JANUARY 1980

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

55p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

SPECIAL VIDEO ISSUE

- cameras
- projects
- reviews

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RADIO & TV COMPONENT DISTRIBUTORS
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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!

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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
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BZY88 11V	0.10
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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
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BZX61 15V	0.25
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BZX61 20V	0.25
BZX61 22V	0.25
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BZX61 27V	0.25
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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
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BC114	0 15
BC115	0.20
BC116	0.20
BC117	0.20
BC118	0.20
BC119	0.50
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BC126	0 20
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BC142	0.40
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BC154	0.15
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BC159	0 15
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BC171	0 15
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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
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BC206	0.15
BC207	0.15
BC208	0.15
BC209	0.15
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BC213L	0 15
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BC225	0.40
BC237	0 15
BC238	0.15
BC251A	0.15
BC301	0.40
BC303	0.50
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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
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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
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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
TBA560CO	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
TCA270SQ	2.00
TDA2030	8.00
TDA2140	6 00
TDA2150	6.00
TDA2160	6.00
TDA1230	3.00
TDA 3089	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
PCL 82	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

OIRECT 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, IK7 + 116 + 462, 126	1 10
TCE 1500 350 + 20, 148, IK5, 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
Antistatic	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	10.50
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

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CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF.

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this month

OUR NEXT ISSUE DATED FEBRUARY WILL BE PUBLISHED ON JANUARY 21

THE PROFESSIONAL CHOICE. NATIONWIDE

NEW SPARES

TYPE	PRICE £
AC107	0.20
AC113	0.17
AC115	0.17
AC117	0.24
AC125	0.20
AC126	0.18
AC127	0.19
AC128	0.17
AC131	0.13
AC141	0.23
AC142	0.19
AC141K	0.29
AC142K	0.29
AC151	0.17
AC165	0.16
AC166	0.16
AC168	0.17
AC176	0.17
AC176K	0.28
AC178	0.16
AC186	0.26
AC187	0.21
AC188	0.20
AC187K	0.30
AC188K	0.30
AD130	0.50
AD140	0.65
AD142	0.73
AD143	0.70
AD145	0.70
AD149	0.64
AD161	0.40
AD162	0.40
AD161 } AD162 }	1.30
AF106	0.42
AF114	0.23
AF115	0.22
AF116	0.22
AF117	0.30
AF118	0.40
AF121	0.33
AF124	0.33
AF125	0.29
AF126	0.29
AF127	0.29
AF139	0.39
AF151	0.24

TYPE	PRICE £
AF170	0.25
AF172	0.20
AF178	0.49
AF180	0.60
AF181	0.30
AF186	0.29
AF239	0.43
AU113	1.29
BA130	0.08
BA145	0.14
BA148	0.17
BA155	0.08
BAX13	0.05
BAX16	0.08
BC107	0.10
BC108	0.10
BC109	0.10
BC113	0.09
BC114	0.12
BC115	0.10
BC116	0.10
BC117	0.11
BC119	0.22
BC125	0.12
BC126	0.09
BC136	0.12
BC137	0.12
BC138	0.21
BC139	0.21
BC140	0.24
BC141	0.22
BC142	0.19
BC143	0.19
BC147	0.07
BC148	0.07
BC149	0.07
BC153	0.12
BC154	0.12
BC157	0.10
BC158	0.11
BC159	0.11
BC160	0.22
BC161	0.22
BC167	0.09
BC168	0.09
BC169C	0.09
BC171	0.08

TYPE	PRICE £
BC172	0.08
BC173	0.12
BC177	0.12
BC178	0.12
BC179	0.12
BC182L	0.09
BC183L	0.09
BC184L	0.09
BC186	0.18
BC187	0.18
BC209	0.11
BC212	0.09
BC213L	0.09
BC214L	0.09
BC237	0.07
BC240	0.31
BC281	0.24
BC262	0.18
BC263B	0.20
BC267	0.19
BC301	0.22
BC302	0.30
BC307	0.10
BC337	0.11
BC338	0.09
BC307A	0.10
BC308A	0.12
BC309	0.14
BC547	0.09
BC548	0.11
BC549	0.11
BC557	0.11
BD112	0.39
BD113	0.65
BD115	0.30
BD116	0.47
BD124	1.30
BD131	0.32
BD132	0.34
BD133	0.37
BD135	0.26
BD136	0.26
BD137	0.26
BD138	0.26
BD139	0.40
BD140	0.28
BD144	1.39
BD145	0.50

TYPE	PRICE £
BD222/T1P31A	0.37
BD225/T1P31A	0.39
BD234	0.34
BD222	0.50
BDX22	0.73
BDX32	1.98
BDY18	0.75
BDY60	0.80
BF115	0.24
BF121	0.21
BF154	0.12
BF158	0.19
BF159	0.24
BF160	0.23
BF163	0.23
BF164	0.17
BF167	0.23
BF173	0.21
BF177	0.26
BF178	0.24
BF179	0.28
BF180	0.30
BF181	0.34
BF182	0.30
BF183	0.29
BF184	0.23
BF185	0.29
BF186	0.30
BF194	0.09
BF195	0.09
BF196	0.12
BF197	0.10
BF198	0.11
BF199	0.14
BF200	0.28
BF216	0.12
BF217	0.12
BF218	0.12
BF219	0.12
BF220	0.12
BF222	0.12
BF221	0.21
BF224	0.12
BF256	0.37
BF258	0.27
BF259	0.27

TYPE	PRICE £
BF260	0.24
BF262	0.28
BF263	0.25
BF271	0.20
BF273	0.12
BF336	0.28
BF337	0.24
BF338	0.29
BFT42	0.26
BFT43	0.24
BFX84	0.27
BFX85	0.27
BFX88	0.24
BFY37	0.22
BFY50	0.15
BFY51	0.15
BFY52	0.15
BFY53	0.27
BFY55	0.27
BHA0002	1.90
BR100	0.20
BSX20	0.23
BSX76	0.23
BSY84	0.36
BT106	1.18
BT108	1.23
BT109	1.09
BT116	1.23
BT120	1.23
BU105/02	1.50
BU105/04	2.00
BU126	1.40
BU205	1.20
BU208	1.60
BY126	0.09
BY127	0.10
OC22	1.10
OC23	1.30
OC24	1.30
OC25	1.00
OC26	1.00
OC28	1.00
OC35	1.00
OC36	0.90
OC38	0.90
OC42	0.45
OC44	0.20

TYPE	PRICE £
OC45	0.20
OC46	0.35
OC70	0.22
OC71	0.28
OC72	0.35
OC74	0.35
OC75	0.35
OC76	0.35
OC77	0.50
OC78	0.13
OC81	0.20
OC810	0.14
OC82	0.20
OC820	0.13
OC83	0.22
OC84	0.28
OC85	0.13
OC123	0.20
OC169	0.20
OC170	0.22
OC171	0.27
OA91	0.05
BRC4443	0.65
R2008B	1.50
R2010B	1.50
R2305	0.38
R2305/BD222	0.37
SCR957	0.65
TIP31A	0.38
TIP32A	0.36
TIP3055	0.53
T1590	0.19
T1591	0.19
TV106	1.09

SPECIAL OFFER

SL901B	3.50
SL917B	5.00

DIODES

1N4001	0.04
1N4002	0.04
1N4003	0.06
1N4004	0.07
1N4005	0.07
1N4006	0.08
1N4007	0.08
1N4148	0.03
1N4751A	0.11
1N5401	0.12
1N5404	0.12
1N5406	0.13
1N5408	0.16

VALVES

DY87	0.52
DY802	0.64
ECC82	0.52
EF80	0.40
EF183	0.60
EF184	0.60
EH90	0.60
PC86	0.76
PC88	0.76
PCC89	0.65
PCC189	0.65
PCF80	0.70
PCF86	0.68
PCF801	0.70
PCF802	0.74
PCL82	0.67
PCL84	0.75
PCL86	0.78
PCL805	0.75
PLF200	1.00
PL36	0.90
PL84	0.74
PL504	1.10
PL509	2.45
PY88	0.63
PY500A	1.60
PY81/800	0.57

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950 MK2 1400	2.00
1500 18" 19" stick	2.37
1500 24" 5 stick	2.48
Single stick Thorn TV 11.16K 70V	0.75
TV20 2 MT	0.75
TV20 16K 18V	0.75

IC's

SN76013N	1.20
SN76013ND	1.00
SN76023N	1.20
SN76023ND	1.00
SN76226DN	1.50
SN76227N	1.20
TBA341	0.97
TBA520Q	1.10
TBA530Q	1.10
TBA540Q	1.45
TBA550Q	1.40
TBA560CQ	1.50
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
TCA270SA	1.45
TCA1327B	1.00

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Pye 731	5.20
Pye 691/693	4.50
Decca (large screen) CS2030/2232/2630/2632/2230/2233/2631	5.00
Philips G8 520/40	5.30
Philips 550	5.30
GEC C2110	5.50
GEC Hybrid CTV	5.10
Thorn 3000/3500	5.00
Thorn 8000	2.42
Thorn 8500	4.75
Thorn 9000	5.50
GEC TVM 25	2.50
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Grundig 3000/3010 Saba 2705/3715 Telefunken 709/710/717/2000	6.80
Korting	6.80

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Working Colour £15.00 extra.
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Pye Olympic etc.	7.00

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Bush	10.00
GEC	10.00
Philips	10.00
Pye	10.00
Thorn	10.00

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Pye 169 chassis	12.00
Thorn 1500	12.00
GEC series 1 & 2	12.00
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S/S COLOUR

	19" £	20" £	22" £	25" £	26" £
GEC	40	40	40	40	40
Philips	—	—	40	40	40
Thorn	55	—	60	45	65
Korting	—	—	55	—	60
Pye Mechanical	40	—	40	40	40
Pye Varicap	45	—	45	45	45

MAINS DROPPERS

Mono

Bush 161	60p
Philips 210 30+125+2K85	50p
Philips 210 118R+148R	48p
Thorn 1400	75p
GEC 2018	58p
Thorn 1500	70p

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Bush A823	72p
Pye 723 27Ω+56Ω	57p
GEC 2110 –41Ω	45p
GEC 2110 –12R5+12R5	47p
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Thorn 8000	58p
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QUARTZ LCD 5 Function

Hours, mins, secs., month, date, auto calender, back-light, quality metal bracelet.

£6.65

Guaranteed same day despatch.
Very slim, only 6mm thick.

M1

SOLAR QUARTZ LCD 5 Function

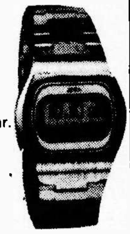
Genuine solar panel with battery back-up. Hours, mins., secs., day, date. Fully adjustable bracelet. Back-light. Only 7mm thick.

£8.65

Guaranteed same day despatch.

M2

QUARTZ LCD 11 Function SLIM CHRONO



6 digit, 11 functions.
Hours, mins., secs., day, date, day of week.
1/100th, 1/10th, secs., 10X secs., mins.,
Split and lap modes.
Back-light, auto calendar.
Only 8mm thick.
Stainless steel bracelet and back.
Adjustable bracelet.
Metac Price

£10.65 Thousands sold!
Guaranteed same day despatch.

M3

QUARTZ LCD ALARM 7 Function

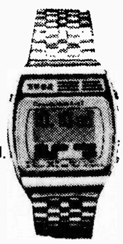
Hours, mins., secs., month, date, day. 6 digits, 3 flags plus continuous display of day and date or seconds. Back-light Only 9mm thick.

£12.65

Guaranteed same day dispatch.

M4

MULTI ALARM 6 Digits 10 Functions

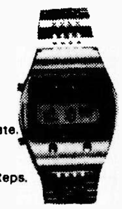


- Hours, mins., secs.
- Months, date, day.
- Basic alarm.
- Memory date alarm.
- Timer alarm with dual.
- Time and 10 country zone.
- Back-light.
- 8mm thick.

£18.65

M5

FRONT-BUTTON Alarm Chrono Dual Time



6 digits, 5 flags,
22 functions.
Constant display of hours and mins., plus optional seconds or date display.
AM/PM indication, month, date.
Continuous display of day.
Stop-watch to 12 hours 59.9 secs., in 1/10 second steps.
Split and lap timing modes.
Dual time zones.
Only 8mm thick.
Back-light. Fully adjustable open bracelet.
Guaranteed same day dispatch

£22.65

M6

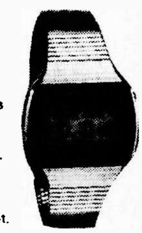
SOLAR QUARTZ LCD Chronograph with Alarm Dual Time Zone Facility

6 digits, 5 flags.
22 functions.
Solar panel with battery back-up.
6 basic functions.
Stop-watch to 12 hours 59.9 secs., in 1/10 sec., steps.
Split and lap timing modes.
Dual time zones.
Alarm. 9mm thick. Back-light.
Fully adjustable bracelet.

£27.95

M7

ALARM CHRONO with 9 world time zones



- 6 digits, 5 flags.
- 6 basic functions.
- 8 further time zones.
- Count-down alarm.
- Stop-watch to 12 hours 59.9 secs. in 1/10 sec. steps.
- Split and timing modes.
- Alarm.
- 9 mm thick.
- Back-light.
- Fully adjustable bracelet.

£29.65

M8

SOLAR QUARTZ LCD Chronograph

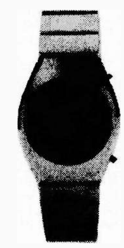
Powered from solar panel with battery back-up.
6 digit, 11 functions.
Hours, mins., secs., day, date, day of week.
1/100th, 1/10th, secs., 10X secs., mins.
Split and lap modes.
Back-light, auto calendar. Only 8mm thick.
Stainless steel bracelet and back.
Adjustable bracelet.
Metac Price

£13.65

Guaranteed same day despatch.

M9

QUARTZ LCD Ladies Day Watch



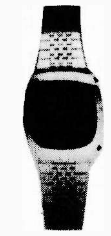
Only 25 × 20mm and 6mm thick.
Hours, minutes, seconds, day, date, backlight and auto calendar.
Elegant metal bracelet in silver or gold fully adjustable to suit very slim wrists.
State colour preference.

£9.95

Guaranteed same day despatch.

M15

QUARTZ LCD Ladies Fashion Watch



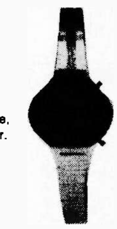
Elegant bracelet in bronze/gold finish or silver colour.
Hours, mins, secs, day, date, backlight and auto calendar. Adjustable for the slimmest of wrists.
State colour preference.

£14.95

Guaranteed same day despatch

M17

QUARTZ LCD Ladies Cocktail Watch



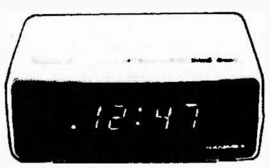
Highly functional watch which also suits those special occasions.
Beautifully designed with a very thin bracelet which retains strength as well as elegance.
Hours, mins, secs, day, date, backlight and autocalendar.
Bracelet fully adjustable to suit slim wrists.
State gold or silver finish.

£19.95

Guaranteed same day despatch

M18

HANIMEX Electronic LED Alarm Clock



Features and Specification
Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on/off control. Display flashing for power loss indication. Repeatable 9-minute snooze. Display bright/dim modes control. Size 5.15" x 3.93" x 2.36" (131mm x 11mm x 60mm) Weight 1.43 lbs (0.65 kg)

AC power 220V

£10.20 Thousands sold!
Mains operated.

Guaranteed same day despatch.

M13

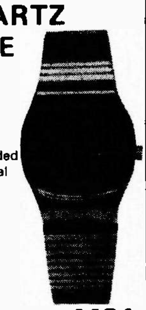
EXECUTIVE ALARM WATCH

6 Functions plus Alarm:
Conference signal,
5 minute snooze alarm.
Conference signal sounds 4 secs., before main alarm to give advance warning and an option to cancel.
Snooze sounds 5 mins., after main alarm and is always preceeded by the conference signal.

£14.95

M60

MACY QUARTZ ANALOGUE



Automatic Calendar
Day and Date
infinite bracelet.
This mans watch has elegance as well as the robust appearance provided by a watch with traditional features. Accuracy is provided by a quartz crystal powered by a long life miniature battery.

£24.95

M21

Metac price breakthrough for an Alarm Chronograph with Dual Time only

£18.95

OUTSTANDING FEATURES

- **DUAL TIME.** Local time always visible and you can set and recall any other time zone (such as GMT). Also has a light for night viewing.
- **CALENDAR FUNCTIONS** include the date and day in each time zone.
- **CHRONOGRAPH/STOPWATCH** displays up to 12 hours, 59 minutes, and 59.9 seconds.
- On command, stopwatch display freezes to show **intermediate (split/lap) time** while stopwatch continues to run. Can also switch to and from timekeeping and stopwatch modes without affecting either's operation.
- **ALARM** can be set to anytime within a 24 hour period. At the designated time, a pleasant, but effective buzzer sounds to remind or awaken you!

Guaranteed same day dispatch.

M16

HOW TO ORDER

Payment can be made by sending cheque, postal order, Barclay, Access or American Express card numbers. Write your name, address and order details clearly, enclose 40 pence per single item for post and packing or the amount stated in the advert. All products carry 1 year written guarantee and full money-back 10 day reassurance. Battery fitting and electronic calibration service is available to customers at any Metac shop. All prices include VAT currently at 15%.

Metac Wholesale:
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Telephone orders: Credit card customers can telephone orders direct to Daventry (03272) 76545 or Edgware Rd. 01-723 4753 24 hours a day.

Service Enquiries 03272-77659
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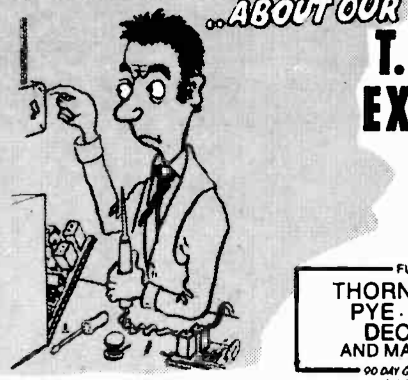

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AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68
AC128	0.46	BC107*	0.16	BC207*	0.39	BC461	0.78	BD238	0.68
AC128K	0.55	BC108*	0.15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

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
BF244*	0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.46	2N3906	0.20
BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
BF257	0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
BF262	0.73	BU102	3.35	OC44	0.68	2N1164	8.29	2N4292	0.32
BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
BF271	0.42	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
BF272A	0.80	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
BF273	0.33	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
BF274	0.34	BU205	2.58	OC81D	0.95	2N1711	0.47	2N5061	0.30
BF336	0.63	BU206	2.59	OC139	1.30	2N1893	0.52	N5064	0.63
BF337	0.65	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
BF338	0.68	BU407	1.38	OC170	0.80	2N2217	0.55	2N5087	0.50
BF355	0.72	BUY77	2.50	OC171	0.82	2N2218	0.38	2N5208	0.59
BF362	0.49	C106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
BF363	0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
BF367	0.29	C111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
BF457	0.46	E300	0.42	OCP71	1.98	2N2401	0.80	2N5449	0.18
BF458	0.49	E1222	0.47	ON236A	0.94	2N2484	0.35	2N5457	0.46
BF459	0.52	E5024	0.19	R2008B	2.72	2N2570	0.74	2N5458	0.40
BF594	0.16	GET872	0.46	R2010B	2.79	2N2646	0.82	2N5459	0.58
BF596	0.17	ME0402	0.18	R2322	0.75	2N2784	1.15	2N5494	0.85
BF597	0.27	MF0404/02	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
BFR39	0.30	ME6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
BFR40	0.29	ME6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
BFR41	0.30	MJ2955	1.30	TIC44	0.25	2N2905*	0.39	2N6122	0.60
BFR50	0.29	MJ3000	1.58	TIC46	0.35	2N2906*	0.36	2N6178	1.07
BFR52	0.33	MJE340	0.68	TIC47	0.45	2N2926G	0.15	2N6180	1.39
BFR61	0.29	MJE341	0.72	TIP29A	0.47	2N2926O	0.14	2N6211	2.74
BFR62	0.28	MJE370	0.74	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
BFR79	0.30	MJE371	0.79	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
BFR80	0.29	MJE520	0.85	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
BFR81	0.30	MJE521	0.95	TIP32A	0.56	2N3054	0.66	2SC930D	1.50
BFR88	0.42	MJE2955	1.20	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
BFT41	0.48	MJE3000	1.95	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
BFT43	0.55	MJE3055	1.22	TIP34A	0.84	2N3254	0.58	2SD234	1.48
BFW11	1.02	MPF102	0.40	TIP41A	0.72	2N3391A	0.38	3N128	1.60
BFW30	2.58	MPS3702	0.33	TIP42A	0.80	2N3633	12.70	40250	0.98
BFW59	0.19	MPS3705	0.30	TIP2955	0.77	2N3703	0.17	40251	1.14
BFW60	0.20	MPS6521	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
BFW90	0.65	MPS6523	0.36	TIS43	0.44	2N3705	0.17	40361	0.48
BFX29	0.38	MPS6566	0.44	TIS73	1.36	2N3706	0.16	40362	0.50
BFX84	0.42	MPSA05	0.30	TIS90	0.23	2N3707	0.18	40410	0.94
BFY50	0.38	MPSA06	0.32	TIS91	0.28	2N3708	0.17	40429	0.88
BFY51	0.37	MPSA55	0.43	ZTX108	0.14	2N3715	1.70	40530	0.79
BFY52	0.36	MPSA56	0.45	ZTX109	0.16	2N3771	2.09	40595	1.39
BFY53	0.36	MPSA93	0.56	ZTX213	0.23	2N3772	2.08	40603	1.13
BFY90	1.98	MPSL01	0.33	ZTX300	0.16	2N3773	2.90	40636	1.25
BPX25	1.62	MPSU01	0.61	ZTX304	0.26	2N3794	0.40	40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)	Type	Price (£)	Type	Price (£)
BRC1330	0.93	SN76008KE	2.56	TBA240A	3.98
CA810QM	2.44	SN76013N	1.56	TBA281	2.07
CA3005	1.85	SN76013ND	1.40	TBA395*	2.58
CA3012	1.45	SN76018KE	2.56	TBA396	2.40
CA3014	2.23	SN76023N	1.56	TBA400	2.20
CA3018	0.71	SN76023ND	1.40	TBA480Q	1.84
CA3020	1.89	SN76033N	2.20	TBA500*	2.21
CA3028A	0.80	SN76110N	1.20	TBA510*	2.21
CA3028B	1.09	SN76115N	1.62	TBA520*	2.98
CA3045	3.75	SN76116N	1.78	TBA530P	2.24
CA3046	0.70	SN76131N	2.10	TBA540*	2.88
CA3065	1.74	SN76226N	2.60	TBA550*	3.13
CA3068	1.90	SN70227N	1.61	TBA560C*	3.18
CA3130S	1.57	SN76228N	1.80	TBA570*	1.29
FCH161	2.40	SN76502N	1.92	TBA611B	2.68
FCJ101	3.32	SN76530P	0.97	TBA641	2.55
LM309K	1.98	SN76533N	1.38	TBA641A12	2.35
LM380N-14	1.65	SN76544N	1.85	TBA641B11	2.61
LM1303N	1.03	SN76546N	1.85	TBA651	2.12
MC1307P	1.82	SN76570N	1.81	TBA673	2.31
MC1310P*	1.84	SN76620AN	0.99	TBA700*	2.50
MC1312P	2.34	SN76650N	1.48	TBA720AQ	2.38
MC1327P*	1.86	SN76660N	0.64	TBA720Q	2.38
MC1330P	0.83	SN76666N	0.96	TBA750*	2.18
MC1350P	1.22	TA7073P	3.51	TBA800	1.65
MC1351P	1.42	TAA263	2.20	TBA810AS	1.69
MC1352P	1.42	TAA300	3.85	TBA920*	2.80
MC1357P	2.92	TAA320	1.10	TBA940	3.52
MC1358P*	2.30	TAA350A	2.48	TBA950	2.08
MC1458G	1.43	TAA370A	3.18	TBA990*	2.90
MC1496L	1.15	TAA435	1.70	TCA270A*	3.55
MC3051P	0.58	TAA450	3.39	TCA280A	1.43
MFC400B	0.85	TAA521	1.10	TCA290A	3.46
MFC4060A	0.98	TAA522	2.09	TCA420A	2.10
MFC6040	1.11	TAA550	0.35	TCA440	1.67
MFC8020A	1.10	TAA560	1.93	TCA640	4.26
ML231	3.57	TAA570	2.20	TCA650	4.26
ML232	3.57	TAA611A	1.67	TCA660	4.26
NE555	0.72	TAA611B	1.89	TCA730	4.10
NE556	1.34	TAA621AXI	2.33	TCA740	4.04
NE566	1.95	TAA630Q	3.91	TCA750	2.53
SAA1024	5.70	TAA630S	4.18	TCA760	1.52
SAA1025	10.35	TAA661A	2.39	TCA820	3.29
SAS560A	2.[illegible]	TAA661B	1.75	TDA440	4.16
SAS570	2.01	TAA700*	2.80	TDA1003	1.68
SC9503P	1.40	TAA840	3.38	TDA1004	2.73
SC9504P	1.38	TAA861A	0.95	TDA1005	3.04
SL414A	1.91	TAA930A	1.43	TDA1022	6.89
SL432A	2.52	TAA930B	1.43	TDA1024	0.97
SL450	5.10	TAA960	3.20	TDA1034	2.98
SL901B	4.20	TAA970	2.81	TDA2610	2.86
SL917B	5.60	TAD100	2.66	TDA2640	2.86
SL918A	5.95	(Filter)	0.98	ZN414	1.45
SN72440N	2.21	TBA120A	0.90		
SN76001N	1.67	TBA120S*	0.99		
SN76003N	2.20	TBA120SA	1.02		
		TBA231	1.1[illegible]		

* Indicates Q version is also available.

