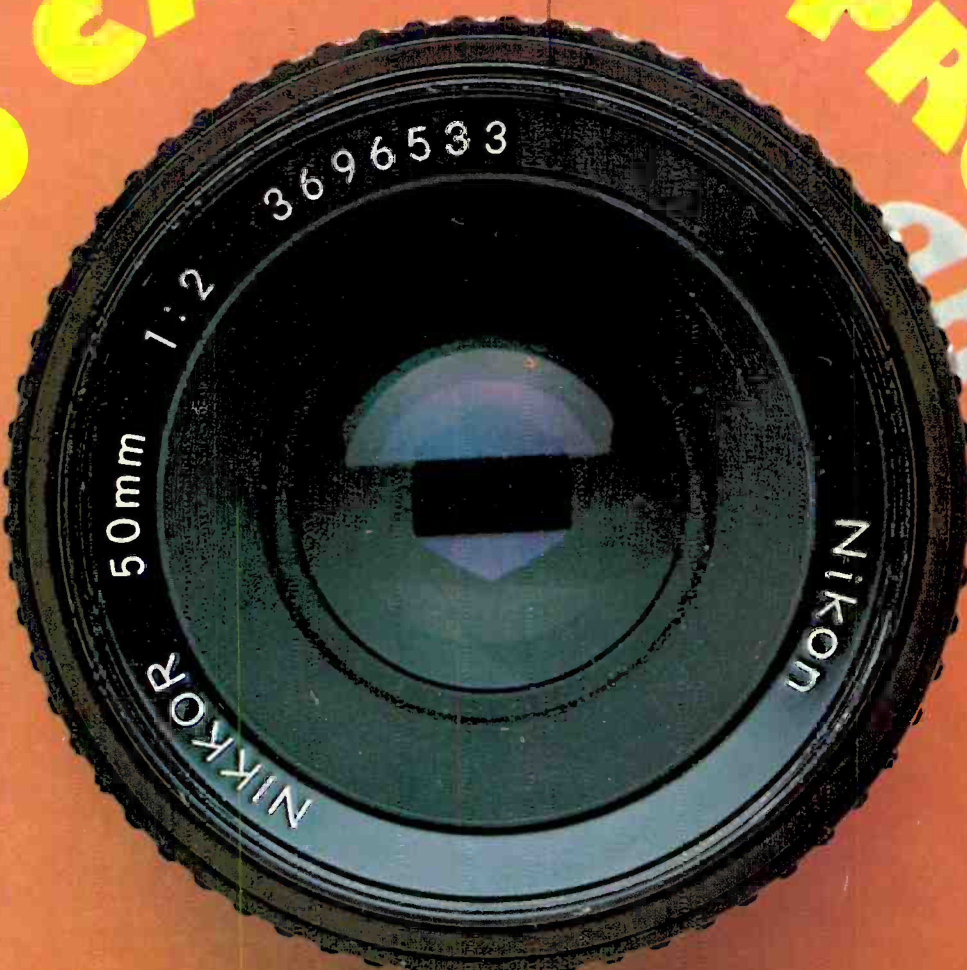
OCTOBER 1980
Australia $1.50; Malaysia $5; [O] New Zealand $1.60
60p

TELEVISION

SERVICING · VIDEO · CONSTRUCTION · DEVELOPMENTS

VIDEO CAMERA PROJECT



VINTAGE TV
VCR NO-COLOUR FAULTS
SERVICING THE INDESIT T12S
THE PHILIPS PROJECTION TV

TELEVISION

October 1980 Vol. 30, No. 12 Issue 360

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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An annual subscription costs £10 in the UK, £11 overseas ($24.20 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

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

this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 22

THE UNBEATABLE BRIARWOOD SERVICE

EX-EQUIPMENT SPARES

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

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

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

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

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

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

VALVES (MONO & COLOUR)

PCL82	0.10	30C1	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECL80	0.10
PCL83	0.25	30C17	0.10	30C15	0.10	EF184	0.10	6/30L2	0.10	PL509	1.00
PCL84	0.10	PCF802	0.10	30C18	0.25	6BW7	0.10	30PL1	0.25	PY500	1.00
PCL85	0.10	PCF805	0.25	PC97	0.20	EH90	0.10	30PL13/4	0.10	GY501	1.00
PCL86	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30FL1/2	0.25	PL508	0.50
PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
PCF801	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC81	0.10	EY51	0.15

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

WE DO NOT SELL RUBBISH AT BRIARWOOD TV

D/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	EHT	REG	CON	S/OUTPUT	POWER	L/TB	F/TB
Bush/Murphy	5.00	5.00	6.50	—	—	5.00	1.50	5.00	—	—
GEC/Sobell	5.00	5.50	—	—	—	5.00	—	—	—	7.50
Philips	5.00	7.00	—	—	—	5.00	—	—	—	5.00
Decca	5.00	9.00	9.00	—	—	5.00	2.00 (19" only)	6.00	—	5.00
Thorn 2000	5.00	5.00	5.00	6.50	6.50	7.00	—	6.50	10.00	5.00
Pye	7.00	6.00	7.00	—	—	5.00	—	—	—	5.00
Baird	6.50	8.50	7.00	—	—	5.00	—	—	—	5.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	VIDEO	CON	POWER	L/TB	F/TB
Bush 184	9.50	—	12.00	—	6.00	6.00	12.00	—
GEC Hybrid	6.00	6.50	9.00	—	5.00	—	—	12.00
Philips G6 S/S	9.50	—	10.00	—	5.00	—	—	6.00
Thorn 3000	6.00	6.00	6.00		5.00	20.00	20.00	6.00
Pye 691/693	6.00	6.00	8.00	—	5.00	—	15.00	5.00
Thorn 3500	6.00	6.00	6.00	6.50	12.00	20.00	20.50	6.00

Korting and other foreign panels available on request.

Postage & Packing £1.25

COLOUR TUBES

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

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

COLOUR TUNERS

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

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

COLOUR LOPTS
Most Lopts available from £5.00. Both British & Foreign makes. Please ring or write.
P&P per Lopt £1.

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

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

CALL IN AND SEE 100's OF TOP QUALITY COLOUR TV's ALWAYS IN STOCK

All with good tested tubes • Clean cabinets complete • All sets ready for inspection

OPENING TIMES MON-FRI 9.00-12.00/1.00-5.45 (CLOSE 4.30 SAT)

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

BRIARWOOD

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
8C113	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

SPECIAL OFFER

Philips PL802 2.55

E.H.T. TRAYS MONO

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

E.H.T. TRAYS COLOUR

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
ITT/KB CVC 5/7/8/9	5.10
RRI (RBM) A823	5.00
Bang & Olufsen 4/5000 Grundig 5010/5011/5012/6011/6012/7200/2052/2210/2252R Tandberg (radionette) Autovox	6.60
Grundig 3000/3010 Saba 2705/3715 Telefunken 709/710/717/2000	6.80
Korting	6.80

P & P 75p per order.

All transistors, IC's offered are new and branded. Manufactured by Mullard, I.T.T., Texas, Motorola etc. Please add 15% VAT to all items and overseas at cost

P & P U.K. 50p per order, overseas allow for package and postage. Cash with all orders. All prices subject to alteration without notice.

TELEVISION SALE
DISCOUNT FOR QUANTITY

BRIARWOOD'S UNBEATABLE OFFER TO THE TELEVISION TRADE COLOUR SETS WITH TESTED TUBES & GUARANTEED COMPLETE

	IN 10'S	IN 20'S	GOOD WORKING IN 10'S
PYE 691	£18.00 EACH	£15.50 EACH	£33.00 EACH
BUSH 184	£23.00 EACH	£21.00 EACH	£38.00 EACH
THORN 3000 25"	£23.00 EACH	£21.00 EACH	£38.00 EACH
KORTINGS	£23.00 EACH	£21.00 EACH	£43.00 EACH
TELPRO	£23.00 EACH	£21.00 EACH	£38.00 EACH

***COLOUR T.V'S AS THEY COME COMPLETE BUT WITH UNTESTED TUBES @ £13.00 IN BATCHES OF 10'S.**

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
Colour	
Bush A823	72p
Pye 723 27Ω+56Ω	57p
GEC 2110 –41Ω	45p
GEC 2110 –12R5+12R5	47p
GEC2110 –27R5	45p
Thorn 3500	58p
Thorn 8000	58p
Thorn 8500	54p
Philips G8 47R	30p
Philips G8 2.2+68	42p

All plus VAT at 15%

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

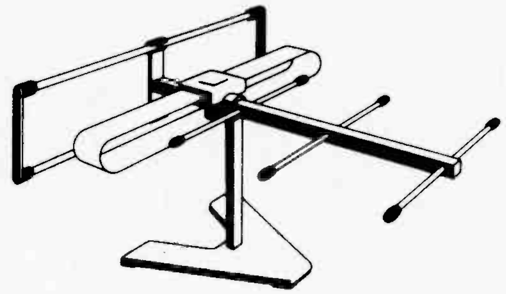
EXPORT COLOUR & MONO T.V.s AVAILABLE READY FOR USE OVERSEAS

TELEVISION

Briarwood House Preston Street
Bradford West Yorkshire BD7 1NS
Tel. Bradford 306018 (STD code 0274)

BRIARWOOD TELEVISION LTD

Britain's Mail Order TV Specialists



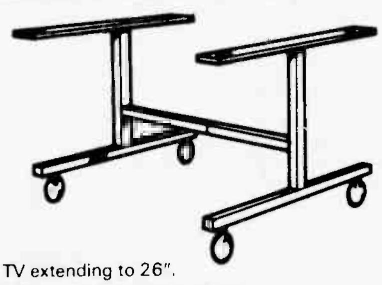
Wide band aerial for all UHF TV transmissions **£2.50** + P&P £1.00

Mail order offers only.
Good, Fully working Colour TV's
– Engineer tested before despatch.

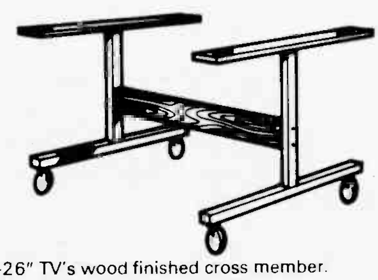
THORN	3000	19″ @ **£70.00**
THORN	3000	25″ @ **£60.00**

PYE	691	22″ @ **£55.00**
PYE	691	26″ @ **£55.00**
PYE	697	22″ @ **£65.00**
PYE	697	26″ @ **£65.00**
BUSH	184	19″ @ **£70.00**
BUSH	184	22″ @ **£70.00**
BUSH	184	26″ @ **£70.00**
PHILIPS	K70	22″ @ **£80.00**
PHILIPS	K70	26″ @ **£80.00**
GEC	2040	19″ @ **£55.00**
GEC	2040	22″ @ **£55.00**
GEC	2040	25″ @ **£55.00**
GEC	2040	26″ @ **£65.00**
KORTING		22″ @ **£70.00**
KORTING		26″ @ **£80.00**

Please note there is 15% V.A.T. on all the above prices. Plus £10.00 p & p ENGLAND, WALES AND SCOTLAND. Inland N & S IRELAND **£15.00**



For any TV extending to 26″. All metal frame **£7.80** + P&P £1.75



Fits 22″-26″ TV's wood finished cross member. State size required **£5.75** + P&P £1.75

Good working Mono TV's
PYE, GEC, BUSH, etc.

20″ & 24″ S/S	**£15.00**
20″ & 24″ D/S	**£14.00**
19″ & 23″ D/S P/Button	**£12.00**
19″ & 23″ D/S Rotary	**£8.00**

Cheques, P.O. or Cash with orders please
P & P £5.00 for Mono TV's to England, Wales and Scotland.
(Inland) N & S Ireland £7.00 per set.

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

Why we take with rin

Swing a 1lb steel ball from 6ft against a TV tube without a rimband and it'll go off like a grenade.

That's how vital a correctly fitted rimband is to tube safety.

But if it's not taken off during re-processing, the high temperature could cause the adhesive resin to fail.

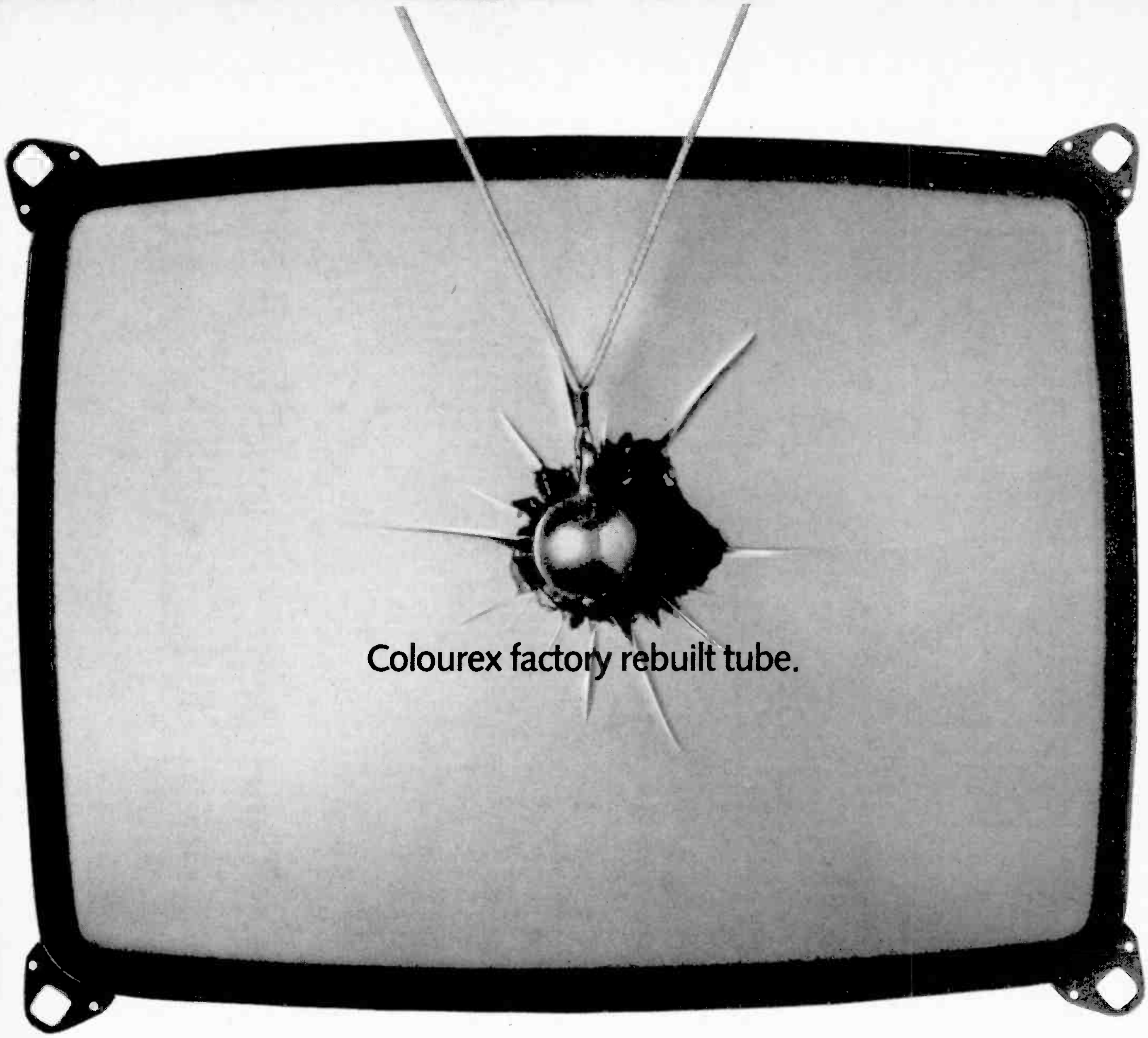
A defect that could turn out to be just as dangerous.

However, when tubes are being reprocessed at Mullard's factories every care is taken with rimbands.

With a new Mullard gun inserted the tube is pumped at a high temperature, ensuring a lasting quality picture.

One which, however closely he looks,

Colourex stockists: Solus (Electronics) Limited, Cambridge. Telephone: (0223) 51502. HRS Electronic Compo


Colourex factory rebuilt tube.

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	0.35
AF115	0.35
AF116	0.41
AF117	0.42
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	1.58

Type	Price (£)
AU103	2.40
AU107	2.75
AU110	2.40
AU113	2.60
BC107*	0.16
BC108*	0.15
BC109*	0.16
BC113	0.22
BC114	0.22
BC115	0.24
BC116*	0.25
BC117	0.30
BC118	0.24
BC119	0.34
BC125*	0.30
BC126	0.30
BC132	0.20
BC134	0.22
BC135	0.21
BC136	0.22
BC137	0.30
BC138	0.35
BC140	0.36
BC141	0.44
BC142	0.35
BC143	0.38
BC147*	0.12
BC148*	0.12
BC149*	0.13
BC152	0.42
BC153	0.38
BC154	0.41
BC157*	0.13
BC158*	0.12
BC159*	0.14
BC160	0.52
BC161	0.58
BC167B	0.15
BC168B	0.14
BC169C	0.15
BC170*	0.15
BC171*	0.15
BC172*	0.14
BC173*	0.22
BC174A & B	0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	0.15
BC182L*	0.15
BC183*	0.14
BC183L*	0.14
BC184*	0.15
BC184L*	0.15
BC185	0.36
BC186	0.25
BC187	0.27

Type	Price (£)
BC192	0.56
BC204*	0.39
BC205*	0.39
BC206*	0.37
BC207*	0.39
BC208*	0.37
BC209*	0.39
BC211*	0.36
BC212*	0.17
BC212L*	0.17
BC213*	0.16
BC213L*	0.16
BC214*	0.18
BC214L*	0.18
BC225	0.42
BC237*	0.16
BC238*	0.15
BC239*	0.22
BC251*	0.25
BC252*	0.26
BC253*	0.38
BC261A*	0.28
BC262A*	0.28
BC263*	0.26
BC267*	0.20
BC268*	0.28
BC286	0.40
BC287	0.49
BC291	0.27
BC294	0.37
BC297	0.36
BC300*	0.62
BC301	0.38
BC302	0.86
BC303	0.64
BC304	0.44
BC307*	0.17
BC308*	0.16
BC309*	0.18
BC317*	0.15
BC318*	0.15
BC319*	0.19
BC320	0.17
BC321A&B	0.18
BC322	0.28
BC323	1.15
BC327	0.16
BC328	0.18
BC337	0.17
BC338	0.17
BC340	0.19
BC347*	0.17
BC348A & B	0.17
BC349B	0.17
BC350*	0.24
BC351*	0.22
BC352A*	0.24
BC360	0.59

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.06
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

Type	Price (£)
BD234	0.68
BD235	0.63
BD236	0.63
BD237	0.68
BD238	0.68
BD253	1.58
BD410	1.65
BD433	0.65
BD435	0.70
BD436	0.71
BD437	0.74
BD438	0.75
BD519	0.88
BD520	0.88
BD599	0.87
BD600	1.23
BD663BR	0.86
BDX18	1.55
BDX32	2.95
BDY16A	0.63
BDY18	1.55
BDY20	2.29
BDY38	1.38
BF115	0.48
BF117	0.48
BF120	0.55
BF121	0.85
BF123	0.48
BF125	0.68
BF127	0.51
BF137F	0.78
BF152	0.19
BF158	0.25
BF159	0.27
BF160	0.20
BF161	0.84
BF163	0.65
BF164	0.95
BF166	0.50
BF167	0.38
BF173	0.35
BF177	0.36
BF178	0.46
BF179	0.58
BF180	0.53
BF181	0.53
BF182	0.44
BF183	0.52
BF184	0.44
BF185	0.42
BF186	0.42
BF194*	0.14
BF195*	0.13
BF196	0.14
BF197	0.15
BF198	0.29
BF199	0.29
BF200	0.25
BF218	0.42

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

Type	Price (£)
BPX29	1.62
BR101	0.53
BR103	0.64
BR303	1.06
BRC4443	1.76
BRY39	0.60
BRY56	0.44
BSS27	0.92
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	3.35
BU105	1.80
BU105/02	1.95
BU108	2.98
BU126	2.91
BU204	2.50
BU205	2.58
BU206	2.59
BU208	2.75
BU407	1.38
BUY77	2.50
C106D	0.80
C106F	0.43
C111E	0.46
D40N1	0.64
E300	0.42
E1222	0.47
E5024	0.19
GET872	0.46
ME0402	0.18
MF0404/02	0.18
ME6001	0.18
ME6002	0.18
MJ2955	1.30
MJ3000	1.58
MJE340	0.68
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	1.22
MPF102	0.40
MPS3702	0.33
MPS3705	0.30
MPS6521	0.36
MPS6523	0.36
MPS6566	0.44
MPSA05	0.30
MPSA06	0.32
MPSA55	0.43
MPSA56	0.45
MPSA93	0.56
MPSL01	0.33
MPSU01	0.61

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R2008B	2.72
R2010B	2.79
R2322	0.75
R2323	0.85
ST2110	0.49
ST8120	0.46
TIC44	0.25
TIC46	0.35
TIC47	0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.51
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	0.44
TIS73	1.36
TIS90	0.23
TIS91	0.28
ZTX108	0.14
ZTX109	0.16
ZTX213	0.23
ZTX300	0.16
ZTX304	0.26

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.48
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	8.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N2926O	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.66
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	0.80
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.16
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

Type	Price (£)
2N3819	0.47
2N3820	0.72
2N3866	1.08
2N3904	0.20
2N3905	0.20
2N3906	0.20
2N4036	0.94
2N4123	0.17
2N4124	0.17
2N4126	0.17
2N4236	2.20
2N4289	0.32
2N4292	0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
2N5042	1.65
2N5060	0.28
2N5061	0.30
2N5064	0.63
2N5086	0.49
2N5087	0.50
2N5208	0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.16
2N5449	0.18
2N5457	0.46
2N5458	0.40
2N5459	0.58
2N5494	0.85
2N5496	1.05
2N6027	0.55
2N6107	0.71
2N6122	0.60
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB3378P	4.28
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.55
2SD234	1.46
3N128	1.60
40250	0.98
40251	1.14
40327	0.67
40361	0.46
40362	0.50
40410	0.94
40429	0.68
40530	0.79
40595	1.39
40603	1.13
40636	1.25
40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
BRC1330	0.93
CA810QM	2.44
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4008	0.85
MFC4060A	0.98
MFC6040	1.11
MFC8020A	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SC9504P	1.38
SL414A	1.91
SL432A	2.52
SL450	5.10
SL901B	4.20
SL917B	5.60
SL918A	5.95
SN72440N	2.21
SN76001N	1.67
SN76003N	2.20

Type	Price (£)
SN76008KE	2.56
SN76013N	1.56
SN76013ND	1.40
SN76018KE	2.56
SN76023N	1.58
SN76023ND	1.40
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.46
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.85
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	1.89
TAA621AXI	2.33
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
(Filter)	0.98
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.1-

Type	Price (£)
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20
TBA480Q	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	2.55
TBA641A12	2.35
TBA641B11	2.61
TBA651	2.12
TBA673	2.31
TBA700*	2.50
TBA720AQ	2.38
TBA720Q	2.38
TBA750*	2.18
TBA800	1.65
TBA810AS	1.69
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA760	1.52
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	2.73
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	2.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

* Indicates Q version is also available.

DIODES

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

Type	Price (£)
BY114	0.60
BY118	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY184	0.44
BY189	5.30
BY190	4.90
BY206	0.26
BY238	0.25
BYX10	0.30
BYX38/600	0.70
BYX70/500	0.53
ITT44	0.08
ITT210	0.63
ITT827	0.80
MCR101	0.48
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

ZENER DIODES

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

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E296ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
R53	1.75
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.46
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	2.00
PCL82	0.93
PCL83	1.12
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL508	1.85
PL509	3.10
PL519	3.10
PL802	3.25
PY81/P810	0.60

BRIDGES

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

10A and 25A ranges also stocked.

RESISTORS

Carbon Film (5%)

	Ea	10 of one value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.40	£5.40
½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.40	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£28.90

Mixes of a minimum of 10pcs of any value: 50pc, 100pc, 500pc.

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
Labgear are introducing a new, improved, unit this Summer – please contact us for details.

COLOUR BAR GENERATOR
CM6052/DB. VHF/UHF gives standard 8 band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster + crosshatch + greyscale stepwedge + colour bar + centre cross + dot pattern + centre dot. **£182.25**

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

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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

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TELEVISION

What's Economic?

To the layman, the economics of having something repaired or serviced must inevitably seem rather odd. And in fact when you come to look a little deeper into this subject, the whole basis of advanced, modern economies begins to look odder and odder.

You buy a nice new set, at a very reasonable price when you consider the technology that's gone into it, and say five years later there's a major failure. Or maybe only a minor one. In either case you could find yourself in for a bill that seems quite disproportionate to the original purchase price. This holds true of course whether it's a TV set, a car, a watch, an item of domestic electrical equipment, a pair of shoes or what have you. Those of us in the know may not be too surprised about this, but even so the underlying situation seems to be not quite what it could perhaps be in the best of all possible worlds.

There are many contributory factors to this state of affairs. To start with of course the economics of carrying out a repair and selling a complete set are much the same. Both take time – the repair often much longer. In both cases premises have to be provided, stocks carried and various overheads paid for.

The situation with TV servicing has been aggravated by the remarkable way in which the price of new sets has risen at a much lower rate than inflation. As a result, the effects of inflation on servicing costs have been much greater than the rise in the price of the new sets one can offer. How you put that across to the unsuspecting public I don't know – though various explanatory leaflets are now available and should help. A reasonable charge for replacing some i.c.s is say £15, and for most LOPTs £25 upwards. That makes them draw in their breath, doesn't it? But there's no way around the predicament, which we feel incidentally is the explanation for the absence of service only shops in the UK. Whereas in the States there has been a tradition of separate servicing and retailing stores, in the UK it would be almost impossible to run a servicing shop without some income from the sale of new equipment – and with negligible profit margins on these items, even this combination hardly adds up to economic sense.

Possibly one answer is that the price of new domestic electronic equipment has been rather too low for rather too long. After all, where else have prices consistently lagged behind the rate of inflation? This may sound like heresy in view of the prevailing belief in free trade. But for one thing trade isn't quite so free in most countries as it is here, and we do tend to flog whatever we can lay our hands upon. The present government doesn't believe in "artificially low" prices, as its energy policies show.

The credit mechanism also works to aggravate the situation. Most of the time the credit merchants fall over themselves to finance the purchase of new equipment, but if you asked them to help out with the cost of say a new tube you'd get a rather dusty answer. And for quite legitimate reasons. The change from purchase tax to VAT was another burden on the servicing industry as a whole. Another factor is the low cost of new equipment due to the rock-bottom prices at which manufacturers are able to buy their components. This latter point could explain some of the difficulties being experienced by component manufacturers – how do you invest in meeting the more stringent specifications demanded by setmakers in the interests of greater reliability when profits are almost non-existent?

One could argue that society has been brainwashed into accepting the throw-away approach to goods. Those of us whose childhood coincided with the war years, when there wasn't anything to throw away and the motto was make do and mend, possibly acquired a degree of immunisation to this attitude. But one really does wonder whether the economy's dependence on a continuous flood of cheap new goods is entirely sound. After all, we've seen market saturation in one field after another. And after the boom, what then? The manufacturer finds himself with a drastically reduced market, and the retailer with hardly any customers. Ah, but then something else always comes along, doesn't it? Like video maybe? Well, one can be less than convinced that it's possible to go on repeating this trick indefinitely.

It's interesting to reflect on the very different situation found in third world economies. They vary enormously of course, so that generalisation must be treated with caution. But in one respect they do seem to be more efficient – in recycling goods and materials. Almost everything in fact, from cardboard, used bottles and old tin cans to jalopys and reconditioned domestic electronics. Now I'm not suggesting that we return to expensive, small-scale manufacture and get busy washing old jam jars and living in large numbers (as happens in some parts of the world) on the municipal refuse heap. But our present situation does seem excessively wasteful from every point of view. Oh yes, and very difficult for those struggling to provide a repair service.

REBUILT TUBES

In our article on the above subject last month it was stated that anode and grid bombing is not carried out by independent tube rebuilders. We have since learnt that in fact some independents do carry out this procedure. Yates Electronics Ltd. (Units 1-2, Lee Smith Street, Hull, North Humberside) for example employ equipment imported from the USA for the purpose, and carry out bombing as a standard part of their tube rebuilding process. Our apologies for the incorrect impression given.

Teletopics

PHILIPS V2020 LAUNCHED

We originally announced the joint Grundig/Philips V2000 VCR system in these columns well over a year ago. Deliveries of Grundig machines (the 2 × 4) started last March, and it was stated at the summer trade shows that the Philips V2020 was about to appear on the market. Deliveries in quantity of the Philips V2020 to the trade are now understood to have started, the suggested retail price being around £675.

We hope we don't sound sarcastic about the delays. It's perfectly in order to announce forthcoming developments when these will affect distributors' policies and customers' decisions, and a sophisticated item such as this obviously requires a great deal of development work. It's worth remembering that this is the first $\frac{1}{4}$in. track system (two $\frac{1}{4}$in. tracks on the $\frac{1}{2}$in. tape), and that in order to keep the heads aligned with the minute tracks technology (the dynamic-track following system) that's entirely new to domestic equipment is involved.

Visionhire are understood to be taking a substantial proportion of the initial machines. There have also been delays, due to manufacturing difficulties, with the longer playing cassettes. Grundig four and six hour tapes have been available for some time, but the eight hour cassettes are still hard to come by.

CONSUMER ELECTRONICS SHOWS – 81

There are to be two major European consumer electronics shows next year in Germany. The usual "International Radio and TV Exhibition" will be held in West Berlin on September 4-13th. In addition, a new exhibition, organised by the West Midlands firm Industrial and Trade Fairs Ltd., is to be held in Nuremburg on May 10th-13th. It will be interesting to see whether manufacturers take to the idea of annual exhibitions in the spring and autumn.

The "Entertainment '81 – Audio, Video and Television Fair" is to be held on May 10-17th at the National Exhibition Centre, Birmingham. The first three days will be set aside for trade only – assuming that the trade hasn't decamped to Nuremburg at the time, or vice versa.

CASSETTE WARNING

JVC have issued a warning about the increasing number of "pirate" blank VHS cassettes appearing in the UK. They point out that the cassettes, which come from Taiwan, Singapore and Hong Kong, where there are no VHS cassette making licensees, are of inferior quality in addition to being illegal. They don't conform to the standard VHS dimensions, construction, mechanical operation and electrical specifications, all of which can affect the overall performance and operation of VHS machines. JVC intend to take legal proceedings to protect their rights.

We're not surprised to hear of this since a similar situation, with both VHS and Betamax cassettes, has been plaguing the US for some time. It seems that most of the "counterfeit" cassettes there come from Taiwan. The cassettes are apparently loaded with computer tape instead of tape correctly formulated for VCR use. Thanks to *Radio-Electronics* for that warning.

ANOTHER IBA ENGINEERING FIRST

Work being carried out by the IBA is showing that the transmission of video signals in digital form could have useful advantages for news gathering and national and international signal distribution via satellites. The latest success reported by the IBA is the transmission for the first time of digital colour television signals via a European space satellite, using compact small-dish aerials at both ends of the link. The test signals were transmitted and received at the IBA's Crawley Court Engineering Centre using a 14GHz 2·5m dish for the up-link (transmitter power about 1·5kW) and a 3m dish receiver terminal. The IBA's experimental 60Mbit/s digital converter was used to encode and decode the signals. The bandwidth of the satellite's transponder is 120MHz.

