempted to receive RUV (Iceland). Starting at 0115, he received for twenty minutes rolling pictures that were out of both field and line sync. This suggests a system M signal. Cyril reports that the signals were "in the middle of the tuner, at around ch. E3", i.e. ch. A2. No sound was present unfortunately, so the origin of the signals will never be known. I feel that they are most likely to have come from the eastern seaboard, since they were picked up from a westerly direction.

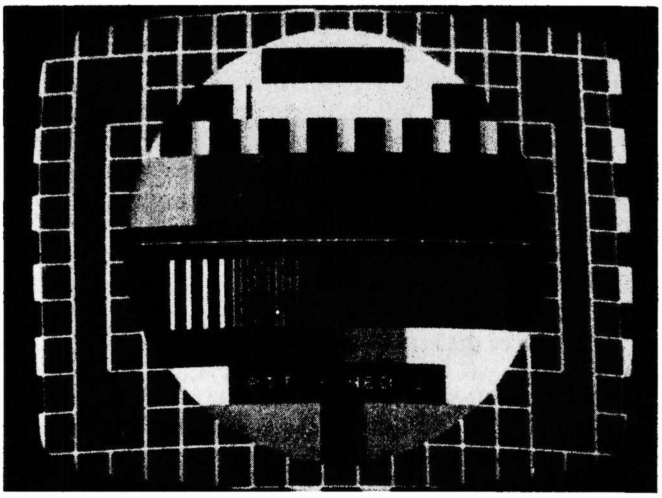
A correction to the July column incidentally. On page 475 the Lopik channel should have been given as E4, not E3.

News Items

Luxembourg: CLT is using a 1,000kW transmitter at Dudelange to facilitate reception in Belgium and W. Germany. It's the first time that the same programmes have been transmitted on different standards from co-sited transmitters.
Albania: A new transmitter in Tirana is operating on ch. E10, providing a superior signal to the ch. C outlet.
Eire: New EBU listings: Cork ch. IG 100/50kW vertical; Sligo ch. IG 100/10kW horizontal; Gort ch. IH 100/50kW vertical; Kilkenny ch. IJ 100/50kW vertical – all RTE-2. Three Rocks RTE-1 ch. 29, 25kW horizontal. The Dublin ch. B3 and B7 and Sligo ch. B11 transmitters have now closed down.

The 30-50MHz Band

With the exception of ch. B1 and TV from ch. E2 upwards, the band 30-50MHz is empty in the UK – apart from i.f. radiation of course. In other parts this spectrum is used for medium-haul ground-wave communications, and of course for forward-scatter communications in Eastern Europe. When F2 propagation is increasing, this band can be used to advantage to see how high the maximum usable frequency has reached. Signals you may receive can come from Indian or African mobile radio transmitters, Russian communications, or US Highway Patrol and paging



The NOS (Holland) PM5544 test pattern, received by Gareth Price (Lowestoft) on ch. 27.

stations. Short-wave radio harmonics abound of course.

Covering this spectrum is a problem unfortunately, since apart from specialised communications receivers (the Eddystone 770R etc.) there's little equipment available. I've approached the problem in various ways over the years, and do at present have a means of covering this spectrum accurately.

During the last sunspot cycle I modified the coils of a government surplus RF26 unit, feeding its i.f. output into a short-wave receiver. The next approach was to use a home-built tunable converter, covering 25-55MHz, using EF80/ECF80/EF80 valves and Denco coils. The Denco range of v.h.f. coils, reaching to about 80MHz, is still available and could probably be used with f.e.t. circuitry. Subsequently I obtained through *Practical Wireless's* VHF Bands columnist Ron Ham an historical (circa 1939) Hallicrafters S21 receiver covering 25-66MHz. Later types, including the S36, cover 26-150MHz and are available at low cost. Unfortunately, impressive though these receivers look they use elderly valves which by today's standards have low gain and poor noise performance. For the wealthy in our midst, Eddystone manufacture both v.h.f. and u.h.f. radio units (990 series).

Perhaps the easiest and cheapest way of covering the spectrum, assuming that you have a short-wave receiver covering 10·7MHz, is to use the tuner head available from Ambit International (Brentwood, Essex). Their 5402 varicap tuned head unit is available covering 30-50MHz and features a BF256 f.e.t. input amplifier driving a TFK1062 v.h.f. i.c. with an output at 10·7MHz. There's a pin diode a.g.c. system, but the only voltage requirements are a 12V supply and the tuning voltage. The cost (early June) is £14·75 plus VAT, and delivery approximately four weeks.

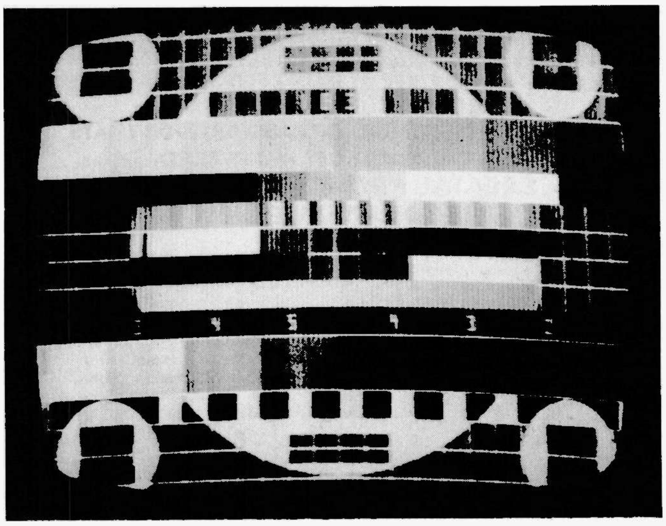
Coverage of 30-50MHz can also be obtained by using imported transistor radio receivers intended for the American market and for police monitoring. They are imported by Allan Electronics, 21 Ocean View, Whitley Bay, Tyne and Wear, NE26 1AL, and several models are available. I invested in the cheapest one, which is a Radioshak model with the Realistic emblem, made in Taiwan for export to Tandy in Canada. The "Patrolman 50" I'm using covers 30-50MHz, 108-174MHz and 450-512MHz with f.m. demodulation and squelch provision, and the broadcast bands 88-108MHz and MW. The electronics, including the miniature u.h.f. tuner, are mounted on a single board. Switching from band to band connects the aerial to the appropriate tuner, separate tuners being provided for each band with a common ganged tuning capacitor. The gain is good and the overall quality better than expected. Being intended for the American market, the mains transformer is for 120V a.c. input, though the importers say that 240V adaptors are available.

The set I ordered came via a Canadian air cargo flight and was held for a considerable time by the customs at Heathrow. Apparently there are now ample stocks however. Unfortunately, recent price and VAT increases have made this a less attractive proposition than last winter, but it does provide the quickest way of monitoring the required band with minimum effort. In its original form (120V a.c. and 6V battery operation) the Patrolman 50 costs £80·44, or £85 with 240V in-line adaptor, inclusive of postage and VAT.

Any other ideas from readers on covering the 30-50MHz band would be welcome.

F2 Propagation

Ian Roberts (South Africa) reports that an s.s.b. two-way



The Russian electronic test pattern received on ch. R2 via SpE by Gareth Price.

An example of reception during a period of enhanced tropospheric propagation – photo by Gareth Price.

contact has taken place at 144MHz between Italy and Luderitz (S.W. Africa), setting a new world record. Texas TV DXer Pat Dyers received ch. A2 (at up to 58MHz) from Venezuela on April 17th, the first time in this cycle. Jerry Pulice (Staten Island, USA) reports that during good F2 conditions in February the UK ch. B2 could be received at high levels, though with no sign of ch. B1 at 45MHz. On other days during February ch. B1 was generally very, very strong!

From our Correspondents . . .

The many letters I've received this month indicate that SpE reception has been experienced throughout the country. Mike Gaskin (Croydon) has been using a JVC 3050 portable TV set with excellent results, despite being only two miles from Crystal Palace. His loggings include Denmark chs. E3 and E4 via a very short skip path, and a 200W 88MHz RUV (Iceland) f.m. station.

Frank Jimenez (Clapham) has logged SR, NRK and RUV with only a small aerial sticking out of the window. He too has received short-skip signals from Denmark. John Lees (Cheltenham) has noted the RAI test card with "RAY 1" identification, and two West German transmitters at Ochsenkopf and Kreuzberg, using an indoor aerial. Gareth Price (Lowestoft) has sent us an excellent photograph of the Russian electronic test pattern, received on ch. R2.

Long-distance TV for the Beginner

The Long-distance Television column and its predecessor DX-TV have been running monthly in this magazine since the early 1960s. There have been many changes over the years: colour is now often a feature of long-distance (DX) reception; there has been a vast increase in the number of transmitters (all seemingly using that plague – for identification purposes – the PM5544 test pattern); but perhaps the change that has become the greatest problem is the increase in the number of programme hours, with the corresponding reduction in test card transmission time, making station identification increasingly difficult. The technology has also changed: u.h.f. DX-TV reception is now firmly established, while some enthusiasts have already sampled the delights of satellite TV. And with advances in tuner and aerial technology, it's possible to achieve reception at very low signal levels. To cater for newcomers, it's necessary from time to time to go over the basic techniques of DX-TV reception, so here we go again. My apologies to those who already know it all: I'm sure they will understand.

Perhaps most viewer's first introduction to DX-TV reception comes when they find on their screen a signal that hasn't come from one of the local transmitters. This may happen while tuning between the usual stations, and may lead to an exploration over the whole u.h.f. TV band. This will probably reveal further unexpected signals.

The quality of distant TV signals varies from day to day, and the signals may last for a few hours or less. Warm, settled weather is best. There may in some locations be distant signals of sorts present every day, stronger on some days than on others. U.H.F. signals are particularly dependent on weather conditions. Remember the "old 405-line days" however, when the BBC signal would sometimes be upset during the summer months by weird patterning and Spanish voices, leading to the familiar "foreign interference" announcements. That's another form of DX-TV reception, but at distances of 500 miles or more, actual signal strength being very strong and receivable even on an indoor aerial.

The potential DX-TV enthusiast will obviously wish to minimise his initial expenditure until he can assess the possibilities that expensive aerials and ancilliary equipment might bring at his location. Fortunately it's possible to use a standard u.h.f. TV receiver (preferrably one with full dial tuning rather than push-buttons for channel selection) for both v.h.f. and u.h.f. DX reception – more on that next month.

Considering first long-distance u.h.f. reception, we've already pointed out that the number of transmitters that can be received and the quality of the signals is related to the weather. This is determined by the conditions in the troposphere – the region from the Earth's surface upwards to some 25,000ft. (8,000m.). For obvious reasons, this type of reception is called tropospheric reception. Pointers to the likelihood of such reception are the slow-moving high-pressure systems that give us our sunny, cloudless summer days, with a rapid fall in temperature at night due to the clear skies. This results in the signals improving during the evening, falling off next morning as the Sun heats the Earth's atmosphere again. Fog is another effect that's often present during such conditions, and during the autumn you'll often find that remarkable tropospheric reception is possible during foggy conditions. Sometimes, when a moving weather system produces abrupt pressure changes along the isobars, a form of signal ducting occurs – *along* the line of the isobar. So it pays to keep an eye on the weather maps.

You don't need a vast or complicated installation to start experimenting with DX u.h.f. reception. Obviously an aerial is required, and a basic rule of aerials is the larger the system the higher the gain, i.e. a big aerial captures more signal. Fortunately however the advent of low-noise aerial preamplifiers has made it possible to achieve reasonable DX reception using a compact array.

The bandwidth of u.h.f. aerials (and preamplifiers) varies. Most aerials sold for normal domestic reception of local transmissions are grouped, i.e. designed to receive particular groups of channels – group A, channels 21-34; group B channels 39-53; group C/D channels 48-68. There are also wideband u.h.f. aerials – for channels 39-68 (group E); channels 21-48 (usually suffixed K); and the /W type which covers the entire u.h.f. bandwidth (channels 21-68). To minimise outlay, a single /W aerial is a sensible purchase. Since gain falls with increase in bandwidth however, improved results will be obtained by employing a group A and group E aerial or by employing three aerials (group A, B and C/D) to cover the bandwidth. For a given type of aerial, the greater the number of elements the higher the gain and the more directional the response (assuming that the system is correctly designed of course).

Gain is specified in decibels (dBs), the basic half-wave dipole being assumed to have zero gain. Add a reflector rod and perhaps a couple of director rods and the aerial gain is increased, at the same time making the system more directional, i.e. restricting the forward pickup angle (helpful in reducing interference from unwanted signals). An aerial with a 3dB gain has twice the signal output of a single half-wave dipole, i.e. there's a power gain. A four times increase is 6dB, an eight times increase 9dB, a sixteen times increase 12dB – in fact a 3dB power gain every time the output doubles. If you want to go into aerial theory in greater depth, it would be worth consulting Gordon J. King's "Practical Aerial Manual", 2nd edition, published by Newnes-Butterworths. If I may include a commercial break at this point, you'll also find much information on aerials in my own book "Long-Distance Television (DX-TV) for the Enthusiast", published by Babani Publishing at £1·45. There's far more information there than I can include here.

So you buy your aerial, and we'll assume you don't live within five miles or so of a high-power transmitter (if you do, you've got problems!). The next thing is where to point it, since there are signals in all directions. It's obviously best to be able to rotate the aerial. Aerial rotators are available, but again this involves expense. If you have access to a wall and ground however you can erect the aerial on a scaffold pole mounted on a large ball bearing. Support the pole with wall brackets and thrust/ballrace/bearings – so long as the friction is low and the aerial clears the roof, it can be turned by hand (for further details see the article by Keith Hamer and Gary Smith in the March 1978 issue of *Television*).