DIODES

Type	Price (£)	Type	Price (£)
AA113	0.17	BY114	0.60
AA119	0.21	BY118	1.10
AA129	0.28	BY126	0.20
AA143	0.18	BY127	0.21
AAY30	0.28	BY133	0.35
AAZ13	0.42	BY140	1.40
AAZ15	0.35	BY164	0.75
AAZ17	0.28	BY176	2.80
AY102	3.85	BY179	0.83
BA100	0.24	BY182	1.14
BA102	0.36	BY184	0.44
BA104	0.19	BY189	5.30
BA110	0.80	BY190	4.90
BA111	0.70	BY206	0.26
BA115	0.17	BY238	0.25
BA116	0.56	BYX10	0.30
BA121	0.85	BYX38/600	0.70
BA129	0.45	BYX70/500	0.53
BA145	0.19	ITT44	0.08
BA148	0.19	ITT210	0.63
BA154	0.06	ITT827	0.80
BA155	0.17	MCR101	0.48
BA156	0.12	MR854	1.10
BA157	0.25	OA5	0.88
BA158	0.28	OA10	0.58
BA159	0.40	OA47	0.20
BA164	0.14	OA81	0.19
BA170	0.18	OA90	0.13
BA182	0.27	OA91	0.15
BA201	0.13	OA95	0.20
BA202	0.14	OA200	0.13
BA203	0.14	OA202	0.13
BA216	0.08	OA210	0.89
BA219	0.11	TIL209	0.14
BA243	0.45	TIL211	0.18
BA317	0.06	TV20	2.25
BA318	0.07	IN914	0.06
BAV10	0.10	IN916	0.06
BAV21	0.18	IN4001	0.06
BAW62	0.06	IN4002	0.07
BAX13	0.07	IN4003	0.08
BAX16	0.10	IN4004	0.08
BAX17	0.19	IN4005	0.09
BAY72	0.16	IN4006	0.10
BB104B	0.52	IN4007	0.12
BB105B	0.33	IN5400	0.15
BB105G	0.30	IN5401	0.17
BR100	0.40	IN5402	0.20
BY100	0.35	IS920	0.09
BY103	0.35	IS921	0.11

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	†£1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each
75W stud	7.5-75V	£7.95 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298EO	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DO/P116-P354	all 0.23
E299OH	
/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	0.65
PCL86	1.27
PCL805/85	1.00
PO500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL508	1.85
PL509	3.10
PL519	3.10
PL802	3.25
PY81/P810	0.60

BRIDGES

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

10A and 25A ranges also stocked.

RESISTORS

Mixes of a minimum of 10pcs of any value:

Carbon Film (5%)	Ea	10 of one value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	96p	£1.48	£6.40
½W 10Ω-10MΩ (E24)	3p	25p	96p	£1.48	£6.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£26.90

Wirewound (5%)

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

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

FUSES (all packs of 10)

20mm Time Delay (BEAB)
40mA **£3.68**
50, 63mA **£2.55**
100mA **£1.86**
160, 200, 250mA **£1.44**
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A **all £1.19**

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

LABGEAR (Details of full range on request)
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/OB. 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**

SPECIAL OFFER

AU110 transistor for line output, etc. on portables.
Single piece normally £2.40
But, while stocks last:
1 pc **£2.00** 10 pcs **£15.00**
5 pcs **£9.00** 100 pcs **£120.00**

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
3kV	1.5nF	20p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
8kV	250, 270, 300pF	39p
10kV	1nF	67p
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

P. & P. UK: £0.12 per order. **Overseas:** At cost.
Please add VAT at 15% on all items.
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The Wonderful World of Video

In the present issue we've altered our emphasis somewhat, turning more to the video side of the subject for a change. Our main concern is always with the technical rather than the user side of TV, which is why the amount of space we normally devote to video tends to be limited. After all, once you've covered the basic principles of video tape recording, TV games, and the various types of cameras, all things we've done in some detail in the past, what more is there to say? Developments are covered as they come along, while with VCRs the servicing side consists mainly of routine cleaning and adjustment – and awkward one-off electronic faults. Some of the latter can nevertheless be intriguing, and we intend to publish more on this in later issues.

The fact is however that an interesting point has been reached in the development of domestic video technology. The user is now being offered VCRs and cameras at very reasonable prices; video discs are on the market (in the USA now, in the UK before long); video games are legion, and of growing sophistication; and the data side, teletext and Prestel, looks poised for a take off. The major question remains how consumers will respond to all these goodies?

This column seems to have got itself a reputation as being something of a jeremiad when it comes to video. We've been accused of pouring cold water over VCR prospects, and when it comes to the TV data services we were asked recently why no Churchillian call to action? Well, as a technical journal we feel that our job is to try to attempt a realistic assessment of possibilities rather than to help push particular marketing efforts. And as for Churchillian calls, unless these are made at a time when the country is in extremis they unfortunately tend to be ignored.

The major Japanese TV firms at any rate regard video as being a key element in their future prospects, and as a Sony spokesman recently put it their job is to make their products obsolete. Hence the heavy expenditure by the leading Japanese firms on the development of domestic video technology. Europe's largest electronics firm, Philips, is likewise concerned to assure for itself a strong presence in this field – smaller manufacturers will probably have to content themselves with marketing operations. But however much effort is put into development, there's a limit to what's possible – and to consumers' wish or ability to rise to the bait.

Over the last couple of decades, audio has been a great success story. Many people seem to think that this success story can be repeated with video. There are fundamental differences between the two however. The audio enthusiast is concerned with better quality reproduction. Understandably enough to those of us who remember railway announcement systems at their worst, and single pentode record reproducers with the motor winding doubling as the mains dropper. The point with video on the other hand is to extend the range of uses: the picture remains of the same quality. In fact the video market is rather closer to the home movie market, which though large is not exactly a mass one.

At the present time, VCR manufacturers are not helping themselves by constantly introducing new machines with extra features – and completely new systems. Considerable buyer resistance has been reported to us. Why purchase a current VCR when a similar machine at much the same price will soon be available with still pictures, slow-motion replay, more adaptable time switching and so on? Many prospective buyers are probably at present waiting to see the Philips VR2020 and its derivatives, while possibly keeping a weather eye open on the prospect of LVR machines. Purchasers can hardly be expected to rush for their chequebooks when confronted with such a confusing scene.

When it comes to the video disc however one is rather closer to the world of audio. Simply put it on and watch. It's likely that discs will have a greater appeal to the man in the street than videocassettes, especially as they'll probably be much cheaper. But ... Haven't we all heard those complaints about continual repeats on TV? The fact is that music bears repetition to a far greater extent than visual programme material. It's nevertheless interesting to note the efforts being made by those with competing disc systems to obtain rights to use popular programme material: RCA with its Selectavision video disc system for example has recently signed agreements with Paramount Pictures Corporation and Rank Film Distributors giving it licence rights to 95 feature films for its US disc catalogue. RCA envisage 25-40 million video disc players in use a decade after their introduction.

On the teletext side a boost has been reported with the introduction of cheaper, 22in. models. The price of the chips seems set to fall, and it could well be that in the long run the majority of sets will incorporate teletext. After all, most people now automatically have colour. Why not teletext also, once the price is right?

QUERY CHARGE

We regret the need to increase the charge made for dealing with readers' servicing queries – to 75p (including VAT) from the present issue. The charge has remained at the previous rate since July 1976.

COVER PHOTO

Our cover photo this month was taken by Ian Hirstle and shows Julie Vickerman with an Hitachi GP7 colour camera.

Teletopics

GETTING ON WITH TV4

The IBA seems intent on wasting as little time as possible in setting up the UK's fourth TV network – or channel as most people, including the IBA itself, seem to want to call it. The IBA's engineering plans are to have thirty main high-power transmitting stations installed and ready for the simultaneous launch of the new service in all ITV regions (except the Channel Islands) by November 1982. From the outset, the new service will be available to over 80 per cent of the UK's population – it will be the first new programme service in the history of British television for which the majority of viewers will already have suitable receivers and aerials when the service starts. During 1983-4 a further eighteen main high-power stations will join the network, at the rate of one a month. Priority is being given to coverage of Wales, where 90 per cent of the population should be able to receive the service on "start-up day".

The IBA has already placed substantial contracts with Marconi and Pye TVT for the supply of the klystron transmitters for the 48 high-power main stations. These will operate with the same e.r.p. as existing transmitters, but will have greater conversion efficiency, with more compact power supplies and smaller air-cooling systems, and will come into operation – when in the standby mode – within seconds rather than minutes of a fault developing in a main transmitter.

The IBA is proposing to set up a new company to run the fourth service. The company would have a contract with the IBA to commission and acquire programmes, plan schedules, take on staff and operate within a budget provided by the IBA. It would not itself make programmes or own studios, commissioning programmes instead from existing ITV companies and outside producers. It's estimated that £60-80 millions a year would be required to run the service. The idea would be to raise this from each existing ITV company in the form of a "subscription" which would be calculated on the same basis as the rental already paid to the IBA. In return, each ITV company would have the right to sell advertising air time for both services in its area, also recouping its expenditure by selling programmes to the new company. The extra income thus obtained by the ITV companies is not expected to match the cost of running the new service in the early years. During this time the main ITV network would be subsidising the new one – as part of the price of involvement in the new venture. The Exchequer would also bear a substantial part of any early losses, since a decrease in ITV's profits automatically reduces the levy the ITV companies pay to the Exchequer.

The idea of setting up the proposed company is to establish a "distance" between the IBA and its new charge – as exists at present between the IBA and the current ITV franchise-holding companies. One problem is that for the IBA to be able to keep to its tough schedule for inaugurating the new service it would like to appoint the board of the new company in early 1980, whilst the bill authorising the new service is not expected to receive the Royal Assent until later in the year.

TV RECEIVER CONTROL SYSTEMS

TV receiver control systems still seem to be in a process of rapid evolution. The latest stage, proposed by both Philips and ITT, is to use a microcomputer i.c. as the heart of a set's control system. The approach previously proposed, to use special-purpose LSI i.c.s for the purpose, has the disadvantage that such i.c.s will probably turn out to be rather expensive while if they are to be capable of meeting a wide range of possible customer requirements they will contain a lot of reduntant circuitry. So Philips is developing a series of microcomputer-controlled i.c.s which will form a versatile Video Tuning System (watch out for those initials – VTS). This will operate on similar lines to the DICS (digital channel selection) system we described last April (see page 304, April 1979), but will also control the analogue receiver control functions and can be extended to control teletext and viewdata circuits, on-screen channel/station display and so on. The ITT system uses a microcomputer in the remote control transmitter.

MULLARD'S COLOUREX TUBES

Mullard have invested a further quarter of a million pounds at their Simonstone plant on equipment for reconditioning and rebuilding the colour tubes sold in the Colourex range. The market for reconditioned colour tubes is expected to reach 750,000 this year (1980), and Mullard say that their Colourex tubes are as good as if not better than the originals at only half the price. The range covers 18-26in. sizes at 90° and 22 and 26in. 110° types. According to Mullard, many of the reconditioned tubes at present being sold are not implosion proof. Those, including Mullard's Colourex range, rebuilt to the BSI standard are safe in this respect.

VIDEO

Bang and Olufsen have announced that their first VCR will be of the Philips V2000 type. It's expected to be launched early next year (1981). JVC is entering the pre-recorded videocassette market with a range of fifteen exclusive titles which will sell at £19·95 each (including VAT). They'll be to the VHS format only of course.

ANOTHER EUROPEAN TV SATELLITE?

Following the decision by France and Germany to go ahead with a joint TV satellite programme, Luxembourg is understood to be planning a satellite service of its own. Cost/efficiency studies have apparently already been completed. The service area of the satellite's transmissions would cover from Lyons, France in the south to Hamburg in the north. Programmes would be transmitted in French, German and Dutch.

A SAD STORY

Back in May 1976, at a time when Thorn had just closed its Skelmersdale colour tube plant, we reported on plans to set up a completely new colour tube plant in Finland. The idea was that setmaker Salora would take a 20% interest, Hitachi a 20% interest and provide the technical know-how, with the Finnish government providing the remaining 60% stake. If the Finns could do it we commented, why the UK's colour tube troubles? Well, in the event it seems that the Finnish attempt to get into this field has produced little but trouble so far, which is possibly not too surprising when you consider that world colour tube production in 1978 reached 32·5 million while only 30·1 million colour sets were produced (figures from Mullard's Economic and Market Research Department).

Salora and Hitachi have withdrawn from the company (Valco), which is now wholly state owned. The original aim was to produce 400,000 tubes a year, but by the time production started in the autumn of 1978 the planned production had been halved. When production was temporarily stopped last October, only 85,000 tubes had been produced. The aim for the present year remains at 200,000, with a heavy cut in the workforce. It seems that in addition to excess world capacity the venture suffered from the decision to develop a green field site 160 miles from Helsinki – a decision taken in the hope of dealing with the high level of unemployment in the area.

NEW TV SETS

Decca's latest colour set, Model CV950, uses the new 70 series chassis to drive a 22in. 90° tube. A small UK company, Radicom Ltd., has introduced a tri-standard colour receiver capable of operating on the PAL, SECAM and modified NTSC standards. It will also handle videocassettes recorded using any of these systems. There are 20, 22 and 26in. versions. Radiocom's address is 45 Gladstone Road, Croydon, Surrey, CR0 2BQ.

PUBLICATIONS

Newnes-Butterworths have published a book by Steve Money entitled *"Teletext and Viewdata"*. The price is £5·50 and it's as easy an introduction to the subject as you'll find. Steve of course is a regular contributor to these pages. The latest in a series of occasional engineering publications published by the IBA under the general title IBA Technical Review is *"Techniques for Digital Television"*. This extensively illustrated, 70-page book describes the pioneering work that led to the demonstrations of all-digital studio and transmission techniques by the IBA in 1977, and considers the questions arising from the current search for an international coding standard for digital television. Enquiries should be sent to IBA Engineering Information Service, Crawley Court, Winchester, Hants SO21 2QA. The Libraries and Arts Department of the North Tyneside Metropolitan Borough Council has published a new edition of its *Electronics Projects Index* – covering projects published during 1978 in seventeen magazines. The cost of the index is £1·30, including post and packing. It's available from M. L. Scaife, Central Library, Northumberland Square, North Shields, Tyne and Wear NE30 1QU.

NEW IF STRIP APPROACH

Plessey Semiconductors have developed an interesting new approach to the design of a TV receiver i.f. strip. The circuit, shown in Fig. 1, consists of a couple of i.c.s, an acoustic surface-wave filter to shape the passbands, and a handful of capacitors and resistors. The initial i.c. is an i.f. preamplifier which also provides the tuner a.g.c. voltage – type SL1431 is for use with pnp transistor tuners, type SL1432 for npn transistor tuners. The most interesting bit follows. The SW180 SAWF provides separate vision and sound i.f. outputs which are fed to separate channels within the SL1440 i.f. amplifier/detector i.c. The detectors are of the wideband switching type which require no tuning. The vision channel incorporates an a.g.c. loop, the sound channel being made to hard limit.

COMMERCIAL CORNER

B and B Electronics (Steve Beeching) have introduced an advanced receiver/monitor based on the new Grundig 80 series chassis, which uses the 30AX tube. There's automatic TV/monitor switching by selecting a special AV channel, the signal routing being solid-state. Features include: digitally controlled self-seeking tuning and station memory; remote control of all main functions; automatic selection of external inputs by the channel selector; 15W audio output; continuous station output even in the monitor mode; E to E monitoring on CCTV recorders; isolated chassis; rear input/output connector panel; customer specified connectors to order. All for £495 including VAT. Enquiries to 64 Manners Road, Balderton, Newark, Notts.

Manor Supplies have introduced a new teletext decoder kit based on the latest Mullard teletext i.c.s. There's full colour and infra-red remote control. The price of the complete kit, including case, is £268·70 plus £2·50 p.p. plus 15% VAT.

TRANSMITTER OPENINGS

The following relay stations are now in operation:

Bollington (Cheshire) BBC-1 ch. 21, Granada Television ch. 24, BBC-2 ch. 27. Receiving aerial group A.

Glen Urquhart (Inverness) Grampian Television ch. 41, BBC-2 ch. 44, BBC-1 ch. 51. Receiving aerial group B.

Guiting Power (Gloucestershire) ATV ch. 41, BBC-2 ch. 44, BBC-1 ch. 51. Receiving aerial group B.

Newton Ferrers (Devon) BBC-1 ch. 55, Westward Television ch. 59, BBC-2 ch. 62. Receiving aerial group C/D.

Oakamoor (Staffs) BBC-1 ch. 21, ATV ch. 24, BBC-2 ch. 27. Receiving aerial group A.

Teignmouth (Devon) BBC-1 ch. 39, Westward Television ch. 45, BBC-2 ch. 49. Receiving aerial group E (fourth programme ch. 67).

Threlkeld (Cumbria) BBC-1 ch. 57, Border Television ch. 60, BBC-2 ch. 63. Receiving aerial group C/D.

Ubley (Avon) BBC-1 ch. 21, HTV West ch. 24, BBC-2 ch. 27. Receiving aerial group A.

All the above transmissions are vertically polarised.

The IBA has published the latest (October 1979) issue of its *Pocket Guide to Transmitting Stations*.

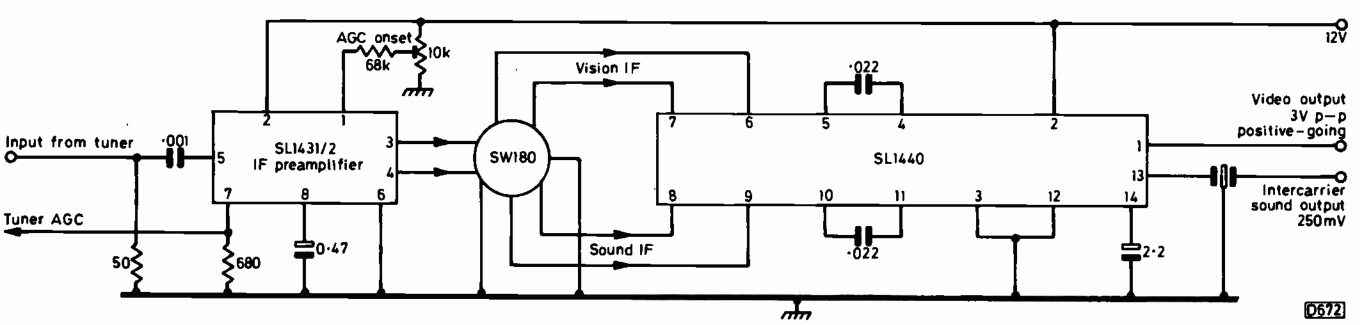


Fig. 1: Plessey's parallel sound and vision i.f. strip – the SW180 SAWF separates the sound and vision signals.

Video Tradex '79

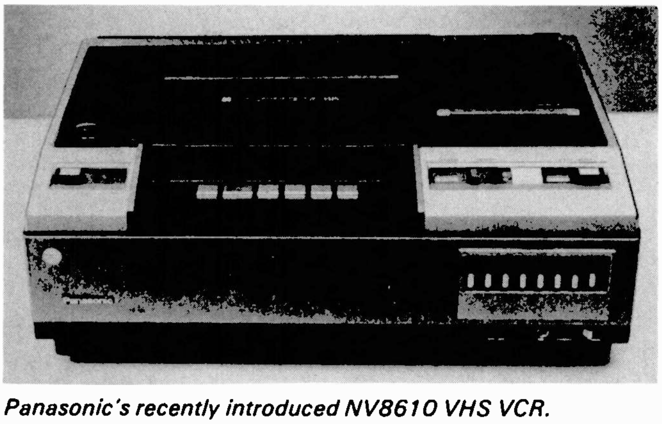
D.K. Matthewson, B.Sc., Ph.D.

FROM small beginnings at the Heathrow Hotel in 1975, this exhibition and conference have grown to beome one of the most important and prestigious video events in Europe. This time it was held at the Wembley Conference Centre, during October 15-18th.

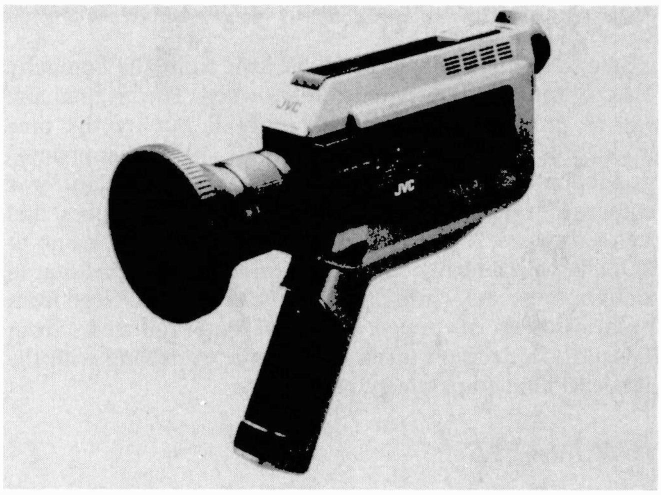
Conference sessions included one on video origination, including tape formats, digital effects etc. and electronic publishing, mainly orientated towards viewdata systems; one on low-cost colour, dealing with timebase correction and processing amplifiers, cheap colour cameras, telecine, slide to tape transfer and similar topics; video distribution, including the second generation problems encountered using both the Betamax and VHS systems, and brief information on various techniques designed to prevent the illicit copying of pre-recorded video cassettes; and information on the new Philips VCC (V2000) system.

The exhibition itself occupied both floors of the exhibition area, and attracted the well known UK, European and Japanese manufacturers you'd expect. Unfortunately BASF did not have on display its much heralded logitudinal video recording (LVR) machine, but the Philips stand had an example of the new VR2020 machine, and also one of the V200 three-tube portable colour cameras. The latter is said to be capable of providing very high quality colour pictures, but it has to be admitted that the demonstration results were not particularly impressive, possibly due to the adverse lighting conditions. The VR2020 did however seem to fulfil all its promises. It's versatile, can be programmed up to several days in advance, and promises very cheap video recording – the estimated cost is about £2·30 per hour. Optional infra-red remote control and a plug-in video input/output module are available for use with it. A player only unit, an editing machine and a portable version are to be introduced at a later date. It should also be noted that a prototype of a machine able to give up to 48 hours' continuous recording or playback, using a ski-cassette changer principle, was demonstrated at the recent Berlin Radio and Television Show.

A feature of this year's exhibition was the large number of stands where pre-recorded videotapes were being sold and displayed. The subjects ranged from adult movies to family entertainment such as popular films of the Mary Poppins, The Guns of Navarone etc. type. Several large firms, for example EMI and The Mirror newspaper group,



Panasonic's recently introduced NV8610 VHS VCR.



JVC's new GX77 single-tube colour camera.

now have interests in this field and are investing considerable amounts of capital.

An interesting development in this area is the trend away from outright purchase of feature film on video cassette to cassette rental at more reasonable prices. A typical two-day rental charge for a three-hour feature film is some £5-6, while the purchase price for the cassette would be £39-45 depending on the tape format.

Another prominant feature of the exhibition was the very large increase in the number of domestic VCRs on display. Most of these were of the VHS type, though there were quite a lot of Betamax ones as well.

Hitachi were showing a prototype of what is claimed to be the world's lightest portable VHS machine. It was running on the US NTSC colour system, but a PAL version is expected later this year. It performed as well as any other portable VHS VCR I've come across, and was indeed light and easy to use. An interesting point is that touch-sensitive buttons are used instead of the usual piano-key type switches. Hitachi hope it will turn out to be the cheapest as well as the lightest machine of its type.

Panasonic were also showing a portable VHS machine, as well as their latest mains-operated VCR, the NV8610, which allows the user to freeze any one frame of picture information and also to advance the frames at a very slow rate.

JVC was the first company to introduce a portable VHS machine in the UK – the HR4100, in May 1979. Their range of mains-operated machines has been extended with the HR3660. This incorporates all the features of the recently launched HR3330, such as audio dubbing, eight-day digital clock/timer for unattended recording, easy operation and a three-hour playing time, and in addition has slow-motion playback, enabling the user to study details of motion at the touch of a button. This is the first VHS machine to feature slow motion, and in addition the slow-motion speed can be varied by the user. For even closer detail, a freeze frame facility is included. The HR3660 also features double-speed playback, enabling irrelevant material to be speeded up and particular items on the tape to be quickly located. A voice compression effect ensures that the speech remains intelligible in the doble-speed mode. Finally, a six-function remote control unit is available for use with this machine.

The various Japanese companies exhibited a large number of essentially domestic portable colour cameras. JVC in fact now have six colour cameras in their range, with prices running from £450 upwards. The GX33 and GX77 are aimed at the Super-8 market, and although they

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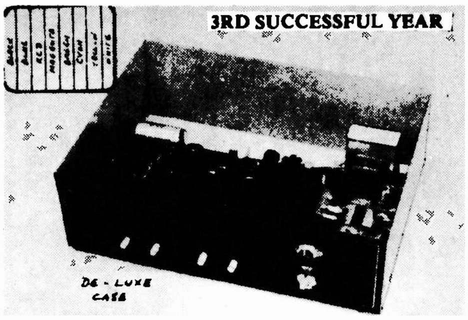

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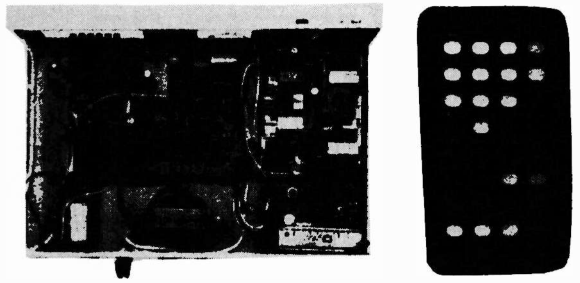

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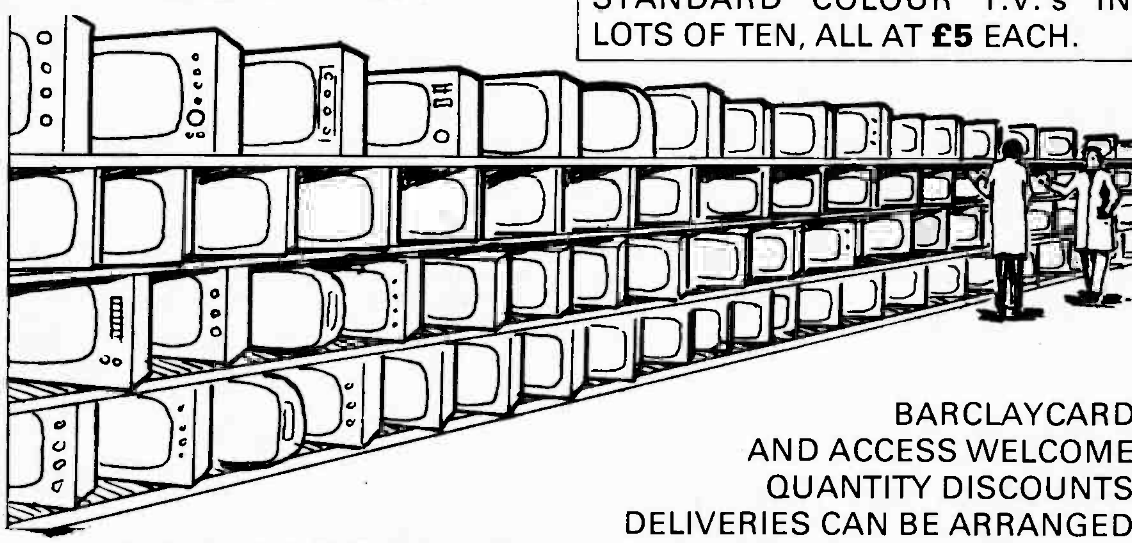

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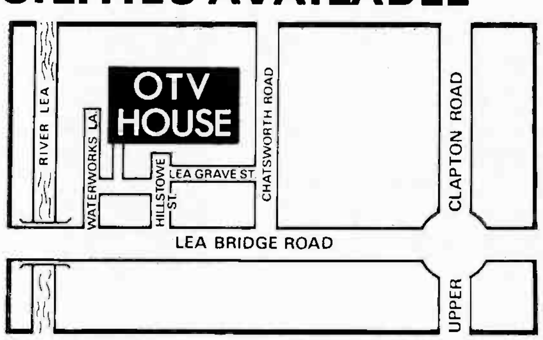

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are rather basic they incorporate all the features most domestic users would require. Both use a ⅔in. stripe-filter vidicon tube, and have a built-in microphone, auto or manual iris control and optical viewfinders. The GX77 is the more sophisticated of the two, having an auto white balance control, electric/manual zoom lens and various LEDs to indicate white balance, exposure, battery life and VTR record mode. The JVC range includes a very basic monochrome camera, the GS1000, which will be available for around £200.