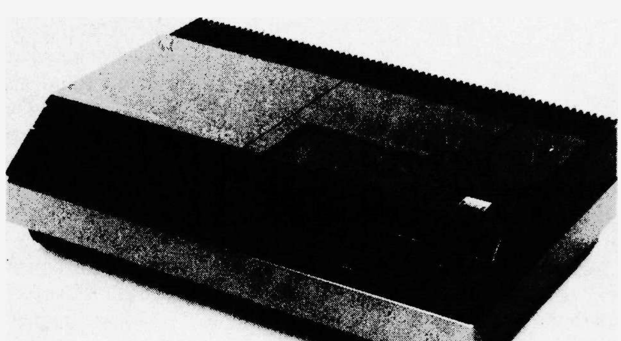
INDUSTRIAL CHANGES

Thorn-EMI have announced a co-operation agreement with Japanese consumer electrical/electronics manufacturer Sharp involving mutual licensing, the exchange of technology and reciprocal trading. EMI's Central Research Laboratories at Hayes and Sharp's Research Centre near Osaka are to co-operate on a "positive programme of joint research and development". Initially, the agreement will affect mainly domestic electrical products, with Thorn-EMI producing Sharp microwave ovens at Spennymore, Co. Durham, and Sharp handling Kenwood Chefs in Japan. Sharp has an annual turnover of around £760 million, of which half is exported, and is a major TV setmaker.

ITT have sold their French TV and consumer appliance businesses to the Swedish domestic electrical appliance manufacturer AB Electrolux. Included in the sale are Oceanic SA, Sonolor SA and Televisso SA.

PRESTEL ADAPTOR

Ayr Viewdata have announced that UK made adaptors to convert ordinary domestic TV sets for use with the PO's Prestel service will be available this autumn. The trade price will be "around £100", and rental could be as little as £1 per week.



The Philips V2020 VCR, which is now becoming available in quantity. The flip-over cassette gives up to eight hours' recording time. There's microcomputer control of the various operations, with touch-sensitive controls, also search tuning and memory programming for up to five separate programmes 16 days in advance.

This is the second such "black box" to be announced – we mentioned the Radofin Electronics adaptor last July. Such adaptors could well provide a stimulus to the Prestel service which, like teletext, doesn't seem to be exactly setting the Thames on fire at present.

UNUSUAL LT CIRCUIT

Last month we mentioned some of the interesting circuitry used in the new Salora G chassis, devoting a separate article to the main power supply/line timebase arrangement. The l.t. supply is also unusual, featuring as it does a circuit that's a cross between a series regulator and a chopper (see Fig. 1).

A 20V supply is obtained from pin 5 of the line output transformer by DB17/CB40. Most of the low-voltage circuitry in the set is powered by a stabilised 12·5V rail which is derived from the 20V line by the circuit just mentioned, using transistors TB17-TB20. TB17 can be considered as a normal series regulator, driven by TB18 and TB19, with the latter sensing variations in the output voltage. TB17 also acts as a chopper however, in conjunction with its inductive reservoir MB3 and the efficiency diode DB26 – a standard series chopper arrangement in fact as used in the Thorn 3000/3500 chassis for example. The chopper switching is controlled by TB20. 180V peak-peak line flyback pulses are integrated by RB80 and CB44 to produce a 1·2V sawtooth waveform which is fed to the base of TB20. When the sawtooth is sufficiently positive, TB20 conducts. The increased current through, and voltage across, RB74 then switch TB18 and TB17 off. Thus TB17 is acting as a chopper to drop the voltage from 20V to 12·5V, and as a series regulator during its on periods. An efficient, power-saving circuit.

The inductive reservoir also enables a –23V supply to be obtained, via a secondary winding and rectifier DB25.

RB75 provides the start-up action.

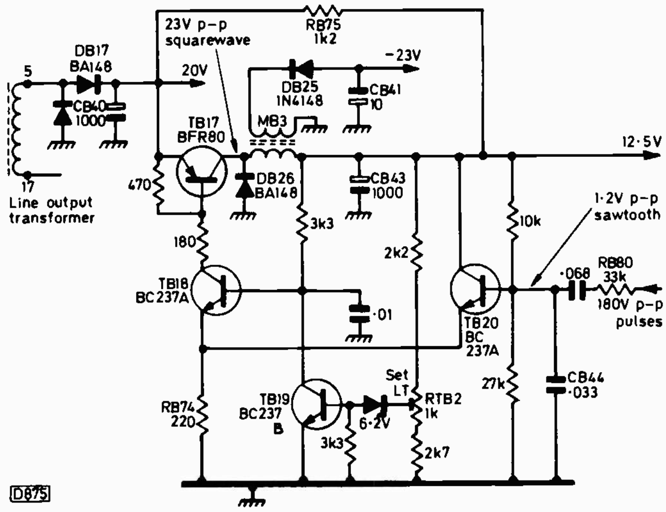


Fig. 1: L.T. supply circuit used in the Salora G chassis.

BATC'S ANNUAL CONVENTION

The British Amateur Television Club's annual convention is being held this year at the Post House Hotel, Braunston Way, Leicester on October 5th. The hotel is located just off the A46, about a mile into Leicester from the M1. Attractions will include a "video tape" show, an OB van belonging to G8GQS, etc.

TI AWARDED SPEECH SYNTHESIS PATENTS

Three US patents covering solid-state speech synthesis have been awarded to Texas Instruments. They are for an i.c. that digitally synthesizes human speech using linear predictive coding (LPC), a single-stage speech synthesis filter and a digital-to-analogue converter capable of driving a speaker directly from a speech chip. All these operations are carried out in a single i.c., which produces synthetic speech from digital filter coefficients and excitation control values stores in an external memory device. Talking TVs have already been announced by two Japanese setmakers, and an article on the subject will be appearing in *Television* during the next couple of months.

US TV INDUSTRY WORRIED

Whilst controls on imports of colour sets from Korea and Taiwan to the USA have been extended for a further two years, restrictions on imports from Japan have been lifted. This has produced a strong reaction from Compact (the Committee to Preserve American Colour Television), a joint union-manufacturers organisation. The restrictions were apparently lifted because imports from Japan had fallen from 1·75 million in 1978 to 500,000 in 1979. This could simply be explained by exchange rate alterations and the fact that most major Japanese setmakers now have plants in the USA. Compact is not impressed however, and points out that the industry has already lost some 60,000 jobs and sees the remaining 65,000 in jeopardy. In the mid-sixties there were 25 US owned setmakers: only six now remain. Profitability has fallen from 9·6% in 1972 to just 1·2% last year. TV imports to Taiwan face a 35% duty, while imports to Korea face a 50% duty. Trade with the far east rather often seems to be a one way affair.

HIGH-SPEED VIDEOTAPE COPIER

One of the advantages of videodiscs compared to prerecorded videocassettes is the low cost of disc production. The duplication of videocassettes has at present to be done in real time, i.e. a three hour tape takes three hours to duplicate. The helical-scan format precludes the use of the conventional high-speed copiers used in the audio cassette field. At this year's NAB (National Association of Broadcasters) Exhibition in the USA however Matsushita demonstrated a prototype high-speed VHS copier that can duplicate a three hour tape in three minutes.

The machine is intended for automatic operation and incorporates a number of interesting features (see Fig. 2). The method of duplication used is based on the bifilar printing system, in which a high-coercivity master tape is wound in close contact with a blank tape, both being exposed to a magnetic field. As a result, the master tape's image is copied on to the blank tape. Matsushita say that

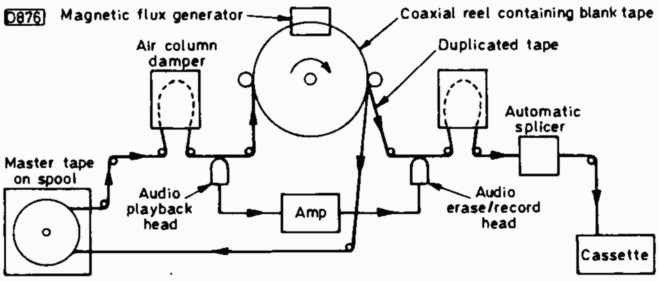


Fig. 2: Basic operation of Matsushita's prototype bifilar high-speed tape duplicator. The audio signal is transferred separately to achieve optimum quality.

the machine can handle PAL, NTSC and SECAM signals, and reckon that a master tape should be able to give up to 1,000 copies without noticeable degradation. The machine can be linked to an automatic cassette changer which stores twelve cassettes.

STATION OPENINGS

The following relay stations are now in operation:
Grassington (N. Yorkshire) Yorkshire Television ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-1 ch. 33.
Headingley (Leeds) TV4 ch. 54, BBC-1 ch. 58, Yorkshire Television ch. 61, BBC-2 ch. 64. Note: Horizontal polarisation.
Macclesfield (Cheshire) BBC-1 ch. 22, Granada Television ch. 25, BBC-2 ch. 28, TV4 ch. 32.
Millport (Firth of Clyde) TV4 ch. 54, BBC-1 ch. 58, Scottish Television ch. 61, BBC-2 ch. 64. Note: horizontal polarisation.
Netherton Braes (Glasgow) BBC-1 ch. 22, Scottish Television ch. 25, BBC-2 ch. 28, TV4 ch. 32.
Otford (Kent) TV4 ch. 53, BBC-1 ch. 57, Thames/London Weekend Television ch. 60, BBC-2 ch. 63.

Apart from Headingley and Millport, the above transmissions are vertically polarised.

NEW SHADOWMASK STEEL

NKK (Nippon Kokan) and Nippon Mining Co. Ltd. have jointly developed a new type of sheet steel for making shadowmasks for colour c.r.t.s. The new material is aluminium-killed steel, which is being produced through specially controlled continuous casting – rimmed steel is usually used for shadowmasks. The new sheet is being marketed in Japan and abroad. The advantage of the new sheet steel is a much higher yield ratio. Cold-rolled sheets for shadowmasks call for ultra-stringent quality, much higher than for conventional cold-rolled sheet, and for this reason the yield ratio of cold-rolled rimmed steel up to the finished stage of shadowmask production is less than 50%. With aluminium-killed steel the yield ratio is improved to almost 100%.

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Vega A61/120 24" 110°	£15.00

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17", 18", 19", 20"	£28.00
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26" 110°	£36 00

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COLOUR	£5.00

NEW VALVES

30FL2	1 21	EY86/7	68	PCL84	81
DY802	72	EY500A	1 33	PCL85/805	79
DY86/7	66	EZ80/1	56	PCL86	81
ECC81	60	GY501	1.45	PD500	2.93
ECC82	68	G234	1 56	PFL200	1 35
ECC83	60	KT66	6.98	PL36	1.15
ECC84	80	PC86	81	PL81	94
ECC85	98	PC88	81	PL82	46
ECC88	1.35	PC92	80	PL83	1 43
ECF80	80	PC97	1.14	PL84	84
ECF82	88	PC900	80	PL95	1.00
ECH81	1 04	PCC84	70	PL504	1 32
ECH84	1.13	PCC85	85	PL508	1 43
ECL80	84	PCC88	82	PL509	2.39
ECL82	77	PCC89	79	PL519	2 78
ECL86	84	PCC189	1 07	PL802	2 15
ECF86	78	PCC805	1.40	PY33	61
EF80	68	PCF80	75	PY88	81
EF85	68	PCF86	1.13	PY500A	1 40
EF86	1.19	PCF200	1.23	PY800/1	69
EF89	1 43	PCF800	1.38	UCF80	67
EF183	68	PCF801	1.13	UCH81	1 43
EF184	68	PCF802	86	UCL82	84
EH90	1.02	PCF805	1.63	UCL83	94
EL34	1.63	PCF806	1.30	UL84	1.02
EL81	86	PCF808	1.63	U26	1 30
EL84	68	PCH200	1 45	U191	95
EL90	82	PCL82	78	6F23	85
EL509	2.22	PCL83	2 00	UY85	80

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Thorn 950	£4.25	GEC 2110 before Jan '77	£6 95
Thorn 1500/1580	£3 85	GEC 2110 after Jan '77	£6.65
Thorn 1500 5 stick	£4.25	GEC 1028, 2028, 1040	£5.64
Thorn 1600	£3.45	ITT/KB CVC5/7/8/9	£5 35
Thorn 3000/3500	£6.89	ITT/KB CVC20/25/30	£5 35
Thorn 1400	£3.85	Korting (similar to Siemens TVK1)	£6 65
Thorn 8000	£3.51	Philips 3113 550/1/3	£5 35
Thorn 8500/8800	£5.40	Philips G8	£5.35
Thorn 9000	£7.43	Philips G9	£6.33
Decca CTV 19/25	£5 35	Pye 691/3	£5 13
Decca CS1730/3, CS1830/5	£3.68	Pye 731/25	£5.40
Decca 1910 Bradford 2213	£5.92	Rank BM A823/2179	£5.78
		Rank BM A823 A/V	£6.89
Decca 30	£5.92	Reddifusion MK1	£6.04
Decca 80	£6 28	B.R.C. 2000	£6.60
Decca 100	£6.04	"Universal Tripler"	£5.40

MAINS DROPPERS

Type	Price (p)
Decca 20 Series	£1 00
G.E.C. 2018	64
Philips 210/5050	60
Philips 210/5051	55
Philips G8 5081	32
Philips G8 5083	51
Pye 725	48
R.B.M. 161	50
R.B.M. A823	70
Thorn 1500	88
Thorn 3500	62
Thorn 8000	78
Thorn 8500	76

RESISTORS

WIREWOUND		Price Each (p)
4 watt	1 ohm-1.5kohm	13
	2 2k, 3 3k	15
	4 7k, 6 8k	17
	10k	22
7 watt	1 ohm-4.7 kohm	14
	5.6k-12k	15
	15k-22k	18
11 watt	1 ohm-6 8kohm	17
	10k-15k	18
	22k	21
17 watt	1 ohm-10 kohm	24
	15k, 22k	25

TRANSFORMERS

LINE OUTPUT TRANSFORMERS

Type	Price (p)
Bush A774	£10.75
Replacement Tripler for A774	£10 75
Decca 80	£7.80
Decca 100	£7 80
Decca 1730	£7 80
Decca 2230	£7.80
G.E.C. 2040	£9.20
G.E.C. 2047	£5.00
G.E.C. 2110	£8.59
Philips G8	£9.00
Pye 691/693	£11.00
Pye 697	£14.00
Pye 731	£10.15
Thorn 3500 Scan AC EHT Transformer	£5.00
Thorn 8000	£9 00
Thorn 8500	£9.00

Type	MAINS TRANSFORMER	Price (p)
Thorn 3000/3500		£9.50

AERIAL EQUIPMENT

10 Ele. UHF. A-B-C/D	£1.62
18 Ele UHF. A-B-C/D	£2.63
2 Ele. F.M	£4.28
3 Ele F.M	£5.78
6 Ft Mast	£1.16
Lashing Kit 6" Bracket	£1.58
Low Loss Coax Cable per 100m	£13 50
Coax Plugs	20p

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SEMICONDUCTORS

Type	Price (p)	Type	Price (p)
AC126	22	BC109B	13
AC127	22	BC109C	11
AC128	20	BC114	12
AC128K	32	BC116A	12
AC141K	34	BC140	32
AC142K	30	BC141	26
AC176	25	BC142	21
AC176K	32	BC143	24
AC187	26	BC147	9
AC187K	28	BC148	9
AC188	25	BC149	9
AC188K	37	BC157	11
AD140	75	BC158	9
AD143	82	BC159	10
AD149	79	BC160	25
AD161	42	BC161	28
AD161/2	£1 15	BC170B	10
AD162	42	BC171	9
AF124	34	BC171A	10
AF127	32	BC171B	10
AF139	42	BC172	9
AF239	45	BC172A	10
AL102	£2 00	BC172B	10
AL103	£2 00	BC172C	10
AU110	£2.00	BC173B	12
AU113	£1 49	BC174B	10
BC107	11	BC182	9
BC107A	12	BC182LB	10
BC107B	13	BC183A	12
BC108	11	BC183LA	10
BC108A	12	BC184	9
BC108B	12	BC184LA	10
BC108C	14	BC204	9
BC109	11	BC208	13
BC109A	14		

SEMICONDUCTORS

Type	Price (p)	Type	Price (p)
BC209	10	BCY72	13
BC212	9	BD115	30
BC212L	9	BD116	65
BC213	9	BD124	60
BC213B	10	BD131	33
BC213L	9	BD132	35
BC214	9	BD133	40
BC214L	10	BD135	26
BC237	9	BD136	27
BC238	8	BD137	23
BC251A	12	BD138	23
BC251B	15	BD139	28
BC252A	12	BD140	30
BC252B	12	BD144	£1.20
BC261A	18	BD182	70
BC261B	15	BD183	65
BC262A	15	BD201	85
BC262B	15	BD202	80
BC300	30	BD203	80
BC301	28	BD204	84
BC303	28	BD222	46
BC307	10	BD225	47
BC307A	10	BD232	45
BC327	11	BD233	35
BC328	8	BD234	31
BC337	11	BD235	31
BC338	9	BD236	31
BC461	30	BD237	31
BC546	7	BD238	33
BC547	10	BDX32	£1.50
BC548	10	BDY	20
BC549	7	BF115	35
BC550	7	BF127	26
BC557	7	BF154	12
BC558	7	BF158	18

SEMICONDUCTORS

Type	Price (p)	Type	Price (p)
BF160	27	BF459	35
BF167	24	BFT42	28
BF173	22	BFT43	27
BF178	26	BFW10	60
BF179	28	BFX29	30
BF180	36	BFX84	27
BF181	36	BFX85	28
BF182	30	BFX86	28
BF183	30	BFX88	25
BF184	30	BFY50	20
BF185	30	BFY51	20
BF194	11	BFY52	20
BF195	10	BFY90	75
BF196	10	BR100	17
BF197	11	BR101	30
BF198	18	BRC4443	80
BF199	15	BRX46 (TIC46)	40
BF200	30	BRY39	30
BF224	16	BT106	£1.00
BF241	15	BT108	£1.24
BF257	28	BT116	£1.21
BF258	25	BU104	£2.00
BF259	26	BU105	£1 25
BF271	24	BU105/02	£1.65
BF273	12	BU106	£1 50
BF274	13	BU108	£1.80
BF336	36	BU124	£1 30
BF337	30	BU126	£1 49
BF338	34	BU204	£1 50
BF355	37	BU205	£1.34
BF362	37	BU206	£1 80
BF363	33	BU208	£1.60
BF371	30	BU208A	£1.65
BF457	23	BU208/02	£2.00
BF458	24	BU308	£1 75

SEMICONDUCTORS

Type	Price (p)	Type	Price (p)
BU326A	£1.42	2N3705	10
BU407	£1 25	2N3706	10
E1222	28	2N5294	38
MJE340	40	2N5296	48
MJE520	44	2N5298	38
OC71	27	2N5496	53
OC79	15	2SC643A	£1 50
R2008B	£1 80	2SC1172Y	£2.20
R2010B	£1.80	CRYSTAL 4.43MHZ	£1 30
R2265	£1.40	Crystal	
R2322	58		
R2323	67		
R2461	£1.50		
R2540	£2 80		
RCA16334	90		
RCA16335	80		
TIP29C	43		
TIP30C	43		
TIP31C	41		
TIP32C	42		
TIP41C	46		
TIP42C	47		
TIP47	70		
TIP2955	90		
TIP3055 (SEP3055)	63		
TIS91	21		
TV106/02	£1.20		
2N696	19		
2N2905	22		
2N3054	60		
2N3055	60		
2N3702	11		
2N3703	10		
2N3704	10		

DIODES

Type	Price (p)
AA119	7
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BAX13	4
BAX16	5
BB105B	30
BB105G	30
BY126	10
BY127	11
BY164	45
BY176	85
BY199	10
BY206	14
BY210/800	22
BY298/400	22
ALL IN SERIES IN STOCK	10

INTEGRATED CIRCUITS

Type	Price (p)	Type	Price (p)
CA3065/ ETT6016/ ML232B	£2 20	TAA700	£1.70
ETTR6016/ ML231B	£2 20	TBA120B	£1.30
MC1307	£1.00	TBA120S	69
MC1327	£1 00	TBA120AS	70
MC1349	£1 20	TBA120SQ	79
MC1351	£1 00	TBA120U	£1 00
MC1352	£1.00	TBA396	80
SAS560S	£1 80	TBA480Q	£1.25
SAS570S	£1.80	TBA510	£3 00
SL901B	£4.45	TBA520Q	£1.20
SL917B	£6.25	TBA530	£1.20
SL1310	£1.80	TBA530Q	£1.28
SL1327Q	£1.20	TBA540Q	£1 49
SN76003N	£1.75	TBA550Q	£1.58
SN76013N	£1.15	TBA560CQ	£1 59
SN76013ND	£1 15	TBA570	£1.00
SN76023N	£1 45	TBA750Q	£1 39
SN76023ND	95	TBA800Q	89
SN76033N	£1.53	TBA810AS	£1.35
SN76110N	89	TBA920	£1 80
SN76131N	£1 30	TBA920Q	£1.99
SN76226N	£1 55	TBA990Q	£1 49
SN76227N	£1.10	TCA270Q	£1.20
SN76532N	£1 50	TCA270SQ	£1 25
SN76533N	£1.30	TCA800	£1.99
SN76544N	£1.35	TCA940	£1.60
SN76650N	89	TDA1170	£1.99
SN76660N	60	TDA2030	£2.80
SN76666N	70	TDA2522	£2 40
TAA550	28	TDA2640	£2 50
TAA570	£1.80	TDA2690	£1 00
TAA661B	£1 20	Sockets – 8 pin	10
		– 14 pin	12
		– 16 pin	14

CAPACITORS

DOUBLE ENDED

Volts	MFD	Price (p)	Volts	MFD	Price (p)
10	22	7	63	4 7	7
10	47	7	63	10	9
10	100	8	63	22	12
10	220	11	63	47	16
10	470	18	63	100	19
10	1000	20	63	220	30
10	2200	30	63	470	38
10	4700	48	63	1000	53
25	4 7	8	63	2200	85
25	10	7	100	10	12
25	22	7	100	22	14
25	47	9	100	47	19
25	100	10	100	100	29
25	220	17	100	140	32
25	470	22	100	220	35
25	1000	36	450	1	23
25	2200	46	450	4.7	28
25	4700	80	450	10	28
40	2200	52	450	22	56
63	1	7	450	33	62
63	2 2	7			

MIXED DIELECTRIC

Volts (DC)	MFD	Price (p)	Volts (DC)	MFD	Price (p)
400	.022	9	1000	.47	75
600	.1	38	1250	.033	32
1000	.01	20	1250	.1	45
1000	.047	29	1500	022	24
1000	.1	32	1500	033	39
1000	22	48			

ZENER DIODES

Type	Price (p)
BZX61	
6V2, 7V5, 8V2, 9V1, 10V 11V, 12V, 13V, 15V, 16V, 18V, 20V, 22V, 24V, 27V, 30V, 33V, 36V, 39V, 47V, 56V, 68V, 75V	15
BZY88	
2V7, 3V, 3V3, 3V6, 3V9, 4V3, 4V7, 5V1, 5V6, 6V2, 6V8, 7V5, 8V2, 9V1, 10V, 11V, 12V, 13V, 15V, 18V, 24V, 27V	7

REPLACEMENT ELECTROLYTICS

Type	Price (p)
Decca 30 (400-400/350V)	£2.35
Decca 80/100 (400/350V and 800/250V)	£2 50
Decca 1700 20-20-2420 (200-200 400-350V)	£2 49
Philips G 8 (600/300V)	£1 76
Pye 691 (200-300/350V)	£1.90
Rank A 823 (2500-2500/30V)	90
Thorn 850-950 (100-300-100-16/275V)	£1.25
Thorn 1400 (150-100-100-100-150/320V)	£2 20
Thorn 1500 (150-150-100/300V)	£1.60
Thorn 3000 (100-100-200/350V)	£2.05
Thorn 3000-3500 (1000/63V)	52
Thorn 3000-3500 (1000/70V)	53
Thorn 3000-3500 (1500/70V)	67
Thorn 3500 (175-100-100 400/350V)	£1.95

DATA BOOKS

TRANSISTOR EQUIVALENTS

TVT 80/80 2 part A-Z/2N/2S	£5.95
TVT 80 A Z	£3.05
TVT 80 2N	£3.25

FUSES

	Price per 10
1¼" QB	
100ma	48
250, 500, 750ma 1A	49
1.5, 2, 2 5, 3, 5A	40
1¼" AS	
250, 500, 600, 630, 750, 850ma	
1, 1 25, 1.5, 2A	£1.41
2.5, 3, 5A	£2.16
1" Mains	
2, 3, 5, 10, 13A	84
20mm AS	
80ma	£3.11
100ma	£2 08
160, 200ma	£1 89
315, 500, 630, 800ma	
1, 1.25, 1.6, 2A	£1.07
2.5, 3.15A	£1 43
20mm QB	
100ma	45
250, 500, 630, 800ma	
1, 1 25, 1.6, 2, 2 5, 3 15, 5A	37

THERMAL CUT-OUT

Thorn 3000 2 amp	98

TUNERS

Type	Price (p)
AEG/NSF equivalent to ELC1043/05	£7 10
ELC1043/06	£7.10
4 way P/B for Decca etc.	£5 80
6 way P/B for Decca etc	£7.00
4 way P/B for Pye 713	£9.00
6 way P/B for Pye 201	£16.00

HOW TO ORDER

Add 15% V.A.T. to all prices.

IMMEDIATE DESPATCH

Add 60p per order to cover P&P on all items. – However customers who require 1 small single item need send only 20p.

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Carriage on tubes is as stated on list.

Studio 80 Project: Video Camera

Part 1

Malcolm Burrell

THE aim of this project has been to provide for constructors a simple, easy-to-build monochrome camera design, at low cost and using readily available components. The vidicon tube used is a 2/3in. type, and the whole unit is contained in a Vero box measuring 205 × 110 × 140mm. The camera is self-contained but can also be synchronised with other video sources. It can be mains or battery operated. Simple mixer and effects generator units have also been produced, and will be featured in the magazine at a later date. Together, the units provide a low-cost video studio system which we've called "Studio 80". The camera can resolve about 4MHz.

To simplify the design, i.c.s have been used wherever possible. Though this is not the first camera I've built, it nevertheless took me many months to try out various possible circuit arrangements and to evolve the final circuit with the performance optimised and the bugs ironed out.

Design

The starting point for the present design was a circuit suggested by Siemens. Many of the components used in this turned out to be difficult to obtain however, while it soon became clear that the use of alternative circuits for some operations would considerably reduce the cost of the camera. Only a small part of the camera remains reasonably faithful to the Siemens circuit – the video amplifier and the TDA1170 field timebase. The use of a TBA920 as the line oscillator was initially considered, but a simple 7400 NAND gate i.c. offered a cheaper and simpler solution.

The design of the power supply presents a number of difficulties. The tube requires a heater current of 100mA at 6·3V, and to this must be added the power consumption of the timebases, the video amplifier and the sync circuits. This brings the total up to about 600mA, and means that a substantial mains transformer is required. All transformers produce a magnetic field of course, but the problem with a camera is that the transformer is inevitably in close proximity to the tube and is likely to cause hum bars on the scans. The solution adopted to overcome this problem will be discussed later.

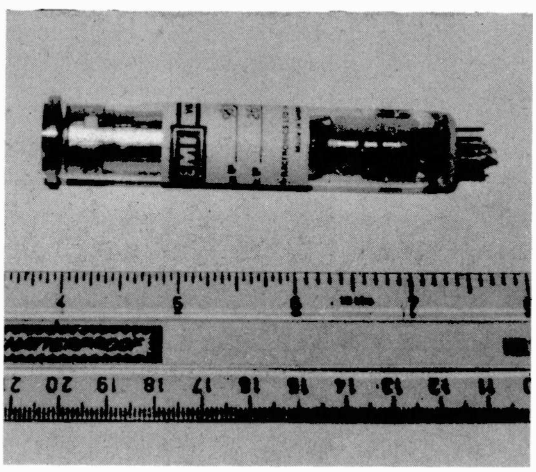
A block diagram of the camera is shown in Fig. 3.

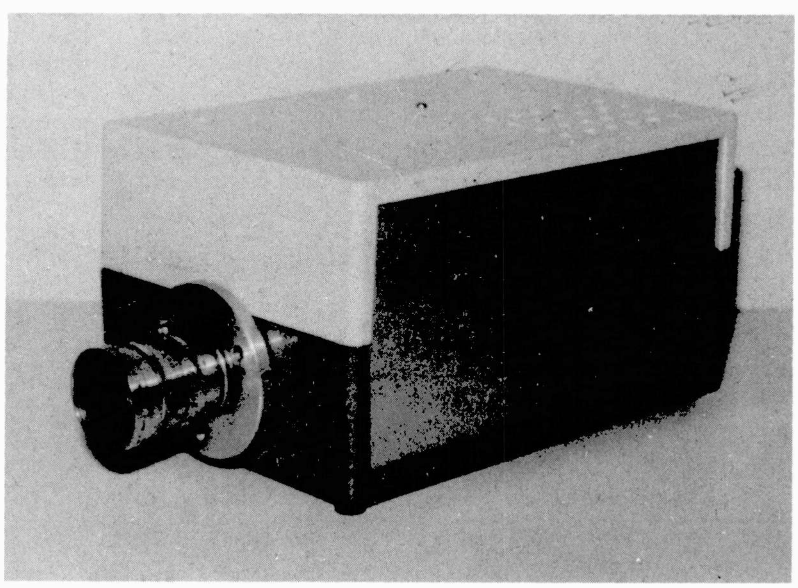
The line output stage is quite conventional, with a choke as the load. It can be driven directly by the 7400 i.c., dispensing with the need for a discrete driver stage. To obtain the supplies required by the tube, the line output stage choke was initially arranged as a transformer. Due to the high winding ratios required however few turns could be comfortably accommodated – though the circuit did work. The main problem was that to obtain sufficient horizontal scan the stage was worked hard, the linearity was poor and even a microampere of beam current severely damped its operation. The solution was either to use a bigger, better transformer or separate line output and h.t. generator stages. The latter course was adopted.

The TDA1170 provides a straightforward field timebase. The only difference between its use here and in a TV set is that the flyback diode at pin 5 is unnecessary due to the very much lower deflection current required with a vidicon tube.

The video section consists of a couple of transistors in the head amplifier, with a f.e.t. as the first stage, followed by TBA500P and CA3046 i.c.s. The front end must be screened to prevent stray r.f. pickup.

The sync pulse generator circuit used is very similar to that featured in the August 1979 issue of *Television.* A 555 timer i.c. is used as the basic oscillator, with the component





The EMI 2/3in. vidicon used in the prototype camera.
The first prototype camera, which is fitted with a surplus lens.

