JUNE 1982

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TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

DISCS ARE HERE!

THE PHILIPS LaserVision SYSTEM

VCR MODIFICATIONS

CHECKS ON GEC HYBRID CTVs

SERVICE NOTEBOOK

TELEVISION

June 1982

Vol. 32, No. 8
Issue 380

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, 25 Lavington Street, London SE1 0PF.

SUBSCRIPTIONS
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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 JULY WILL BE PUBLISHED ON JUNE 23

PANEL BEATERS

EXCLUSIVE OFFER - BARGAIN PRICE PANELS

ON/OFF SWITCHES

THORN 1600, 1615, 3000, 3500, 8000, 8500, 9000, 9500, 9600, 9800. .50 each
RRI A823
DECCA 30

MULTISECTION CAPACITORS

RRI 300+300/350v	£ 2.00
THORN 1500, 150+150H00/350v	£ 1.50
THORN 8000, 2500+2500/63v	.75p
700/250v	.75p
400/350v	.75p
THORN 8800 1000/250v	.75p
THORN 9000 400/400v	£ 2.00
THORN 95/9600 220/400v	£ 2.00
THORN 1600/1615 200+200/300v	£ 1.00
RRI T20 220/400v	£ 2.00
ITT CVC 40/45 220/400v	£ 2.00

DROPPERS

TCE 1600	.50p
1615	.50p
8000	.50p
9800	.50p

LOPT

RRI RANGER 2 and 3	
RRI A823	£ 3.50
RRI Z179	£ 8.00
TCE 9000 9200 9300	£ 8.00
9500 9600 9900	£ 8.00
1690	£ 8.95
9800	£16.00

MAINS TRANSFORMERS

THORN 3000 – 3500 £7.00

EHT MULTIPLIERS

THORN 9000 (ITT)	£4.50
THORN 9500 (VARO)	£9.00
THORN 8000	£2.00
TV 13 RECTIFIER STICKS	35p

TUNERS – NEW

TUNERS – NEW	
MULLARD ELC 2000	£6.00
FAGUR SCF 29	£6.00
MULLARD U322	£6.00
MULLARD ELC 1043/05	£6.00

★ ★ ★

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9000 SERIES

IF/VIDEO/CHROMA	£19.00
TIMEBASE	£15.00
LINE & POWER	£25.00
CYCLOPS	£ 4.00
RASTER CORRECTION	£ 3.00
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SWITCH MODE POWER SUPPLY	£15.00
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TUNER PANEL/REMOTE CONTROL UHF VHF	£10.00
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6 CHANNEL TOUCH PADS	£ 4.00
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T.V. STANDS
22" & 26"
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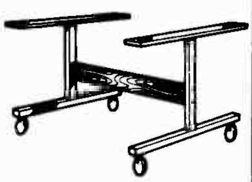

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MULLARD U314	£5.00
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DECCA 30 LARGE	£1.50
DECCA 80 SMALL	£1.00
DECCA 80 LARGE	£1.50
ITT CVC 20, 30, 40, 45	£1.50
THORN 3500	£1.50
THORN 8000	£1.50
THORN 9000	£2.00
THORN 9500/9600	£2.00

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100K TUNING POTS, THORN, GEC	35p
100K TUNING POTS, PHILIPS G8	50p
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1 MFD MAINS FILTER 250v	75p
VA 8650	25p
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18 PIN	20p
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SAS570S	1.80
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SL1310	1.80
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SL76544	2.00
SN76003N	1.75
SN76013N	1.50
SN76013ND	1.50
SN76023N	1.45
SN76023ND	95
SN76110N	89
SN76115N	2.27
SN76131N	1.30
SN76226(D)N	1.56
SN76227N	1.18
SN76532N	1.50
SN76533N	1.38
SN76033N	1.53
SN76544N	1.35
SN76650N	89
SN76660N	80
SN76666N	70
SW153	2.74
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TA7051P	85
TA7074P	1.00
TA7108P	3.43
TA7120P	2.43
TA7141P	95
TA7193P	5.87
TA7171P	1.80
TA7172P	1.80
TA7173P	1.45
TA7176P	75
TA7193P	5.87
TA7609P	4.38
TAA350A	80
TAA300	58
TAA310	2.83
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TAA630S	2.50
TAA621 AX1	3.00
TAA840/S1	1.86
TAA700B	1.70
TAA700	1.70
TAA661B	1.20
TBA120A	70
TBA120S	70
TBA120SA	70
TBA120AS	70
TBA120B	1.30
TBA120SB	1.30
TBA120U	1.00
TBA395	2.28
TBA396	80
TBA440N/TBA1441	2.75
TBA440P	2.50
TBA460	1.20
TBA480Q	1.20
TBA500P	1.50
TBA510	3.00
TBA520Q	1.20
TBA530Q	1.28
TBA530	1.20
TBA540	1.40
TBA550	1.58
TBA550Q	1.58
TBA560Q	1.58
TBA570	1.00
TBA690	1.50
TBA673	1.18
TBA700	2.12
TBA720A	1.95
TBA720Q	2.12
TBA750	2.05
TBA800	99
TBA810AS	1.35
TBA820	1.78
TBA890	3.94
TBA920	1.80
TBA920Q	1.80
TBA950(2X)	2.40
TBA970	4.09
TBA990	1.40
TBA1441	2.95
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TCA760	2.30
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TDA1190	2.60
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TDA1270	3.73
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TDA1352B	1.80
TDA1412	1.20
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TDA2140	5.95
TDA2190	4.70
TDA2020	4.06
TDA2030	2.80
TDA2521	4.17
TDA2522	2.40
TDA2523	2.20
TDA2530	1.85
TDA2532	2.45
TDA2524	2.25
TDA2540	3.84
TDA2541	2.85
TDA2560	1.80
TDA2581	2.25
TDA2590	3.25
TDA2591	2.75
TDA2593	2.50
TDA2600	3.25
TDA2611A	1.95
TDA2640	2.25
TDA2680	3.15
TDA2690	1.90
TDA3560	2.95
TDA3950	2.38
TDA3960	2.95
TDA9400	2.95
UPC566H	2.85
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UPC1025H	2.95
UPC1025HI	4.50
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UPC1350C	4.15
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8 pin 24 16 pin 20
14 pin 18 14 pin Dil/Quil 28

SEMICONDUCTORS

AC107	35
AC126	22
AC127	22
AC128	20
AC128K	32
AC141K	34
AC142K	30
AC176	25
AC176K	35
AC186	41
AC187	28
AC187K	28
AC188	25
AC188K	37
AD143	82
AD149	79
AD161	42
AD161/2	1.15
AD162	42
AF106	49
AF114	88
AF118	82
AF121	58
AF124	34
AF125	35
AF126	34
AF127	32
AF139	42
AF178	1.54
AF239	45
AF279	87
AL102	2.00
AU106	2.50
AU107	2.00
AU110	2.00
AU113	1.40
BC107	20
BC107A	20
BC107B	20
BC108	20
BC108A	20
BC108B	20
BC108C	20
BC109	20
BC109B	20
BC109C	20
BC114	12
BC116A	12
BC117	20
BC119	24
BC140	32
BC141	26
BC142	21
BC143	24
BC147	8
BC148	9
BC149	10
BC157	11
BC158	10
BC159	10
BC160	25
BC161	28
BC170B	15
BC171	9
BC171A	10
BC171B	10
BC172	9
BC172B	10
BC172C	10
BC173C	12
BC174A/B	10
BC177	27
BC178	28
BC182	8
BC182LB	10
BC183LB	10
BC184/L/B/C	10
BC204	10
BC208	13
BC209	10
BC212	8
BC212L	8
BC213	8
BC213B	10
BC213L	8
BC214	8
BC214L	10
BC237B	12
BC238A/B/C	8
BC251A	12
BC252A	12
BC252B	12
BC261A	18
BC261B	15
BC262A	15
BC262B	15
BC300	33
BC301	28
BC303	28
BC307	10
BC308A/B	17
BC327	11
BC328	8
BC337	11
BC338	8
BC461	30
BC547	10
BC548	10
BC549	8
BC550	7
BC557	8
BC558	8
BCX34	27
BCY72	13
BD115	32
BD116A	85
BD124P	80
BD131	33
BD132	35
BD133	40
BD135	28
BD136	27
BD137	28
BD138	23
BD139	28
BD140	31
BD144	1.20
BD159	85
BD160	1.30
BD166	52
BD179	52
BD182	72
BD183	75
BD201	85
BD202	80
BD203	80
BD204	84
BD222	46
BD223	58
BD225	47
BD232	45
BD233	36
BD234	37
BD235	33
BD236	40
BD237	33
BD238	35
BD410	55
BD434	55
BD437	88
BD438	84
BD507	52
BD508	55
BD509	55
BD510	88
BD517	80
BD520	75
BD698A	1.40
BDX32	1.50
BF115	35
BF117	38
BF125	28
BF127	28
BF154	12
BF158	18
BF160	27
BF167	24
BF173	22
BF177	35
BF178	28
BF179	28
BF180	38
BF181	38
BF182	30
BF183	28
BF184	30
BF185	38
BF194	11
BF195	11
BF196	10
BF197	11
BF198	18
BF199	15
BF200	30
BF224	18
BF241	15
BF256LC	28
BF256	28
BF257	28
BF258	25
BF259	24
BF262	84
BF263	58
BF271	24
BF273	12
BF274	24
BF310	30
BF311	38
BF336	38
BF337	30
BF338	34
BF355	37
BF362	37
BF363	33
BF371	30
BF457	35
BF458	28
BF459	38
BF639	28
BFR39	27
BFR90	1.74
BFT42	28
BFT43	28
BFW10	80
BFX29	30
BFX84	27
BFX85	30
BFX86	28
BFX88	25
BFY50	20
BFY51	22
BFY52	20
BFY90	75
BR100	17
BR101	30
BR103	58
BRC4443	88
BRX46	48
BRY39	30
BRY56	57
BT106	1.00
BT108	1.24
BT109/600R	1.28
BT116	1.21
BT119	3.00
BT120	3.80
BT151/800R	1.20
BT161/800R	1.20
BU104	2.00
BU105	1.25
BU108	1.80
BU124	1.30
BU126	1.40
BU204	1.50
BU205	1.34
BU208	1.80
BU208	1.60
BU208A	1.65
BU208/02	2.10
BU326A	1.42
BU407	1.25
BU500	1.95
E1222	20
MJE340	40
MJE520	44
MJ3000	2.36
OC71	27
OC79	20
R2008B	1.80
R2010B	1.80
R2265	1.40
R2322	58
R2323	87
R2461	1.58
R2540	2.80
RCA16334	90
RCA16335	80
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	41
TIP32C	42
TIP33B	75
TIP41C	48
TIP42C	47
TIP47	70
TIP2955	90
TIP3055	63
TIS91	21
TV106/02	1.55
2N696	21
2N2904	51
2N2905	28
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3705	10
2N3706	10
2N3708	17
2N2904	30
2N5294	40
2N5296	46
2N5298	60
2N5496	53
2N6107	75
2N6109	81
2SA715	1.00
2SC495	1.10
2SC496	1.31
2SC643A	1.50
2SC1096	1.72
2SC1172Y	2.20
2SC1173Y	1.09
2SC1306	2.73
2SC1307	3.00
2SC1449	1.97
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC2028	1.82
2SC2029	2.80
2SC2078	2.00
2SC2091	1.34
2SC2166	2.73
DT112	1.01
DT121	1.01
SW150	3.00
SW153A	2.74
BU105/02	1.58

THERMISTORS

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

CRYSTALS

4.3Mhz	1.30
8.8Mhz	1.30

WE NOW HAVE THESE SPECIAL CB INTEGRATED CIRCUITS

TA7205AP	3.72
2SC1909	1.41
2SC495	1.10
LC7130	5.03
AN240	3.84
MSN5807	7.07
AN7150	3.97
TA7222	4.07
TA7310P	2.78
PLL02AG	8.89
MC1351P	1.00
AN2140	3.01
LA4031P	3.21
LC7120	5.87
TA7204P	3.77
TA7130P	1.83
UPC1158H	4.28

Please enquire for others

NEW VALVES

30FL2	1.41
DY802	72
DY86/7	66
ECC81	80
ECC82	60
ECC83	60
ECC84	80
ECC85	88
ECC88	1.35
ECF80	80
ECF82	80
ECF86	1.50
ECH81	1.04
ECH84	1.13
ECL80	84
ECL82	77
ECL86	84
EF80	60
EF85	60
EF86	1.18
EF89	1.43
EF183	60
EF184	60
EH90	1.02
EL34	3.50
EL81	2.05
EL84	88
EL90	82
EL509	4.50
EY86/7	66
EY500A	1.50
EZ80/1	56
GY501	1.45
GZ34	1.58
KT66	7.00
KT88	8.00
PC86	81
PC88	81
PC92	80
PC97	1.14
PC900	80
PCC84	78
PCC85	85
PCC88	82
PCC89	78
PCC189	1.02
PCC805	1.40
PCF80	75
PCF86	1.13
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	80
PCF805	1.80
PCF806	1.30
PCF808	1.83
PCH200	1.45
PCL82	78
PCL83	2.00
PCL84	81
PCL85/805	90
PCL86	81
PD500	2.83
PFL200	1.36
PL36	1.15
PL81	84
PL82	40
PL83	1.43
PL84	84
PL95	1.00
PL504	1.50
PL508	1.50
PL509/19	4.50
PL802	3.80
PY33	81
PY88	81
PY500A	1.40
PY800/1	80
UCF80	87
UCH81	1.43
UCL82	84
UCL83	84
UL84	1.02
U26	1.30
U191	85
6F23	85
UY85	80
PL802T	3.50
40KD6	4.50
21LU8	3.80
17DW4A	1.80
3AT2B	2.25

CERAMIC FILTERS

6Mhz	74
5.5Mhz	74

All valves are new — boxed — guaranteed.

Please add 15% VAT to ALL items.

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	8
BA155	14
BA156	15
BA317	28
BAX13	4
BAX16	8
BB105B	30
BB105G	30
BY126	12
BY127	11
BY133	16
BY164	45
BY176	85
BY179	83
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	80
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX36/600	35
BYX55/600	30
BYX71/600	90
OA47	8
OA90	5
OA91	6
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	5
IN4007	6
IN4148	2
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	18
IN5407	18
IN5408	18
ITT44	4
ITT2002	11
Y969 (30V Thorn 3500)	89

ZENER DIODES

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

ACCESS ACCEPTED

RECTIFIER TRAYS

THORN 950 Mk II	4.26
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	4.55
THORN 1500 5 Stick	4.95
THORN 1600	3.90
THORN 3000/3500	7.39
THORN 8000	4.25
THORN 8500/8800	8.18
THORN 9000	7.93
DECCA 1730/1830	4.80
DECCA 1910/2213 Bradford	5.92
DECCA 30	8.28
DECCA 80	8.40
DECCA 100	8.14
UNIVERSAL I.T.T.	6.00
GEC 2100	7.40
GEC 2200 (2DAX)	8.50
GEC 2040/2028	6.78
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	8.35
PHILIPS G8 Long Focus 550	8.35
PHILIPS G9	8.33
PYE 691/3	5.93
PYE 713 4 Lead	7.80
PYE 731/25	8.75
R.B.M. A823 (plug in) AV	8.46
R.B.M. A823	8.45
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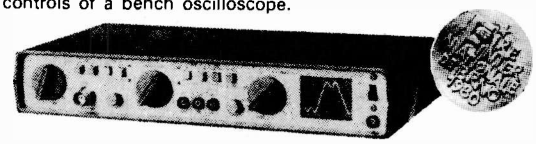

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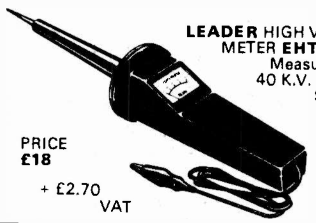

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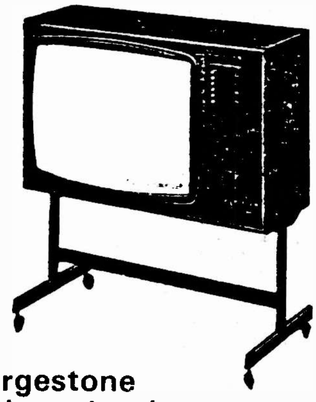

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AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63	BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63	BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.46	BC107*	0.16	BC207*	0.39	BC461	0.78	BD238	0.68	BF244*	0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
AC128K	0.55	BC108*	0.15	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.46	2N3906	0.20
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65	BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65	BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71	BF257	0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74	BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	0.30	BC213L*	0.16	BC550	0.24	BD438	0.75	BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
AC153	0.42	BC118	0.24	BC214*	0.18	BC556	0.23	BD519	0.88	BF262	0.73	BU102	3.35	OC44	0.68	2N1164	10.29	2N4292	0.32
AC153K	0.52	BC119	0.34	BC214L*	0.18	BC557*	0.16	BD520	0.88	BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD599	0.87	BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.17	BD600	1.23	BF271	0.42	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	0.20	BC238*	0.15	BCY10	0.30	BD663BR	0.86	BF272A	0.80	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BDX18	1.55	BF273	0.33	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95	BF274	0.34	BU205	2.58	OC81D	0.95	2N1711	0.47	2N5061	0.30
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	BDY16A	0.63	BF336	0.63	BU206	2.59	OC139	1.30	2N1893	0.52	2N5064	0.63
AC188	0.52	BC137	0.30	BC253*	0.38	BCY72	0.27	BDY18	1.55	BF337	0.65	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
AC188K	0.61	BC138	0.35	BC261A*	0.28	BD115	1.35	BDY20	2.29	BF338	0.68	BU407	1.38	OC170	0.80	2N2217	0.55	2N5087	0.50
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BDY38	1.38	BF355	0.72	BUY77	2.50	OC171	0.82	2N2218	0.38	2N5208	0.59
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48	BF362	0.49	C106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
ACY17	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF363	0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF367	0.29	C111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
ACY28	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF121	0.85	BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
ACY39	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.48	BF457	0.46	E300	0.42	OCP71	1.98	2N2401	0.80	2N5449	0.18
AD140	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.55	BF458	0.49	E1222	0.47	ON236A	0.94	2N2484	0.35	2N5457	0.46
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51	BF459	0.52	E5024	0.19	R2008B	2.72	2N2570	0.74	2N5458	0.40
AD143	1.78	BC153	0.38	BC297	0.36	BD137	0.40	BF137F	0.78	BF594	0.16	GET872	0.46	R2010B	2.79	2N2646	0.82	2N5459	0.58
AD149	1.42	BC154	0.41	BC300*	0.62	BD138	0.42	BF152	0.19	BF596	0.17	ME0402	0.18	R2322	0.75	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25	BF597	0.27	MF0404/02	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
AD161/162	1.22	BC158*	0.12	BC302	0.86	BD140	0.50	BF159	0.27	BFR39	0.30	ME6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20	BFR40	0.29	ME6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	1.32	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84	BFR41	0.30	MJ2955	1.30	TIC44	0.25	2N2905*	0.39	2N6122	0.60
AF115	1.26	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BFR50	0.29	MJ3000	1.58	TIC46	0.35	2N2906*	0.36	2N6178	1.07
AF116	1.28	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BFR52	0.33	MJE340	0.68	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	1.32	BC168B	0.14	BC309*	0.18	BD157	0.51	BF166	0.50	BFR61	0.29	MJE341	0.72	TIP29A	0.47	2N2926O	0.14	2N6211	2.74
AF118	0.98	BC169C	0.15	BC317*	0.15	BD158	0.75	BF167	0.38	BFR62	0.28	MJE370	0.74	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
AF121	0.68	BC170*	0.15	BC318*	0.15	BD159	0.68	BF173	0.35	BFR79	0.30	MJE371	0.79	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
AF124	0.38	BC171*	0.15	BC319*	0.19	BD160	2.69	BF177	0.36	BFR80	0.29	MJE520	0.85	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
AF125	0.38	BC172*	0.14	BC320	0.17	BD163	0.67	BF178	0.46	BFR81	0.30	MJE521	0.95	TIP32A	0.56	2N3054	0.66	2SC930D	1.50
AF126	0.36	BC173*	0.22	BC321A&B	0.18	BD165	0.66	BF179	0.58	BFR88	0.42	MJE2955	1.20	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
AF127	0.86	BC174A & B		BC322	0.28	BD166	0.88	BF180	0.53	BFT41	0.48	MJE3000	1.95	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
AF139	0.58		0.26	BC323	1.15	BD175	0.90	BF181	0.53	BFT43	0.55	MJE3055	1.22	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	0.16	BD177	0.58	BF182	0.44	BFW11	1.02	MPF102	0.40	TIP41A	0.72	2N3391A	0.38	3N128	1.60
AF149	0.45	BC177*	0.20	BC328	0.18	BD178	0.92	BF183	0.52	BFW30	2.58	MPS3702	0.33	TIP42A	0.80	2N3633	0.60	40250	0.98
AF178	1.35	BC178*	0.22	BC337	0.17	BD181	1.94	BF184	0.44	BFW59	0.19	MPS3705	0.30	TIP2955	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	2.10	BF185	0.42	BFW60	0.20	MPS6521	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
AF180	1.35	BC182*	0.15	BC340	0.19	BD183	1.34	BF186	0.42	BFW90	1.65	MPS6523	0.36	TIS43	0.44	2N3705	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD184	2.30	BF194*	0.14	BFX29	0.38	MPS6566	0.44	TIS73	1.36	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC348A & B		BD187	1.20	BF195*	0.13	BFX84	0.42	MPSA05	0.30	TIS90	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14		0.17	BD188	1.25	BF196	0.14	BFY50	0.38	MPSA06	0.32	TIS91	0.28	2N3708	0.17	40429	0.88
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15	BFY51	0.37	MPSA55	0.43	ZTX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF198	0.29	BFY52	0.36	MPSA56	0.45	ZTX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BFY53	0.36	MPSA93	0.56	ZTX213	0.2	2N3772	2.08	40603	1.13
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BFY90	1.98	MPSL01	0.33	ZTX300	0.16	2N3773	2.90	40636	1.25
AL103	1.58	BC187	0.27	BC360	0.59	BD233	0.62	BF218	0.42	BPX25	1.62	MPSU01	0.61	ZTX304	0.26	2N3794	0.40	40654	0.89

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CA3028B	1.09	SN76115N	1.62	TBA520*	2.98
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CA3046	0.70	SN76131N	2.10	TBA540*	2.88
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CA3130S	1.57	SN76228N	1.80	TBA570*	1.29
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MC1307P	1.82	SN76570N	1.81	TBA673	2.31
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MC1352P	1.42	TAA263	2.20	TBA920*	2.80
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MC1458G	1.43	TAA350A	2.48	TBA990*	2.90
MC1496L	1.15	TAA370A	3.18	TCA270A*	3.55
MC3051P	0.58	TAA435	1.70	TCA280A	1.43
MFC4008	0.85	TAA450	3.39	TCA290A	3.46
MFC4060A	0.98	TAA521	1.10	TCA420A	2.10
MFC6040	1.11	TAA522	2.09	TCA440	1.67
MIC1P	1.10	TAA550	0.35	TCA640	4.26
ML231	3.57	TAA560	1.93	TCA650	4.26
ML232	3.57	TAA570	2.20	TCA660	4.26
NE555	0.72	TAA611A	1.67	TCA730	4.10
NE556	1.34	TAA611B	1.89	TCA740	4.04
NE566	1.95	TAA621AXI	4.75	TCA750	2.53
SAA1024	5.70	TAA630Q	3.91	TCA760	1.52
SAA1025	10.35	TAA630S	4.18	TCA820	3.29
SAS560A	2.01	TAA661A	2.39	TDA440	4.16
SAS570	2.01	TAA661B	1.75	TDA1003	1.68
SC9503P	1.40	TAA700*	2.80	TDA1004	3.85
SC9504P	1.38	TAA840	3.38	TDA1005	3.04
SL414A	1.91	TAA861A	0.95	TDA1022	6.89
SL432A	2.52	TAA930A	1.43	TDA1024	0.97
SL450	5.10	TAA930B	1.43	TDA1034	2.98
SL901B	4.75	TAA960	3.20	TDA2610	2.86
SL917B	5.60	TAA970	2.81	TDA2640	2.86
SL918A	5.95	TAD100	2.66	ZN414	1.45
SN72440N	2.21	TBA120A	0.90		
SN76001N	1.67	TBA120S*	0.99		
SN76003N	2.20	TBA120SA	1.02		
		TBA231	1.12		

* Indicates Q version is also available.