In all this was the most impressive Video Tradex Exhibition so far. It emphasized the need for an annual show at least to keep the trade and the industrial user up-to-date with developments.

Letters

SECAM COLOUR

I was interested to see the article on the SECAM colour system in your October issue, as there's not much information on it available in English. In general the article provided a clear and easy to follow account of the principle features of the system, which was first introduced in France and subsequently adopted by many other countries, particularly in Eastern Europe, various Arab countries, and many former French overseas possessions. One important point was not fully covered however – the technique used to synchronise the switch that separates the modulated red and blue subcarriers (not the same as the PAL U and V signals incidentally).

The original system used did indeed function by reference to the "bottles" of unmodulated subcarrier transmitted during the active line time of lines 7-15 and 320-328 inclusive. All sets manufactured during the last few years ignore these signals however, operating instead by reference to the unmodulated blue and red subcarriers transmitted alternately during the back porches of the line sync waveform – just like the colour burst used in the PAL and NTSC systems. In fact the SECAM transmissions in several countries that have recently adopted the system omit the "bottle" reference signals, and it's the official policy in all the other countries still transmitting them to discontinue this as soon as possible.

As Keith Cummins mentions, this is to eliminate the transmission of redundant sync information during the field blanking interval, so that more useful signals such as those for the Antiope teletext service can be transmitted instead. Incidentally, just as with the UK teletext system the Antiope system has been modified in various ways since the description of it appeared in the November-December 1975 issue (No. 40) of the French magazine *Radiodiffusion-Télévision* (pages 18-23). The current transmissions, broadcast with the Antenne-2 programme service, can be decoded satisfactorily using equipment intended for the original version.

Alan F. Reekie,
Brussels, Belgium.

P.S. Long-distance television enthusiasts may be interested to know that a comprehensive list of channels and addresses of the numerous Italian local radio and TV stations was published recently by the magazine *Millecanali*, Piazza Boromeo 10, I-20133 Milano. The list is entitled *Guida Radio-TV*, and the price is 2500 lire.

MINI CRT REACTIVATOR

I view with some misgivings Mr. Wood's c.r.t. reactivator (see *Letters*, October 1979). What happens if one of the $4{\cdot}7\mu$F dropper capacitors goes short-circuit? It's doubtful whether the 2A fuse could operate fast enough in all conditions, so the heaters could be blown open-circuit. Also, the inrush current which can flow if the mains supply is switched on at the peak of the a.c. cycle might not be too good for spot welds etc. in the tube's heater system. The situation is worse with a colour tube, since there are three capacitors in parallel, thus trebling the risk. It doesn't matter how reliable the capacitors are: there's always the chance of failure, however remote, so I question the wisdom of placing a customer's colour tube at risk in this way. I'd sooner carry the weight of a transformer than the weight of worry associated with the use of capacitive droppers.

Keith Cummins,
Southampton.

LOW-LEVEL HUM

I was interested to see the reply in *Your Problems Solved* to the query regarding low-level hum on a Sony Model KV1340UB. There's an official modification for this problem on sets below serial number 012001 – to fit an audio output transformer shield plate, part number 4-316-261-01, underneath the transformer's plastic mounting bracket. Change the bracket's mounting screw to a self-tapping BV3X10 type. Later sets incorporate this modification.

S. A. Storie,
Minehead, Somerset.

N1700 VIDEO OUTPUT

Several readers have queried the voltage readings given on the N1700 video output circuit (page 23, November issue), in particular since Tr2 would be reverse biased. The voltages have been checked on one of the converted machines therefore, using an Avo Model 8, and the following corrections should be noted. Tr1's collector voltage should have been shown as 11V instead of 9·6V: its emitter voltage is 3V and its base voltage 3·8V. Tr3's base voltage is 5·5V: its collector voltage varies depending on whether or not its emitter is terminated at 75Ω – it's 8V with signal and a 75Ω load, 12V with no signal and no load. I've had several of these boards working successfully, with the circuit as published, for over six months now.

D. K. Matthewson, B.Sc., Ph.D.,
Huddersfield, Yorkshire.

SNOWY PICTURE

The problem I had with an Indesit Model T24EGB was a snowy picture. The obvious course was to fit a new r.f. amplifier transistor in the u.h.f. tuner. I tried a couple of AF239s, which improved matters for a few days each time, and then obtained the correct replacement. This gave an improvement for about ten days, after which the trouble was back again. Remembering some trouble I'd had with older sets quite a time back, I next tried replacing the AF139 mixer-oscillator transistor. That was several months ago, and seems to have finally cured the problem.

S. J. Morris,
Stoke-on-Trent, Staffs.

There's a Moose Loose

Les Lawry-Johns

HOW I got the name confused I don't know. She phoned to say that her Bush had lost its sound and picture. She also seemed to know us well, which was a mystery to me as I couldn't recall her or the set. She said her name was Loose, which I took to be the surname, and when I sounded vague she gave the other name, which was Pretty. So I wrote down Pretty Loose.

In fact it turned out to be Lucy Pretty, but I couldn't be expected to know that at the time. When I got there it all became clear, because I'd known Lucy from way back. But she'd married again, and now had the name Pretty and a TV which we didn't know.

The set turned out to be a Bush model fitted with the Z179 chassis. This is one I've yet to get on really familiar terms with. There was a raster on the screen, but precious little else. With the rear cover off we pondered upon the possibilities. With the voltage supplies intact but no sound or vision signals, it seemed likely that the fault would be in the i.f. strip. This is a plug-in panel on the left side main frame, which can be withdrawn when the bottom runner is pulled round.

The TBA750 intercarrier sound i.c. is at the top, and using a finger as a test probe we found plenty of life at the input to this, with some fellow talking to me in a language I didn't understand. This i.c. is fed from the SC9503P video detector i.c., and the fellow chatted away when we touched its output but had nothing to say at the input. So it seemed likely that this i.c. could be the culprit. Did we have one? No, but we did have an MC1330P which does the same job. Take out the i.f. unit, whip off the little chip with a wave of the desoldering braid, and plonk in the MC1330P with eight deft dobs. Slide the i.f. unit back in and check. Now it talks in my own language and there's a picture.

Now there's a bit of luck we thought, viewing the rest of the chassis with some trepidation.

"Done it already?" cooed Mrs. Pretty. "It must be a much easier set than the one we had years ago that you took so long to get right. You must remember. The Philips with the big flat screen."

I remembered. Well. As a matter of fact, I still have the projection unit, slightly rusted, to remind me.

Mind you, Lucy was a cracker in those days. Still quite nice, albeit a little weather beaten you might say. Who isn't?

With a short exchange of pleasantries I prepared to leave, but at the moment of departure Mrs. Pretty remembered that her neighbour had asked her if her man would pop in to have a look at their set?

"Would you pop next door to look at Mrs. Moose before you go? Their set is playing about."

A Visit to Mrs. Moose

So that is how I came to be ringing the bell next door. A pleasant woman opened the door, and I heard a voice call from inside the house "who is it?"

"It's the telly man dear."

"The tally man? Oh my Gawd." There was a sound of someone beating a rapid retreat.

"Not the tally man, the television man, stupid. Come back." I never did find out why Mr. Moose didn't want to meet the tally man.

The set was a Thorn 3000 which couldn't be tuned. The push bar and spring from the tuner were at the bottom of the cabinet. It didn't take long to reassemble it and solder up.

The programme could then be tuned in, but apart from a few faint bars the colour was absent. This responded to a tweek of L302 (reference oscillator output coil) and the colour apeared to be fine through a mirror – until the snooker table came on that is.

It was red. I thought snooker tables were all green, except when they are blue. Then I noticed the player's face. He didn't look at all well. Someone's changed over the tube leads I mused quietly to myself. They hadn't, and for the life of me I couldn't think of a reason for this reversal. As I crouched behind the set, crying my heart out so that the bitter tears hissed on to the hot dropper at the rear of the power board, I heard Mrs. Moose mumbling something about lovely colour.

I looked up and the table was green, with faces a nice bright orange. It transpired that the normal sequence of events was that the picture would come on with no colour, then some bars would appear for about five minutes, then the colour would come on with reversed reds and greens, and then all would be well. What I'd done was to tune in the reference oscillator so that the colour would be there from switch on, but the reversal remained, for a few minutes only, after which normal service would resume.

"We only wanted you to get the tuning right. The colour doesn't worry us. We thought it was supposed to be like that until it warmed up. I hope the bill is not going to be too much, only my husband is a little short this week so we can afford only bare essentials."

Which is why I didn't find out what really was happening, and I still don't know. I've seen plenty of out-of-phase conditions which usually respond to adjustment, but not a complete reversal that rectifies itself so suddenly (which shows just how ignorant I am).

Returning to the pad, footsore and weary, I was greeted with the usual smarty pants remark.

"Where have you been? Playing fast and loose no doubt."

"Fast and moose you mean," and I related the sorry tale to the disbelief of her highness who flounced off upstairs and shortly began to sing her bitter song of hatred and resentment.

"I'm a little prarie flower
Growing wilder by the hour.
No one cares to cultivate me,
So I'm as wild as wild can be."

I could tell she was a bit mad by the way she banged things about. I don't know why, but then I never could understand the wonderful workings of a woman's mind. It's a good job we are so logical and placid, so understanding and reasonable. No one can accuse us of doing unreasonable things, even when we are faced with insurmountable obstacles and impossible tasks (as we are every day, as you know only too well). I sometimes feel we are not given the credit that is our just due.

Trouble rarely comes singly. If you get one horror there's bound to be another close behind.

A Brace of Bushes

I was just finishing off a Pye 697 which had had just about everything wrong with it, including an open-circuit reservoir electrolytic, an open-circuit 10MΩ resistor in the width circuit, an open-circuit 12kΩ red output pentode load resistor, open-circuit print to the blue ditto, open-circuit line sync discriminator diodes due to the 47kΩ reference pulse feed/integrating resistor going low before disintegrating, plus a few less trying teasers, when a couple popped in to ask if they could bring in their 22in. Bush colour set which had popped off. I said they could, so off they went to get it.

In the tussle with the Pye the enthralled owner had been watching each and every move. He'd come from way out of town, and was quite happy to wait for it. For my part I don't mind people watching me suffer provided it's a set I know. If it's a set I don't know, I don't like it at all as I wallow around trying to find where to start, conscious of the pitying glances.

"Wouldn't be so bad if he knew his job, would it?"

For the Pyes and the Philips etc. we don't mind an audience, provided they applaud every time we pull a rabbit out of the hat, and gasp with sheer admiration at the wonderful works taking place under their very eyes.

So off went the owner of the Pye, back to the back woods from whence he came. And in came the Bush.

"Our son had someone in to look at it while we were away, but as the chappie said it was going to cost quite a bit to repair he left it until we came back. So we thought we'd see what you had to say about it."

Fortunately is wasn't one of those Z179 ones, but one of the more familiar A823 type. The h.t. line fuse at the top of the power panel was a nasty black colour, denoting that it had died a violent death, probably due to something over on the line output side. We checked the resistance to chassis. The needle flicked over and climbed back towards infinity.

What devil's work was this? Infinity meant no circuit through the smoothing resistors etc. Both the 68Ω and 56Ω wire-wounds in the h.t. circuit were open-circuit (see Fig. 1). Killed no doubt by someone bunging in a heavy fuse or some other blunt instrument. Check at the other end of the 56Ω resistor. Still no reading, except for a faint suspicion of a movement. Look over to the scan panel. All three plugs out.

Put them back in and now record the low resistance reading expected. So we pronounced our verdict.

"This is a clear cut case of the Howling Heebie Jeebies. It's never an easy thing to cure, and it'll have to stay overnight."

Left alone it didn't take us long to establish that the line output transistors were short-circuit. So some patience and a fair bit of time were going to be needed, as replacing these in this set is not our favourite occupation.

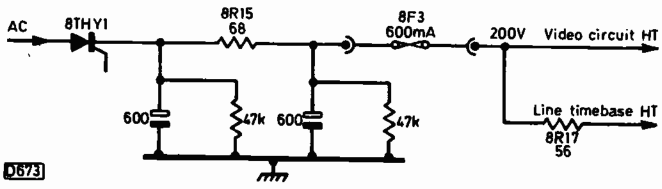


Fig. 1: H.T. feed circuit, Rank A823 chassis. The h.t. fuse 8F3 and the two resistors 8R15 (smoothing) and 8R17 (anti-breathing) were all open-circuit.

I'd just removed the right side assembly from the main frame when a mini drew up outside. Incredibly, there was a 26in. colour set strapped on top of it, giving the little car a decidely top heavy apperance. How it had stayed put I just don't know.

"Hallo" said Mr. Sparks. "It wouldn't go inside. Could you give me a hand to lift it off?"

The spindly luggage rack groaned as we unstrapped the set, and I'm sure the little car rose a foot when we lifted the big Bush free.

"One thing's for sure Mr. Sparks. It won't go back home like that. I'll deliver it for you."

"Don't worry" said the indomitable Mr. Sparks. "I had one arm out of the window supporting it when we went round corners."

So now we had two.

Back at the bench we wrestled with the first one. In went the transistors, back went the tripler (leaving the input out, just in case this was the original cause of the trouble) and the unit was reassembled. Both the wire-wound resistors were replaced and all seemed ready. We wound down the "set H.T." control and connected a meter switched to the 1A range in place of the h.t. fuse.

On switching the set on, the meter hardly moved. This was not encouraging, so we put a 630mA fuse in and checked the h.t. voltage. It was under 200V, and this was also present at the line output unit.

We next checked the line driver transistor and found it had no 20V supply. Back to the power unit, where the 6·8Ω resistor (8R2) was found to be open-circuit. In went another resistor and the timebase now started working.

We next had to check the tripler, so out came the h.t. fuse and the meter was again connected in its place. It read under 400mA, so the tripler was reconnected and the e.h.t. rustled up nicely and the meter showed only a small increase. Back went the fuse and all was well.

There were a few questions for which there seemed no answers. If the 6.8Ω resistor supplying the 20V line went first, the line timebase would have been inoperative, drawing no current. Could the line output transistors short under these conditions – h.t. high maybe? How come the two h.t. wire-wound resistors were both open-circuit if the correct fuse was fitted? Why were the plugs left out on the scan panel? Could it be that the two black ones had been interchanged by the first intrepid explorer? The answers to these and many other questions will not be revealed in the next instalment.

Mr. Sparks' Bush

Up on the bench Mr. Sparks' Bush was coaxed into giving up it's secrets. You'll never guess, but the 600mA h.t. was blown. Oh no, not again. Please not again.

I raised the convergence panel to check the condition of the front smoothing resistors, and was immediately confronted with a nice big hole where 7RV3 (7Ω R/G horizontal tilt control) had been. The remains of 7RV3 were found laying at the bottom of the cabinet.

Did it die or was it killed? Hope it died, but proceed as though it has been killed. Fit a new control of a more robust type. Check for shorts at the fuse holder and at the h.t. resistors, which both seemed intact. Connect the meter across the fuse holder and switch on. Two amps. Switch off quick.

Disconnect the input to the tripler. Switch on. Now 400mA. Fit another tripler and 630mA fuse. Check h.t. and reduce to 200V. Tidy up convergence and prepare report for Mr. Sparks.

Domestic Video Cameras

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

THE last few years have seen the price of the small CCTV colour camera drop by a factor of about ten. It's good to know that in these days of seventeen per cent inflation something has actually become cheaper! You can in fact now buy quite a respectable two-tube colour camera for about £600, while a similar monochrome one will cost you around £120-200.

The major factor involved in this fall in prices seems to be a distinct shift in the market at which the video manufacturers are aiming. It's moved from the near broadcast/industrial user to the domestic "home movie" type buyer. To interest this type of customer, the price of a colour camera must be reduced to much the same as or slightly less than the price of a domestic VCR. A complete, portable colour outfit, VCR plus camera, will set you back about £1,400-1,700 depending on the facilities you want. At these prices domestic video is not quite an economic alternative to Super-8 film – at least not yet! A cheaper alternative is to use a monochrome camera, bringing the cost of the VCR plus camera combination down to around £1,100.

Let's consider the basic pros and cons of domestic cameras, and the various facilities offered. We'll then take a more detailed look at a couple of representative examples – a JVC monochrome camera and a Hitachi colour one.

Basic Facilities

Most domestic cameras, whether colour or monochrome, are similar in appearance and offer the same basic facilities. The simplest ones have a fixed focus lens and an optical viewfinder for composing the picture. The viewfinder is usually a sort of telescopic device. The more sophisticated cameras have zoom lenses, electronic viewfinders and, on the most recent models, electronic lens iris controls. The advantage of a zoom lens is that the camera shot can be changed from a telephoto close-up to a wide-angle shot without having to move the camera position or change lenses. An electronic viewfinder not only ensures that all the shots are correctly framed, it also acts as an instant replay monitor for playing back tapes from the portable VCR.

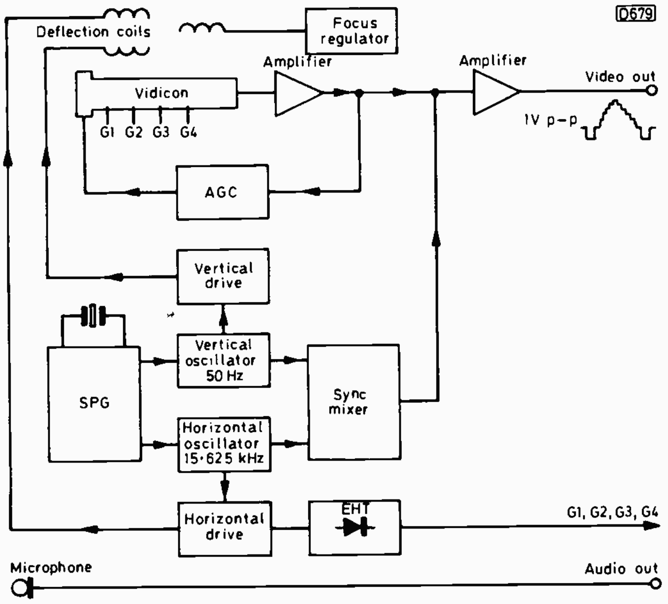


Fig. 1: Block diagram of the JVC GS1000 monochrome camera.

All domestic cameras incorporate a microphone so that the sound is recorded along with the vision. The most common location for the microphone is at the front of the camera, above the lens. It can often pick up the noise of the lens being operated therefore, so it's better to use an auxiliary microphone plugged directly into the VCR. This also enables a directional microphone to be used, giving better quality sound with less background noise.

Most of the cameras are designed to run off a 12V d.c. supply. This is often supplied by the portable VCR with which the camera is being used. Alternatively, some cameras can be run off a separate power supply, or even from self-contained batteries.

Many domestic cameras can be run from portable VCRs, in which case a single 10- or 12-way multicore cable is used to link the two. As well as supplying power, this cable also carries the microphone signals, auto VCR start, camera video out, replay video in, low battery indicator signals etc. Some of the more sophisticated cameras derive their sync signals from the VCR, and these are also fed via the multicore cable. The more basic cameras rely on a built-in sync pulse generator and are not intended for use in multi-camera set-ups.

If the camera is to be used with a mains-operated VCR, or as a surveillance camera, it can be run off a mains adaptor, supplying a standard 1V into 75Ω composite video signal.

One final general point. Although most cameras are designed to give a video output a few, notably from the Philips group, are designed to give a modulated u.h.f. sound and vision signal which can be fed straight into an N1700 or similar machine. The monochrome V100 and colour V200 cameras are of this type. I think it's fair to say that this type of signal processing does not give as high quality a picture as with a direct video output.

Having discussed the facilities one would find on most domestic cameras, let's next consider how both monchrome and colour cameras function. A block diagram of a typical inexpensive (around £200) monochrome camera intended for the domestic market is shown in Fig. 1.

The JVC GS1000 Camera

As an example of this type of camera, JVC recently introduced the GS1000 – a portable battery-operated camera along the lines of a Super-8 film camera. It's designed for use with a suitable portable VHS machine or, with its mains unit, any VTR or monitor. With the addition of a u.h.f. modulator, the output could be fed straight into a TV set. I recently had the opportunity to borrow one of these cameras so that I could examine it in more detail, and must say that for a camera selling at a recommended retail price of around £200 including VAT I was quite impressed.

The resemblance to a Super-8 camera is more than superficial. The camera weighs slightly over 1kg and fits well in one's hand. It has a reflex optical viewfinder, which works through the ×2 zoom lens. The lens runs from 16 to 32mm, has a minimum aperture of f2·5 but is of the fixed focus type. In practice this means that one has to be about 1·5m away from the subject to get a clear picture.

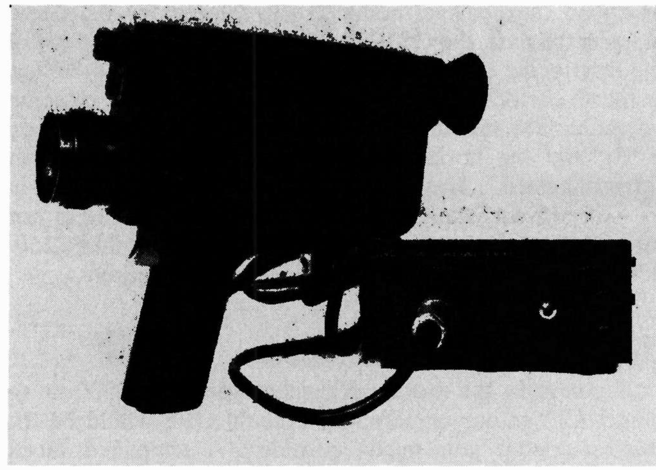
There are three aperture stops, f2·5, 5·6 and 11, which coupled with the a.g.c. system ensure correctly exposed pictures under most lighting conditions – even with a 100W bulb, acceptable scenes were obtained. The minimum practical illumination level is about 50 lux, and the manufacturers state that the a.g.c. will cope with light levels up to 100,000 lux – needless to say, I couldn't check this upper limit. Suffice it to say that under most conditions the a.g.c. worked well. As with all cameras of this type however, it could be fooled by one bright spot, i.e. a light, in the scene.

To avoid burn-in problems with the $\frac{2}{3}$in. vidicon tube, a metal shutter is provided. This can either be locked open, for use with a mains VCR etc., or be opened when the camera trigger is pressed. The latter action also sets a suitable battery-operated portable VCR in the record mode. The trigger is non-locking, and has to be continuously squeezed to keep recording. A red LED in the viewfinder comes on to remind you that you're recording.

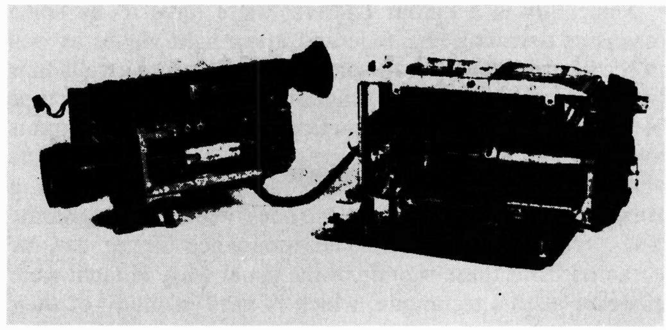
I didn't have a suitable VHS machine to hand, so pressed an older Sanyo VCR into service. With this the GS1000 gave monochrome pictures that most domestic users would find acceptable.

Electronically, the camera is one of the smallest and neatest I've come across. All the electronics are housed in the camera head, on two main PCBs. Referring to Fig. 1, a crystal-controlled sync pulse generator provides the line and field frequency pulses which all TV cameras require. A 2:1 interlaced 625-line 50Hz output of 1V into 75Ω appears at the output connector. Using a similar arrangement to that employed in TV receiver e.h.t. systems, the 12V d.c. supply from the battery (or a.c. adaptor) is multiplied up to the several hundred volts required by the light-sensitive vidicon pick-up tube. The a.g.c. or automatic sensitivity control works by sampling the output from the video preamplifier, using a type of negative feedback to reduce the tube's sensitivity if its output rises above a preset level. This, along with the iris diaphragm, ensures that correctly exposed pictures are always produced. It's interesting to note that on some of the more sophisticated cameras, and also on some that employ a special (silicon-diode) type of vidicon to which this type of a.g.c. cannot be applied, electrically operated irises are being introduced: these alter the iris setting in response to the output from the tube.

The very small signal provided by the tube is amplified, mixed with the line and field sync pulses, and then fed to the output amplifier. On cameras using an electronic viewfinder, a portion of the signal is tapped off and used to drive the viewfinder.



The JVC GS1000 monochrome camera with its mains adaptor.