An aerial preamplifier is helpful – essential in some locations, but occasionally a problem (less than five miles from a local transmitter). It can be used indoors where the feeder run is very short (say less than 30ft.) and very low-loss, high-quality coaxial cable is used. If a long length of cable is necessary however the preamplifier must be mounted at the aerial end. Select a medium- to high-gain preamplifier, with low noise and good cross-modulation performance, i.e. it can withstand a high-level local signal without overloading (producing interference on other channels). Wideband preamplifiers can be obtained with noise figures of less than 3dB and gains of 22dB minimum (voltage gain, not power gain) over the entire bandwidth. It's worth taking a look at the Labgear and Wolsey ranges.

Turning to aerials again, if minimum outlay is essential I'd suggest giving thought to a stacked bowtie system, such as the Wolsey Colour King and other variants, or a multiple Yagi aerial such as the /W versions in the Antiference XG range. Fuba also have a range of wideband aerials with a high reputation.

If interference from a local channel is a problem, a simple filter can be made to attenuate such channel(s). If preamplifier overloading is taking place however the filtering will have to be done prior to the preamplifier. Hugh Cocks covered the whole subject of filtering in the November 1977 issue of *Television*.

Tropospheric signal propagation can result in u.h.f. reception over many hundreds of miles, at high signal levels. In the eastern coastal areas of the UK, signals have been received from as far away as Poland, the USSR, Sweden, Czechoslovakia, Austria and Switzerland. On a more local note, in most areas a good aerial installation should provide at least one additional IBA channel.

Tuners for DX-TV

Hugh Cocks

For some time the ELC2000 tuner has been much sought after by DXers. This tuner covers the v.h.f. and u.h.f. bands, with the advantage of an extended low-band coverage (Bands I and II) up to approximately 90MHz, enabling the OIRT and Italian/Albanian Band II channels to be received. The disadvantage of the tuner is its price, also its availability, though the latter has improved recently.

I recently came across a cheaper solution which also has a marginally improved frequency coverage – the ELC2060 tuner. This is physically identical to the ELC2000, the difference in coverage being that the low band extends to over 100MHz, enabling channel R5 to be received (not possible with the ELC2000). The ELC2060 is intended for use in sets destined for the Australian market, which accounts for the extended frequency range.

A minor advantage of this tuner is that on Band III it's aligned down to 138MHz, the Australian channel 5A. Coverage in practice extends well below this, down to about 110MHz, making possible reception of a multitude of non-TV signals. The ELC2000 also has this band coverage, but the tuned circuits are aligned only as far as the bottom of the European Band III (approximately 175MHz).

The ELC2060's u.h.f. coverage is good – from below channel 21 to well above channel 68.

The tuner is available from Sendz Components, 2 Woodrange Close, Thorpe Bay, Essex. The price at the time of writing is £4·50, including VAT and postage.

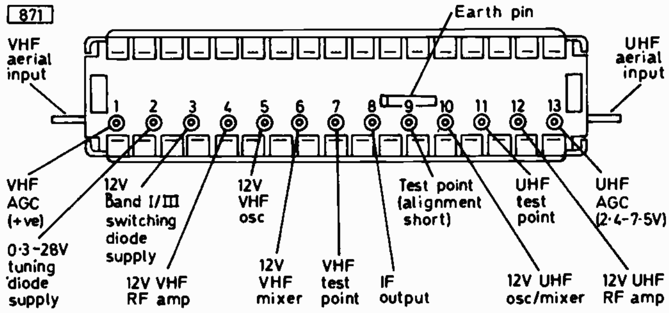


Fig. 1: ELC2000/ELC2060 u.h.f./v.h.f. varicap tuner pin connections. The output from the u.h.f. section of the tuner is coupled to the v.h.f. mixer.

TV Troubles

Robin D. Smith

Rank A823 Chassis

A six year old set fitted with the Rank A823 chassis was in need of a general overhaul. It came in initially because the customer complained of a "ticking" noise which we never heard. We decided to fit a new tube and while the chassis was out had a good look around. The h.t. reservoir/smoothing capacitors 8C9/10 had leaked badly over the chassis, so had to be replaced, but we doubted whether this could have had anything to do with the "ticking". Close inspection in the e.h.t. compartment then revealed that the focus stick 6VDR1 had crumbled badly, so we assumed that this was the cause of the complaint.

With the new tube fitted and the e.h.t. set up correctly there was a reasonable picture but not one of the quality that should have been present with a new tube in the set. Attention was turned to the two-chip decoder therefore, and the U reference signal at 3TP7 adjusted for 600mV by means of the preset colour control 2RV6 (see my notes in the July 1978 issue, page 465). The general colour still appeared to be desaturated however. A new decoder panel produced the results we were after, so we realigned the original following the instructions in the manual. We found that by setting up the matrix amplitude control 3RV3, the V reference phase coil 3L5, the U reference phase coil 3L10 and the matrix phase coil 3L7 our troubles were completely cured.

We've since had several of these decoders in with similar alignment errors.

The customer himself had had a go on one of the later A823B versions of this chassis. Finding the l.t. voltages to the decoder and i.f. unit low, he'd decided to check the smoothing electrolytics 8C3/4 in the power supply. He came to the conclusion that they were both leaky, but as he didn't have a replacement he decided to refit the panel while obtaining a new can. He forgot to refit the screws securing the panel to the chassis however, and on switching the set on there was a loud bang. When he'd sorted that out, he discovered he'd got no picture. This is where we came on the scene.

The l.t. was low but e.h.t. was present. We then advanced the c.r.t.'s first anode controls to maximum, obtaining a negative picture. It's my experience that this is generally due to the SL901B i.c. on the decoder panel, so I came to the conclusion that he'd destroyed it when the power supply earthing had been incorrect. I decided to leave this however until the l.t. supply was correct. It was about 3V down, with hum at minimum volume and a hum bar. 8C3/4 were checked but seemed to be all right, so the other two electrolytics 8C1/2 came under suspicion. Muck had started to leak out, but a replacement block still didn't cure any of the faults.

So if the power supply panel and 8C1/2 weren't the cause of the trouble, what was? I remembered a similar fault that took me an age to find many years ago. There's a tagstrip near 8C1/2/9/10, secured to chassis by two screws which provide the necessary earth connections for the components mounted on the strip. On examination, one of these screws was found to be very loose. It was tightened, with a little difficulty, the chassis assembled and the set switched on. L.T. now correct, no zero volume hum, no hum bar. Replace the SL901B, reset the chroma reference signal level, generally converge and the results were excellent.

Intermittent Signals

The trouble on an ITT colour set fitted with the CVC9 chassis was intermittent loss of sound and picture – the sound and vision would cut out, leaving just a snowy raster. This suggested a fault in the i.f. strip, not uncommon on these sets. We noticed however that the picture geometry was not quite correct when the fault appeared, and felt that maybe the fault was in the line output stage. Now the small panel on the line output transformer is prone to dry-joints, so instinct told us to look there first. Luckily we found the fault quickly – at the pulse winding earth pin 3 – and resoldering cleared the trouble. Why did this remove the signals? Well the 75V pulse from pin 4 of this winding is used to gate the a.g.c. circuit. With no pulse present, there's no a.g.c. action and the first two i.f. transistors are driven into saturation, removing the signals.

Signal Cramping

A customer brought in a Bush monochrome set (TV161 series) with the fault weak field lock. He'd been having a go himself, having fitted a regunned c.r.t. and checked the field timebase thoroughly. On switching on I noticed that the picture was not as good as it should have been with a replacement tube, indicating a fault in the video circuitry. The voltages around the PFL200 video output/sync valve were all correct, so I moved back to the video phase-splitter transistor 2VT4. The collector was at the l.t. rail voltage, while both the base and emitter read 0·7V. Clearly the transistor was short-circuit base-to-emitter, and a replacement gave a sharp picture with good field lock. From experience, I've found that tube flashover is usually the cause of the failure of this transistor – remember that a new tube had been fitted.

2VT4 acts as an emitter-follower on 625-lines incidentally, with no gain but a high input and low output impedance. The short-circuit would load the detector circuit therefore, clipping the sync and video information.

Terrible Striations

The same customer, a bit of a TV cowboy, subsequently brought in a Philips dual-standard monochrome set (210 chassis) with the worst vertical striations I'd ever seen – alternate black and white bars, about 2in. wide, right across the screen. This time he'd fitted a new line output transformer – and after some time spent checking the connections, we found he'd got them wrong. The moral here is always to make a drawing before removing any part which has multiple connections, in particular noting the destinations of any wires with the same colour coding.

Line Drive Trouble

Back in February I described an awkward fault on a Decca Bradford chassis – the picture getting darker after the set had been on for a while. The trouble then was due to the feedback capacitor (C427) in the line oscillator stage being of the wrong value, as a result of which the line drive waveform was incorrect. The set was back with us recently with similar trouble – low amplitude line drive, as a result of which the line output valve was overheating, eventually blowing the 500mA h.t. fuse. Checking the voltages in the line oscillator circuit didn't reveal any major errors, but then meters aren't always that accurate when it comes to oscillator stages. This time the fault was traced to the pentode's anode load resistor R444, which had changed value from 33kΩ to something more like 3·3kΩ.

Yet More Cowboys

The 'phone rang one morning recently. "Have you a 13A to 15A fuse for a colour TV set?" "There's no such thing" we replied. "Well the one fitted was 13A, and a 13A mains fuse blows." So we had the set in and duly noted a 13A fuse in the mains fuse holder. It turned out to be a Bush set, fitted with the A823A chassis. Checks revealed that the thyristor rectifier was short-circuit, the series thermistor shattered, and the associated print blown apart. After making the necessary repairs, fitting the correct fuses (none of them correct) and setting up we awaited the return of this other cowboy. When he came in we asked him what made him think the fuse was rated at 13A? "Well the old one was marked T3·15A" he said, "and I took this to mean 13-15A."

Another A823A chassis had received the attentions of the son of the house. He'd started a job in electronics and, after four months, thought he could repair colour television sets. He'd apparently found the l.t. fuse blown, due he discovered to a short-circuit l.t. rectifier, but on replacing these still had no picture. We first checked the h.t., which was found to be high at 240V. This indicated the reason for the absence of e.h.t. – the over-voltage protection circuit had tripped, stopping the line oscillator. So we turned the set e.h.t./h.t. control 8RV1 to minimum, then advanced it to read 200V at the h.t. fuse 8F3. Still no picture, because the tube heaters were not alight, but a healthy oscillation could be heard and the hairs on the back of a hand placed close to the tube face confirmed the presence of e.h.t. The absence of the heater supply was simply a plug-and-socket fault, soon put right.

It's very easy to move 8RV1 accidentally when working on the power supply panel, which was presumably why the h.t. was high and the over-voltage trip had operated. We always turn it to minimum before switching on after carrying out any repairs in this area.

Anyway, we now had a picture – but it was negative, with flyback lines. From experience we concluded that the SL901B demodulator/matrixing i.c. on the decoder panel was faulty, and a replacement produced a normal picture.

We gave the budding apprentice a short talk, and I expect he got a thick ear when his father received our bill for £17. Shame!

A Pye Hybrid Colour Set

We were caught again the other day by a stock fault on the Pye hybrid colour chassis – lines across the top of the picture due to a defective pincushion correction potentiometer, RV41 – though the fault had taken eight years to put in an appearance. The cause of the trouble was a dead spot on the wirewound track – the fault disappeared when the preset was moved. Cleaning and refitting the control cleared the problem. Another fault on the set was that the green first anode control couldn't be adjusted, due to its series 1·5MΩ resistor R465 being open-circuit.

While setting the receiver up, R389 (3·3kΩ) on the CDA panel started to glow like a bulb. This resistor supplies the screen grids of the PCL84 colour-difference output valves, also the tuning voltage for the varicap tuner. It's decoupled by a 4μF electrolytic, which was our first suspect, but the trouble turned out to be due to a screen grid-cathode short in one of the PCL84 valves.

On making some further adjustments we had the set working very well for its age.

20AX Tube Fault

The complaint on a set fitted with the ITT CVC32 chassis was lack of brightness. The set was only four weeks old, so we thought that adjusting a preset was probably all that would be required. On inspecting the test card however we found that the focus and convergence were very poor at the edges – in fact the picture was poor generally. It turned out to be a faulty tube – our first defective 20AX type. Very easy to change and set up on this chassis.

All Part of the Service . . .

The customer complained that the sound on his GEC C2110 series receiver cut out after a couple of hours. Fitting a replacement sound panel cured the problem – these panels are not worth repairing by us – but a week or so later the customer phoned to say that the trouble had returned, along with varying brightness. On examination, we found the set to be thoroughly wet, with the e.h.t. sparking away. We brought it into the workshop to dry it out, after which it performed correctly. All this had to be done free of charge, since the set was under guarantee. All we could do was to give some advice on heating and hope for the best.

TV Servicing: Beginners Start Here . . .

Part 24

S. Simon

LAST month we tiptoed into the shallow end of colour receiver servicing, and found that the power supply and line timebase sections of a hybrid colour set present little in the way of problems that we've not already met in dealing with monochrome receivers. We must now wade into slightly deeper water.

The next part of the set – sticking with Pye hybrid chassis – we're going to look at is the CDA panel – CDA standing for colour-difference amplifier. Why colour-difference? Well, remember first that there are three beams in a colour tube, to activate the red, green and blue phosphors, and that the luminance signal will drive the colour tube to produce a monochrome display just as with a monochrome set – in fact the luminance signal in a colour set is exactly the same as the video signal that drives the c.r.t. in a monochrome set. Clearly then to get colour on our colour tube we require something in addition to the luminance signal. That something consists of three colour-difference signals, one each for the three primary colours, red, green and blue. They may be positive- or negative-going, so as to add to or subtract from the luminance signal applied to each gun. Say we want to turn our display from monochrome to red. Obviously we have to turn up the red beam, but at the same time we have to turn down the blue and green beams, in order to preserve the correct brightness level. This is what the colour-difference signals do.