DIODES

Type	Price (£)	Type	Price (£)
AA113	0.17	BY114	0.60
AA119	0.21	BY118	1.10
AA129	0.28	BY126	0.20
AA143	0.18	BY127	0.21
AAY30	0.28	BY133	0.35
AAZ13	0.42	BY140	1.40
AAZ15	0.35	BY164	0.75
AAZ17	0.28	BY176	2.80
AY102	3.85	BY179	0.83
BA100	0.24	BY182	1.14
BA102	0.36	BY184	0.44
BA104	0.19	BY189	5.30
BA110	0.80	BY190	4.90
BA111	0.70	BY206	0.26
BA115	0.17	BY238	0.25
BA116	0.55	BYX10	0.30
BA121	0.85	BYX38/600	0.70
BA129	0.45	BYX70/500	0.53
BA145	0.19	ITT44	0.08
BA148	0.19	ITT210	0.63
BA154	0.06	ITT827	0.80
BA155	0.17	MCR101	0.48
BA156	0.12	MR854	1.10
BA157	0.25	OA5	0.88
BA158	0.28	OA10	0.58
BA159	0.40	OA47	0.20
BA164	0.14	OA81	0.19
BA182	0.27	OA90	0.13
BA201	0.13	OA91	0.15
BA202	0.14	OA95	0.20
BA203	0.14	OA200	0.13
BA216	0.08	OA202	0.13
BA219	0.11	OA210	0.89
BA243	0.45	TIL209	0.14
BA317	0.06	TIL211	0.18
BA318	0.07	TV20	2.25
BAV10	0.10	IN914	0.06
BAV21	0.18	IN916	0.06
BAW62	0.06	IN4001	0.06
BAX13	0.07	IN4002	0.07
BAX16	0.10	IN4003	0.08
BAX17	0.19	IN4004	0.08
BAY72	0.16	IN4005	0.09
BB104B	0.52	IN4006	0.10
BB105B	0.33	IN4007	0.12
BB105G	0.30	IN5400	0.15
BR100	0.40	IN5401	0.17
BY100	0.35	IN5402	0.20
BY103	0.35	IS920	0.09
		IS921	0.11

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
R53	1.75
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 9B003	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	3.80
PCL82	0.93
PCL83	5.25
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	4.75
PL519	4.75
PL802	5.60
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.

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

RESISTORS

Carbon Film (5%) — *Mixes of a minimum of 10pcs of any value:*

	E●	10 of one value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.40	£5.40
¼W 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	£3.80	£6.40	£28.90

Wirewound (5%)

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

Presets (†)

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

0·2W (Vertical and Horizontal) Values as 0·1W **all 14p each**

FUSES (all packs of 10)

20mm Time Delay (BEAB)

40mA	£3.68
50, 63mA	£2.55
100mA	£1.86
160, 200, 250mA	£1.44
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all £1.19

20mm quick-blow (BEAB)

100mA	68p
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 56p
2A circuit breakers metal	£1.52
plastic	£1.48

LABGEAR (Details of full range on request)

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VIEWDATA ADAPTOR 7050. Prices and details on request.

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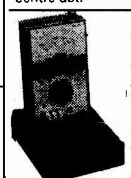

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AC Voltage: 3, 6, 15, 60, 150, 300, 600, 900.

DC Intensity M/A: 0.06, 0.6, 6, 60, 600, 3000.

AC Intensity M/A: 0.3, 3, 30, 300, 3000.

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

H.V. Disc Ceramic (†)

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

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Backing and not backing winners

As we coast through 1982 aboard the good ship Information Technology Year, one can't help wondering just where it will eventually end up. The idea of course is to focus attention on future technological needs and prospects. And quite right too. Identify areas in which there are good prospects for new products and jobs, then encourage users to use and manufacturers to manufacture. One wishes it was that simple. There have in fact been many efforts during the post-war era to identify those industries that are likely to do well and to encourage them on their way. Not, unfortunately, with any great degree of success. The UK is not alone in this respect: nor, very often, is industry all that more successful than are governments and civil service departments at identifying and backing winners.

In Roger Bunney's column this month there's a fascinating bit of history about the early days of TV in the USA. It brings out how advanced RCA then were in the TV field and some of the contributions they made. Experimental all-electronic transmissions as early as 1933, using a 240-line system, followed by an experimental service in 1936 using a 343-line system. RCA were in the forefront, with transmitters, studio equipment and of course receivers. They went on to develop the complete colour system that eventually came to be known as the NTSC system – cameras, colour tubes and the circuitry required. They also played a leading role in the development of VTRs, and more recently produced the first PIL type colour tubes and the Selectavision disc system. During the thirties RCA was a high flyer on Wall Street: great things were expected of it, and the technical achievements were there for all to see.

During the early thirties EMI in the UK were also devoting themselves to TV as the thing of the future. The outcome, as we all know, was the 405-line system that went into service in 1936 and, after a brief dual-standard trial period, was adopted as the UK's TV standard in early 1937.

Two companies that have certainly excelled themselves at various times. Just the sorts of winners to back. Yet both eventually lost their way. Having developed TV as we came to know it in the UK, you'd think that EMI would have made a killing out of producing and selling the sets for its reception. Yet EMI pulled out of this field in the mid-fifties, before the TV boom came. They were back in the forefront in the early days of colour in the UK, with justly famed cameras. But that too fizzled out. As did the famed body-scanner of the seventies. EMI are now part of Thorn. There was always more to EMI than electronics of course. Records, films, hotels and so on. Maybe that was the trouble: the board didn't always back the winners.

There are similarities with the recent history of RCA. Computers seemed to be the thing to get into, so into it they got – and burnt their fingers. The solid-state side of the business never seems to have lived up to expectations, and NBC has not been a very successful TV network. Then there was diversification, into the Hertz car hire and other fields, culminating in the purchase of a large finance company in 1979. RCA has had four chief executives in the past six years. They clearly also have problems in knowing what to back.

An even stranger company that's had periods of great success followed by a time of uncertainty is ITT. In 1959 it was a simple telephone company. Fourteen years later it had bought over 250 companies and had major interests in insurance, industrial products, food, hotels, forest products, motor components, electronic components, finance, consumer appliances and energy. Someone certainly did a lot of backing there (Harold S. Geneen, actually). What they ended up with was a lot of problems.

Now the moral of all this is not that RCA, EMI and ITT, the examples we've quoted, have done particularly badly. It's just that there are no simple ways of ensuring that winners are spotted and backed – and that this information technology business is unlikely to do any better.

Backing high technology because it is high technology can in particular be a mistake. One thinks again of that useless supersonic airliner. More mundane economic activities are sometimes a lot more successful. Retailing for example. Marks and Spencer manage to increase sales and profits nearly every year, while in the consumer electronics field Thorn have done better out of their retail and rental activities than out of manufacturing. The moral here is difficult to see however – other than to leave manufacturing to the Japanese who appear to be so good at it.

It's interesting that the Japanese do very often manage to back winners. They also organise their industries along rather different lines from other countries. Most major Japanese firms are conglomerates, but the various activities are more closely linked. A finance house will be involved, so that funds are available on favourable terms. Then there are "controlled competition" and the activities of the Ministry of International Trade and Industry. It seems to work, but it's hard to see how anything quite like this could work in the UK's rather different industrial and social conditions.

COVER PHOTO

Our thanks to Philips Video who provided our front cover photograph this month.

CORRECTION

In the line output transformer tester article last month VR2 should have been specified as 2·2kΩ in the components list and VR1 as a linear carbon preset (RS 184-322).

Routine TV Receiver Tests: GEC Hybrid Colour Receivers

Part 1

S. Simon

THERE are still quite a lot of the single-standard hybrid GEC colour sets around: they can be confusing when first encountered, and the aim of the following notes is to clarify the points to be considered when servicing attention is required.

Fuse Blowing

As in most of the older colour sets, the tube's heaters are fed from a winding on the mains transformer. Thus if power is being supplied to the set and the mains fuse FS1 (3A) is intact, the chances are that the tube's heaters will be glowing. If not, first ensure that power is present as it's quite likely that the 3A fuse has blown. The mains supply (live) is taken direct to the fuseholder, which you'll find floating around somewhere under the control panel: it's a car type bayonet holder.

If the fuse has failed, examine its appearance. If it's severely blackened, it's likely that the plug fuse has also been dealt a mortal blow, so this should also be checked. The mains filter capacitors C61/2 are likely suspects in this event – they are located behind the on/off switch and are 0·1μF types rated at 1kV. As a result of this high voltage rating they don't fail often, but once in a while they do decide to short and you find a blackened fuse. Another possibility is that the BY127 mains rectifier (D51), under the right side section, has gone short-circuit.

If the fuse has failed but is not blackened the fault is more likely to be found in the line output stage, where the boost reservoir capacitor C523 (0·47μF, 1kV) is liable to go short-circuit. This is the large blue-white capacitor on the timebase board to the left of the right side power unit, i.e. it lives on the same board as the PCF802, PL508, ECC82 etc. The easy way to check this is to connect the ohmmeter across its ends: a very low reading is sufficient cause to disconnect one end of the capacitor to check it on its own. If the capacitor is not at fault, look around for a damaged high-voltage disc capacitor associated with the line output transformer – the usual suspect is the fifth harmonic tuning capacitor C53 (300pF, 8kV).

If a PY500 is not fitted, check the BY147P efficiency diode next to the PL509 line output valve. If a PY500 is fitted, check this (of course). We are so used to seeing a PY500 next to the PL509 that it comes as a bit of a shock not to find one there in some of the earlier sets in this series.

It's also quite common in these sets to find a burnt patch on the timebase panel near the height control: this could well be an indication as to where the cause of the fuse blowing lies. The height control's feed resistor R526 (560kΩ) often decomposes, rapidly losing value. The associated components are also suspect in this event – the VDR (VDR500, type E298CD/A258) and the decoupling capacitor C519 (0·01μF), though the latter is not so often at fault. The panel suffers as a result of R526 becoming very hot, and a patch-up job to repair the damaged tracks is often necessary together with cutting away the affected part of the panel. Slightly messy this, but not too much so. The replacement resistor must be rated at 2W in order to avoid a repetition. We're running ahead of ourselves a bit here however, since the symptom when these components start to play up is quite likely to be reduced height rather than a blown mains fuse.

A final note on the mains fuse being blown. A suspect that may not be too obvious is the audio output valve's screen grid decoupling capacitor C403 (4μF) which lives on the centre output panel along with the PCL84s etc.

Missing Supplies

If the set is apparently dead but the tube's heaters are glowing we know that the mains supply is intact: if the valve heaters are not glowing the series heater circuit is broken. This would normally suggest either an open-circuit dropper resistor or an open-circuit valve heater. In these sets the latter could well be the case, but there's a common defect that rarely occurs in other chassis. The heater circuit thermistor (TH501/2) is a relatively strange beast that fulfills a dual role – in addition to acting as the heater circuit surge limiter there's a small end section (TH502) that shunts the degaussing coils. The problem with this device is that it parts company with its leadouts, as a result of which the heater circuit becomes open-circuit. It's situated on the front end of the timebase panel. If this item is intact one moves on to the valve heaters, starting with the PY500 if one is fitted and then going on to the PL509, PL508 etc. as necessary. Note that deterioration of TH501/2 can affect the picture.

If the heaters are all glowing but the set is otherwise dead one assumes that the h.t. is missing. This can just happen or may be the result of another fault. The drill is first to confirm the presence of the full mains a.c. at the rearmost tag of the top right dropper resistor. If there is full a.c. here it should also be present at the next tag since the 6Ω surge limiter resistor R62 is the only thing in between. If this is open-circuit there will be no h.t. of course.

If both these tags have a.c., proceed to the other tags. These should carry the d.c. output from the BY127 h.t. rectifier. If there's no h.t. at these tags it's likely that the thermistor (TH50, VA1104) in series with the rectifier is open-circuit: it may be found underneath the power section in a state of distress, i.e. with one leg off the body or the body off both legs.

Smoothing Circuits

If all the appropriate tags on the dropper have d.c. on them there should be other signs of life in the set. There are various h.t. filtering/dropping resistors hung on the main multi-unit reservoir/smoothing electrolytic can C65-9 which is round at the front of the power unit. In fact little happens in this neck of the woods as a rule until the electrolytics start to dry up, producing an undulating picture where the sides slowly curve in and out and the bottom rises and falls with the 50Hz ripple. Poor earthing can cause similar symptoms, and this can sometimes be a tedious business to clear. The presence of a hum bar on the other hand should direct attention to the l.t. supply reservoir/smoothing electrolytic block C58/9.

The Line Timebase

Whilst the PL509 and PY500 line output stage valves are suspect in the event of a narrow picture, attention should be directed first to the width control itself (P506, labelled set e.h.t.). This is in the centre of the timebase panel and often develops a dud spot, as an attempt at adjustment will prove. It's not sufficient to reset the control however as this will lead to further complication. Replace it and rest easy. R540 and R539 might also need to be checked.

Some care must be used in replacing items on the panels due to the use of double-sided print. Merely applying the iron underneath and pulling the item off the print can result in an inch or two of the top side print also coming away, which can be very annoying. Apply the iron to the top side and remove any excess solder with desoldering braid or a vacuum pump.

The red button cut-out is on the lower right side and is in series with the PL509's cathode. In the event of a no e.h.t. fault, pressing the button will often restore full working – unless a fault is causing the PL509 to draw excessive current. If there's lack of drive (there should be about −60V at the PL509's control grid), try a new PCF802, check for charred resistors in this stage and suspect the polystyrene capacitors C507, C509 and C512.

In the event of weak line sync/pulling, check R500/501 (56kΩ and 33kΩ respectively) which tend to overheat and change value. They are in the sync separator transistor's collector circuit, but whereas the transistor itself is on the i.f. panel its collector circuit components are on the timebase panel. Check the line sync discriminator diodes D500a/b in the event of incorrect line frequency, and C508 (4μF) in the line oscillator's h.t. feed circuit if there are sudden changes of line frequency.

Finally in and around the line timbebase, if the focus is poor check the value of R67 (10MΩ) which is in series with the focus control, while if the picture is dim due to lack of voltage for the tube's first anodes check whether R529 (100kΩ) has gone high-resistance. Lack of brightness can be due to a more subtle fault however. If the PL509's cathode decoupler C529 (200μF) dries up, the beam limiter comes into operation. The offending electrolytic is on the timebase panel.

The Output Panel

A dark picture is usually the sign of a failing PL802 luminance output valve on the output panel however, while a fault in the supply to this valve will often result in either no picture at all or an excessively bright raster. In either case voltage readings taken at the tube base will reveal what's going on before you need delve underneath.

The output panel carries the three PCL84 colour-difference output/clamp valves and the PCL86 audio

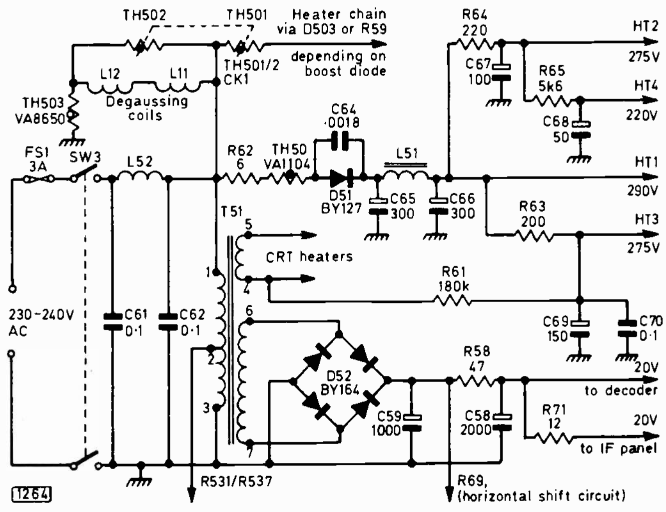

Fig. 1: Power supply circuit. Where a PY500A boost diode is used the heater chain is fed via R59 (130Ω) which is part of the mains dropper: where a solid-state (BY147P) boost diode is used the heater chain is fed via a BY127 diode dropper (D503). In the event of field collapse check R65 which feeds the PL508 field output valve's screen grid.

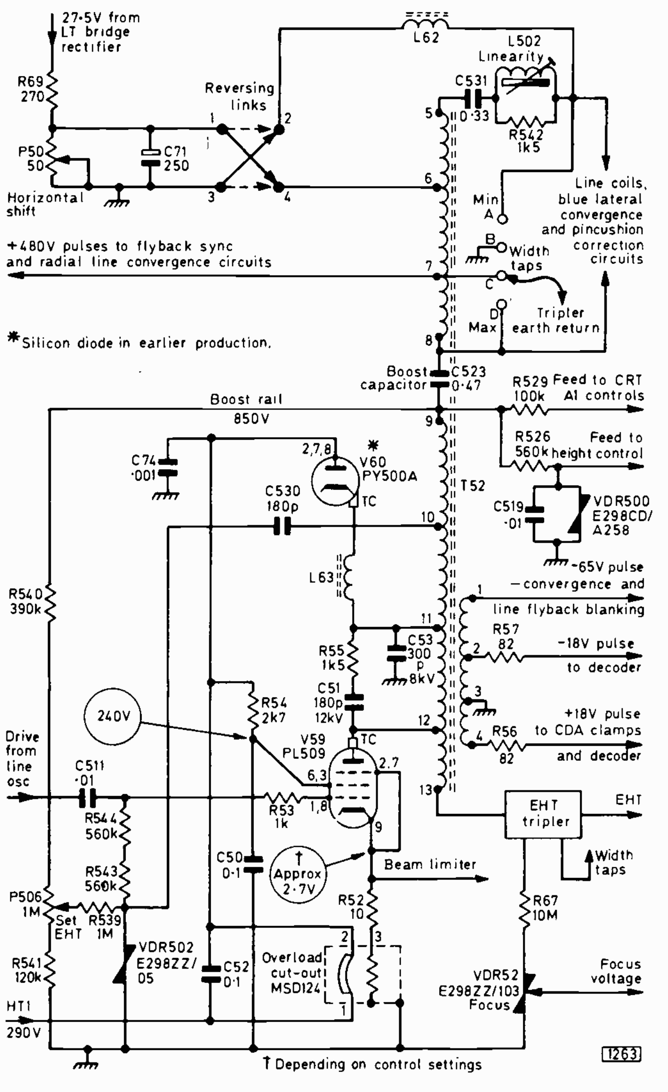

Fig. 2: Line output stage circuit. In earlier sets the boost rectifier was a BY147P silicon diode. Note that the line output valve's cathode decoupling electrolytic C529 is mounted on the timebase board. Shorted turns on the transductor (T701) in the line scan circuit will damp the line output stage (also check R704/5/C702 if necessary).

output valve in addition to the PL802. Most colour problems originate on this panel, which is just as well since the decoder is not the easiest to work on. Lack of one primary colour should lead to a check of the operating conditions of the PCL84 valves – very often taking voltage readings and comparing these with the others will reveal the source of the trouble. Note that the three PCL84s have a common screen grid feed resistor R416 (18kΩ), so if this burns out there will be a monochrome display. Before replacing R416, check whether its decoupling electrolytic C423 (4μF) is leaky or short-circuit.

The set's main frame is secured at the rear by two 4BA bolts. When these are removed, with their angle clips, the main frame can be swung up and locked on the rear plastic members to enable work to be carried out on the underside. To withdraw the main frame to gain access to the smoothers etc., remove the screws from the swing arms at either side.

Substitutes for the 12HG7

Eugene Trundle

BANG and Olufsen hybrid colour sets are getting a bit long in the tooth now. There are still many about however, and with their beautiful cabinets and good sound and picture they are worth keeping going until the c.r.t. and the expensive line output transformers wear out. The sets concerned are the 90° 3000 (don't confuse it with the much newer solid-state 3000!), 2600 and 3200 (chassis types 3606/3618/3619), and the 110° 3400 (types 3232-3235). They were described in detail in the March/April/May 1977 issues (90° chassis) and the July/August/September 1980 issues (110° chassis).

It's some years now since these sets went out of production, and whilst most spares continue to be available the RCA 12HG7 luminance output pentode is now obsolete. The alternative type 12GN7A will work in the 90° models, but you're unlikely to trip over many of these in the High Street either! Fortunately it's not difficult to modify the sets to use the more common PL802 luminance output pentode. Before delving into this however let's describe the sorts of faults that a defective 12HG7 will produce.

In the 90° chassis, a low-emission 12HG7 will produce a flat, under contrasted picture. More subtle is the effect when the valve develops intermittent internal leakage: the screen momentarily flashes very brightly (sometimes for less than the 20msec field period, giving rise to horizontal bands of black or white), with much clicking and rustling from the sorely overloaded e.h.t. generator. This is a most intermittent and misleading symptom, and disappears like magic when a new luminance output valve is fitted.

The same problems arise with the 110° chassis, but in this case there's a circuit quirk that's rather reminiscent of certain Philips sets. The valve's heater is fed from a stabilised 32V rail, and forms part of the series resistance (see Fig. 1) feeding a 12V zener diode which in turn supplies the vision i.f. and a.g.c. circuits and also the u.h.f. tuner. Thus an open-circuit heater will result in the loss of the raster and sound. Conversely, incorrect conditions on the 32V or 12V lines, due for example to a leaky 12V zener diode or a mis-set 32V regulator, will wind the liminance output pentode's cathode temperature up or down, with great effect on the contrast and brightness.

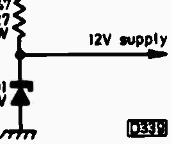

Fig. 1: A rather unusual circuit feature in the Beovision 110° hybrid colour chassis – the heater of the 12HG7 luminance output pentode is fed from the 32V stabilised supply and in turn forms part of the resistance, with 1R47, providing the 12V supply for the small-signal stages.

Modifications

Once you've established that the 12HG7 is faulty, the circuit can be modified to enable a PL802 to be used. Fortunately the pin connections of the two valves are mostly the same (see note at end), the changes required being confined to the heater circuit. The modification with the 110° chassis is simple. Since the PL802's heater resistance is higher, all that's necessary is to replace 1R47 (see Fig. 1) with a 12Ω, 3W wire-wound resistor. Note that there is no connection to pin 6 in this chassis. In the 90° chassis the heater is fed from a winding on the mains transformer – this is not clearly shown on the circuit diagram in the manual. So the circuit has to be modified to enable the PL802's heater to be included in the main series heater chain. To do this, remove and discard the brown lead connected to pins 4 and 5 of the valveholder, then cut the print connecting pins 4 and 5 and the print to pin 6. Locate and disconnect the brown wire feeding pin 4 of the PL84 audio output pentode and take it to pin 4 of the PL802 instead. Finally wire pin 5 of the PL802 to pin 4 of the PL84. It will not normally be necessary to adjust the heater current flowing in the series heater chain – it's usually rather high anyway, and no ill effects will arise from including the additional resistance of the PL802's heater in the circuit.