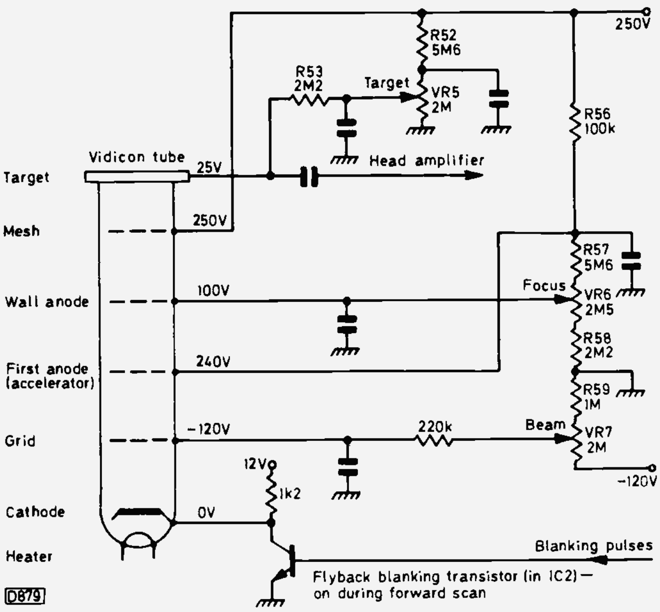


Fig. 1: Supplies to the vidicon tube.

values used selected to ensure that it switches states during the line blanking interval. This has been done because in the form initially tried the switching action produced a spike on the supply lines. This was amplified by the video amplifier, producing a vertical line near the centre of the picture. The field drive pulses are obtained from the oscillator section of the TDA1170 i.c.

The number of presets used has been minimised to simplify matters. Their functions will be described when we come to the setting up procedure. Those in the timebases operate in similar ways to normal TV receiver timebase controls. Note however that their effects when observed on a monitor screen are the opposite to what you might expect – for example increasing the line scan amplitude makes the picture smaller.

Case

Most of the project cabinets currently available are unfortunately the wrong shape for camera use. The plastic Vero box type 203 was selected because the 65mm diameter C lens mount can be mounted on the lower half of the shell with little overlap on to the top half. A plastic case is also easier to drill than a metal one – in fact the large hole required for the lens mount aperture can be made with a hot soldering iron, since the mount will mask the ragged edges.

Operating the Vidicon

From what has been said so far it will be apparent that there's much in common between a television camera and receiver. For those not familiar with the vidicon tube, the following notes on its operation are included.

The tube used is the latest 18mm (2/3in.) type with a separate mesh connection. Fig. 1 shows the supplies for the various electrodes. The electron gun is broadly similar to that employed in a display c.r.t., but the beam from the cathode scans a photosensitive target instead of a fluorescent screen. Coils around the tube deflect the beam horizontally and vertically. As the beam scans the target, a minute current proportional to the illumination focused on the faceplate flows from the target connection. This is amplified and then mixed with the blanking and sync pulses. The composite video signal thus obtained can be fed to a monitor or to a u.h.f. modulator for feeding to the aerial socket of a standard TV receiver.

The target consists of a layer of photoconductive material with a thin, transparent layer of conductive tin oxide at the front. The target connection is made to the tin oxide layer. The resistance of the photoconductive layer decreases when light is focused on to it. The resistance is still very high – of the order of tens of megohms when brightly illuminated. The action is basically that of discharging a capacitor, with the photoconductive layer forming the dielectric and the tin oxide layer and electron beam the two plates of the capacitor. The beam current discharges the capacitance it sees at each point on the target, and since this capacitance is proportional to the scene illumination a video signal is produced at the target connection.

Between the cathode and the target are four electrodes. The grid and first anode perform the same functions as in a c.r.t. The wall anode is used for electrical focusing, and nearest the target is the mesh. This is exactly what it says – a very fine mesh through which the electron beam passes to reach the target.

The mesh is responsible for making the spot size as small as possible in order to obtain the sharpest focus. In older vidicons the mesh was internally connected to the wall anode, but better results are obtained by operating it at a higher voltage, as here.

The definition of the picture is determined by the tube's operating voltages, the bandwidth of the video amplifier, the scene illumination and the quality of the optical lens used. The high-impedance supplies for the vidicon are obtained from the separate h.t. generator stage TR4. This operates like a line output stage, with a transformer feeding a pulse to a voltage-doubling rectifier circuit. A separate winding feeds a single rectifier diode to obtain a negative voltage of around −120V. Off load, the doubler circuit would produce some 900V. This voltage would fluctuate considerably with variations in beam current however, so a VDR is used to provide a stabilised 250V supply. This is a good practical level since although 700V or so would give fractionally better definition, higher working voltage capacitors would

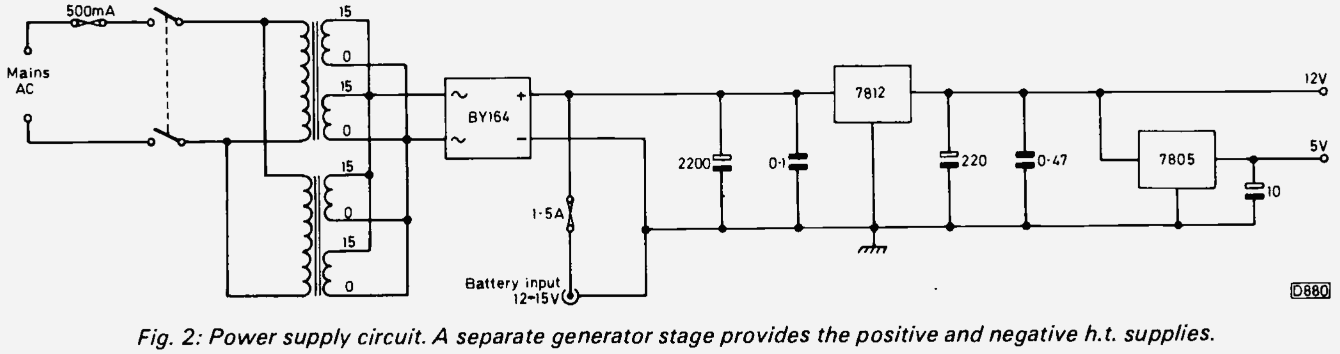


Fig. 2: Power supply circuit. A separate generator stage provides the positive and negative h.t. supplies.

be needed for smoothing while a more efficient transformer than could be accommodated on the little pot core used would be required.

The beam control VR7 performs a similar function to a brightness control with a normal TV tube, though the effects on the viewed picture are not the same – it produces a negative picture at some part along its range. R56 applies h.t. to the first anode and R57 supplies the focus control. The target requires a bias of around 25V, which is derived from the h.t. line via R52 and the target control VR5. R53 feeding the target is in fact the load resistor across which the vidicon's output signal is developed.

The vidicon's cathode is returned to chassis via a transistor in the CA3046 video amplifier/mixing i.c. This transistor is used for flyback blanking, being switched off during the line and field flyback intervals. The vidicon's cathode is then at 12V, cutting off the beam.

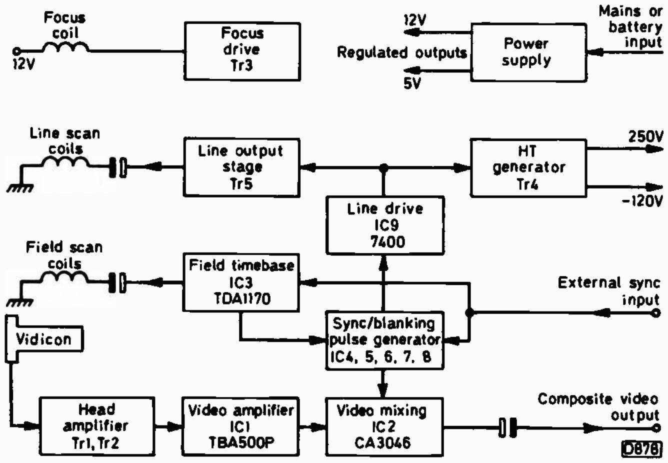


Fig. 3: Block diagram of the camera.

Power Supply Circuit

The power supply circuit is shown in Fig. 2. As mentioned earlier, the mains transformer presents something of a problem. A large transformer could be accommodated in the case, but even with careful orientation magnetically introduced hum on the scans would not be completely removed. Instead, two smaller 6VA units are connected in parallel. After rectification this combination feeds a 7812 12V regulator which in turn drives the 7805 5V regulator. All earth returns should be made to a single earthing tag bolted to the 7812. Only the 7812 needs a heatsink – the 7805 and the transistors remains cool in free air.

Earth loops must be avoided. Whilst they are unlikely to cause hum, they will cause striations and possibly instability.

The complete circuit will be given next month. Printed circuit boards prepared by the magazine are undergoing evaluation.

Servicing The Indesit T12S

John Law

THE original version of the Indesit 12in. mains-battery portable, the T12LGB, was covered in the November 1976 issue of this magazine. Since then the BEAB approved T12SGB version has appeared. It's a much simpler set, making greater use of i.c.s. The i.f. strip consists of a TBA440C i.c. with a BF194 preamplifier stage, while a TBA950 takes care of the sync and line oscillator departments. For the field oscillator, there's a simple unijunction transistor circuit. The most important section from the servicing point of view, the combined line output/power supply arrangement, remains much as in the earlier set however, with the distinctive pump transistor arrangement. The sound side is also similar to the earlier set, consisting of a TBA120B intercarrier sound i.c. followed by a TAA611B audio amplifier/output i.c. The video output transistor is a BF257.

These popular little sets are easily identified by their orange or white plastic cases and absence of protruding knobs at the front or side.

The earlier version was prone to failure of the transistors used in the field output stage (AC141K and AC142K), and the recommendation was to replace them with silicon transistors of a higher power rating, for example types BC286 and BC287 as used in the T12SGB. The large heat shield plate to which the earlier transistors were bolted is discarded in the later version, in which each output transistor has its own top-hat heatsink.

The appearance of the two models is very similar, but while the T12LGB has a rotary tuner with a side-mounted tuning knob the T12SGB has a four-button selector unit mounted at the top of the case and a varicap tuner within.

Different Panels

The simplified circuitry used in the T12SGB means that there's better spacing on the large printed panel which, as before, fills the whole area of the cabinet. The components have been renumbered and repositioned, and to further complicate matters three different print layouts have been used. When ordering service sheets from Indesit therefore be sure to quote all the information given on the back of the set. Circuits and spares are available from Indesit Ltd., 292 Streatham High Road, London SW16.

Access

Because of the lightness and flexibility of the plastic case, these sets have a reputation for being awkward to dismantle and put together again. A little care is usually all that's necessary. The cabinet splits neatly into front and back halves, with the c.r.t., speaker and push-button block secured to the front section: the rear section is simply an empty shell. Since the soft plastic is easily marked, it's advisable to lay the set on a soft surface before opening the case.

To gain access, remove the two Phillips screws from the

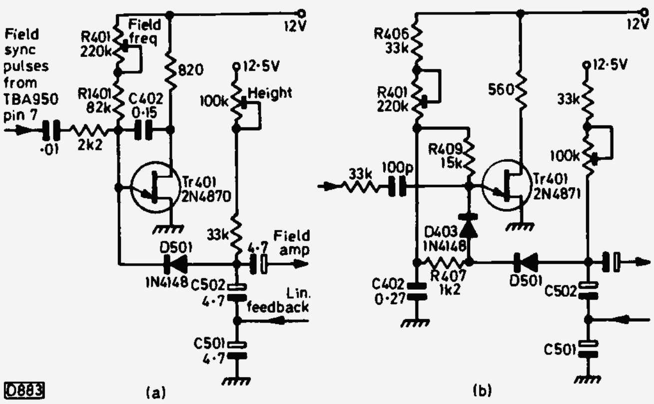


Fig. 1: Contrasting unijunction transistor field oscillator circuits used in the T12S. (a) Miller type, with the timing capacitor C402 connected between the emitter and B2 connections of TR401. When TR401 conducts, C402 charges negatively on its left-hand plate. The charge leaks away via R1401 and R401, and when TR401's emitter is sufficiently positive it switches on again, charging C402 and discharging C501/2 via D501. Positive-going field sync pulses synchronise the action. (b) Alternative version, with a 2N4871 transistor and simple RC timing circuit. This time C402 charges via R401/6 when TR401 is off. When TR401 switches on, C402 and the field charging capacitors C501/2 are discharged.

bottom of the set with it laying face downwards. Lift the bottom up and out towards the top until the positioning lugs lift free of the two holes in the top of the case. The back will then come clear, exposing the green printed panel which is attached to the front half of the case by two top screws and two more at the bottom. With these removed, raise the set upright and ease the panel from the case. A word of warning: removing the panel leaves the set front heavy so that it can topple forwards, with some risk of damage to the neck of the c.r.t. To guard against this, place a weight of some sort on the bottom of the cabinet as the panel is withdrawn. Take care when passing the tube base through the round hole in the panel. One inch diameter tube necks are delicate, and replacement tubes are expensive.

There are separate supply leads for mains or battery operation.

Power Supply Operation

Difficulty in servicing these sets is usually due to lack of understanding of how the power supply circuit works. Since the majority of failures occur in this area, it's worth giving a brief outline of the way in which the various supplies are obtained.

On mains operation the a.c. from the on/off switch is passed to the rectifier diode D902 via the 5·1Ω surge limiter resistor R904. The rectifier produces around 315V across its reservoir capacitors C905/6, which are connected in series. There follows a 250mA fuse (F902) and smoothing filter (R908/C908). R908 is a 17W, dropper type resistor, mounted on a heatsink attached to the aerial panel. The d.c. is now down to 230V, and is fed via the fusible 27Ω resistor R907 to the collector of the pump transistor TR902, type BU104 or BU134.

The pump transistor provides a switch-mode action, being switched on briefly once each line by the flyback pulse. When it's switched on, energy is fed into the line output transformer T402, which thus acts as the switch-mode reservoir. Note that TR902 is used as a voltage dropper rather than as a regulator. When it switches on, its emitter is connected to pin 1 of the line output transformer via D907. The switch-on pulse is provided by winding 3-2. TR902 switches off at the end of the flyback pulse, when the efficiency diode D401 begins to conduct in the normal manner to provide the first half of the line scan. It also charges C909 to produce the 17V supply for the line driver and output stages. The 15·5V supply for the field timebase and the 12V supply for most of the rest of the circuitry are derived from this 17V supply.

The basic purpose of TR902 then is to obtain an l.t. supply from the mains without the need for a separate mains transformer. The "pumping" action of TR902 in building up the 17V supply accounts for the term "pump transistor". The h.t. supplies required for the tube and the video output stage are derived from the line output transformer in the usual manner.

Stabilisation is still required of course, to avoid changes in picture size with mains voltage or load variations. This is achieved downstream by the shunt regulator transistor TR901, which produces the stabilised 12V rail in conjunction with R903 and also provides overall stabilisation. Variations in the 12V supply are sensed by R901 and applied to the base of TR901 which, being connected in the common-emitter mode, produces an inverse effect at its collector to compensate.

The pumping action can't start until the line output stage comes into operation of course. This is the reason for the series-connected reservoir capacitors and the series-connected resistors R905/6 in parallel with them. At switch on some 6V is developed at the junction of these components. This is fed via D904 to the line oscillator and via D905 to the line driver and output stages, and is enough to get things going. Once the 17V supply has been built up, D904/5 are reverse biased and isolate the start-up circuit. D903 operates the other way round, being reverse biased at switch on to prevent the start-up supply being loaded down by the rest of the set.

The pump circuit plays no part on battery operation, when the 12V d.c. supply is fed to pin 5 of the line output transformer via D908 which acts as the boost diode. D907 then isolates the pump circuit.

There are a lot of diodes in the line output/power supply section, but their functions should now be fairly clear. An appreciation of which does what can save a lot of time when looking for the cause of a power failure.

Common Faults

Fuse failure is the first thing to look for when a breakdown occurs. We've already mentioned the 250mA h.t. fuse F902. There's also a mains fuse, F901, which is rated at 2·5A. F902 is a quick-blow type and F901 an anti-surge type. When one of the fuses has blown, examine it to see whether there are signs of burning. If the glass is clear the fuse may simply have died of old age, and replacing it may well clear the fault. If the glass is black however there's been a heavy overload and further checks must be made. Two immediate suspects are TR902 and C908. If the capacitor is faulty, check R908 since the short may have burnt out its wire. F902 is likely to be the burnt fuse in either of these events. A fault likely to burn out F901 is a short in the mains filter capacitor C902 – this can shatter F901. In this event check that the contacts of the on/off switch have not been damaged, and that the surge limiter resistor R904 is intact (note that it's a fusible type in some sets).

The mains rectifier D902 is another item that can break down for no apparent reason. If it goes open-circuit it will die quietly: if it goes short-circuit its passing can be noisy, with F901 shattered – you'll find it black or maybe broken in two.

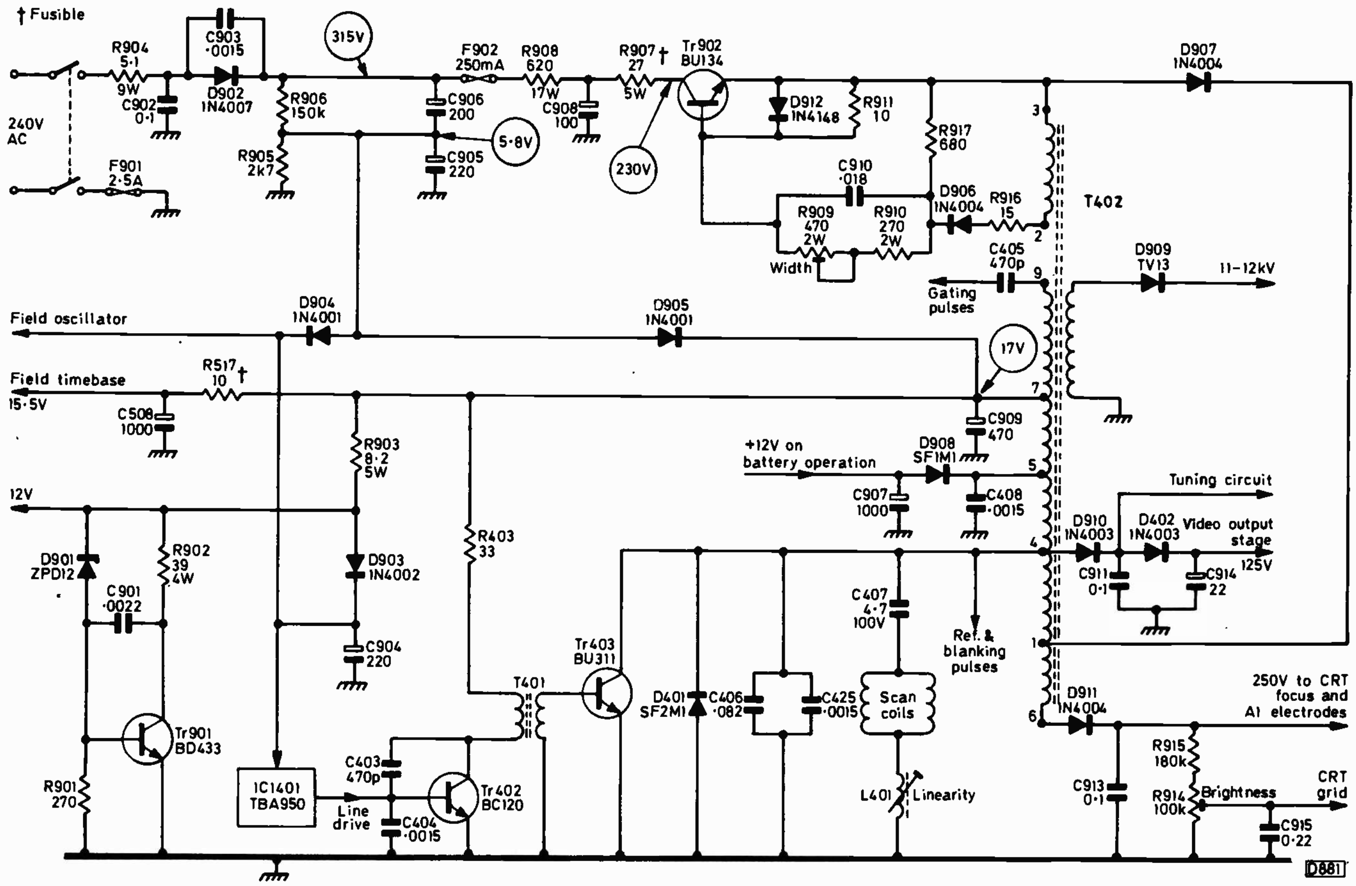


Fig. 2: Power supply, line output and line driver stage circuitry. See Fig. 3 for alterations that may be found in some sets. R903 is 8·2Ω with c.r.t. type A31-120W and 7·5Ω with c.r.t. type A31-410W.

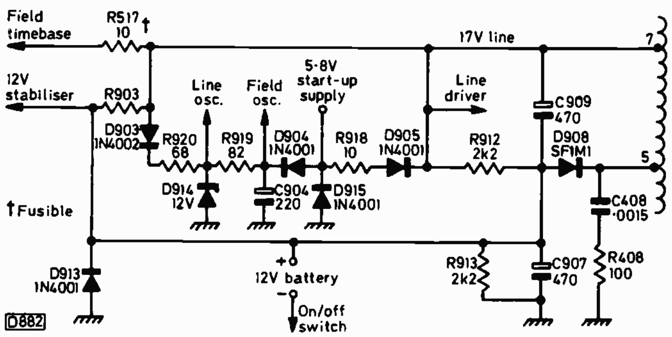


Fig. 3: Alternative power supply arrangements used in some sets. At switch on, D904/5 provide the start-up feeds, D903 being reverse biased. Once the 17V supply is established, D903 switches on and D904/5 switch off. Note that the link between D913/R903 and the junction of R913/C907 etc. is made on battery operation only.

R908 in the smoothing circuit leads a fairly hard life, and can go open-circuit to give the no results on mains symptom. It usually fails without warning, from old age.

The electrolytics in the mains supply circuit give rise to a certain amount of trouble. The usual fault is C906 or C908 drying up. This results in a small picture following a slow start up, with the 12V line down to 7-8V.

The zener diode D901 which provides the reference voltage for the shunt stabiliser can fail, and this is often accompanied by failure of the stabiliser transistor. Voltage checks will soon show whether the fault is in this area.

Diode Checks

The various diodes can be easily checked with an Avo on the Ohms range. With the black lead to the anode and the red lead to the cathode, a reading of around 1kΩ should be obtained. Reversing the leads should give a higher reading if the diode is in good condition. A truer reading will be obtained if one end of the diode is disconnected. Since diodes are cheap, it's quicker to replace any that seem doubtful. If a replacement diode is not to hand, examine the suspect one under a good light. If the surface is cracked or the white lettering or positive ring at one end is discoloured, the diode is probably faulty.

Transistor Alternatives

A BU104, BD253, BU134 or BU111Y can be used in the TR902 position. The shunt stabiliser can be a BC302 or BD433. The line output transistor TR403 can be a BU311, BU312 or BU109, and the driver transistor TR402 a BC120, BC140-10 or BC302-5.

Sensitivity

The original T12LGB performed best when used with a suitable aerial. The T12SGB will usually give excellent results using just its ring aerial.

An Odd Fault

Finally, a set that had received DIY attention came our way. You're unlikely to get this, but the results are interesting. The fault was a very small picture, and it transpired that the line and field scan coil leads had been interchanged. The leads to the line coils are colour coded black and white and plug on to pins 41-2 on the panel: the leads to the field coils are colour coded red and white and go to pins 51-2.■

All on a Quiet Afternoon

Les Lawry-Johns

WE'VE been a bit slack lately, and business hasn't been too good either. I'm always a bit suspicious when it's too quiet though. It always seems to herald the approach of a hurricane. This started on the stroke of midday, when Miss Pocock phoned to say that her colour set was changing colour, Miss Fox phoned to say that her black and white set was going grey, and Anna Logg popped in to say that her father's set was all green. "All right" I said to one and all. "I'll call this afternoon and you'll all be o.k. by teatime."

A Jowett Van

At ten past twelve there was a clattering noise outside and a 1934 Jowett van (two cylinder horizontally opposed engine) pulled on to the forecourt, attracting more attention than our window has for the last ten years.

I helped the owner extract the large Dynatron (still on it's legs) from the rear of the van after he'd unroped it. The castors rolled quite easily on the wood plank floor, and it was soon in the shop where it was found to be suffering from the usual Pye hybrid ailments too mundane to mention.

It was not the set which caused the trouble. It was the little van with its large wire spoked wheels attracting so many people that other vehicles could not get on the forecourt. I hurriedly completed the repair to the Dynatron and back it went into the little square van with its number plate on the top.

Off it clattered, to the disappointment of the crowd which quickly dispersed to allow Derek to bring in his 3500 Ultra, Mr. Deadman to bring in his 24in. monochrome set which needed a new tube, and Geoffrey to bring in his Telpro. I told them all to come back at five o'clock, as the repairs would all be done by teatime.

I was about to start on the first one when a lady came in with a Decca portable (MS1212).

"I want you to tell me how much it will cost and what is wrong before you do it."

So I whipped out the eight screws and lowered the back. When I plugged the set in the screen lit up and there was a faint hum from the speaker. It was a fair bet that the MC1330 detector chip was at fault.

Talking Chip

"If this thing with eight legs talks to you in foreign languages when you touch it, the voices will be saying that the repair will cost about eight quid give or take a bit allowing for the exchange rate in Tokyo."

"You mean the set will tell us how much the repair will cost?"

"It's the latest thing in silicon chips, but it talks in every language other than English you see."

"Lets see what it says then." I could see she was dubious. So I touched the output pin with the tweezers and the speaker burst into life with various voices as predicted but unfortunately someone was also reading the world news in English, which upset my little game. Just to be sure of the diagnosis I touched the input pin. It was dead, though my claim that it could also estimate its own repair didn't hold water.

"How much then?"

"Eight pounds twenty one including VAT."

Enter the Audiophiles

So we replaced the chip and started to put the new tube in the monochrome Ferguson set, or rather to take the old tube out. Just as all the bits were cluttering up the bench the audiophiles arrived.

"Have you a lead with a 5-pin plug at one end and four plugs at the other?"

I showed him a 5-pin DIN to 4 phonos.

"No it's not like that. Look, I'll draw it for you."

"Sorry sir, they don't make them with wander plugs on the ends."

"Can you make one up for me?"

"Which pins do you want the plugs to connect to, apart from pin 2?"

"All of them."

"Sorry sir. Try the shop down the road."

The next one to come along put me right off.

"Are you Mr. Littlejohn?"

I knew at once I didn't like him.

"You could say that. What can I do for you?"

"I've this Ferguson Studio 6 music centre. There's nothing wrong with it and it won't take you a jiffy to fix. It's just that the v.h.f. wanders off after about half an hour and there's some distortion on one channel after about two hours. I don't mind paying a couple of quid for your trouble."

"Thirty."

"How much? You must be joking."

"Thirty, and if you like to bring it back this time next month I'll see if I can fit it in."

"**** you. I'll take it somewhere else or do it myself."

And off he went whilst we concentrated on the tube change.

The job completed we then polished off the Telpro which wanted only a new boost reservoir capacitor and a fuse.

The 3500 proved to be more of a headache, requiring a tripler and an e.h.t. transformer. The rippled picture then obtained and the squeaking noise proclaimed that the core had dropped out of L502 during the tussle, suspicion centring upon the cat who had been heard playing with something that rolled. It was finally found under the Telpro. I suddenly remembered Miss Pocock etc. Time was slipping by. Teatime I'd promised.

Out Amongst the Femmes

Now think. Anna Logg's father had gone green. We'd sold him a new Ultra three years back. An 8800. Probably a shorted green output transistor. Make sure we've some BF337s in the box. Miss Pocock had merely said changing colour. Pye hybrid, probably the CDA panel. Take a spare one just in case. Miss Fox was going grey. Decca monochrome set. Probably the tube, possibly the PFL200, so check to see that we have one.

Off we drove, glad of the chance to get some fresh air. Bowling along with the window down. Who wants to smoke? Throw cigarette end out of window and wind blows it back in again. Where has it gone? Can't stop here. Pull over when we can. Feel a pleasant warmth on inside of thigh, suddenly becoming an agony. Hole in trousers and blister on thigh. Seat covering singed. Press on, the customers await your expertise.

Miss Fox had left the door open, as she was largely confined to a chair with arthritis (she had arthritis, not the chair). Having exchanged pleasantries we got down to work. Off came the rear cover whilst we waited for the valves to warm up. On came a grey picture, but the raster was bright enough. Not the tube. Note the effect of the contrast control. Working, but it couldn't put much black and white into the picture.

Pull out the PFL200. Didn't seem to want to come out. Eventually it did, but being in two halves the new one went in to stay.

"How's that Miss Fox?"

"There's a nice white line down the middle."

Now if there's one thing these sets suffer from it's dry-joints under the line output stage, leading to the scan coils. What with all the pulling that had been required to remove the PFL200, it was hardly surprising that one (dry-joint) should show up. So out came the main panel and sure enough there was a hole where a lead connection should have been. This done, we put the panel back and refitted the rear clips. The picture was now quite nice, so we put the back on – with all the screws along the top, at the sides and across the bottom.

"Nice and quiet around here Miss Fox."

"Have you turned the volume down then Mr. Johns?"

"No er, I don't think . . ."

Out came all the screws.

"What's that you're saying Mr. Johns?"

"Not a lot Miss Fox."

Naturally when I'd upended the panel to solder the underside I'd pulled off a speaker lead and hadn't noticed it.

"Oh that's better Mr. Johns, I'm so pleased to have it going again. Do I owe you anything?"

"Not a lot Miss Fox."

Rush off to next call, as it was now past four o'clock. Drive straight across crossroads as I was on the main road, only to realise that the vehicle coming from the right wasn't stopping either. Some fool had been up all night painting a roundabout which of course gave the other fellow priority. You just can't rely on anything being the same for two minutes nowadays.

Changing Colours

Miss Pocock threw the key out of the window as she has arthritis almost as bad as Miss Fox.

"Hallo Miss Pocock, how's the legs today?"

Fancy me asking Laura Lovitt a question like that . . .

"The colour keeps changing. One minute it's a nice colour, then it goes all red."

The CDA panel was the obvious place at which to start. We turned it over, expecting to find some nice cracks that could be bridged with nice bits of wire. There were no cracks, the supply to the red output stage being intact.

Back went the CDA panel. We watched the picture for some time. Then suddenly it went red, in a way which meant that there was a high voltage on the grid of the red gun. This in turn meant that the triode of the PCL84 wasn't passing current. A new PCL84 seemed to restore order, and another simple job was done. Refit back cover and prepare to leave. Screen went red.

Remove rear cover. Check valve base, but all contacts seemed good. Rocking the valve produced the fault however, so it appeared that there was an intermittent open-circuit inside the base.

I didn't feel inclined to change the valve base at this time of the afternoon, so I fitted the solid-state replacement panel and promised to return with the original the following day.

A Question of Ethics

Anna Logg's father (I always forget his name but I can't forget hers) lives on the fourth floor of a large block of flats. It's no joke collecting or delivering a set there because of the large number of twin doors – quite apart from the lift. When I arrived Anna let me in. Her father was having one of his bad turns, with his distressing lung condition which makes you feel bad just to look at him fighting for breath. He has oxygen equipment by his chair, and that's all that can be done.

The set was on when I got there, and seemed perfectly alright for a time. Then the screen flashed bright green. I immediately accused the green output transistor at the top of the signals panel of playing about. A meter check showed that the output voltage occasionally dropped to a low figure.