Colour Mixing

This is obviously a mixing process. We mix the luminance signal (Y) with the colour-difference signals (B – Y, R – Y and G – Y) in order to get the correct colour in the display. Now this mixing can be done in several ways. It can be done by a simple resistor network before application of the signals to the c.r.t., or as in most recent chassis in an i.c., or alternatively, as in many hybrid chassis including the Pye ones, by feeding the Y signals to the c.r.t. cathodes and the colour-difference signals to the tube's control grids (see Fig. 1). This latter technique is for obvious reasons called colour-difference tube drive; the alternative arrangement, in which the tube is driven (almost always at its cathodes) by RGB signals, is for equally obvious reasons called RGB tube drive. Note that for a monochrome display the colour-difference signals simply disappear, the tube being driven by the luminance signal only.

Grey Scale

As you'd expect, there are some complications. Since the human eye has an uneven colour response, the signal levels have to be adjusted to take this into account. The correction required is done at the transmitter. To take into account receiver circuit tolerances, and differences between the characteristics of different tubes, highlight presets are incorporated in the tube drive circuits while the tube's first anodes are provided with low-light presets that set the cut-off levels of the three guns (since the PIL type of tube has a common first anode structure, the low-light presets with this type of c.r.t. must act on the tube's biasing). When everything is set up correctly, we should have a tint-free grey scale from bright white through to dark grey.

This is all very nice, but alas tubes age and the emission of the three guns tends to vary over a period of time, with the result that the displayed picture may show decided colour tints at different brightness levels. Assuming that the tube's emission is good however, the grey scale should not be too difficult to set up, if indeed this is necessary at all. The point to bear in mind is that if a good black-and-white picture cannot be resolved with the colour off, it will be impossible to obtain correct colours when colour is restored to the display. You have the first basic rule of colour receiver servicing therefore: first get it right in black and white.

CDA Circuitry

RGB drive to the tube's cathodes is the more efficient system, since the cathodes are being swung with respect to steady voltages on the first anodes and control grids, i.e. if the cathode is driven negatively, this is the same as both the control grid and the first anode being driven positively, whereas when a colour-difference signal is applied to the grid the voltage difference between the cathode and the first

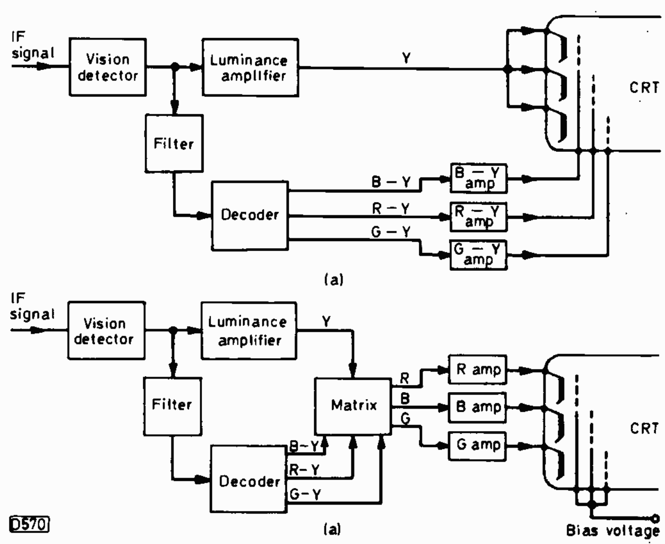


Fig. 1: Methods of driving a colour tube. (a) Colour-difference drive, with the luminance signal (Y) applied to the three cathodes and the three colour-difference signals applied to the grids. The tube then carries out the RGB matrixing, the phosphor screen being activated by the three primary-colour signals. (b) RGB drive. In this case matrixing is carried out prior to the tube, the RGB signals being applied (almost always) to the three cathodes.

anode remains the same, so that a larger signal swing is required. This large signal swing requirement persuaded most designers of early sets to opt for valve colour-difference amplifiers. If the signal voltage swing required to drive a beam from full on to full off is 150V, this must be developed across a resistor of some 10kΩ from a supply line of over 200V. A valve with a fairly good mutual conductance figure (change of anode current with change of grid voltage) is required to provide the current necessary to produce this swing across the 10kΩ load resistor. So it's quite common to find three colour-difference amplifier valves of the PCL84 type driving the three tube control grids, while a PL802 luminance output pentode drives the three tube cathodes. This valve line-up is not universal however: in the Philips G6 chassis for example you'll find a PFL200 used as the luminance output valve and three PCF200 valves as the colour-difference amplifiers.

The PCL84 and PCF200 valves are triode-pentodes, the pentode sections being the high-gain amplifiers which drive the c.r.t. grids, while the triodes are used as clamps to keep the d.c. conditions at the tube grids correct (because the pentodes are a.c. coupled to the grids). The basic idea is shown in Fig. 2. The drive signal developed across R1 is coupled via C1 to the c.r.t. grid. The triode clamp is driven hard on at the end of each line by a pulse derived from the line output stage. As a result, the junction of C1 and R2 is restored once each line to the voltage set by the potential divider R3/R4, thus stabilising the d.c. conditions.

The clamp triode's anode resistor is of a high value, typically 10MΩ, and it's not uncommon to find one of these (remember that three such circuits are required, one for each c.r.t. control grid) open-circuit or very high in value, thus allowing the relevant tube grid to drift, rendering the grey scale quite wrong. Note that as a result of the a.c. coupling a faulty pentode anode load resistor (R1) will not affect the grey scale (there's no colour signal swing) but will really upset the colour rendering.

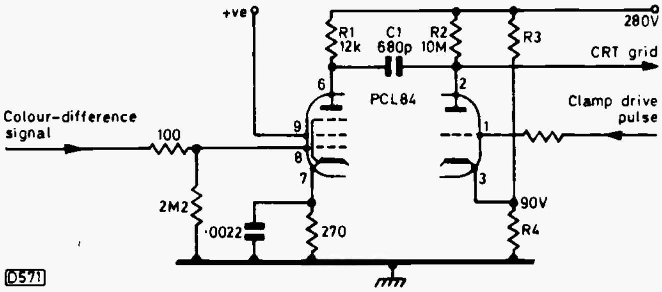


Fig. 2: A typical colour-difference output stage, with triode clamp. C1 couples the signal to the c.r.t.'s grid, with the triode setting the d.c. conditions at the grid. The black level is set by the potential divider R3/R4.

Poor Grey Scale

Inability to obtain a good grey-scale with a tube that's known to be good must direct attention to the tube base voltages, checking that the first anode voltages are roughly equal (say 450V at each first anode pin), that the cathodes are at whatever is stated in the service data for the set (say 220V) while the grids are at around 80-100V (assuming colour-difference tube drive). If the application of the voltmeter to one cathode drastically changes the colour, check the preset drive control associated with that cathode (see Fig. 3). If the grid voltages are not roughly the same, check the clamp triode and its associated components, particularly the high-value anode resistor. Also remember this: the grids of the three clamp triodes are connected together, so that a fault in one triode will affect the others. PCL84 valves are particularly prone to developing faults in their triode sections, and one faulty one will affect the other two.

The Pye hybrid sets are also particularly prone to developing troubles on the CDA panel itself, due mainly to decomposition of the plastic panel material (the heat from the four valves being conducted down on to it by the base contacts). Thus incorrect colours may well be due to cracks in the panel, leakage through the panel material, and poor earthing to the rear clips. The earthing is made by spring wires which pass through loops of metal, and it's the loops that are soldered to the panel earth. Poor contact between the wire and the loop therefore will result in a poor earth connection to the main frame. This is one cause of colour shading from the left to the right of the screen (say green to the right and blue to the left). The remedy is to solder the wires to the loops, or connect a flying lead from the panel earth to a screwed earth on the main frame. Speaking generally, many strange effects can be displayed on almost any make of colour set as a result of poor earthing, and the connection of a lead from the main frame to the various panel earths can be a rewarding exercise.

Signals in a Colour Set

Now let's just briefly consider the various signals we're concerned with in a colour set. There are three colour-difference signals plus the luminance signal, and when these are mixed, either before the c.r.t. or by application to the c.r.t. electrodes, we get R, G and B primary-colour signals to activate the colour phosphors on the screen. The luminance signal is the same as the video signal in a monochrome set, and has the full video bandwidth, i.e. the picture detail is contributed by the luminance (Y) signal, exactly as in a monochrome receiver. In addition, two colour-difference signals are transmitted. Only two, you may ask? Yes, because if you look at the mathematical relationships between the two transmitted colour-difference signals (R – Y and B – Y) and the luminance signal (Y), i.e. their relative amplitudes, you'll find that the third colour-difference signal (G – Y) can be obtained quite simply in the receiver by adding together certain preset proportions of B – Y and R – Y. This is done in the G – Y matrix, which may consist of a couple of resistors or be something that in more recent sets goes on within an i.c. The two transmitted colour-difference signals have a much narrower bandwidth than the luminance signal, since the human eye is not sensitive to colour detail, and are carried on a common subcarrier which fits within the channel bandwidth. The various signals are separated out in the receiver by filters, and sent to the appropriate parts of the set.

The chrominance signal, as the transmitted colour-difference signals when modulated on to their subcarrier is called, passes from the video detector (or a separate detector) to the colour decoder, whose function is to process and demodulate the chrominance signal and present to the video output circuits either RGB signals or the luminance and three colour-difference signals depending on receiver design. The colour-difference signals are adjusted in amplitude at the studio to correspond with the sensitivity of the human eye, and are further weighted to avoid overloading the transmitter. The latter is corrected in the receiver simply by presetting the relative gains of the R – Y and B – Y amplifiers. The PAL system introduces some clever twists to overcome the effects of signal distortion in the transmission process – but we'll have to leave a look at that side of things until we come to the decoder. Our main

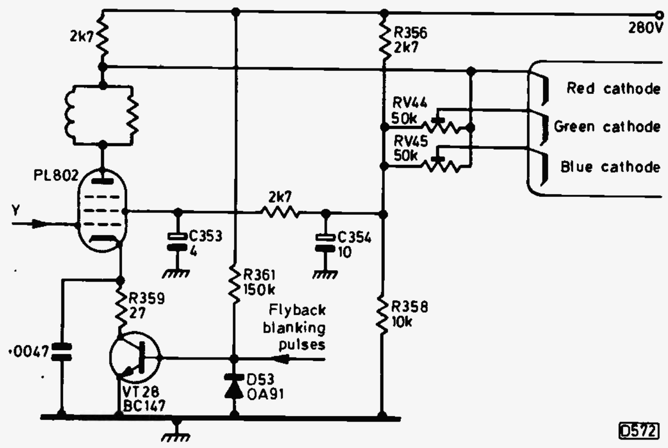


Fig. 3: A typical pentode luminance output stage. In some receivers there are preset controls in all three c.r.t. cathode circuits. The luminance signal is a.c. coupled to the PL802's control grid, and the brightness control acts here via a d.c. restorer. Beam limiting is also generally carried out at this point in hybrid colour receivers.

concern at this stage is to get clear the idea of three tube beams being separately driven and that errors in the drives, due to incorrectly adjusted preset controls or component faults, will result in incorrect colours in the display.

Luminance Output Stage

One of the main trouble spots in a hybrid set with colour-difference drive is the luminance output stage. This usually features a PL802 valve, though as we've already pointed out the Philips G6 uses a PFL200 for the purpose. Since we're taking the Pye hybrid chassis as our example however, we'll stick with the PL802. Fig. 3 shows a simplified circuit of the PL802 luminance output stage used in the Pye chassis. Its anode is directly coupled to the c.r.t.'s red cathode, while preset controls are incorporated in the drives to the green and blue c.r.t. cathodes. These presets enable the circuit to be set up for correct (untinted) white. Since d.c. coupling is used between the PL802 and the c.r.t. cathodes, it's obvious that the voltage at the cathodes depends upon the current passed by the valve. As the valve's emission falls, its anode voltage and the voltages at the tube cathodes rise and the picture gets darker and darker. This fault does not have to be due to the valve losing emission however. The same effect will be produced if its control grid becomes too negative with respect to its cathode, or its cathode becomes too positive with respect to its control grid, which is the same thing though the causes are different.

Quite apart from the signal swinging the PL802's control grid voltage up and down, the beam limiter and the brightness control also operate on the control grid. So we need to know how the beam limiter functions. It's quite simple, really. If the e.h.t. current demand is excessive, which doesn't do the tube, the tripler or the line output transformer much good, the PL509 line output valve will be asked to pass excessive current. If we connect a resistor in its cathode lead, the voltage developed across this will be proportional to its cathode current and we can thus monitor the conditions in the line output stage. This voltage is applied to a sensing circuit which consists of a transistor and a few resistors, including a present control (RV16). When the voltage across the PL509's cathode resistor exceeds a certain level, the transistor conducts and reduces the voltage applied to the brightness control. In consequence the PL802 passes less current, and the c.r.t. current (i.e. the e.h.t. current) is reduced to a safe level. RV16 in the transistor's emitter circuit sets the operating level of the beam limiter circuit. Thus the setting of the beam limiter, on the power unit, is closely related to the brightness control on the front panel. (See Fig. 2, page 581).

Dark Picture

In practice the beam limiter circuit is relatively trouble free. Complaints of a dark picture, with the brightness control up full, are nearly always due to failing emission in the PL802 valve, which can nowadays be replaced by a solid-state equivalent which is marketed under the same type number except that it carries a suffix such as T to indicate that it's different.

Flyback Blanking

Another operation that's carried out in the luminance output stage is flyback blanking – cutting the tube off when the spot is returning from the right-hand side of the screen to the left-hand side or from the bottom to the top. Blanking can be effected by raising the c.r.t.'s cathode voltages with respect to its grid voltages, or by dropping the grid voltages with respect to the cathodes. On most sets employing colour-difference drive the former is the chosen method, the luminance output valve being cut off during the flyback times. This raises the anode voltage and thus the c.r.t. cathode voltage to the full h.t. voltage.

In our specimen chassis the cathode of the PL802 is returned to chassis via a small resistor (R359) in series with a transistor (VT28). When the transistor is fully conductive, the resistor provides the only bias and the PL802 works away normally. During the flyback periods however the transistor is turned off by the blanking pulses, and the valve is thus also turned off. Its anode voltage rises, cutting off the c.r.t. In the absence of flyback blanking pulses, the transistor is held conductive by R361 (150kΩ). While the blanking circuit is normally reliable, the valve is sometimes blamed when in fact R361 has gone high in value, the transistor has gone open-circuit, or the associated base protection diode D53 has gone short-circuit.