All is revealed! The JVC GS1000 (left) and the Hitachi GP5 (right) shown alongside with the side covers removed.

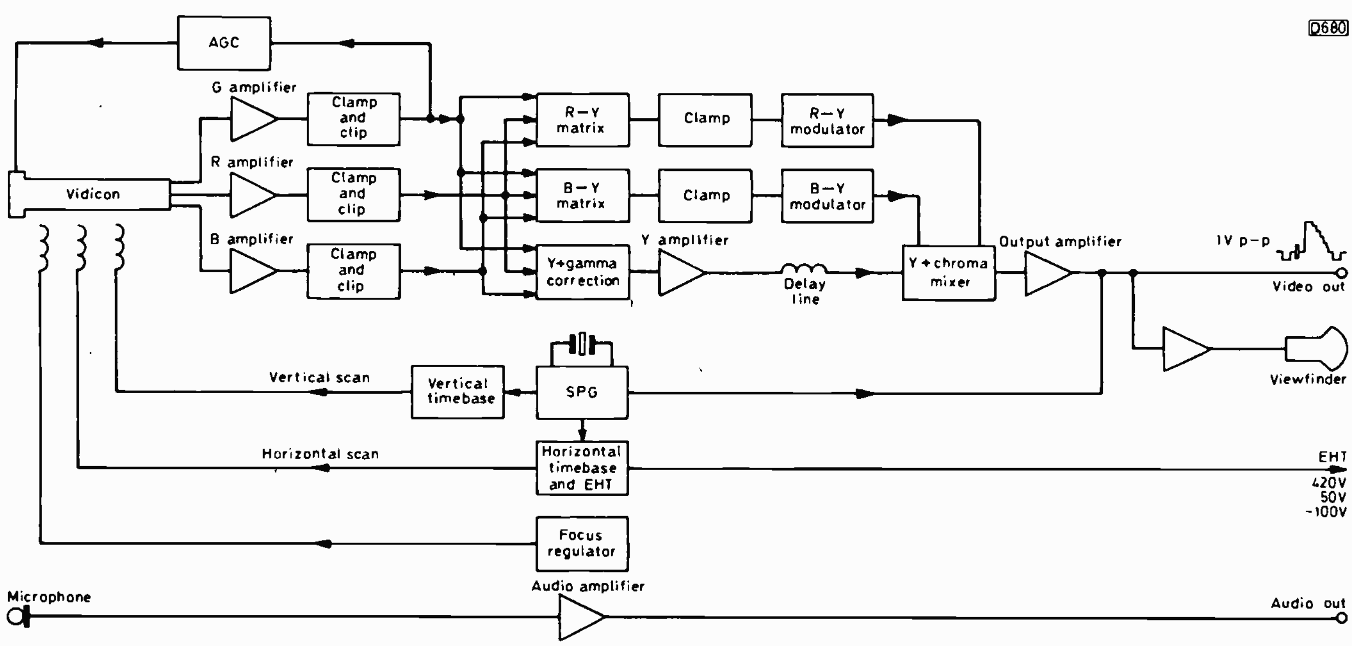


Fig. 2: Block diagram of the Hitachi GP5 single-tube colour camera.

As an inexpensive monochrome camera for the home video enthusiast, the GS1000 has a lot to recommend it, not the least being the ease of operation. Its main disadvantage is the fixed focus lens, which limits the camera's close-up potential. The measured signal-to-noise ratio was 39dB on video, and the horizontal resolution around 420 lines at screen centre. The sound output from the built-in microphone was adequate, though not hi-fi! Whether or not most domestic users would prefer to spend another £250-300 to buy a colour camera is another matter entirely...

The Hitachi GP5 Colour Camera

If you're in the market for an inexpensive (£500 or so plus VAT) colour camera, the Hitachi GP5 would be the sort of model you might consider. A simplified block diagram is shown in Fig. 2, and the similarity with Fig. 1 is apparent.

Since this is a colour camera, there have to be some means of detecting red, blue and green light values as well as the luminance value. In some colour cameras a vidicon is provided for each of these functions, but in the cheaper type of camera a single tube is employed. The technique used is to interpose between the tube's glass faceplate and the photoconductive layer a tri-colour striped filter and a corresponding set of strip electrodes which feed separate pins with RGB outputs. The luminance signal can be obtained from these signals in the usual way. Hitachi were pioneers in this technique, which is used in many of their cameras.

The GP5 is available in either the basic version, with a fixed focal length lens and optical viewfinder, or in a de luxe version with a x6 f2 zoom lens and an electronic viewfinder. The camera is inevitably somewhat larger than the GS1000, and weighs slightly over 2kg. It's very easy to operate, having only three controls besides the normal lens ones (iris, focus and zoom). These are a trigger for remote start of a battery-operated VCR (from which the camera can be powered) and two potentiometers, one for picture contrast and the other to adjust for various lighting conditions. The latter in effect alters the colour temperature by adjusting the ratio of the red to blue outputs from the respective preamplifiers. The green gain control is a factory preset. This arrangement enables the camera to be used in daylight or artificial lighting without the need for external filters. Those of you familiar with 35mm. colour film work will appreciate the problems involved. As with the GS1000, the camera comes with a mains adaptor so that it can be used with any VTR or straight into a TV monitor.

A useful indicator is a LED which shows when there's not enough light on the subject to get a respectable picture. Another LED, in the electronic viewfinder, shows when the VTR is in the record mode. Following normal practice, a microphone is built into the front of the camera. It gives reasonable quality sound, but can be cut out by using an external microphone, giving superior results.

And that's really all there is to operating a GP5!

Electronically the GP5 is again similar to the GS1000, but with all the additional circuitry required for colour operation. The a.g.c. system enables usable pictures to be obtained at light levels from 200 to 100,000 lux. In practice around 2,000 lux is required to give good quality colour pictures. When I say good quality, I mean it: although a domestic camera, the GP5 gives pictures that when shown on a studio monitor are better than those many viewers watch every night at home! My only complaint is that it won't handle fully saturated reds, rendering them as more of a pink. But for the price...

There are four main PCBs – video, sync pulse generator, regulator and filter. The video board amplifies the red, blue and green signals from the tube, clamps and clips them and then performs matrixing operations to get the required R – Y, B – Y and Y signals. The Y signal is gamma corrected, then all three signals are fed to the SPG board. Here the Y signal is fed to a delay line while the colour-difference signals are modulated on to a 4·43MHz subcarrier. The whole lot are then added together, along with the syncs, giving a PAL compatible composite colour video output. The sync pulse generator itself is a single crystal-controlled i.c. which also provides all the pulses required for PAL colour operation.

The regulator PCB contains a 9V regulator, the focus current circuit, microphone amplifier and deflection circuits. The filter PCB provides stable voltages to operate the tube.

That sums up the basic principles of the GP5 colour camera. Most domestic colour cameras follow similar lines.

To be honest, when I first saw a GP5 about two years ago I expected very Mickey Mouse pictures. Having used several GP5s for some eighteen months now however I'd say that if you want a simple domestic or basic industrial camera you'd be hard pushed to get better value for money. Having said that however I should add that this is a fast-moving field, and by the time you read these words in January 1980 the GP5 is due to be replaced by the cheaper, smaller and simpler GP4. This will use a ⅔in. instead of a 1in. vidicon tube, and will be available in both basic and de luxe forms.

Table 1: Typical domestic video cameras.

Manufacturer	*Model*	*Colour or mono*	*Tube(s)*	*Approx. price including VAT.*
Akai	VC300	Mono	17mm.	£294
Elbex	EX803	Mono	17mm.	£207
Ferguson	3V04	Mono	17mm.	£213
Ferguson	3V06	Colour	25mm.	£863
GBC	Mk15	Mono	17mm.	£316
Grundig	FAC1800	Colour	17mm.	£800
Hitachi	GP5	Colour	25mm.	£750
Hitachi	VKC500	Colour	25mm.	£760
JVC	GC3300	Colour	2 × 17mm.	–
JVC	GC4100	Colour	2 × 17mm.	£995
JVC	G31	Colour	25mm.	£633
JVC	GX33	Colour	17mm.	–
JVC	G71	Colour	25mm.	£863
JVC	GX77	Colour	17mm.	–
JVC	GS1000	Mono	17mm.	£213
Panasonic	WV460	Mono	17mm.	–
Panasonic	WV3310	Colour	25mm.	£613
Panasonic	WV3300	Colour	25mm.	£840
Philips	V100	Mono	17mm.	£460
Philips	V200	Colour	3 × 17mm.	–
Sanyo	VC1400	Mono	17mm.	–
Sony	DXC1610	Colour	25mm.	£2,990
Sony	AVC1420	Mono	17mm.	£216

Choice of Cameras

To give you some idea of the range and choice of domestic type cameras, Table 1 summarises most of those currently available.

Acknowledgements

My thanks to Ian Hirstle for photographs and to JVC, Hitachi and Panasonic for various information. ■

Colour Receiver Options

3: Adding teletext & remote control

Luke Theodossiou

THIS month we're describing our ultimate option for the colour receiver project – adding teletext with remote control. With this option, constructors will end up with a high quality set offering much the same facilities as up-market commercial receivers but with the added bonus of a price advantage.

We have been asked by a number of readers who are contemplating starting the project whether it would be cheaper than going out and buying a set. Unfortunately, when buying components in one-off quantities you are bound to pay a penalty which makes competing with the setmakers impossible. On the other hand though, the selling price of the luxury type of receiver is not in exact proportion to the cost of the extra components used to provide these luxury functions – so we can justify the project from a financial point of view provided you build in the up-market options.

A straight comparison between the constructor and the setmaker is inaccurate of course and downright unfair: for instance we haven't taken into account the large number of hours you have spent slaving over a hot iron . . . but then we hope this is compensated for in part by being able to claim you built the set yourself!

The remote control receiver circuit is identical to that used in our previous option. The only difference is that we've decided to have the preamplifier section built on a separate small p.c.b. which can then be screened. The main reason for this is that the effective range of operation (i.e the maximum distance between the transmitter and the receiver) can be severely reduced if the preamplifier is allowed to pick up any stray signals such as hum or line pulses. If you experience this problem with the remote-control-only option, you can cure it by screening the preamplifier section – preferably on both sides of the board. Due to the extra complexity of this board, which made a double-sided design unavoidable, we felt that a separate small board would be far easier to screen.

The circuit diagram for the preamplifier is shown in Fig. 1. For a description, refer back to the November issue. Fig. 3 shows the printed board pattern, while Fig. 4 is the component location diagram. The transducer is glued to the board using an epoxy adhesive. The idea is that the complete unit will be screened in a tin "matchbox" with a window cut out for the transducer. The assembly is then fixed to a convenient place behind the front cabinet panel, with a hole cut out for the transducer. The connections to the interface board can be made with "stereo" type audio screened cable. Don't forget to make sure the tin screen is earthed to the cable braid.

The complete circuit of the interface board is shown in Fig. 4. As we pointed out earlier, the circuitry around the remote control receiver i.c. (IC1, SAA1130) is identical to that described in the November issue.

The differences start at the programme outputs – pins 13, 14, 6 and 7. After the level-changing resistors, the signal follows two paths. The first goes to IC2 which is a quad D-latch, type 4042, and from there to the 1-of-10 decoder (IC3), type 4028. This in turn drives each of the tuning potentiometers via the relevant switching transistor when the appropriate channel is selected.

The latch is present to prevent channel changing while operating in the text mode, since the first eight of the possible 16 channels double up as page digits. The latch also prevents channel changing if any of the last eight buttons is pressed. The channel-change inhibit command is derived from a flip-flop (IC4) which is driven by three signals: "picture", "text", and the D-bit of the programme output word of the SAA1130.

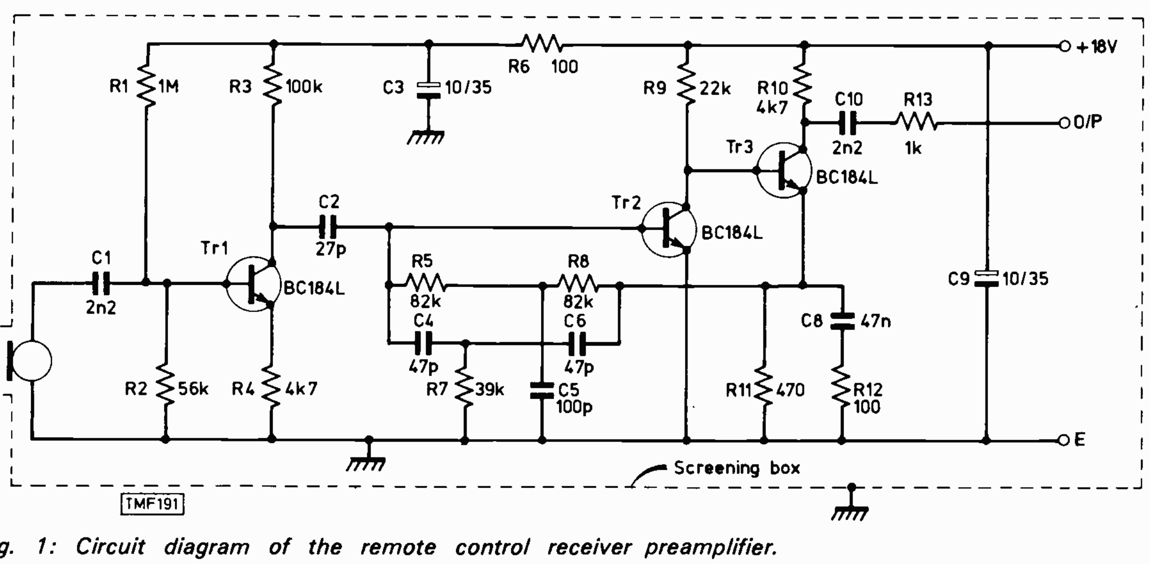


Fig. 1: Circuit diagram of the remote control receiver preamplifier.

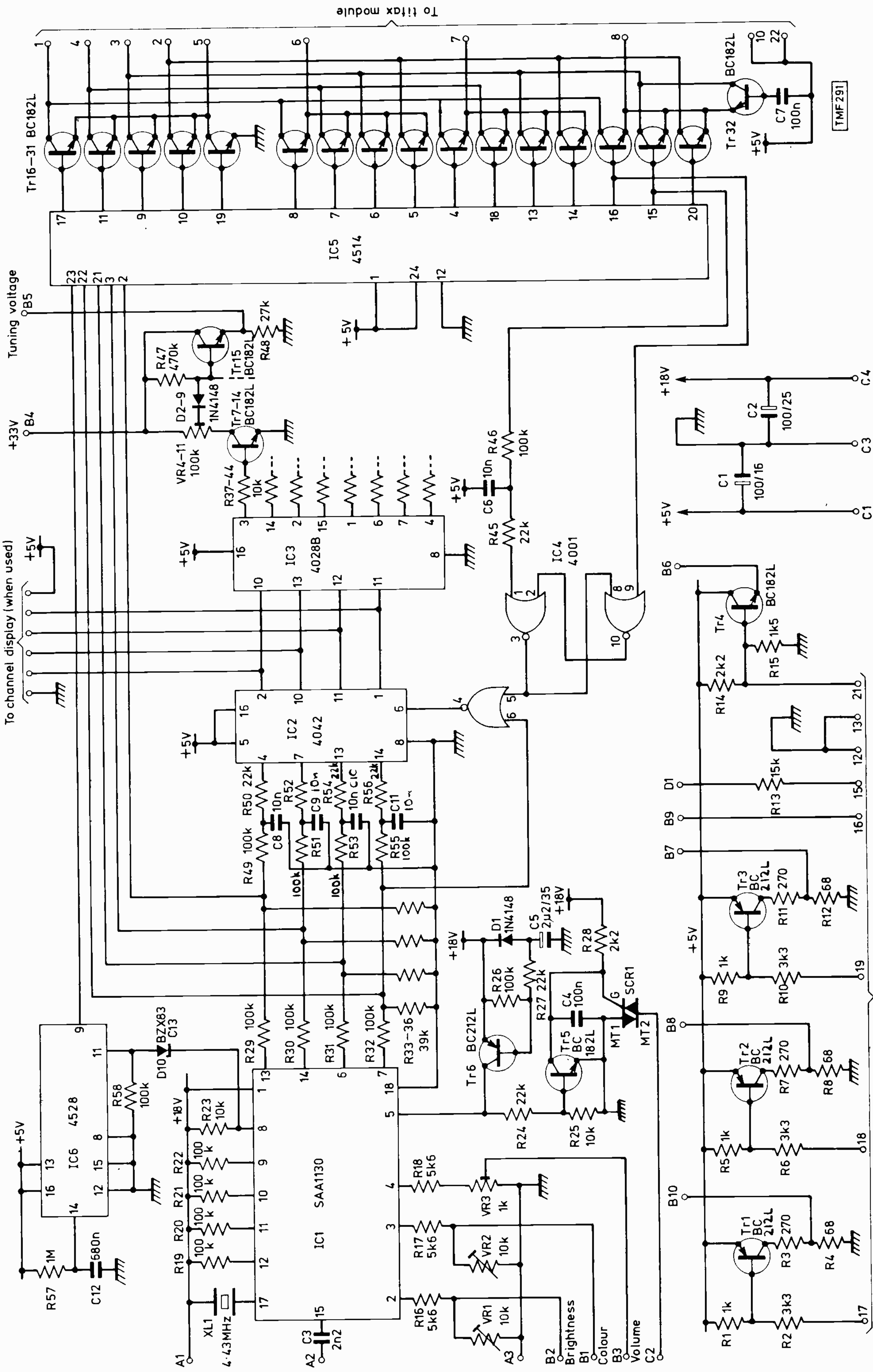


Fig. 2: Circuit diagram of the interface p.c.b.

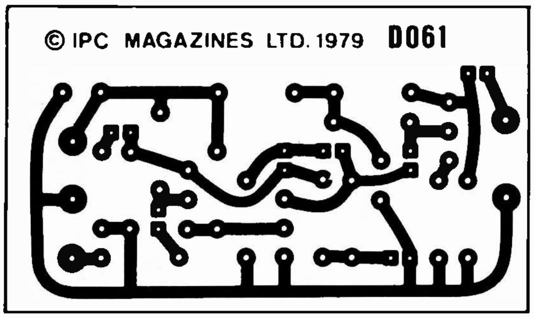


Fig. 3: Copper pattern for the receiver preamplifier p.c.b. ref. no. D061.

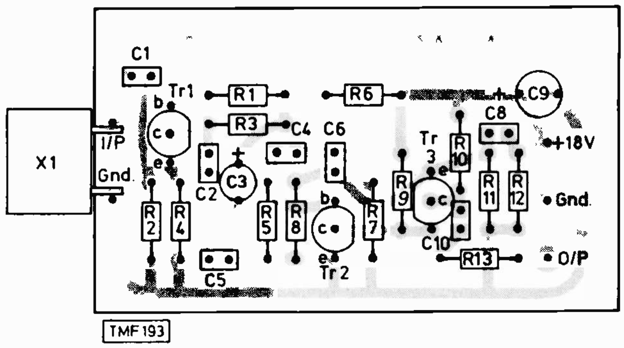


Fig. 4: Component layout for the preamplifier p.c.b.

The second path of the programme outputs from IC1 drives IC5, which is a 1-of-16 decoder. The outputs of the i.c. activate transistor switches which connect the appropriate strobe output to one of the inputs on the Texas XM11 decoder module. For a more detailed description of the XM11, refer to the October 1979 issue.

The 16 commands provided when in the teletext mode are: ten digits for page selection; picture; text; select page; time code; update; reveal. Since we have only 16 channels available in this format, the "mix" mode can't easily be provided and is therefore absent. Tr32 together with C7 form a picture initiation circuit for use when the receiver is first switched on.

As with our previous option, we've decided to use an ITT transmitter unit which can be bought as a spare part. This is for purely aesthetic reasons – there's nothing to stop readers making their own unit, based on the circuit of the commercial one shown in Fig. 5.

A components list, together with full constructional and connecting up details, will be given next month.

Signals Board Instability

A number of constructors have experienced instability problems with the signals board. Symptoms include low gain, patterning and colour noise. It appears to depend on the earthing arrangements and to a lesser extent on the particular i.c. samples used.

The first suspect is the 7812 regulator i.c. Some types are prone to oscillation, and the surest cure is to connect an 0·22μF capacitor between pins 1 and 2 – this can easily be accommodated on the back of the board.

The next (and possibly most important) area to look at is the earthing arrangements. As we pointed out before, it's essential to earth the signals board and timebase board independently, i.e. run a reasonably thick cable from the signals board to the power supply board and another one from the timebase board to the power supply board (omit the link between connector pins B2 and C2).

In order to prevent instability in the feedback loops to the TDA3500 i.c., connect 33pF ceramic plate capacitors across R19, R34 and R46 in the RGB output stages.

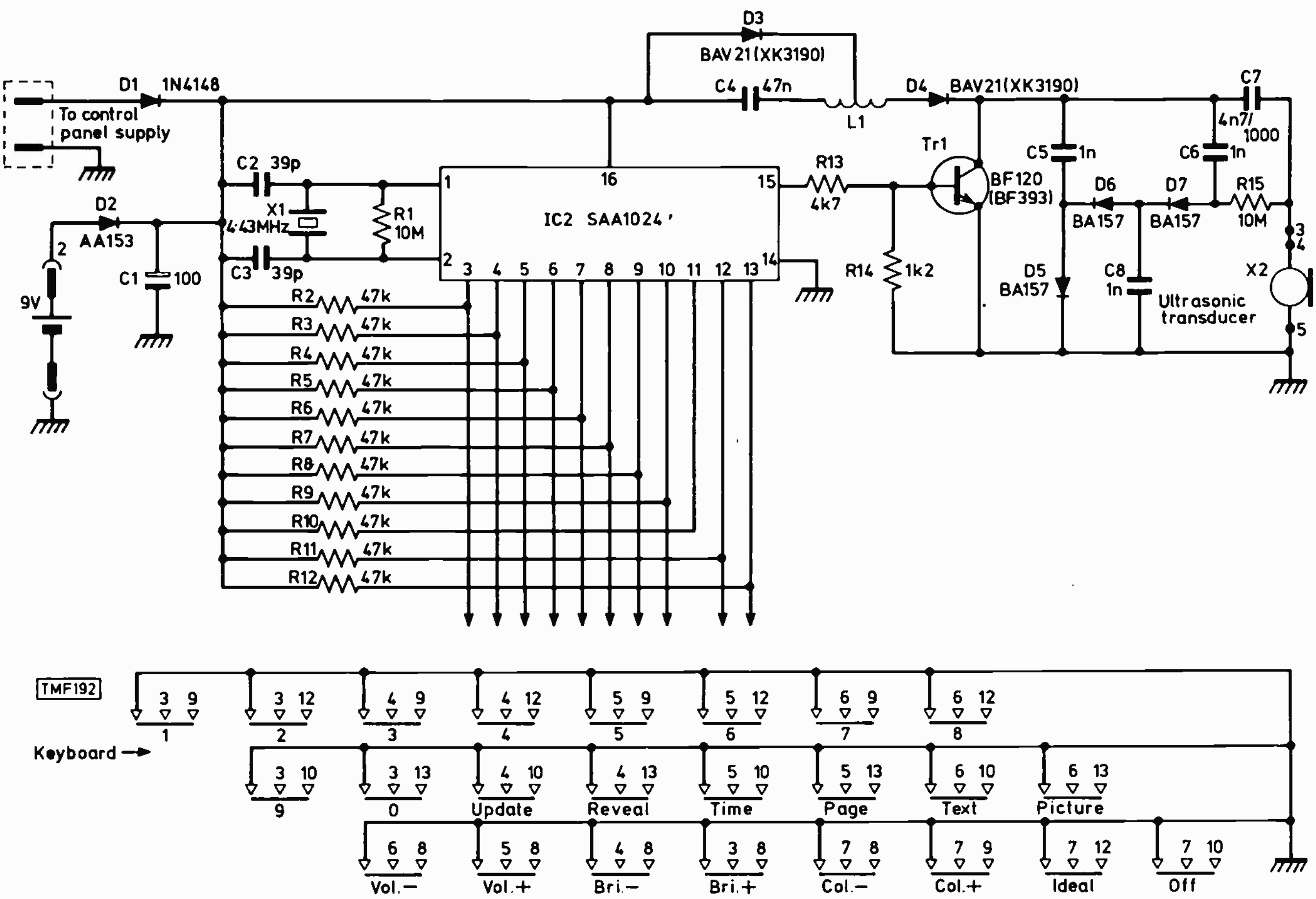


Fig. 5: Circuit diagram of the remote control transmitter unit.

Portable CCTV Test Box

Andrew Parr, B.Sc., C.Eng., M.I.E.E.

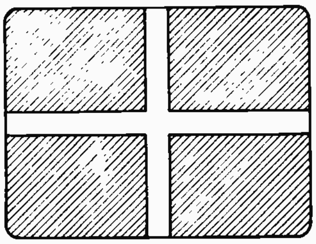


Fig. 1: The pattern.

INDUSTRIAL closed-circuit television installations are often maintained by non-technical personnel, on the basis of replacing complete units when defective. At this level, a CCTV channel consists of three elements: a camera, a monitor, and the cable linking them. Cameras and monitors are bulky items, and it can be infuriating to carry a camera over a distance of say half a mile, and then 100ft in altitude, only to discover that what you actually have is a cable fault.. In accordance with Murphy's Law, this is all too likely . . .

The unit featured in this article was designed to assist electricians doing first-line maintainance on CCTV and VDU systems in industrial plants. It consists of a small battery-powered pattern generator that can be used to test a monitor or cable on site. The unit is small and light enough to be carried in a pocket, and has proved an invaluable aid for first-line fault finding.

The unit is designed to give a go/no go test. This means that a very simple circuit can be used. The pattern produced (see Fig. 1) is a white cross on a black background, which is adequate for seeing whether a monitor is operating and a cable has continuity.

The circuit is shown in Fig. 2. IC1 and IC2 are 555 timer i.c.s connected as equal mark-space ratio oscillators. IC1 operates at line rate (15·625kHz) and IC2 at field rate (50Hz), the timing components being R1-4 and C1-2. The negative edge of each waveform is differentiated (see Fig. 3) by C3/R5 and C5/R7, then combined in IC4b. This produces a bright-up pulse at the centre of each line and each field, thus producing the white cross. To get the sync waveform, the oscillator outputs are inverted by IC3a/b, differentiated by C4/R6 and C6/R8 and combined in IC4a. IC3d gates the bright-up and sync pulses to inhibit line bright-ups during the field flyback period. The bright-up and sync pulses are finally combined by R13-15. When feeding a 75Ω load, the waveform is approximately 1V peak-to-peak.