Although we've never tried it, we can see no reason why the readily available solid-state substitutes (PL802S and PL802/T) should not work satisfactorily in these B and O sets. With these devices the heater energy is wasted by the inclusion of a resistor in place of the heater. It's tempting therefore to modify the module or the set to remove this source of heat and energy waste. In the 110° chassis you will have to make such a modification anyway, to maintain the critical link between the 32V and 12V lines. In the 90° sets the solid-state PL802 should run cold and work well without any receiver modification other than cutting the print to pin 6.

This latter point brings us to the single difference between the PL802's pin connections and those of the 12HG7. In the 12HG7 there are three heater pins, 4, 5 and 6, the latter being a centre tap. In the PL802 pin 6 is connected internally to pin 8 (the screen grid). So should you try this substitution in any other chassis using a 12HG7 (we don't know of any that were sold in the UK), make sure that you isolate pin 6.

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Ready for Channel 4?

Pat Hawker

NOVEMBER 1982 will see the start of the Channel Four service in England and Scotland and Sianel 4 Cymru in Wales. It's interesting that this represents the first occasion on which a new TV service has been launched in the UK for an audience that already has sets and aerials suitable for its reception. When the BBC-1 transmissions started from Alexandra Palace in 1936 there were only some 300 sets in existence; when ITV started in 1955 Band III aerials and tuners were required; while BBC-2 in 1964 was initially for the few who had acquired the early dual-standard 405/625-line sets and Band IV/V aerials.

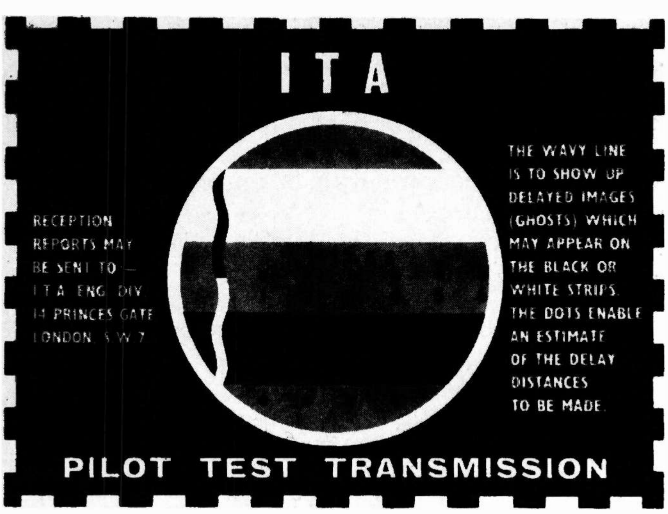
It might seem therefore that the coming of C4/S4C, the first new national TV services for 18 years, will be something of a non-event for the trade, service engineers and aerial riggers. In practice this will not always be so, and it's as well that all concerned with TV should be fully informed about what's planned, what will need to be done and when, and the sorts of problems that may arise.

Getting the New Service Started

The public already knows, or soon will, that C4/S4C will start in all 14 ITV regions next November. What may not be fully appreciated however is that all viewers will not be able to receive the new programmes immediately – some will have to wait several years before C4 is available along with the existing ITV-BBC services.

Under government direction, priority is being given to the Welsh S4C network. All six main high-power stations in the Principality (Wenvoe, Llanddona, Carmel, Presely, Blaen-Plwyf and Moel-y-Parc) will be ready before the launch, and the additional transposers required will be installed in about 100 low-power relays. S4C coverage will thus come near to matching that of HTV Wales from the start.

The position with C4 is rather different. About 25 main stations, at least one in each ITV region and covering over 80 per cent of the population, will be ready. But a further 20 main stations will remain to be commissioned during 1983 and 1984 – starting with Craigkelly and Bluebell Hill and ending with Bressay in the Shetlands towards the end of 1984. Equally important is the fact that to start with there will be virtually no local low-power relay stations (except Whitehaven) in operation outside Wales. The IBA have not yet published a timetable for the opening of C4 stations after November 1982 – but with hundreds of low-power relays to be equipped this is clearly going to take a number of years.



Remember this one from the early days of Band III?

The transmitters that are due to be ready in November can be discovered from the latest edition of the IBA's "Transmitting Stations – A Pocket Guide", which is available on request from the IBA Engineering Information Service, Crawley Court, Winchester, Hants. SO21 2QA (telephone 0962 822444).

A number of C4/S4C transmitters have already been installed and engineering test transmissions have taken place. These are at various power levels etc. and are not wholly suitable for reception checks (though they do enable tuners to be set to the right channel). The plan is for the transmitters that will be ready on the launch date to radiate trade test transmissions from about August to the opening – mostly in the form of the IBA test card. This will allow sets to be tuned, aerials to be checked, etc.

Aerials

All C4/S4C transmitters will be co-sited with the existing BBC-ITV stations and will have similar effective radiated powers. The channels have been allocated since the original stations were built, so the aerial groups for C4/S4C are exactly the same as those recommended by the broadcast authorities for ITV, BBC-1 and BBC-2 reception. There are no exceptions. This does not however mean that no work at all will be needed to get good reception of all four channels. This is likely to be particularly so in areas subject to standing waves due to reflections (areas where ghosts are a problem). In such areas critical aerial realignment may prove necessary to provide equally good (or equally fair) reception on all four channels.

There could also be problems in areas where the channel groups are "non-standard" and the C4 channel is the odd man out. Although the broadcast authorities have always recommended the use of group E or wideband aerials in such areas, it seems that many group B aerials have been installed in order to get extra gain on the other three channels. Areas where this could be a problem include Bluebell Hill (Kent) and Hannington (Hants), and the areas served by the Llanelli and Teignmouth relays. Many viewers in these areas may find it necessary to install new wideband aerials, particularly since a group B aerial used at the top of Band V will not only provide very little gain but will also have greatly changed directional characteristics.

It's also quite likely that when installation engineers check on reception of the new C4 transmissions they'll find that the original array, maybe well over ten years old, will have deteriorated, giving far from perfect pictures on all channels. The ingress of moisture in coaxial cables can also greatly attenuate signals.

The ETP1 Pattern

The new IBA electronic test pattern (ETP1), about which the editorial in the February issue was far from complimentary, has now come into general use throughout the ITV network. It will also be used for C4/S4C. Whilst one can readily appreciate that service engineers and others regret the absence of a circle and squares as a means of checking picture geometry and linearity, it must be pointed out that the broadcast authorities no longer regard test patterns as an expensive (to them) substitute for a pattern generator. The IBA took care to consult fully with the various trade associations (BREMA, RETRA, NFAC – now CAI – and NTRA) during the development of the equipment, which is located at the unattended "programme injection points" throughout the network and in addition generates "apology captions" (under the control of the four IBA Regional Operations Centres).

The pattern was evolved with the needs of aerial and installation engineers particularly in mind, the "white needle pulse" providing an effective method of checking short-term echoes that can also affect teletext reception. Other features of the pattern include a crosshatch for convergence checks; a grey scale; gratings (1·5, 2·5, 3·5, 4 and 4·5MHz) for bandwidth/resolution checks; 150kHz squarewaves for checking transient response; a black rectangle within a white rectangle for low-frequency response; and so on. A full colour reproduction of the ETP1 test pattern together with information on its use is provided in the IBA's leaflet EIS120. This is available on request from the Engineering Information Service at the address previously given, and we do urge readers of *Television* to find out how to make optimum use of the pattern before condemning it out of hand!

VCR Servicing

Part 9

Mike Phelan

LAST month we talked about the parts of the f.m. video circuit on the pre-rec board. On some later JVC/Ferguson machines, for example the 3V29 and 3V30, there's no separate pre-rec board, these parts of the circuit being on the combined luminance-chroma-audio (YCA) board. The combined f.m. test point is above deck however on what the makers call the "deck terminal board". It's important to know where the f.m. test point is: as we've seen, it is very useful when diagnosing various types of fault.

Now to the remainder of the f.m. signal circuitry. The record and playback portions are usually entirely separate, so we'll deal with playback first.

Faults on Playback

Complete loss of playback video is about the most common thing to find (we assume that a check has been made with a known good tape of course). First check whether the monitor's screen is a nice clean blank, or whether a certain amount of noise is present. If the latter situation is found, the fault will be in or before the f.m. demodulator – which is either working to demodulate noise or making it! It is far quicker to look for the cause of these faults with a scope rather than relying on voltage measurements – except maybe in the event of missing supplies to the various i.c.s due to the small feed chokes going open-circuit.

Apart from complete loss of signal, faults in the f.m. circuits give rise to various strange effects such as inversion of whites. This takes the form of black streaks following a vertical white edge, and looks as if someone has dipped the edge in a bowl of black spaghetti!

This effect is caused by the f.m. that reaches the demodulator being of excessive amplitude or containing amplitude modulation, and the causes are legion. Assuming that the fault is on playback, the heads could be worn (causing excessive noise in the f.m. signal), the playback f.m. level could be low or high, or the limiter circuit could be maladjusted or faulty.

Fortunately, faults in this part of the circuit are rare. On VHS machines there are up to three adjustments – two limiter controls and a carrier balance control in the f.m. demodulator circuit (refer back to Fig. 25 in Part 4). The "limiter balance 1" potentiometer is best adjusted visually for minimum "spaghetti" – misadjusting the tracking control will help. The other two controls must be adjusted as per the manual, using a scope. Disturb these settings only as a last resort.

Failure to Record

If the machine works perfectly well with a prerecorded tape but won't record video, a scope check with the machine recording is again the quickest way of finding the cause of the fault.

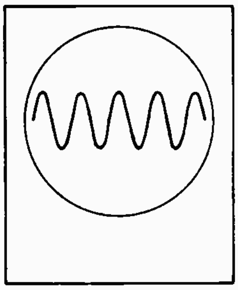
If there is no luminance signal at the f.m. modulator but an E-to-E picture is displayed on the monitor, the tuner, i.f. strip and some of the luminance circuit are working – the signal is being lost around the stages which prepare it for modulation, i.e. the white and dark clip and pre-emphasis circuits (see Fig. 21, Part 3). Any recordings made will show little or no noise on a blank raster.

If the f.m. carrier is not being generated, or is being lost before it arrives at the record current amplifier, there will be excessive noise on the raster on replay.

Beware of falling into a common trap whilst carrying out these checks: it's easy to be misled by finding f.m. coming out of the modulator and assuming that everything must therefore be o.k. – the modulator will still produce a carrier if no luminance signal is going into it. If this is the case the carrier will be unmodulated and thus constant in frequency.

With a good scope the carrier waveform can be expanded to show individual cycles. If the carrier is unmodulated, the waveform can be locked on the scope (see Fig. 39). If it contains modulation however the display will be slightly unstable (see Fig. 40). Note that only early machines using discrete Kalitron type modulators with a tuned circuit give an ideal sinewave – later i.c. types produce some very strange waveforms indeed! This does not affect performance, as the carrier and its harmonics are well filtered out on playback.

There can be several adjustments in the record f.m.



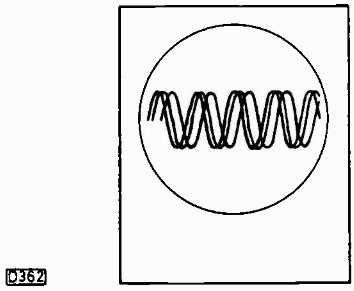


Fig. 39 (left): Unmodulated carrier – note that only some machines will show an ideal sinewave as shown here.

Fig. 40 (right): Unstable display produced by a modulated carrier.

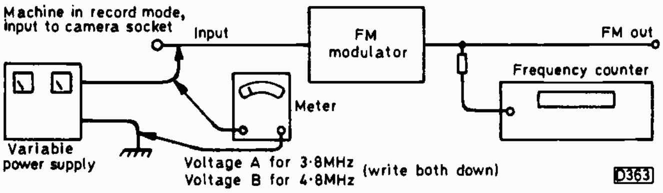


Fig. 41: Method of finding the voltages that give 3·8MHz and 4·8MHz from an f.m. modulator.

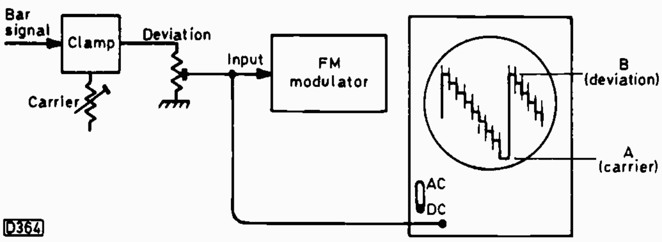


Fig. 42: Adjusting the carrier and deviation controls.

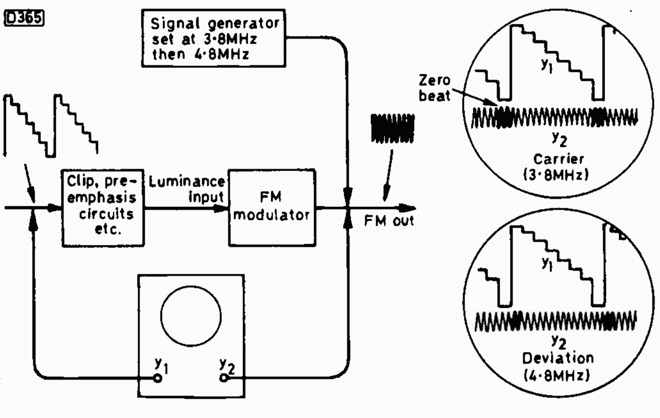


Fig. 43: Alternative method using a signal generator and a double-beam scope.

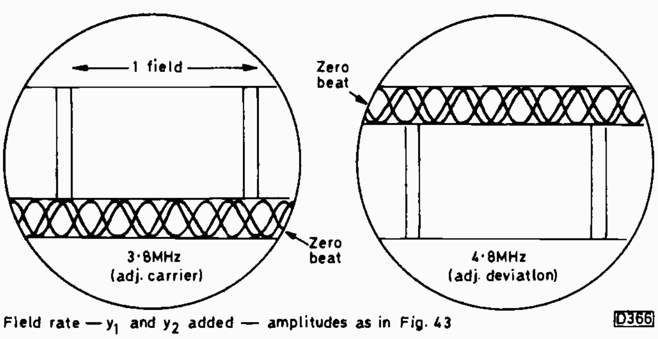


Fig. 44: Displays with the scope connected as in Fig. 43.

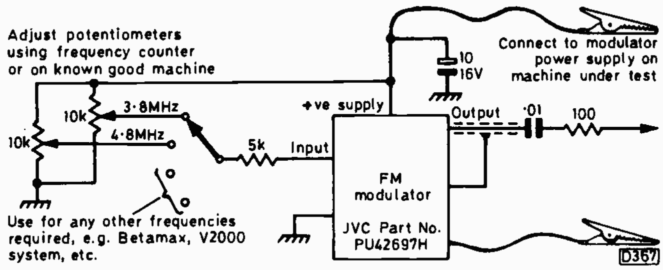


Fig. 45: Simple spot-frequency generator.

section. The white and dark clips are usually adjustable, and should be set up as per the manual to give the required degree of clipping of the overshoots produced by pre-emphasis. A colour bar or grey-scale wedge signal is preferable for this purpose. Maladjustment shows up as fine patterning, especially following edges, or as clipping of peak whites or sync pulses.

The most important adjustments, which should not be touched without the correct equipment, are those that determine the modulator's output frequencies. On the basic VHS machine there are two. One, labelled "carrier", is adjusted to set the d.c. level of the sync-tip clamped luminance signal so that the sync tips produce an output at 3·8MHz from the modulator. The other one, labelled "deviation", varies the amplitude of the luminance signal and is set so that peak white produces an f.m. carrier at 4·8MHz.

Simple, isn't it? Not quite as simple as it might appear however. We need a frequency counter and a good scope at least. Unfortunately, signals which consist of pure sync or pure peak white are not easy to come by. So we have a choice of two basic methods.

The first is shown in Figs. 41 and 42. With no signal, find the two voltages that give 3·8 and 4·8MHz, then with a scope on d.c. adjust the carrier control so that the sync tips sit on voltage A and the deviation control so that peak white is at voltage B. It's necessary to turn the white and dark clips off for this.

The second method uses a signal generator to beat with the f.m. carrier and a double-beam scope – which of course you acquired before putting trimming tool to preset. See Figs. 43 and 44. If the scope has an add facility, display one field: if not, one line as shown. Adjust the carrier control for zero beat between 3·8MHz and the sync pulse part of the f.m. and the deviation control for the same, i.e. zero beat between 4·8MHz and peak white.

If we built a spot-frequency generator giving 3·8 and 4·8MHz we could dispense with the frequency counter once we'd calibrated the generator. So Fig. 45 shows how to do this using for convenience the f.m. modulator from one of these machines. Variations in the supply voltage will affect the frequency slightly, but we're not that critical. To make the point, on the Toshiba V5470 the carrier is set for 3·4MHz with no signal input and the deviation is then adjusted to give the correct contrast ratio in the recording.

Next time we'll be dealing with the chroma part of the circuitry.

Correction

Finally a correction: in Fig. 34 last month "5msec" should have read "20msec" while "100mV" should have read "250mV" – 5msec and 100mV were the X and Y amplitudes per division respectively.

Teletopics

UK TO START VCR ASSEMBLY

VCRs are to be assembled for the first time in the UK – they will be VHS machines produced as part of the J2T Holdings BV joint venture set up earlier this year by Thorn EMI, JVC and AEG-Telefunken to manufacture video products in Europe. In announcing the decision on behalf of their partners, Thorn EMI point out that the continuing high demand for VHS machines (the market leader) has resulted in the need to commence assembly operations in the UK in addition to those due to start shortly in W. Berlin. The recorders will be assembled at Thorn's Newhaven plant, where audio machines have been produced for many years. A £2 million factory installation and refit programme is due for completion in October, after which production of a high-specification recorder will start. Production is planned to reach 240,000 machines a year by mid-1983.

Production will initially be from imported kits of parts, but it's intended to increase the locally produced content of the machines progressively and to start subassembly work at a satellite factory at Bexhill. A comprehensive programme of staff retraining and transfer to the new production line will be balanced by a planned cutback of audio production. Once production of home-market machines at Newhaven has stabilised, PAL and SECAM export versions will go into production. The W. Berlin plant will be producing a complementary model.

MARKETING THE DISC SYSTEMS

Caution seems to be the order of the day amongst the video disc manufacturers. Philips expect to see only a "very gradual" development of the UK disc market – to a penetration of some 4 per cent in the first five years. JVC have postponed the introduction of the VHD system in Japan, though the UK launch is to go ahead as planned this September. The UK is likely to be the first market in which VHD discs will appear therefore – Thorn's well developed rental organisation could be a major factor in opening up the market. Discs are already being produced at Cologne, and test production runs have started at the Thorn EMI Swindon plant.

Following the failure of disc systems to make headway in the US, many observers there have suggested that the market is not yet ready for discs, with VCRs themselves still a relatively new product. There is also of course the fact that the US is going through a fairly severe recession, whilst even Japan has been undergoing an economic downturn. Pioneer have been selling only half the planned 5,000 a month LaserVision machines in Japan.

Since discs provide playback only, the provision of an adequate disc catalogue is vital. Here again tapes seem to have the advantage at present – there are said to be over 3,500 prerecorded titles already available in the UK, with the list growing month by month.

A recent stockbroker's report suggests that VCR market penetration in the UK will rise from the present level of around 4 per cent to some 21 per cent in three years' time. If discs catch on, it's expected that the players will be acquired in addition to VCRs. At least the trade will have the opportunity to sell two lots of equipment instead of one, and it could be that many smaller outlets will find disc players easier to handle and service than VCRs.

CABLE PROSPECTS

The government seems to be maintaining its impetus on the cable TV front. Whilst a lot of new investment and a lot of new jobs are nice things to contemplate, one wonders how it will all work out – assuming that the cable operators get their 30-40 channels as planned, with possible deregulation (removal of the requirement to carry the existing BBC/ITV programmes). For one thing, a lot of the investment could consist of digging holes in the road rather than creating jobs and manufacturing capacity in the high-technology sector of the economy. That would at any rate ensure that most of the jobs created are in the UK! As to where the electronics would be produced, that could be another matter. It's understood for example that a good many US cable operators have already taken a look at the prospects here. Others would no doubt be interested in providing equipment. But before anyone jumps in, the extent of the likely demand will need to be carefully assessed. Whilst linking everyone – well, everyone in convenient urban areas – to cables could work out at a reasonable price per connection, if the initial demand is low the price per connection could be quite a deterrent. So cabling up might not turn out to be quite the bonanza the government seems to expect.

NEW TV SYSTEMS PASS SATELLITE TESTS

Mention was made in this column last month of the systems being developed by the BBC and the IBA to give improved picture quality with satellite transmissions. The BBC call their system, in which the high-frequency luminance signal components are converted to occupy a band above the chroma signal, extended PAL. The IBA's MAC (multiplexed analogue component) system keeps the luminance and chroma signals separate by using a novel time-compression system which is said to be a logical extension of techniques now coming into use for other applications, including the latest generation of compact VTRs. The BBC's system has the advantage of being able to provide pictures on existing monochrome or colour sets via a simple adaptor, or much enhanced pictures via an adaptor or new receiver incorporating an extra demodulator circuit that uses very similar technology to a PAL decoder. The advantage of the IBA system is that it would provide enhanced pictures along with compatibility between various colour systems.

Successful experimental tests of both systems have now been conducted via the OTS satellite. The BBC tests were carried out on March 26th whilst the IBA carried out tests on April 2nd and 7th. The BBC and the IBA at the same time tested high-quality TV sound using a digitally modulated subcarrier.

DATA ON ANTIQUES

Not much is given away for nothing these days – especially information. The National Wireless Museum in the Isle of Wight is willing to assist any reader in dire need of technical data for an antique receiver however. A fine collection of very old service sheets, workshop manuals and wiring diagrams for TV sets, radio receivers and tape recorders, well antedating BT (before transistors), has recently been donated to the Museum. In the first instance enquiries should be made to the honorary curator Douglas Byrne, G3KPO-GB3WM, QTHR, by phoning Ryde 62513.

STATION OPENINGS

The following relay stations are now in operation:
Aldbourne (Wilts) BBC-1 ch. 21, Television South ch. 24, BBC-2 ch. 27, TV4 (future) ch. 31. Vertical polarisation.
Bellanoch (Argyll) BBC-1 ch. 39, Scottish Television ch. 42, BBC-2 ch. 45, TV4 (future) ch. 49. Vertical polarisation.
Roadwater (Somerset) BBC-1 ch. 21, HTV-West ch. 24, BBC-2 ch. 27, TV4 (future) ch. 31. Horizontal polarisation.

VIDEO EQUIPMENT

The first VCR to appear in the Murphy range, Model MVR7007R, is a Beta machine produced by Sanyo. The recorder is not directly equivalent to either of the Sanyo machines currently on the UK market, though the same basic chassis is employed. The specification is aimed at offering one of the best buys at the lower-price end of the market – it's expected to retail at around £430.