To clear the tube of suspicion I removed the fly lead. The voltage at the signals panel them remained steady, falling only when the tube lead was reconnected. Oh dear. A heater-cathode short in the tube was all we needed. Although the tube was insured for four years, it isn't funny having to implement this. I toyed with the alternatives. Disconnect the heater from earth and tie it to the green cathode instead via a suitable resistor? But if the short still occurs the green will smear across the screen. Fitting an isolating transformer would restore almost normal working, and this is what we do if the tube is not insured. This tube was insured however, and the old boy was entitled to a new one.

"The tube's at fault and will have to be replaced" I told them. "I'll bring over a loan set while we're waiting for the replacement."

"I don't want a loan set. I've never borrowed anything in my life."

Anna looked resigned. "He's like that. He depends on the TV as he can't get out, but he won't accept one which isn't his – even from us. He's a cantankerous old bugger, aren't you dad?"

This was an unexpected snag. Since Thorn take at least a month to replace a faulty tube (counting the transport there and back, which accounts for a few days), the stubborn old chap was going to be lonely for several weeks unless we told a white lie. So we lugged our test gear down to the van, then came back for the set – fortunately having Anna to open the doors for us. Back at the shop we whipped out the tube, and within half an hour it was on its way to Edmonton via UK roadlines (carriage £5·38), albeit in a Mullard box since we didn't have a Thorn one. We then nipped back to the shop and fitted a Thorn New Life tube which we had in stock, and decided to take the set back to him the next day in case he disbelieved that the correct replacement could have been obtained so quickly.

When we took the set back the old chap was very pleased.

"They're very good at implementing their guarantees, aren't they? I think I'll write and thank them."

I charged him a fiver and he said I'd earnt that for all the lugging about.

I wonder what would have happened it he'd been one of those clever people who buy their sets from a discount warehouse? No doubt he would still have found a kindly soul who would have done exactly the same as I had.

Note for Thorn. Isn't it possible to speed things up a bit? Say by having spare tubes at local branches so that they can be dispatched the same day. After all a dealer isn't going to go to all the trouble of taking a tube out and sending it back if it isn't faulty. And again, we do go to a lot of inconvenience in implementing your set guarantees without recourse to you at all. Do you want a list?

Your good name is being upheld by our unpaid efforts. What about a bit of cooperation in keeping the customers happy?

Letters

REBUILT TUBES

In talking about rebuilt tubes (June issue) Les Lawry-Johns comments that he's "probably got it all wrong", which invites replies. May I therefore say that the symptoms Les has been unfortunate enough to experience are typical of tubes that haven't been properly evacuated. Les mentions that at least one of the sources he's tried uses hot pumping. But this isn't the whole secret. In my experience, excellence of the pumping system, combined with high temperature, are the essentials for proper tube evacuation.

Les questions the ageing process. I can say without fear of correction that a cathode properly converted from the metallic carbonates with which it is initially coated becomes a metallic oxide coating which, *in a vacuum,* will remain stable. The oxide coated cathode will change only if there's some other factor at work – and in the tubes he describes this other factor is almost certainly gas present due to inadequate pumping. The measures Les has been obliged to adopt are in fact not reageing but acceleration of the gas absorption by the getter.

There are approximately seventy companies engaged in the business of tube rebuilding in the UK, and I'm sure that the reputable majority of them will agree that Les has been singularly unfortunate. Anyone experiencing the sort of problems that Les describes should return the tube as unsatisfactory and ask for his money back.

T.W. Smith, C.Eng., M.I.E.R.E.,
Managing Director,
Display Electronics,
96-100 Waterloo Road, Uxbridge Middx.

VCR SPEED CONVERSION

G. Beard's article on VCR speed conversion in the July issue was excellent. For those who wish to double the playing time but don't require the machine to be compatible with the N1700 standard however there's a simpler approach. The only part that has to be purchased is an N1700 head drum – the extra servo head, new audio/sync head and centreless grinding of the capstan are not required. This is how I modified my N1500 machine – the job took a couple of hours and was well worth while.

The N1700 head drum was first fitted, giving a tremendous improvement in picture quality and much more positive adjustment of the tracking control (due to the slanted heads). The motor pulley was then removed, and a gauge was turned up to fit the groove (see Fig. 1). A piece of quarter-inch mild steel was then chucked up, projecting $\frac{3}{4}$in. from the chuck, and carefully turned down until the motor pulley was a tight fit (this is essential if it's to run true). The pulley was next clamped on tight and turned down to 0·505in. (Fig. 2). You'll find that the cone-shaped end of the pulley is just under 0·5in., which is a useful guide. With alternate use of a 90° V tool and a narrow parting tool made from a hacksaw blade, the groove was turned until the gauge fitted perfectly (see Fig. 3). The pulley was then replaced and all the drives cleaned. No adjustment was necessary, but an 0·1μ F capacitor was connected across SK401 3-5 to correct for loss of audio h.f.

The timer was modified as suggested in the October 1978 issue, page 646 (not page 64 as stated). Another way of doing this is to fit a switch above SK12, which closes when the machine laces up, shorting out the timer switch SK6, so that when the latter opens after an hour the tape runs to the end, the auto-stop then operating. For short-period recording, this can be disabled by using the CK switch, which is not used usually, so that the timer's switch off facility is used (see Fig. 4).

So there you are: if you don't want to be able to replay prerecorded tapes or tapes from N1700 machines the modification for double playing time is quite simple.

Mike Phelan,
Holmfirth, W. Yorks.

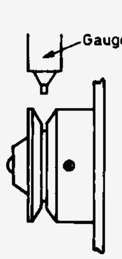


Fig. 1.

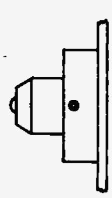


Fig. 2.

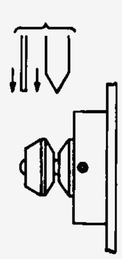


Fig. 3.

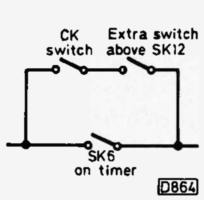


Fig. 4.

VIDEO POLARITY

Other readers may be interested in the problem that confronted us recently and the way in which we managed to resolve it. The set, a "Continental Edison" monochrome receiver, was brought to us with the complaint that "it wasn't working". The symptoms however were a negative picture and loss of both line and field sync, with normal sound.

After some investigation, we found that the set was intended for use with positive instead of negative vision modulation. The video channel consists (see Fig. 5) of a detector diode followed by a couple of emitter-followers and then the output transistor. The second emitter-follower provides two outputs, one to the output stage and the other, from its collector, to the sync circuit. Our first thought was simply to reverse the detector diode, but this was not successful as the video signal's d.c. component cut off the first transistor. Our second approach to the problem, transposing the video and sync outputs from the second stage, was more successful. This produced a normal, positive picture, but the sync locking was still unstable. We tried to improve the sync by taking the sync feed from the output stage instead of the second stage, but while this improved the sync locking it made the picture worse – the distorted frequency response produced smeary vision.

We finally decided to try to get the signal polarity right by modifying the first video stage – by taking the output from the collector instead of the emitter of the first transistor (see Fig. 6). This was most successful, and gave a better quality picture than some comparable, unmodified

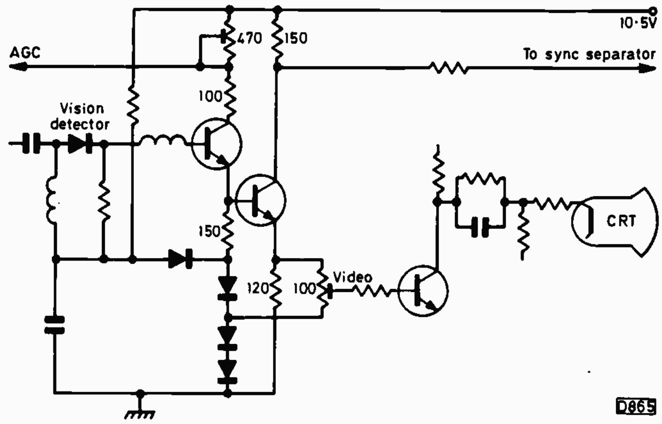


Fig. 5: Circuit of the original video channel.

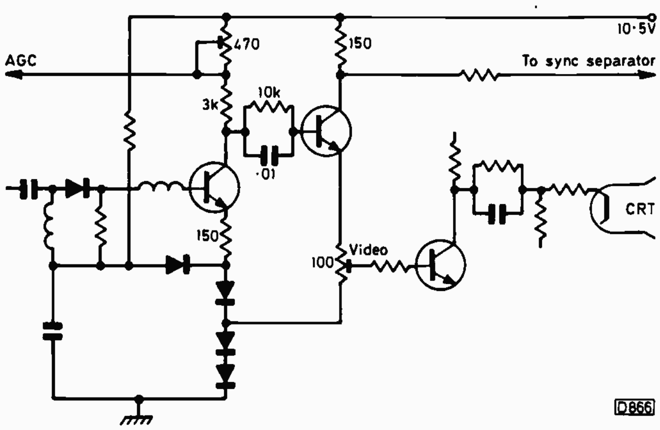


Fig. 6: After modification to cater for negative-going vision.

sets. The most suitable value for the first stage's collector load resistor was found to be 3kΩ. The interstage coupling is via a 10kΩ resistor in parallel with an 0·01μF capacitor, and the second transistor's emitter load resistance was increased by removing the 120Ω resistor previously fitted here.

Dr. Karailiev,
Senior Lecturer, College of Science and Technology,
Port Harcourt, Nigeria.

PROJECTION TV

Vivian Capel's article on vintage projection TV systems (June issue) reminded me of things I'd almost forgotten. At the time, I was fortunate in attending a one-day course on projection sets, with particular attention to the Schmidt optical system, run by Philips/Mullard engineers at their Birmingham depot. Whilst the article covers the system very well, I was given the following instructions on resetting the corrector lens. This, as you say, is very important.

At the centre of the lens there's engraved a circle with a V inside it. This is used for setting up. While the c.r.t. and the scan assembly are still removed, pull back from inside the unit the rubber tube mask. With an external light shining through the lens one will then, on looking through the lens at an angle, see an inverted reflection of the V on the corrector lens. By sliding the lens in various directions, it's possible to make the point of the reflected, inverted V touch the point of real V, thus forming an X. The lens is then correctly set and the fixing clamps can be tightened. This method is accurate and dispenses with the need to use L-shaped jigs.

R.A. Cotterill,
Christchurch, Dorset.

Vintage TV: The HMV Model 901

David Looser

NO fewer than nine manufacturers exhibited receivers for the BBC's new high-definition TV service at the 1936 Radiolympia. The service was due to begin that November. Amongst the exhibitors of course were EMI, who had developed the 405-line all-electronic system which, along with Baird's 240-line system, was to be used by the BBC (the two systems were used alternately during the initial trial period). EMI exhibited two receivers under each of their brand names – HMV and Marconiphone. The HMV sets were the 901 and the 900. The latter incorporated an all-wave sound receiver. The corresponding Marconiphone sets were the 701 and 702. All four receivers employed the same basic electronics, the differences being confined mainly to the cabinets and the sound receivers.

About a year ago I was offered an HMV Model 901 which was virtually complete but had not been used for some time and was showing signs of deterioration.

Basic Features

The 901 has a 12in. c.r.t. which is mounted vertically in a substantial (and heavy) wooden cabinet, the picture being viewed via a mirror fitted to the inside of the cabinet's lid. This arrangement was quite common with sets of the period. It was done because of the length of the narrow-angle deflection tubes then in use. The Emiscope 6/6 12in. tube used in the 901 is about 2ft. long: mounting it horizontally would not be exactly convenient.

The electronics used in the 901 are on four steel chassis as follows:

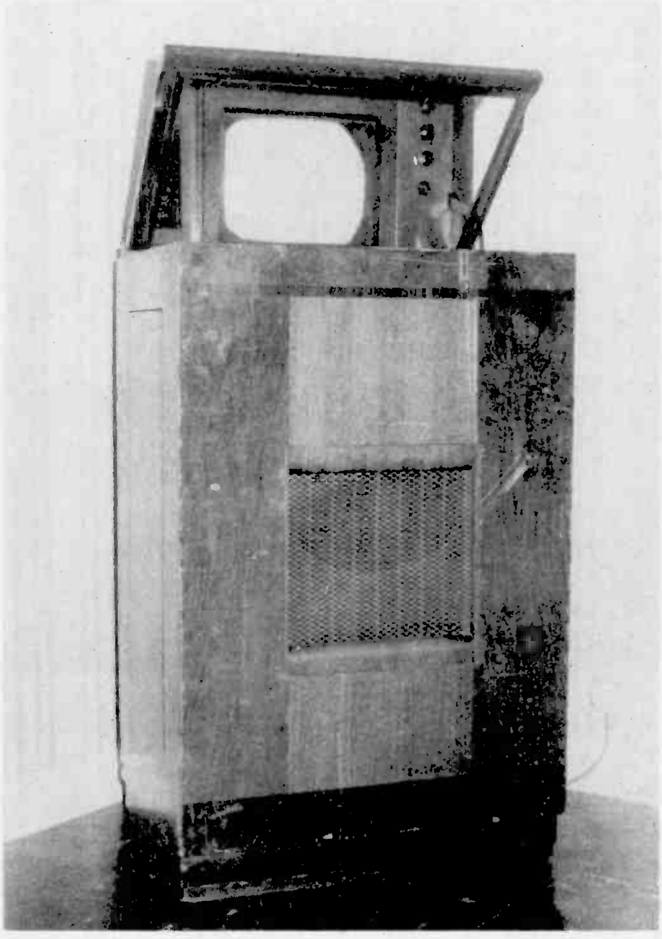
(1) The t.r.f. vision receiver, which is mounted vertically down the right-hand side of the cabinet.

(2) The superhet sound receiver, which is mounted across the front of the cabinet.

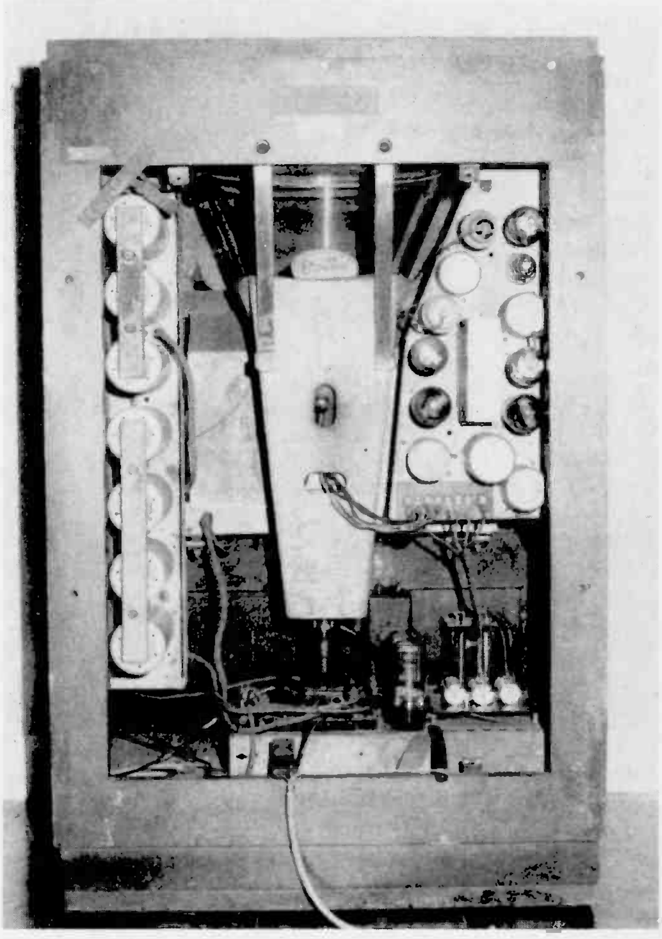
(3) The timebase chassis (or synchronising unit as EMI called it) on the left-hand side of the cabinet.

(4) The power supply unit, which is mounted at the bottom of the cabinet.

The accompanying photograph shows the innards with the back removed. The tube, centre, was a remarkable device, with a hexode gun structure, electrostatic focusing and a peculiar seven-pin base.



TV 1936 style, with viewing via a mirror. The cabinet is typical of EMI's radiograms of the period, and the 10 × 6in. ellipitcal speaker can certainly give decent audio. Thirteen controls are grouped around the c.r.t. faceplate.



Inside the 901, with the tube in its cradle at the centre, the t.r.f. vision receiver unit at the left, the timebase unit at the right and the power supply unit at the bottom. The sound receiver is at the front of the cabinet.

Thirteen front panel controls are grouped around the tube face. They include an r.f. sensitivity control (there was no a.g.c. in those days), the 240/405-line system switch, and a lot of what would nowadays be relegated to internal presets – for example line hold, linearity and width etc. In fact there's only one internal preset control – the sync separator bias adjustment.

Restoration

I decided to restore this receiver to working order, and EMI were able to sell me a photocopy of the original service manual – not bad for a set that had been obsolete for 40 years!

As a first step the set was dismantled and cleaned. Not surprisingly, the innards were filthy. Whilst doing this I checked around for damage, broken components, etc.

Power Supply

The power supply unit was obviously the thing to start on first, with its two separate mains isolating transformers for the h.t. and e.h.t. supplies. The h.t. transformer was o.k., as were the twin U12 h.t. rectifiers. The three reservoir/smoothing electrolytics showed excessive leakage however. They weren't the originals, so I had no hesitation about replacing them with modern equivalents.

Vision and Sound Receivers

With the h.t. and l.t. supplies available, it was time to test the sound and vision receivers. The sound receiver is a conventional four-valve superhet (X41, VMP4G, MHD4, N41 valves) whose circuit was typical of the standard broadcast receivers of the period. It works at the single frequency of 41·5MHz of course. The local oscillator can be fine tuned from the front panel to accommodate drift, the i.f. being 1·5MHz. The only problem with this unit was an intermittently open-circuit primary in one of the i.f. transformers. After this was rewound and realigned, the unit functioned perfectly. The vision receiver was even less trouble – in fact it worked without any attention at all. It consists of six r.f. amplifier stages (five MSP4s and an MSP41), followed by a D42 detector which feeds the c.r.t. grid without any video amplification at all. A high-level contrast control is included between the detector and the c.r.t. grid (see Fig. 1). Since the video signal is d.c. coupled to the c.r.t. and there's no a.g.c., the true black level is displayed, something that few modern monochrome sets seem capable of doing.

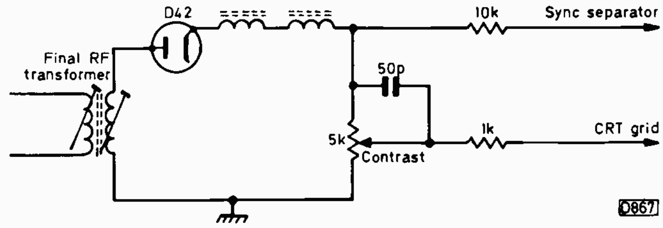


Fig. 1: The video signal is fed to the grid of the c.r.t. via the contrast control, with no video-frequency amplification.

Timebases

The timebase unit employs separate sync separator valves (two more MSP4s) for the line and field sync. The grids and cathodes are connected in parallel, but the anodes are kept separate to feed the respective timebases. The sync feed to the field oscillator includes a D42 interlace diode. Both timebases employ conventional blocking oscillator circuits, but there's a curious extra valve in the line timebase (see Fig. 2). This valve, an MH4 triode, is referred to as a "compensator valve" and was apparently necessary because in the Baird 240-line system the line sync pulses were suppressed during the field sync pulse. It presumably improved the basic frequency stability of the timebase: anyway, it was omitted from the later 405-line only versions of the receiver. The line and field output stages are similar, both employing an N41 output pentode, transformer coupled to the scan coils. Without the need to generate the e.h.t., the line output stage is delightfully simple.

The timebase unit had suffered rather more than the receiver units. Most of the electrolytics and some of the

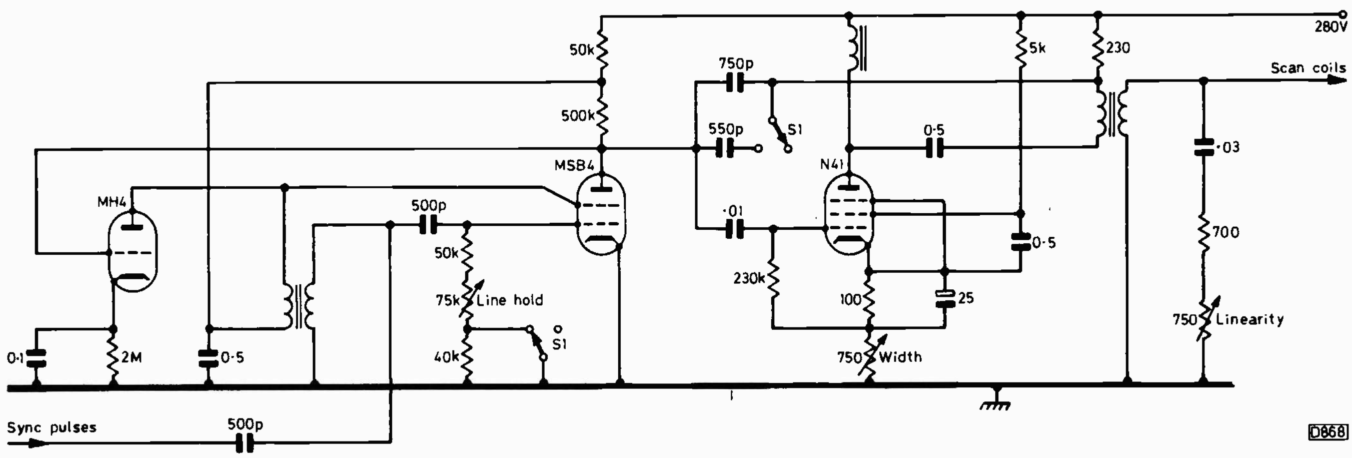


Fig. 2: The grandad of all line timebase circuits? Well one of them, anyway, used in the HMV Model 901 of 1936. It's interesting that the charging capacitors (750pF and 550pF, switched for 240/405-line operation – switch S1 is shown in the 405-line position) are charged negatively by the MSB4 blocking oscillator valve during the flyback, Miller style, discharging to h.t. via the 500kΩ and 50kΩ resistors to drive the N41 output valve progressively harder on during the forward scan. The output valve is a.c. coupled to the output transformer – as in most hybrid colour sets of the 1967-9 era. The tetrode blocking oscillator circuit is conventional, with feedback between its screen and control grids via the blocking oscillator transformer, but what does the MH4 triode do? EMI called it a "compensator valve", and apparently included it to compensate for the fact that in the Baird 240-line system the line sync pulses were not present during the field sync period. It would seem to work as follows. You'll notice that the positive-going line drive waveform is applied to its control grid, as well as to the N41's control grid. At some point therefore it will conduct, its anode current flowing via the primary winding of the blocking oscillator transformer to ensure that the blocking oscillator valve switches on at the right time.

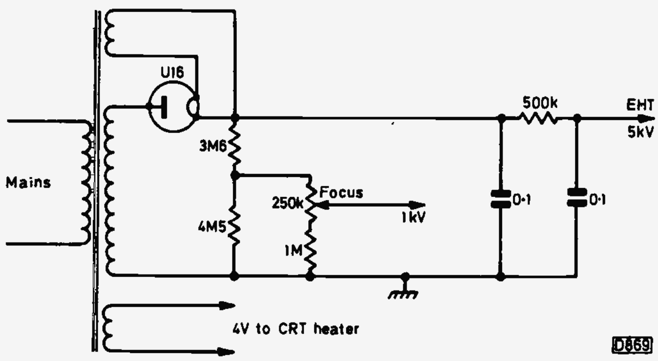


Fig. 3: E.H.T. from the mains, with a pi filter network. The bleed resistance chain ensures good regulation and provides a tap for the focus voltage. Note that this type of e.h.t. system can be lethal.

resistors had to be replaced, and in addition the 240/405-line system switch had at some time in the past been removed, leaving a bird's nest of the wiring that had previously gone to it. For the present I've tidied this wiring up, but I've not entirely given up hope of obtaining a replacement switch and restoring the set to dual-standard operation.

The Tube

All that now remained before I could attempt to get a picture was to refit the tube and get some e.h.t. The tube has a number of odd features. For example, although the diameter of the neck is quite large (about 2in.), it reduces considerably a few inches from the bulb, the scan coils sitting over this reduced diameter portion. The idea was obviously to improve the tube's deflection sensitivity (it also stops the scan coils sliding down the neck), but it means that the coils have to be assembled on to the neck of the tube – a fiddly job that was not helped by my being worried about putting stress on the tube's glass at its weakest point. The c.r.t. merely rests in position inside the cabinet, in a metal cradle which occupies the centre of the cabinet – it can be clearly seen in the accompanying photo.

E.H.T. Supply

The e.h.t. supply (see Fig. 3) turned out to be a bit of a problem. The output from the high-voltage secondary winding of the e.h.t. transformer is rectified by a U16 valve and smoothed by a pi-section filter. A bleeder network (3·6MΩ plus 4·5MΩ) across the reservoir capacitor ensures that both capacitors are discharged when the set is switched off, and also ensures good e.h.t. regulation by swamping the c.r.t.'s beam current. A tapping feeds the tube's first anode via the focus control. Note that e.h.t. supplies of this type are *lethal,* and should be treated with respect.

The transformer showed considerable signs of overheating, and I was not surprised to find that it suffered from shorted turns. I put it aside for rewinding therefore and set about devising a temporary supply. A surplus e.h.t. transformer rated at 20mA, 3·7kV was obtained and this, after rectification, produced a nice 5kV for the final anode. With a separate transformer for the tube's 4V heater supply, and a BY476 silicon diode as the e.h.t. rectifier, I was ready to try the set out.

Moment of Truth!

With everything assembled, I switched on. After about 30 seconds I was rewarded with sound and line whistle, so I gingerly turned up the brightness control. This produced a dim raster, and adjustment of the other controls then turned this into a recognisable TV picture. My triumph was short lived however, for after a few minutes the picture disappeared to the accompaniment of crackling sounds from the power supply chassis – one of the e.h.t. capacitors had decided to go short-circuit. A replacement was obtained from the remains of an early post-war (but still mains e.h.t.) TV set, and in this form the 901 has been functioning ever since.

Performance

It must be admitted that the picture is extremely dim by modern standards. How much of this can be laid at the door of the elderly tube is difficult to say. The presence of an ion burn in the centre of the screen suggests that the tube had been in use for a not inconsiderable number of hours. The focus and scanning geometry are nothing to write home about either, but the correct black level presentation and excellent e.h.t. regulation are plus points. The sound is very good, certainly better than the majority of modern sets. It's helped by having 4·5W of audio driving a 10 × 6in. speaker mounted in a decent timber cabinet. The effect is marred however by the 10kHz whistle from the line timebase.

An HMV 901 would have set you back 95gns in 1936, the equivalent in modern terms to about £1,500. For this you'd have been able to watch up to two hours of TV a day (but not on Sundays). Is it surprising therefore that a year after the start of the service only some 1,000 sets had been sold to the public, while correspondents to *Wireless World* were complaining that TV was a flop?■

Bionic Alternatives

Eugene Trundle

BACK in June 1979 we reported on some solid-state replacement modules introduced for use with the Pye hybrid colour chassis. Amongst these was a CDA panel produced by LEDCo. Another panel for the same purpose was sent us for testing not long since, manufactured this time by DR Developments of Melton Mowbray. The original Pye valved CDA panel simply cooked itself up, so that most of the originals are now in dire need of pensioning off.

The DR panel differs from the LEDCo one in several respects. The main differences are as follows. First, instead of using feedback clamps, the DR Developments panel uses driven clamps of a similar design to those in the original panel (see Fig. 1). Secondly, the time-constant of the field flyback blanking pulse in the DR Developments design has been increased in order to suppress the teletext lines at the top of the screen. The panel is again a direct plug-in replacement, with a minimum of presets, designed to be fully compatible with the existing circuitry in the Pye chassis.

In the DR Developments panel there are fourteen transistors in a circuit that's not far removed from the original Pye one. There's provision for setting the green and blue colour-difference signal levels, and these are the only presets necessary or provided.

The valid comment made by Alan Pemberton (*Letters*, September 1979) regarding the adverse effect of the LEDCo panel on the black-level performance of the luminance channel also applies to the DR Developments design, since the black-level clamp again looks into a low impedance which drastically shortens the time-constant of the clamp components in the Pye brightness circuit. The answer to this would perhaps be to massively increase the value of the coupling capacitor C39 (0·22μF, on the i.f. panel), or to use a high-impedance f.e.t. circuit as the first luminance stage on the CDA panel. Neither of these alternatives is attractive, the former since it would involve the repairer in delving into another panel, the latter because it would involve extra circuitry and, due to f.e.t. spreads, extra presets.

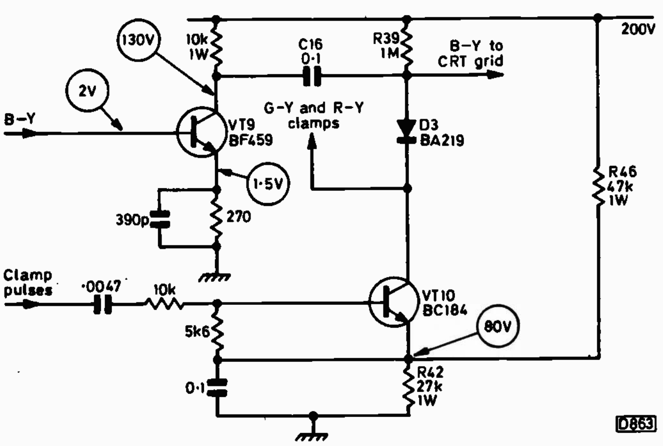


Fig. 1: The driven clamp circuit used in the DR Developments solid-state CDA replacement panel. Transistor VT10 drives D3 and the other two clamp diodes. When VT10 and the clamp diodes switch on, C16 and the corresponding coupling capacitors in the other colour-difference signal channels are returned to the clamp potential at the junction R46/R42. Thus VT10 and three diodes replace the three clamp triodes used in the original Pye circuit.

We fitted the DR Developments CDA panel in a suitable receiver and ran it on soak test. The picture, assessed subjectively, was as good as that given by one of the original hybrid panels when in good condition, and the factory settings of the G − Y and B − Y presets were correct. The teletext/VITS blanking arrangement worked well, and would no doubt be a great boon in cases where the c.r.t. suffers from the "halo effect" produced by secondary emission. We found that the flyback blanking was quite adequate with our test sample, and that the luminance output transistor was driven fully to cut off during the line and field flyback blanking periods.

We feel that the driven clamps used in the colour-difference output stages are not quite as effective as feedback clamps: this was noticed on a reasonably good tube – we were unable to lay our hands on a set with a gassy tube to check this point fully.

The ballast resistor used to replace the valve heaters in the original hybrid design consists of two 100Ω, 11W resistors each dissipating 10W and mounted close together just 13mm from the surface of the panel. There are several other hot little resistors, one or two of which are operated close to their maximum ratings: all of these are mounted close to the panel. This means that the panel is likely to suffer in the long run from the effects of overheating – though by then the set would probably have reached the end of its useful life.

The DR panel has a plus point in its teletext blanking, but we cannot see any reason to give preference to the design in other respects. The picture is perfectly satisfactory, but there is the concern one feels about the long-term effects of the rating and mounting of some of the resistors on the panel.