One also has to take into consideration the possibility that the blanking circuit is in order but the beam limiter is faulty, biasing back the valve's control grid. "Oh dear" you may say, "what do we do?" Well, eliminating the blanking circuit from the list of possibilities is quite simple. You simply short out the blanking circuit by taking the bias resistor R359 direct to chassis, noting the effect. If the brightness returns to normal, the blanking circuit is proved faulty and one checks the transistor, resistor and diode. These items need not be wholly short- or open-circuit: degrees of defectiveness can result in poor picture definition plus distinct striations (vertical rulings) down the left half of the screen, though we hasten to add that the most common cause of the latter fault is that the resistor which damps the line linearity coil has gone high in value. This resistor (R228) should be 1·5kΩ, but as it's a carbon one it tends to cook up. The result is that it goes high in value and fails to damp linearity coil which rings, causing the striations.

Other CDA Faults

There are lots of other items that can play tricks on the CDA panel, such as open-circuit electrolytic decoupling capacitors which can mess things up colour wise, open-circuit resistors, and missing supply lines. The latter problem is not necessarily due to an open-circuit resistor since, as we've already mentioned, deterioration of the panel occurs: as a result, the fact that the h.t. is present at the panel input point does not mean that it gets to where it's supposed to be. Cracks in the tracks you see, something to bear in mind.

Later versions (693, 697) of the Pye hybrid chassis employ a varicap tuner which requires a stabilised 30V tuning line. This is obtained from the h.t. line through a resistor or resistors on the tuner panel. The h.t. is not taken direct from the power supply however, but is derived from a point on the CDA panel. Deterioration of the panel can thus result in the absence of the tuning voltage, with the result that the tuner cannot select any signals and simply produces noise. The tuning voltage also disappears when R389 goes open-circuit, but as this also removes the supply to the c.r.t.'s control grid clamp circuits the result is no or very little screen illumination and no sound signals of course. The trick is to know what voltage to expect and where to expect it. Almost back where we started, aren't we?

Summarising

In conclusion this time we'd mention that whilst the colour decoder, which we've yet to consider, is far more complex than the colour tube's drive circuitry (the luminance and colour-difference amplifiers), the fact is that the vast majority of colour faults are due to something amiss in the c.r.t. drive/biasing arrangements. There are also convergence and purity to consider, though the results of faults here are mainly self-evident.

Letters

EW TINTING

I've read with interest the comments in *Television* on EW tinting with the Pye hybrid colour chassis. The fault has come my way only once, and what I can't understand is how switching the c.r.t. first anodes on and off could have cured it, even temporarily.

I arrived at the cause of the trouble after giving it some thought. What was obviously happening was that one of the guns was being turned on progressively harder as its beam scanned across the screen. This was verified by using the scope to monitor the c.r.t. cathode waveforms and also by observing the three rasters separately. This threw suspicion on the colour-difference output/clamp circuits, and the 12kΩ pentode anode load resistor was found to be open-circuit (R391 in the G – Y channel in this case). I've since been told that the fault is quite common on these chassis. The sure-fire way of checking this is to disconnect the lead supplying the 47V pulses to the clamps: this stops the clamp action, and if the tint disappears the pentode anode load resistor is the cause of the trouble.

I'd also like to take this opportunity to agree with your contributors who have commented on the low standards of performance most people are prepared to accept from their TV sets, even when new.

Gerald Messent, North Cornelly, Bridgend, Glamorgan.

Editorial comment: Since the pentode anode load resistors sometimes go open-circuit intermittently, it would seem that the first anode switching business is coincidental.

BIONIC PYES

We read with interest the article entitled *Bionic Pyes* in your June issue, covering certain of our products specifically designed as replacement units for use in Pye hybrid colour receivers. We appreciate the fair presentation and recommendations, but would like to add a few comments.

First the CDA panel on which your tests were made was an early production one. Although many thousands of these are now in use, the only modification we have found to be desirable is to change the colour-difference output transistors from type BF259 to type BF459 so that we can use a different type of heatsink. There is nothing wrong with the BF259 as such, but the tall heatsink we used with it makes it top heavy and vulnerable to damage, especially when sent through the post. Rough handling could result in the transistor leads being pulled out of the board, and this could have been the cause of the dry-joint trouble referred to in your article. There have been very few cases of this reported to us, but we decided to prevent it by changing to the BF459 with its lighter heatsink – this was some eight months ago.

The audio module, like the CDA panel, has also been very successful and well received by users. We have found however that the supply of the SN76013ND i.c. in production quantities is too erratic, though it is readily available for replacement purposes. Being unable to find a suitable alternative i.c., we decided to redesign the module using discrete components which we can get in sufficient quantities to maintain production. The new module is still a direct replacement for the LP1162, and of course we've used silicon transistors which make it more reliable than the original Mullard LP1162 unit.

Your readers may be interested in our new 915 module, which has been designed as a direct replacement for the i.f. selectivity/gain unit used in the Pye 713, 725, 731, 735, 737 and 741 chassis and the Philips 570 chassis. The original units have proved troublesome due mainly to the use of a number of through board connections and double-sided print. Our replacement unit uses a SAWF to provide the bandpass response and an i.c. to provide the gain, and as a result we've managed to achieve a single-sided print layout.

W. Kennedy, LEDCo, Thornton Heath, Surrey.

LEDCo CDA PANEL

Having been plagued for some time by drifting grey-scale and other problems in an ageing Pye hybrid colour set (697 chassis), I decided some while ago to fit the LEDCo CDA panel reviewed in your June issue. For nine months or so the board has performed admirably in eliminating these defects, and looks like adding several years to the life of the set. I was surprised however that you omitted to mention a rather obvious shortcoming in the design of the solid-state circuit. This is that the components which bias the base of the luminance input transistor (VT701) upset the action of the d.c. restorer D39, causing the black level to float up and down with the picture content as if the luminance was a.c. coupled. I must say however that this is far less annoying than the effects of tired valves.

Alan Pemberton, Sheffield.

P.S. Poor field lock on this set turned out to be the field sync pulse integrating capacitor C41 (0·0047μF) open-circuit, replacement curing the trouble. I've not seen this one mentioned in your columns before. It's mounted on the i.f. panel, along with the sync separator.

Your PROBLEMS solved

Requests for advice in dealing with servicing problems must be accompanied by a 50p postal order (made out to IPC Magazines Ltd.), the query coupon from page 603 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.

TELEFUNKEN 709 CHASSIS

The set will work perfectly all evening provided the channel is not changed. If another channel is selected after the set has been on for some time, it's impossible to obtain a picture. The situation is the same on all channels. The set works normally when first switched on from cold.

The tuning voltage stabiliser diode GR971 (ZTK33) has a tendency to cause slight tuning drift when warm, since it then stabilises at a slightly different voltage. This effect is often sufficient to throw the set off tune when a different channel is selected. Another area that gives trouble on this chassis is the gated a.g.c. circuit. This is on the main signal board, alongside the i.f. unit. Operation of the circuit can become very critical when, as the set warms up, either of the transistors T171 (BC237A) or T172 (also BC237A) starts to break down, reducing the voltage at pin 3 of the i.f. strip so that overloading occurs. Under these conditions it's extremely difficult to tune the receiver to any station at all.

GEC C2002H

There's a dynamic convergence problem with this set. The colours are correct at the centre of the screen. The top left-hand side is all green however and the bottom red, the right-hand side being the same but with the colours reversed. The colouring tends to vary with the brightness.

The most likely cause of this would seem to be a defect associated with the horizontal R/G symmetry coil L905 on the convergence panel. There must be d.c. continuity, since the line scan current flows through this coil. Try setting it up, and if this fails fit a replacement.

THORN 3500 CHASSIS

The set will work perfectly for perhaps a few hours, then the cutout will operate. If this is reset, the set will again work satisfactory for a while but will eventually trip. This can happen several times in the course of a evening. A possible clue is that R609, which is in series with the chopper transistor, tends to burn out. The tripping continues after replacing this resistor. The cutout itself has been replaced, and everything else appears to be in order.

The cutout operates when the crowbar thyristor W621 fires, shorting R609 to chassis in the process. It seems therefore that there is repeated crowbar action. Suspects in this area are the crowbar thyristor W621, the sensing zener diode W617, and C618 (100μF) which is present in this circuit to suppress transients. Alternatively, the h.t. supply could be rising so that the trip operates. Disconnect the feedback amplifier by removing R621: this should give a small picture, with the h.t. supply falling to about 30V. If the trip still operates, the chopper transistor is probably faulty. If the h.t. is rising due to the monostable being held on too long, check W615. Make sure the print around W621 is clean – the electrolytics tend to leak.

DECCA 30 SERIES

This Decca 30 series chassis is actually in a Telefunken model. The picture is very good once the set settles down after the first few minutes, but some odd things occur initially. After switching on, one usually gets to start with a very dark, diffused picture, mainly in blues and greens. Then the screen becomes almost entirely white, with very pale colours here and there. Eventually a vague picture is seen, then a hissing noise occurs accompanied by dark lines across the screen. Then the picture comes up much clearer.

It seems to us that the most likely cause of these symptoms is simply that either the PL509 or PY500 line output stage valve is lazy. Alternatively, it could be that the c.r.t. is loading the e.h.t. generator due to its being driven hard as a result of a fault on the decoder panel. This would show up as an abnormally low voltage on all three cathodes, and could be due to a faulty MC1327P demodulator/matrixing i.c. or a fault in the luminance emitter-follower (TR204) circuit.

CHECKING CAPACITORS

Reference is often made in your magazine to leaky capacitors. Can you advise on the equipment and method of checking this? What I do is to use a scope to trace the signal, then use a multimeter to check for open- and short-circuit capacitors when the scope indicates that a fault is present. Some capacitors check out o.k. however, though replacement produces an improvement. Other capacitors look as if they're defective but perform satisfactorily.

We cannot suggest any improvement upon your method of checking suspect capacitors. The only additional factor we tend to rely on is that some types of capacitor are more prone to failure than others. Other than this if in doubt, chuck it out.

ITT CVC8 CHASSIS

The trouble with this set is loss of colour. I managed to restore the colour by replacing the delay line driver transistor T29, using a BC107, but the colour went again after a couple of days. Using the correct BC171B transistor produced no results. The voltages seem to be correct, except for those at the output pins 1, 2 and 4 of the MC1327 i.c. These are 7·5-8V instead of 6V. I've changed the varicap diodes in the saturation control circuit, also C161 which couples the signal to the base of T29.

First check that the bistable transistors are working – the collector voltages of the two transistors (T36/37) should be 9-10V with a colour signal. Then check C165 which decouples the emitter of T29 and C162 which smooths its base bias. These are both 4·7μF tantalum electrolytics. There are three other capacitors of this type in the chroma amplifier circuit, C155, C153 and C151. All may need to be checked – observe correct polarity if any need to be replaced. The chroma amplifier transistors T27 and T28 are also suspect. Loss of colour is commonly due to faults in the burst/reference oscillator section, such as oscillator drift, but this would be betrayed by a rainbow pattern as the fault comes and goes. If necessary, check that the output from the ident stage is adequate – there should be 11V across C218 with a colour signal.

THORN 1500 CHASSIS

The problem with this set is wavy verticals, from the bottom to the top of the screen, slightly more noticeable on the right-hand side. There is no buzz on sound however.

In spite of the absence of hum, the main electrolytic block C88/91/101 could be faulty. Check its connections to the printed board before condemning it. A more likely suspect however is C102 which smooths the h.t. rail used by the line generator and sync circuits. Other suspects are C98 which decouples the line output valve's screen grid, C32 which smooths the video driver transistor's base bias, C56 and C58 which smooth the l.t. supplies, or possibly heater-cathode leakage in the PY801 boost diode.

TELEFUNKEN 634E

Recently, after the set has been switched on the picture appears first as a slot across the centre of the screen. The picture then "flicks", and during the next couple of minutes expands vertically. It never quite reaches the top and bottom of the screen however.

This set is in fact fitted with the Decca hybrid colour chassis, and consequently the same fault-finding approach is required. The most common culprit causing sluggish opening out of the field scan is simply the PL508 field output valve, which may be taking rather a long time to reach full emission. When this valve starts to fail, its cathode bias resistor R413 (560Ω) and screen grid feed resistor R415 (3·9kΩ) tend to cook, so these should also be checked. The PCF80 (triode section) which forms part of the field oscillator is usually reliable, though it's emission has been known to fall, giving similar results. Lack of height is commonly due to the resistors in the height control circuit changing value. Check R402 (820kΩ) and R405 (270kΩ).

PYE 691 CHASSIS

A band, approximately 1½in. wide, passes through the picture. It varies in speed and direction, sometimes going from the top of the screen to the bottom, then changing direction. At other times it's almost stationary. The main smoothing block C306/315 has been changed and other capacitors in the smoothing section checked by substitution. Voltage checks show a slight variation in the voltage at the collector of the field output transistor VT27, in sympathy with the band. The verticals in the band bend to the left, but there's no change of colour. Both the line and field locking are good.

It could be tricky trying to find the source of this hum problem. As a start we suggest you double check the smoothing electrolytics, especially the 1,250μF ones (C307/313/308/309). If these are satisfactory, the interconnecting plugs and the chassis bonding connections will have to be checked. Remember that the i.f. strip's l.t. smoothing capacitors are on the top of the i.f. panel itself.

THORN 1500 CHASSIS

The trouble is that the field hold cannot be held for any length of time before it drifts away again. I've tried a new PCL805 field timebase valve without success.

This sort of trouble is often due to the circuit between the anode of the output pentode section of the valve and the triode grid. There are two resistors (R101 and R102) that tend to change value. Check that they are still 18kΩ. If it's necessary to replace them, use 1W types. Then check the associated capacitors, particularly C75, since these can become leaky. Also check the sync separator's screen grid feed resistor R44 (47kΩ), again replacing if necessary with a 1W type.