The circuit is supplied by a 5V rail obtained from a 9V battery. The 5V regulator IC5 stabilises this supply. With a current consumption of about 15mA, the battery gives several hours' use. We used PP3 batteries in the original units, but as funds permit we are replacing them with rechargeable batteries.

The circuit is built on Veroboard, the layout being shown in Fig. 4. The unit, with its battery, can be built into a pocket sized box. Our units have two outputs in parallel, a lead with plug for testing monitors and a socket for testing

★ Components list

Capacitors:

C1	4700pF ceramic plate
C2	0·33μF polyester
C3	2200pF ceramic plate
C4	1000pF ceramic plate
C5	0·047μF polyester
C6	0·047μF polyester
C7	10μF 16V electrolytic
C8	0·01μF ceramic disc
C9	0·01μF ceramic disc
C10	0·22μF polyester
C11	0·47μF polyester

Resistors:

R1	1k
R2	4·7k
R3	1k
R4	22k
R5-12	10k
R13	470Ω
R14	330Ω
R15	330Ω

All ¼W 5%

Miscellaneous:

Veroboard, case, switch, video connector, battery with connectors.

Controls:

VR1	10k
VR2	10k

Linear trimpots

Semiconductors:

IC1	555
IC2	555
IC3	7400
IC4	74132
IC5	78L05
D1	1N914

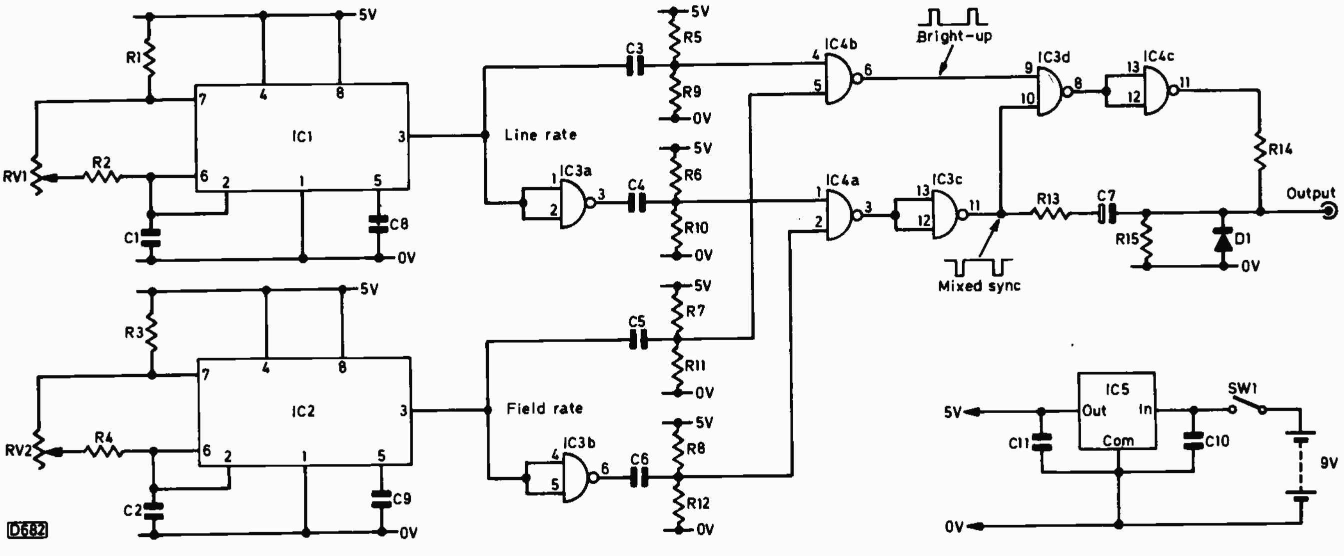


Fig. 2: Circuit diagram. Pin 14 of IC3/4 is connected to 5V, pin 7 to 0V.

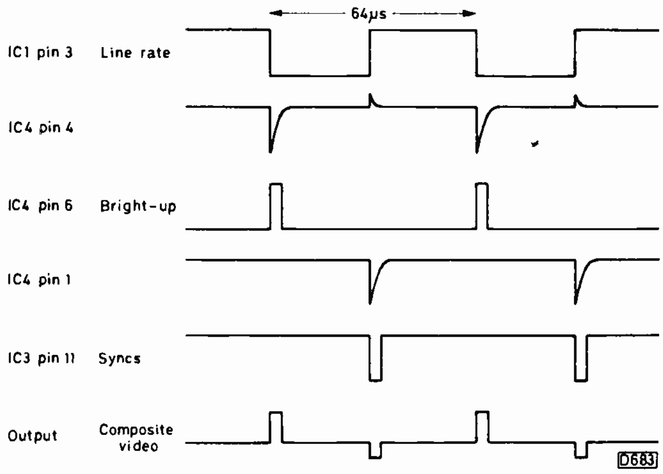


Fig. 3: Line rate waveforms. The field waveforms are similar.

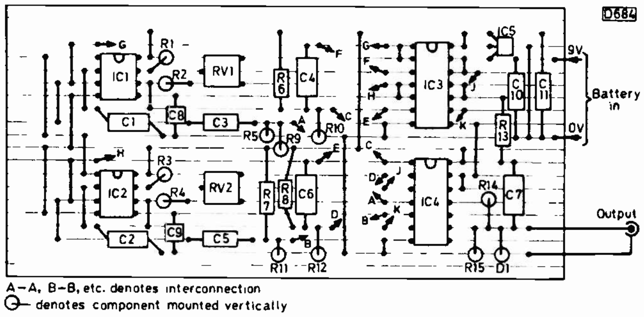


Fig. 4: Component layout on 0·1 matrix Veroboard.

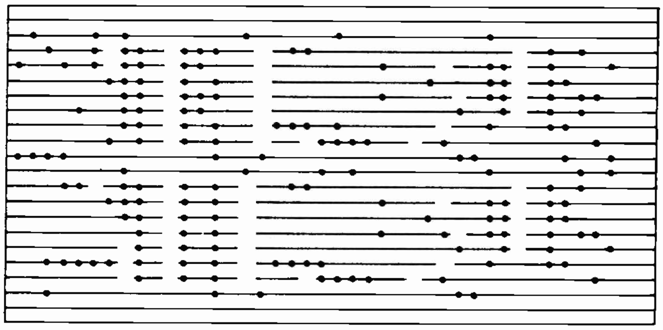


Fig. 5: Cuts and connections on the copper side of the board.

cables. It's advisable to use sockets for IC1-4, particularly as this type of test unit is almost certain to be plugged into a cable with a high voltage on it some day – common cable trenches and men with shovels often cause inter-cable shorts . . . Incidentally, the output can be shorted indefinitely without harm.

The only adjustments are RV1 and RV2. These should be set so that the average monitor locks with its hold controls at range centre.

IC1 and IC2 could be replaced by a single 556 i.c. When a CMOS replacement for the 555 becomes readily available, battery life will be improved by using it in the IC1 and IC2 positions. No 556 CMOS device seems to be on the cards, so we stuck to 555s to allow replacement with a CMOS equivalent at a later date. IC3 can be replaced with a low-power TTL 7400, or a 74 replacement CMOS device, which will reduce consumption further. It's not feasible to replace IC4, because of the low-impedance output required.

A number of these units have been issued to electricians on our site. They've proved very useful in identifying faults, and have saved many wasted journeys carrying a monitor or camera.■

TV Servicing: Beginners Start Here . . .

S. Simon

Part 28

LAST month we tackled the subject of the PAL decoder, showing with the aid of a block diagram what basically has to happen in order to decode the colour signal and produce three RGB primary-colour signals to drive the cathodes of the c.r.t. – or alternatively three colour-difference signals to drive the c.r.t.'s grids, with the luminance signal used to drive the cathodes. It must be emphasized that there are a lot of differences in the detailed arrangements used in the decoders fitted in the various colour chassis – different PAL switching systems, colour-killer circuits, matrixing and quadrature phase-shift systems for example. To put some flesh and bones on our account of the decoder however, let's look at a typical circuit. As in many past instalments, we'll take as our example the circuit used in the Pye hybrid colour chassis (the 691). This closely follows the arrangement shown in our block diagram last month, the main difference being that the Pye chassis uses colour-difference tube drive.

Chrominance Channel

The circuit of the Pye 691 chassis' decoder is shown in Fig. 1. We're not showing the luminance channel, which is relatively straightforward, but the section that started with the high-pass filter in last month's block diagram. The high-pass filter consists of C91 and R91. A composite video signal from the i.f. strip enters the decoder at SK6, and after filtering to remove the low-frequency, i.e. luminance, part of the signal the remaining h.f. part is coupled by C92 to the base of the first, gain controlled, amplifier stage (VT12 and associated components). The signal applied to the base of VT12 is of about 20mV peak-to-peak amplitude. The automatic gain control (or a.c.c. – automatic chrominance control) circuit is simplicity itself. D15 rectifies the burst signal present in VT14's collector circuit, producing a negative control voltage across C105. This is filtered by R105/C93 and applied via R94 as reverse bias to VT12's base. A positive, forward bias is also applied via R93 from the slider of RV9, which enables the a.c.c. level to be adjusted.

Colour Control

The output from the first chrominance amplifier stage goes two ways. Via C96 to the base of the first burst amplifier transistor VT13, and via C125/D23/D24/C128 to the base of the second chroma amplifier transistor VT20. Let's consider the latter, rather complicated looking path. The two diodes D23/24 serve two purposes. First of all they form part of a very effective user colour control circuit. The user colour control RV11 adjusts the forward bias applied to the anodes of these two diodes, and thus their conduction. In this way the amplitude of the chroma signal flowing via the two diodes is varied. The colour and contrast controls are electrically linked so that they track together, i.e. whichever of these two user controls is adjusted, both the colour and contrast are varied.

Burst Blanking

The second function served by D23/24 is to enable burst blanking to be carried out. Negative-going line pulses enter the decoder at SK8. They are used to trigger the PAL switch (we'll return to this later) and also pass via D25 to the anodes of D23/24, switching them off during the burst period so that the burst signal is removed from the chrominance signal path. VT20 amplifies the chroma signal only therefore. The output appearing across its collector load resistor R148 is fed via L30/C133, a 6MHz trap to remove any intercarrier sound signal that may be present, to the base of the delay line driver transistor VT21.

Delay Line Circuit

The latter provides two outputs. Its collector drives the delay line's input coils, while its emitter provides an output which is coupled via C138 and R165 to the centre tap on the delay line's output coils. The output coils thus receive both the direct and delayed (previous line) chroma signals, and carry out the add/substract actions. As a result, R – Y appears at the top end of R174 and B – Y at the bottom end. Another result of this addition and subtraction of signal voltages is that the effect of any spurious phase shift is converted to a slight reduction in the amplitude of the output signals. This can be seen if one plots vector diagrams of the signals on alternate lines (remembering that the polarity of the R – Y component of the signal is inverted on alternate lines). We can't go into that here however. The two separated but undemodulated colour-difference signals thus obtained are then fed to two bridge rectifiers, D30-33 and D34-37.

For the addition and subtraction processes to be carried out correctly, it's essential that the direct and delayed signals are of equal amplitude and in phase. RV12 is included for amplitude and L31 for phase adjustment. The correct setting of RV12 is particularly important: the effect of incorrect adjustment is a line by line colour change, i.e. Hanover bars. Incorrect adjustment of L31 will have the same effect.

The two chroma demodulators D30-33 and D34-37 are of the synchronous type. They require two inputs, the signal input and a reference signal input which is obtained from the reference oscillator. The action can be thought of in terms of timing and sampling. What happens is that the 4·43MHz reference signal switches the demodulator on once during each signal cycle, the demodulator then sampling the signal input. We thus get a demodulated output, i.e. a signal of amplitude equal to that of the input signal at the instant of sampling. These outputs are fed via filters, to remove the 4·43MHz component, to the decoder panel's output sockets SK9 and SK10.

From this it's clear that the reference signal must be very accurate – dead on from a frequency point of view, and phase controlled. The use of a crystal controlled oscillator (VT16 and associated components) ensures frequency stability, while the use of the burst signal in a feedback control loop produces phase synchronisation.

Burst Gating

This takes us back to the burst channel. We saw that one output from VT12 is taken to VT13. This is a straightforward tuned amplifier which drives the second burst amplifier transistor VT14. This latter transistor also provides the burst gating action. Since VT14 has no fixed forward bias, it spends most of its time in the non-conductive state. We want to switch it on for a brief period only, when the burst signal is present, so that only the burst signal is developed across its collector load — transformer T9. For this purpose, line sync pulses are fed into the decoder at socket SK7. The timing of these pulses is not correct for burst gating however, since the burst is present during the back porch immediately following the line sync pulse. We need a slightly delayed pulse therefore for accurate burst gating. For this purpose the sync pulses are fed to the tuned circuit L28/C126, which produces a cycle of oscillation whose positive excursion occurs during the back porch period. This cycle is fed via R103/C100 to the base of VT14, which thus switches on to allow the burst through.

Reference Oscillator Phase Control

There are two detectors in VT14's collector circuit. We've already seen that the simple half-wave rectifier D15 is used to develop the a.c.c. potential across C105. The other detector is another synchronous one consisting of the centre-tapped secondary winding on T9 and the two diodes D16/17. C102 and C104 couple the burst signal to the diodes, while T10 feeds the reference signal back to the junction of the two diodes. RV10 applies a standing bias to the circuit. If the bursts and the reference signal are correctly phased, the demodulator produces zero output, the bias voltage provided by RV10 appearing at the base of the d.c. amplifier VT15. If the bursts and the reference signal are not correctly phased, the diodes produce a positive-going or negative-going output which adds to or subtracts from the voltage provided by RV10. The resultant output is smoothed by C107 and C106/R109. We thus obtain a control voltage to adjust the oscillator's phase, RV10 setting the basic frequency. The control voltage is amplified by VT15 and used to bias the varicap diode D18 in the reference oscillator circuit. As you'll recall from a previous instalment, the capacitance of a varicap diode alters as the bias voltage applied to it is varied. So our control voltage is being used to adjust the capacitance in the reference oscillator's tuned circuit.

The result of all this is that the reference oscillator transistor VT16 develops across its collector load T11 a 4·43MHz signal which is held stable in frequency and phase. This signal is fed to the emitter-follower VT17, which is included simply to act as a buffer between VT16 and its load. The signal at the emitter of VT17 is fed back to T10 to provide the phase control action, and via C150 to the chroma demodulators. Before following this latter path however there's another lump of circuitry to consider.

Generating the Ident Signal

As we mentioned last month, the burst phase varies on alternate lines due to the PAL switching at the transmitter. As a result, the burst detector produces a 7·8kHz (half line frequency) squarewave output in addition to the d.c. output it provides. This burst ripple as it's called appears at the collector of VT15 and is coupled via C111 to the base of the ident amplifier VT18, which develops a large-amplitude 7·8kHz sinewave across its collector tuned circuit L27/C118/C119. The important thing here is that this ident signal, as it's called, follows the phase of the burst ripple. It can thus be used to synchronise the PAL switching in the decoder. Before getting on to this however there are a couple of other points to note.

Using the Ident Signal

VT18 is followed by the emitter-follower transistor VT19. The signal developed across this transistor's emitter load resistor R131 goes off in three directions. First via R129 back to the ident tuned circuit. This is positive feedback, and serves to increase the amplitude of the ident signal. Secondly via C122 and D20 to the PAL switch, to which we'll return shortly. The third feed is to the colour-killer rectifier D22, which rectifies the ident signal, producing a positive voltage across its reservoir capacitor C123. The idea is no burst = no colour = no voltage across C123. The voltage developed across C123 during a colour transmission is used to forward bias the base of the second chroma amplifier VT20, which is thus non-conductive when a monochrome transmission is being received. This is the colour-killer action of course.

90° Phase Shift

The final thing to consider is the path the reference signal follows from the emitter of VT17 to the two chrominance synchronous demodulators D30-33 and D34-37. Let's take the easy bit first. One path is via C148/C149 and T16 to the B – Y demodulator D34-37. The transformer is used simply to apply the signal across the bridge. C148/C149 with R178 provide the 90° phase shift which we talked about last month. The idea is that to demodulate the quadrature modulated signals correctly, an equivalent 90° phase difference is required between the reference signals used to time the synchronous detectors. This shift is included in the B – Y reference signal feed.

The PAL Switch

There's no phase shift in the reference signal feed to the R – Y synchronous demodulator, but to invert the effect of the PAL switching at the transmitter we have to invert the reference signal fed to the R – Y synchronous demodulator on alternate lines (alternatively we can invert the signal feed to the demodulator on alternate lines – it makes no difference – but in this Pye decoder it's the reference signal that's inverted). This inversion is carried out by the two secondary windings on T15 and diodes D28/29, which are switched on and off by the bistable circuit VT22/23.

A bistable circuit is not something we've encountered before in this series of articles. It's simply a pair of cross-coupled transistors – observe that the collector of VT22 is coupled via R167 to the base of VT23, whose collector is coupled via R168 to VT22's base – which switch each other on and off. The result is the generation of opposite polarity squarewave outputs at the collectors of the two transistors. The bistable circuit has to be driven by trigger pulses – in the absence of trigger pulses, one transistor will turn on and the other off and they'll remain in this condition. The line frequency pulses fed into the decoder at SK8 are used to do

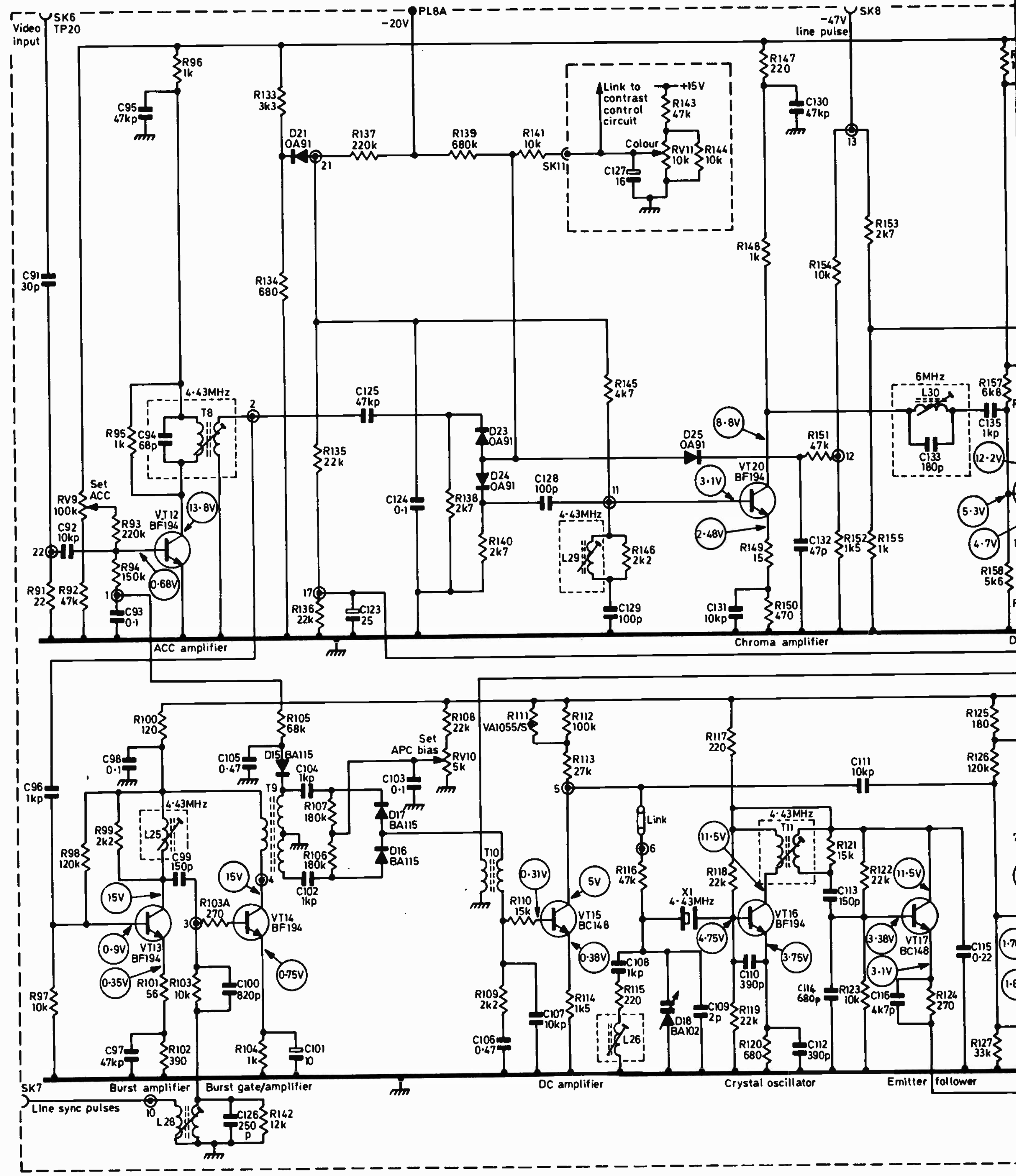
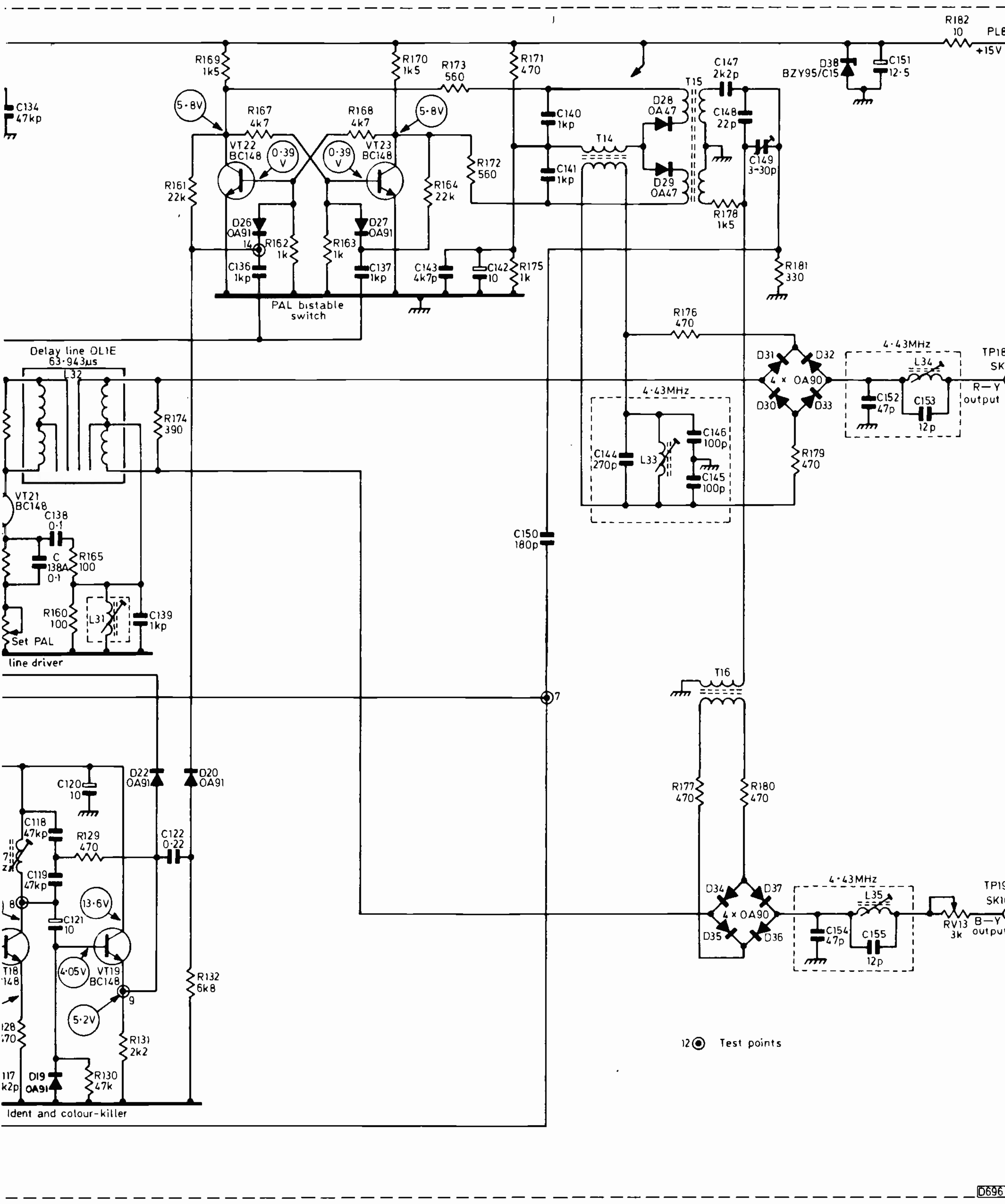


Fig. 1: The colour decoder circuit used in Pye hybrid colour receivers. The circuitry around the

the triggering, being fed via C136/D26 and C137/D27 to the bases of the two transistors – where they switch *off* whichever of the two transistors happens to be conducting. The squarewave outputs thus produced are at half line frequency, and switch D28 and D29 on and off alternately on alternate lines. T14 applies the reference signal to D30-33, and is fed on alternate lines by D28 and D29. These connect either one or other of the two secondary windings on T15 to T14, and since the two secondaries are wound in phase opposition we get the required inversion of the polarity of the R – Y reference signal fed to D30-33.

Synchronising the PAL Switch

The final point is to ensure that this switching is synchronised with the transmitter's PAL switching. This takes us back to the ident signal at the emitter of VT19. As we've seen, the ident signal follows the transmitter's PAL



'ay line varies in different versions of the chassis, due to the use of different types of delay line.

switching. The positive-going excursions of the ident signal are coupled by diode D20 to the bistable triggering circuit, where they suppress the triggering for a single cycle if the triggering is incorrectly phased, i.e. they so to speak make the bistable miss count.

Decoder Outputs

The Pye decoder panel produces two demodulated colour-difference signal outputs, R – Y and B – Y. These are fed to the chassis' CDA (colour-difference amplifier) panel, where the G – Y matrix is also located. This matrix consists of a couple of resistors across which set proportions (determined by the values of the resistors) of the B – Y and R – Y signals are added together to give us the missing G – Y signal.