IF MODULES

The Pye hybrids were eventually replaced by a range of solid-state sets which were covered in these pages in some detail by Mike Phelan (see the September-November 1979 issues). One problem that assails these sets concerns the i.f. module. It's been mentioned on various occasions, and can be summed up as double-sided print, bad joints and trousered capacitors. To overcome this difficulty, both DR and LEDCo have introduced replacement panels.

At this point we must comment that we've never experienced any problems with repairing the offending Pye panel using the means advocated by Mike on page 642 of the October 1979 issue. Perhaps regular readers will recall the Trundle mean streak – make do and mend is better than cough up and send! For those who don't want to get involved in this type of repair however the replacement modules do offer a most adequate substitute.

We had one of each type for review, the LEDCo 915 module and the DR "IF Gain Module". Both use a single-sided panel, with more robust print tracks than the Pye original, and both up-date the circuitry by using a Plessey SW150 SAWF to form the i.f. passband.

LEDCo have opted for a low component count of 24 by using a single transistor to drive the SAWF whose output feeds the differential inputs of an 8-pin MC1349 i.f. amplifier chip. A.G.C. is applied to the chip.

DR Developments on the other hand use a circuit which follows the original design more closely – apart from the use of a SAWF that is. There are three transistors, the first driving the SAWF and the other two providing the gain thereafter, the first of these being gain controlled. The component count is 32.

The relative merits of these two approaches to the problem are not really important, since both give excellent performance and neither is likely to break down. If they should, normal diagnostic and repair methods can be used – a circuit diagram comes with each module.

On test, both modules worked very well, giving results comparable to a very well aligned conventional coil strip. We suspect that the performance obtained from the set once the module has been fitted depends more on the alignment of the vision detector coil, the luminance channel frequency response and the condition of the c.r.t. than on the replacement module's i.f. response. Thus any small differences in the performance of the modules is likely to be masked.

Neither module requires any adjustment, neither does the set into which the module is fitted. We would not hesitate recommending either module to anyone who cannot or doesn't want to repair the original Pye panel.

PRICE AND AVAILABILITY

The LEDCo 915 module is available from LEDCo, 21 Clifford Road, South Norwood, London SE25 5JJ at £11.45. The DR Developments CDA panel is available at £19 and the IF Gain module at £9.50 from Lloyd Electronics, 63 North Parade, Grantham, Lincs. All prices include VAT and post/packing, and quantity discounts are available.

DR Developments have recently added to their range a replacement power supply panel for the Rank A823 solid-state colour chassis. The Rank panel is another one that tended to suffer from burn ups, mainly due in this case to the VA1104 surge limiting thermistor. To overcome this particular problem, DR Developments use a slow-start arrangement. For further details, see *Teletopics,* July 1980, page 482. The panel is available from Lloyd Electronics at £17.50. We hope to try one out in due course. The replacement panel strikes us as a sound idea since a defective Rank power supply panel can affect the adjacent decoder panel, leading to quite an expensive repair bill.■

VCR No-colour Faults

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

FROM time to time one is going to meet a Betamax or VHS machine with the no colour fault. Before diving in with the soldering iron to change the colour chip, read on.

Colour signal processing takes place during record and replay in these VCRs, so any number of discrepancies in these circuits can cause loss of colour. In previous issues (see the May and June issues this year) I described the colour record/replay systems used in these machines. The purpose of the present article is to deal in greater detail with a part of the system that's caused some problems. The specific circuitry described is that used in the Sony Betamax VCR – the Sanyo and Toshiba versions are the same however.

Colour Processing System

Fig. 1 shows a block diagram of the system, with the colour subcarrier recovery arrangement operating in the replay mode. The off-tape colour signal, with a 685kHz or 689kHz subcarrier on alternate tracks, is mixed with 5·119MHz or 5·123MHz carriers (these frequencies have been rounded off to simplify matters), the resulting difference signal being the required 4·43MHz one. The 5·119MHz and 5·123MHz carriers are obtained from the 4·43MHz signal provided by a crystal oscillator after adding 685kHz or 689kHz, the latter two signals being obtained from a phase-locked loop which is locked to the replayed line sync pulses. It's the phase-locked loop that's our main concern here.

The loop contains a variable-frequency oscillator (VFO) whose output is divided by eight to give 685kHz or 689kHz. The oscillator's output has to be switched at 25Hz, i.e. track-by-track. The reference for this switching is a pulse obtained from a pick-up coil mounted near the head assembly. The pulses are delayed and then applied to a flip-flop. This produces a 25Hz squarewave that controls the switching. I've called this V/2, i.e. half field rate. The other input to the phase-locked loop consists of line pulses (fh). In the record mode these are obtained from the video input signal; on playback they are obtained from the replayed video signal.

A fault in this circuitry can cause no colour recording or no colour on replay. Whenever you encounter the no colour fault, first establish whether the trouble is on record or playback – by playing a known good tape.

Circuit Action

As with any loop system, the story has to be picked up somewhere. The VFO can be considered as the system's clock, so we'll call its output the clock pulse output. This is as good a point as any at which to start. Fig. 2 shows the relevant circuitry in greater detail while Fig. 3 shows the various pulse waveforms.

Say the clock is running at 5·48MHz. Its output, suitably squared, is being counted by IC8. Fig. 3 picks up the count at 321. Two outputs (÷4 and ÷8) are combined in the nand gate IC11/1 with the V/2 signal which is in its high state. The output at pin 6 is high unless all three inputs to the gate are high, when the output goes low. The ÷8 output from IC8 also goes to gate IC11/2, where it's combined with the output from IC11/1, giving the CK input to IC9/1 – a gated bistable. A rising edge at the CK input plus the appropriate state at the D input initiates reset of IC8's count. The ÷8 output from IC8 is in addition fed to the ÷44 counter in IC12 to give a line rate output we'll call f'h. This is compared with fh in the a.f.c. i.c. (IC6), whose output controls the frequency of the VFO. Note that after a count

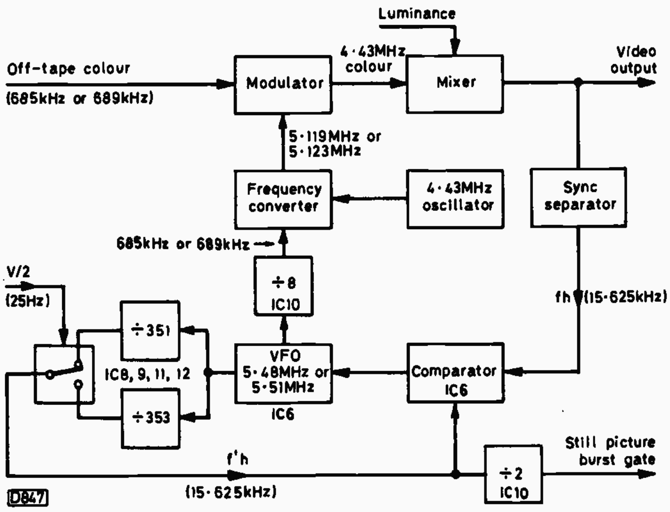


Fig. 1: Block diagram of the colour signal processing system used in Betamax VCRs. The recorded colour subcarrier is at 685 or 689kHz on alternate tracks. This is mixed with a 5·119 or 5·123MHz carrier in a balanced modulator to produce the 4·43MHz colour signal required for playback. A rather elaborate system, including a phase-locked loop, is used to produce the 5·119 or 5·123MHz carrier (see text). Missing signals anywhere in this area will lead to loss of colour.

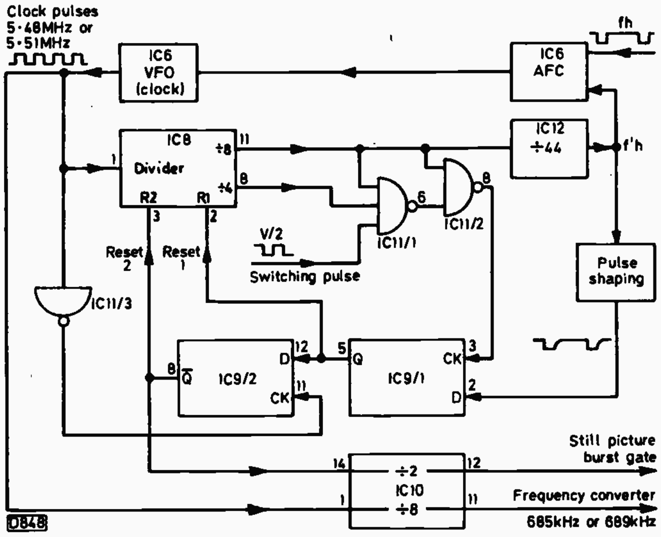


Fig. 2: The phase-locked loop circuit. IC8/9/11/12 divide by 351 or 353 on alternate tracks.

of 351 f'h will be slightly ahead of fh, while after a count of 353 f'h will be slightly later than fh. The error signal applied to the VFO thus varies, with the result that the VFO gives the 5·48MHz and 5·51MHz outputs required.

A pulse shaper puts a slope on the trailing edge of f'h. This is important! Compare (Fig. 3) the two inputs to bistable IC9/1, CK and D (f'h). After f'h sends the D input low, the next rising edge at the CK input triggers the bistable provided the trailing edge at D has risen high enough.

The output from IC9/1 is the "reset 1" input to IC8 (pin 2). IC8 requires both its reset inputs to be high before it responds. Therefore the output from IC9/1 is also fed to the D input of bistable IC9/2, whose CK input consists of the clock pulses after inversion by IC11/3. The action of this second bistable is similar to that of the first. Reset 1 at pin 12 sends the D input low, and the next rising edge at the CK input triggers it. This corresponds to a count of 328. When reset 1 ends, input D goes high again and the next clock pulse resets IC9/2. This gives the "reset 2" output, which is shifted by a clock pulse interval and inverted by

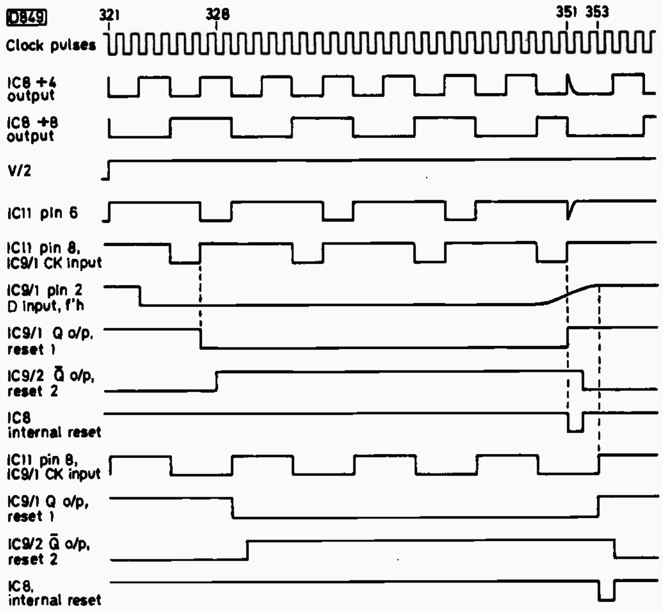


Fig. 3: Timing chart – the pulse waveforms around the phase-locked loop. Note that the shape of the waveform at pin 8 of IC11 depends on whether the V/2 signal is high or low.

being taken from the $\bar{Q}$ output.

All this activity is required to provide IC8 with two reset inputs that are coincidentally high for only one clock pulse period. This resets IC8 at the count of 351. To count 353, the V/2 input must be low, holding gate IC11/1 off. The output at pin 6 is then high, the second gate acting as an inverter. The CK input to the first bistable is thus an inverted version of the ÷8 signal. The D input to IC9/1 is as before, but this time the rising edge that initiates reset occurs two clock periods later, i.e. at a count of 353.

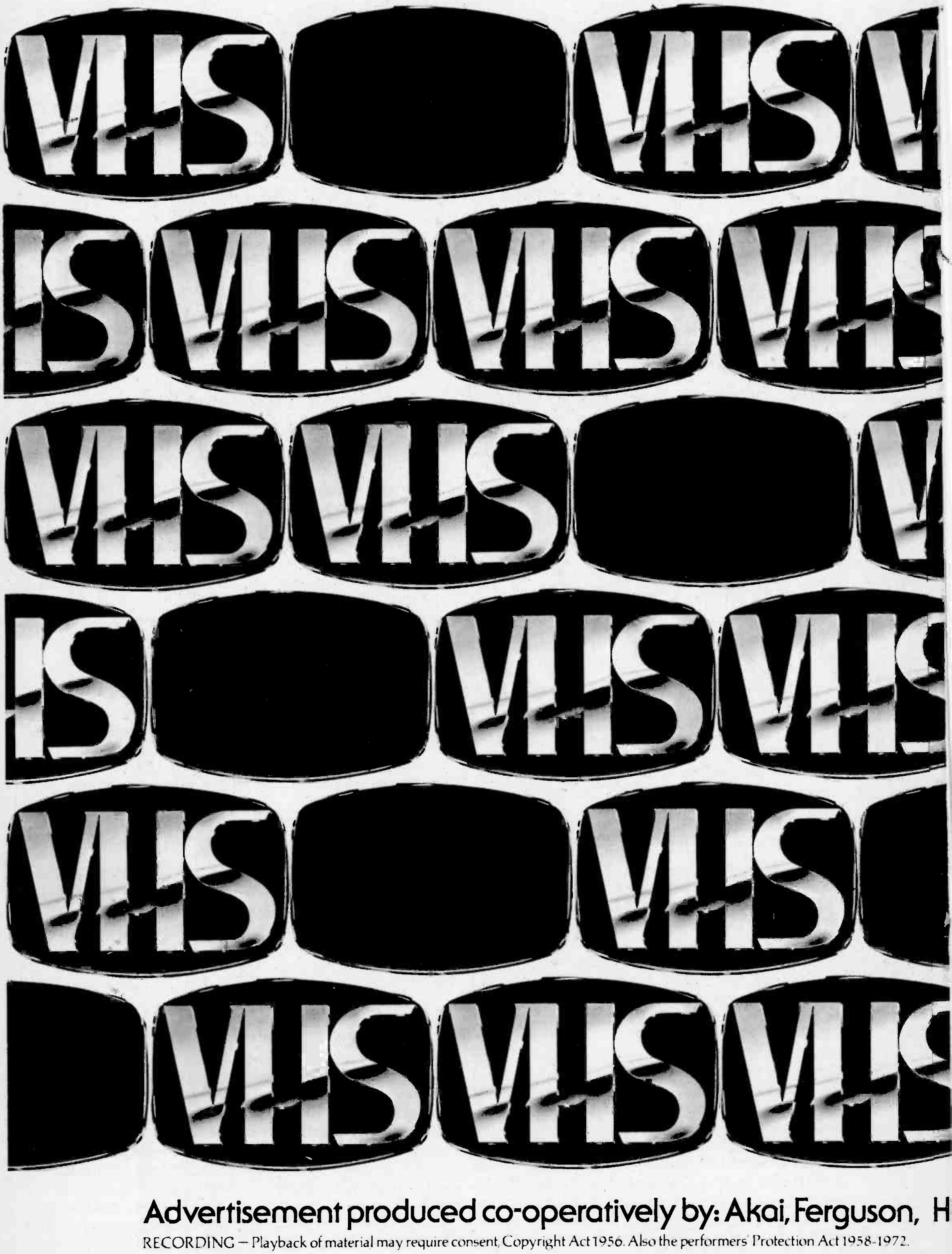
The output for the colour carrier frequency conversion stage is not taken from within the loop. Instead, the clock pulses are taken to a separate ÷8 counter in IC10 – probably because the ÷8 output from IC8 is already driving three inputs and is thus well loaded. IC10 also has a ÷2 counter which is fed from IC9/2. This is simply a convenient way of picking off line rate pulses for the still picture circuit.

Faults

Faults we've had in this part of the VCR have been absent line (fh) and V/2 pulses, mainly because of dislodged plugs and sockets. A more complex problem arose when bistable 1 (IC9/1) went intermittent, as a result of which the whole loop failed because IC8 was being held reset. It was difficult to decide where the fault was, but eventually a check revealed that both the Q and $\bar{Q}$ outputs of IC9/1 (pins 5 and 6) were high. Replacing IC9 cured the fault.

A few tricks can be used to check parts of the loop. The V/2 input can be kept in the high state by earthing the base of Q38 or in the low state by earthing the collector of Q38. A frequency counter can then be used to measure the count. Another point is that a dual-beam scope can be used to see and compare the CK and D inputs to IC9/1. This enables you to see the points on the sloping, trailing edge of the D input at which the reset edges occur. The display is difficult to lock and is confusing without inhibiting the V/2 input.

I'm not going to pretend that fault-finding in this area is easy. The service manuals are not too clear, and contain errors. I hope this article has provided some insight into what goes on however.■



Components for TV

Part 4

Harold Peters

WE said at the outset that we wouldn't go into valves and semiconductor devices. There's one point worth making however – the use of semiconductor devices to replace valves, for example the "solid-state PL802". This is quite a good way of keeping an otherwise good elderly set going. Similarly, it's perfectly in order to replace indicator lamps with LEDs.

If, after what has been said in previous instalments, the reason for the use of a particular item in a set is still obscure, you may find the answer by measuring its dissipation in use and comparing this with the component's specification. One reason for the success of our oriental friends is the way they design their sets to run well within the ratings of the components and the board material used. As a rough guide, if a component is operated at just over half its maximum rating (or less) it will have a long life. A 63V capacitor operated at 50V has only 13V in hand for flashovers, surges and so on. Resistors that dissipate watts warm the inside of the rest of the set, while hot coils invite shorted turns by raising the temperature of the insulating varnish to near melting point.

Some of the worst problems arise from the use of underrated semiconductor devices – an inheritance maybe from the days of valves, which are relatively tolerant of overloads etc. Data books often quote transistor dissipation at a typical junction temperature – typical because it's almost impossible to measure. The nearest you can get to the junction is in the flat type of output transistor, where the metal disc that presses against the heatsink is connected directly to the substrate and is at a temperature only 2° different from the junction. If a thermocouple is inserted here, theory and practice can be brought together. What if you find that things aren't as you expected? This could mean that allowance has not been made for a complex timebase waveform sitting on top of the d.c. bias. Another possibility, especially with small transistors that feel much hotter than you would expect, is that they are very close to a large dissipator of power. There's not much that the user can do of course, other than to ensure that there's adequate ventilation. Removing the back is not to be recommended, since apart from the danger the back has holes that provide a chimney effect to aid the ventilation.

DELAY LINES

Back to our passive components then. Colour sets incorporate two different sorts of delay lines. The luminance delay line is used to compensate for the different bandwidths of the luminance and chrominance channels, while the chrominance delay line delays the chroma signal for one whole line to enable the PAL-D decoding process to be undertaken.

Luminance Delay Lines

Luminance delay lines usually have a delay time of about 400nS (0·4μS), and behave like a bit of coaxial cable. Provided it's correctly terminated, the delay line will delay all frequencies presented to it equally. Until the advent of the lumped inductance line, which has only just appeared, the form taken by the luminance delay line has consisted of a winding, with many turns of thin wire, over a foil covered with a pattern of metallic patches. The biggest of these – the middle one – is connected to chassis. Electronically the line looks like an infinite number of coils connected to an infinite number of capacitors (see Fig. 21).

The line should be terminated at each end with its own characteristic impedance – usually of the order of 1·5kΩ. It seldom is in practice, because the devices on each side are usually i.c.s which have somewhat flexible input and output impedances. The delay can be varied to suit the circuit by varying the number of turns of wire used for the winding. Changes of up to 100nS can be made in this way without altering the line's other characteristics unduly. Most luminance delay lines attenuate the higher frequencies, and it's common practice to build compensation into the end of the winding – a few turns are deliberately carried on past the end of the foil, giving an h.f. lift to compensate for the losses in the line.

The two most common failures are the coil going open-circuit (the wire is only 0·05mm), or the pin to the PCB becoming dry-jointed. Both faults give loss of luminance with the colour maintained. The open-circuit in the coil usually occurs at a termination, and you can afford to lose a turn or two in order to repair it. If a double luminance image appears, the foil has become disconnected from chassis.

The delay time can be checked using the full field pulse and bar test signal that's radiated daily before the start of all BBC transmissions. Override the colour killer and check the chroma/luminance pulse just to the left of screen centre – to see that the blue-green coloured signal fits fairly well over the grey luminance pulse.

Chroma Delay Lines

To delay the chroma signal for exactly one line, it's converted from an electrical to an ultrasonic signal, sent down an "echo chamber", picked up 64μS later and converted back into an electrical signal (see Fig. 22). To start with heavy lumps of glass were used. You need a 160mm length of glass (about 7in.) to delay an ultrasonic pulse for 64μS. The conversion is done by a pair of transducers mounted at the same end of the line: this permits a reflecting surface at exactly the right distance away to be ground at the other end while measuring the line under signal conditions. All the other surfaces of these early lines were made crinkly to disperse spurious reflections.

Modern chroma delay lines – commonly known as billiard table lines – use a multiple reflection path to enable the 160mm to be folded up. These are "guided lines", with the vertical component of the ultrasonic wave concentrated, headlamp style, straight down the plane of the line. They are very thin therefore, about 0·8mm (160/283·5mm for pedants). To absorb stray reflections, pillars of epoxy resin are printed on to the flat glass surfaces at points outside the beam. You can make your own pillars by dropping blobs of solder or flux on to the line – even sticky fingers provide good attenuation.

To say that the delay is 64μS is not exactly true. Unless

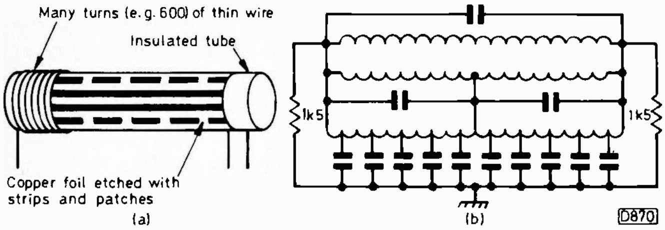


Fig. 21: (a) Luminance delay line, conventional construction; (b) equivalent circuit. The line is equivalent to an infinite number of tuned circuits, behaving in a similar manner to a long length of coaxial cable though with a higher impedance. Altering the number of turns varies the delay time.

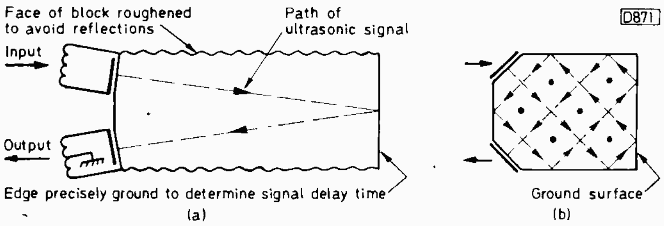


Fig. 22: (a) Early type of chroma delay line. (b) Current "billiard table" type of chroma delay line. Despite the reduced size, the path length is the same. Efficiency is improved by making the glass one cycle thick and placing epoxy pillars "off beam" to absorb stray reflections.

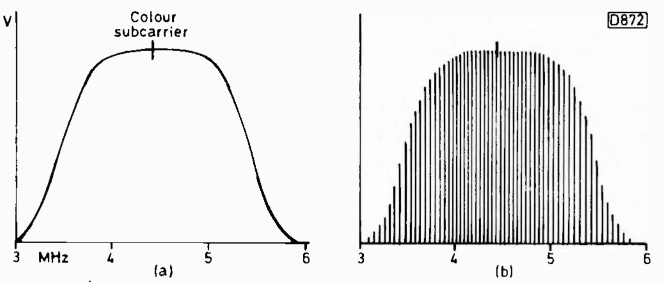


Fig. 23: (a) Chroma delay line frequency response, with direct signal path added. (b) The same swept slowly – the output undulates as the direct and the delayed signals add and subtract with change of phase. For this reason the chroma delay line with its associated circuitry is often called a "comb filter".

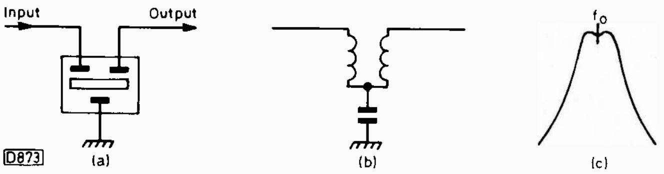


Fig. 24: Ceramic filter. (a) Usual symbol. (b) Equivalent circuit. (c) Frequency response.

it's a Secam line that is. Secam uses f.m. colour, and relies on sidebands far away from the subcarrier, so its delay lines need to have a good bandwidth. The broadest bandwidth lines are picked for Secam, and we get the rest for PAL. Because of the half-line, quarter-field offset employed in the PAL system to make the subcarrier dots crawl diagonally across the raster to reduce their visibility on monochrome sets, the PAL subcarrier is not an exact multiple of the line frequency. The delay line has to provide an output that's in phase with the direct signal, and this means that the delay time is actually 63·943μS. Small coils are provided at each end to provide a fine trim so that the delay is exactly right.

When this condition is met, raising the applied subcarrier frequency by one cycle (Hz) will result in the output dropping from maximum, through zero to negative, then back again through zero to maximum. You can see this if you look at a colour bar display with an unlocked reference oscillator. Red changes to green and back a number of times, with bands of no colour in between. This action goes on right through the sidebands, and if viewed on a slow sweep looks like a series of teeth (see Fig. 23).

CRYSTALS

A quartz slice cut and ground in a certain way and then sandwiched between two electrodes behaves like a very high inductance in series with a very small capacitor. It can be made to oscillate at a fixed frequency determined by the grinding process therefore. This provides a very stable oscillator which can be varied only very incrementally by means of a small adjustable padding capacitor. A varicap diode can be used.

Such crystals are used in the colour decoder's reference oscillator stage – at either 4·43MHz or, more recently, 8·86MHz, i.e. twice the subcarrier frequency. The latter enables a very accurate 90° phase shift to be achieved by simply dividing the output by two. A 6MHz crystal is used in teletext decoders, to provide the dot rate generator from which all characters and the line and field pulses are derived by dividing down.

CERAMIC FILTERS

A similar device is the ceramic filter. These are piezoelectric devices that resonate or "twist" – just like a record pickup of the same type – with the applied a.c. They are usually drawn as a pair of mutually coupled resonant circuits (see Fig. 24). The input signal twists the ceramic, the twist inducing a secondary voltage in the output plate. The resultant characteristic is like that of a bandpass tuned circuit.

The main application is as the 6MHz input circuit in the intercarrier sound channel. More recently the sound discriminator's quadrature coil has sometimes been replaced by a ceramic filter. While the 6MHz input filter is a symmetrical device capable of working both ways round, the discriminator filter needs a phase reversal to give the correct S curve. One section of the device is reversed with respect to the other therefore, the device being polarised.

SURFACE ACOUSTIC WAVE FILTERS

You can combine the principles of all the above mentioned devices into a unit with an encapsulation no bigger than an output transistor to obtain a device that will provide all the i.f. shaping required in the receiver. This is the surface acoustic wave filter, which we'll mention only briefly since detailed consideration has been given to it in these pages before (see for example pages 645-9, October 1976). When one of these devices is used to replace the discrete component filter unit, it's necessary to arrange the i.f. strip as follows. An i.f. preamplifier is needed to counter the SAWF's insertion loss, which is fairly high. The SAWF should be followed by a synchronous demodulator (exalted carrier or quasi-synchronous type, as used in most recent TV designs). And the earth path layout recommendations should be followed, otherwise funny effects can occur.

A properly designed SAWF circuit has a superior group delay characteristic compared to the equivalent discrete coil arrangement, but in bulk production this superiority can be easily negated as a result of production spreads. This makes the hand-aligned coil strip as capable of giving a regular result.■

Service Notebook

George Wilding

Poor Vertical Linearity

The fault on a Pye hybrid colour set was poor vertical linearity – the base of the raster being somewhat cramped and the top unduly extended. The field timebase panel in these sets gives little trouble, field collapse usually being due to the absence of one of the three l.t. supplies to the panel. Our first step was to adjust the two linearity presets to see what effect they had. RV24, which sets the output stage mid-point voltage, had considerable effect, but RV23, the feedback linearity control, produced no effect at all. It seemed then that RV23 was probably dry-joined or had a break at one end of its track. At this point however the field linearity suddenly righted itself, and careful examination around RV23 showed that the 15Ω resistor (R261) in series with it was of the type that has circular end caps, one of which was only loosely attached.

Replacing R261 and readjusting the presets restored perfect field linearity, but good focus overall was difficult to obtain. Examination of the screen showed this to be due to bad flaring by the green gun. Usually of course it's the red and blue guns that first show this symptom when a tube ages.

Low LT

The complaint with a Thorn portable fitted with the 1590 chassis was "no results". On switching on we found that there was a pronounced grating noise from the speaker as the volume control was advanced, but nothing else. It seemed likely that the l.t. voltage was low. The input to the series voltage regulator transistor was found to be correct at about 12·5V, but the output at its collector was only about 5·5V. Both the transistor and its 10Ω shunt resistor were running warmer than usual, so clearly there was a partial short across the l.t. rail.

Inspection showed that the boost diode was very discoloured, indicating a fault in the line output stage. Now the reservoir capacitors for the rectifiers fed from the line output transformer often give trouble in these sets, but both were cool and with perfect casings. The next likelihood was the line output transistor itself, and on isolating its emitter and base connections a severe collector-base leak was discovered. Replacing the transistor and boost diode restored normal results.

No Colour

There was an excellent monochrome picture on an ITT colour set fitted with the CVC5 chassis – but total absence of colour. Now in any colour set the first step when confronted with this symptom should be to override the colour killer. The easiest way of doing this in the CVC5 chassis is to connect a 10kΩ or 12kΩ resistor between the positive side of C152 (8μF), which decouples the supply to the chroma amplifiers, and the positive side of C162 (4·7μF), which smooths the colour-killer bias applied to the base of the delay line driver transistor T29d. These capacitors are quite close to one another, and are easily bridged with a suitable resistor. The result was fairly strong colour, though of incorrect hue and with Hanover bars. The fact that the colour was locked however showed that the burst and reference oscillator circuits were working correctly, whilst the presence of colour proved that the chrominance channel was operational. Clearly the fault was in the colour-killer department.

A somewhat unusual arrangement is used in these sets. The colour-killer turn-on voltage is obtained from the collector of one of the transistors in the bistable circuit. The bistable trigger pulses are removed on monochrome, but on colour the bistable starts (or should start) switching and the resultant squarewave at the collector of one of the transistors is smoothed and used as the colour turn-on bias. A voltage check at the collector of one of the transistors showed that the bistable circuit was not switching despite a colour signal being present. A check on the transistors then showed that one (T36d) had an open-circuit base-emitter junction. A replacement restored the colour, and after slight adjustment of the static convergence magnets a first class picture was obtained.

A Frustrating Experience

Sometimes the simplest of faults can be the most frustrating to cure. For example, we were called to see a hybrid Pye colour receiver with the complaint "bad colour". This was due to one or more dry-joints around the green PCL84 colour-difference output valve – pressure on the panel in the valve's vicinity would cure the complaint. Suddenly however all the valve heaters went out, though the sound remained.

When this happens in a hybrid colour set of any kind the first suspect is always the PY500 boost diode. In view of the suspected dry-joints on the CDA panel however we decided to check the heater chain on this first. It turned out to be continuous, so clearly the fault was on the large power supply/line timebase panel where the other three valves, plus the diode dropper, the thermistor and the dropper resistor, are mounted. The heat from the thermistor and the 22Ω dropper resistor (R303) often causes bad connections on the board, though none were apparent this time and the components were intact.