BUSH TV300

When the set has not been in use for a while, a normal picture is obtained after switching on. This lasts for half an hour to an hour, then the white parts of the picture begin to streak to the right and eventually, even with the contrast control at minimum, the picture goes almost totally white. Try the set within three days and the streaking is still pretty bad: leave it a week or so and a normal picture is obtained again. The resistors and electrolytics in the video output and contrast control circuits have been checked, and the video output transistor TR10 changed, but the trouble persists. The voltage at the collector of the video output transistor is very low with the fault present.

The low collector voltage on TR10 is the key factor. The supply comes from the line output stage, and is smoothed by C519 and C520 (both 1μF). Every time we've come across these symptoms, one or other of these electrolytics has turned out to be responsible. It's possible that the rectifier concerned (D505), the filter resistor R515, or the discharge resistor R234 could be at fault however.

TELETON VX1110

The raster collapses, as though the set has been switched off, reappearing a few seconds later. This can happen two or three times, then the set will settle down with no further trouble. There's also intermittent loss of field hold, and poor field linearity (top elongated).

For the loss of e.h.t. (picture collapse), open the right side compartment flap to expose the 3AT2 e.h.t. rectifier and check with a neon tester – the neon should light up when brought near (not touching) the valve. You should also be able to see the glow of this valve's heater. If the neon remains alight when the picture goes off, see if the heater fades out. If it does, make sure that the e.h.t. is discharged and then remove the valve base to check the heater contacts and the 2·2Ω series resistor. If the neon goes out, check the line timebase valves and voltages. The line output valve is a 31JS6A and the boost diode a 17DW4A. The field trouble should respond to a new 17JZ8 field output valve. If necessary, check its cathode bias components and those in the linearity network.

PHILIPS 210 SERIES

There's an odd sound fault on this set. After switching on, the sound comes on at full volume, with a trace of hum, even with the volume control at minimum. After about half an hour however the conditions stabilise and the volume control operates normally.

The volume control is returned to chassis via a 2·5μF electrolytic capacitor (C1503). Either the volume control itself is defective, the capacitor is defective or improperly connected, or the earthing is not being made to chassis. Note that the positive side of C1503 goes to chassis, the negative side to the volume control.

QUERY COUPON

Available until 17th September, 1979. One coupon, plus a 50p (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 602.

TELEVISION SEPT. 1979

TANDBERG CTV2

The original fault with this set was loss of raster, with the power supply module going into its "purring" mode. The cause was found to be a defective horizontal shift choke (L752), and replacing this restored the sound and picture. There are still a couple of faults however. First the picture is of reduced width, the width control R860 (in the EW modulator circuit) having no effect at all. The voltage at the supply end reads 30V instead of 25V. Secondly, although the 6·8V reference zener diode D975 in the switch-mode power supply control circuit has been changed (to cure picture size variations) the h.t. supply cannot be set any higher than 150V (should be 160V). The set h.t. control R976 can be used to reduce the h.t. below 150V however. Whilst checking around the circuit I noticed that the EW modulator diodes D750 and D751 seem to have been running hot, as the board is slightly scorched in the vicinity.

All your problems are likely to be resolved by replacing the EW modulator diodes, plus the EW modulator output transistors Q853/852 if necessary. Also check whether the horizontal shift control R772 is burnt.

THORN 980 CHASSIS

The trouble with this set is very critical line hold, which has to be constantly adjusted – every three to four minutes. A new line oscillator valve has been tried but has not improved matters.

The fault could be in the flywheel line sync circuit, where the discriminator diodes W3/4 are the first suspects. A very likely possibility however is a fault in the video output stage. You will find a bias stabilising resistor (R26, 39kΩ, 1W) connected between the screen grid and the cathode of V5. This commonly falls in value, upsetting the bias conditions in the stage and therefore severly clipping the sync pulses. The sync separator's screen grid and anode load resistors would also be worth checking.

TEST CASE

201

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.

An ASA Model CT6000 colour receiver had been working satisfactory for at least four years – with good sound and bright pictures – at a site within six miles visible range of a low-power transmitter. Being a worker with "unsociable hours", the owner decided to try out a video cassette recorder, and for the first week or so was happy with the results. The pictures were crisp and the colours accurate, both off-air (through the machine's "monitor" mode) and off-tape.

As the days went by however, the early morning viewer of the previous night's programmes became less enchanted. He found the recorded pictures getting less sharp, though the colour accuracy was unaffected. The distaff side started to complain that it was necessary to turn down the brightness and sometimes the contrast, and to darken the room, in order to achieve acceptable viewing from the set. It was discovered that the pictures could be improved by altering the position of the set-top aerial so that it was broadside on to the distant, though visible, transmitting aerial, whereas previously the best pictures had been obtained with the aerial pointing at the transmitter.

Since the colours remained accurate, the technician investigating the problem concluded that the e.h.t. tripler was at fault, especially after one or two measurements revealed that the focus potential at pin 1 of the tube was lower than normal even with the focus preset at maximum setting.

Unfortunately, tripler replacement failed to solve the problem. The picture was still weak and not properly in focus at any point on the range of the preset focus control, though at full brightness setting the overall screen illumination was quite reasonable. Replacing the focus preset gave no improvement, and it was then concluded that video crushing was responsible. Detailed tests in the colour-difference and video amplifier stages failed to shed any light on the problem however.

What was the most likely cause of the trouble, and why was the fault seemingly aggravated by the use of a VCR? See next month for the solution and for a further item in the series.

SOLUTION TO TEST CASE 200
–page 550 last month–

It will be recalled that the Decca CTV25 mentioned in last month's test case was suffering from two faults, weak field sync and slight variations in height accompanied by an audible sizzle. The weak field sync was not a difficult problem to solve. The field sync pulses are applied to one of the control grids of the ECC82 cathode-coupled field multivibrator via an OA81 interlace diode (D301) whose cathode is biased by a potential divider consisting of a 3·3MΩ resistor (R302) connected to the h.t. rail and a 150kΩ resistor (R303) to chassis. With age, the higher-value resistor in the network tends to rise considerably in value, and the fault was completely cleared by replacing R302.

The field amplitude jitter was located less scientifically! Had it not been for the "reflected spark", diagnosis would have been more protracted. In the event, it was discovered that the spark was concentrated around the positive tag of the 400μF h.t. reservoir capacitor C2705 in the power pack. The tag had developed a high-resistance contact to its termination, and the result was a tendency to spark across due to the heavy ripple current. C2705 was still providing capacitance, but the ripple discharge was affecting the field scan more dramatically than any of the other sections of the receiver fed from the h.t. rail.

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by Carlisle Web Offset, Newtown Trading Estate, Carlisle. Distributed by IPC Business Press (Sales and Distribution) Ltd., 40 Bowling Green Lane, London EC1R 0NE. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £9.50, Overseas £10.50 per annum payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

TV LINE OUTPUT TRANSFORMERS (Prices include VAT at 15%)

Post and Packing 70p

BUSH
TV123, TV124, TV125 or U, TV128, TV134, TV135 or R, TV138 or R, TV139, TV141, TV145, TV148, TV161, TV165, TV166, TV171, TV175, TV176, TV178, TV181 or S, TV183 or D, TV183S, TV183SS, TV185S, TV186 or D, TV186S, TV186SS, TV191D, TV191S, TV193D, TV193S, TV198, TV307, TV313, TV315

MURPHY
V843 all models to V979, V153, V159, V173, V179, V1910, V1913, V1914, V2014 or S, V2015D, V2015S, V2015SS, V2016S, V2017S, V2019, V2023, V2027, V2310, V2311C, V2414D, V2415D, V2415S, V2415SS, V2416D, V2416S, V2417S, V2419, V2423, A774

Price £7.36

BUSH MURPHY
A816 Chassis
TV309 TV311
V2029 V2427

Price £10.30

DECCA
MS1700, MS2000, MS2001, MS2400, MS2401, MS2404, MS2420

Price £7.36

PHILIPS
23TG170a all models to 23TG176a
G24T230a ... all models to G24T310
19TG170a ... all models to 19TG179a
G19T210a, G19T211a, G19T212a, G19T314a, G19T215a, G20T230a

Price £7.36

INDESIT
20EGB
24EGB

Price £7.85

PYE

58	64
59	68
60	75
61	76
62	77
63	80
81	93
83	94
84	95/4
85	96
86	97
92	98
150	161
151	170
155	170/1
156	171
160	171/1

Price £7.36

KB-ITT
By Chassis:
VC1, VC2, VC3, VC4, VC11, VC51, VC52, VC52/1, VC100, VC100/2, VC200, VC300

Price £8.48

GEC
BT454, BT455, BT455DST
2000DST ... all models to 2044
2047 ... all models to 2084
2104 or /1
2105 or /1

Price £7.36

SOBELL
ST196 or DS, ST197, ST290, ST297
1000DS ... all models to 1102

Price £7.36

THORN GROUP
Ferguson, H.M.V., Marconi, Ultra.
By Chassis:
800, 850, 900, 950/3, 960, 970, 950/1, 950/2, 1400, 1500, 1500, 1580, 1590, 1591, 1612, 1600, 1712
Or quote model No.

Price £8.48

COLOUR TRANSFORMERS

DECCA	CS1730, 1733, 1830, 1835	£9.51
DECCA	30 Series Bradford Chassis	£9.51
DECCA	60, 80, 100 Series	£9.51
GEC	Dual STD Hybrid	£11.59
GEC	Single STD Hybrid	£11.59
GEC	Single STD Solid State	£9.51
ITT	CVC 1 to CVC 9	£9.51
ITT	CVC 20	£10.53
ITT	CVC 30, CVC 32	£9.51
PYE/EKCO	725 Chassis	£9.51
PYE/EKCO	731, 735, 737, 741 Chassis	£9.51
PYE/EKCO	713, 715 Chassis	£9.51
PHILIPS	G8, G9 Chassis	£9.51
PHILIPS	570 Chassis	£10.53
THORN	3000, 3500 EHT and SCAN	£8.48
THORN	8000, 8000A, 8500, 8800	£10.02
THORN	9000	£10.02
TELPRO	All Models	£9.51

PYE EKCO 691, 692, 693, 697 Chassis
Wired in version of above — Price on Application
Printed Circuit Version of above — **£15.26**

EHT Winding PYE 691 to 697 Chassis* — **£3.07**
Primary Winding PYE 691 to 697 Chassis* — **£4.60**
*Please state Printed Circuit version or Wired version.

Tidman Mail Order Ltd.,
236 Sandycombe Road,
Richmond, Surrey.
Approx. 1 mile from Kew Bridge.
MON-FRI 9 am to 12.30 pm.
1.30 pm to 4.30 pm.
Closed Wednesday afternoon
Phone: 01-948 3702

Hamond Components (Midland) Ltd.,
416, Moseley Road,
Birmingham B12 9AX.
MON-FRI 9 am to 1 pm.
2 pm to 5.30 pm.
Phone: 021-440 6144.

Contact your nearest depot for service by-return. Callers welcome. Please phone before calling.

STANDERD T.V. TUBE

HIGH QUALITY COLOUR AND MONO-CHROME REPLACEMENT TUBES AT COMPETITIVE PRICES.

- ★ Complete New Gun fitted to every Tube.
- ★ Two year Guarantee
- ★ Every Tube Electrically Tested.
- ★ Every Tube Picture Tested.
- ★ Supplier to Major Rental Companies.

19", 20"	£22
22"	£25
25", 26"	£28

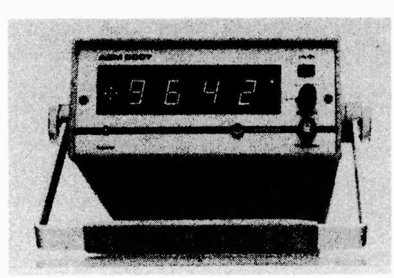
11-29, Fashion Street, London E1

Ring Standerd T.V. Tube Reguner
Tel. 01-247 3097

---

schuh **ASM 5007**

A NEW APPROACH TO T.V. TESTING



50kV PROOF + AUTO RANGE + MEMORY DISPLAY
Withstands EHT mistakes!

VOLTS DC
9·999 99·99 999·9V ± 0·08% ± 1 digit
VOLTS AC
9·999 99·99 999·9V ± 1% ± 1 digit to 20KHz
OHMS
9·999 99·99 999·9K ± 0·02% 9999K ± 1%
FREQUENCY
9·999 99·99 999·9KHz

Tone indication of new reading. Sample + Hold facility. High brilliance 16mm display. 220/110V 50/60Hz 10W. Fast Reading 12/sec.

£290 + VAT + Carriage

ADRETTA LTD.
NORTH STREET
WELLINGTON, SOMERSET
TEL (082 347) 3535

MAIL ORDER PROTECTION SCHEME

The Publishers of *Television* are members of the Periodical Publishers Association which has given an undertaking to the Director General of Fair Trading to refund monies sent by readers in response to mail order advertisements, placed by mail order traders, who fail to supply goods or refund monies owing to liquidation or bankruptcy. This arrangement does not apply to any failure to supply goods advertised in a catalogue or in a direct mail solicitation.

In the unhappy event of the failure of a mail order trader readers are advised to lodge a claim with *Television* within three months of the date of the appearance of the advertisement, providing proof of payment. Claims lodged after this period will be considered at the Publisher's discretion. Since all refunds are made by the magazine voluntarily and at its own expense, this undertaking enables you to respond to our mail order advertisers with the fullest confidence.

For the purpose of this scheme, mail order advertising is defined as:—

'Direct response advertisements, display or postal bargains where cash had to be sent in advance of goods being delivered'. Classified and catalogue mail order advertising are excluded.