Next month we'll take a look at some practical decoder servicing problems.

Battery Charger for Portable Video

Ian Pawson

THE portable video recorder (JVC HR4100) and camera I bought recently are powered by a 3Ah dryfit battery housed inside the recorder. This enables you to record for just over an hour, and I was surprised to find how quickly this time can be used up. To give a longer recording time I bought a 12V 5·7Ah dryfit battery (RS type 591-398). I enclosed this in a wooden box with a short lead terminated with a 4-pin DIN plug to connect to the recorder's external power socket (for details of the socket see Fig. 3). This is used to give a couple of hours' recording time, a futher hour then being obtained from the recorder's internal battery. It then occurred to me that it would be useful to be able to recharge the battery from a car battery, via the cigar lighter socket, and the unit described in this article was devised for the purpose.

Dryfit batteries need to be charged from a constant voltage source of 2·3V per cell. Thus for a 12V battery, 13·8V is required. To obtain this from a car battery, a d.c.-d.c. converter is needed. The charging current is self-regulating, but the initial charging must be limited to about 2A. As the battery charges the current decreases, until at full charge it takes less than 50mA.

Most d.c.-d.c. converters use a transformer. The one thing I hate in a project however is having to wind an inductor or transformer. In this case the output required is nearly 30W, so a large pot core would be needed. I thus decided to adopt a transformerless circuit.

Circuit Operation

The circuit is shown in Fig. 1. Gates N1 and N2 of IC1 form an oscillator which runs at around 1kHz. The output is buffered by N3, with N4 providing inversion. Transistors Tr1 and Tr2 are thus turned on and off alternately, via the limiting resistors R3 and R4. This in turn switches Tr3 and Tr4 on and off.

With Tr2 and Tr4 turned on (Tr1 and Tr3 off), C2 charges via D1 and R7 to 12V. When Tr1 and Tr3 switch on (Tr2 and Tr4 off), D1 is reverse biased. C2 is now in effect in series with the 12V supply, via R7 and Tr3. As a result, C3 charges via D2 to about 21V off load. D2 prevents C3 discharging back into C2 when Tr1 and Tr3 switch off and Tr2/Tr4 switch on again. The value of C3 is large enough to smooth out the ripple caused by the switching action.

The voltage developed across C3 is applied to the i.c.

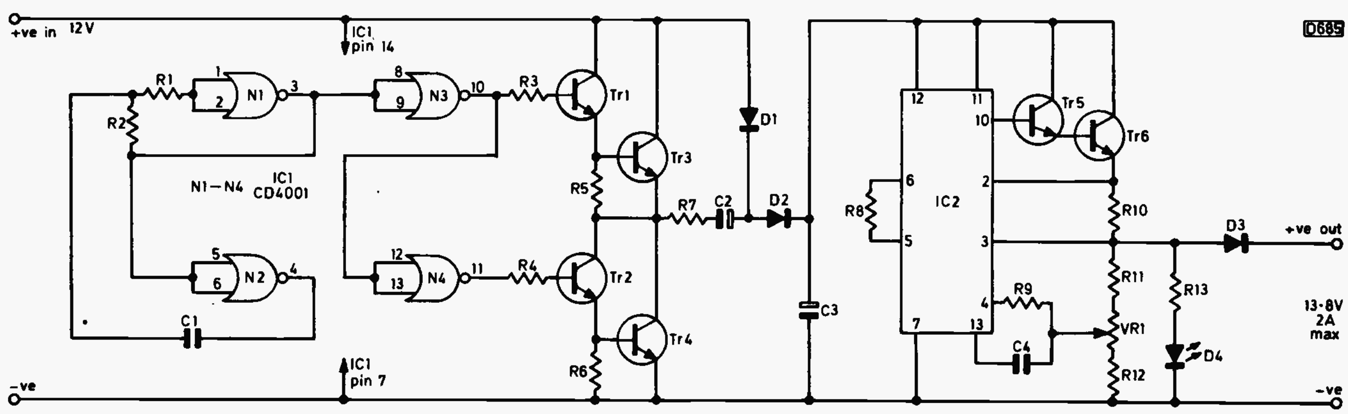


Fig. 1: Circuit of the d.c.-d.c. converter for charging 12V dryfit batteries.

★ *Components List*

Resistors:

R1	820k
R2	390k
R3	1k
R4	1k
R5	820Ω
R6	820Ω
R7	0·27Ω 2·5W w.w.
R8	4·7k
R9	2.2k
R10	0·33Ω 2·5W w.w.
R11	5·6k
R12	5·6k
R13	1k
VR1	1k miniature horizontal

All ¼W 5% unless otherwise specified.

Semiconductors:

IC1	CD4001
IC2	L723 (DIL)
D1-2	RS 261-019
D3	1N5401
D4	LED
Tr1, 2	BC109
Tr3, 4	TIP3055
Tr5	2N3053
Tr6	TIP3055

Capacitors:

C1	0·001μF ceramic plate
C2	1000μF 35V electrolytic
C3	4700μF 35V electrolytic
C4	0·001μF ceramic plate

Miscellaneous:

RS 401-964	heatsinks for Tr3, 4, 6
RS 401-548	heatsink for Tr5
RS 509-967	case

Two 4-pin DIN sockets

PCB and aluminium for D1, 2 heatsinks.

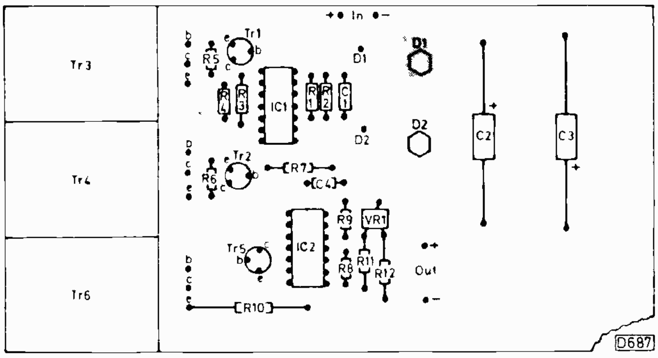


Fig. 2: Printed board layout.

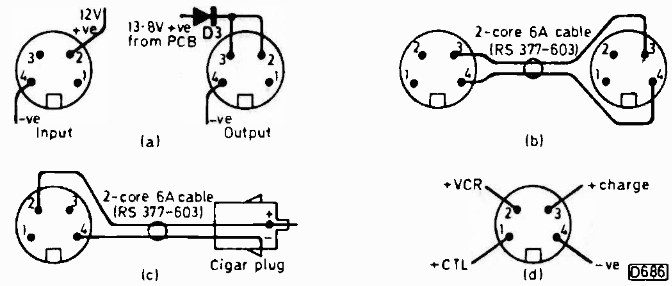


Fig. 3: (a) The charger's input and output sockets. (b) Connections between the charger and the recorder. (c) Lead from the car's cigar lighter to the recorder or charger. Plugs and sockets viewed from the tag side. (d) The recorder's external power socket.

voltage regulator IC2, whose output is buffered by the Darlington pair Tr5/6. R10 provides the current limit of 2A, with VR1 providing fine adjustment of the output voltage. D3 is a protection diode while D4 gives a positive indication that the unit is working.

Construction and Use

The PCB details are shown in Fig. 2. Tr3/4/6 are mounted on the board on RS heatsinks. Tr5 is also provided with a small heatsink. D1 and D2 are stud mounting types and are bolted through the board with, as a heatsink on top of the board, a short length of 18 s.w.g. aluminium bent in a U shape with a hole drilled in the middle. Short lengths of wire are used to connect the anodes of D1 and D2 to the adjacent holes in the board.

On completion, mount the board in the case with the heatsinks towards the rear. D3 is a wire-ended type connected between the board and the output DIN socket. Details of the input and output sockets are shown in Fig. 3.

The lead for powering the recorder from the car's cigar lighter socket (see Fig. 3) is also used as the charger's input lead.

The DIN plug on the spare battery is plugged into the converter's output socket. To charge the recorder's internal battery, a lead with 4-pin DIN plugs at both ends has to be made up – see Fig. 3(b). To enable this lead to be used, pins 2 and 3 of the converter's output socket are connected together.

D4 is mounted on the front panel between the two DIN sockets. Tr3 and Tr4 get warm, Tr5, D1 and D2 get fairly warm, and Tr6 gets *hot!*

To set up, turn VR1 to its mid position and connect the input to 12V. D4 should light. Connect the output to the battery and with a voltmeter adjust VR1 for an output of 13·8V. The unit is then ready for use.■

Servicing in the Field

Part 3

George Wilding

THE line timebase and power supplies are responsible for most service calls in all types of chassis, whether all valve, hybrid or solid-state. When it comes to solid-state chassis however the power supply arrangements and line output stage circuitry vary so much that it's difficult to generalise about fault finding procedures. When confronted with a faulty set of this type, the best field servicing procedure to adopt will be dictated largely by one's experience of the particular chassis and the setmaker's recommended approach to fault finding.

Common Failures

There are one or two components that are particularly suspect in certain chassis. In the large-screen Pye solid-state chassis (725, 731 etc) for example, C563 (0·1µF or, later 0·22µF) across which the c.r.t.'s first anode supply is developed is a frequent offender. You may find the h.t. fuse blown, or the dead set symptom if the set was switched off quickly enough. You may also find the tripler, line output transistor and transformer all defective if you're unlucky. Use a replacement rated at 1·5kV – the capacitor is mounted inside the e.h.t. can. The capacitor used for the same purpose in the ITT FT110 chassis (C517, 0·001µF, 1·6kV) is similarly a common offender. When this goes short-circuit however an electronic trip operates, preventing damage to other line output stage components.

There are quite a few components that tend to break down after some years' service in solid-state chassis. The two components just mentioned however can fail very quickly. Let's summarise a few of the components that experience indicates tend to fail with age.

The wirewound surge limiting/smoothing resistor R1367/81 (2·2Ω +68Ω) in the Philips G8 chassis frequently goes open-circuit, giving the symptoms c.r.t. heaters alight but set otherwise dead.

In the Rank A823 chassis used in many Bush/Murphy single-standard colour receivers the BY164 or BY126 l.t. bridge frequently fails, blowing the 2A l.t. fuse 8F1. Since there will be no line drive, the dead set symptom will be present. Other common faults on these chassis (A823, A823A etc.) are loss of capacitance in the h.t. reservoir/smoothing block 8C9/10, and no h.t. due to the smoothing resistor 8R15 (68Ω) going open-circuit.

In both the Philips G8 and the Rank A823 chassis the older type of BT106 mains rectifier thyristor often goes short-circuit, blowing the mains fuse.

The thyristors used in the line output stage in Grundig colour sets, and/or a perforated insulating washer, can result in the cut-out operating on switching the set on. Spark-over between the washer and heatsink will always trip the cut-out: careful inspection will reveal the perforation. As to which of the two thyristors is responsible, if the cut-out operates immediately suspect the flyback thyristor Ty511 (TA16091), if there's a slight delay suspect the scan thyristor Ty518 (TA16090).

Severe loss of capacitance in the triple electrolytic can C602/3/6 used in the Thorn 3000/3500 chassis causes low h.t. voltages with a high hum content. Severe loss of capacitance in C607 (1,000µF) results in a low 30V rail with all its attendant symptoms, e.g. a dead set due to lack of drive to the chopper transistor. Shorts in power rectifier diodes are not uncommon, especially in the 30V supply rectifiers W603/4. As mentioned last month, the c.r.t. first anode switches on these sets tend to develop leakage to chassis, reducing the first anode voltage(s) to the associated gun(s) so that the output from them is either reduced or absent. Quite often the leakage current through the associated 1MΩ or 1·5MΩ feed resistor causes it to rise in value, making the problem worse.

Having strayed for a moment from line timebases and power supplies, it's also worth noting that the ETTR6016 i.c. used in GEC colour sets featuring touch-button channel selection is often responsible for channel change problems.

No EHT

Triplers don't fail all that often, but nevertheless provide a considerable percentage of the troubles with UK and continental colour receivers. The incidence of tripler failure in Japanese sets is almost unbelievably low. I don't know the proportion of Japanese sets in my catchment area, but whilst I've serviced most makes of Japanese sets for a variety of faults I've yet to replace a tripler.

When a tripler is suspected of being faulty, particularly if the set doesn't incorporate overload protection circuitry, the aim must be to prove or disprove the suspicion without subjecting the rest of the line output stage to stress – a defective tripler can quite easily destroy the output transistor, transformer and associated components. Hence the protection circuitry used in some sets.

This protection circuitry can be ingenious. In the Saba H chassis for example the h.t ripple is sampled and if excessive activates a thyristor which in turn operates a relay which opens the mains switch. In the Thorn Model 3787 (NordMende F VI chassis) a bistable circuit alters the voltage at pin 4 of the TDA2590 line oscillator i.c. from 11V to 6V, stopping the line oscillator and shutting down the set. In sets using a switch-mode power supply there's usually an excess current trip, while in many older solid-state sets protection is provided by correct fusing, fusible resistors and thermal cut-outs.

In all cases the simplest and surest way of determining whether or not a tripler is faulty is to remove the pulse input to it. In many sets this can be done by unplugging a connector – the Thorn 3000/3500 and some Philips chassis are examples. Where protection circuitry is incorporated and this action restores normal supplies, the tripler is clearly defective. It's possible, though rare, for the trouble to be due to a succession of severe flashoves or even an internal short-circuit in the tube however, especially in some regunned tubes.

Where there's no protection circuitry, replace any blown fuses and, with the tripler disconnected, check whether an arc can be drawn from the pulse supply point. If so, the tripler has probably broken down.

If the e.h.t. is present, the other possible causes of the no raster symptom are zero or low first anode voltages to all tube guns or excessive tube bias. Check tube base voltages and follow up whichever are incorrect.

If no arc can be drawn after disconnecting the tripler, how does one tell whether the fault originated in the line generator or output stage, or alternatively the line output transformer has been damaged by a faulty tripler? Take a sniff at the tripler – breakdown of selenium types is usually accompanied by an obnoxious smell. In addition, check for any signs of swelling, and note whether any thermoplastic top or back filling is at all spongey in places or generally. In any event, you'll have to follow the appropriate procedure to establish why the line timebase is not working. Check voltages and follow up any clues. If the h.t. to the line output stage is low, disconnect the h.t. and check at the power supply to see whether it rises. If so, try disconnecting the items fed by the line output transformer to find out which is causing an overload. Resistance checks will help. If the h.t. at the line output stage is correct, find out why the output transistor(s) aren't being driven.

Output transistor and/or transformer failure due to a defective tripler often means that an incorrect fuse has been fitted, prolonging the overload condition. Tripler failure on the other hand is often caused by excessive input pulse amplitude. The excessive pulse amplitude may well be due to the h.t. being high, as a result of incorrect setting of the set HT/set EHT control in the power supply. Whilst manuals usually tell you to set this control for the correct e.h.t., in practice most engineers tend to set it for the specified h.t. voltage. To be on the safe side, it's best to set the h.t. towards the lower end of the range quoted – about 61V in the case of the Thorn 3000/3500 chassis for example.

The vulnerability of line output transformers and transistors to tripler failure varies widely from chassis to chassis, and although it's not all that common it's expensive when it does occur. ITT report that in certain circumstances failure of the tripler in the CVC25/30 series chassis can destroy the transformer, the EW modulator driver transistor T13 (BD238, later type BD442) and the EW modulator module. This problem usually occurs during the set's twelve month guarantee period, but ITT have extended the warranty on these items to 24 months. That said, I have the highest regard for ITT triplers, which are used by a number of setmakers. In fact in the case of the ITT CVC5-CVC9 hybrid series chassis, which form a high proportion of the sets in my area, I've had to replace only one tripler.

Before fitting a replacement tripler, check whether any components connected to the earthy end of the e.h.t. overwinding have been damaged.

Dead Set Clues

In the case of a completely dead set, some clues can usually be obtained by finding out how the failure occurred. If the set was working normally until switched off, it's likely that the surge induced by the action of switching off or on is responsible for the fault. There's always the possibility however that the start-up circuitry used in many sets to get the line generator circuitry to work prior to the line output stage coming into operation is at fault, but this is not common. The switch-on or switch-off surge may have been just too much for an ageing cartridge fuse. After years of use their susceptibility to failure increases. The same can be said of a fusible resistor's soldered connection — deterioration can occur here due to repeated thermal changes.

If the fuse is shattered, the surge could have been due to a short-circuit rectifier – and we must always remember the tendency of mains filter capacitors to go short-circuit.

Where the set failed while viewing however it's likely that the fault is in the line output stage.

Trip circuitry varies so much that where you encounter a set which is tripping the maker's recommended servicing procedure should be followed.■

A Videocassette Rewind Machine

John de Rivaz, B.Sc. (Eng.)

OWNERS of VCRs will doubtless be well aware of the replacement costs of the video heads and parts in the tape path. For each hour spent viewing, a rewind period, with the tape rubbing against the heads, is required. For the Philips N1500 VCR, the playing time is an hour and the rewind time 400sec. It follows from this that a saving of about 10 per cent of head replacement costs will be achieved if a separate chassis is used for rewinding. There's another good reason for having a rewinding machine.

It's occasionally possible to buy, for about £1·50, broken videocassettes for repair. Such repairs are possible if parts can be exchanged between cassettes. Points to look for include warped spools, dirty bores in the PTFE rollers, out of tolerance combinations of spools and cases, broken springs, and foreign matter in the mechanism. It's worthwhile having a separate rewind machine when working on such cassettes, since they can sometimes be very hard on the mechanism by suddenly jamming up. One was found with a knot tied in a break! If you don't want to splice, you can make a VC30 from a VC60 say by loading it with a continuous half length of tape.

I obtained an N1500 chassis from a dealer for £25 plus VAT and carriage – others may be able to better this price. It contained the head and drive motors, mains transformer, a broken head disc with drum assembly and drive belt, a cassette drive assembly, flywheel and control linkages. The lacing motor and parts had been removed, but the cassette unlocking spigot was still in place, with its linkage back to the position previously occupied by the lacing chassis. The cassette loading structure had been removed, together with the record and eject buttons and the stop solenoid.

The mains transformer wasn't really needed, so I removed it along with the voltage selector. The motors could then be wired as shown in Fig. 1 for mains operation. Cassette loading was to be done by hand, so a handle was fitted to the drum in the place previously occupied by the top mounting support for the head disc. A lever was then fitted to the unlocking linkage so that it engaged with a

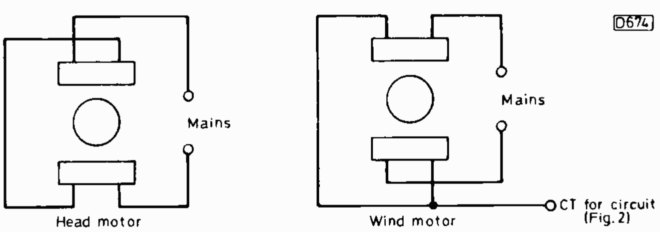


Fig. 1: Method of connecting the head and wind motors, with the mains transformer removed.

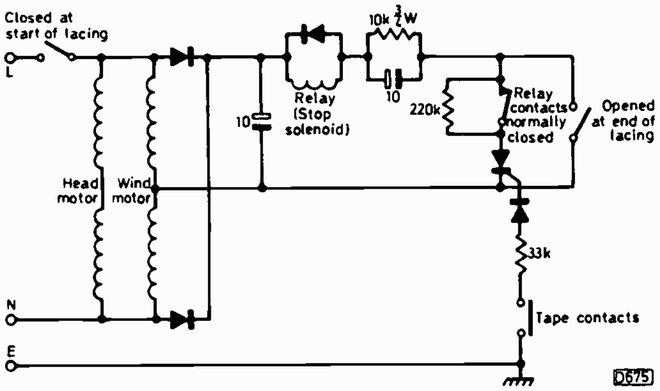


Fig. 2: Circuit used to provide an autostop facility. The thyristor is a 200V, 1A type; the diodes have a p.i.v. rating of 400V and the electrolytics a voltage rating of 400V. The relay is a 240V a.c. mains type with normally-closed contacts.

spigot fitted to the underside of the drum in the fully unlaced position – with the effect of locking the cassette in the usual manner. To make the new system work, the spring on the locking mechanism situated under the cassette drive was reversed, so that its pressure had the effect of unlocking the cassette.

The machine could have been used as a winding machine in this condition, but there would be no autostop. The circuit shown in Fig. 2 was used to provide this feature. The stop solenoid having been removed, a Potter and Brumfield KU25011 mains relay was found in the spares box and used. It has two metal strips fitted to the armature, and one of these was bent to engage with the stop lever. The circuit was built on a small tagboard mounted next to the relay.

The 10kΩ resistor provides holding current without overheating the relay: the parallel 10μF capacitor provides the boost required for the initial movement. The 33kΩ resistor in series with the thyristor's gate limits the trigger current to the rated 10mA. The 220kΩ resistor across the relay contacts, together with the mechanical time-constant of the relay, switch off the thyristor without any bouncing. A microswitch was fitted to the drum so that it opens when the tape is fully laced. This was connected as shown, and has the effect that the stop relay is energised until the tape is properly laced.

If the stop foil is missed or not present on the cassette being reclaimed, the tape will jerk the drum around on reaching the end and will close the microswitch, activating the stop solenoid. This is not ideal, but is better than stretching the tape to breaking point or stalling the motor!■

Receiver/Monitor Conversion

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

THE MC1552G i.c. used in the video distribution amplifier I designed some time ago (see Letters, *Television* August 1978) is getting rather expensive. I decided therefore to design a new video distribution amplifier to supersede the earlier i.c. design. During the development of this it became clear that the amplifier's potential could be expanded – to make it suitable for use as an interfacing board for converting certain standard TV sets for use as receiver/monitors. The result is a single PCB that can be used in a number of ways.

Basic Circuitry

The basic circuit adopted is shown in Fig. 1. It consists of a fairly common wideband amplifier circuit (Tr1/2) and a couple of emitter-follower buffer stages (Tr3/4). For a 75Ω video input signal, input termination is required (R14). This is followed by d.c. isolation (C1) in case there's some standing voltage on the incoming line. Then come the wideband amplifier and emitter-follower Tr3. An additional emitter-follower stage is added, with provision for base biasing (R10/11): this will drive a 75Ω terminated output at the standard 1V peak-to-peak video level. The amplitude and d.c. level of the signal provided by Tr1-3 can be set by altering the value of R4 to get the required gain and the values of R1/2 for the desired standing level. The reason for using this arrangement is that to prevent large changes in contrast and brightness when the set is switched between the TV and monitor modes the signal fed into the set via Tr1-3 must match the detected signal within the set.

Uses

Tr3 is in fact not often required, though I do use it when employing the circuit as a video input for Philips VCRs. Various components in the output driver stage Tr4 are also not always used. R13 ensures the correct 1V into 75Ω output.

For use as a distribution amplifier, link the collector of Tr2 to the base of Tr4, replace R13 with a link, and feed the

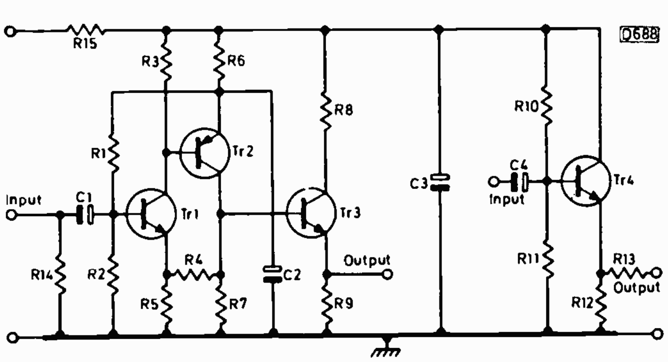


Fig. 1: Basic circuitry provided by the board.

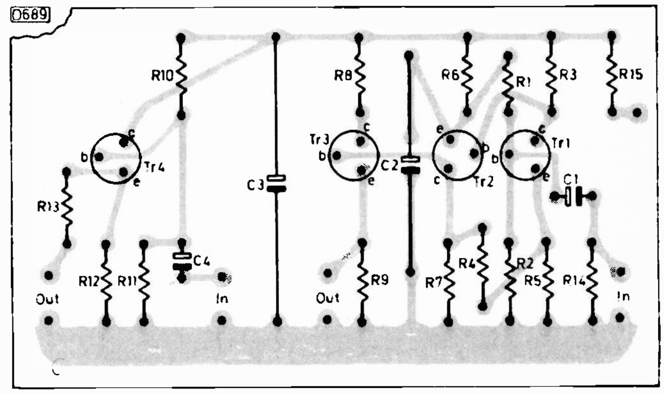


Fig. 2: Layout of the board.

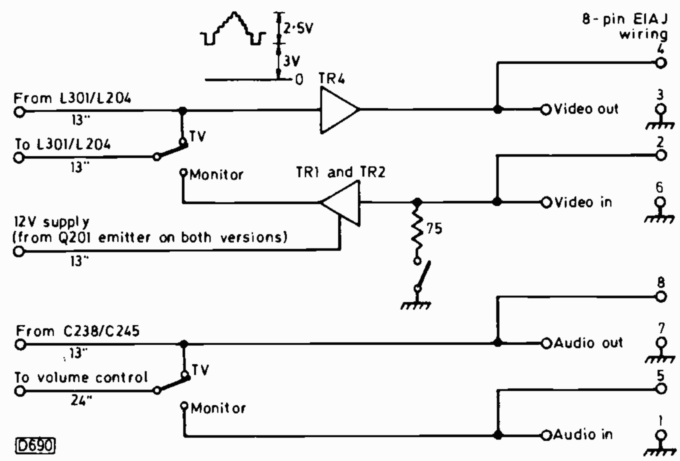


Fig. 3: Interconnections to the Sony Model KV2000 Mk II.

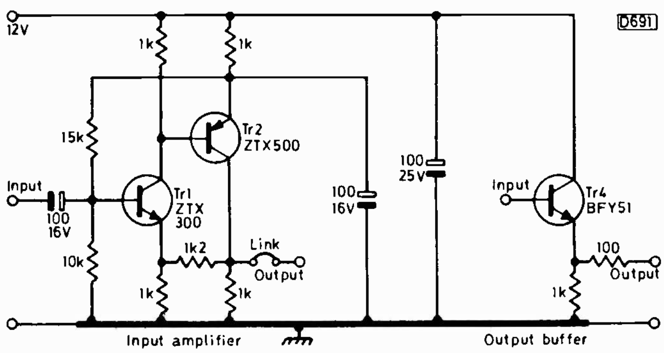


Fig. 4: Circuit as used with the Sony Model KV2000 Mk II. Link out the component positions not needed on the board.

output via 75Ω resistors to up to five parallel terminations.