The problem was eventually traced to a very bad contact at pin 5 of the PY500's valveholder – though not without difficulty since there are slight differences between the course of the heater supply in earlier and later versions of the chassis and we didn't have all the circuits to hand. What proved the point was that pushing the PY500 over to one side would restore heater continuity. You sometimes get dry-joints at the base of this and the PL509 due to heat, but this time the soldering was still perfect. The problem was that the spring-like contact for pin 5 of the PY500 had become widened: with care, we managed to close it up, using the large, strong needle we carry with us for this purpose. Prior to making tests to discover the cause of the poor colour we'd had to turn the cabinet of this large 26in. model around, and this had apparently been enough to loosen the PY500 just that little bit more in its holder.

Line Scan Problems

The complaint from the owner of a set fitted with the Thorn 3000 chassis was that the picture width had decreased gradually over a period of a few weeks, so that there was now a considerable gap at each side. Furthermore, all vertical outlines had a "corrugated" appearance. The first obvious step was to check the h.t. voltage, which turned out to be correct, while the main electrolytics, which tend to dry up or even go open-circuit in older versions of these sets, appeared to be in order. Attention was turned to the line timebase panel therefore, and on removing this we noticed that L502, in the h.t. feed to the line driver and output stages, had no core – in fact the core had fallen out on to the decoder panel beneath. Replacing the core, this time with a little locking compound, plus a little adjustment, restored a full sized picture free from vertical irregularities.

No Results

We were called to see a dual-standard hybrid GEC colour set with the fault "no results" – due to a blown mains fuse. Now it takes a fairly heavy direct or indirect short to blow this fuse on any type of set, so it was prudent to check the main possibilities before changing the fuse and switching on. The first step was to check the mains filter capacitor, which seemed to be in order, so we went on to check from the top cap (cathode) of the boost rectifier to chassis. Not surprisingly, with the meter on the ohms range we obtained a leakage reading – of a little over 2k Ω in fact. Now the main possibilities when you get a leakage reading from this point to chassis are: (1) a heater-cathode short in the boost rectifier; (2) a leaky or short-circuit pulse capacitor providing line output transformer third or fifth-harmonic tuning; (3) a short from the primary winding of the line output transformer to the earthed frame or an earthed secondary winding; or (4) a short-circuit boost capacitor – where this is returned to chassis rather than the h.t. line. Though extremely rare, another possibility is an internal short in the line output valve, between the anode and an earthed electrode.

Our next move was to disconnect both valve top cap connectors, thus eliminating the two valves from the search. The leakage reading remained, and the odds were that the boost capacitor was in order – when it does break down, unfortunately quite often, it usually goes dead short. The reading from the PY500's top cap to chassis would then be low, certainly not as high as 2kΩ. Similarly, when a line output transformer's insulation breaks down it usually does so completely – especially in colour sets. So the prime suspect was a harmonic tuning capacitor. These don't usually go short-circuit suddenly, but progressively increase their leakage as the leakage current increases their temperature, in a cumulative manner. Often the first sign is decreasing width, plus a faint burning smell, before the viewer switches off or the fuse blows.

We couldn't see any ceramic pulse capacitors until the small earthing plate behind the valves was removed. We then discovered C83 (200pF), which was blackened on one side and cracked in two almost as soon as it was touched. On replacing it and switching on, a good picture was obtained, and despite the heavy overload current before the fuse blew the PY500 seemed to be o.k. – as always we gave it a tap or two to see whether there were any internal sparks.

Had there been no leakage from the PY500's top cap to chassis, the next step would have been a check on the h.t. supply.

Problems on a 1500

"The height keeps altering" said the voice on the phone. "Sometimes the screen is full, and at other times there's a black band at the top and bottom, varying spasmodically at times." The set was fitted with the Thorn 1500 chassis, and the trouble could have been due to several causes. The main thing however is to see the extent to which the linearity is affected when the height is reduced.

Fortunately the picture height was at about minimum when we called and, being more compressed at the top than at the bottom, it was clear that the fault was in the output rather than the oscillator part of the field timebase. Not unexpectedly, a new PCL805 valve made no difference, so the next move was simply to hold a 100μF test electrolytic between the pentode cathode pin and chassis. This cured the trouble, indicating the need to replace the decoupling capacitor here (C79, 160μF).

After doing this, we noticed that the focus was poor, the control having no effect. This fault is quite common on these sets after they've had a few years' use, and is usually due to R120 (1·5MΩ) in the feed to the focus control going open-circuit. The surprising thing is that the owners seldom complain about the poor definition – possibly because the resistor progressively goes higher in value before finally succumbing.

Awful Picture

The picture displayed by a Pye colour set fitted with the 697 hybrid chassis was over-bright and bleary, with severe smearing. When the test card appeared, the h.f. definition was so poor that the 2MHz grating could hardly be resolved. Since the timebase locking was perfect and optimum picture quality coincided with maximum sound, there was almost certainly a fault in the luminance channel rather than i.f. misalignment – the i.f. bandwidth needs to be in excess of 2·5MHz to preserve the shape of the field sync pulse in particular, a response markedly less than this invariably producing weak field lock.

The brightness control acts on the PL802 luminance output pentode's control grid circuit, and though working to some extent could not reduce the brightness level to normal. The luminance output stage was strongly suspect therefore, the symptoms suggesting that the value of the anode load resistor had markedly increased. This would reduce the video bandwidth, while the resultant low anode voltage would produce excessive brightness.

The anode circuit consists of a peaking coil (L50) with parallel damping resistor (R355, 10kΩ), the load resistor itself (R354, 2·7kΩ), and R353 (680Ω) to the h.t. line, decoupled by C352 (32μF) – the latter network increases the l.f. gain. Our first suspicion was that L50 was open-circuit, thus adding 10kΩ to the value of the total load resistance. The continuity of L50 was o.k. however, and the trouble turned out to be that R354 was open-circuit – at least, that's how it read on our meter. Presumably the PL802 had been kept operational due to the h.t. connection to its anode via the c.r.t.'s cathode drive controls. Anyway, replacing R354 restored a good picture with normal brightness control action.

Two Quickies

A couple of quickies. No results but all valves glowing on the Decca Bradford hybrid colour chassis is almost always due to the h.t. rectifier's surge limiting resistor R603 (3·9Ω) going open-circuit. It's mounted across the power supply panel, which must be removed to make repairs – after removing the vertical timebase panel. As everything plugs in, this can be done quite quickly – but remember the long flying lead from the timebase panel to the sync pin on the main board.

Secondly, intermittent loss of picture and sound on the Pye 725/731/etc. solid-state chassis, accompanied by severe sparking from the power supply panel at the bottom right-hand side of the cabinet (and soon resulting in permanent loss of sound and raster) is often caused by bad contact and arcing between one or other of the two lugs between the mains input choke L909 and the printed wiring. Scrape away any carbonisation on the panel before resoldering the lug to a jump lead.

Long-distance Television

Roger Bunney

SPORADIC E reception continued well into July. There were some quite dramatic openings, giving many enthusiasts the sight of really exotic signals. Of particular interest is the number of sightings of Arab signals on channels E2, 3 and 4 – more on this later. My own activities have been somewhat irregular this month as a result of a week's holiday with the family at Swanage, atop the cliffs (using a 5in. Panasonic portable!) followed on my return by a severe bout of tonsilitis. The latter unfortunately coincided with a period (the 23rd-25th) during which an excellent tropospheric opening seemed to be developing. On recovering I was rewarded with an afternoon SpE spell which produced RTVE (Spain) and RTP (Portugal). This was on the 30th. The log for the period is as follows then:

4/7/80 TSS (USSR) ch. R1; TVP (Poland) R1, 2; MTV (Hungary) R1; NRK (Norway) E2, 3, 4; SR (Sweden) E2 twice, E3.

7/7/80 An evening SpE opening produced many East European and Scandinavian programmes.

8/7/80 SR E2; TSS R1.

9/7/80 TSS R1, 2.

10/7/80 TSS R1, 2, 3, 4; TVP R1, 2, 3; CST (Czechoslovakia) R1; SR E3; NRK E2; RAI (Italy) IA, B; RTVE E2, 3, 4; RTP E2, 3; plus many unidentified signals.

11/7/80 This was an interesting day. Though at work for most of the time, reports suggest that conditions were excellent all day. Before 0900 I had RAI IA, B and JTV (Jordan) E3. During the evening, from 1830, TSS R1, 2; RTVE E2, 3, 4; RAI IA; SR E2, 3, 4; NRK E2, 3, 4; and RUV (Iceland) E4 were received. At 2120, system M (525-line) signals were noted here on ch. A2 – see later.

13-20/7/80 On holiday at Swanage, using the 5in. Panasonic portable reviewed last month. Reception of sorts was obtained at the cliff-top flat with a 12ft. wire. In view of the signal from Rowridge, a ch. B3 sound notch filter would have helped. The best logging was YLE (Finland) E2 on the 18th. Other countries received during the week were TSS, TVP, CST, MTV, RTVE, RTP and SR on chs. E2, R1 and R2. There was tropospheric reception from TDF (France) at u.h.f. on the evening of the 16th – fantastic signal levels, but dead channels the following day.

20-23/7/80 Nightly reception from Scandinavia on chs. E2, 3, 4.

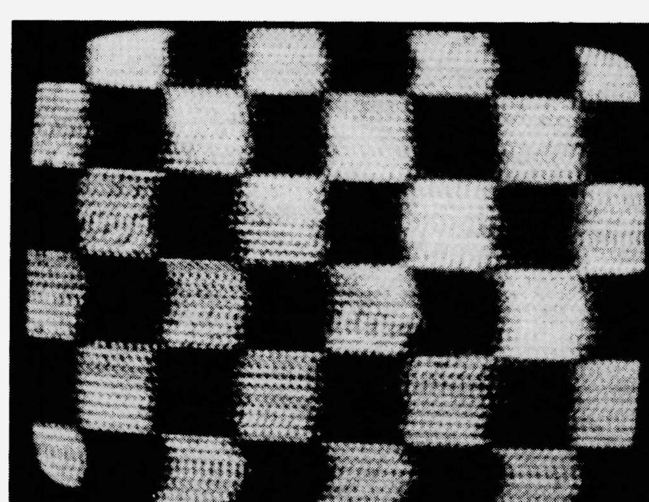
23-24/7/80 On both mornings from 0750 onwards MTV-1 was present at high signal levels on chs. R1 and R2.

30/7/80 RTVE E2; RTP E2, 3.

The most dramatic and unusual logging was on July 11th, with system M ch. A2 vision and sound from 2120-2300 BST. At the start SR was fading out on ch. E3. The new signal was seen floating over ch. E3 but was clearly unsynchronised. After adjusting the sync, an image that was obviously on ch. A2 was obtained (last winter's F2 experiences confirmed that!), while the matching sound channel produced suitably accented audio. Unfortunately the signal was mainly at noise level, with occasional lifts to give recognisable images – apparently puppets/Muppets, a rapidly upwards moving rolling caption at 2159, another at 2202, and people talking, but all too vague to be able to identify anything positively. A margarine commercial was noted however. The signals faded at 2300, with very spaced out fades up from the noise. Sound was monitored on the above mentioned portable, and this was perhaps of greater help than the visual displays. I assume that the signal arrived via a double-hop path (RUV ch. E4 had been seen earlier), similar to the reception in late July 1978 when both ch. A2 and A3 signals were seen – the WTFL saga, which eventually turned out to be reception from CKCW-TV Moncton. I hastily phoned strategically placed DXers when the signal was noted, but mine seems to have been the only logging. Did anyone else see it?

Many letters have arrived reporting other signals during the period, and the Arab content is most interesting. JTV was present on the 13th, 15th and 17th, and on the 15th Hugh Cocks sighted colour bars on ch. E2 at 1800 followed by a flag at 1830 (approximately twelve horizontal stripes, with the pole on the right-hand side, on a grey background) then the station opening and a programme with French spoken sound, similar to TF-1. Hugh suspects that this was Lebanon. He also noted a mystery Arab signal on ch. E2 during the mid-afternoon of the 20th – suspected Dubai. On the 21st, Hugh had Albania ch. IC at 2115.

Ray Davies presided over a mini-DX-TV convention, which included several Dutch friends, at his Norwich location during the 11-13th. For once such a gathering actually witnessed DX signals in profusion! Of particular interest was Gwelo, Zimbabwe ch. E2, received via TE on both the 12th and 13th at 1750-1805, and Ray's reception of Syrian sound on ch. E4 between 1800-1900 on the 14th. Ray also reports excellent u.h.f. tropospheric reception during the 21-26th, peaking on the 24th when Band III transmitters were received as well. Tropospheric



The mystery ch. E3 chessboard pattern, phographed by Keith Hamer. It's thought to be from an Italian "free" station.

propagation was present again on the evening of the 22nd, with Switzerland, Spain and RTE (Eire).

In all then an excellent and varied month.

Several enthusiasts have reported seeing a small black chessboard pattern on ch. E3. It's thought to come from an Italian "free" TV transmitter. The only clue to date is the caption "TV Nocoj" that followed the fade out of the chessboard – this was seen by Mark Baldwin (Rugby) on July 7th at 1900 BST. The photograph shown was taken by Keith Harmer (Derby) 45 minutes after Mark's logging!

Mike Allmark has sent in a detailed letter describing his envious reception in Leeds. He specifically mentions the ch. E4 reception with Arab content that's been seen elsewhere, and wonders whether it's Syria or Lebanon. The situation in the latter country is as hazy as ever, though it's understood that the ch. E2 and E4 transmitters are now either in operation or about to be put "on air", with plans to increase powers.

News Items

West Germany: An agreement with France has now been signed giving the go-ahead for the satellite TV project – with two satellites transmitting at 12GHz to domestic terminals. The service is expected to start in 1983-4. The Steinkimmen ch. E2 NDR-1 transmitter closed down on July 1st.

Poland: A newly opened studio centre enables Szczecin to produce its own programmes as an opt-out from the main TVP-1 service.

Italy: We now have a more detailed list of some of the "free" stations transmitting in Bands I/II:

Ch. IA: TV NCT (Nord Centre Television); Tele Spazio Campano (at Sante Agato Dei Goti).

Ch. IB: Tele Trieste Mia (Trieste); Telespazio Quadrifonic (Rome); Tele Bari (Bari); Teleradio San Marco (San Marco); Radio Sud Television Video Fatamorgana; TVC4 Mori (in Cagliari, Sardinia); T.O. Sardegna (in Sassari, Sardinia); Teleor (in Oristano, Sardinia).

Ch. IC: Tele Sud Italia; Radio TV Atri.

Our thanks to Brian Fitch and Keith Harmer for this information. Given the right SpE conditions, reception of all these stations is possible in the UK. Note that NCT transmits on ch. E3, not ch. IA as Italian listings suggest.

UK: The IBA's latest Pocket Guide to Transmitting Stations (dated June 1980) has been issued and includes dates for the first 405-line transmitter closures. It's available free from IBA Engineering Information, Crawley Court, Winchester, Hants SO21 2QA.

From our Correspondents . . .

Graeme Wilson (Middlesborough) is using a much modified Thorn 1500 chassis, with selectivity switching by means of three input selectivity modules from the Bush TV161 series connected in cascade and adjusted to give a 2MHz vision bandpass. Despite the cascade connection, the insertion loss is low. He's also experimented with replacing the BF196 in the Philips G8 selectivity module, using a BF256 f.e.t. The advantage is improved noise performance, but mismatching lowers the gain. Graeme would be interested in hearing of anyone else's efforts along these lines. He also uses switching to operate the tuner and i.f. strip only, extracting the sound from an emitter-follower after the volume control. The idea is to provide signal monitoring without running the power consuming sections of the set. The video is fed into a small audio amplifier/power supply (which also powers the signal circuits), and if signal activity is detected the whole unit is run up.

Alister Pink (Ilkeston) has received excellent ch. E2 signals from RTVE Madrid using a Ferguson 3787 colour portable fed from a Band II f.m. array, while a London enthusiast has received Band I SpE signals using a Wolsey Colour King u.h.f. array... Any other unusual aerials in use?

On July 7th Arthur Milliken noted the RETMA test card on ch. R2. Any ideas? The time was 1100 BST. Bulgaria maybe? Arthur did well in logging Izana (Canaries) at 1245 and Amman (Jordan) at 1805 on the 13th, both on ch. E2 – obviously a good day!

Brian Fitch (Scarborough) mentions receiving the SABC overseas programme at just below ch. R2. Assuming that this isn't some form of amplifier cross-modulation, I would suspect that this must be due to third harmonic radiation. The time was 1755 GMT, and at this time the SA European Service uses a northerly beam at 21·535 or 21·695MHz. Since Band I isn't used in SA, no harmonic interference would be noticed there. It's a good pointer for TE propagation!

Wenlock Burton (Melbourne) reports receiving mystery u.h.f. (ch. 34) signals in his area – source unknown, and officially there are no such transmissions!

Geoff Perrin is really pulling in the signals on his 50ft. mast in Oman. He's had signals from Italy to the north west, from deep into Russia, from India in the east and unknown sources. He's also been seeing a mystery ch. E4 Arab signal from just west of north at his location 90kms north of Salalah in Oman. Apparently the Bahrain E4 news announcer has a logo that resembles the London Transport symbol at the upper right-hand side. Pakistan is received on a fairly regular basis (PM5544 test pattern with "PAKISTAN" and "TELEVISION" identifications and a digital clock across the centre), and he's received Bombay once. Iran ch. E8 uses the Fubk test card (it seems reasonable to assume that all the other NIRT stations use it as well) with both Arab and English identifications in the central black portion.

New Antiference Export Aerials

Antiference Ltd. (Bicester Road, Aylesbury, Bucks) have introduced two new ultra-wideband v.h.f./u.h.f. TV aerial systems intended for the export market. The MHX3510 provides a gain of 4dB in Band I, 6-9dB in Band III and 10-13dB over the ch. 21-48 spectrum. The MHX355 is a compact version for local service areas, providing a gain of 3dB in Band I, 5dB in Band III and 10dB at u.h.f. Though such systems are not ideal for DX use, it's interesting to see Antiference extending their range.

Whistling Colour Sets

Derek Snelling

THE problem of ear-splitting whistles from the backs of colour sets has always been with us. Over the last couple of years however, with the new generation of 110° sets, it's reached almost epidemic proportions.

The whistling is caused by the vibration of coils, chokes or transformers (and in older sets valves) at line frequency. Whether you hear the whistle depends to some extent on how old you are. At over 50 it begins to fade away, but your pet dog will suffer.

To cure the problem means preventing the offending component from vibrating. First however you have to locate the part. Unfortunately the fault is nearly always temperature dependent, occuring either when the set is first switched on, then fading away, or starting after the set has been on for a few hours. The reason for this is that expansion and contraction of the various parts affects their ability to vibrate. If you have the back off the set and it's whistling away, finding the offending part is a matter of lightly pressing the coils and transformers in turn. When you reach the culprit, the whistle will either disappear or change dramatically. Don't limit your search to the line output panel or area – many modern sets use a switched-mode or chopper power supply operating at line frequency, so this should also be checked. Don't forget the line output and boost valves in older sets.

Cures

The cure depends on which part is causing the fault. With valves, replacement is the only cure. Note that a new valve will sometimes whistle for the first few hours, then settle down. You may not be able to put up with it that long however. With transformers, the two halves of the core are usually held together by a clamp: slight tightening of the nuts can provide a cure, but be careful not to overtighten them as this may crack the core. Coils and chokes don't usually have a clamp. A cure for these components is to spray the coil with a liquid plastic such as Servisol Plasti-Seal or Radiospares Anti Corona spray. Both of these sprays are designed to prevent arcing in e.h.t. circuits and thus have excellent insulation properties. They are best applied in two or three coats – if the coil is left in circuit, take care not to spray any preset controls. Another word of warning: these sprays give off a flammable vapour whilst drying, so don't switch on for about ten minutes after spraying.

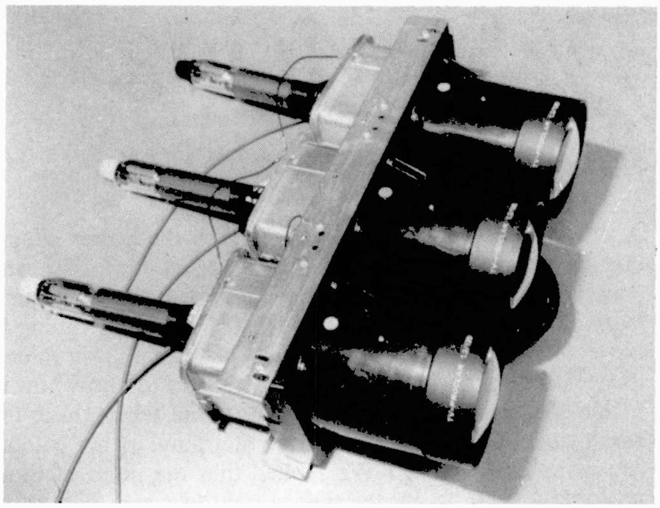
Hints

If you have trouble in locating the faulty part, try tapping likely coils and transformers. If one whistles, however briefly, then that's probably the culprit. A few common offenders are: The line linearity coil (it's on the convergence panel) in the Philips/Pye G11 chassis; the raster correction transductor in hybrid ITT colour sets; the line linearity coil in the Rank T20A chassis; the line output stage valves and transformer in the Decca series 10 and 30 hybrid colour chassis; and the line driver transformer (despite a plastic sleeve) in the Decca 80/100 solid-state colour chassis.

One final point. I came across one set where the whistle was due to an electronic rather than a mechanical fault. The set was fitted with the ITT CVC20 chassis, and the whistle came from the chopper transformer in the power supply. Changing this had no effect however. ITT were contacted, and pointed out that the fault can be caused by the generation of unwanted harmonics in the power supply as a result of one or other of the small electrolytics being faulty. ■

The Philips Projection TV System

Harold Peters



The three tubes/lens assemblies before being cased.

IN the early 50s projection TV receivers were quite common. Recent vintage TV articles in this magazine have outlined the basic techniques then employed, including the Schmidt optical system. In more recent times a number of Japanese colour projection systems have gone on sale in the UK. One of the latest colour projection systems to be introduced comes from Philips. It's being produced in quantity at the Philips Lowestoft plant, mainly for mainland Europe but also for the UK.

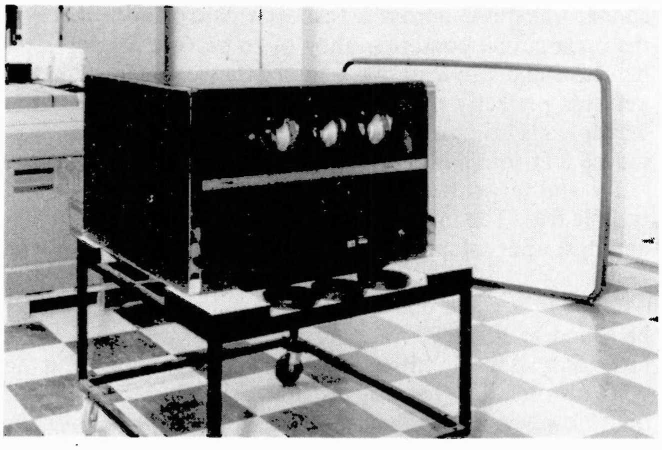
The set is in two parts. First a 60in. aluminised plastic moulded screen which can be either wall mounted or free-standing. And secondly the optical-electronic unit. This is housed in a low trolley that doubles as a coffee table. There are three single-colour 6in. c.r.t.s, each of which is linked to three specially constructed TV-Proclar lens assemblies.

So far as the user is concerned, setting up is simply a matter of positioning the trolley so that the centre lens touches a cord stretched to it from the screen corners.

The Electronics

The electronic chassis is an adapted version of the standard K12Z direct-view chassis, with the three thick-film RGB output stages mounted on the three separate c.r.t. bases. There's adequate drive, and because of the narrow deflection angle of the three projection tubes the chassis has sufficient scanning power too.

Extra convergence is necessary, for as well as the three beams having to converge at the screen horizontally they also point slightly upwards. The convergence drill is quite straightforward however. Since there are three separate tubes, the effect of moving say red upwards does not, as with a delta-gun, direct-viewed c.r.t., displace green sideways. There's no elaborate gun switching either: you simply cover up the lens of the colour not required.



A complete set, with its screen, ready for packing.

The e.h.t. produced by the chassis is split three ways in a jelly-pot that contains the final e.h.t. smoothing capacitance – the tubes don't have the "Aquadag capacitance" of direct-viewed types.

A novel protection circuit has been devised to ensure that the tube screens aren't burnt by failure of any of the six scanning circuits or failure of any of the supplies. It blacks out the relevant c.r.t., at its cathode, as soon as a fault occurs. If the fault is transient, the picture slowly fades back in again from black level, but if the fault persists for longer than two-three seconds the set automatically switches to standby (i.e. the remote control "off"), making human intervention necessary.

Remote Control System

The remote control system used, called "Long", is inherited from the parent K12Z chassis. It has coloured bar tuning facilities on the screen for all the analogue controls (volume, bass, treble, brightness and colour) as well as for station tuning. The automatic contrast control system adjusts to compensate for the ambient lighting level.

The user has a choice of 29 programmable programme selections. These are stored in a memory when first set up. A small on-board calculator type battery, which is recharged when the set is running, keeps the memory going for up to three months between use of the set. Button 29 adjusts the time-constant for VCR use, while button 27 can be used for station hunting with the armchair handset. The same memory stores the users' preferences for the analogue settings mentioned above: they can be recalled instantly by pressing the "granny button".

The remote control system uses infra-red radiation, which is reflected from the screen to a receiver mounted alongside the projection lenses. In the same way, the twin-speaker hi-fi sound is beamed from the reflex enclosure in the "coffee table" towards the screen to prevent "disembodied sound" effects.

And it's UK Made!

In these troubled times, it's interesting and reassuring to note that the set is made in the UK for export to continental Europe, and that the design work for the electronic sections not part of the basic K12Z chassis was done in the UK.■

Photographs courtesy Philips Electrical Ltd.

TV Servicing

S. Simon

A COUPLE of months ago we described the power supply circuit used in the Thorn 8000 (and related) chassis, and considered the servicing aspects. In response to a request from an avid reader and acquaintance, we're now going to have a general look at the run of the mill problems presented by these sets. As he said, it's nice to know how to tackle the power unit, but what happens when the tuner won't tune properly, or the picture is grainy, or the colours are completely wrong? We replied that the point of these articles has been to get the theory right first and then to see how it applied in servicing various makes and models. To this he countered that he'd prefer to have a practical run down model by model, so that he could quickly refer to a particular issue when a particular set came his way.

Well, we've come a long way since this beginners series started in the October 1977 issue. If you've followed us this far, you can't really be a beginner any more, can you? We hope not, anyway. Also, in recent issues we've dealt with some techniques that would hardly be the sort of thing a beginner would dabble with – the switch-mode power supply used in the Thorn 3000/3500 chassis for example.

So we'll drop the "beginners" bit from now on, and concentrate instead on giving practical notes and guidance on particular chassis. We hope readers will find this slightly changed approach acceptable.

Tuner Troubles

We thought that the mechanical aspects of the "1500" type tuner used in the 8000 chassis were by now well known and didn't need further explanation. Not so apparently.

There are two main defects that occur with this tuner. One is fairly obvious and doesn't need to be dwelt upon too much. The buttons push a bar which rotates the tuning spindle. This rotates the moving vanes of the various sections of the tuning capacitor so that as they close into mesh with the fixed vanes the tuning frequency falls – to channel 21 when the vanes are fully closed. When half open, the capacitors should tune to say channel 40, and when fully open to channel 68. It's quite common for the bar to be pulled away from the arms by the spring tension over a period. Before this obvious defect occurs, the bar can become loose on one side, making accurate tuning difficult.

It's not sufficient in this latter event to blob some solder on the loose side and return it to service. The bar should be completely removed, noting which side is presented to the push buttons – you'd be surprised at the number of tuners we find with the bar reversed, so that the ends of the buttons foul the edges of the bar. Having removed the bar, clean the ends and tin them. Repeat with the swing arms. Then refit the bar, close the arms over it, and solder the outside and top, leaving no solder on the inside to impede the button pistons. Note that if the bar is not straight the capacitor vanes will have differing travel and the result will be a grainy picture.

All this is straightforward and presents little difficulty. The second defect is not so obvious. The complaint may well be that the tuning is not accurate, and that some channels are completely unobtainable. This is due to the earthing springs not making good contact between the rotor and the bulkhead or body of the tuner. A certain amount of grease is applied during manufacture, and this eventually hardens, preventing contact instead of enhancing it. While the application of grease solvent may help matters, it's preferable to remove the leaves individually, using a fairly heavy soldering iron. Clean them and the rotor, slightly bend the leaves, and refit them carefully. Do this and you won't have to buy a new tuner.

Plug/socket Problem

It's extremely common on these models to find that the picture suddenly becomes grainy, with perhaps loss of colour. While this can be due to many things, for example a faulty aerial socket (or plug, lead or aerial), or perhaps the r.f. transistor in the tuner, very often it's due to nothing more than poor contact in the i.f. input plug and socket on the lower left side of the combined i.f./decoder board (it's called the signals panel). This is the plug from the tuner unit, with a bared section of the braiding under a clip. Early attention to this small point can save a lot of trouble.

Colour Faults

If the picture is well contrasted and clean, but has no colour content although the control has been advanced and the tuner's buttons have been set correctly, it's likely that the burst gating pulses are not reaching the decoder. These come from the timebase panel (right-hand side), and the feed resistor R404 (33k Ω) at the bottom left may well be found open-circuit.

As these sets get a few years over their heads, the faults commonly encountered may not necessarily be due to the usual well-known stock causes. In many cases for example you'll find that one of the small electrolytics is the cause of a fault that in most of the sets serviced a year or two ago would probably have been due to a faulty 4·43MHz crystal or field-effect transistor (VT110, type BF256LC) in the reference oscillator control loop. In fact we have to be cautious about trotting out "stock causes" when dealing with sets that are more than a few years old.

Much time can be saved by closely examining the ends of small electrolytics for signs of deterioration, replacing those with even the slightest suspicion about them. Whilst voltage checks will often reveal a leaky electrolytic, and shunting a similar value one across a suspect will provide a check for the open-circuit condition, they often become intermittently defective and can lead one a merry dance. Quite often they perform perfectly until subjected to the slightest vibration, which leads one to suspect a faulty lead connection (which indeed it is, internally) or a dry-joint elsewhere on the panel.

By and large the decoder section of the signals panel is trouble free. The main troubles occur where the heat is – up amongst the colour drive components at the top of the panel.

Once in a while one of the RGB output transistors may be found to be defective, causing excess of one colour if it has gone short-circuit or absence of that colour if it has gone open-circuit. These transistors are only occasionally at fault however. When they are, use BF337s for replacement purposes as these seem to be more reliable than the original types fitted.

More often the trouble (if it's on this panel at all) will be due to dry-joints or cracks which have developed over the years and which may not be obvious at first sight. If in any doubt, use your ohmmeter to prove the continuity of a track or joint.

In many cases where the trouble is the absence or partial absence of one colour the c.r.t.'s cathode voltages (i.e. the outputs from the collectors of the RGB output transistors at the top of the panel) will be found to be roughly equal, the trouble instead being due to low first anode voltage on the gun concerned.