Hitachi have now introduced their VKC1000 all solid-state hand-held colour camera in the USA. The camera uses a 2/3in. solid-state image sensor providing a horizontal resolution of 260 lines. It weighs just under four pounds.

NEW PREAMPLIFIERS

Electronic Mailorder (Bury) Ltd., of 62 Bridge Street, Ramsbottom, Bury, Lancs have introduced two new aerial preamplifiers. Model B45H/G covers the entire u.h.f. TV spectrum with a gain of about 20dB and a noise figure of some 3·5dB. It's a two-stage amplifier costing only £9 including VAT and postage. A sample has been sent to us and we'll be reporting on it in due course. Model B14 covers Band III plus the aircraft and two-metre amateur bands, i.e. 108-211MHz, and is also priced at £9 including VAT and postage. The gain is about 30dB.

We've received from one of our contributors a recommendation as to the quality of the second-hand valves supplied by this company.

NEWS FROM LUXOR

Two smart new 16in. colour transportables have been added to the Luxor range, Models 4211 and 4214, the latter having full infra-red remote control. Additional features include a u.h.f./v.h.f. tuner, twin telescopic aerial, 5W r.m.s. sound output, headphone socket, automatic contrast control and facilities for use with a 12V car battery through an external optional extra transformer.

Our suggestion last month that Luxor had been taken over by Philips was premature to say the least. Apparently preliminary discussions only have taken place, and there would be various problems due to Swedish legal requirements. Our apologies to both parties for any embarrassment caused.

TELETEXT ON TARGET

According to a recent survey and the latest trade statistics, the number of teletext-equipped TV sets in use in the UK had by mid-March risen to over 400,000. This is well on the way to the target of over a million sets by the end of 1982. Thirty per cent of the sets had been installed during the preceding three months.

DRAM IMAGE SENSOR

Micron Technology of Boise, Idaho have developed a low-cost 32,000 element image sensor using a dynamic RAM rather than a CCD type chip. The applications envisaged are unusual, including an arrangement which uses a camera, telephone and TV set to send and receive slow-scan monochrome pictures at a rate of one every half a minute.

THAT 3-D TV

By the time this is read, viewers in the TV South area will have been able to see the delayed demonstration of three-dimensional TV on *The Real World* programme. The system used has been developed by Philips. It's based on a stereoscopic camera whose output signals are combined on tape in coded form. The red channel is used for the left-eye image and the green and blue channels for the right-eye image. Special permission to transmit the signals was required from the IBA since they are non-compatible, i.e. a monochrome set simply shows overlapping images whether or not the red/green viewing spectacles are worn.

The result, on a colour set, is a tinted monochrome 3-D picture, the cunning bit being the use of special coding to remove image overlap and system cross-colour effects. Some discomfort is caused by focusing problems at certain distances and the fact that with say bright red one eye receives a bright image and the other a dark one.

Philips comment that their work is experimental and has only limited application at present, e.g. for certain CCTV uses. Full-colour 3-D displays are feasible, but would require dual-channel transmission and special receivers.

SONY'S PROFEEL TV SYSTEM

Sony's latest innovation consists of a "video separates" system called Profeel. The centrepiece is a high-quality monitor which operates in conjunction with a separate rack-type 12-channel tuner, stereo speaker pair, VCR and teletext module. The monitor has a built-in stereo amplifier and a rack is available to hold the lot. The initial monitor has a 20in. Trinitron tube, but a 27in. version will be introduced next year. The monitor itself will sell at about £450, the total package at some £1,000.

"Profeel" comes from Sony's idea of providing for domestic users a TV installation that has a "professional feel" to it, with picture quality said to be equivalent to that of professional studio equipment. The monitor is a multi-standard one (PAL, SECAM and NTSC-4·43, the latter enabling NTSC tapes to be replayed from a suitable VCR such as the SLT7ME) and incorporates two features which Sony call dynamic contrast and dynamic colour. The former aims at improving upon the 10:1 contrast ratio from which TV systems generally suffer, employing feedback for the purpose. Dynamic colour again uses feedback, this time adjusting the colour temperature to provide true flesh tones and correct white rendition simultaneously.

By keeping the various components of the system separate, Sony emphasize that the idea is for the user to be able to update his TV installation as the technology develops.

Mr. Daines' Dynatron

Les Lawry-Johns

BY and large Dynatrons are not sets that lend themselves to being carried about, at least not far. So when Mrs Daines phoned to say that her fairly new Dynatron was giving trouble I packed my bag carefully so as not to get caught short as it were. The initial complaint was of intermittent sound, so we were fairly confident that we wouldn't have to hump the set about too much.

We arrived at the house and exchanged pleasantries with Mrs Daines, her small daughter and her large red setter which appeared to me to be the largest of its breed I'd ever seen, height and lengthwise that is as they are pretty lean dogs. Suffice it to say that when I bent to remove the screws from the back of the set his head and mine were about level – so I was glad his tail was wagging. Since the set used the Philips G11 chassis the number of screws that had to be removed was limited (unlike the twenty million that secure the backs of earlier models).

As I removed the rear cover Jason's tail stopped wagging and he started to bark angrily in my ear. I moved smartly to one side to allow him full territorial rights. I wasn't quite sure what was upsetting him, but in retrospect I can understand: he knew what I was letting myself in for and was warning me off.

"Shut up Jason" I asked him nicely. Bark, bark, bark.

"Sod off then" I said not so nicely. Bark, bark, bark.

Mrs Daines appeared and dragged the irate Jason off. She then shut him in the kitchen and returned to find out what all the fuss had been about.

"What did you do to him?" she demanded.

"I didn't do anything. I just took the back off the set and he started up."

"You didn't kick him or anything?"

"Nope. It was something in your set that upset him. Probably that diode sticking out up there – some lazy bugger's stuck it on the wrong side of the panel and used the wrong type into the bargain."

"You're the first one who's taken the back off: it's practically new and we bought it in the West End, from a very well known store."

"In the sale?" I queried.

"Yes. What difference does it make?"

Audio Output Transistors

"None really I suppose" I said doubtfully. "Anyway it's nothing to do with the sound." So saying I shone my little torch on the lower left centre where the audio output transistors live and there, on the base of one of the BD131s, was a classic dry-joint. I soldered it up properly and tried the set. The sound came on loud and clear. My job was done – so I thought. We let Jason back in and his tail wagged to see the back on again. "Funny dog that" I confided as I took my leave.

A Funny Noise

I'd hardly got back to the shop when she rang again.

"There's a funny noise on the sound, a loud rustling noise."

So back we went and having ensured that Jason was safe in the kitchen we took the back off to try to locate the source of the noise.

It was a remote control model, so there was a small extra panel fitting into a socket which in ordinary models has two of the pins shorted across. When this small panel was removed the noise stopped, so we were sure the trouble wasn't anything to do with the BD131s that had received attention earlier. The noise was also absent when we shorted out the two end pins, so it seemed likely that the trouble was on the panel we'd removed. We put it back and the noise returned, stopping when we shorted the base and emitter of the BC158 on the panel. I searched through my untidy spares box and at last found the required transistor. In it went and the sound was no longer disturbed.

It's Gone Right Off

I was just getting into the car when Mrs Daines called out.

"It's gone right off now, picture and all."

Heaving a sigh, I carried my little boxes back in again.

This time one of the 3·15A mains fuses had blown. Now this normally means that one of the bridge rectifier diodes on the bottom right power supply panel has gone short-circuit. Remove panel and check diodes. As they seemed to be all right I then had a quick run over the thyristors etc. No joy. Change diodes anyway since they are suspect and if the fault lies elsewhere, say on the upper line output panel, the 1A h.t. fuse would have blown. So with four nice new diodes fitted we switched on confidently. Hrrump bonk it went. Now this is not the sound of a direct short – you just get bang in that case. My decision was lightning fast. "Fetch Jason in."

Mrs Daines shook her head in resignation but still fetched Jason. In he came, tail wagging and friendly. Until he saw the back of the set exposed. "Bark, bark, bark. Bark, bark, bark."

My eyes narrowed at this fresh evidence. So out came the supply panel and we examined the h.t. fuse closely. It was a 3·15A type. Swine! In a trice I'd slapped the meter across the protruding diode. Dead short. Now it's one of the EW modulator diodes and although it had no marking it closely resembled a BY127. It should have been a BY223. I showed Jason the shorted diode and he barked at it. "Good boy" I said. "Clever boy – you knew it shouldn't have been there."

So with high hopes we fitted the required BY223, a 1A fuse and two new 3·15A fuses. On came the set as good as gold. Or so it looked to me.

Bowed Sides

Later that evening Mr. Daines phoned. "Thank you for doing our set. But should the sides bow in so much? – the snooker table looks like an hour-glass."

"See you tomorrow Mr. Daines." Why hadn't Jason noticed the concave sides?

Mr. Daines was there when we arrived. He said his wife had popped out just before I was due to arrive as her nerves weren't too good lately. He would watch how Jason behaved.

I took the back off with Jason sitting beside me. His tail wagged all the time, seeing that nice smooth vista of panels. Not one bark passed his lips. When an ordinary picture was examined the edges could be seen to be bowing in, but it was when verticals were displayed that the fault was most obvious.

The EW centre shaping control is on the top left side, just inboard of the width control. Neither control had any effect, so we checked the following transistors and found that the extreme left side one, T150 on the heatsink, was open-circuit. We raked around in the spares box but couldn't find a BD238 and had to settle for a BD428. It seemed to be quite happy in this position, and the width and EW shaping controls now functioned as they should. We asked Jason if he was happy, and as he said he was we had a quick check up for dry-joints on the line output panel (a happy hunting ground for poor connections on this chassis) and at last wrapped up the job.

We haven't heard from the Daines' since, so we must conclude that all is well. The moral of this story seems to be that if you have to go out to a G11, take a red setter with you.

The Philips TX Chassis

We now have to relate the sad story of a set we couldn't do. It was a Pye monochrome portable using the Philips TX chassis. We've serviced lots of these, all with no trouble at all. Most of them have suffered from poor smoothing, which has been put right by replacing the BD434 series regulator transistor or an associated component. When we were presented with this one we were informed that it had been obtained from a club and that it was still under guarantee. We were not wholly enthusiastic about taking it on therefore, but as it was suffering from what seemed to be poor smoothing we thought we might be able to help out with a quick job.

"Call back in an hour or so" we said recklessly.

The heartache then started. We checked the regulator. No fault here but change the transistor just in case. Check the reservoir electrolytic. No fault but change it just the same. Check the voltages and note that the 10·5V preset R113 has no effect at all. Also find that the input to the regulator is little more than 11V instead of 15·3V. Ah ha! A regulator cannot perform its regulating and electronic smoothing functions when the input is low. So why is it low? Check the bridge diodes and change them just in case. Still a horrible hum bar.

Check carefully through the regulator's control circuitry. Everything in order. Note that the 47Ω resistor (R110) in parallel with the regulator transistor is not fitted as the set has remote control. Check the 100μF 10·5V line decoupler (C113) and find it o.k. Begin to sweat. Check everything again. Start to swear. Owner returns and note that he's driving a Decca van. "Sorry" I say. "Can't find the trouble."

"Don't worry. I'll get the chaps at work to sort it out for me. They told me to bring it to you first."

"When they do sort it out" I said humbly, "would you ask them to let me know what it was?"

About a week later they did ring. After much toil and sweat going over the same ground they chased the grey lead up to the remote control receiver panel – not part of the main deck, but on the upper left behind the tuner selectors. There they found an open-circuit resistor. They were quite pleased to let me know. Well done Racal-Decca. Bad show Uncle Les. Clot!

Protection Circuit for the Sanyo VTC9300P

Keith Cummins

THE Sanyo VTC9300P Betamax VCR is certainly a good buy at the price – under £400, sometimes by a fair amount. It's reliability is also understood to be good – apart from troubles with the 12V regulator transistor Q702, something that's not difficult to deal with provided a short-circuit doesn't cause damage elsewhere. I've been out of the retail trade now for some five years, and despite working with other types of recorder my "hands on" experience with VCRs is negligible. So, having bought a VTC9300P and taken a look at the manual, I felt a bit daunted at the thought of what could be blown up by excessive voltage on the 12V line due to a short-circuit series regulator transistor. This led me to devise and add a crowbar-type protection circuit to avoid having to cope with possible damage at a future date.

Devising a Trip Circuit

The power supply in these machines is mostly on circuit board W3. Diodes D701 and D702 on this board form part of a full-wave rectifier circuit, producing a 17V output from which the 12V rail is derived. Both rails are readily accessible at terminations LW715 and LW716, the 0V (chassis) line being available at LW709. The a.c. feeds to the 17V rectifier diodes come via fuses F701 and F702. This makes things very convenient: all that has to be done is to monitor the 12V line and if this becomes excessive place a crowbar across the 17V line to blow fuses F701/2, thus disabling the machine.

The crowbar circuit can be built on a small piece of Veroboard and soldered into the VCR at the three points mentioned (17V, 12V and chassis). No modification to the existing circuit is needed, and the crowbar circuit board is small enough to be supported by the soldered connections alone.

Circuit Description

The circuit of the add-on crowbar circuit is shown in Fig. 1. The 17V supply is connected to the anode of thyristor TH1 via the 2·2Ω wirewound resistor R1 (2·5W, RS type 151-596). If TH1 is triggered a heavy current flows via R1, quickly blowing the fuses. The purpose of R1 is to limit the current so that TH1 is not blown open-circuit by the inrush current from the 10,000μF 17V reservoir electrolytic capacitor C701.

The 12V supply is connected to the cathode of the 12V zener diode DZ1 (type BZY88/12V). Under normal conditions DZ1 is non-conductive, so that no current flows via R2 and R3 (both 390Ω, 0·3W). There is no trigger pulse for the thyristor's gate therefore. R2 is included to limit the gate current while R3 is a pull-down resistor. C1 (10μF, 16V tantalum) is included to prevent spurious triggering on transients.

Should the 12V line rise to approximately 13·6V the gate of TH1 is pulled up to 0·8V (its trigger level) and the thyristor fires. As mentioned previously, fuses F701/2 then blow and the machine dies. Catastrophic short-circuit of the 12V regulator transistor Q702 causes the 12V line to rise almost instantaneously to 17V. Under these conditions the crowbar fires in less than 5 msec. The 17V line will drop before the fuses blow, so the protec-

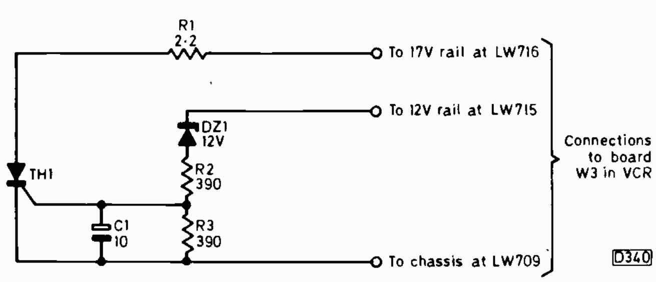


Fig. 1: Circuit of the crowbar trip.

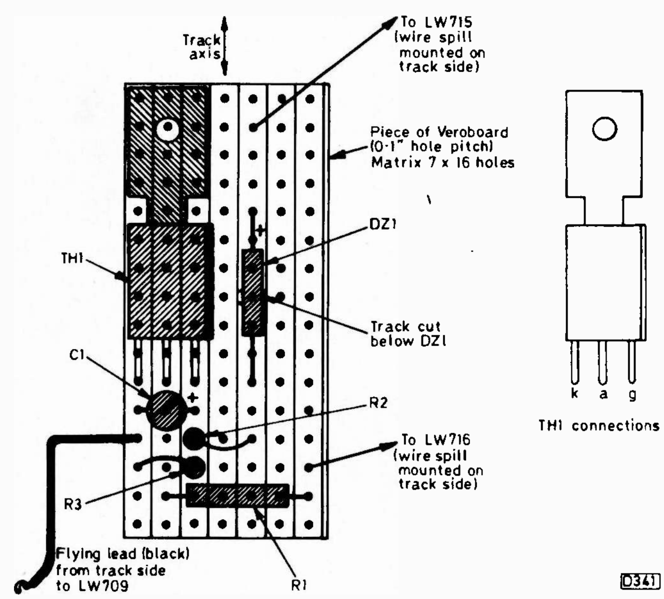


Fig. 2: Veroboard layout for the circuit.

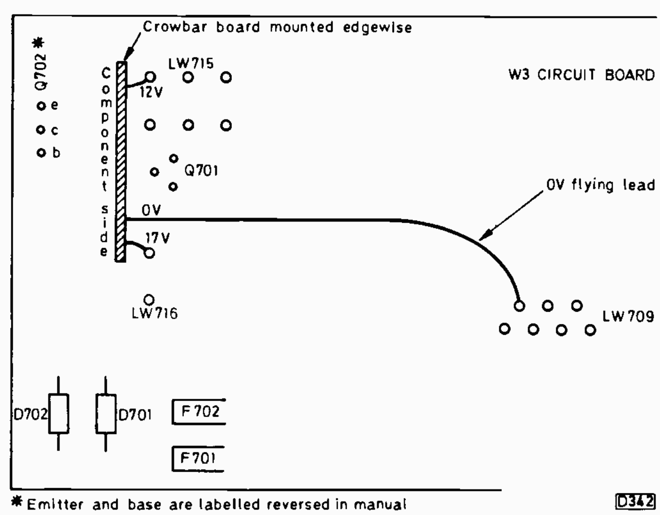


Fig. 3: Interconnections between the trip circuit board and the VTC9300P's power supply board W3.

tion is very fast and no sustained excess voltage is applied to the rest of the machine.

Construction and Installation

Fig. 2 shows the layout of the crowbar board while Fig. 3 shows the way in which it is fitted. The whole job can be done within an hour. It's necessary only to remove the back plate from the VCR to gain access to the W3 board (below the aerial connections) and then simply solder the crowbar board into position. Replace the back plate and the job is complete. The thyristor I used is type C106 (RS 261-817) – an alternative is the NEC type 2P4M.

Fault Experiences with the Regulator Circuit

Since doing this modification I have had the 12V regulator transistor play up – it went open-circuit emitter when it felt like it, for only a fraction of a second but long enough for the machine to drop out of play or record. The flicker of the indicator gave the game away! As a replacement I used a TIP41, which works fine. When the offending device was removed I noticed that silicone grease had been used, but not much of it. So when fitting the TIP41 I put plenty of RS heatsink compound underneath it, also some under the heatsink subassembly where it bolts on to the main heatsink.

Letters

TV-VCR COMPATIBILITY

Further to my article on TV-VCR compatibility last month, the latest issue of the Philips Service publication *Link* gives another modification worth noting. Apparently the black-level clamping problem (random horizontal bars) has been encountered with later versions of the Philips KT3 and K30 chassis that use the TDA3560 single-chip decoder. The recommended modification is to increase the value of the clamp reservoir capacitors C44/5/6 from 0·022μF to 10μF (part number 124 20697). This problem could occur with other chassis using the TDA3560 – one thinks of the Thorn TX10 (clamp capacitors C616/7/8) and later versions of the TX9 (C64/5/6) for example, where the capacitors are 0·1μF.
Eugene Trundle,
St. Leonards-on-Sea, Sussex.

IN-SITU TRANSISTOR TESTER

With reference to the in-situ transistor tester design published in the March 1981 issue and subsequent letters, I too would like to thank Mike Phelan for a truly practical design. Finding the coil originally suggested is not exactly easy however, nor is it an easy matter to wind the coil from scratch. Readers should not be discouraged from building the tester however, since a small driver transformer from a scrapped transistor radio will do admirably. Remove the laminations, then wind 20 plus 20 turns of 36 s.w.g. or thicker wire on top and cover with Sellotape: this will form the new secondary. As one end of the primary, use one end of the driver's secondary (not the centre tap though), the two windings to be in the same direction. Leave this operation till last, when testing. Next, grind a piece of ferrite rod to fit the hole in the coil: if it's not a problem, leave the rod as long as possible – even a length of 2cm will give good results.

As for the rest, I managed to house the whole thing in a transistor radio battery holder – of the type that holds four pen cells!
Victor Rizzo,
Msida, Malta.

BACK INJURY

A TV engineer's life is not a bad one when all aspects are taken into consideration. It seems to me that most engineers have at least one of the following attributes: intelligence; curiosity; loner tendencies; sensitivity; and an acceptance of their lot. It's this last point that concerns me most, particularly in connection with one of the most common tasks carried out by TV engineers – lifting heavy loads. Without due care it's all too easy to end up with an injury to the lower back (slipped discs).

We should all know that you're supposed to bend the knees when taking up a heavy load, and not twist etc. Life can be more awkward however: what about going through customers' doors; going up and down stairs; moving sets into and out of lifts; slippery surfaces; long distances where there's no parking; and other practical problems?

I don't want to scare readers, but having been injured myself and having found that there are quite a few others who share my predicament it seems to me that urgent action is required. I believe in particular that no set above a certain size, weight and awkwardness (to be defined by a competent authority) should be lifted by one engineer alone.

I would be interested in hearing from others who've suffered in this way, with a view to establishing the extent of the problem and presenting the facts to the appropriate people. Perhaps more legislation is required: it certainly seems that clearer guidance on responsibility for injuries sustained is necessary.
Harry J. Todd,
Martins Bend, Sunnyhill Lane,
Oare, Marlborough, Wilts.

SERVICING CUT-BACK?

I read and enjoy the many fine articles in your magazine, especially those on TV and video servicing. I beg to ask however who are the companies getting to service all the many sets and VCRs on the market? I'm a TV technician who's been unemployed for nine months since returning from abroad. The companies here seem to be cutting back on their workforces. Does this mean that TV sets and VCRs are so reliable now, or is it a case of overloading technicians, selling but servicing only as an afterthought – or is it really the effect of the recession?

Since sales are keeping up, it seems to me that management is just looking for extra profit and hoping that when the goods break down, well we'll cross that bridge when we come to it! By then we technicians could well be into other spheres, leading to a scarcity.

I hope that management will use some foresight and that the situation will improve. Meanwhile I still have *Television* to keep me abreast of all the developments – and the servicing hints!
David C. Palmer,
Rosyth, Fife.

TELETEXT LINES

The problem of teletext lines due to slow field flyback in the Pye hybrid colour chassis (691/3/7) was mentioned in the April Service Bureau. A cure is to fit an 0·1μF capacitor from the anode of D44 to chassis. This modification also improves the linearity at the top of the picture, removing any cramping that may be present.
Alan Pemberton, G8ZHG,
Sheffield.

BRITISH IS BEST!

I read with interest Chris Avis's letter on the spares problem in the February issue. Some companies are indeed slow in supplying parts – Indesit took six weeks to supply a service manual for a monochrome portable, and I've had problems with Thorn Domestic Appliances. The picture is not as bad as some make out however, and a point I'd particularly like to emphasize is that on the whole I find foreign manufacturers the worst culprits.

Let's give praise where due. I find Thorn EMI Ferguson very efficient and their technical advice department most helpful – my utmost thanks to their Mr. Goldman! ITT are also worthy of note for their good advice and efficient service facilities. Others who've proved efficient and courteous include Sony, Philips, Roberts-Dynatron, RS Components, Telepart of Wolverhampton plus many local organisations here and electrical concerns.

Since British manufacturers are so efficient, I've no hesitation about recommending my customers to buy home made products every time. Here's one who is not ashamed to proclaim that British is best!