The layout of the PCB is fairly critical: variations are not advised.

To avoid unnecessary work when converting a standard TV set for use as a receiver/monitor or a monitor only, the

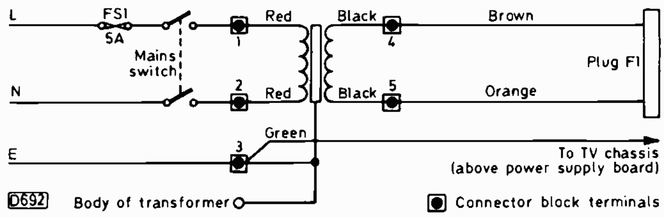


Fig. 5: Mains input wiring to the Sony Model KV2000 Mk II.

following requirements should be met. (1) The set must either incorporate a mains isolating transformer or be capable of running off one which can be housed within the cabinet. This rules out small-screen sets without transformers, and large-screen sets that use thyristor power supplies. (2) The detected video signal should be of the right polarity (video up, sync pulses down), and the sync pulse feed must be maintained when the set is switched to the monitor mode (in some Sony sets for example the sync separator is fed from a point in the a.g.c. circuit, so that the video feed to it in the monitor mode can be lost unless a lot of additional work is carried out). (3) The audio signal must be at a reasonable level at the point of interruption, and preferably not d.c. controlled. These are only general guide lines however.

Converting the Sony KV2000 Mk II

As an example of receiver/monitor conversion using the board, we'll take the Sony Model KV2000 Mk II. Just to make life complicated, there are two versions of this receiver, the first being used up to serial number 600,000. The circuitry we're concerned with is almost identical however, though the component reference numbers are different.

The basic interconnections are shown in Fig. 3 and the board circuit in Fig. 4 The detected video signal is taken via L301 (or L204 as the case may be) to the output buffer stage Tr4. The video input is taken via the wideband

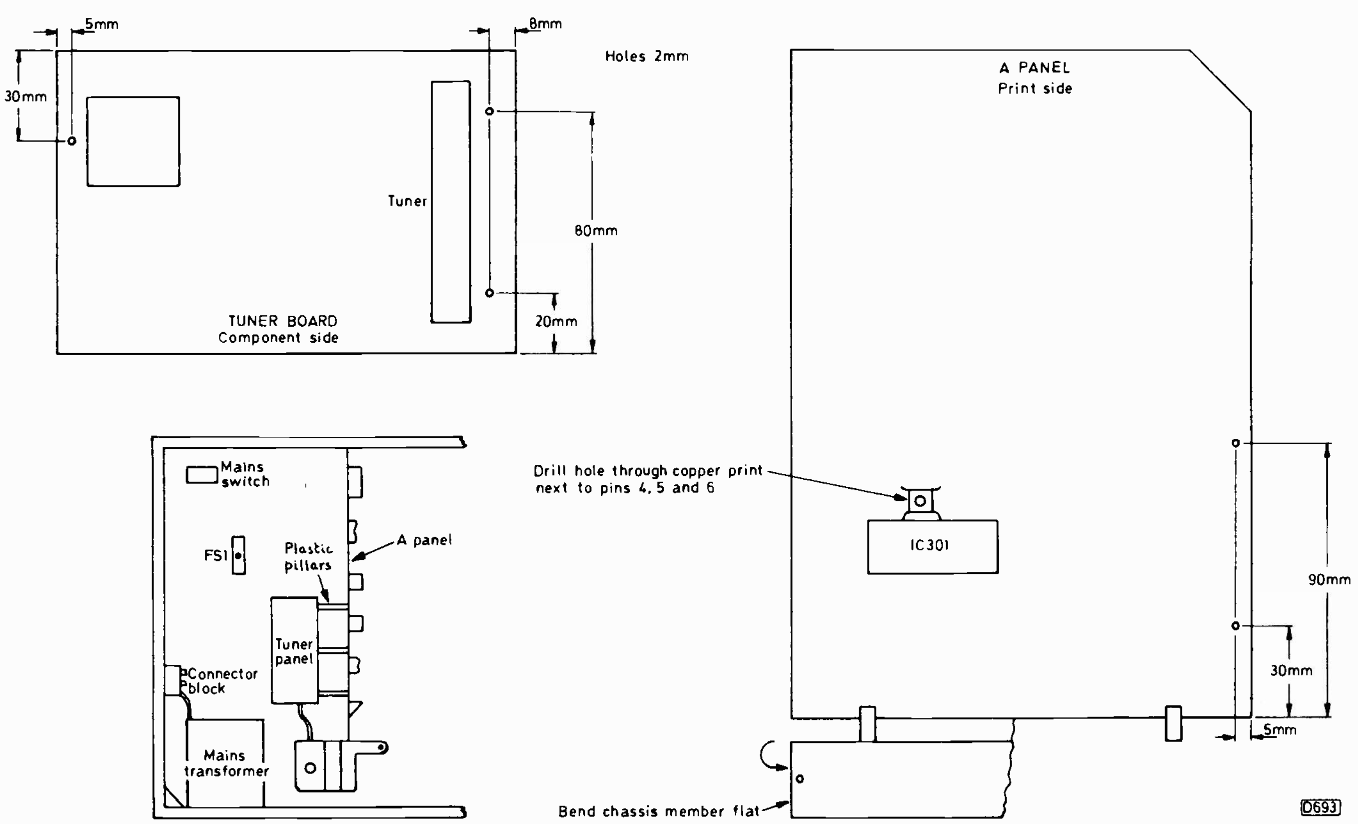


Fig. 6: Repositioning the tuner PCB in later versions of the Sony Model KV2000 Mk. II.

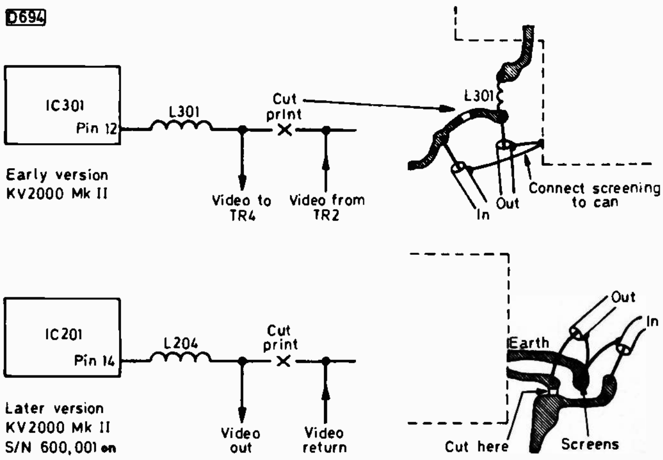


Fig. 7: Video connections to the Sony KV2000 Mk II – board viewed from the print side.

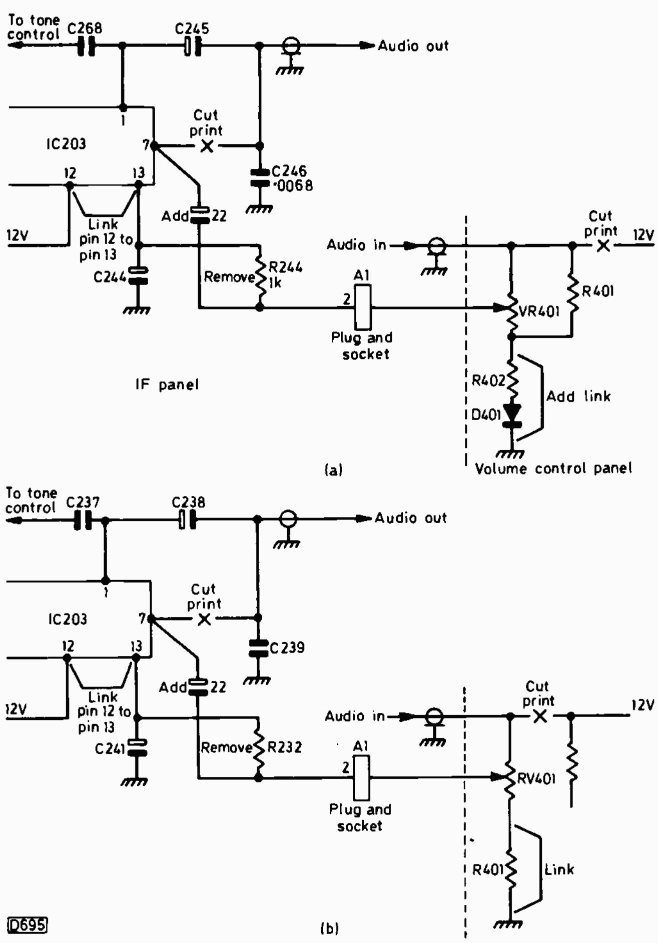


Fig. 8: Audio modifications, (a) early versions of the Sony Model KV2000 Mk II, (b) later versions.

amplifier Tr1/2 and the TV/monitor switch to the circuit print next to L301/204. The audio output is taken from C238/C245, while the input is fed via the TV/monitor switch to the volume control.

To carry out the conversion, first remove signals panel A. All the plugs and sockets are labelled, so there should be no difficulty. Then remove the two-core mains lead, replacing it with a three-core lead. Watch which way round the internal cable clamp is fitted. Add the mains transformer, bolting it down with ¾in. 2BA nuts and bolts – mount it as far over to the left as possible. You may have to remove the set's foot and cut part of it away when the transformer is fitted. Add a 1¼in. fuseholder and a 5A fuse – the RS type 412-677 fuseholder can be secured by a screw holding the tuner pushbutton assembly to the front fascia, at the bottom right of the pushbutton panel.

Wire the mains supply as shown in Fig. 5, using a five-way connector block to link up with the transformer's flying leads – this can be screwed to the side of the cabinet. Earth the transformer body, screen winding and the TV chassis. A convenient point to earth the chassis is at the metalwork above the power supply board, where a black wire connects to the tube's screening plate. The chassis is now isolated.

In earlier versions with a smaller tuner panel the transformer can be fitted without moving this panel. On later versions the tuner panel will have to be moved. The details are shown in Fig. 6. Drill the holes required with a 2mm or 1/8in. drill, and fix the panel with 6BA self-tapping screws and plastic pillars (RS type 543-743). Bend the chassis member flat to avoid catching the transformer, and take care when drilling the location hole next to IC301 – i.c.s don't work too well with holes in them . . . The bit of print next to pins 4, 5 and 6 is well defined and you can't miss it (famous last words).

The video modification is straightforward. Fig. 7 shows the print cuts required – next to inductor L301/L204. In the early version, connect the video cable screens to the adjacent screening can: in the later version there's a convenient bit of print nearby.

The audio modification is more complicated since the circuit must be changed from a d.c. volume control arrangement to an in-line signal contol system. The circuit changes are shown in Fig. 8, and are very similar. Cut the print about 3/8in. from pin 7 of IC203. It's easy to find. Remove R244/R232 as the case may be and wire a 22μF, 25V electrolytic capacitor between the input end of the vacated resistor position and the print adjacent to IC203 pin 7. Sleeve the capacitor's leads to prevent shorts to the rest of the circuit. Link pins 12 and 13 of IC203 together with a bit of solder – this sets the amplifier in the chip at full gain.

Remove the volume/picture control panel. Cut the print at the top of the volume control – make the gap about 1/16in., as you are isolating the control from a power supply. Connect the audio lead, with the screen to the earth print, remove R401 or R402/D401, and add a wire link across the R401 or R402/D401 positions to earth the bottom end of the control. Return the panel to the set.

The set's tone control will affect the audio output signal. This can be useful for cutting down hiss and the excessive h.f. you would have if the control was removed. I use this output to feed a hi-fi installation, and the results are superb. The intercarrier sound channel in this set is so good that all traces of video buzz are removed, leaving crisp, clear sound.

The wire from the slider of the volume control to plug A1 is not screened, and can pick up fields from the timebases. I don't normally screeen the lead when carrying out this conversion, but I do dress it carefully, which is usually satisfactory. If you prefer to replace the lead with a screened cable however, be my guest.

The connector panel used is a matter of preference. I normally use a 5 × 4in. panel, with the video amplifier panel mounted on this with stand-off spacers. I use BNC connectors for the video input/output, and 3·5mm jacks for the audio in/out. Also a double-pole changeover switch for TV/monitor, and the same for a terminate switch if fitted. I've included in Fig. 3 the connections to an 8-pin EIAJ socket which can be fitted for use with U-matic video recorders.

The panel can be fitted to the back cover of the set – there's plenty of room. Fig. 3 includes lead lengths for this type of fitting. Miniature screened cable is used for the audio connections, and RG174 miniature video cable for the video wiring.

The Sony KV2000 Mk II makes an excellent receiver/monitor for colour video use. I think it's one of the best chassis to use for this purpose. The 9in. Sony Model KV9000 can be similarly adopted. The KV2000 Mk. I is difficult to convert due to the sync problem mentioned earlier.

Finally, a commercial. If anyone has difficulty in getting the bits – the special squat mains transformer and any other parts – these can be obtained from B and B Electronics, 64 Manners Road, Balderton, Newark, Notts. Telephone Newark 76895.■

Latest VCRs

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

HITACHI VT5000

THE Hitachi VT5000 VCR's fascia has what one would call style, with light and dark grey tones and graceful lines. It certainly looked nice on the shelf, and my wife compared it favourably with other machines we've had for examination.

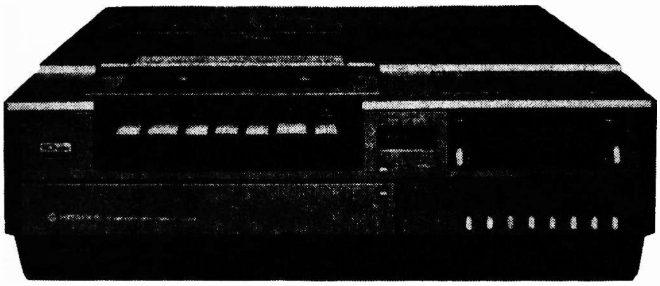
The clock has a preset on and off time, and can be set up to nine days in advance. This is more than earlier models from other manufacturers using the VHS format. It has an 0000 counter memory, and the single press to record button that's now become standard practice.

Unless there was a fault present in the machine I had for a few days, the VTR/TV switch was most interesting. It had no effect in the play mode, when all three programmes plus playback on the allocated channel could be had. I liked this. At least after an off-tape replay I could switch the TV set back to an off-air programme by means of the remote control unit, without having to get up and cross the room in order to press a button – this in fact is similar to the Philips VCR. If the VTR/TV switch is put in the TV position when a recording is being carried out, the monitoring output signal disappears but reception of the transmitted signal remains unaffected.

The instruction booklet is clear, with helpful diagrams, except for the part dealing with the VTR/TV button. It says that if you want the transmitted channels select TV, the machine returning to VTR when you press the cassette play button.

On a subjective assessment, the replayed pictures were average for a VHS machine. There was significant drop-out on the tape supplied, at least towards the beginning. This could have been due to greater usage at the beginning than at the end. My experience to date with VHS machines and tapes tends to confirm that tape drop-out (white spots flashing about) increases with use, pushing cassettes into early retirement.

There was some cross-modulation in the tuner – as if video was present on the sound, producing buzz. The tuning unit is rather flimsy, and very loose when withdrawn to carry out tuning. This lets down the otherwise rugged overall construction.



The Hitachi VT5000 VCR.

The external video and audio connections are all made via phono sockets. The inputs are switched, eliminating the need for tuner-auxiliary switching. I don't myself think it was a wise decision to have the same type of connections for video and audio.

I took a look inside the machine and found the construction good. The casing is made of plastic, with rigid cross struts. There's a screening shield around the head drum to give protection.

The power unit is compact and looks a bit difficult to get at for servicing. This is not true of the main circuit board, which is sturdy and well labelled. An interesting feature is that the main preset controls – head switching, capstan speed, record timing etc. – are all in a row, clearly labelled and accessible. A belt change would be a major operation, though not too impossible.

To sum up, the Hitachi VT5000 is a good-looking machine with excellent styling, but some improvement to the video noise level on playback and a bit more edge ringing to sharpen the picture would give better results. Production machines ought to come through better aligned: there's still some way to go before the VT5000 matches the standard set by the Panasonic NV8610 (I tried the two of them side by side).

A LOOK AT THE PHILIPS VR2020

I recently had an opportunity to try out the new Philips VR2020 VCR – and what a fantastic machine it is! It did everything it was supposed to do, and more. You'll by now be familiar with the dynamic track following technique used (see September 1979 issue, page 574), which is similar to the Ampex AST (automatic scan tracking) system used on broadcast VTRs. The new VR2020 has no tracking control, and can operate in the fast forward or rewind modes at a slow rate with the tape threaded or at a fast rate unthreaded. A future model will provide pictures in slow motion, still frame, and intelligible pictures in the fast foward and rewind modes with the tape threaded. Such is the adaptability of DTF.

The self-seeking tuner seems to be a Grundig contribution to the system, and I'd suppose the same of the microprocessor deck control system.

A most impressive feature is the digital tape counter and programme finder. Every time a cassette rewinds to the beginning, the counter is set to 0000. Thus every cassette has a start datum point, and the beginning of each recording can be logged with the counter number. Say a recording starts at 1236 for example. To find this the go-to button is pressed and the number 1236 entered on the keypad. The VR2020 will then either rewind or move fast forward to position 1236 and stop, no matter where it was on the cassette when the instruction was given.

The V2000 VCR system has been designed for further development – additional features etc. – during the 1980s, and we shall hear more about this when production VR2020s are released in quantity later this year. Already the VR2020 has optional audio/video input/output add-on units, and optional add-on remote control.

Long-distance Television

Roger Bunney

F2 RULES o.k., and BBC TV has started broadcasting internationally – the conditions during October 1979 have been such that Crystal Palace ch. B1 has been transmitting to the world! At the time of writing conditions are still improving, and it's likely that new records will be broken. The coverage of ch. B1 has included the Americas, Africa and Australasia, and Anthony Mann reports that on October 27th BBC-1 on ch. B2 was received, both sound and vision, in the Perth, Western Australia area from 0900 to 1140 GMT. This seems to be a record, but with increasing m.u.f.s greater triumphs may yet occur.

Conditions have been improving in the UK, with US communications and other signals from the Middle East from about mid-September in the low 40MHz band, and occasional ch. E2 signals from Africa during the afternoon and evening. Hugh Cocks received an F2 signal from the SW, with the nowadays unusual RETMA test card, thought to be from Ghana.

There were several prolonged periods of F2 propagation with African ch. E2 signals during the first two weeks of October. Perhaps the reception on the 4th was the most spectacular, with at least two signals present until after 1800. Rhodesia ch. E2 was present here at Romsey until 2030, and at Hugh's location produced reasonable sound and vision. One test pattern signal that's been received on several occasions seems to be from a faulty transmitter, with fluctuating video modulation, flashing and general disturbance. We think it may come from Ghana.

The southerly African signals faded away after the 14th, to be replaced by really high-level ch. R1 F2 signals from distant parts of Russia. It's simpler to list the days when I didn't note signals – the 25th and 30th! Conditions have been too good, in that within five minutes of F2 signals appearing on a previously dead channel it has been completely jammed with signals, making identification impossible. The first five minutes and the fade out of the last signals at the minimum F2 skip distance produce the best quality signals. More than four signals have usually been present within the first few minutes of a typical F2 "opening", with an excess of other Russian signals of the communications/military type jamming adjacent frequencies down through ch. B1. This latter effect gave problems with the next spectacular item on my list.

Australian TV Received in the UK

I didn't return from work on the 27th until 2030. At 2031 Hugh Cocks rang to report reception of the Australian ch. A0 (46·25MHz vision, 51·75MHz sound). Hugh noted signals from the NE from 0917 to 1050 GMT, sufficiently strong for the programme content, apparently Kojak, with captions at 0930, to be observed. The video buzz was first audible on a radio receiver (much narrower bandwidth). Next morning I wasn't at work, and started tuning carefully following the appearance of the by now familiar jammed ch. R1. Soon after 0800 Hugh rang to report that the ch. A0 video buzz was audible, and I eventually managed to lock the syncs and observe real Australian TV. At least the raster locked, and vague images could be seen moving about, but due to the interference from the other signals present the ch. A0 reception was difficult.

Two of my tuners go to just under ch. E2, and I found it best to use an upconverter to ensure that I could tune through ch. B1 – BBC itself couldn't be seen due to the heavy interference from the other signals present. The receiver I was using was the ubiquitous Bush TV125, fed via a Philips G8 i.f. selectivity module, with the i.f. strip in the receiver operating in the narrow-band mode. The bandwidth was down to about 2MHz maximum in fact. This made resolution of the vision possible – on a KB Featherlight with the full 3·5MHz bandwidth the vision could not be resolved. The signal strength, as heard on a receiver tuned to the vision carrier, was relatively strong and consistent, but it was extremely difficult to display the video on a TV screen.

Confusion and Puzzles

There's been plenty of scope for confusion during this recent F2 activity. Along with some of the strongest TSS (Russian) signals, there have been SpE signals from SR (Sweden). The latter can cause confusion by displaying a clock with "UR" identification. Both RAI (Italy) and RTVE (Spain) have been present during the F2 openings, causing confusion when on programme. One signal that puzzles us appeared on ch. E2 on the 23rd, from about 1840 GMT. It consisted of a pulse and bar pattern and was of the F2 type, fluctuating in and out all morning. It was eventually seen going on to the PM5544 test pattern at 1300, with programmes starting at 1330. Hugh thinks it was from Dubai on the Gulf. Several readers have commented on the speed at which an F2 opening establishes itself – from the onset of signals at noise level to perhaps 0·5mV within five minutes, followed by jammed channels.

More Startling Reception

The recent conditions have meant much interference on ch. B1. I recently heard police in the St. Louis area discussing a felon who'd acquired several hundred thousand dollars in cheques! Ian Roberts reports from South Africa that the m.u.f.s to the north have risen above 70MHz daily. His latest catches have included RTP (Portugal) ch. E2 and several stations in the E. European f.m. band (68-72MHz). He also reports that a Salisbury, Rhodesia 432MHz beacon (radio amateur) and two Pretoria, SA 144MHz beacons have been received in Athens. Chris Wilson (Potters Bar) has monitored both US and UN forces carrying out radio tests in the Sinai between 45-47MHz. On the 22nd he heard signals at up to 54MHz. He observed the ch. E2 signal (Middle East?) mentioned above, saw four large Chinese characters on ch. R1 on the 17th at 0720GMT, and heard various N. American radio amateurs on the 20th operating at 50MHz.

Summary

On one occasion I noted a very weak ch. R2 vision signal via F2, but at the time of writing (30th) I've yet to receive the widespread ch. A2 signals. To sum up, the past month has been spectacular indeed, and there's every chance of even better things over the next four-five months.

It Wasn't Gabon!

Further information has been sent by Kevin Jackson (Leeds) on the subject of the reception previously presumed to be from Gabon. The card was a long disused Czechoslovakian one, but it seems that the pattern is resurrected at times for use by links within the OIRT network. The reception was apparently on ch. R2, and the signal is most likely to have come from Czechoslovakia. This view seems to be confirmed by the fact that a Doncaster DX-TV enthusiast received the same card at the same time, with the heading OIRT in white letters. So it seems that Gabon ch. E3 has yet to make it to Europe.

Satellite News

The famed ATS-6 satellite has now been switched off, due to three of its four station keeping thrusters failing. The Russian 714MHz direct broadcast satellite Stat-T, which is just over our horizon, has been causing problems in China. It's putting out such a strong signal that interference has been caused to radio services in Peking. An official complaint has been made. Since normal Yagi aerials are used to receive the signals, a high field strength is necessary.

Steve Birkill reports that the Stat-T satellite was launched as part of the Ekran series. An Ekran-class Stat-5 craft was launched into orbit at 55°E on February 21st 1979, and is expected to transmit at 714MHz and 4GHz. From the Southampton area, the craft is at an elevation of 12°, 116° from north. I and others have looked for signals, but with no results to date.

Publications

Amongst the various publications available from the IBA free of charge is one entitled "Overseas Television", an alphabetical listing of the World's countries and their TV transmission standards. There's also a colour information sheet on their new electronic test pattern, type ETP1. Available from Engineering Information Dept., IBA, Crawley Court, Winchester, Hants SO21 2QA. The Irish broadcasting service RTE has published a colourful and informative booklet which contains a potted history, details of current activities, a transmitter map, plans for the future, etc. It's interesting reading and a useful reference book. Available from Publications Dept., RTE, Donnybrook, Dublin 4, Eire.

From our Correspondents...

The current F2 conditions have meant a record post bag. It's possible to mention only a few letters therefore.

Denis Kenneally (Midleton, Co. Cork) has had great success with SpE reception during the summer months, using a Bush 12in. portable with v.h.f./u.h.f. tuner – and only the set's telescopic aerial. This shows the signal strengths that can occur at times. He's seen signals from much of Europe at v.h.f. For u.h.f. reception, he's using a Vorta VP91 aerial plus Wolsey amplifier. Many UK stations have been logged.