The three first anode presets are the three controls mounted on the left-hand side of the tube base. They are skeleton presets with a value of 2M Ω. They often develop a dud spot which turns into a burnt crack across the track. Don't try to repair the control, as this will only lead to further trouble. A similar fault occurs with the focus control used on the original 8000 version of the chassis – it's at the top right-hand side of the tube base.

The Tube

If the original tube is still fitted, you can't expect it to give equal emission from all three guns. Indeed this could well be the cause of the apparent lack of one of the primary colours. Whilst the effect can be masked to some extent by resetting the drive presets on the signals panel and the c.r.t. first anode presets on the tube base, this is rarely satisfactory. Depending on the circumstances, the tube should either be reactivated or replaced. Readers' attention is drawn to the comments on regunned tubes in recent issues.

Low tube emission may not show up as the absence of one or more primary colour: the effect may instead be one of flaring as soon as the brightness, colour or contrast is advanced to an acceptable level.

Main Chassis Assembly

The main chassis assembly is secured by two screws at the bottom and one at the top strut. When these have been removed, the chassis can be slid out on the lower nylon runners sufficiently to gain access to most parts and to allow the right-hand side timebase panel to be lowered. There are swing catches at the front and rear.

The field timebase (oscillator, driver and output transistors) occupies the centre to the top of the panel, the line oscillator, flywheel sync and line driver stages being on the right-hand side from the centre to the bottom, with the line output pulse feeds etc. at the bottom left. The rest of the left-hand side is taken up by the preset controls, which are clearly labelled. These directions are when viewing from the print side of the panel.

Field Timebase

The faults on this panel are mainly confined to the field timebase, and there's no regular pattern apart from a tendency for dry-joints, mainly around the output section, where careful observation or perhaps vibration will locate the point where the soldering is poor. Voltage checks may well show a correct reading at one end of an apparently good track but not at the other. If this is so a lead should be jumped across the relevant points rather than trying to resolder the suspect area.

Apart from poor connections, it's the field output transistors that, normally running warm as they do, are the items most likely to be at fault. The supply line is 45V positive, so the collector of the npn output transistor VT410 should be at this voltage while the collector of the pnp output transistor VT411 should be at chassis potential. Thus the emitters provide a convenient test point (TP25) for checking that both transistors are drawing roughly the same current. Taking into account the emitter resistors, a voltage of 24V at TP25 is acceptable. If this voltage is correct, the output transistors are not the cause of the field collapse (horizontal white line) condition. This of course leaves 1,001 other possibilities. A pair of high-resistance headphones or a signal tracer with its own built-in loudspeaker is a handy way of proving that the field oscillator is working and that the driver is driving. Experimenting with these two aids on a working set will illustrate the kind of buzz to expect. We say this because much time can be lost searching around in the field timebase when the trouble may (for example) be in the field balance control R460 which is between TP25 and the field scan coils.

Line Timebase

Intermittent loss of line hold is a frequent complaint on these sets, and as with other faults the cause is often one of the small electrolytics dotted around both the timebase and the signals panel. There are four of them (C412, C414, C423 and C427), all 10μF, 25V, in the line oscillator/driver stages. If the culprit can't be readily spotted, save time by replacing all four.

The line driver transistor (VT402, MJE340 or equivalent) works from the 120V line. It often becomes faulty, leading to no line drive, no e.h.t., etc. It's situated on the lower right-hand side of the panel. If h.t. is present at the line output transformer but the output stage isn't working, spare a thought for the driver. If it has gone short-circuit, R729 on the power supply panel may well be found open-circuit.

The drive from VT402 is taken via a two-pin plug at the bottom centre of the timebase panel to the almost centrally mounted line output transistor. This is on its own large heatsink, insulated from the main frame. The 8000 chassis uses a very simple line output circuit with very few components on the transistor's base assembly. The transistor itself (VT401) is a BU105/02. The 8500 chassis uses a BDX32 (2SC1172B) line output transistor, with additional components on its base panel. While the whole heatsink assembly can be interchanged, a BDX32 cannot be fitted in place of a BU105/02 without adding the extra diode and choke etc.

In the event of trouble being experienced in the line output stage, particularly if overloading is in evidence, the first move should be to remove the e.h.t. connection plug from the socket on the transformer's overwinding. If the stage then springs to life, the e.h.t. rectifier is suspect. This is often because the plastic housing is leaking to chassis. Mounting it differently sometimes overcomes the problem.

This type of plastic insulation breakdown can sometimes affect the 8500 (on) chassis, where the focus unit is bolted to the right-hand side of the chassis frame. Having mentioned the focus unit on the 8500 etc. chassis, we must also mention the tendency of the 100k Ω resistor (R609) on the tube base to change value, casting suspicion on the focus unit when in fact this is not responsible at all.

So there we are my friend. Combine these notes with what we said in the August issue on the power supply etc. and you have an idea of the troubles you can expect on the 8000s, 8500s and other relatives that might come your way.

New CTV Signals Board

Part 2

Luke Theodossiou

LAST month we dealt with the basic signals board itself. In this concluding instalment we'll look first at the tuner and i.f. module. Before doing so, there's one modification to the details given last month. We've found this modification worthwhile, but it was too late to take it into account last month. It concerns the zener diode D8.

The ideal voltage at the emitters of Tr7, 8 and 9 is around 2·4V, but the lowest voltage commonly available zener diode is a 2·7V type, which we used in our prototype. Unfortunately this voltage difference is sufficient to produce a change in the black level when the gain controls are adjusted. It was decided therefore to use a LED instead – as in the Thorn TX10 chassis. A LED's "on" voltage is quite constant over a reasonable range of currents, but a more important advantage is that the temperature drift is comparable to that of a silicon transistor. The recommended LED is the RS Components type 586–447. Its cathode (identified by a tiny notch on the body) should be connected to chassis.

The Tuner Unit

The Telefunken tuner unit used is interesting in having a dual-gate MOSFET input stage. The a.g.c. is applied to one gate while the r.f. signal is applied to the other.

IF Module

As in the previous signals board, the i.f. module is a ready-built, prealigned unit which readers can purchase from the source shown in the components list. This policy has been adopted due to the difficulty in ensuring consistent results when strips are set up by individual constructors. Especially where it's intended to use the receiver for teletext reception, very accurate alignment is essential.

Fig. 1 shows a block diagram of the i.f. unit. The i.f. output from the tuner is connected to a coupling circuit inside the module. This produces the correct bandpass response for optimum gain and selectivity. The signal is then passed to a 26dB broadband amplifier which is contained in an SL1431 i.c. It next goes to a surface acoustic wave filter which neatly tailors the i.f. response to the UK channel bandwidth requirements. The SL1431 also detects the amplified signal, generating an a.g.c. signal to control the gain of the tuner. The a.g.c. take-over point can be adjusted by means of the preset inside the module. This should not require adjustment under normal circumstances.

The output from the SAWF passes to a TDA2540 (or TDA2541) i.c. which carries out further i.f. amplification, signal detection, internal a.g.c. and the production of an a.f.c. signal. The latter is brought out at pin 3 and is added to the tuning voltage to counter tuning drift.

The video output from the i.c. is split into two paths. The first one goes to a ceramic 6MHz filter to extract the intercarrier sound signal; the other passes via a 6MHz trap which removes the sound signal from the video and sync feed. The latter signal is taken to a phase-splitter which produces negative- and positive-going outputs. The positive-going output is available at full amplitude (for teletext etc.) and also attenuated to 1V peak-peak for feeding to the decoder section of the panel.

The 6MHz signal is amplified and demodulated by the TBA120U i.c., which also incorporates an electronic volume control circuit.

Construction

The print pattern of the signals panel is shown in Fig. 3 – the board can be purchased from Readers' PCB Services in the usual way. Fig. 2 shows the component layout.

The 7812 regulator and TDA2006V audio i.c. are mounted on a common heatsink which is fixed to the board

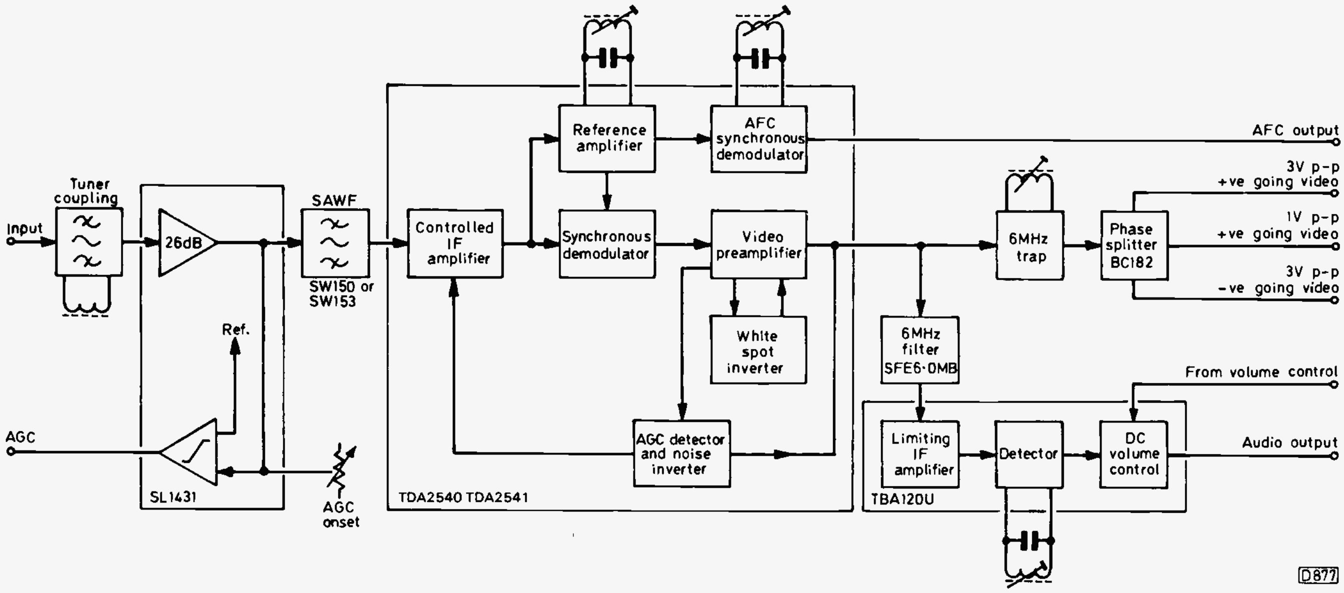


Fig. 1: Block diagram of the i.f. module.

★ Components list

Resistors:

R1	47k	R16	390Ω	R32	680Ω
R2	68Ω	R17	120k	R33	22k*
R3	4k7	R18	47k	R34	22k*
R4	47k	R19	10k	R35	22k*
R5	47k	R20	68k	R36	47k*
R6	1Ω	R21	47k	R37	47k*
R7	1k	R22	15k	R38	47k*
R8	1k	R23	68Ω	R39	1k
R9	1k	R24	68Ω	R40	1k
R10	1k	R25	68Ω	R41	1k
R11	68k	R26	68Ω	R42	1k
R12	47k	R27	2k2	R43	1k
R13	15k	R28	2k2	R44	1k
R14	1k	R29	2k2	R45	1k
R15	390Ω	R30	680Ω	R46	33k 2W
		R31	680Ω		

All $\frac{1}{4}$W 5% carbon film resistors unless otherwise indicated.
*$\frac{1}{2}$W thick-film metal glaze resistors, 2% tolerance.

Presets:

VR1	10k
VR2	1k
VR3	1k
VR4	1k
VR5	1k
VR6	470Ω
VR7	470Ω
VR8	470Ω

Horizontal mounting presets.
VR1 standard, VR2-8 miniature.

Semiconductor devices:

IC1	7812
IC2	TDA2006V or TDA2030V
IC3	TDA3560
Tr1-6	BF458
Tr7-9	BC182L
D1	TAA550
D2-7	1N4148
D8	RS Components type 586-447

Capacitors:

C1-2	100n ceramic disc
C3	220µ 16V pluggable electrolytic
C4	2µ2 63V pluggable electrolytic
C5	220µ 40V pluggable electrolytic
C6	100n ceramic disc
C7	100n Siemens polyester
C8	470µ 16V pluggable electrolytic
C9	10p ceramic plate
C10	100n Siemens polyester
C11	120p ceramic plate
C12	10n ceramic plate
C13	100n Siemens polyester
C14	2µ2 63V pluggable electrolytic
C15	100n Siemens polyester
C16	330n Siemens polyester
C17	2-22p trimmer
C18	330n Siemens polyester
C19	2µ2 63V pluggable electrolytic
C20-22	100n Siemens polyester
C23	10µ 16V pluggable electrolytic
C24-25	10n ceramic plate
C26-28	100n Siemens polyester
C29-30	2µ2 63V pluggable electrolytic
C31	10n ceramic plate
C32	100n 250V Siemens polyester
C33	10µ 16V pluggable electrolytic

Miscellaneous:

Tuner	Telefunken type 204
IF module	Reference no. 39-13-09
L1	00D0-914-001
L2	PC501-L602
XL1	8·8MHz crystal

The above are available from TW Electronics, Kennet Building, Wotton Hill, Newbury, Berks, RG15 9UJ. The tuner is £10·50, if the i.f. module £19·50, the crystal £1·10 and the coils £0·60 (total for both). Prices include VAT and post/packing.

DL1	Orega TLC1392
DL2	Sylvania SDL445

Heatsink for IC1-2 is 50mm length (i.e. half) of RS Components type 401-497

Molex 0·2in. pitch p.c.b. pins.

Note: The preset contrast control VR1 is adjusted in conjunction with the black-level controls. After the grey-scale has been set up, adjust VR2 for minimum Hanover blinds with colour bars or a test card displayed. The chroma delay line's input and output coils should not normally require adjustment.

by two 4BA self-tapping screws. Apart from this, construction is very straightforward and should present no difficulties. We suggest that the aerial connecting cable is soldered directly to the connector A holes on the board rather than using the Molex type connector we normally specify.

The first thing to connect is a nice, thick earth cable from the *underside* of the signals board at connector D3. Take this back to the power supply. The remaining connections are as follows:

A1 Aerial earth.
A2 Aerial input.
B1 33V supply to tuning potentiometers.
B2 Connection to volume control wiper.
B3 12V supply to brightness and colour controls.
B4 Tuning voltage from potentiometer bank.
B5 Earth connection to tuning potentiometers.
B6 Earth connection for volume, colour and brightness controls.
C1 Green data input.
C2 Blue data input.
C3 Video output to options board.
C4 Data switching signal.
C5 Red data input.
D1 To C1 on timebase board.
D2 To C6 on timebase board.
D3 To C2 on timebase board.
D4 To C3 on timebase board.
D5 To C7 on timebase board.

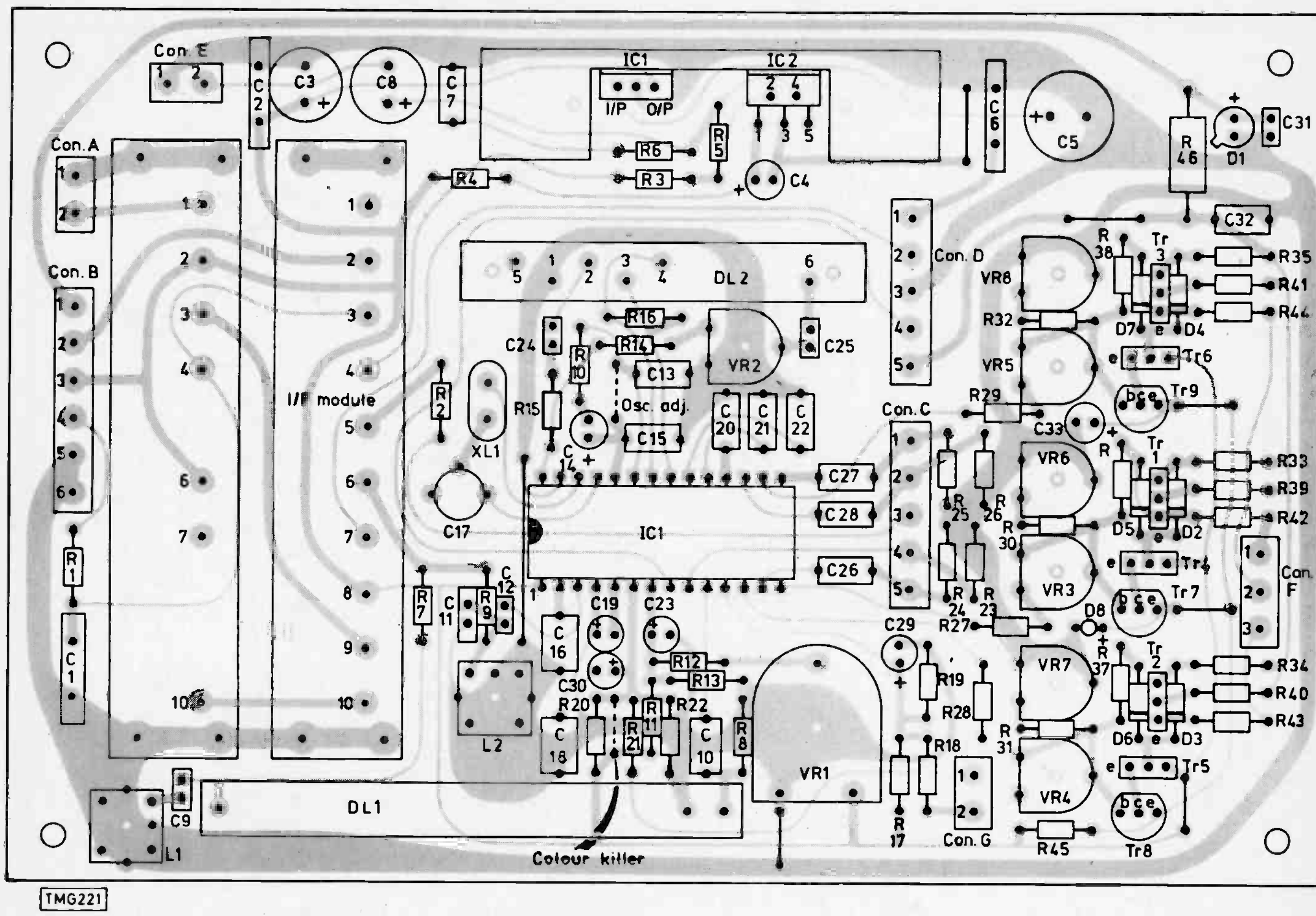


Fig. 2: Component layout.

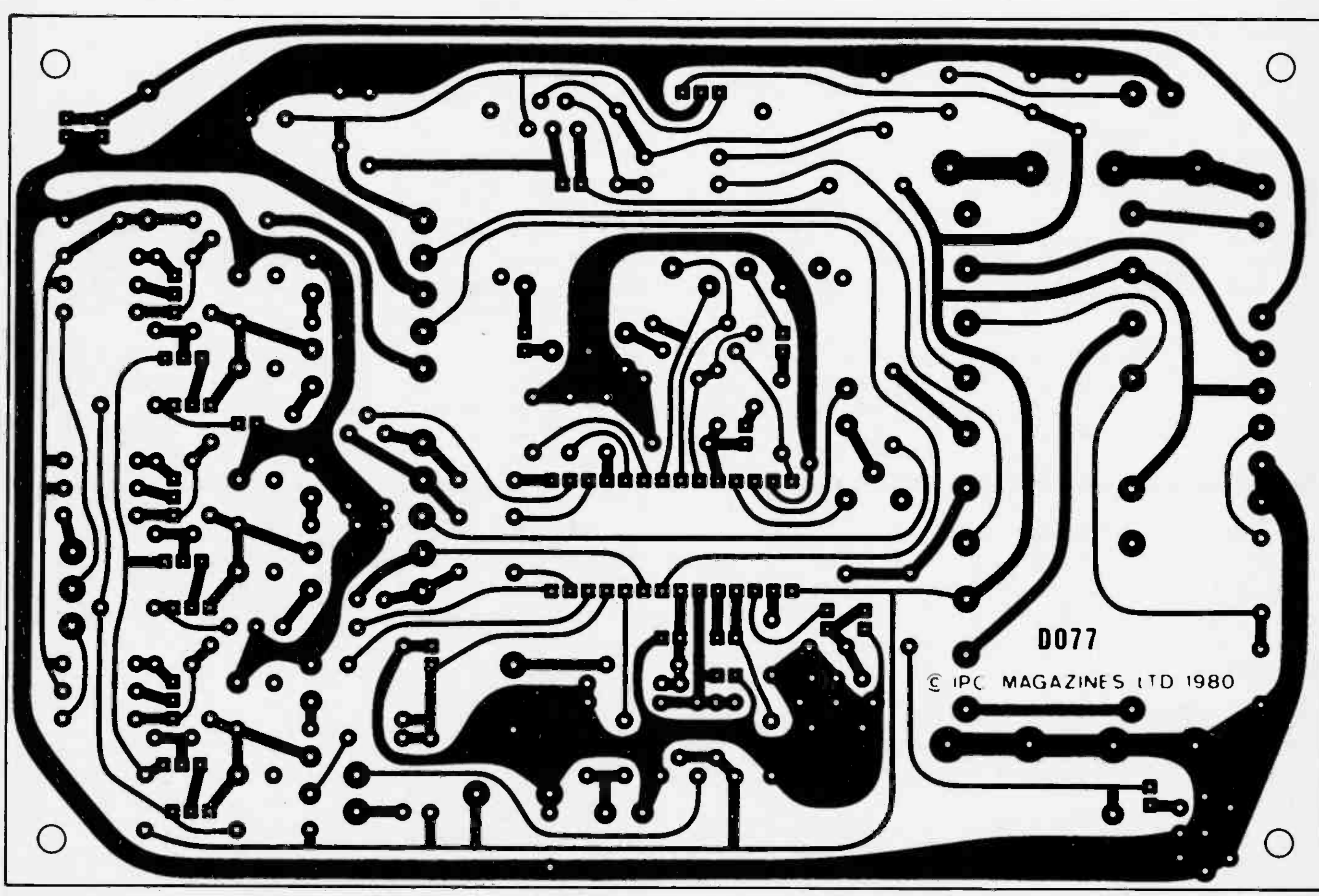


Fig. 3: Board print pattern. Full scale.

Note that connector C8 on the timebase board is not used with the new signals panel.
E1 Loudspeaker (only) earth connection.
E2 Loudspeaker.
F1 Green output to c.r.t.
F2 Blue output to c.r.t.
F3 Red output to c.r.t.
G1 To colour control wiper.
G2 To brightness control wiper.

Front Panel Controls

The front panel controls are wired up in much the same way as before. Connect the colour and brightness controls between earth and the 12V supply, with the wipers taken to the appropriate connector points on the signals board. The volume control's wiper and one end of its track are earthed, the other end of the track being returned to the signals board via a resistor of around 15kΩ. The optimum value is best found experimentally – the resistor adjusts the point at which the volume control begins to allow the sound to be heard. The easiest approach is to turn the volume control to its minimum volume setting, then increase the value of the series resistor until a hint of sound is heard. Finally choose the nearest standard value below this. For those readers using remote control, the correct value is 10kΩ – there's no need to select the resistor in this case.

Setting Up

Apply power and either tune to a station with a colour transmission or use a colour-bar generator. Ensure that a composite video signal of about 1V peak-peak is present at terminal 6 of the i.f. module (a scope is required for this of course).
(1) Connect scope to the junction of L2 and R9. Adjust L2 for maximum burst amplitude.
(2) Connect the scope to the junction of R7 and C9. Adjust L1 for minimum burst amplitude.
(3) Connect the two links shown on the circuit diagram. Adjust C17 slowly until a colour picture is obtained – with the colours just "running through". Disconnect the links.
(4) Adjust the black-level and grey-scale as described on page 425 of the June 1979 issue. VR3, VR4 and VR5 are the gain (highlight) controls while VR6, VR7 and VR8 are the black-level (lowlight) controls.■

Service Hints

Mike Dutton

The trouble with an elderly Dynatron hybrid colour set (Pye hybrid chassis) was no colour. The voltage at SK11 on the decoder panel (connection to the slider of the colour control) was found to be negative and didn't vary with adjustment of the control. The voltages at the colour control itself were correct however. When we came to trace the wiring back we discovered that it disappeared into the remote control cable. Disconnecting this restored colour, and on examination several of the wires were found to be broken and probably shorting intermittently inside the control head.

There was also excessive background blue which couldn't be removed by adjusting the blue first anode preset. The resistor (R464, 1·5MΩ) connected in series with the earthy side of this control had increased in value of course.

Lack of Width

The trouble with a Decca monochrome receiver (Model MS2400) was lack of width. The width control had very little effect, but all the components in this area were found to be o.k., while a new set of line timebase valves failed to produce any improvement. We decided to check the h.t. voltage, and found this some 40V on the low side, due it turned out to the reservoir capacitor being open-circuit. A replacement restored the width, and it's interesting that the only fault was the width problem – the sound was normal, and there was no ripple on the picture. The surge limiter resistor was getting hotter than usual however, due presumably to the increased ripple current flowing through it.

Intermittent Sound

A friend of mine has a Teleton transportable CPL142 colour set. He complained that every now and then the sound would just fade out. A tap on the cabinet would bring it back. I connected an Avo to the audio output stage's power supply and asked him to watch what happened when the sound next disappeared. A few days later he reported that the voltage dropped to zero when the fault occurred.

A separate full-wave rectifier, fed from a centre-tapped winding on the mains transformer, supplies the audio output stage. There are two fuses between the transformer and the rectifier diodes, and on close examination one of them (F704) was found to be quite loose in its holder. Prodding it would result in the sound gradually fading away as the reservoir capacitor discharged. My friend reported no further trouble after I'd tightened the fuseholder.

Faded Picture

The complaint with a Decca hybrid colour set (30 chassis) was that the picture had gradually faded until only a faint green outline could be seen. We switched on and measured the c.r.t. base voltages. First anodes quite normal, as were the cathodes. Adjusting the preset brightness control (c.r.t. grid bias) produced a slightly brighter picture, and by adjusting the first anode controls a reasonable grey scale was obtained. The picture was still very thin however, with a marked lack of contrast and no colour. Suspecting a decoder fault, the set was taken back to the workshop. A replacement panel failed to improve matters however, so a new i.f. panel was tried. This time we got a normal picture.

When a few voltage measurements were made with the original i.f. panel in place we discoverd that things were not at all right in the a.g.c. department. The voltage across the a.g.c. smoothing capacitor C60 (22μF) was nearer 8·5V than the usual 2·5V. Connecting a 1kΩ resistor across C60 restored the a.g.c. line to about the correct voltage, producing a normal picture and proving that the video detector etc. were o.k. So the fault had to be in the a.g.c. department, and each component was removed and checked. The culprit turned out to be C58 (0·01μF), which had a slight leak. This capacitor is the a.g.c. reservoir capacitor, connected between the collector of the peak detector transistor TR8 and chassis. After adjusting the set and turning the preset brightness control down again an excellent picture was obtained.

Scan Currents

S. George

WITHOUT deflection, the tube's beam(s) would produce a stationary spot at the centre of the screen. For horizontal deflection, the beam must be swept to both the left and the right. The current through the line scan coils must flow in one direction to obtain travel to the right and in the opposite direction to obtain travel to the left. The current flowing in the primary winding of the line output transformer must likewise move in both directions during each scan.

Horizontal Scanning

Fig. 1 shows at (a) the basic transistor line output stage circuit and at (b) the horizontal deflection of the beam. The line output transistor Tr switches on towards the centre of the scan. Current then flows through the transistor and the line output transformer's primary winding. The output is coupled to the scan coils via C2, and the positive-going sawtooth drives the beam to the right-hand side of the screen. To initiate the flyback, the transistor is switched off. The tuning capacitor C1 and the line output transformer's primary winding then form a resonant circuit, and the well-known flyback pulse appears at the collector of the line output transistor. As the pulse rises to its maximum value, the beam moves from the right-hand side of the screen back towards the centre. As the pulse then falls back to zero, with current reversal in the transformer/tuning capacitor, the beam is moved rapidly to the left-hand side of the screen. The circuit would then continue to oscillate, but when the voltage at the junction of the line output transformer's primary winding and the tuning capacitor tries to move negatively, the transistor's collector-base junction becomes forward biased. The transistor conducts in the reverse direction therefore, i.e. with current flow from the collector to the base. This damps the circuit, the current then flowing in the line output transformer's primary winding deflecting the beam towards the centre of the screen to give the first part of the forward scan.

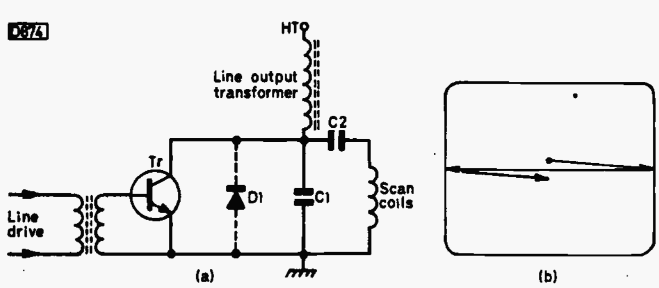


Fig. 1: (a) Basic transistor line output stage. (b) Horizontal deflection of the beam. When the line drive waveform switches the transistor on, current flows via the transistor and the primary winding of the line output transformer to the supply. The resultant sawtooth current flowing in the scan coils deflects the beam to the right-hand side of the screen. When the transistor is switched off to initiate the flyback, the tuning capacitor C1 and the circuit inductance comprise a resonant circuit. The resultant half-cycle of oscillation, with current reversal, deflects the beam back to the centre of the screen and then to the left-hand side. At the end of the half-cycle of oscillation, either the transistor or the shunt efficiency diode D1 conducts to damp the circuit, the current flow then deflecting the beam towards the centre of the screen to provide the first part of the horizontal scan. In practice the transistor is switched on about a third of the way through the forward scan.

In a mains/battery portable, the supply line voltage is limited to 10V or so. The transistor's reverse collector-emitter voltage is then significant and would result in scan distortion at the left-hand side. A shunt efficiency diode (D1 in Fig. 1) is included therefore, providing the current path during the first part of the scan. In a valve line output stage, the reverse current path is provided by the boost diode.

Current flows in the transformer and in the scan coils in both directions therefore to give deflection to the right and to the left. Why then doesn't this problem seem to arise with a field output stage, since this must provide upwards and downwards movement of the beam?

Vertical Scanning

The answer to this is bound up with the very different nature of line and field output stages. The line output valve or transistor is used as a switch. When switched on, the current flowing through it increases linearly due to the highly inductive load provided by the line output transformer. If a d.c. voltage is applied across an inductor, the current flowing through it will rise in the same exponential manner that the voltage across a capacitor rises.

A field output stage acts as a sawtooth amplifier. Since the field frequency is in the ratio of 50/625 to the line frequency, the reactance of a given inductance at field frequency will be only 8% of what it offers at line frequency. The impedance of the output stage's load at 50Hz is in fact predominantly resistive.

The field output valve or transistor(s) is/are biased to a midway point. When the current increases above this point the beam moves one way, while when the current is reduced below the midway bias point the beam moves in the opposite direction. In a nutshell, reducing a current has the equivalent effect to reversing its direction of flow. Or, in other words, a current or voltage which is going say less positively can be regarded as moving negatively. This can be demonstrated by supplying sufficient d.c. to a meter to get a midway deflection of the needle: when the input is reduced, the needle moves backwards – in the same direction as if a small input of the opposite polarity had been applied. Thus a given current reduction can be considered as being the same as the addition of an opposite polarity feed of equivalent strength.