Richard Cragg,
Richard Cragg Radio Repair, North Street, Osbournby, Sleaford, Lincs.

TYPES OF NEON TESTER

I read with interest S. Simon's article on testing with a neon in the March issue. A couple of important points were not made however. First, there are two types of neon tester, one of which can be dangerous. The difference lies in the type of neon tube employed. The two types are shown in Fig. 1. The safe variety is the "festoon" type shown at (a). The type used in cheap plastic testers is shown at (b): it has two parallel electrodes, with the two leads brought out at one end of the glass envelope, one lead being laid back along the outside to provide a connection at the pip end of the bulb.

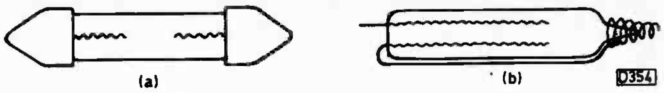


Fig. 1: Types of neon used in neon testers.

Secondly, the festoon type of neon has the advantage that it will tell you whether the supply is a.c. or d.c., and the polarity if the latter. With an a.c. supply both electrodes glow, but with d.c. only one electrode glows, the negative end (where the current leaves), i.e. if your end glows you are negative and the test point is positive. With the non-festoon type the neon appears to glow along the full length irrespective of whether the supply is a.c. or d.c., because of the parallel electrodes.

The danger with the cheap type of tester is that the screw-in end cap becomes loose as a result of the screwdriver feature being used. Subsequent unscrewing and tightening up sooner or later twist the innards so that the neon's leadouts short together. Never forget that the only insulation between you and the live test point is the neon itself.

When you buy a neon tester, look for one with a clear plastic handle rather than a yellow or amber one – the type of bulb fitted can then be seen, and a.c./d.c./polarity tests can more easily be observed.

T. A. Tempest,
Peterlee, Co. Durham.

TV Sound Receiver

In response to many requests we are including this month (see Fig. 1 below) the print pattern for this project.

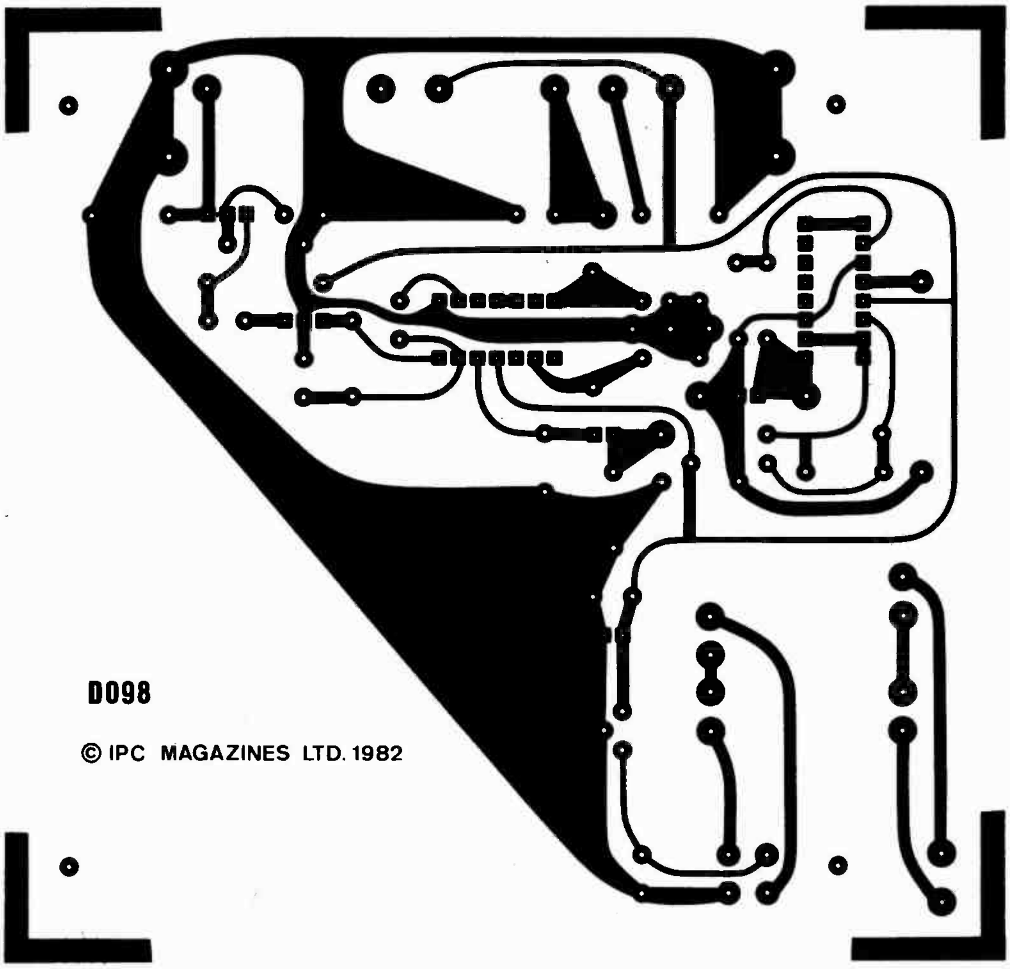


Fig. 1: TV sound receiver PCB track pattern.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Michael J. Cousins, T.Eng. (C.E.I.) and Derek Snelling

MOST of the faults I've had recently have been of a general nature and not particularly interesting. A couple of exceptions are mentioned below.

The latter part of 1982 is likely to see some interesting developments. For example, engineers may find a greater similarity between the next generation of Philips machines and those produced by Grundig – see the VR2025. Sony will be launching some new VCRs, while in the other Beta camps Sanyo and Toshiba are expected to produce portables and restyled low-cost mains-operated VCRs. Anyway, on to those faults.

Sanyo VTC9300

The first concerns a Sanyo VTC9300 which had erratic colour replay: when it stabilised the colour was reversed, like the effect you'd get with a colour TV set whose PAL switch was out of phase. Colour recordings were correct – confirmed by trying the recordings on another machine. In hindsight it should have been easier to track the fault down, but we go about it by making various checks to confirm correct circuit operation.

The chroma a.f.c. loop was first checked and found to be working reasonably. The amplitudes of the outputs from the two crystal oscillators were then checked and found to be o.k. That left the a.p.c. loops.

There are two aspects to phase correction of the replayed colour signal. An analogue system corrects for errors up to 180°. If the error is greater a second system operates an inverter which switches the signal through 180°. As the replayed colour was 180° out the switching came under suspicion. The action takes place within the CX150 i.c. (Q204), whose working conditions are very difficult to check. Since the i.c. was almost certainly at fault it was replaced – giving normal results.

Grundig 2 × 4 Plus

The second machine was a Grundig 2 × 4 Plus with the symptom intermittent colour. After a while the fault was observed to be temperature dependent. The colour board was placed on its extender card and my wife's hairdryer went missing so that I could heat the board in the area of IC624 and IC641. The former switches the phase of the 5MHz carrier before it goes to IC641. It seemed reasonable to check the level of the carrier: when the board was heated, the carrier went "lumpy" as the colour flickered and disappeared, the lumps consisting of a superimposed squarewave. Suspicion fell on the two switched tantalum coupling capacitors C602 and C605, and the application of freezer to C602 confirmed that it was faulty. The manual said that both were 1μF, but in fact they were 4·7μF. Anyway a new 4·7μF capacitor restored correct operation – didn't I read somewhere about a gypsy warning Les to beware of blue tants? **S.B.**

Ferguson 3V30

This machine had a rather interesting fault: it would record and playback all right, but whenever a recording was played back the machine was in the record mode for the first few seconds! To clarify this, if a prerecorded tape was played back everything was in order but if the tape was rewound beyond the starting point and then played there would be an additional recording of a few seconds on the tape.

On investigation we found that transistor Q105 in the mode control circuit had 9V at its collector during the fault condition instead of 0V. It's a pnp transistor, and during playback its base voltage should not be below its emitter voltage. The base voltage comes from the mechacon board and was found to be correct – though when measured at Q105's base resistor R110 under the fault condition it was very low. The trouble was found to be due to the print which had not been fully etched away between tracks, creating a high-resistance path. Scraping a clear channel between the tracks completely cured the problem. **M.J.C.**

Ferguson 3V23

The recorder worked perfectly using the front controls, but remote control would give motor functions only – no tuner/timer commands, i.e. no clock set, programme selection etc. The remote control unit itself was eliminated, leaving rather an interesting problem!

The coded commands from the front motor control function switches consist of serial data trains. These leave the key scan board and then go to the mechacon board where they are converted to parallel data outputs which enter the central processor unit. Similarly a command from the infra-red remote control unit leaves the receiver board and is converted to a parallel data signal on the mechacon board: the parallel outputs go to the processor for the motor functions, and to the tuner/timer board for tuner/timer commands. The difference is that the tuner/timer commands from the front function switches are fed directly from the key scan board to the tuner/timer board. Since the remotely controlled motor functions were o.k., the problem must have been between the five-bit parallel data lines (from the serial/parallel converter) on the mechacon board and the point on the tuner/timer board where the key scan and infra-red messages join a common signal path.

Connecting the scope to the five-bit data lines for outgoing infra-red commands on the mechacon board revealed a large amount of random noise. Disconnecting the data link to the tuner/timer board removed the noise completely. Further investigation on the tuner/timer board revealed the culprit to be the TA57 thick-film transistor array, a replacement restoring normal operation via the remote control unit. **M.J.C.**

Ferguson 3V29/3V30

More faults with recent Ferguson machines. We've had three cases in as many weeks of the VCR-TV lead being faulty, something we've not had trouble with before.

Here's a common problem with the 3V29/3V30. If the symptom is no or intermittent colour and the fault seems to disappear when the bottom is removed, check that capacitor C487, which is mounted under the bottom board adjacent to R417, is not shorting to the bottom plate when this is fitted.

No clock display on one of these machines was traced to the filament current generator transistor Q403 being inserted in the print but not soldered. No vision on record but playback o.k. was traced to one end of C294 being dry-jointed. In another case the machine would lace up then switch off, due to failure of the capstan motor to start. On checking the outputs from the mechacon/function board to the servo board we found that a pause signal was being sent through though the pause button was not pressed. This signal originates from pin 22 of IC4. The output here was correct, as was the output from the following inverter (part of IC6). This output passes via zener diode D23 to the base of transistor Q17, but due to a print fault (not a crack) the diode and the inverter were not linked.

So much for production/quality control faults. We've also had a couple of component failures recently. The fault with a 3V30 was no signals in the E-to-E mode due to failure of transistor Q4 on the tuner/i.f. board. On another of these machines there was no battery back-up (the clock is supposed to keep the correct time and the memory to retain the programme in the event of mains failure). The fault was traced to a component marked CP1: it's in series with the supply to the stand-by circuit and was open-circuit. When a circuit came through we found that this stands for Circuit Protection device – a glorified fuse I suppose.

A problem we get in certain areas of Birmingham is radar interference from the airport. In the past this has usually been confined to Hitachi machines and has been cured by tuning the u.h.f. modulator down towards channel 30. The 3V29/3V30 seem to be even more sensitive to this and tuning down often fails to provide a cure. In this event an attenuator (in one case 18dB) has to be fitted. **D.S.**

Sanyo VTC9300

We've actually had a Sanyo VTC9300 in with a fault other than failure of the 12V regulator transistor! The complaint was that the machine switched off, i.e. the keys tripped up, intermittently. This is usually due to the regulator, but this time replacing it had no effect and we noticed that a few seconds before the keys tripped the pause solenoid operated, stopping the tape. The machine switched off a few seconds later because it detected that the take-up spool had stopped rotating – under normal pause conditions this circuit is overridden.

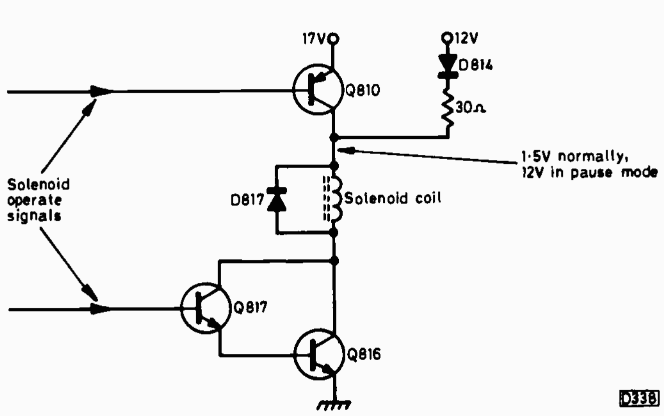


Fig. 1: Pause solenoid drive circuit used in the Sanyo VTC9300. The solenoid drops out when pause is selected.

On checking the voltage at the pause solenoid we found that this was normally 1·5V, rising to 12V when the pause switch was operated. The voltage disappeared completely during the fault condition. The circuit (see Fig. 1) is a bit unusual. The solenoid's coil is normally energised, transistors Q816/7 being switched on. When pause is operated Q816/7 switch off and the solenoid drops out. Q810 provides current to pull the solenoid in, but once it operates Q810 switches off, the solenoid's holding current being provided by D814.

So what was wrong? D817 is the normal protection diode, included to prevent spikes. The fault was caused by this diode going short-circuit intermittently. The solenoid would then drop out, and although the diode would revert to normal the current via D814 was insufficient to pull the solenoid back in. To get the solenoid on again the play or pause switch had to be operated. A new diode put things right. **D.S.**

Tape Life

A point about the life expectancy of tapes. We have customers who use their machines regularly but have only one or two cassettes. As a result the tape wears out, producing various effects. With a VHS cassette you get intermittent sound and poor picture quality near the beginning of the tape, due to wear where the threading takes place. Elsewhere along the tape you get flashes on the screen, similar to a worn head, or rolling and/or faulty sound if the edge is wrinkled due to stretching. With Betamax tapes you get an intermittent picture when the edge of the tape wrinkles, due to their system of picture blanking when the control pulses fall below a certain level. In addition the tape tends to start shedding its coating on to the heads, so that head cleaning is required every couple of weeks.

From experience I've found that if the same tape is used regularly, i.e. once or twice a week, it will last for about six months if it's a VHS tape. If it's a Betamax type it will last a little longer, perhaps for nine months. This is not to say that there's no deterioration before this point is reached, or that the tapes are unusable afterwards. It's the point at which people generally start to find the quality unacceptable. I have to change the VHS tape I use for testing machines every three months on average – it gets used several times a day, often in machines with faults that can damage the tape. **D.S.**

Four-hour Tapes

Finally a point about the four-hour tapes available for VHS machines. A customer phoned to say that his Panasonic NV8600 worked perfectly with all his cassettes except for a four-hour one he'd bought. The tape seemed o.k., i.e. no wrinkled edges, so Panasonic were consulted. They pointed out that the machine had been designed with two-hour tapes only in mind, and that whilst it could cope happily with three-hour tapes the tension was insufficient for four-hour tapes. I assume that the four-hour tape is thinner and perhaps requires a higher tension to ensure good contact with the heads.

A few days later we had the same problem with a Ferguson 3292. The symptoms differed however. Whilst the problem with the Panasonic machine was rolling, with the Ferguson VCR there were thin noise bands near the top and bottom of the picture. **D.S.**

The LaserVision Disc System

Vivian Capel

AT last video discs have been launched on the UK market, in the form of the Philips LaserVision system. We've had to wait quite a while: the Philips disc system was demonstrated as long ago as 1972, and a lengthy article appeared in June 1974 issue of *Television*. The system has undergone considerable development since those days however, when it was known as VLP (video long play) to differentiate it from various other disc systems that were then being proposed and had much shorter playing times per disc. Anyway, be that as it may LaserVision is what we must learn to call the system that's now taken its place alongside the various video tape systems. LaserVision because a laser beam is used to scan the disc.

The Disc

The signal modulation is impressed on the disc in the form of a spiral train of pits, the "track" starting from the inside of the disc and spiralling outwards – the opposite to an audio gramophone record. A lead-in portion starts at 107mm from the inside, the programme material starting at 110mm: during those 3mm the disc rotates some 900 times. The disc itself has a diameter of 12in.: the programme continues to 290mm from the inside, after which there's a lead-out period during which the disc rotates 600 times. During the lead-in period a start code sends the scanning system to the start of the programme at nine times the normal speed; during the lead-out period an end code orders the scanning system back to the inside of the disc at seventy five times its playing speed. During the return, the video and sound signals are muted.

The pits are not on the upper surface of the disc. During manufacture, they are formed as "bumps" at the rear – by pressing the disc against a stamper. The upper surface is covered with a transparent plastic material through which the scanning beam of laser light passes. The rear side is coated with a thin metallised surface to reflect the beam. This surface is about 0·04μm thick and is then sealed with a protective layer. Two such discs are attached to each other back to back to form the final double-sided disc.

There is no physical access to the modulation therefore and so no likelihood of wear or damage – a major feature of the system. The front is a plane surface, like a normal back-silvered mirror, the scanning beam being reflected back from the metallised surface through the plastic covering: some 75-85 per cent of the light is reflected.

The width of the pits is 0·4μm (see Fig. 1), the depth 0·1μm and the pitch, i.e. the distance between the centre of adjacent sections of the track, is nominally 1·6μm, increasing slightly at times to 2μm.

Modulation

The modulation varies the track in two ways – pit length and spacing. When the disc is played back, these produce variations corresponding with frequency change and pulse-width modulation respectively. Unlike tape systems, the complete PAL video signal frequency modulates a 6·76MHz carrier (see Fig. 2). The sync tip is at 6·76MHz, black level at 7·1MHz and peak white at 7·9MHz. The lower sideband extends to approximately 2·5MHz, giving a total recorded video bandwidth of some 5·5MHz.

The limit to the sidebands that can be recorded, and thus the video bandwidth, is set by the cramped conditions at the centre of the disc where the information density is greatest. In earlier prototypes the limit was 3MHz, which meant that the 4·43MHz colour subcarrier could not be included. Instead, the colour signal was down-converted on to a 1MHz carrier. This naturally led to complications with the player, which had to convert the colour back to 4·43MHz before the signal could be fed to a TV set. We are lucky that we shall not have to deal with frequency conversion circuitry!

The problem with the original system arose from the need to record as far as possible into the centre of the disc in order to achieve a reasonable playing time – in fact the recording started at a diameter of 100mm. By closing the track pitch from 2μm to 1·6μm and narrowing the width of the pits from 0·8μm to 0·4μm, more information can be recorded and the start can be farther from the centre – at not less than 110mm, as we've already mentioned. The extra bandwidth this allows at the centre enables the normal PAL colour signal to be recorded without elaborate processing.

As a point of interest, the track length from end to end is some 21 miles!

There are two sound channels, allowing for stereo sound or dual-language recordings or sound with/without commentaries and other possibilities. Two f.m. carriers are used for this purpose, with centre frequencies of 684kHz and 1,066kHz (easy to remember that last one!). The deviation is 100kHz in both cases.

Now these three signals (PAL video plus two audio channels) are carried on the single track. This is done by amplitude modulating the main vision f.m. carrier with the two sound carriers. The sound carriers are of much lower frequency, making this technique possible. The resultant signal is applied to a limiter circuit which chops off the amplitude variations, leaving us with the f.m. vision carrier with flat tops (see Fig. 3). An examination of this diagram will show that the flat tops vary in width in proportion to the cut-off amplitude modulation: in effect, the limiting has converted the amplitude modulation to pulse-width modulation. So we end up with frequency modulation for the video signal and pulse-width modulation for the sound, recorded on the disc as pit length and spacing variations.

Optical Pickup

An intense spot of light of very small diameter is required to read the information recorded in this way. In fact the spot size sets the limit of the pit size and track pitch, and thus of the information storage density, as any

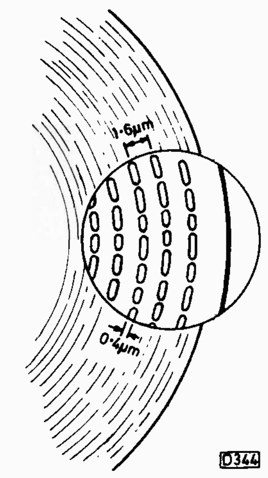
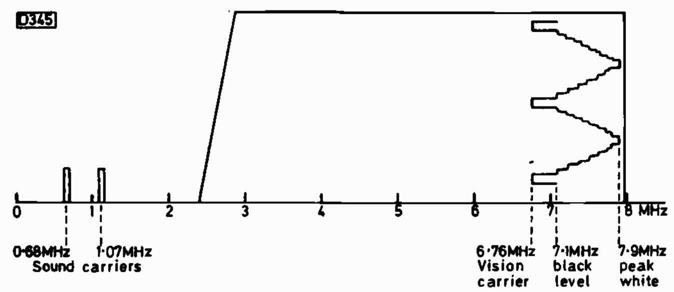


Fig. 1 (left): Magnified portion of the disc, showing the pit width and the pitch between adjacent sections of the spiral track.

Fig. 2 (below): Frequency spectrum of the vision and sound f.m. signals.



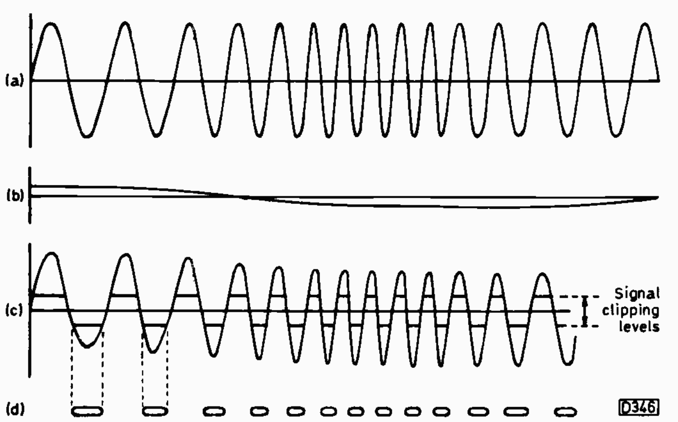


Fig. 3: (a) Frequency modulated vision carrier. (b) Sound carrier. (c) Sound carrier amplitude modulated on to the vision carrier. The combined signal is then limited to produce a frequency and pulse-width modulated squarewave signal. (d) Resulting pit pattern, with the pits modulated in length and spacing.

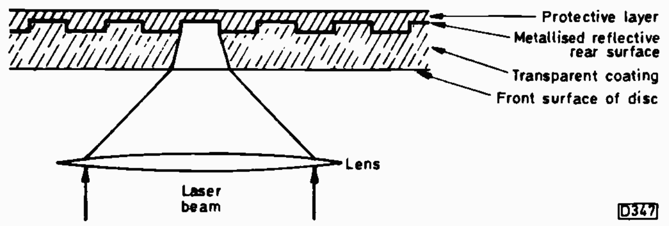


Fig. 4: Refraction of the beam in the disc's transparent coating lengthens the field of focus at the metallised rear surface while maintaining a wide beam area at the front surface, thus minimising the effect of blemishes.

overlap with adjacent tracks will produce crosstalk.

Owing to light refraction at the edges of the final lens aperture, the spot does not have a sharply defined edge, diffusing into rings of decreasing brilliance instead. The spot diameter is defined therefore as the point where the light intensity falls to half its centre brightness. This diameter is a function of the lens aperture and the light wavelength. The latter is fixed by the laser source and is 0·63μm (the non-coherent light radiation produced by any other type of source could not be focused to such a small point). The largest practicable aperture is 0·4, this combination giving a spot size of 0·9μm. Besides being very costly, a larger aperture lens would have a smaller depth of focus: this would make the focusing more critical and make greater demands on the servo system used to control it.