M. Baldwin has received signals from many European countries, including YLE (Finland), using an upconverter with his u.h.f. only receiver. The KRS3 identification he saw comes I think from Czechoslovakia. Roger Powell (near Abindgdon) has been receiving Lopik ch. E4 and asks

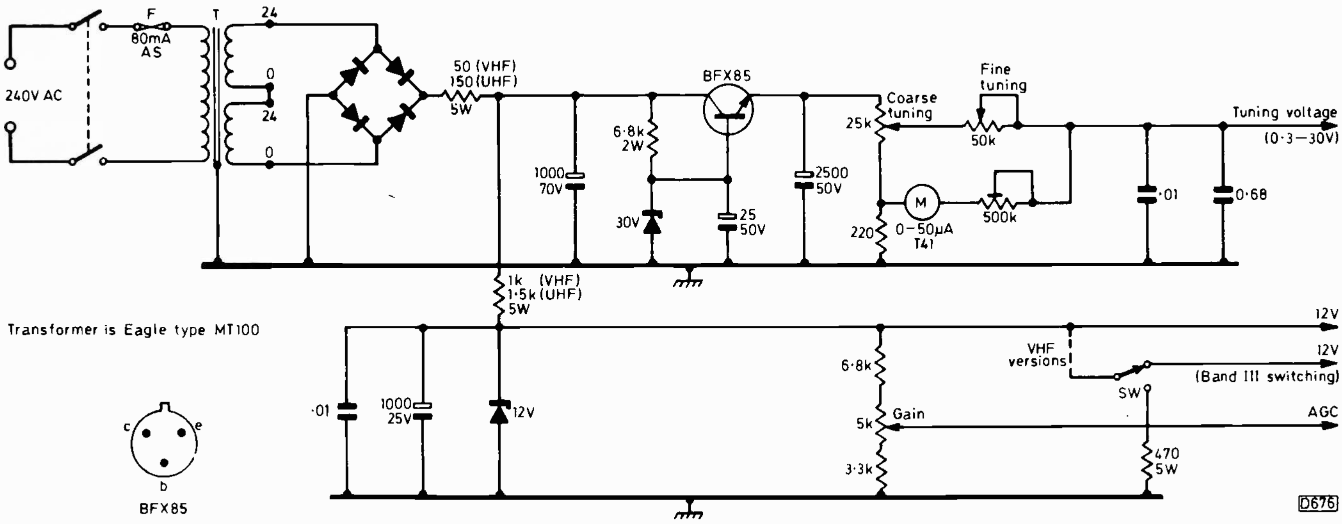


Fig. 1: The original varicap tuner power supply circuit devised in 1973.

whether the characteristic slow fading and rising signal strength indicates tropospheric propagation. Yes. He's heard from the IBA that the new ETP1 pattern will not carry any identification for individual regions. A pity.

Christian Mardon, 28 Rue Baudry-Lacantinerie, 33100 Bordeaux-Bastide, France would like to contact an experienced UK DX-TV enthusiast to exchange news etc. John Tellick reports that during a recent visit his Brussels hotel room had a TV outlet providing the Belgian BRT 1 and 2 and RTB 1 and 2 networks, Luxembourg, Dutch 1 and 2, Germany 1, 2 and 3 and France 1, 2 and 3, the latter converted to system B PAL. Apparently BBC-1 and 2 and ITV are to be added. He saw several PAL/SECAM sets in a Calais supermarket.These also operated on system I, but the price was around £610 for a 26in. model.

Cable TV is increasing in popularity in Austria, Vienna already having a five-channel system. Thirteen channels are planned for the future, plus up to fourteen radio channels. The connection charge is £92 and the monthly rental £3.50.

30-50MHz Receivers

In the September 1979 column I mentioned receivers covering the 30-50MHz band available from Allan Electronics of Whitley Bay. This firm is no longer able to supply these receivers.

DX-TV for the Beginner – 5

When it comes to tuning, it's best to be able to sweep cleanly over the frequency band of interest: fewer signals are missed, and the whole band can be monitored in a matter of seconds. This is easy to arrange with a varicap tuner, and by using an upconverter you can tune across the v.h.f. bands using a u.h.f. tuner. The operation of a varicap tuner is based on the use of variable-capacitance diodes in the tuned circuits. The capacitance of these devices depends on the reverse bias applied to them, so by altering the bias you alter the tuning. All you have to do therefore is to supply the correct voltages to the varicap tuner.

The voltages normally required are a 12V supply, a gain/a.g.c. bias voltage of 2-8V, a 12V supply for band switching in the case of a v.h.f. varicap tuner, and a tuning voltage of 0·3-30V (stabilised and hum free of course!). In the case of an integrated v.h.f./u.h.f. tuner, an extra switch position is required to provide a further 12V feed for v.h.f./u.h.f. switching.

Varicap tuners are nowadays readily available and

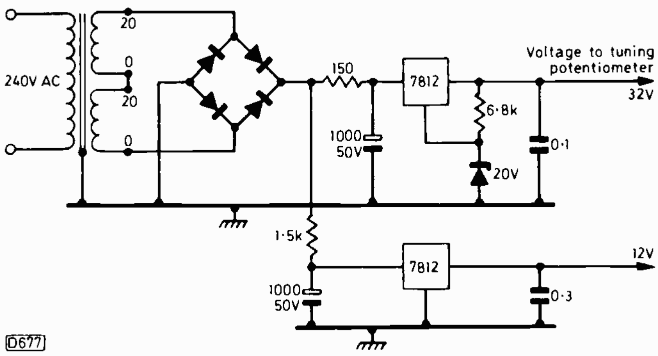


Fig. 2: I.C. stabilised varicap tuner power supply circuit devised by Robin Crossley.

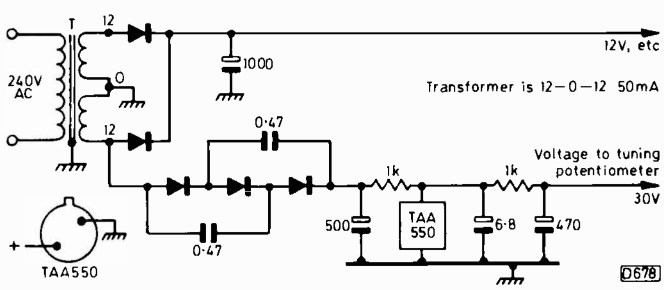


Fig. 3: Hugh Cocks' varicap tuner power supply circuit, with 12V transformer and voltage tripler system.

inexpensive. Sendz Components for example regularly advertise in the magazine some ten or so types of varicap tuner for v.h.f. and u.h.f. operation, and it's up to the individual whether you decide to buy two separate tuners for v.h.f. and u.h.f. operation, an integrated v.h.f./u.h.f. type, or use a u.h.f. tuner with a upconverter. The use of an integrated v.h.f./u.h.f. tuner instead of two tuners has the advantage that the installation is simplified.

I first started using varicap tuners for DX-TV reception in mid-1973 (see article in the October 1973 issue). The original tuners are still in use. The power supply circuit I used is shown in Fig. 1. It's rather dated but there have been no faults in any of the six units I constructed. The only trouble that does occur from time to time is with the 270° carbon potentiometers. Dirt on the track can cause fluctuating tuning. This can be particularly troublesome at the l.f. end of the tuning range, where even a small spot of dirt will give abrupt tuning changes. The usual squirt of cleaner will cure this however. Alternative circuits are shown in Figs. 2 and 3.

I found that the most effective channel readout was a large-scale 4in. Adastra 50μA panel meter, the channels being noted on a table of readings alongside. A new scale could be devised, but in the event of using a new tuner or drift in the tuning diode characteristics the readings would change. A digital readout is another possibility, but cost may dictate the cheaper meter – though meters are anything but cheap nowadays. When I made the units in 1973, multiturn potentiometers were expensive. These days they can be obtained cheaply at surplus disposal depots, and this could be a more effective way of tuning – though not as fast as the two 270° potentiometers in series! I understand that Hugh Cocks has in stock a low priced 10-turn potentiometer with standard shaft, but the present price is not known.

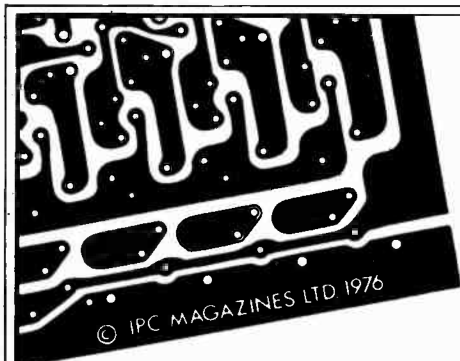
If you're reluctant to modify the existing receiver i.f. strip to get switched narrow/wideband operation, selectivity switching can be provided between the varicap tuner and the i.f. strip using the famed G8 selectivity module — which can be operated from the same power supply.

How the i.f. output from the external varicap tuner is fed into the set depends on the type of set. With an old all-valve receiver it's often possible to wind down the ch. B1 coils to the set's i.f., remove the h.t. feed to the triode oscillator in the tuner, and connect the varicap tuner's output to the set's aerial input socket. The valve tuner then acts as an i.f. preamplifier. Alternatively the signal can be fed to the v.h.f. tuner's i.f. input socket (where the tuner is of the type that accepts an input from a separate u.h.f. tuner). Or, with reduced gain, the output from the varicap tuner can be fed directly into the i.f. strip. D.C. isolating capacitors of at least 400V a.c. rating must be used in both the signal and earth connections between the external tuner and a mains-operated TV set. Care is required with any modifications to live-chassis, mains-operated sets. If in doubt, don't.

I usually operate with at least 18dB preamplifier gain ahead of any tuner. It might be found that with optimum gain there's a tendency for cross-modulation of a strong local signal on to adjacent channels. If this problem is experienced, a reduction in gain will usually offset the problem with minimal reduction of the wanted weaker signal.

Sources of supply: tuners, Sendz and Manor Supplies; meters and transformers, Maplin Electronics; G8 modules, Manor Supplies or Hugh Cocks. I understand that Hugh is willing to construct one-off tuner units – send s.a.e. with any enquiries.

In the concluding instalment in this series for beginners we'll deal with preamplifiers and simple interference problems.



TELEVISION
READERS PCB SERVICE

All boards are epoxy glassfibre and are supplied ready drilled and roller-tinned.
Any correspondence concerning this service must be addressed to READERS' PCB SERVICES LTD, and not to the Editorial offices.

Issue	Project	Ref. no.	Price
November 1976	Ultrasonic Remote Control	D007/D008	£3.24 per set
December 1976	IC Sound Circuits for the Constructor	D009	£1.44
		D017	£1.44
March 1977	Teletext Decoder Power Supply	D022	£3.24
May 1977	Teletext Decoder Input Logic	D011	£10.53
May 1977	Single-chip SPG	D030	£3.30
June 1977	Wideband Signal Injector	D031	£0.79
June 1977	Teletext Decoder Memory	D012	£8.51
July/Aug 1977	Teletext Decoder Display	D013	£8.62
August 1977	Logic State Checker	D038	£1.70
September 1977	Teletext Decoder Switch Board	D021	£1.43
September 1977	Teletext Decoder Mother Board	D027	£4.36
October 1977	Teletext Decoder IF Board	D041	£6.50
Feb/March 1978	On-Screen Clock	D045	£7.03
April/May 1978	CRT Rejuvenator	D046	£2.76
May/June 1978	Test-Pattern Generator	D048	£9.15
Aug/Sept 1978	Diagnostic Pattern Generator	D051	£8.62
October 1978	Colour Receiver PSU Board	D052	£3.83
January 1979	Colour Receiver Signals Board	D053	£10.75
February 1979	Commander-8 Remote Control System	D054/5	£5.43 per set
March 1979	Colour Receiver Timebase Board	D049	£17.13
July 1979	Colour Pattern Generator	D062	£13.50
		D063	£9.15
September 1979	Teletext Decoder Options Board	D064	£8.50
August 1979	Teletext Decoder New Mother Board	D065	£5.00
August 1979	Simple Sync Pulse Generator	D067	£4.00
September 1979	New Teletext Signal Panel	11331	£8.00
October 1979	Teletext Keyboard	D057	£3.50
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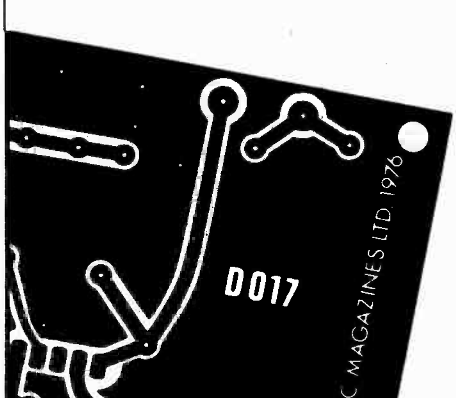

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ITT CVC9 CHASSIS

The trouble on this set is excessive height, with some strange voltages around the PCL805 field timebase valve – 200V instead of 90V at the triode anode for example. A new PCL805 has been tried but makes no difference.

Your fault is likely to be due to failure of either D57h (OA91) or R413h (200kΩ). These components are used in the circuit which mutes the sound at switch-on – until the line output stage comes into operation. They are fed from the boost rail, which also feeds the height circuit – hence the link. If the diode is responsible, the brightness will be excessive and its anode voltage in excess of 1V instead of 0·34V.

THORN 8500 CHASSIS

Despite replacing the e.h.t. stick and the components in the focus circuit, including the spark gap, the focus takes some four minutes to come right. The picture is quite acceptable apart from severe flaring when either the colour, brightness or contrast control is advanced.

The symptoms all suggest a low-emission c.r.t., especially as the picture flares with increased brightness/contrast. You've replaced all the usual causes of the problem except the c.r.t.

DECCA 30 SERIES CHASSIS

The picture is very blurred towards the bottom, while the width decreases progressively, with wavy verticals. The faults are less prominent with bright scenes, while they get worse the longer the set is left on.

The h.t. smoothing seems to be defective. Check the a.c. voltage at the anode of the h.t. rectifier D600 and multiply this figure by 1·4. A d.c. voltage something like the result of this multiplication should be present at the cathode of D600. If something more like half the a.c. voltage is present instead, the reservoir electrolytic C602 (400μF) is open-circuit. If the voltage at the cathode of D600 is roughly correct (about 300V) try connecting a test electrolytic across the smoothing section C601 (also 400μF). If this produces a noticeable improvement, replace C601/2. If the fault is still present however the smoothing choke L600 could be faulty or one of the line timebase valves could be suffering from heater-cathode leakage.

THORN 1500 CHASSIS

The trouble is excessive height – long faces, tops of heads cut off, and subtitles cut off at the bottom.

If the width is inadequate, attend to this first (the e.h.t. will be low). Try a new PL504 line output valve, check the setting of the width control R132 and the value of its series resistor R130. If the width is adequate, check the height control R94, the height stabilising v.d.r. Z1, and if necessary the field linearity controls R106 (main) and R104 (top). R106 could be open-circuit at one end of its track.

PYE 11U SERIES

Five minutes after switching the set on, the picture lines start to tear. Several minutes later this tearing becomes excessive, and eventually the line hold is badly affected. The effect seems to vary considerably with picture content however: a very simple picture is moderately stable.

This fault is caused by the 0·1μF coupling capacitor to the grid of the sync separator being leaky. It's C84, situated on the upper part of the panel to the left of the centre gap.

DECCA 30 SERIES CHASSIS

The problem of wavy verticals when the brightness control was advanced was cured by replacing the boost capacitor C436 (0·22μF). The capacitor I removed however was of a much lower value, and on several Bradford chassis I've serviced I've found that C436 is 0·03μF. I managed to check back to the original set with the wavy verticals fault and found that it worked all right with an 0·03μF boost capacitor. This seems strange!

Many thanks for the tip. The confusion over the boost capacitor value is because different components are used in the small screen (17 and 18in.) versions of the chassis and the larger screen versions. For the small screen versions the correct value is 0·033μF, for the larger screen versions 0·22μF. It's important to quote the model number or screen size therefore.

PYE 697 CHASSIS

When the set's first switched on, a greenish monochrome picture appears. About half an hour later a correct monochrome picture appears. After a further half hour or so, colour bars appear. These eventually lock into a colour picture.

You are suffering from a lame crystal oscillator! The initial green is characteristic of a stalled oscillator, while the colour bars are indicative of a gradual frequency drift towards the correct point, when the colour becomes locked. Check the d.c. amplifier transistor VT15, the oscillator transistor VT16, the tuned circuit capacitors C110 and 112 (both 390pF), and the varicap diode D18. The crystal itself can also play up. Gentle application of warm air from a hair dryer, followed by freezer from an aerosol, should help locate the component responsible.

GEC SERIES ONE

The trouble with this single-standard monochrome set is foldover at the top of the screen, with loss of height.

It's likely that the fault is in the linearity feedback circuit, and we suggest you replace the top linearity control P203 (1MΩ) and the 0·1μF capacitor (C213) connected from its slider to chassis. We assume that the PCL805 is in order.

THORN 8000 CHASSIS

The picture is cramped at the extreme right-hand side of the screen. Any ideas?

Temporarily disconnect the shift circuit choke L401 by disconnecting the shift reverse plug. If the non-linearity remains, check the scan-correction capacitor C407 (0·33μF) which could be leaky and adjust the linearity control L402 for optimum results.

GEC 2010 SERIES

The fault is that the picture keeps jumping up and down. A new PCL805 field timebase valve has been fitted, and the components in this area appear to be in order, but the fault persists.

We suggest you replace the field sync pulse integrating capacitor C156 (0·05μF or 0·047μF) and the cross-coupling capacitor C150 (0·005μF or 0·0047μF, 1·2kV peak). Then check the soldering to the PCL805's pins above and below the panel.

THORN 3500 CHASSIS

There are width problems on this set. When it's switched on from cold, the picture takes a long time to fill the last half inch of the screen on the right-hand side. Also on certain picture shots the width decreases, depending on picture content, by up to half an inch. An improvement was obtained by increasing the h.t. to 65V (from 62·5V). This fills the screen from switch on, but there's still variation in the width and in addition when there's excessive movement on the screen from top to bottom the width bounces.

It seems that the line timebase is heavily loaded. This can be confirmed by measuring the voltage across R907 on the beam limiter board. If the voltage is markedly above 1·3V with the beams switched off, suspect an incorrectly adjusted width control (L751A on the convergence panel) or linearity control (L503). Shorting turns on the choke (L504) in the shift circuit (remove it from the panel, then check the width), or leakage in the c.r.t. first anode supply components W505/C523 or the shift rectifier W506, could also be responsible. We don't recommend leaving the h.t. at its maximum permissible setting (65V).

GEC C2110 SERIES

The red output transistor TR303 was replaced, and after setting up the picture for a good monochrome display all was well, with perfect colour, for about half an hour. Colour was then lost, but was restored by slight adjustment of the set oscillator frequency trimmer C264. After a while however the colour became excessive, calling for adjustment of the colour control. This situation didn't last long, and on switching off for a few minutes then on again correct colour was obtained. The same thing then started over again. Before going to the trouble of changing i.c.s, your views would be welcome.

We wouldn't consider changing the reference oscillator i.c. until other possibilities have been exhausted. There's probably a dry-joint on one of the left-hand side boards, or a defective preset control whose wiper is not making proper contact with the track. Try gentle probing around the reference oscillator panel PC444, and check the set a.c.c. level control P251.

THORN 1400 CHASSIS

When the set is switched on, the picture jitters – it looks as if it's about to collapse to a horizontal line. The field and line hold are also unsteady. The picture improves if the set is left on for a quarter of an hour or so, but still remains rather jittery. On one occasion the raster did collapse to a narrow horizontal band about an inch wide. This was very dim, even with the brightness control turned fully up. The fault had gone after removing the back to make checks, but the picture was still jittery.

The fact that the line was dim when the fault occurred suggests a defect in the boost supply. The trouble is normally due to R133 (220kΩ), which feeds the height control, decomposing. Alternatively its associated decoupling capacitor C104 (1μF) could be leaky – check the value of R133 first however. It's also prudent to check the value of R72 (620kΩ) which is fed from the same point.

PYE 697 CHASSIS

The trouble with this set is intermittent loss of colour. Adjusting the tuning buttons has no effect on the fault, though changing channels or switching the set off and on again may restore colour – it never returns on its own. Sometimes the set works normally for several days, then the fault returns.

The most likely cause of the trouble is that the reference oscillator in the decoder is off tune. Adjusting RV10 should fix matters. When this control is correctly set to stabilise the colour, the voltage at TP5 (collector of the d.c. amplifier VT15) should be about 5V.

PHILIPS N1500 VCR

There's a tracking fault on this machine – a tracking line sometimes occurs about a third of the way up the screen when a recording is played back. The tracking adjustment control moves this line up and down but doesn't remove it. Switching off the VCR, removing the cassette and then replacing it and switching on again usually clears the fault. The machine was serviced and cleaned, which got rid of the fault for a few weeks, but now it's back again.

The trouble is due to the machine lacing the tape in slightly different ways each time. If the machine laces the tape in mode one during record and then mode two during playback, it will be impossible to adjust the tracking control so that the head follows the recorded tracks. Either mode is stable, so it's chance as to which mode the machine settles down in, though there may be a tendency for one mode to predominate.

The fault is due to dirt collecting on various parts of the tape transport system – follow the cleaning instructions given in the users' handbook or the manual. A very hard patch of dirt can collect unnoticed under bush 106 (shown as item B in Fig. 8 of the users' handbook, though the drawing is a poor likeness of the bush). The bush can be removed by inserting a small pair of pliers in the two holes at the top and unscrewing it, but doing this disturbs the lacing adjustment. It's best to clean the bush in situ therefore. If this fails to remove a very hard deposit, make a careful note of the position of the two holes relative to other parts of the machine, and count the number of turns required to unscrew the bush so that it can be returned to its original position after cleaning.

Sometimes lacing faults can be caused by the lacing cord springs being stretched beyond their elastic limits. Replacement is the only cure. With this fault however the symptom is usually confined to the bottom of the screen. Metering the servo system (see *Television*, February 1977, page 195) would probably help by giving an early warning of the fault described.

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TELEVISION JAN. 1980

DECCA 30 SERIES CHASSIS

The trouble is intermittent operation of the line oscillator circuit. The set usually operates correctly when switched on, but about one time in four the oscillator fails to start, resulting in no raster and an overloaded line output valve.

This trouble can usually be resolved by replacing C427 (470pF). It's essential to use a polystyrene or silver mica capacitor in this position. Less likely possibilities are the electrolytics C419 and C425 (both 5μF) in the oscillator circuit.

THORN 1590 CHASSIS

The raster suddenly dropped to about half the size of the screen, though the picture itself is still good.

It seems that the voltage on the set's l.t. supply rail is low. We suggest you check the connections to the AD149 series regulator transistor VT21. This is mounted on the large heatsink to the left-hand side. The troube could be nothing more than a dry-joint at the base or emitter pins, or a poor contact down to the panel pins. If all is in order here, check the AD149, its BC147 control transistor VT22 and this transistor's base circuit components – the "set h.t." control R104 should set VT22's base voltage at 5V.

RANK A823A CHASSIS

There's lack of width on this set – about half an inch is lost at each side of the screen. There doesn't seem to be any width control

Check the h.t.: there should be about 200V at fuse 8F3. If this is low, try adjusting 8RV1 (set e.h.t.). If this fails to produce 200V, check the reservoir/smoothing electrolytics 8C9/10, 8R6 (470kΩ) which could have fallen in value, and the control transistor 8VT1 which could be leaky. If the h.t. voltage is correct, the fault is in the line output stage. Check the shift circuit choke 6L26 which could have shorting turns, the flyback tuning capacitors 6C5/6, and try using a different width tap (pins 7-10) on the line output transformer.

TEST CASE

205

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.

One of the best known hybrid colour chassis is the Pye 691. It's found in various sets bearing the Pye, Invicta, Ekco and Dynatron brand names, and was the subject of one of Len Briggs' series of dealer lectures.

An Ecko set fitted with the chassis came into the workshop with the complaint "intermittent picture (raster)". The picture would sometimes appear normally after switching the set on, while at other times the viewer had to wait for ten minutes or more, while when the picture eventually arrived it was out of lock, calling for critical adjustment of the line hold control.

As luck would have it, the picture appeared after the normal warm-up time when the set was placed on the test bench and switched on, but there was no line lock. The picture could just about be locked by carefully adjusting the line hold control, but the control was pretty well at one end of its travel. The line oscillator circuit consists of the conventional PCF802 valve arrangement, with the pentode section of the valve acting as a Hartley oscillator and the triode section working as a variable reactance, under the control of the flywheel sync circuit, in the oscillator tuned circuit. The coil's core can be adjusted for optimum lock with the line hold control at its centre position – an operation that's best done with the line sync pulse input to the flywheel sync circuit removed.

Since the field lock was solid, it was assumed that the sync separator and sync pulse feed circuits were in order and that the trouble was in the line oscillator circuit. So the PCF802 was replaced and the coil adjusted with the line hold control in its centre position. On restoring the sync pulse feed however the locking was still weak, while the display tended to wobble sideways within the raster. The line hold control circuit was then checked, and it was found that R210, which is in series with the hold control, had increased significantly in value. After replacing this, no lock at all could be achieved within the range of the control. So a further adjustment of the coil was tried.

When the setting of this had been optimised under the new conditions, the lock was much more solid. But before there was time to do anything else the raster vanished! It didn't take long to establish that the line oscillator stage had failed completely. Switching the set off and then on again a few minutes later brought the raster back. What was the most likely cause of the trouble? See next month for the solution and a further item in the series.

SOLUTION TO TEST CASE 204
– page 98 last month –

When a TV set has had several years' busy use, the electrolytic capacitors are amongst the first components to become defective. Certainly where a fault is present any electrolytics in the circuit being checked are suspect. The technician delving into the intermittent colour tinting fault with the Decca 10 series chassis should not have overlooked the 5μF electrolytic (C214) which couples the blue signal to the base of the blue driver transistor TR207. This is a classic case where a dying electrolytic can cause problems.

The trouble was in fact eventually traced to this capacitor: heat and age had resulted in it drying up and becoming slightly leaky electrically. A replacement enabled the preset blue drive control to be set to the centre of its range, and restored the picture to its former glory. As a precaution, the equivalent electrolytics in the red and green channels were also replaced.

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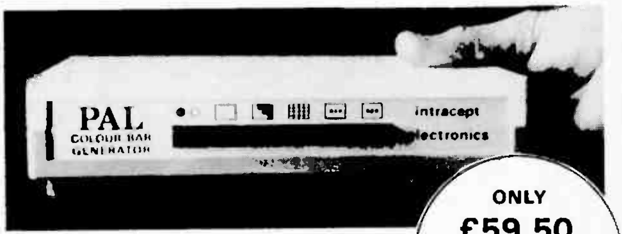

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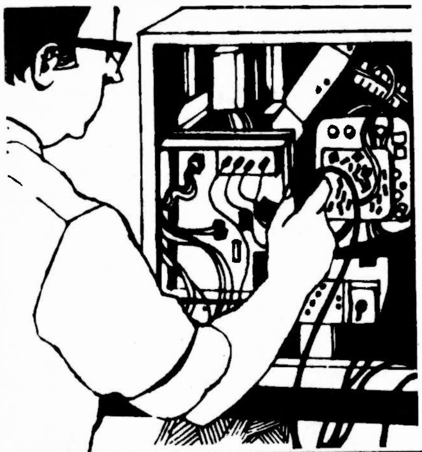

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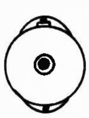

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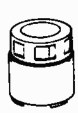

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