What about the field flyback? At the end of the forward field scan, i.e. with the beam at the bottom of the screen, the field output valve is cut off. The cessation of anode current flow produces a positive-going flyback pulse at the anode of the output valve, and the circuit is arranged so that during this period the beam is deflected back to the top of the screen. The precise action with transistor field output stages varies, since quite a variety of types of circuit are in use. Once again however the transistor conducting at the end of the forward scan is abruptly cut off, as a result of which current flow reversal occurs in the field scan circuit. In a two-transistor output circuit the upper transistor generally conducts in the reverse mode during this time.■

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 683 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

RANK A823A CHASSIS

The fault on this set was a vertical blue band about a quarter of the way across the screen from the left-hand side, also occasional horizontal blue bands. The voltages around the SL917A i.c. on the decoder panel were measured as a first step, and were found to be as specified except for pin 5 which read 1·33V instead of 0·29V nominal. All the peripheral components seemed to be o.k., so a new chip was fitted. This made no difference. After some further checking, diode 3D1 in the feed to the burst gate pulse timing circuit was found to be leaky. Replacing this has produced a good picture, but the voltage at pin 5 of the i.c. is still 1·33V. Is this o.k.?

A circuit change in later versions of the panel has resulted in a higher voltage being specified at pin 5 – 1·5V nominal. Everything seems to be in order therefore. We'll make a note about 3D1 – this sort of fault is difficult to trace.

TELETON TVC14

This set initially suffered from a collection of faults. No e.h.t. was found to be due to an open-circuit heater in the 3AT2 e.h.t. rectifier – due in no small part to the supply bypassing the 2·2 Ω series resistor, which was connected across two internally connected pins. Using a suitable base, wired correctly, a GY501 was brought into service and restored normal e.h.t. No colour was then overcome by slight adjustment of the colour killer control. The remaining problem is horizontal pulling accompanied by excessive width (one square on each side of the test card is missing). The pulling is not present when the set is first switched on (though there's excessive width), but gradually gets worse, distorting straight verticals badly. When the brightness is increased, they seem to straighten slightly. The main smoothing block has been replaced and the h.t. is about right.

The line oscillator consists of a cathode-coupled multivibrator using an 8FQ7 valve, and it's likely that replacing this will straighten the verticals. Note that in addition to the line hold potentiometer there's a stabilising coil, L701 – adjusting this might well help. For the width problem we suggest checking the resistors in the width circuit, in particular R719 (2·2MΩ). If you're unlucky, the line output transformer might be in need of replacement. The line drive at the control grid of the 31JS6A line output valve should be about –45V.

FOCUS FAULT

The trouble with this Autovox colour receiver is no focus – just a blurred picture. The e.h.t. is 23·5kV, and the tripler is supplying 8kV to the focus circuit. The high-value resistors in the focus control network have been tested by substitution, but only 1·5kV can be obtained at the c.r.t. focus electrode and this cannot be increased. The fault was intermittent initially, the picture coming into focus after about half an hour, but is now permanent. The focus electrode is drawing about 750μ A. Do you agree that the tube could be at fault?

Make sure that the 750μ A is disappearing into the c.r.t. and not through the focus spark gap due to leakage. If the tube is drawing 750μ A it's definitely faulty. The normal focus electrode current is less than 10μ A.

PHILIPS G8 CHASSIS

The trouble with this set is that the line oscillator coil L4501 has to be adjusted each evening when the set is first switched on. The line hold is then generally o.k. for the rest of the evening.

This sort of trouble is generally due to the 18V zener diode D4531 which stabilises the supply to the line oscillator. The diode goes open-circuit, producing line drift with the receiver settling down once adjusted. The same trouble can be caused by the 12V zener diode D2166 on the i.f. strip. If necessary check the voltages around the transistors TR4500 and TR4511 in the line oscillator circuit, and the electrolytics in this area. A less likely possibility is the TAA700 jungle i.c. on the i.f. panel, since this incorporates the flywheel line sync circuit.

KÖRTING HYBRID COLOUR CHASSIS

The initial fault was that the l.t. fuse had blown and the l.t. bridge rectifier was open-circuit. These items were replaced, and a check was made for shorts. The only part of the set where any faults were found was on the raster correction panel. R464, which is connected between the line windings on the transductor, was badly burnt and open-circuit, and the heat had scorched the transductor. R464 was replaced and the transductor checked for shorts between windings. It seems to be o.k., but I can't check for shorted turns. The set was then switched on and after adjusting the 24V regulator sound and a perfect picture were obtained. After about twenty minutes however the picture gradually got darker, the red became more saturated, and R464 started to overheat. The set was switched off, but nothing could be found wrong. Switch on again and the same results are obtained. Any suggestions?

It seems to us that the excessive current flowing through R464 is excessively loading the line output stage and the power supply generally. The main suspect must be the electrolytic C464, which provides a d.c. block between the line output stage and the raster correction circuit. It probably has a substantial leak. If C464 turns out to be o.k., the transductor is clearly suspect for shorted turns. As you say, this can't be tested for shorting turns.

PYE 697 CHASSIS

I'm having difficulty with the field hold on this set. The field won't lock and continually drifts. There's ample range of adjustment on the field hold control however – the picture can be made to roll up or down at varying speeds, but won't lock. A replacement field timebase panel has been tried, and the transistor, diodes and resistors in the sync separator circuit have all been checked.

The most common cause of this problem is a poor connection in the screened sync lead from PL4A on the i.f. panel to PL9 on the field timebase panel. Use of a scope should enable you to track down quickly the point where the sync pulses are failing.

PHILIPS 320 CHASSIS

The trouble is the presence of teletext lines about two-three inches from the top of the screen. They can be "lost" if the height is reduced by about a third.

This symptom is due to slow field flyback. It can be caused by shorting turns in the field deflection coils, but there are several other things to check – the driver and output transistors TR2506/7/8 for leakage, also the flyback pulse clipper diode D2509 and the scan coupling and bootstrap capacitors C2539/C2558.

GEC SERIES 1

There's a field hold fault on this set. Sometimes, especially when the set is cold, good lock can be obtained. When the set is warm however, also sometimes when cold, the setting of the hold control is very critical – and when lock has been obtained it's usually accompanied by field jitter. The hold control is not to one end but is in the centre of its travel. Turning the contrast up fully helps, but of course the picture can't be viewed. I've changed the field timebase and video/sync valves, and replaced the field sync pulse integrating capacitor. What next?

Try replacing the field sync pulse coupling capacitor C206 (500pF). If reducing the contrast improves matters, try very slight adjustment of the final i.f. coil L106. The vision detector diode D103 should also be checked.

PYE 697 CHASSIS

The first problem was that the shift choke burnt out. This turned out to be due to a short to earth on the track of the shift control – through the anchor lug soldered to the earth track. Now, with or without the shift components in circuit, there's a colour picture with a quarter inch foldover down the centre of the screen, from top to bottom. There's no loss of width, neither does the picture pull to one side. There's no overheating in the line output stage.

There are two main possibilities: either a hiccup in the line drive waveform, possibly due to one of the electrolytics (C214, C213 and C210) in the line oscillator circuit; or the boost capacitor C218 is faulty. An oscilloscope check at the control grid of the line output valve should sort this out.

ITT VC52 CHASSIS

The original fault condition was a loud hum when the picture was dark, the picture then going very black with the verticals etc. breaking up. Replacing most of the components in the a.g.c. circuit cured that, though there's still hum at normal contrast settings. It sounds like the result obtained when a station is turned off tune. What have I overlooked?

This type of i.f. overloading normally occurs only at abnormally high settings of the contrast control. We suggest you use an attenuator to reduce the signal from the aerial to the point where noise is just slightly noticeable, then advance the setting of the contrast control for a normal picture. If the fault persists, replace the i.f. coupling capacitor C44 (120pF) which could be slightly leaky.

PHILIPS G8 CHASSIS (550 SERIES)

After the set has been on for about an hour an intermittent green band appears across the screen, some four inches from the top. The fault does not occur when the set is operated with the rear cover removed, and disappears on turning down the colour control.

It appears that the bistable is running in the wrong phase when the fault occurs. Check the tuning of the ident coil L205 (adjust for maximum output at the collector of Tr197). Then if necessary check the trigger pulse coupling capacitors C284/5 (0·01μF). Finally suspect the TBA520 chip. Use of a hair-dryer and freezer should help identify the culprit.

DECCA 30 SERIES CHASSIS

There's an odd fault on this set – a very bad flutter, similar to that caused by aircraft. It comes and goes erratically during the first hour, then goes completely when the set has thoroughly warmed up. It seems to be affected by camera changes and very contrasty scenes, and also darkens the picture. The set is otherwise excellent.

This is unusual on the Decca chassis, and probably stems from instability in the a.g.c. circuit. We suggest you try heating/freezing the two transistors (TR8/9) and capacitors C58 (0·01μF) and C60 (22μF). Another possibility is trouble in the beam limiter circuit. Items to check here are the PL509's cathode components R467 and C434 (100μF), also the smoothing capacitor C69 (50μF).

PYE 169 CHASSIS

The trouble is loss of line hold – all I can get is wavy lines. I've changed the PCF802 line oscilator valve and some of the components in the flywheel line sync filter network but the trouble persists. I now suspect the a.g.c./sync/video jungle chip (TAA700). Is there anything else I should try before changing the i.c.?

There are several items to check before replacing the i.c. The first check should be of C49 (16μF), which smooths the h.t. supply to the line oscillator stage. If necessary, next check the capacitors in the line oscillator circuit – C67 (820pF), C64 (0·001μF) and C65 (0·0033μF). Also check the line oscillator coil itself – we assume you've tried adjusting it. If the coil is faulty, squeezing it will probably change the frequency.

BUSH TV300

The fault with this portable seems to be some sort of overloading. When it first started, a white smear or streaks, pulling over to the right, would appear after about half an hour. Eventually the whole screen would go white, with only the dark parts of the picture just visible. The fault now appears almost immediately after switching on. Adjusting the a.g.c. controls etc. makes no difference.

The problem is not unusual on this set and is usually due to one of the 1μF capacitors C519 and C520 that smooth the h.t. supply to the video output transistor. Replacements should be rated at 160V or more. Less likely culprits are the video output transistor itself (TR10, type 2SC1103) or its base signal coupling capacitor C226 (100μF).

PHILIPS G6 S-S CHASSIS

The trouble is field jitter, triggered by any change of camera or picture content. I've changed all likely suspects in the field timebase, the PFL200 video/sync valve and the two 40μF electrolytics in the a.g.c. circuit. The fault also seems to affect the verticals slightly.

Check by substitution C2047 (12·5μF), which decouples the video amplifier's screen grid, and the field sync pulse coupling resistor R2124 (1·5MΩ). If the fault persists, check resistor values in the sync separator circuit – the screen grid feed resistor R2122 (220kΩ) and grid resistors R2118 (2·2MΩ) and R2119 (1MΩ) in particular.

THORN 8800 CHASSIS

There are foldover problems at the top of the screen. Over the top four inches there are faint lines and, more severe, the teletext lines. The latter occupy a depth of some two inches, an inch or so down from the top.

The problem is due to a slow field flyback. This is usually caused by leakage in the field output transistors, VT410 or VT411, or problems in either the driver transistor VT409 or C448 (100μF) which decouples the drain of the buffer amplifier transistor VT412. If you are unlucky, the field scan coils are faulty.

INDESIT T24EGB

There's an intermittent fault – ragged horizontal streaks to the right of white areas in the picture. The trouble seems to be triggered by changing channel, and can sometimes be cleared by repeated channel changes.

First note the effect of turning up the brightness. If this makes the effect worse, suspect the e.h.t. pencil rectifier. If advancing the brightness control has no effect on the symptom the trouble would seem to be in the video output or driver stages. If the transistors (TR201 and TR205, types BC148B and BF178) and the peaking coil (L204) are in order, suspect C208 (220μF).

RANK A640 CHASSIS

The trouble with this set is false line lock, i.e. there's a vertical black line down the centre of the screen with half the picture on one side and half on the other side. Which components should I check?

On this chassis (Bush TV161 series) the problem is almost always due to failure of the flywheel sync diode block – 3MR1-3, the small black block about half way up the right side of the timebase panel (the third diode is the field interlace diode). Separate BY206 diodes can be used, with a 15kΩ resistor in series with each line sync diode.

TEST CASE

214

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.

VCR sales seem to be one of the few bright spots on the currently gloomy TV retailing scene. We now have a respectable number of them to look after, mainly on rental, and are of necessity learning the ropes as we go along. Experience bought dearly now will stand us in good stead in the future – provided we don't get too great a proliferation of models and tape formats.

Anyway, a recent case involving a JVC HR3660EK provided us with a bit of a puzzle. This is a VHS machine of course, and similar models are to be found in other ranges, such as Ferguson. It arrived in the workshop with the complaint that the picture was broken up, and on playing back a test tape bands of severe noise were observed at the top edge and over the bottom quarter of the screen, with the rest of the picture almost normal.

Routine checks were carried out on the servos, and all was found to be well here. The tracking control was also working. These parts of the circuit were exonerated therefore. The next suggestion was that the heads might be faulty or damaged, but close inspection revealed no defects – in fact the heads were undamaged and in good condition.

Several suggestions (not all of a technical nature!) were put forward and discarded, and finally the audio-cum-VCR man sent everyone away and decided to sort the trouble out himself, thank you! This he proceeded to do. Can you suggest where the most likely source of the fault lay? All will be revealed next month.

SOLUTION TO TEST CASE 213
– page 620 last month –

We left our engineer last month faced with a puzzling case of a malfunctioning beam limiter in an ITT colour set (CVC20 chassis). The d.c. voltages measured at the base and emitter of the first transistor T1 suggested that it should have been turned off. Both transistors were conducting however – shorting the base-emitter junction of either of them removed the fault, restoring normal brightness and contrast levels.

Our intrepid engineer next hooked an oscilloscope across C7, which decouples T1's emitter, and was confronted with a messy line-rate waveform consisting mainly of damped oscillations from the line output transformer. The peak-to-peak amplitude of these oscillations was no less than 10V! Clearly T1's base-emitter junction was rectifying this waveform. This produced d.c. conditions suggesting that T1's base-emitter junction was reverse biased when in fact the transistor was conducting (remember the auto-bias operation of line output valves?).

The culprit was C7 of course. It was completely open-circuit, thus failing to iron out the waveform superimposed on the d.c. sample voltage obtained from the tripler.

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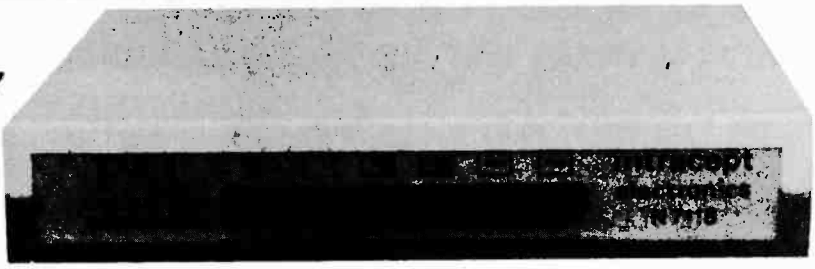

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Scrap panels FREE if buying £10 or more of panels. Used valves Free, also if buying £10 worth. Come and haggle for quantity discounts for callers!
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£999

includes VAT, P&P & insurance.
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A49-120X, A51-110X	£30
A56-120X, A56-140X	£33
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A66-140X, A67-120X/150X	£36
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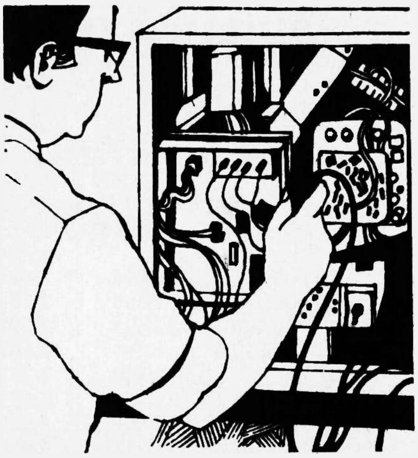

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BU208	1.60p	BD131	30p	2N4444	1.10p
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0602 813329

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£25.00 ea

EXCHANGE & VAT

2 YRS guarantee optional 4 YRS
Delivery Service Available

INLINES *certainly* just phone for quote.

ALL SIZES OF MONOS AVAILABLE

All tubes are fitted with high definition guns & high temperature pumped (385°C).
All tubes electronically picture tested immediately before despatch.

NOW YOU HAVE SEEN THE REST GET THE *BEST* FROM TRENT TUBES

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UHF output, plugs straight into aerial socket, 5 patterns, battery powered, size 3¾"×3"×1½".

£17.45 including VAT

Please add 30p towards P&P.

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EB91	12p	PCC84	8p	PL36	20p
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ECL80	8p	PCC89	8p	PY32/33	15p
EF80	8p	PCC189	8p	PY81/800	15p
EF85	8p	PCC805	15p	PY801	20p
EF183	10p	PCF80	8p	U191	15p
EF184	10p	PCF86	15p	6F23	15p
EH90	13p	PCF805	20p	6/30L2	15p
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Type 12 18 Watts 2K5 2K85 **46p ea.**

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Philips G8 2R2 + 68R	57p
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PCL85/805	15	8
PCL86	12	6
PFL200	15	8
PL36	20	10
PL504	20	10
PL508	30	15
PL509	80	25
PL519	90	40
PY500	40	19
PY800/81/801	15	8
PY801/88	15	8
30FL1/2	25	12
PL802	£1.20	

Please add 10p per valve p. & p. for orders under £2.00.

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- Always available.
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All fully tested.

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Tube prices + V.A.T.

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New Circuit Supplied
G.E.C. VHF/UHF 8 C.H.
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4 Pots Transistor etc.
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4 Push Button. Unit 7 Transistors. V/Condenser. 10 Coils. Rod Aerial. I.C. Decoder CA758E. (No Power Supply and O/P Stage).
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200+200 350V	60p
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10 mixed Thermistor 50p
4 pots & 6 Push Button Unit for V/Cap. Mains on-off switch & Mains Filter. ITT £3.50

Triplers TS25 11TDT THORN	£2.50
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GRUNDIG 3000/3010 SIEMENS TVK52 Triplers	£3.00

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Triplers
GEC C2110 after 27/1/77 £3.50

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THORN 3500 THORN 8500 Focus Unit DECCA Focus Unit (Large or small)	£1.00 each
4 Push Button Units 1400-1500 THORN	£3.50
Used in G.E.C. T/V small neon lamps NE-2B6H-2	3p
TCE527	20p
TV 20	50p
TV 18 EHT	40p
BYF3214 20KV Rectifier Sticks (TV20 Type)	25p each
BYF3123 18KV Wire ends	25p
BA 248	6p
BSS 68	20p
BYX55/350	10p
BT106 S/Type	40p
BT 106	95p
BT 116	95p
BT 119	95p
BT 109	70p
BT 146/750V MULLARD THYRISTOR	25p
Thyristors 8A/800V 2N6399A	30p
Thyristors 7A/400V 52600D	30p
Y827 Diodes	30p
Bridge Rec B30C 600A6	12p
B30C 500	12p
DE Solder Pumps	£4.00
Philips T/Units UHF New	£2.00
New Circuit Supplied UHF 8 C.H. Light action unit 4 I/C for V/cap tuning G.E.C. C2001/C2201	£5.00
4 Push Button T/Units UHF MULLARD	£2.00
AE Isolating Sockets UHF & Lead	
PYE & THORN ITT	35p
Transistor UHF Units with AE Socket and Leads GEC 2000 Rotary type NEW	£2.00
UHF Aerial Socket and Leads PYE, ITT & THORN	35p
Co.ax Plugs	12p
ITT Mains on/off switches Push-button	25p
DP Push Button Switch ON/OFF	10p
Mains ON/OFF Push Button T/V	20p
Mains ON/OFF Rotary T/V	12½p
Main Dropper THORN 6R+1R+100R	35p
Mains Droppers 69R+161 PYE	40p
AD 161 AD 162	Pair 60p
147+260 PYE	40p
(731) 3R+56R+27R	50p
Plug and Sockets 3 & 6 Pin Printed Circuit Type	pair 10p
4 push button unit (for Varicap Tuning) 20K New	50p

CONDENSER SALE PRICE

2.7/63V	220/10V	4700/10V
4.7/63V	220/16V	1/250V
10/250V	470g-25V	10/40V
22/40V	680/40V	330/63V
160/25V	680/25V	.47/160V
1/63V	33/100V	8/300V
100/100V	33/63V	.47/250V
2.2/160V	33/35V	.01/100V
100/16V	100/63V	.005/1,500V
330/25V	22/160V	.01/600V
3.3/250V	100/40V	
330/10V	47/40V	
5p each	47/63V	5p each

4700/40V	30p	33/350V	6p
1000/50V	10p	2000+2000/35V	30p
220/63V	8p	.01/1000V	8p
1500/40V	8p	.047/1000V	8p
470/63V	8p	.47/1000V	30p
106/350V	20p	.1/800V	8p
100/450V	40p	.1/400V	5p
220/450V	40p	.0047/1,500V	8p
470/40V	8p	2N2/1,500V	8p
8/350V	6p	1N8/1,500V	8p
10/500V	10p	.1/2000V	15p
33/500V	10p	2500+2500 63V	50p
33/450V	10p	B9A Print	5p
4700/25V	25p	V/Holders	
4700/30V	25p	PYE 697	
22/350V	6p	(Long)	15p

3500 6 push button units for Thorn 3500 Varicap tuning £1.00
Varicap F.M. Tuner Tuning range 78.5 to 108MHz £2.00
(I.F. Panel with circuit) £2.00
6 position 12.5KV/Resistor Unit for Varicap 50p
Thorn Mains Lead & ON/OFF switch & Control Panel with Slider Pots 75p
GEC IF Panel (204C) £7.50
GEC Mains Dropper fits model no.

C2001H	C2118H	C2113H
C2110H	C144H	C2601H
C2136H	C2202H	C2015H
C2219	C2611H	20p

BD253/B	35p
BD124	£1.50
BU105/04	£1.00
BU204	40p
AU113	£1.00
BU205	£1.00
BU108	£1.00
BU208	50p
BU500	£1.00
BU126	£1.00
R2008B	£1.00
R2010B	£1.00
BU208/02	£1.00
BU208A	£1.00
TTY80	20p
BTY80	20p

BB 105 UHF BA182
BB 103 VHF Varicap diodes 5p each

ITT PT266 3W12 (Thermistor Degause-ing) Fits Most Sets 15p

PHILIPS SNIPS CUT MOST THINGS £1.50

ELC 1043 AEG	£4.00
MJE 1661	25p
XTALS T/V 4.433.610KHz	50p
BYX 38/600R	50p
BT138 Triacs 10a/600V	65p
RCA40506 Thyristors	50p
MJE 2955/15A	50p
TIP 41A-42	pair 40p
GT1 Philips Thyristors	60p
PYE Thyristors 2N4444-0T112 BT116	85p
SP8385 Thorn	25p
5 amp 300V Thyristors	25p
SCR 957	65p
BD561-2	pair 30p
BC365	10p
10 Watt LP1173	£1.00
IF LP1170	50p
AM/FM T/Unit (Seconds)	50p
AT1025/08 Blue Lateral	15p
Tip P3T A/B	20p
10 Watt Mullard Amps New	£2.00
DECCA Bradford Tuner 5 Button New (4 push)	£2.75

BC116	5p	BC207	5p
BC142	5p	BC463	5p
BF237B	5p	BAV10	5p
BF273	5p	BC238	5p
BC171B	5p	BC250	5p
BF245A	5p	BC251	5p
BC308B	5p		
BFY50	15p	BY298	12p
TIP29C	20p	BD416	25p

Bush Rank 6 push button unit for V/cap £2.50

100kΩ 40 Turn Pots for V/Cap tuning 20p

6 volt, 23 watt Soldering Iron £2.00

1000+2000m/35V 25p

THORN UHF TUNER UNIT & PANEL FOR 9000 SERIES £8.00
ALSO THORN 9000 FRAME PANEL £9.00

CVC9 ITT Control Panel £4.00

CVC20 ITT 6 Push Button unit & Input Panel £5.00

PT3 4p

Thermistor 200+200+75+25 4 Fuse Holder & 2BY133 & Resistors ITT Panel £1.50

4700/25 10p

Philips TV IF Modules 38Mc/s first & second IF £1.50 each

G9 PHILIPS Tripler £3.75

100 mixed ceramics & plate condenser £1.00

THORN Hearing Aid Units & Ext. Loud-speaker £2.00

Line O/P Trans CVC20 £5.00

ITT Control Panel with Mains Lead, 4 Slider Pots Mains Filter £2.50
3.5mm Jack Socket 7p
2200/40V 10p

Hitachi 12" tubes new A31/300W £12.00

5.5 MHz Filters 15p
6 MHz Filters 25p

Red & green LEDs mixed 14 for £1.00

5×3 Speaker 80R or 50R 50p

G9 Seakers 70R £1.00

Speaker 5×3 35 ohm 75p

Speaker 6×4 15 ohm £1.00

Long Wires
300 Mixed Carbon Film Resistors
5 of each type ¼ Watt IR to 2 Meg – ITT £1.50

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BU105	50p
BU105/04	75p
BU204	40p
BY176 Type	25p
SAA1020	£6.00
SAA1024	£4.00
SAA1025	£5.00
SL901	£3.00
TBA120A	30p
TBA120AS	30p
TBA120B	30p
TBA120C	30p
TBA120S	30p
TBA120SB	30p
TBA120U	30p
TBA510	£1.00
TBA480Q	£1.00
TBA520Q	£1.00
TBA550Q	£1.00
TBA560CQ	£1.00
TBA750Q	£1.00
TBA800	40p
TBA720A	£1.00
TBA810S	£1.00
TBA890	£1.00
TBA950	£1.00
TBA990Q	£1.00
TBA920	£1.00
TDA1170	£1.20
TDA1190	£1.20
TDA1412	50p
TDA2540	£1.00
TDA2680	£1.00
TDA2690	£1.00
TCA830S	£1.00
TCA800	£1.00
TBA641BX1	£1.50
TCA270SQ	£1.00
TCA270Q	£1.00
TCA270	£1.00
TDA2640	£1 each

TAA320A	50p
CA270	50p
CA270EW	50p
TBA651	80p
BTT822	£1.00
BTT8224	£1.00
TBA396	£1.00
TAA550	20p
TAA570	£1.00
TAA700	£2.00
TBA1441	£1.00
TBA673	£1.00
TCA640	£1.00
TCA650	£1.00
TCA660	£1.00
TCA740	£1.00
NPN TIP 130 60V/8A Darlington 2230	30p
Thyristor 40506 RCA	50p
IS5024A	50p
IS5030A	50p
IN3899	50p
BY 179 bridge 800V/1 Amp rectifier	35p
BU124	50p
BU1377	60p
BU326	60p
BU126	50p
2N3055	25p
BD238	20p
SN76001	£1.00
SN76003	£1.00
SN76003	£1.50
SN76033	£1.50
SN76226	50p
SN76227	50p
SN76131	50p
SN76544N	£1.00
SN76660	30p
SN76666	50p
SAS560	£1.00
SAS570	£1.00
SN76115N	50p
SN7650N	£1.00
SN7630P	50p
SN29848	50p
SN76532	50p
SN76550R	15p
SN76570N	50p
SN16964	50p
PUA758PC	£1.00
MC1349P	50p
TCEP100	£1.20
TBA625	£1.00
SN29848	50p
SN76532	50p
SN76707N	50p
SN16964	50p
SN76018KE	£1.00
SN76008KE	£1.00

SN76546N	£1.00
BSX20	5p
R2603	50p
BD136	10p
TBA800	40p
BU126	50p
NPN TIP 33B 10A/80V	30p
BYF 3126 30KV stick diodes	50p
3 Amp Diodes approx Volts 1,200	7p
ITT Bridge Rectifier C73 1½ amps	20p
IN4003	5p
IN4004	5p
IN4005	5p
IN4006	5p
IN4007	5p
BY127	10p
BYX/55/350	10p
BY133	8p
BY190	40p
BR100	30p
BT100	30p
BT106	75p
BT109	£1.00
BT116	£1.00
BT119	£1.00
2N6348	50p
2N4442	60p
2N4444	£1.00
BT151/800R	70p
3 amp Diodes 300V	10p
3 amp Diodes 100V	7p
1 amp Bridges 100V	20p
1 amp 400V	20p
3 amp Bridge	25p
W005M Bridge	15p
W04 Bridge	20p
BY296	7p
BY298	10p
BY299	10p
BT146	25p
BT138 10/A	70p
1600/volt 1 amp diodes	7p
1300/volt 1 amp diodes	7p
BD595	35p
BD596	35p
BD131	25p
BD132	25p
AC187-8K	pair 40p
AF139	25p
AC128	20p
BD239	12p
FT3055	20p
NPN-PNP 60V 5 amp 80W	20p pair
GEC 8Ω speakers	70p
(Cost £10) New (NSF/AEG) UHF/VHF Varicap T/Units	£4.00
BF458T	12p
BF458 NPN	10p
BF423 PNP	7p
TCE527	20p
TCE157	20p
Y716	20p
BD807 10A/70V WPN 9 watt	25p
MJE51T NPN 300V/4A	25p
3 amp Diodes approx. 1,200 volts	7p
BY204/4	6p
BY296 10p BY206	7p
BY299 10p BY127	10p

GEC 122M	60p
Philips G11 Thyristor	
BF240	5p
BC546	5p
BC207	5p
BC250	5p
BC251	5p
BC308B	5p
BC139	5p
BC173	5p
BC116	5p
BF273	5p
BC174	5p
BAV10	5p
BC238	5p
OA90	5p
Thermistors	
PTH451 A or B	20p
Thermistor	
PT37P	25p
GEC4700M/25V	15p
1000M/63 ITT Axle	15p
22M/375V ITT	20p
BF127	20p
BF264	20p
BF180	20p
BF181	20p
BF182	20p
BF200	20p
BC300	20p
BC303	20p
BC350	20p
BC257	30p
BF137	20p
BF185	20p
BC460	20p
BC336	20p
BF157	20p
E1222	20p
BFT43	20p
TIP29A	20p
TIP30A	20p
TIP32	20p
TIP31B	20p
BD221	20p
BD238	20p

MR501 3 amps/100V	7p
MR508 3 amps/800V	12p
IN4006	5p
IN4007	5p
BY210/400	5p
BY210/800	10p
BY176	50p
BY133	8p
BA159	7p
BY184	25p
BY 187/01 (EHT Diode 11.5KV 2 M/A)	10p

BC147C	2N3566
BC148B	BF198
BC149C	BF274
BC195	BSY79
BC108	BC327
BC109	BC213LA
BC107	BC212LT
BF594	BF195
BC158	BC182L
2N2222	BF594
2N390	BC183
2N4355	BC238A
2SK30A	BC454
BC455	BC559
BC337	7p each

Small Red LEDs Type TLR102	5p
ORP12	40p
BF355 300V	30p
BD681	25p
BD228	25p
BD207	30p
20 small red LED	1.00
2N6099	25p
5 amp 300V Thyristors	25p
Pair TIP 41-42	50p
4 Push button for v/cap with pots	50p each
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