The spot is focused on the metallised surface of the disc, most of the light being reflected back to the optical system. When a pit passes, light is reflected back from its bottom, but as the width is of a smaller order than the light wavelength the light is refracted, just as ordinary light is when passed through a slit. As a result the light is scattered, very little returning back through the lens. Light continues to be reflected back from adjacent surfaces however, as the spot overlaps the pit as each side.

With the earlier 0·8μm width pits almost an equal amount of light was reflected from the small side overlap as was diffused back from the bottom of the pit. As the pit depth was roughly a quarter wavelength of the light, the two reflections cancelled – being 180° out of phase. Cancellation was never complete, because it also depended on the pit length which varied with the modulating frequency, also on the focusing and tracking. It nevertheless produced a major drop in light intensity, each pit producing a dark pulse which the photodiode detector could easily distinguish from the unmodulated surface illumination level.

With the narrower pits subsequently adopted more adjacent surface light is reflected. This means that the detected dark pulses are of smaller amplitude. The signal-to-noise ratio is thus smaller, but this is one of the penalties of greater information density packing. Even so, the video-noise ratio is more than 37dB and the sound ratio greater than 60dB, which is more than adequate for domestic reproduction.

The small depth of focus of the 0·4 aperture lens offers one important advantage: any scratches, fingermarks or even dirt particles on the surface are well out of focus, as the beam is focused on the rear surface. The maximum focus range is 2μm, so with a material thickness of some 1,300μm it's obvious that surface blemishes are a long way from being in focus. They can have no material effect on reproduction unless they are very large, so that unlike other types the discs can be handled without any special precautions.

The small field of focus makes focusing critical however, and means that the focus control system must be very accurate. Fortunately another factor helps out here – by lengthening the focus field at the reflecting surface. This is a bonus of having the reflecting surface at the rear of the disc instead of at the top surface. The factor is the refraction index of the material used, 1·5 – the same as for glass. This is the ratio of the speed of light through the material as compared to that through air. It produces bending of the light rays at the point where the light strikes the front surface of the disc (see Fig. 4).

The Optical Path

So much then for the disc and how the modulation it carries is picked up. We will next take a look at the path travelled by the beam from its source to the disc, and then from the disc back to the photodiode. The source being used at present is a helium-neon laser with an output of

1mW – cheaper, solid-state lasers may come into use at a later date. As with all lasers, the light output is coherent, i.e. all the individual light waves are in phase. The light is also polarised by being passed through a Brewster window.

From the laser the light beam passes through a grating (see Fig. 5) which separates it into three beams, the main signal beam which is three times as intense as each of the others, and two auxiliary beams which travel alongside the main beam and are used for tracking purposes.

Next comes a spot lens which together with the final objective lens modifies the beam. It's similar in function to the first lens of a telescope. From here the beam passes through an aperture in the photodiode assembly: it's this assembly that detects the light on its way back, but it has no function on the outgoing light journey.

The beam then travels underneath an astigmatic lens whose purpose will be described later. The following pair of angle mirrors fold the light path into a U shape which is more easily accommodated. The Wollaston prism performs a vital function on the return journey, the following quarter-wavelength plate (which produces a 45° rotation in the plane of the polarised light) again being essential on the return.

We now come to two movable mirrors. The first is a radial tracking mirror which can deflect the beam radially over a limited path. This has a vertical spindle, the mirror pivoting in the horizontal plane. The second mirror is the tangential one with a horizontal spindle to permit pivoting in the vertical plane, enabling the beam to be longitudinally deflected backwards or forwards along the track of pits. Both these mirrors are electromagnetically controlled by the servo systems we'll describe later.

The tangential mirror deflects the beam upwards through the objective lens on to the underside of the disc – unlike an audio disc, the LaserVision disc is read from beneath. There are no moving parts above the disc. This simplifies loading, and protects the optical components. A conventially sized turntable is obviously not possible. Instead a three-inch turntable supports the centre of the disc only: a magnetic device in the lid clamps the disc when closed. There's no problem about supporting the main area of the disc: it doesn't have to carry the weight of a pick-up, and it's kept flat by the centrifugal force of its high revolution rate (basically 1,500 r.p.m., anticlockwise) and the cushion of air trapped beneath.

Now for the beam's return journey. The modulated light from the disc is reflected back through the objective lens and then passes via the two mirrors to the quarter-wave plate. Since this has already produced a 45° rotation of the polarisation on the outward path, the return beam emerges at 90° (right angles) to the polarisation of the original beam. Next comes the Wollaston prism, a three-element quartz device which produces refraction angles that are dependent on the polarisation. As a result, the returning light beam comes out at a slightly different angle. Instead of returning to source therefore (through the slot in the detector assembly) the beam is deflected upwards to pass through the astigmatic lens. It thus reaches the detector assembly.

Focusing

A focusing error of only 2μm is permissible. This is very little – disc warp and other factors could cause displacements of up to 500μm. So the focusing must be continuously monitored and controlled.

Adjustment is effected via the final objective lens, which is constructed along the lines of a moving-coil loudspeaker (see Fig. 6). A concentric coil, surrounding the lens system and linked to it, is free to move up and down between the polepieces of a magnet. Current from the control system is fed to the coil, thereby altering the position of the lenses. As most of the correction will be required because of disc warpage, most of the movement will be at the disc's rotational frequency of 25Hz. To draw as little power as possible from the control system, the lens assembly has been designed with a resonant frequency of 25Hz so that it responds quickly to the control signals.

The method of monitoring the focusing relies on the optical system. The detector diode is actually four diodes in a square formation (see Fig. 7), the beam being aligned so that the spot covers the centre of the square. When the focus is correct the spot is circular, covering an equal part of all four diodes.

Prior to arriving at the detector assembly on its return journey the beam passes through the astigmatic lens. This is of cylindrical shape, giving a round spot on the target only when the beam is in focus. When the beam goes out of focus, the spot becomes an ellipse, the angle of the ellipse depending on whether the focus is too short or too long.

Since the ellipse will produce unequal illumination of the four diodes, one diagonal pair will be illuminated more than the other when the focus is incorrect. The outputs from each pair are added and applied to the two inputs of a differential amplifier. When one pair has a greater signal than the other, a difference signal is thus produced to control the objective lens. A circular spot gives equal signals at each input, so there's no error signal.

The r.f. (video plus sound) signal is obtained by adding the outputs from all four diodes.

Tracking

As there is no physical contact between the pick-up system and the disc, optical means must be used to align the beam with the recorded track of pits. This again calls for a high degree of accuracy. The whole optical system, including the laser itself, is mounted on a carriage which runs radially along a pair of guides, being driven at a speed of 2·5mm per minute by a small motor.

The beam tracking error must be maintained at less than 0·1μm, a feat that would be impossible without some guidance system controlled by the track itself. This is where the two auxiliary beams produced by the grating come in. They pass along the optical path in the same way as the main beam, and are focused on to the disc. Their position however is fore and aft of the main beam and slightly to each side (see Fig. 8). Each is reflected back to its own photodiode on the detector assembly.

The sideways displacement of the auxiliary beams means that they read the *edges* of the track pits, each one the opposite side to the other. Thus part of the spot covers the pits and part the adjacent reflective surface. If the spot reads more surface than pit area the reflected light detected will increase and vice versa. The outputs from the two photodiodes are compared, and if one is greater than the other it means that one spot is too far over the adjacent surface while the other is too central on the pits. When the outputs are equal, their positions are equidistant from the track centre and the main beam is correctly

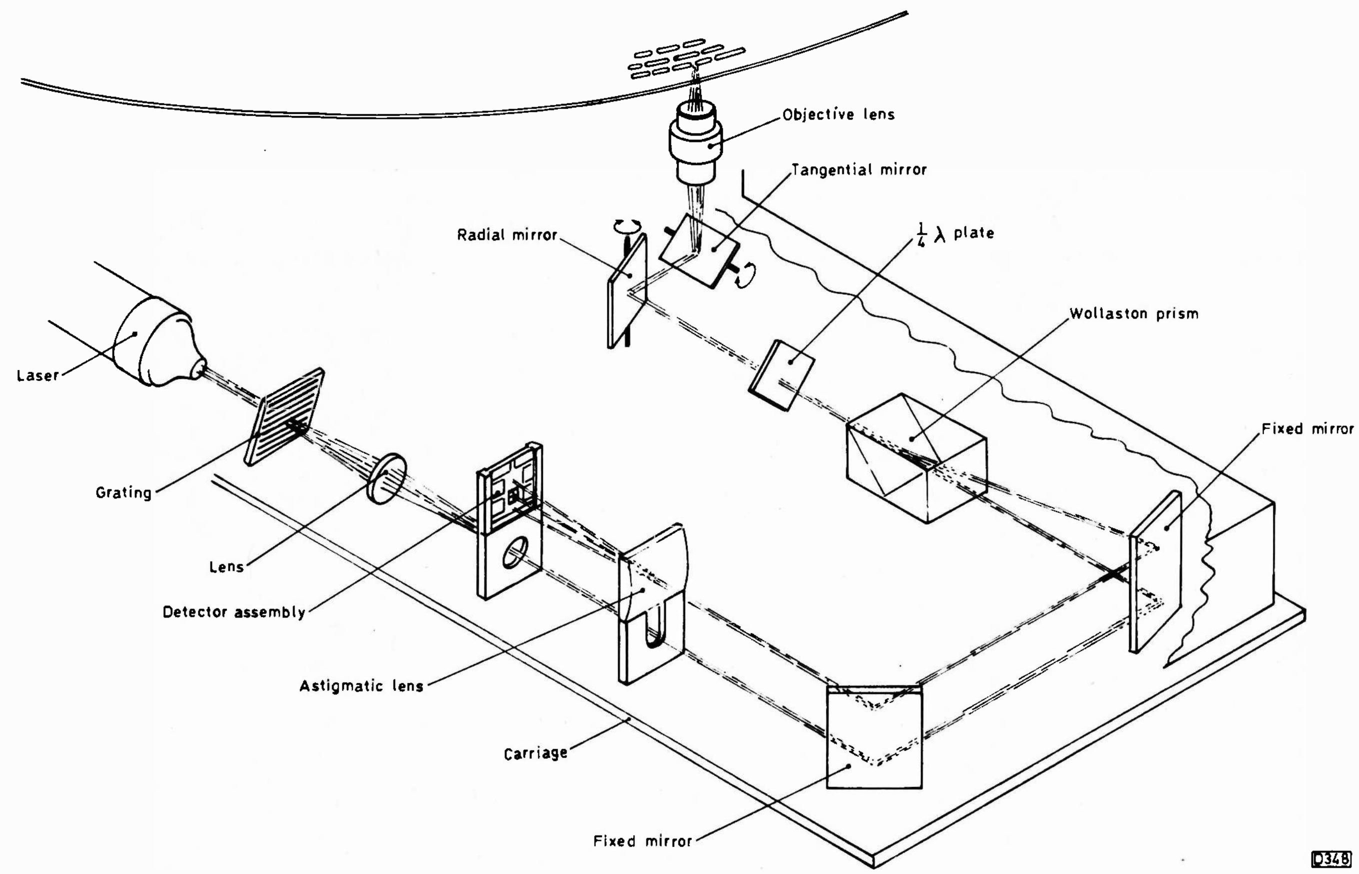


Fig. 5: The paths followed by the forward and return laser light beams. The whole optical system is mounted on a carriage which is driven radially along a pair of guides.

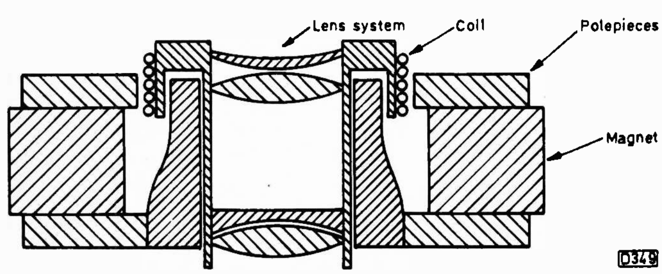


Fig. 6: The objective lens system, showing the four optical elements – convex/convex, plano/concave, convex/convex and convex/concave. Focus control is achieved by means of a moving-coil system similar to that used in a loudspeaker.

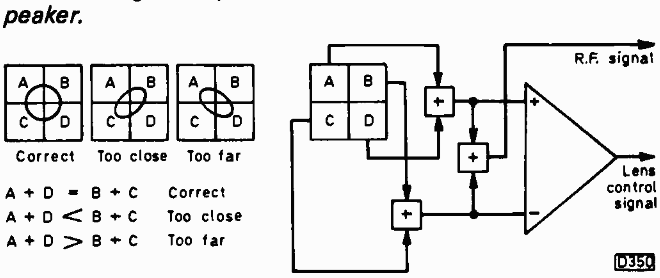


Fig. 7: If the beam is out of focus, it takes on an elliptical form after passing through the astigmatic lens. The result is unequal outputs from diagonally opposite pairs of photodiodes. The difference signal is used to produce focus correction. The output from all four photodiodes is summed to give the video/sound signal.

aligned with the track.

A low-pass filter (cut-off frequency 20kHz) is included in the output from the tracking beam photodiodes so that the tracking control system responds to the average pit density only and not the actual modulation, which could differ over the longitudinal displacement of the spots.

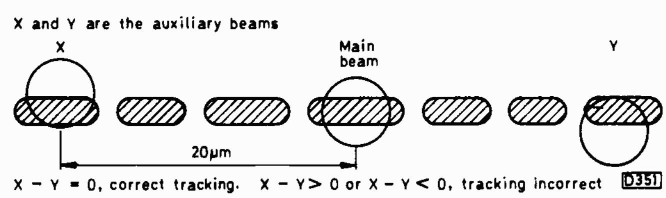


Fig. 8: Auxiliary beams fore and aft of the main beam provide signals for tracking control.

The error signal obtained from comparing the outputs from the two photodiodes is used to adjust the position of the radial mirror to provide compensation. This gives a fine control of the spot position, but a coarse control is also required otherwise the motor could move the carriage too far over or not far enough, with the result that the correction required would be outside that possible using the mirror's radius. Coarse control is achieved by monitoring the average current in the mirror coil and using the signal thus obtained to control the carriage motor. If the current in the mirror coil deviates from normal beyond a minor fluctuation, the motor is adjusted to reduce this deviation.

Disc Drive Motor

The disc drive motor's speed must be controlled to a high degree of accuracy if the TV set's sync circuitry, particularly the colour circuits, are to be able to handle the off-disc signal. The maximum timing error specified for satisfactory performance with any TV receiver is 10nsec. The upper disc-player eccentricity tolerance is 100μm however, which would produce timing errors of over 10μsec at the inner portion of the track, a thousand times as much as the specified maximum error.

To minimise timing errors the motor's rotational speed must be rigidly controlled. For this purpose line sync pulses are separated from the off-disc video signal and applied to a phase detector along with the output from a crystal-controlled oscillator. Any deviation produces an error signal which is used to control the motor's speed. This does not deal with speed irregularities greater in frequency than the rotational speed however, so further measures are required. This is where the tangential mirror comes in: as it can deflect the beam back and forth along the track, it can compensate for such rotational speed fluctuations – wow and flutter as audio enthusiasts call them.

Mirror control is achieved by using the off-disc colour burst. This is gated out and applied, along with the output from a local oscillator, to a phase detector whose output controls the mirror drive.

Service Notebook

George Wilding

Thorn 1590 Chassis

This mains/battery portable had an unusual field fault. At switch on a folded-over raster about half to one inch high would usually appear. This would spasmodically increase and return to its initial state, then after about five minutes it would often assume a stable condition. On other occasions the raster would be perfect at switch on, but within a minute the picture would start to roll, the hold control having no effect. Within a very few minutes the raster would intermittently collapse, then occasionally stay full size for some time.

The fact that the symptoms included loss of hold as well as field collapse indicated a fault in the field oscillator circuit, which uses two pnp transistors in a multivibrator arrangement. The fault's apparent sensitivity to temperature change suggested that one of the transistors was defective – I generally find that unusual faults and symptoms are caused by a faulty semiconductor device. The voltages in the circuit were found to be near enough to those shown in the circuit diagram, but resistance tests revealed that there was negligible difference in the forward and reverse readings obtained across the base-emitter junction of VT15. Replacing this transistor restored normal field timebase operation.

Thorn 3000/3500 Chassis

Yet another instance of a fault that's been mentioned before in these columns came our way recently. The cause is so surprising however that it's worth recounting. The set was one fitted with the Thorn 3000 chassis, the fault being lack of brightness. It was eventually traced to R907 on the beam limiter board: this 1·5Ω wirewound resistor carries the line output stage current and provides the beam sensing action. The voltage across it should be about 1·3V under normal conditions, but when it increases in value this voltage rises and the beam limiter circuit comes into operation. Usually a wirewound resistor is either within tolerance or open-circuit, and one would not expect a significant change of value in a 1·5Ω resistor. Furthermore such a low value is difficult to measure accurately.

GEC Series 1

The problem with this set was excessive contrast, the contrast control itself having no real effect. We decided as a start to check the voltages around the a.g.c. amplifier transistor TR105. As expected, the transistor was continuously saturated, disconnecting and reconnecting the aerial producing no noticeable change in its collector voltage. The transistor is controlled by the a.g.c. detector diode D102, which produces an increasingly negative voltage at its base with increased signal strength. So obvious possibilities were a defective transistor or diode – it transpired that the diode was open-circuit, a replacement restoring normal a.g.c. operation.

Another of these sets produced an excellent picture apart from the fact that the verticals, especially near the top of the screen, were markedly bent. A new PCF802 line oscillator valve brought no improvement, and as the line hold was not quite up to standard the flywheel sync discriminator diodes were next changed. This produced perfect line lock, but the verticals were still bent. The problem was eventually overcome by replacing the flywheel sync filter capacitor C216 (0·01μF).

Thorn 1500 Chassis

"Picture keeps flickering" was the complaint with one of these sets, but on investigation the flickers were so brief it was difficult to see with any certainty just what was happening, though the fault sometimes instigated a partial field roll. Brief loss of video looked the most likely cause, so we decided to check the voltage at the collector of the video output transistor to see whether voltage changes coincident with the flickering were present here. Before we'd even got this far however we discovered that all three connections to the transistor were completely unsoldered: though they'd previously been soldered lightly, it appeared that heat had resulted in the leadout wires making only very fragile contact. The transistor could be removed without any need to use the soldering iron, and it was really surprising that there had been any video output stage operation at all.

Two other sets of this type came along recently with the complaint of intermittent, varying cramping at the bottom of the screen. In both cases the cause was the usual one for this type of fault, the field output pentode's cathode decoupling electrolytic, C79 (160μF) in this case – it's mounted vertically, quite close to the valve, and is thus subject to considerable heat.

Collapsing Raster

A Pye hybrid colour set (697 chassis) would come to life following the normal warm-up period, but after a few minutes the raster would usually collapse to a thin vertical line and then vanish, leaving the sound unaffected. We've had trouble in the past from bad soldered joints on the valveholders of the PL509 and PY500 line output stage valves, but this time the soldering appeared to be perfect, whilst the fault was not affected by wobbling the valves in their holders.

When the raster collapsed, we checked at the PL509's anode cap to see whether there was any pulse output. Amazingly enough, we'd get an arc that also restored the raster. We got the impression however that the pulse output was not present until we applied the screwdriver blade to initiate it. Similarly, there always appeared to be a negative potential at the PL509's control grid, but again there seemed to be a brief pause between applying the test prod and the voltage appearing. Applying the voltmeter across the PL509's 10Ω cathode resistor R226 revealed that there was the normal slight voltage across it when the raster was present, the voltage rising rapidly when the raster vanished.

It seemed that either the drive from the PCF802 line oscillator was being interrupted or the loading on the line output stage was intermittently excessive. As the picture always came on from cold however we were inclined to suspect the PCF802. It's difficult to get at in these sets, but a replacement completely cured the trouble. We never discovered the exact fault with the valve, but the initial thermal delay leads one to suspect that it was probably either a short across the heater or a grid-cathode short.

ITT Hybrid CTV – Smoke

The saga of an ITT hybrid colour set (CVC5 chassis) started about seven weeks ago, when the owner phoned to say that smoke had suddenly poured from the back – though the picture and sound had continued until she switched off. When I called next day the first thing I checked was the high-voltage ceramic capacitors in the e.h.t. compartment – in all makes of set these can go leaky, giving off smoke and fumes before the leak gets so bad that a fuse blows. They were perfect however, no shorts could be detected, and there was no "tripler smell". With no signs of any damage, all we could do was to switch on and await developments. The picture and sound came on perfectly, and remained so for the next half hour while we were examining a radiogram. So we left the set working and asked the owner to report when the fault reappeared.

It was seven weeks before the smoke returned! Once again the set worked normally when we switched on, but this time a faint smell of burning wood permeated the cabinet. At the bottom, on the convergence box side, were two small globules of hardened wax-like material that had obviously dripped down when the fault was present. The culprit was revealed when the convergence box was removed – the mains filter capacitor C257. Its yellow casing had burst in two places, revealing a blackened interior. It was also quite warm to touch. A replacement put everything right, but the amazing thing is the lengthy period between the two calls. It seems that the capacitor had to get really warm before it started to give off smoke. Anyway, if you get this smoke complaint you'll know what to do!

Vanishing Signals

Although sets fitted with the Pye single-standard hybrid monochrome chassis (169, 569, 769, 173 and 573) give a very good picture and are reasonably reliable, they are awkward to repair since the bottom hinged chassis doesn't open wide enough and only a proportion of the components are identified on the outer, print side. Anyway, in a recent example that came along the picture and sound would usually appear normally after switching on from cold, but would then simultaneously disappear within anything from a minute or so to almost an hour. Now as regular readers will know, the usual cause of loss of signals in these sets is failure of VT2 (BF194) in the cascode i.f. stage. In this set however all the transistors in the i.f. strip gave normal voltage readings when the sound and picture vanished. Furthermore, when the test prod was applied to the base of the first i.f. transistor under the fault condition a radio signal was picked up and a lot of noise appeared on the screen. Clearly the i.f. strip and the video stages were operating normally. This placed suspicion on the tuner unit, a varicap type in this particular set. Such tuners quite frequently give trouble, though I've never experienced symptoms like these before.

So the voltages on the tuner pins were the next things to check. Under the fault condition we found that there was nothing on pins C and D, which are fed from the TAA550 30V stabiliser i.c. Things then clicked, for whilst I'd not experienced failure of a 30V stabiliser i.c. in one of these sets before I'd known them break down after a short period of time in other chassis, notably in the ITT CVC5 series. As expected, we discovered that there was virtually zero voltage across the i.c. when the signals disappeared. The i.c. read all right when tested with an ohmmeter, but replacing it and its 20kΩ feed resistor R122 (which was considerably discoloured) restored normal tuner voltages and results.

Most TAA550 i.c.s are coded with a yellow dot to indicate that the stablised voltage range is 32-34V. A red dot indicates that the range is 31-32V and a green dot that the range is 34-35V. In practice, any may be used.

Tuning Drift

I've on several occasions mentioned how the push-button channel selectors fitted to hybrid ITT colour receivers cause intermittent tuning variations, as a result of which the gain varies and/or there's colour drop-out. The only practical remedy is to return the unit to ITT, who have a repair service and make only a nominal charge. This week we were called to a set which had these symptoms, but the selector panel had been replaced only a month previously. The 30V stabilizer i.c. was replaced in case it was responsible, but the results remained exactly the same. So it was either the selector panel or the tuner.