TV'S TV'S TV'S

THOUSANDS OF MONO TV'S IN STOCK

All makes – all sizes from **£1.15.** Square screens from **£6.90.** Clearance of 25" D/STD CTV'S (Philips 500 and GEC 2028 only). Checked complete **£16.10** each, add £8 p/pkg. Earlier model S/STD (Philips 511, GEC 2040, Pye Hybrid etc) Singles tested tube & checked complete **£39.10.**

Quantities from £27.60 each
Singles working £48.30 each
Add £6 p/pkg

More recent S/STD CTV'S always in stock (Pye Varicaps, Bush Integrated, Thorn 3500/8000, Decca Bradford, GEC 2100, Korting, Grundig, Luxor, Japanese etc). Sold with tube tested from **£46,** working from **£64.40.**

Ring for quotations

EX-TV SPARES

RANK BUSH MURPHY 184 SERIES ETC

Decoder (Single IC) or Line Board	£13.80
I.F. Panel or Power Panel	£9.20
Convergence Panel	£6.90
Tuners	£6.90
Complete EHT Stack	£20.70

GEC HYBRID 2040/1 SERIES AND PYE HYBRID CHASSIS

Decoder or DCA (Inc. Valves)	£13.80
I.F. Panel or Convergence Panel	£9.20
Line Panel	£16.10
Tuners	£6.90

PHILIPS 511

I.F. Panel	£9.20
Tuners	£6.90
Lopt	£9.20

Any above add £1.60 postage & packing

RING FOR QUOTATIONS ON OTHER SPARES

COLOUR TUBES
(fully tested)

25"	£18.40
19"	£20.70
22"	£25.30
26"	£29.90

Plus £4.00 p/pkg.

MONO PANELS/ TUNERS

Most types £3.45
£1 p/pkg.

ALL PRICES ARE INCLUSIVE OF VAT.

VEGA MONOCHROME TUBES

(Brand new USSR Manufacture in Maker's Box with 12 months Guarantee)

20" Size	£15.53
24" Size	£17.83

Add £2.50 p/pkg.
Discounts for orders over five.

MULLARD COLOUREX/MAZDA NEW LIFE TUBE REBUILDS
(Callers only)
One year guarantee.
Any size only **£30.65** plus old glass.

SPECIAL OFFER

20"/24" Single/STD PYE/EKCO/ PHILIPS TYPE 230 (Plastic back) Re-furnished with good cabinet and brand new USSR tube (12 month guarantee).

20" Model	£32.20
24" Model	£34.50

Add £4.00 p/pkg.

TRITEL GROUP

NORTHERN
Thornbury Roundabout
Leeds Road
Bradford 3.
Tel: (0274) 665670

SCOTLAND
Peacock Cross
Industrial Estate,
Burnbank Road
Hamilton.
Tel: (0698) 282141

LONDON
Kingsley House
Off Avonmore Rd.
(Opp Olympia)
Hammersmith Rd.
LONDON W14.
Tel: (01) 602 2982

LONDON
395/397 Albany Road
Off Walworth Road
LONDON SE5
Tel: (01) 703 4040

WEST
Unit 4a
Bulwark Industrial
Estate, Chepstow,
Nr. Bristol.
Tel: Chepstow
(02912) 6652

MIDLAND
48/52 Pershore
Street,
Birmingham 5.
Tel: (021) 622 1023

SOUTHERN
Watling Street
Hockcliffe, North
Dunstable (on A5)
Tel:
Leighton Buzzard
(0525) 210768

MAIL ORDER SEND CWO (CHEQUES OR UNCROSSED PO'S) TO ANY BRANCH

EX-EQUIPMENT SPARES
(NONE CHEAPER)
Valves – Colour and Mono

PCL82	£0.08	PCF802	£0.10	PCC86	£0.08	EY86/7	£0.08
PCL83	£0.20	PCF805	£0.20	PC97	£0.18	EY8/7	£0.08
PCL84	£0.08	PCF806	£0.08	PC900	£0.08	DY802	£0.08
PCL85	£0.08	PCF808	£0.08	EF80	£0.08	PY800/1	[illegible]
PCL86	£0.08	PCF80	£0.08	EF85	£0.08	PL36	[illegible]
PFL200	£0.08	PCC189	£0.08	EF183	£0.08	PL504	£0.20
PCF801	£0.08	PCC86	£0.08	EF184	£0.08	PL81	£0.08
30C1	£0.08	30C15	£0.08	6BW7	£0.08	6/30L2	£0.08
30C17	£0.08	30C18	£0.20	ECC85	£0.08	U26	£0.08
PL83	£0.08	PL84	£0.08	EH90	£0.08	30PL1	£0.25
30PL13/4	£0.08	30P12	£0.08	30FL1/2	£0.20	ECC82	£0.08
ECC81	£0.08	ECH81	£0.08	ECL80	£0.08	ECL82	£0.08
PL509	£0.95	PY500	£0.95	GY501	£0.95	PL508	£0.45
PCH200	£0.45	PCF200	£0.45				

PLEASE NOTE – 25p Postage and Packing

SPEAKERS
£0.75 each
State oval or round with order.
Postage and Packing £0.25

COLOUR TUBES
(FULLY TESTED)

19"	£17.00
19" A49/192	£18.00
20"	£18.00
22"	£20.00

Plus Postage/Packing £8.00 per tube

MAIL ORDER COLOUR TELEVISIONS
(GOOD WORKING ORDER)

GEC	19"	£55.00	22"	£60.00	Postage/Packing Per set G.B. £8.00
BUSH	19"	£70.00	22"	£75.00	Ireland £15.00

OTHER MAKES AND MODELS AVAILABLE – All prices inclusive of V.A.T.

Cash with order please to:-

Scarborough T.V. Trading Ltd.
Ridings House,
Depot Lane,
Seamer Road,
Scarborough,
North Yorkshire.
Tel. 0723 68087

OR

N.W. Electronics (Bfd) Ltd.
Bolingbrooke Buildings,
Bolingbrooke Street,
Bradford 5.
Tel. 0274 390121.

We're giving away Trade secrets

West Midlands T.V. Trade Sales Ltd.
021-444-6464
92 HIGH STREET
KINGS HEATH
BIRMINGHAM B14 7JZ

★ NOW OPEN ★
New Warehouse at 37-39, Jamaica St. Bristol.
0272-48266

FOR EX-RENTAL COLOUR AND MONO TELEVISION

Why not call in and see us.... A relaxed friendly atmosphere, together with a choice of hundreds of sets at low, low prices. Colour from £15. Mono from £2. Also stands, spares, etc. Send an S.A.E. or phone, for our current price lists and area map showing how to find us. Export enquiries welcome.

N.G.T. COLOUR TUBES

***First* Independent Rebuilder with**
B.S.I. CERTIFICATION
(Certificate No. 004)
12 month's guarantee: 4 year option

Tubes are processed using high temperature pumping schedules giving high definition and long life. They are then fitted with an implosion safety system approved by the British Standards Institution.

N.G.T. ELECTRONICS LTD.,
120, SELHURST ROAD., LONDON S.E.25
Phone: 01-771 3535.
20 years experience in television tube rebuilding.

SETS & COMPONENTS

RE-BUILT COLOUR TUBES

19" £29.50	MONO	20" £30.50
22" £32.50	20" 24"	25" £34.50
26" £38.50	£16	

One Year Guarantee.
MATRIX TV LTD.,
112 Essex Road, London N1. Tel: 226 1111

ANOTHER FIRST
from
LEDCo
THE PANEL PEOPLE

Specialists in the design, manufacture and servicing of TV panels

Module 915: A state of the art replacement for the IF Filter/Gain Module used in the Philips 570 & Pye 713-725-735 and similar chassis. **£11.45** each

Solid State CDA Panel for Pye Hybrid	**£21.50**
Solid State PL802	**£2.45**
LP1162 Equivalent	**£6.60**

As featured in June issue of this magazine.

Prices include VAT & Carriage
Discounts for five or more.
Send for details of these and our TV panel repair service.

LEDCo. 189a Livingstone Road, Thornton Heath, Surrey CR4 8JZ
Tel. 01-653 7575

COLOUR TV's
Many working for disposal, trade only.
All sizes and makes available.
Mono sets also available.
Ingertone (London)
24 Dames Road, Forest Gate,
London E7. Tel: 01-555 5569
Ingertone (Bristol)
28 St. Thomas St., Bristol 1.
Tel: 0272 211179

SMALL ADS

The prepaid rate for classified advertisements is 21p per word (minimum 12 words), box number 60p extra. Semi-display setting £4.00 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Television, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

CONDITIONS OF ACCEPTANCE OF CLASSIFIED ADVERTISEMENTS

1. Advertisements are accepted subject to the conditions appearing on our current advertisement rate card and on the express understanding that the Advertiser warrants that the advertisement does not contravene any Act of Parliament nor is it an infringement of the British Code of Advertising Practice.
2. The publishers reserve the right to refuse or withdraw any advertisement.
3. Although every care is taken, the Publishers shall not be liable for clerical or printers' errors or their consequences.

VALVE BARGAINS

ANY 1–20p, 5–80p, 10–£1.25, 50–£5.50

ECC82, ECH84, EH90, PFL200, EF80, EF183, EF184, PCF80, PCF802, PCL82, PCL84, PCL85/805, PY81, PY800, PY88, PL36, PL504, 6F28, 30PL14.

COLOUR VALVES 50p EACH
PY500/A, PL508, PL509, PL519.
Postage & Packing 30p, no VAT

VELCO ELECTRONICS
9 Mandeville Terrace, Hawkshaw, Via Bury, Lancs.

S/S Colour **£30**, Mono Push Button **£3**. Plus VAT. Phone Southend 559895. Any time.

TR500 UNIVERSAL T.V. TUBE TESTER

TESTS:—
- ALL COLOUR AND MONO TUBES
- EMISSION (Moving Coil Meter)

PLUS:—
- REACTIVATION
- STABILIZED HEATER AND TEST VOLTAGES
- PROFESSIONAL WORKSHOP OR FIELD INSTRUMENT
- SUPPLIED WITH FULL INSTRUCTIONS AND GUARANTEE

COSTS:—
ONLY **£26.62** Incl. VAT

CASH WITH ORDER PLEASE TO
NEW DIMENSION TELEVISION
12 BUXTON ROAD, HEAVILEY, STOCKPORT, CHESHIRE
Send stamped addressed envelope for details.
CALLERS WELCOME

COLOUR PANEL EXCHANGE SERVICE

BRC 3000 – 3500 8000 – 8500
Philips G8 and GEC 2110 series.

Free delivery in London area on Exchange Panels. Large stock of BRC 3500 series spares. New and S/H BRC Panels for sale. Immediate exchange on repairable panels.

Catalogue available on request.
KAY JAY TV SERVICE
34, Clauson Avenue, Northolt. Phone 864 0350.

T.V. SPARES, PANELS AND MANUALS
PHILIPS · GRUNDIG
TELEVIEW 01-994 5537
194, Acton Lane, London W.4.

REBUILT COLOUR AND MONO TUBES IN
South Wales

All tubes are guaranteed for 12 months. Colour tube guarantee extendable to 4 years.

Colour	Price examples
18", 19"	**£31.00**
20", 22"	**£33.00**
25"	**£35.00**
26"	**£36.00**

20AX and P.I.L. tube prices available on application.

Mono	
20"	**£11.00**
24"	**£12.00**

Add V.A.T. @ 15% to all the above prices.

Prices are based on a sound tube for tube exchange.

For further details, contact:
C.R.T. Services
Telephone: Newport (0633) 412112
And Llanwern 2112

ELECTRONIC COMPONENTS. Send S.A.E. For List. Special Offers monthly. Radnor Supplies, 23 Arbury Road, Nuneaton, Wark's.

TELEVISIONS

LARGE STOCK OF COLOUR & MONO TV's MOST MAKES AND SCREEN SIZES, WORKERS & NON WORKERS, SUITABLE SALE OR RE-RENT TESTING FACILITIES AVAILABLE, QUANTITY DISCOUNTS.

GENERAL FACTORS
Union Street
(off St. Sepulchre Gate West Doncaster)
0302 – 49583 & 68416

DX-TV

South West Aerials can offer both the planning for, and supply of aerial equipment for DXing installations (TV-FM) from its ample ranges, largely based on U.K. manufactured sources and at highly competitive prices. Drawing on the knowledge of two noted DXers with many years of operating experience between them, correct equipment for the required frequency range will be assured. Several narrow and wide band aerials are available for both Bands 1 and 3. The UHF aerial range covers all group and wide band versions. N.B. Initial supplies of the Vorta DX 4/4-DUPLEX wide band UHF aerial are available. The range of supporting hardware of Rotors, Cables and Lashings is extensive. Customer advice is freely available from a company that understands and appreciates DXing. Please send S.A.E. for full price lists and any enquiries.

SOUTH WEST AERIAL SYSTEMS Tel.
10 Old Boundary Road, Shaftesbury, Dorset. (0747)-4370

URGENT TRADE NOTICE

Large quantities of good quality mono and colour TV receivers for sale, at competitive prices.

WHY not come to us where your custom will be welcomed and appreciated.

WE supply receivers to all parts of the UK, and to EIRE. All export enquiries welcomed.

TV WHOLESALE SUPPLIES
35 Shipston Road, Stratford-on-Avon.
TEL: 0789 4424

TELEVISIONS to the Trade. Large quantities of Mono from £2.00; Square Screen from £6.00. Colour T.V.s Working from £65. R.B.M. GEC, Pye, Thorn etc. Phone Scarborough 0723-68087-65451. Scarborough T.V. Trading, Ridings House, Depot Lane, Seamer Road, (A64) Scarborough.

QUALITY REBUILT TUBES

HIGH TEMPERATURE PUMPING

Colour (2 year guarantee) from £32
Mono (including thin necks) from £12

Send or phone for full list and terms
OPEN MONDAY-SATURDAY
WELTECH PICTURE TUBES
5 Masons Avenue, Wealdstone, Harrow, Middx.
01-427 5063.

COLOUR TUBES

Rebuilt with new electron gun, to British Standard. High temperature pumping.

Here is what you pay.