It's quite easy to check the selector. Remove the three d.c. supply leads and connect them instead across a medium-value potentiometer which can then be used as a rotary tuning control. The tuning is naturally very sharp, but nevertheless quite manageable. The problem remained when this was tried, so tuner replacement was necessary. This restored perfect results.

Plastics Problem

Sound but no raster was the complaint with a Pye hybrid colour set – the report also mentioned a distinct smell of burning. The usual causes of burning smells on these sets are R203 and R227, on the line timebase/power supply panel, but both had been changed previously and were certainly not overheating. At this point we noticed a faint whisp of smoke from the area of the line output transformer, and on removing the protective metal plate we discovered an irregularly shaped yellowish area on the plastic cheek plate – mainly between the anti-corona soldering point to the PY500's top cap and the central earthed metal plate.

Well, we've known some plastic materials break down and become conductive after prolonged subjection to high voltages and temperature changes – remember the Perspex used in early Ekco receivers?! So we carefully chipped away all the discoloured material and, as everything else seemed to be in order, switched on. The result was a perfect picture, with no further suggestion of smoke or a burning smell. That incident was some weeks ago now, and no further trouble has been reported.

Still Frame Conversion

Mike Phelan

Machines that have a still frame facility vary in their degree of sophistication. The simplest have a "random" still frame, which means that the tape is simply stopped. There are several disadvantages to this. First, the angle of the video head with respect to the recorded tracks (see Fig. 1) will change along the length of the tracks, causing the f.m. video output signal to fall to zero in places. The result is a "noise bar". If the tape is stopped so that the bar is moved to the top or bottom of the picture however the field sync pulse will be obliterated. This gives the second disadvantage, field roll or jitter. Things can be improved by making one or both heads slightly wider than the recorded tracks. This simple system can nevertheless give quite reasonable results.

The next type of machine stops the tape so that the noise bar is at the top or bottom of the picture and therefore not visible, and generates an "extra" field sync pulse. Some machines (JVC) also have one wide head to improve matters still further. Even more sophisticated machines have an almost perfect still frame. The Toshiba V8600 uses two extra heads to this end, whilst Philips and Grundig V2000 series machines have the heads mounted on piezoelectric crystals with the result that the heads can be continuously adjusted to follow the video tracks.

It's possible to convert the Ferguson 3V00 and 3V22 machines (and the equivalent JVC Models HR3330 and HR3320 etc.) to obtain quite a passable random still frame when the pause control is operated.

When the pause key is pressed, the pinch roller solenoid is released and the squelch circuit on the Y-C board mutes the video. So the first thing to do is to disable the latter. Remove the bottom cover (stand the machine on its top), remove the two screws from the front corners of the Y-C board (the large PCB), then disconnect the link connected to plug 41 (see Fig. 2).

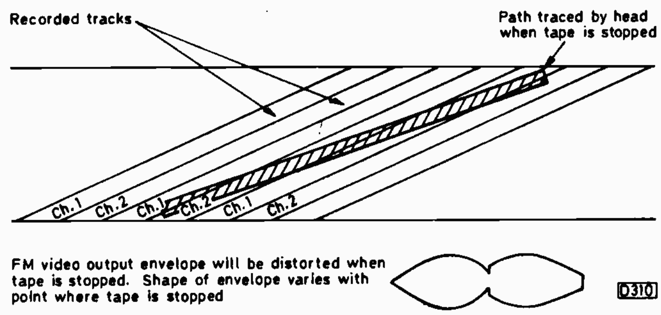
On the 3V00 and earlier 3V22 machines the take-up clutch (see Fig. 3) has to be modified. This is because the clutch is disengaged when the pause key is operated and as a result the tape is not held in tension around the head drum. Remove the take-up clutch (see Fig. 3) by taking off the circlip and removing the spring. Remove the roller and pin from the clutch, and replace the pin after filing a flat on it (see Fig. 4). This will prevent the clutch disengaging in pause. Replace the clutch.

If the machine is of the later 3V22 type the clutch will be different from that shown. With these machines the only modifications required are to open-circuit the mute link and then carry out the following modification.

On all 3V00 and 3V22 machines the following modification is necessary to prevent tape creep by ensuring that the capstan motor stops positively. Remove the bottom (four screws), top (two screws) and left-hand side (two screws) of the cabinet. Locate the microswitch behind the pause key: this will be seen to have an unused tag. Next locate transistor X10 on the left-hand (audio/servo) board and connect a pnp transistor (BC307, BC308, BC157, BC158 etc.) and a 6·8kΩ ¼W resistor as shown in Fig. 5, running the sleeved lead to the spare contact on the pause switch. This will short out X10 and stop the capstan motor in pause – in effect, we're providing a "not-pause 12V" supply (we can't use the "pause 12V" rail at this is also used in the load and unload modes).

If a head drum of the type used in the freeze frame models 3V16 and 3V23 (JVC part number PU31332F or PU31332L, or Thorn part number 01X0-033-001) is fitted, the amount of noise on the picture will be considerably reduced. Unless the drum needs replacement however I personally don't consider this change to be worthwhile.

Note that it will sometimes be necessary to press the pause control several times to get the best still picture.



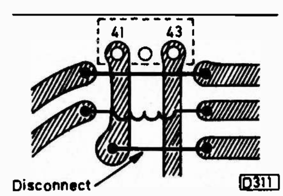
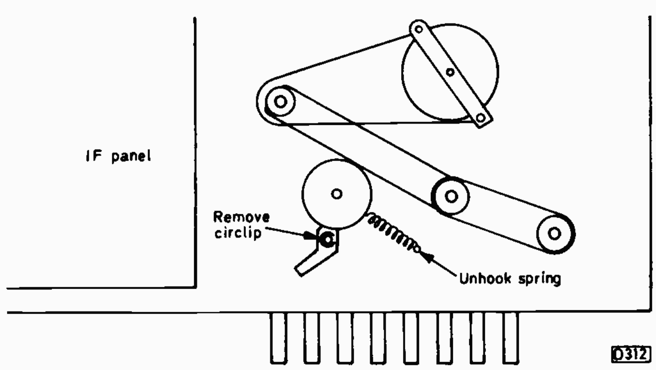


Fig. 1 (above): The cause of still frame noise bars.
Fig. 2 (left): Disabling the squelch circuit.
Fig. 3 (below): Take-up clutch in early machines.



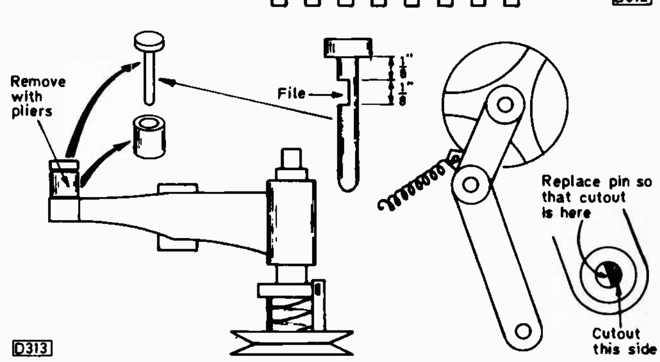


Fig. 4: Modification to the take-up clutch.

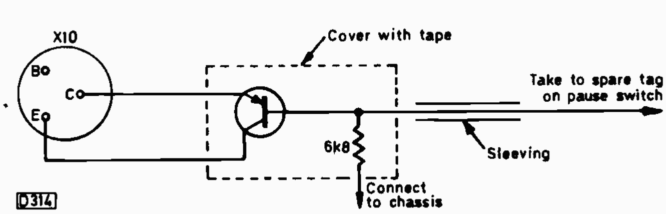


Fig. 5: Modification to prevent tape creep.

Inside the Philips VR2020

Part 3

Brian Dempster

To control the head drum and capstan motors a servo circuit is required for each. Not only must the speed be held constant during record and playback: the phase must also be accurately controlled. Both motors, which are of the d.c. direct-drive type, are fitted with tachogenerators that generate sinewaves as the motors rotate. The frequency of these sinewaves is thus proportional to the speed of rotation. So if we've a reference signal whose frequency corresponds to that of the tachogenerator's output at the correct motor speed, we can employ a discriminator circuit to produce an output voltage proportional to any error. By feeding this error signal in the correct phase to say a d.c. amplifier that drives the motor, we have a complete motor speed control system.

Servo Requirements

This is the basic principle used in the VR2020's servo systems. Matters are a little more complex in practice however. Information about speed and phase is required separately by each servo. Therefore a speed discriminator and a phase discriminator are needed. Once the correct speed has been attained, the output from the speed discriminator remains constant: any phase correction required is brought about by the action of the phase discriminator. Should the speed change, due say to a signal interruption, the output from the speed discriminator moves in the appropriate direction to provide correction. The phase discriminator is unable to correct frequency errors and vice versa.

The circuit used for motor control is straightforward. The voltage from the frequency discriminator is one input of an operational amplifier: the phase discriminator provides the other input. Thus any change of phase or frequency produces a change in the output voltage from the operational amplifier. This output is fed to the power amplifier that supplies the motor, thus bringing about any error correction necessary.

The Drum Servo

The drum servo speed discriminator is shown in block diagram form in Fig. 21. The sinewave from the drum motor tachogenerator is first linearly amplified and then fed to an operational amplifier without negative feedback. The result is a squarewave at the original frequency. This is fed to a 13μsec monostable. The signal at the output from this monostable is used as the sampling pulse – it's positive-going and 13μsec wide.

This pulse is also fed to a second 13μsec monostable. These monostables are negative-edge triggered devices, so the trailing edge of the first pulse initiates a second 13μsec pulse. The trailing edge of the second pulse starts a sawtooth generator, whose ramp output is sampled by the first 13μsec pulse. The ramp time-constant provides the reference, while the sample-and-hold circuit acts as the discriminator.

The drum speed control voltage thus produced is inversely proportional to the speed of the head motor: when the speed is correct, it should be at about half the supply line voltage, i.e. 6V. This voltage remains constant unless the speed changes: it forms one input of an operational amplifier (the non-inverting input, see Fig. 22).

The inverting input is fed with a voltage that corresponds with the phase of the head drum relative to the field sync pulses. This voltage is obtained as follows. The field sync pulses are divided by two and then used to generate a ramp waveform. This waveform is sampled by the head position pulse in a sample-and-hold circuit whose output is used as the phase control voltage.

So we now have both speed and phase control voltages to feed to the operational amplifier whose output in turn

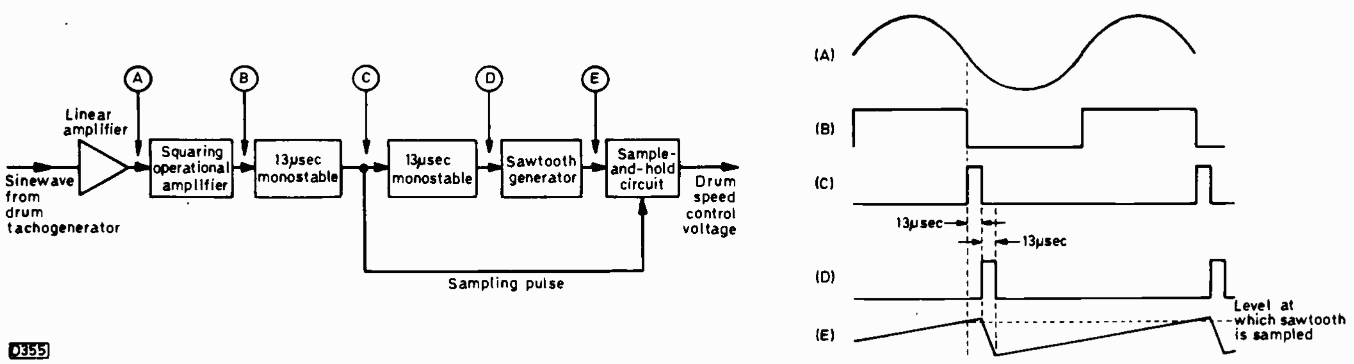


Fig. 21: The drum speed control loop – block diagram and waveforms.

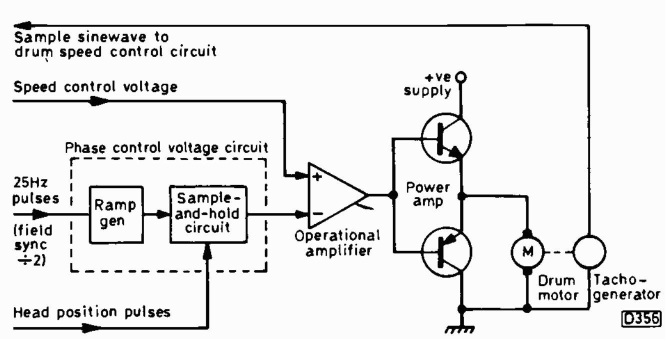


Fig. 22: The drum phase control loop and the drum motor drive arrangement.

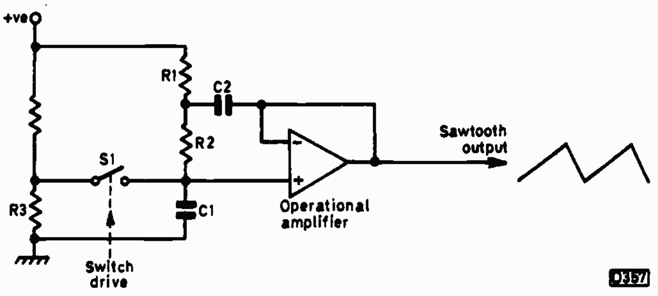


Fig. 23: Sawtooth generator circuit, using an operational amplifier with bootstrapping to obtain a linear ramp.

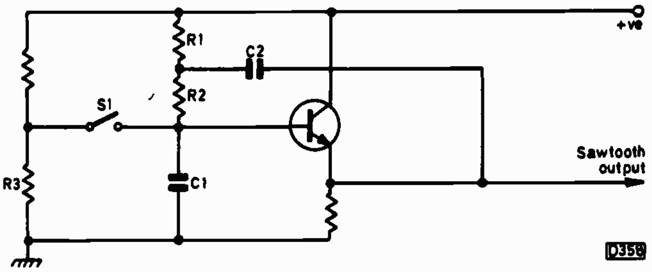


Fig. 24: Transistor bootstrap ramp generator circuit.

controls the drum motor power amplifier.

Sawtooth Generators

The sawtooth generators used in the drum and capstan servos are similar. A capacitor is charged via a high-value resistor, thus producing a rising ramp, and is then discharged via a low-value resistor. But as we all know charging a capacitor in this manner produces an exponential waveform rather than a perfect sawtooth – unless, that is, the capacitor is charged by a constant current. The old-fashioned technique of bootstrapping is employed for this purpose – see Fig. 23. Since the output from the operational amplifier used here is connected back to its inverting input, the device is being used as a buffer. During the rising ramp, switch S1 is open and C1 charges via R1 and R2. Switch S1 is then momentarily closed, with the result that C1 discharges rapidly via R3. The process is then repeated. Capacitor C2 provides the bootstrap action, by ensuring that the voltage across R2 remains constant. For those who prefer to see a transistor rather than a "black box", the equivalent circuit is shown in Fig. 24.

The Capstan Servo

The capstan servo also uses separate speed and phase control loops, with the speed control sample signal again provided by a tachogenerator. This produces an output at 419Hz when the tape speed is correct. The arrangement is similar to that used in the drum speed control circuit, though a simple *RC* delay network takes the place of the second monostable. The capstan servo circuit is shown in block diagram form in Fig. 25, in the record mode.

The phase control section is a little different this time. During record, all that's necessary is for the phase to be locked to the 419Hz reference signal produced from the 4·9MHz crystal oscillator that also produces the track-following signals (see Fig. 20 last month). This is simply achieved by using the squared output from the tachogenerator to set a bistable and the 419Hz capstan reference signal to reset the bistable. The capstan reference signal will drive the bistable's Q output to zero while the tachogenerator signal will raise it to the l.t. rail voltage. The average or mean level of the output depends on the mark-space ratio of the Q output waveform and thus upon the phase relationship between the capstan tachogenerator signal and the 419Hz reference signal.

On playback however the capstan phase must be controlled in such a way that optimum tracking is maintained. Referring back to Fig. 14 last month, an output signal from the actuator control system to the capstan servo is shown – it's labelled "auto tracking". This goes to the capstan servo on playback only, via switch S1. If you examine the actuator control circuit you'll see that this signal consists of the tracking error voltage for first one actuator and then the other, i.e. the average of the two.

Now if one error voltage is say low and the other high, this indicates that just one video head is mistracking and this will be corrected by the actuator concerned: since the two voltages are in opposition, the average is the nominal value and the capstan servo is not affected. If both actuators receive an error voltage in the same direction however this indicates a tape position error. The average of these signals will then move to a value other than the nominal one and the auto tracking signal thus produced will correct the phase of the capstan drive.

One oddity about this arrangement is that, because the capstan servo is under the control of signals from the dynamic track following control system on playback, head servo problems can lead to audio wow. This would normally be attributed to capstan servo trouble of course, so servo fault diagnosis needs a little more thought with this system.

Safety Features

The safety inverse motor stop signal will stop the machine if certain conditions occur. It's generated whenever switch S3 closes. This can occur for two reasons. First, if a blocked rotor signal arrives from the drum servo panel, indicating that the drum has stopped. Secondly if a high output occurs at the inverted-Q output of monostable two. The time-constant of this monostable is such that its inverted-Q output is permantly low at normal drum speeds. If the drum speed falls to half or less however the inverted-Q output goes high.

Since a stopped head drum or capstan is cause for concern only when the tape is threaded, switch S2 closes to remove any safety signals when the machine is unthreaded.

Sample-and-hold Circuits

The sample-and-hold discriminator circuits used in both servos use CMOS bilateral switches and junction f.e.t. operational amplifiers. The switches are normally "open-circuit" and have very low leakage currents – of the order of 100pA. When turned on by a logic high signal at the gate electrode they exhibit an almost purely resistive characteristic of about 300Ω, with a very short switch-on time. When the gating signal is removed they revert to being virtually open-circuit. The junction f.e.t. amplifiers have a typical input impedance of 10^{12}Ω, and a slew rate of about 13V/μsec.

Fig. 26 shows the drum servo phase discriminator arrangement. On record, the reference ramp is derived from the divided-by-two field sync pulses. The sample pulse is a sharpened version of the pulse obtained from

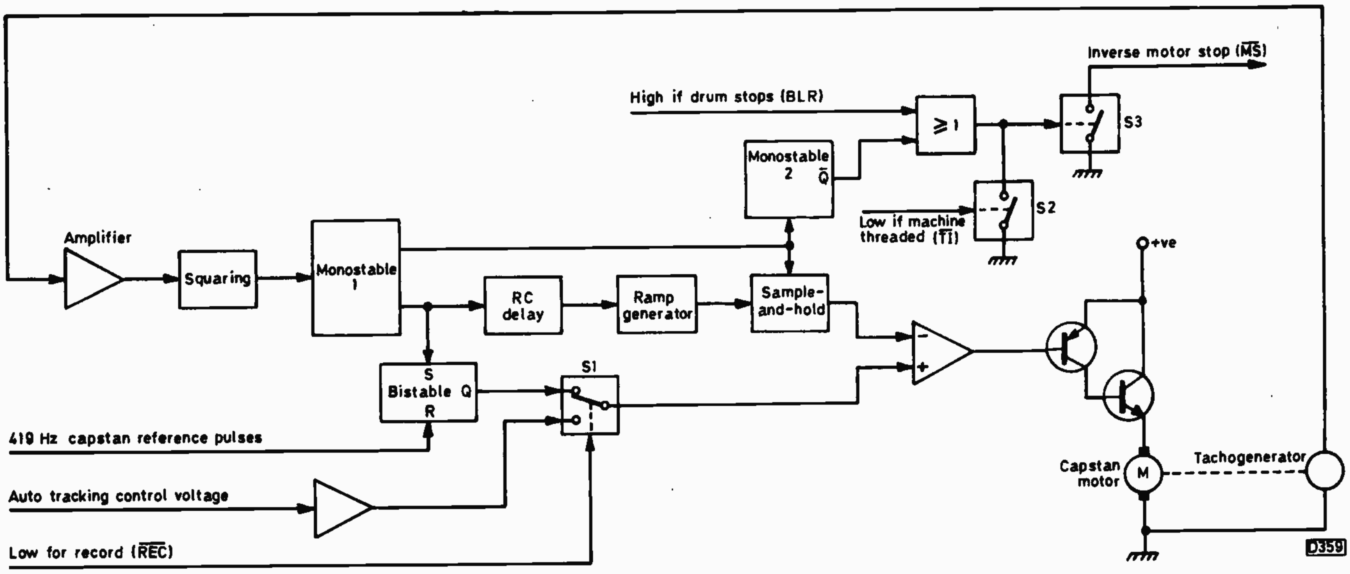


Fig. 25: Block diagram of the capstan servo system and the stopped drum/capstan safety circuit.

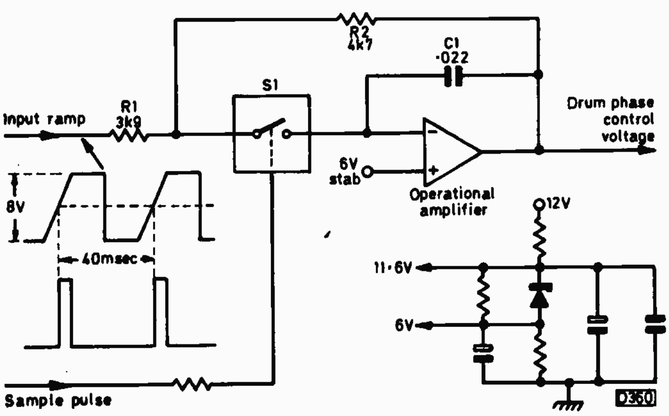


Fig. 26: Sample-and-hold discriminator circuit used in the drum phase control loop. C1 holds a charge proportional to the reference ramp at the instant of sampling.

Track 4	180	180	0	0	0	0	180	180	180	180
Track 3	180	180	180	180	0	0	0	0	180	180
Track 2	0	0	180	180	180	180	0	0	0	0
Track 1	0	0	0	0	180	180	180	180	0	0

D361

Fig. 27: Chroma signal phase shift pattern on the tape.

the LED/optotransistor arrangement mounted near the drum (head position pulse). When the drum phase is correct, the sample pulse will arrive approximately half way up the ramp. When this pulse arrives, switch S1 closes, allowing the inverting input of the following operational amplifier to sample the ramp voltage attained at that instant.

In this state the amplifier's gain is little more than unity, due to the relationship between R1 and R2 (it's a virtual-earth input amplifier). The output goes to a value determined by the ramp voltage and the voltage at the non-inverting input (6V stabilised). The output is thus inversely proportional to the ramp voltage at the sampling time. Capacitor C1 charges rapidly to this value before the sample pulse ends. When S1 opens, the amplifier's high input impedance prevents C1 discharging to any extent, thus "freezing" the sampled voltage at the amplifier's output until the next sample-and-hold cycle.

Corrections

Finally this month some corrections to Part 1 of this series. There were a couple of errors in the block diagram of the U120 module shown as part of Fig. 9. First, an output should have been shown from the amplifier following the 4·43MHz bandpass filter to the colour-killer at the top – this is the E-to-E colour signal. Secondly there's no output from the colour-killer detector to the 0/180° switching in the record mode.