17-18-19 inch.............................£29.00
20 inch.............................£30.00
22 inch.............................£32.00
25 inch.............................£34.00
26 inch.............................£38.00

Guarantee 2 years.
Exchange basis.
Prices negotiable for contracts.
Old Colour tubes purchased.
Carriage £5·00.

TELESTAR TUBES
575c Moseley Road, Birmingham B12 9BS.
Tel: 021-440 5712.

DXTV EQUIPMENT supplied. Also Televisions for French Reception. Excellent signal strength in Kent, E. Sussex. HUGH COCKS, Bre Cottage, Staplecross, Robertsbridge, E. Sussex. Tel. 058083-317.

VALVE LIST

ALL VALVES FULLY TESTED

Five valves or over postage paid
Under five valves postage 6p each

DY86/87	15p	PC900	8p	PCL85/805	20p
EB91	12p	PCC84	8p	PL36	20p
ECC82	10p	PCC85	20p	PL504	25p
ECL80	8p	PCC89	8p	PY32/33	15p
EF80	8p	PCC189	8p	PY81/800	15p
EF85	8p	PCC805	15p	PY801	20p
EF183	10p	PCF80	8p	U191	15p
EF184	10p	PCF86	15p	6F23	15p
EH90	13p	PCF805	20p	6/30L2	15p
EY86/87	13p	PCL82	15p	30F5	10p
PC86	15p	PCL83	15p	30FLI	20p
PC88	15p	PCL84	15p	30PL14	15p

AND MANY MORE AVAILABLE

S. W. ELECTRONICS
114 Burnley Road, Rawtenstall, Rossendale, Lancs.

MAINS DROPPERS AND CAN CONDENSERS

Philips G8 47Ω	43p
Philips G8 2-2-68Ω	63p
Philips 210 118-148-LoopΩ	63p
Philips 210 30-125-2K85Ω	74p
Philips GT23 6-124-84Ω	74p
Thorn 3500	74p
Thorn 1500 350-20-148-1500-317Ω	90p
Thorn 1400	80p
Thorn 8000 56-1K-47-12Ω	90p
Pye 725 27-56Ω	63p
R.B.M. TV161 250-14-156Ω	70p
GEC 2010 8-15-17-70-63-188Ω	90p

2010 Covers 2013 2014 2017 & Sobell 1010 10A 13 & 1014
Bush TV165-166-171-175-176-178 70p
Murphy V1910-1913-1914-2014-2310-2311-2312 2314 70p
Bush A823 68-56Ω 90p

TV Condensers:	– 200 + 200 ± 100 mfd 300V			45p each
	150–100–100–100–150M 325V			£2.00
	150–150–100M 300V			£1.60
	175M 400V 100–100M 350V			£2.05
	400–400M 350V			£2.65
All	2500–2500m 30V	80p	2500–2500m 63V	£1.45
Can	4700m 25V	85p	1500m 70V	80p
Cond	2200m 40V	65p	1000m 63V	63p
	BDX32	£1.98	PL802T Special	£3.50
	100–300–100–16m 300V			£1.70

Post Free, Cash with order, VAT paid.

Durham Supplies
367 Kensington Street, Bradford 8, West Yorkshire

TELEVISION AERIALS

The full range of quality BASC aerials, amplifiers, lashing kits, cables, masts, rotators and accessories can be supplied at extremely competitive prices, normally from stock. Representative examples are shown. For quotations on specific items, or general and technical application queries, please write sending S.A.E. with all enquiries. Full price lists on request.

TELENG "Superverter" Upconverter	£27.52
JAYBEAM JBX21 High Gain UHF Aerial	£38.06
VORTA "True Sound" 6 element High Gain VHF/FM Aerial	£16.39
LABGEAR CM7025 High Gain UHF Amplifier (29dB in Group 'A')	£15.60
Matching Power Supply for above unit CM6001	£11.95

All prices include VAT post and packing.

WE are happy to advise on specific installations and associated problems. An improved version of the high performance UHF amplifier (JULY Television) incorporating dual input switching is anticipated shortly, providing a 2nd ITV channel in most areas.
Please write for details (SAE). BASC: Aerialite, Antiference, Jaybeam, Maxview, Wolsey. Premier Industries.

SOUTH WEST AERIAL SYSTEMS
10 Old Boundary Road, Shaftesbury, Dorset.
Tel. (0747)-4370.

TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact Coles-Harding & Co., 103 South Brink, Wisbech, Cambs. 0945 4188. Immediate settlement.

P. V. TUBES

12 months guarantee

Colour tubes supplied on a 'glass for glass' basis
Callers ring to arrange to bring your glass for on the spot exchange from our stocks
Lancashire/W. Yorks. deliveries by arrangement
Carriage costs per tube: Portables £1·60; Mono £3·50; Colour £4·50; incl. VAT

REBUILT MONO

A28-14W	11" (Pencil)	£14
A31-410W	12"	£14
A31-120W	12" (Pencil)	£14
A31-18W	12"	£14
A34-100W	14" (Pencil)	£14
A38-160W	15" (Pencil)	£14
A44-120WR	17"	£14
A59-23W	23"	£14
A50-120WR	20"	£11
A61-120WR	24"	£11

Glass is required for portable rebuilt mono please.

REBUILT COLOUR

17" 18" 19" 20"	£28
22"	£30
25" 26"	£34
26" 110°	£36

NEW MONO

A31/510 12" Replaces A31/120, A31/410	Mullard 2 year warranty	£17
A34/510 14" Replaces A34/100		£18·50
A50/120WR 20"		£12
A61/120WR 24"		£13·50

All tube prices subject to 15% VAT

No minimum order limit – you may order as you please
Cash with order please – any excess refunded
Cash with order please
SAE all enquiries please
Immediate despatch
Many more "U" series valves in stock

NEW VALVES

Valve prices include 15% VAT

Type	Price	Type	Price	Type	Price	Type	Price
30FL1/2	£1.28	EF184	63p	PCC85	62p	PL36	92p
DY802	89p	EH90	77p	PCC89	67p	PL81	52p
DY86/7	80p	EL34	£1.04	PCC189	67p	PL84	67p
ECC81	53p	EL84	52p	PCF80	83p	PL95	£1.02
ECC82/3	63p	EL509	£2.58	PCF86	67p	PL504	£1.38
ECC85	51p	EY86/87	52p	PCF200	£1.63	PL508	£1.84
ECC88	74p	EY500A	£1.53	PCF801	61p	PL509	£2.81
ECF80	67p	EZ80	51p	PCF802	83p	PL519	£3.07
ECF82	67p	EZ81	51p	PCF805	£1.69	PL802	£2.27
ECH81	58p	GY501	£1.43	PCF806	71p	PY81	70p
ECH84	£1.02	GZ34	£1.79	PCF808	£1.74	PY88	82p
ECL80	62p	KT66	£3.58	PCH200	£1.23	PY500A	£1.63
ECL82	62p	PC86	77p	PCL82	75p	PY800/1	70p
ECL86	77p	PC88	77p	PCL84	83p	UCH81	87p
ECF86	83p	PC92	86p	PCL805/85	87p	UCL82	77p
EF80	41p	PC97	77p	PCL86	87p	UCL83	£1.02
EF85	41p	PC900	77p	PD500	£3.37	UL84	£1.02
EF86	62p	PCC84	31p	PFL200	£1.28	U26	48p
EF183	63p					U191	48p

ALL VALVES ARE UNUSED - BOXED - AND GUARANTEED

Post & Packing charges 14p for 1 valve - 7p for each
Additional valve - 2p extra for large valves - max. 80p.
Post free orders over £20 - any parcel insured extra 10p.

P. V. TUBES *Regd. Office* Tel. (0254) 36521 and answering service.
38A Water Street, Accrington, Lancashire. BB5 6PX
V.A.T. No. 291-1937-45.

THORN 2000 TRIPLERS

75 only **£7** each inc. P. & P.
Thousands of other spares for 2000
S.A.E. FOR FREE LIST
P.H.S. 18 Digby Avenue, Mapperley, Nottingham Tel: 0602-606980.

SITUATIONS VACANT

FULL QUALIFIED T.V. Engineer with Sales and Managerial Experience returning from Overseas late August seeks position preferably with accommodation any Area considered. P. Dancey, c/o 181 Shenley Road, Bletchley, Milton Keynes, MK3 7AW.

SERVICE SHEETS

HUGE G.T. TV/RADIO/ETC. CATALOGUE
(with £4 worth of useful vouchers)

Lists thousands of service sheets, manuals, etc. Many unobtainable elsewhere. Plus up dated Chassis Guide, newsletter, etc. Essential for every firm/engineer – Save £££s – only £1 plus large S.A.E.
S.A.E. for details of our Giant Service Sheet Collections – not available elsewhere.

G.T. TECHNICAL INFORMATION SERVICES
76 Church Street, Larkhall, Lanarkshire ML9 1HE

Largest stocks of manuals, etc. anywhere. £1 + large S.A.E. brings any requested full size service sheet. **Service sheets from 50p:** S.A.E. for full details of this and unique T.V. Publications. The new 1979 British Colour T.V. Repair Manual and the First Foreign Colour T.V. Repair Manual for **£4·90** each – both for **£9·50.**

S.A.E. brings full details of these and other unique publications.

Specialists in Colour & Mono T.V. Information – most manuals can be supplied by return of post at highly competitive prices.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

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

NAME ....
ADDRESS ....
....

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

Company registered in England. Registered No. 53626. Registered Office: King's Reach Tower, Stamford Street, London SE1 9LS.

EDUCATIONAL

TELEVISION & VIDEO SYSTEMS SERVICING

15 MONTHS full-time Diploma course to include a high percentage of practical work.

- ELECTRONIC PRINCIPLES
- MONO & COLOUR TELEVISION
- CLOSED CIRCUIT TELEVISION
- VIDEO CASSETTE RECORDING
- DIGITAL TECHNIQUES
- TELETEXT & TV GAMES

Shortened courses for applicants with suitable electronics background.

Next session starts September 17th.

(Also available 2½ year course in Marine Electronics & Radar for employment as ships Radio Officer.)

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept. TT9, 20 Penywern Road, London SW5 9SU. Tel. 01-373 8721.

BETTER JOB! BETTER PAY!

GET QUALIFIED WITH ICS IN:

COLOUR & MONO TV SERVICING
COLOUR & MONO TV ENGINEERING
COLOUR & MONO TV MAINTENANCE

PLUS: Telecommunications, radio, electronics, electrical engineering, technical communications, radio communications, etc., etc.,

NEW: Self-build radio courses with free kits

Train in your own home, in your own time with ICS, the world's most experienced home study college.

RETURN THIS COUPON TODAY FOR FREE BROCHURE!

ICS Int Correspondence Schools
L284 Intertext House, Stewarts Rd.
London SW8 4UJ. Tel: 01-622 9911

Name ....

Address ....

....

FOR SALE

TEXAS/TIFAX XM11 Teletext Decoder Module plus Keyboard. Perfect working order. £100.00. Luton 598928.

NEW BACK ISSUES of "TELEVISION" available 70p each post free. Open P.O./Cheque returned if not in stock – BELL'S TELEVISION SERVICES, 190 Kings Road, Harrogate, N. Yorkshire. Tel: (0423) 55885.

75 **EX-BROADCAST** 2 inch VIDEO TAPES (Ampex Type). Mixed Memorex and EMI. Offers. All letters answered. Box No. 149.

CCTV BARGAINS. EMI Camera Type 8. Min. Mains/Batt. Video/RF. £140. Siemens Industrial CCIR System £160. Vidicons £15. Plumb/Cons £25. All articles in Good Used condition. Enquiries after 7 p.m. Tel: 01-855 8892.

SEVERAL SELECTED S/STANDARD B & White T.V's. Tested and serviced. For sale or rental. Reasonable offer accepted. Tel. 0332-27460. After 6pm.

TWO MULLARD A65-11W Tubes Brand New Boxed, also Decca Projection Set. Offers. Telephone Worcester 27989.

TV TUBE REBUILDING – for everything from a complete plant to sundry materials, training, electron guns etc. WESTERN WHYBROW ENGINEERING, Penzance. (073 676) 2265. DEMONSTRATION PLANT AT LONDON BRANCH.

WANTED

NEW VALVES and CRT's required, PCL805, PL504, PL509, PY500A etc. Cash waiting. Bearman, 6/8 Potters Road, New Barnet, Herts. Tel: 01-449 1934/5.

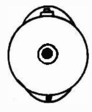
LADDERS

ALUMINIUM Roof Crawlers. Sizes 12ft.-24ft. Also aluminium ext. up to 62½ft. Leaflet. Ladder Centre (TEL2), Halesfield (1), Telford. Tel: 586644. Callers welcome.

MISCELLANEOUS

C.T.V. Panels Ect lists S.A.E. No Callers. Sole, 37 Stanley St., Ormskirk, Lancs. L39 2DH.

RIGONDA AGENTS. For all spares and repairs. Fast dispatch Trade Services available. 01-476 1928. Star Radio, 272 Barking Road, London E13.



BELLS AND SIRENS
CARTERS SIREN £5.95
INDUSTRIAL SIX INCH BELL £8.95
PRICES INCLUSIVE.
SEND CHEQUE, P.O. to:
CWAS ALARM
11 Denbrook Walk,
Bradford BD4 0QS

6 to 12v D.C. — 12v D.C.

SAE for full price list of Professional Burglar Alarm Equipment.

VIDEORECORDER SERVICE and Technical consultancy – B & B Electronics, Newark 76895. Call Steve Beeching.

VIDEO, VCR, and STUDIO SOUND EQUIPMENT REPAIR, conversion and installation. The VIDEO-Workshop Chelsea, Studio 352 3800 Home 603 9649.

NOTICE TO READERS

When replying to Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.
(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
(D) That your letter is correctly addressed to the advertiser.

This will assist advertisers in processing and despatching orders with the minimum of delay.

VIEW WELL WITH WELLVIEW TV TUBE REBUILDS

Exchange Mono

	our price	+VAT 15%	total price
CME 1601-1602	£9·30	£1·39	£10·69
A44/120WR	£9·30	£1·39	£10·69
A50/120WR	£9·30	£1·39	£10·69
AW59/23W	£11·00	£1·65	£12·65
A61/120WR	£11·00	£1·65	£12·65

Exchange Colour

	our price	+VAT 15%	total price
A44/270X-271X	£27·00	£4·05	£31·05
A47/342X-343X	£27·00	£4·05	£31·05
A49/120X	£27·00	£4·05	£31·05
A51/110X	£27·00	£4·05	£31·05
A55/14X	£32·00	£4·80	£36·80
A56/120X	£32·00	£4·80	£36·80
A63/120X	£36·00	£5·40	£41·40
A66/120X	£36·00	£5·40	£41·40
A67/120X	£36·00	£5·40	£41·40
A67/200X	£36·00	£5·40	£41·40

18 month full guarantee (Established ten years).

Send cash or cheque together with old tube with your order.
Carriage=£4·50 including VAT

ALSO YOUR VALVE SUPPLIER NEW AND BOXED
(inclusive of VAT)

DY802=74p	ECC82=64p	EF183=78p
EF184=64p	PCC89=72p	PCF802=98p
PCL82=78p	PCL84=92p	PCL805=97p
PEL200=£1·15	PCL86=97p	PC504=£1·38
PL509=£2·82	PL519=£2·92	PY88=70p
PY800=70p		PY500Y=£1·52

Postage and Packing 10p per valve. All orders over £10 Free of charge.

WELLVIEW TUBES LTD.,

Unit 7, KING ROAD,
CHARFLEET INDUSTRIAL ESTATE,
CANVEY ISLAND,
ESSEX
TELEPHONE CANVEY ISLAND 65372

COLOUR TUBES

STANDARD TUBES

METAL BAND TUBES

Rebuilt with new Electron Guns to British Standard 415/1972. Clause 18.2.

SUFFOLK TUBES LIMITED

214, PURLEY WAY
CROYDON, SURREY
01-686 7951

Britain's Largest *Independent* TV Tube Rebuilder

3 amp 1¼ Fuses	2p
Long wires 300 Mixed Carbon Film Resistors 5 of each type ¼ Watt 1R to 2 Meg – ITT	£1.50
Red & Green L.E.D.s mixed large and small 14 for	£1.00
Convergence Panel for GEC 2040 11 pots 5 coils 2 Resistors E.T.C. New	£1.50
(Reject Varicap Units) ELC1042/ELC1043	50p
ELC2000	£1.00
10 Watt LP1173	£1.00
IF LP1170	50p
AM/FM T/Unit (Seconds)	50p
AT1025/08 Blue Lateral Ass.	15p
10 Watt Mullard Amps New	£2.00
BD 207	30p
TIP 31	20p
TIP 2955	50p
2N3583 250V/1A Output Transistor	40p
BD 252	20p
(MJE2021) (SJE5451) NPN 80V/5A	15p
(661 pair 80W/5A (660 90V	pair 28p
40V 2A O.P. Trans B0375/6	pair 20p
BZV 15/12R PYE	50p
BD226	25p
BD238	25p
MJE 1661	25p
XTALS T/V 4.433.610KHz	50p
BYX 38/600R	50p
BT138 Triacs 10a/600V	65p
RCA40506 Thyristors	50p
MJE 2955/15A	50p
TIP 41A-42	pair 40p
G11 Phillips Thyristors	60p
PYE Thyristors 2N4444-0T112 BT116	85p
SP8385 Thorn	25p
5 amp 300V Thyristors	25p
BRC 4443	65p
SCR 957	65p
BD561-2	pair 30p
BC 365	10p
BD 131	25p
BD 183	50p
AC187-8K	pair 40p

EHT S.Stick 18 or 20KW Triplers (ITT)	£1.50 new
3 amp Diodes approx. voltage 1200	7p each
3500 6 push button units for Thorn 3500 Varicap tuning	£1.00
Varicap F.M. Tuner Tuning range 78.5 to 108MHz	£2.00
(I.F. Panel with circuit)	£2.00
6 position 12.5K V/Resistor Unit for Varicap	50p
Thorn Mains Lead & ON/OFF switch & Control Panel with Slider Pots	75p
TBA 120A	30p
TBA 120B	30p
TBA 120AS	30p
TBA 120SB	30p

EHT Lead & Anode Cap	75p
Star Aerial Amps Channel B or C	£4.00
2200/35	15p
2000+2000/35	25p
2500+2500/63V	50p
4700/25	25p
4700/30	35p
4700/40	50p
1250/50	10p
33/350	6p
100/63	8p
10/350	8p
47/50	5p

4.7NF5KV	10p
6200PF/2000V	10p
180PF/8KV	10p
1000PF/10KV	10p
1000PF/12KV	10p
1200PF/12KV	10p
270PF/8KV	10p
160PF/8KV	10p
.1MFD 400V	5p
.1MFD 800V	8p
.1MFD 2000V	15p
.1MFD 1250V	15p
.01MFD 600V	5p
.01MFD 1000V	8p
.0047/500V	8p
.0022 1500V	8p
.47 250 A/C	8p
.47 1000V	35p
.047 1000V	8p
.22/250AC	8p
1500/100V	25p
10/500V	15p
.47/100V	5p
330/25V	5p
680/40V	8p
22/350V	7p
330/100V	10p
15/450V	10p
47/450V	12p
470/16V	8p
470/25V	8p
470/40V	10p
470/63V	15p
470/100V	15p
220/25V	6p
220/40V	6p
220/63V	10p
160/25V	5p
330/16V	5p
100/16V	5p
2.2/160V	5p
10/40V	5p
TBA 920	£1.00
TBA 920Q	£1.50
TBA 480Q	£1.00

TBA 550Q	£1.50
TBA 540	£1.00
TBA 5400	£1.00
TBA 530Q	£1.00
TBA 990	£1.00
SBA 550B	£1.50
SN76003 No Heat Sink	£1.00
SN 76003	£1.75
SN 76033	£1.50
TBA 800	60p
TBA 810S	£1.00
TCA 270	£1.00
TCA 270Q	£1.00
TCA 275Q	£1.00
CA 270	£1.00
TBA 720A	£1.50
TBA 510Q	£1.50
SN76115N	50p
TAA 700	£2.00
TAA 570	£1.50
TBA 396	£1.00
SAS 570S	£1.50
SN76666	£1.00
SN76660	50p
SN76227	50p
SN76544N	75p
TBA641BX1	£1.50
CA920 AW	£1.00
TBA 750	£1.00
TAA 550	20p
SN76131N	50p
SN76001	£1.00
TBA560CQ	£1.00
SN76530P	50p
SN76650N	50p
TDA1170	85p
BT822	£1.50
BT8224	£1.50

22/40	5p
1500/40	10p
.005/1500V	5p
47/100V	8p
.05/100	3p
4.7/50V	5p
4/350	5p
1000/25	10p
4.7/100	6p
2.2/100	6p
1000/10	5p
8/350	5p
1/250	5p
1/100	5p
6MHz Filters	25p
3300/40	15p
3300/25	5p
1500/25	10p
1/350	5p
220/10	5p
680/100	10p
220/16	5p
47/63	5p
33/63	5p
2.2/63	5p
22/100	8p
4.7/63	5p
1000/40	10p
100/450	30p
22M 350V	20p
33.000	20p
PUA758PC	£1.00
MC1349P	50p
TCEP100	£1.00
TCE120CQ	£1.00

SENDZ COMPONENTS

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

100 mixed 20mm Fuses **£2.00**

3500 Thorn Triplers **£3.50**

Triplers TS2511TDT THORN **£2.50**

Triplers TS2511TBQ PYE **£1.50**

1730 DECCA **£1.00**

GRUNDIG 3000/3010
SIEMENS TVK52 Triplers **£3.00**

Triplers – DECCA **£3.00**
CS 2030 CS 2230
CS 2232 CS 2233
CS 2630 CS 2631
CS 2632

THORN – Needs Mod No 1400 . 1500 Stud Multipliers **£1.50**

Triplers – PHILLIPS
520.540.550 **£3.00**

Triplers – ITT
CVC5 CVC20/25/30
CVC7 CVC8
CVC9 **£3.00**

LP1174/33 DECCA
LP1194/42 PYE
Triplers **£4.00**

G2100 GEC Tripler
TVM25 **£2.00**

THORN 3500
THORN 8500 Focus Unit
DECCA 8500 Focus Unit
(Large or small) **£1.00** each

4 Push Button Units
1400-1500 THORN **£3.50**

4 Push Button Unit 8500
THORN **£3.50**

300 Mixed condensers **£1.50**
300 Mixed resistors **£1.50**
30 Pre-Sets **£0.50**
100 W/W Resistors **£1.50**
40 Mixed Pots **£1.50**
20 Slider Pots **£1.50**
10 Different Types

Mixed Electrolytics
150 **£2.00**

DP Push Button Switch
ON/OFF **10p**

Mains ON/OFF Push Button
T/V **20p**

Mains ON/OFF Rotary T/V **12½p**

Mains Dropper THORN
6R+1R+100R **35p**

Mains Droppers
69R+161 PYE **40p**

AD 161
AD 162
PAIR **60p**

147+260 PYE **40p**

(731) 3R+56R+27R **50p**

100 Mixed Diodes **£1.00**

100 Mixed Transistors **75p**

1 LBs Mixed Components **£1.50**

BU 105/04 **£1.00**
BU 205 **£1.00**
BU 108 **£1.00**
BU 208 **£1.75**
BU 500 **£1.75**
BU 126 **£1.00**
R2008B **£2.00**
R2010B **£1.25**

EHT Rectifier BY212 **10p**

3 OFF G770/HU37 EHT **10p**

12KV 2 M/A Small **20p**

12KV 2 M/A Large **30p**

EHT REC USED IN THORN 1400.1500 Triplers (×80/150) **10p**

CSD 118×MH Rec
THORN 3500 **10p**

220M/450V THORN **50p**

700M/250V THORN **35p**

175+100+100 350V
3500 THORN **£1.50**

400+400.350V DECCA **80p**

470+470.250V **40p**

100+200 325V **40p**

200+200+100+32 350V **70p**

150+200+200.300V **70p**

731 PYE 600/300V
& BUSH **75p** each

200+200 350V **60p**

300+300+100/32/32 **£1.00**

400M 400V **40p**

400M 350V **50p**

800M 250V **30p**

AE Power supplys
15V **£1.00**

Flush Mounted Diplexer
White 2 Coax Sockets
T/V F.M. **35p**

BF 127 BC 303
BF 264 BRC 2108
BF 180 BC 336
BF 181 BF 157
BF 182 BC 161
BC 300 BC 460
AC 128 BC 350
BC 350 E1222
BF 178 BSY95A
BF 257 BFT 43
BF 137 with heat sink
BF 185 T1P 29A
BF 200 T1P 32
AC 153K
20p each

GEC Sound O.P. Panel
I.C. O.P. **£2.50**

UHF Varicap Units + VHF

NEW
ELC 1043/05 **£4.00**
ELC 1043/06 **£4.00**

THORN Varicap UHF
3.500 **£3.50**
New EQV ELC1043/05

DECCA UHF Varicap
New eqv E1C 1043/05 **£4.00**

VHF/UHF AEG Varicap
(New) **£3.50**

G8 PHILLIPS **£3.50**
UHF Varicap replacement

NEW VHF/UHF on panel
ELC2060 **£4.50**

Phillips T/Units
UHF New **£2.00**

VHF/UHF AEG **£2.50**
Varicap NSE
Removed from new panels

VHF Varicap Units
NSF AEG removed from
Print Panels **£1.00**
New 49.00 21.900MHz

VHF Varicap (NSF) AEG **£2.00**
New 49.00 21.900MHz

4 Push Button T/Units
UHF MULLARD **£2.00**

AE Isolating Sockets UHF
& Lead
PYE & THORN **40p**

DECCA 1730 Doubler **£1.00**

Transistor UHF Units with
AE Socket and leads
GEC 2000 Rotary type
NEW **£2.00**

7 button Varicap tuning heads
Variable Resistor with Fascia
Plate 7 Lamps **£3.00**

PYE 6 push button unit for
Varicap Tuning **£2.50**

4 push button unit (for
Varicap Tuning) 20K
New **60p**

DECCA Bradford Tuner
5 Button New **£2.75**

BB 105 UHF
BB 103 VHF
BA 182
Varicap diodes **5p** each
BTY80 **20p**

3 amp Diodes 300V **10p**

3 amp Diodes 100V **7p**

1 amp Bridges 100V **20p**

1 amp 400V **20p**

3 amp Bridge **25p**

W005M Bridge **15p**

BY 127 **10p**
IN4005 **4p**
IN4006 **5p**
BY210/400 **5p**
BY210/800 **10p**
BY176 **50p**
BY133 **10p**
BA159 **10p**
BY184 **25p**
BY187 **50p**

TV 20 **50p**
TV 18 **40p**
Rectifier Sticks & lead &
Anode Cap

BYF3214 20KV Rectifier
Sticks **25p** each

BYF3123 18KV Wire ends **25p**

BA 248 **6p**
BSS 68 **20p**
BYX55/350 **10p**
BY 206 **10p**

BT106 S/Type **50p**

BT 106 **95p**

BT 116 **95p**

BT 119 **95p**

BT 109 **70p**

BT 146 750V **25p**

Thyristors 8A/800V
2N6399A **30p**

Thyristors 8A/400V
52600D **30p**

Y827 Diodes **30p**

Bridge Rec

B30C 600A6 **12p**

B30C 500 **12p**

BC147C 2N3566
BC148B BF198
BC149C BF274
BC195 BSY79
BC108 BC327
BC107 BC213LA
BF594 BC212LT
BC158 BF195
2N2222 BC182L
2N390 BF594
2N4355 BC183
T1591 BC238A
7p each

Add 15% VAT.

SENDZ COMPONENTS

2 WOODGRANGE CLOSE, THORPE BAY, ESSEX.

Reg. Office Only.
Callers by appointment only.

Add postage for all overseas parcels.