Fig. 10 was also incorrect. The chroma signal phase shift pattern is laid down on the tape as shown in Fig. 27.

Miller's Miscellany

Chas E. Miller

In a previous article I wrote about the trouble I'd had with the u.h.f. tuner in a Teleton monochrome portable. When I finally got around to repairing it, I soon realised that the only simple solution was to fit a new tuner. The snag however was that the original unit was a lot smaller than the average UK rotary-driven type. The answer seemed to be to use a varicap tuner in conjunction with an ordinary potentiometer in place of the original mechanical drive.

The set has a 90V, line output stage derived h.t. line for the video output stage, and this seemed a suitable source for the tuning voltage supply. To restrict the additional drain on this line as much as possible, a 100kΩ tuning potentiometer with a series resistor was adopted – keeping the current in this branch of the circuit at only about 0·3mA. Stabilisation was provided by the usual TAA550 i.c., with a 47μF decoupling electrolytic – this value was found to be necessary to prevent a slow oscillation. Fig. 1 shows the circuit.

The tuner unit fitted easily into the space available, leaving ample room for the tuning potentiometer. The latter was mounted on a small bracket which was bolted to the original mounting plate. It would have been possible to use a direct drive, but since an epicyclic reduction gear was to hand this was fitted to the shaft of the potentiometer, giving a reduction ratio of approximately 6:1.

As regards performance, the already good sensitivity has been enhanced still further, while the tuning is well enough spaced to be entirely satisfactory in an area where it has always been possible to receive a minimum of nine channels on the attached loop aerial. In fact BBC-1 channel 46 (Sutton Coldfield) is perfectly adequately separated from BBC-2 channel 45 (Moel-y-Parc). Altogether a very successful job.

Another Tuner Tip

This next one may be of interest to anyone who has to maintain sets for which replacement tuner heads are no longer available. When this happened to me a few months ago I decided to adopt a crafty method of overcoming the problem whilst at the same time providing remote control.

A simple three-postion switch was fitted into a small box of the type used to house electrical fittings, such as 13A flush sockets, together with three 100kΩ preset skeleton potentiometers. The tracks of these were connected in parallel, with the wipers going to the three switch positions. A long length of ordinary three-core flex was then used to connect the unit to the original tuner head in the set – this was left in position for the sake of appearances. The potentiometers were set up for the required channels and the box sealed against fiddlers. The arrangement has worked without any trouble or need for readjustment for over six months, so I think we can justly call it successful.

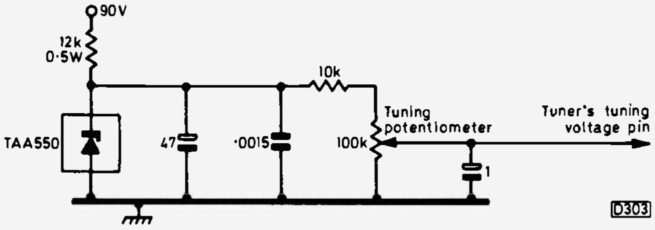


Fig. 1: Simple tuning voltage circuit.

A Colour Teleton

About the same time that I was dealing with the Teleton portable, one of the firm's colour sets came in for repair – a Model TVC20. The owner confessed that he alone was responsible for putting it out of action, though he used a rather more colourful phrase than that.

The initial problem had been that the height had closed in after a couple of hour's viewing. The owner had then taken the back off and turned all the convergence potentiometers. When I tried the set the height was all right, so I reconverged it and left it on soak test for a while. As nothing untoward occurred I returned the set. It then transpired that the owner had experienced no difficulty until he had put the set on a home-made table with a solid top. This restricted the ventilation, so I told him that if he wanted to continue to use the table for the purpose he should make a big enough cut out to restore the free passage of air. This he did, with much hard work, but the result was completely unsuccessful.

The very next day he was back again with the same complaint. The fault wouldn't put in an appearance for me, so I got the owner to try the set at home with a new 21LU8 triode-pentode field timebase valve. That didn't work either. Eventually, after several days of soak testing, the fault did put in an appearance in the workshop and I was able to make some voltage tests. As you might expect, the voltage at the anode of the triode section of the valve was way below the correct figure. It took me ages to find out what had gone wrong however. For one thing the height and vertical linearity controls seem to be mislabelled on the circuit, which is also hard to read and confusingly drawn. Secondly, the fault was not due to one of the high-value resistors in the height network. Instead, it was due to the 10kΩ filter resistor (R724) which precedes these resistors. It was charred so badly that it literally fell to pieces when I touched it with the test prod. I replaced it with a 1W type (the original was rated at ½W) in the hope of avoiding further trouble, and so far the repair seems to have been successful. For once the customer paid up willingly and without a quibble – despite the fact that he's been out of work for several years due to an illness. It's the people with plenty of money that hate parting with it!

Vintage Treat in Store

I've recently acquired a complete Test Card C generator covering the v.h.f. channels 1-13. As far as I'm aware, there's only one other example of this particular piece of test equipment in existence – in the South Kensington Science Museum. So it's rather special. As soon as I've built it up from the numerous subassemblies (they fit into some large Post Office type racks) and given it a test run I'll write a report on it. At least we'll be able to run 405-line sets after the stations have been closed down.

Fire down below!

We're all aware of the type of customer who makes a mountain out of a molehill. Here are a couple of tales of the opposite type. The first concerns a lady farmer who brought in a Thorn 3500 colour set which had been out of use for some months until she'd tried it again. She complained that it now smelt a little when she switched it on, and that it produced a small amount of smoke. Too true! When I tried it, a dense cloud of smoke poured from the back, accompanied by a pong that would have stopped a buffalo in its tracks."That's it" she said calmly, seemingly oblivious to the rapidly gathering gloom in the workshop. I pulled the plug out and promised to report back later, marvelling at her indifference to the noxious vapours. Well, I suppose farmers do have to get used to certain things.

The cause of the trouble was insulation breakdown on the e.h.t. cap – it had tracked across in all directions. The present performance had clearly been an encore, to say the least. Unfortunately the lady's failure to panic cost her dear – the repeated overloads had done naughties to the line timebase panel, which had to be replaced. Thus what should have been a simple case of cap renewal turned out to be a rather expensive job. I suppose she can count herself lucky in one respect – the tripler hadn't given up.

Within a few days I had a very similar experience. This time it was a Murphy colour set (Rank A823 chassis). When I was phoned I was told that there was no sound or picture, but that a small flash could be seen in the works. This innocent sounding description didn't prepare me for the minor explosion that took place when I switched the set on! A sheet of flame ripped down the back of the power supply panel, partially engulfing the decoder. I switched off very quickly indeed!

Strangely enough, the mains fuse didn't seem in the least interested in blowing – the customer told me he'd tried the set several times before calling me and hadn't had to replace the fuse. I believed this, since the condition of the fuse showed that it hadn't been disturbed for years. The cause of the pyrotechnics was the familiar failure of the Paxolin around the connections to the VA1104 thermistor in the mains feed to the thyristor h.t. rectifier, leading to carbonisation. In this case the carbon had deposited itself in a half-inch wide band along almost the full length of the panel, hence the sheet of flame.

One would have thought that one such flash would have deterred the owner from further experimentation, but sadly it hadn't. As a result, a new decoder panel was required in addition to the power panel – the flashover had damaged the decoder panel quite severely. The customer was of the rare breed that wouldn't accept the set back till she could pay for the repair. Would that there were more like her!

A Visit to Ike Hodge

What with various problems recently, I'd not seen Ike Hodge for some time. As I entered his workshop, I nearly collided with a slightly built individual who was just leaving. He was scruffily dressed and had the mien of an undernourished ferret. I couldn't help asking Ike who he was.

"You might well ask" sighed Ike. "That was Fagin, our local TV wrecker. He's just been in to order a new line output transformer for a Thorn 1500 chassis."

"They don't fail all that often" I observed.

"No, and it won't have gone in that set for a cert. It's Fagin's logic. The picture has gone down to a line. Therefore what else can it be but the line transformer. Get it?"

"You're not going to get one for him?" I grinned.

"Why not? If you'd had as much to do with him as I have you'd know it's easier to do as he asks than to argue with him."

"But what will happen when he fits the transformer and it makes no difference?"

"Not my concern" sniffed Ike. "He'll probably scrap the set."

Now I'm well aware that Ike thinks ethics is a county to the north of London, but this seemed a bit strong even for him. I suggested as much – in a roundabout way of course.

Ike wasn't having it. "You can't tell that bloke anything" he persisted. "Know what he did once? Bought a brand new test meter from me, quite a good one that cost over thirty quid. First thing he did when he got back home was to try to measure the resistance of the mains supply."

"You're joking" I said.

"I can show you the very meter" said Ike. "He brought it back as it was under guarantee – or so he expected. Had to send him off with a few choice words." "But he still comes back?"

"Yes. I've tried everything. Insulted him, sold him dud components – even let him owe me money, the ultimate deterrent! But back he comes. Always some tale about his mom's set breaking down, or his sister's or second cousin twice removed."

"He must have a large family" I remarked.

Ike laughed. "The truth is that the set probably belongs to one of his customers and he's got himself into a right mess with it."

"You mean people trust him with repairs?" I asked.

"Incredibly, yes. I wouldn't trust him with a crystal set, but folks give him colour sets to repair. D'you know how he used to test valves for being soft? – he'd drop them on the floor from about two feet. If they bounced, they were soft."

"There's no answer to that" I admitted.

At this point the door opened and Willy came in. "I've posted your letters" he said.

"Good" said Ike. "That means a few more weeks' credit before I have to pay all the big bills." Seeing my puzzled look, he explained "the best time of the year to get a final demand is the last week in December. Send off the cheque at the beginning of January, but put the old year's date on it. It's a natural mistake, and no one will question you much. You've sent it second class, so by the time it gets there and they've sent it back for alteration and you've despatched it again second class you might have got as much as three weeks' extra credit."

"Isn't that just a teeny bit dishonest?" I asked.

"Yes" Ike said frankly, "but not half as bad as witholding payment for six months like (he named a huge engineering firm that's the district's biggest employer) – you ask anyone who subcontracts to them. It must be worth thousands in bank interest to them. Perhaps my next New Year's resolution should be to clear up all outstanding debts" he sighed.

"Glad to hear it" I said.

"Good – now perhaps you'll let me have back that PL81 I lent you in 1958."

I'd no answer to that one either!

Long-distance Television

Roger Bunney

THE main events during a quiet month relate to F2/TE propagation and a good tropospheric opening towards the end of March. Little Sporadic E activity was noted. During the first nine days of the month, F2 was particularly active – as follows:

4/3/82 TSS (USSR) ch. R1 from 0820 onwards.

5/3/82 TSS as above. Dubai ch. E2 at 0915: a very strong signal, with colour bars followed by the PM5544 test pattern. Hugh Cocks reported reception of the Australian ch. A0 from 1000-1100, on programme but weak.

6/3/82 ZTV (Zimbabwe) ch. E2. During the evening there was TE propagation of ZTV, NTV (Nigeria) and GBC (Ghana) signals on chs. E2/3.

8/3/82 A very strong PM5544 test pattern from ZTV on ch. E2 at 1340.

9/3/82 Dubai ch. E2 at 0820.

19/3/82 A very strong NTV signal via TE at 2000-2200 on ch. E3, with a floating signal; weaker ch. E2 signals from GBC/NTV/ZTV.

There was also slight Auroral activity on March 1st/2nd.

Those who operate SX200 scanners and Eddystone 770R receivers often find that they get very weak but consistent daily ch. E2 signals from 1900-2100 (at 48·25MHz). During the mid-day period from 1100-1400, ZTV and other African ch. E2 outlets can be heard – preceded by Dubai to the south east from approximately 0900. The signal levels are such that video cannot be resolved on the screen, though the signals are audible using a narrow-band receiver.

From March 23rd tropospheric reception improved as a result of a high pressure system that drifted slowly into and over the UK and central Europe. In the southern UK many TDF (French) u.h.f. signals were present, while in the south east there was reception from DR (Denmark), W. and E. Germany and the low countries.

The improved F2 conditions noted above produced ch. B2 signals (BBC-1 sound at 48·25MHz) in Darwin, Australia and Japan on March 20th. On the following day BBC-1 ch. B1 and TDF-1 ch. F2 audio signals were received in Perth.

Overall then a rather quiet month. My thanks to Hugh Cocks (E. Sussex), Arthur Milliken (Wigan), Trevor Rose (Lowestoft), Anthony Mann (Australia) and Gosta van der Linden and Ryn Muntjewerff in Holland for their reception reports.

News Items

Three-D TV: Renewed interest in the age-old red/green left/right eye filter technique of getting a stereoscopic effect. ORF (Austria) have been transmitting elderly 3-D feature films, the "glasses" required being on sale widely. The W. German third chain and the UK TVS company have also carried out test transmissions.

Spain: RTVE are transmitting experimental teletext signals on the first network, using the French Antiope system. The term used is "Teletexto".

Hungary: A Russian language service is to start from a new transmitter atop Mt. Kekesteto (the highest point in Hungary). The transmitter is also equipped to radiate MTV-1 and 2 programmes and in due course the third programme.

Satellite news: The first Indian satellite has been launched and will provide a nationwide TV coverage to suitably equipped ground stations. When a second craft is launched some 57 ground stations will be operational. One transponder will carry network programming and the second regional "opt-outs". The material will be largely educational, based on ideas derived from the original SITE experimental transmissions in 1975/6. It's understood that the transmissions will be at 2·5GHz.

A digitally encoded music service is to be started in the USA, via a Westar satellite. Subscribers will require a suitable decoder.

Band I Intruder

On March 4th I noticed a very strong audio tone (at approximately 2kHz) over the band 63·275-64·615MHz. Such a single-frequency tone would spread if received on a TV set due to the wide i.f. bandwidth: using a narrow-band scanner however the signal was found to extend over 1·5MHz, falling off sharply at the extremes. The local Plessey research establishment was contacted but denied any knowledge of the signal, which continued for over two hours. Another mystery!

Moroccan Mystery

The puzzle about the previously unlisted Moroccan TV transmitter that's been received on several occasions seems to have been resolved. A recent list includes a ch. E4 (62·25MHz vision) and a ch. M4 (163·25MHz vision) outlet at Laayoune (13W12 27N08), adjacent to the coast and a little further from the UK than the Canary Islands. The transmitters radiate the normal RTM service at 250kW e.r.p., with horizontal polarisation. The ch. E4 listing is shown amongst several M channel transmitters however: further clarification on M/E listings is awaited.

From our Correspondents . . .

The broadcasting authorities in Korea have confirmed Ryn Muntjewerff's reception of ch. A2 signals from AFRTS Seoul. On November 31st last he received system M programme material at 1024 GMT. Our congratulations!

Henny Demming comments that the ch. E4 caption thought to read "Algerie" is not Algeria but instead an RTVE caption reading "Al Cierre", meaning "at closing time". It appears at approximately a quarter of an hour before close down. He also reports that the Dubai PM5544 pattern has "Dubai" at the top and "2 10 33 41" at the bottom: test slides of local scenes are shown, also at times test card F. The ch. E2 outlet has an e.r.p. of 166kW, from two 20kW transmitters.

A "sound unit" available in W. Germany gives selection of either 4·5MHz, 5MHz, 6MHz or 6·5MHz sound signals: further information is awaited.

An attempt has been made to explain Arthur Milliken's reception of the caption "Lokal TV Gothab" on ch. E4. The idea put forward is that a Gothab (Greenland) dealer was transmitting tapes – "lokal" is Danish for local. I feel that there'll be a more convincing explanation in due course!

I've heard from Michele Dolci about the Italian "fourth national TV network" mentioned in the March column. It seems that the "network" consists of a programme purchasing organisation rather than a transmitter network.

Our Saudi Arabian correspondent confirms that ch. A2 signals are definitely coming from an AFRTS base – he recently saw the Indian Head test card. AFRTS continue to deny the existence of a ch. A2 transmitter in the Middle East however! Our correspondent has been receiving ch. B1 (BBC-1) consistently via F2 using a 405/626-line Sony portable.

Channel A1, What Was

As all TV enthusiasts know, the lowest North American channel is A2 (55·25MHz vision carrier). The story of what happened to ch. A1 provides an intriguing insight into the early days of TV in the States. Ch. A1 was originally there all right – in fact its frequency allocation was changed on two occasions: it finally disappeared on June 14th, 1948.

The WTFDA has been conducting research into the early days of US TV and has recently published a lot of information: a detailed article on the subject also appeared in the March 1982 issue of the magazine *Radio-Electronics*.

The first experimental TV transmissions using an all-electronic system were provided by RCA in early 1933 – from station W2XBS at the Empire State Building. The system used had 240 lines and 24 frames per second (non-interlaced), with a double-sideband signal, a vision carrier frequency of 45MHz and a 2MHz channel bandwidth – a.m. sound and vision of course. The Federal Communications Commission was set up in mid-1934, and shortly afterwards two bands were for the first time allocated for TV use – 42-56 and 60-86MHz. No channels were assigned, because there were no accepted standards. The next major development occurred in June 1936, when RCA began regular transmissions from W2XBS as a field trial of a system using 343 lines and 30 frames per second (interlaced), with a double-sideband signal and a channel bandwidth of 5·75MHz.

At much the same time the FCC began to consider the spectrum above 30MHz. The Radio Manufacturers Association set up a sub-committee to attend the hearings, and in addition to pressing for TV channel allocations proposed a system using 441 lines, 30 interlaced frames per second and a 6MHz channel bandwidth. This was beyond the capabilities of the equipment available at the time, though Philco were able to demonstrate a system that met the specification by February 1937. The first channel allocations, 1-19, became effective in October 1938, with Channel A1 occupying 44-50MHz. The original RMA standards were in the main adopted, the only major change being the use of vestigial sideband transmission. Several stations started transmissions during 1939, but sales of sets were poor.

The first change to the channel allocations came in 1940, when the FCC allocated the spectrum 42-50MHz to f.m. radio broadcasting. Channel A1 was shifted to 50-56MHz, and the number of TV channels was reduced to 18. TV was still regarded as an experimental service at this time, with the FCC refusing to set standards (like its present stand on teletext) and the industry now seriously

Prototype 4GHz receiver using an 18in. dish aerial.

divided on what standard should be adopted. As a result, the RMA set up the National Television Standards Committee to look into the whole area of broadcasting standards and report back. The NTSC was open to members and non-members of the RMA.

In January 1941 the NTSC presented a new TV standard to the FCC – 525 lines, 30 frames per second interlaced, 6MHz channel bandwidth, and f.m. sound. This was accepted and regular broadcast services commenced on July 1st, 1941. The second world war then intervened – TV transmissions were reduced to four hours a day, and the construction of new stations was stopped. The technology raced ahead however, and in late 1944 the FCC began hearings with a view to reconsidering the use of the v.h.f. spectrum. The outcome of this so far as we are concerned was that f.m. broadcasting was moved to 88-106MHz, the number of TV channels was reduced to 13, and ch. A1 went back to 44-50MHz. In addition, ch. A1 could be used for "community TV" only, and had a maximum power restriction of 1kW (compared to the 50kW maximum e.r.p. allowed for commercial stations using the other channels).

There was a remarkable post-war TV boom, and as more stations opened so interference problems began to arise (the FCC had allowed co-channel working with a minimum spacing of 80 miles). In addition, the ch. A6 allocation was shared with fixed and mobile services. An FCC report in May 1948 ruled against shared frequency usage, and as fixed and mobiles had to go somewhere and ch. A1 was of minimal interest to the commercial TV operators that's where they went. So to June 14th, when ch. A1 came to an end – this time the FCC refused to renumber the channels!

The next question is whatever happened to ch. E1? I hope to be able to report back with the answer shortly!

Satellite Reception at 4GHz

As some recent photographs included in this column have shown, the TV transmissions at 3·7-4GHz from the Russian Gorizont satellite can be received in the UK. Unfortunately the high cost of components for use at these high frequencies, together with a general lack of practical information, have deterred enthusiasts from attempting such reception. We are now able to report some progress in the construction of suitable equipment however, along with the news that one enthusiast successfully resolved signals from the high-power European "spot" beam and two of the other hemispherical beams on April 2nd, using relatively simple equipment. The high-power beam carried Moscow-1 programmes and the others a variety of test patterns.

The receiving equipment used consisted of a dish aerial with simple horn feed to a mixer/local oscillator followed by a 70MHz i.f. amplifier providing a gain of 25dB. The output was fed to a Sony v.h.f. receiver. Given the limitations of an f.m. signal being demodulated by an a.m. receiver, the signal quality on the spot beam was noisy but viewable. Lower quality reception was achieved on the other two channels. The horn was fitted at the focal point of the 6ft diameter dish. This result is encouraging indeed, particularly as no front-end amplification was used ahead of the loss-contributing mixer and only a single frequency conversion was employed. My own temporary (experimental) 4GHz unit, with a small 18in. diameter dish, was completed on April 4th, though at the time of writing I've not had an opportunity to try it out. By the time this is read I hope to have a more efficient system in use. The details so far are shown in Fig. 1. A stub dipole and adjustable reflector are mounted on half-inch copper pipe, with a cable running to the rear where it feeds a mixer/oscillator combination (mixer loss −5·5dB). The 70MHz output is then passed to a low-noise transistor preamplifier followed by an i.c. preamplifier with emitter-follower output. The unit is powered at 24V via the coaxial downlead.

Further research is being carried out with the intention of being able to provide details of a practical system in these pages later this year. Cost is a problem however. In this field transistors are available on a "one-off" basis only, being specially selected for their high-frequency performance. It's common to find that a single bipolar transistor or a gallium-arsenide f.e.t. is priced at over £40 plus VAT. Since two such devices are required to provide ample pre-mixer gain and a good overall system noise performance, the cost soon escalates. Anyway, stay tuned!

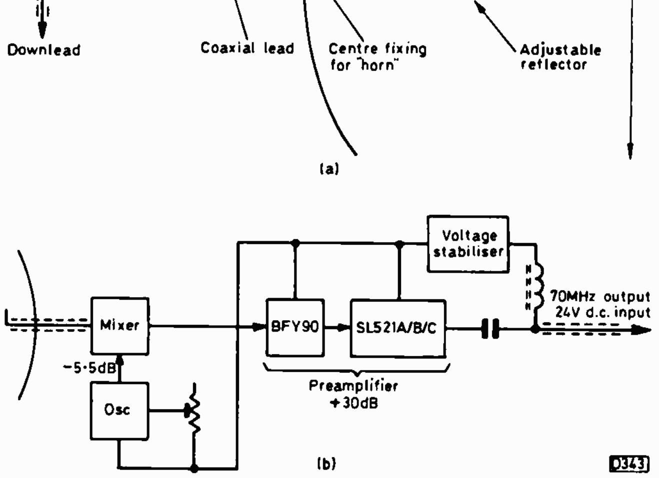


Fig. 1: Experimental 4GHz receiver. (a) Constructional details of the aerial. (b) Block diagram of the down converter.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 437 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

ITT CVC30 CHASSIS

The height is reduced at irregular intervals by four-five inches at the top and an inch at the bottom, leaving a picture approximately 10-11 inches high. This reverts to normal, sometimes at the change of a scene or channel. The loss of height is tending to increase – there are no other problems.

This sort of thing is very often caused by dry-joints around the NS raster correction transductor L32. Check the connections here, and on the phase coil L36. The whole circuit can be eliminated from the search by linking S2 and S3 on the scan coil plug when the fault is present. If the problem remains when this is done, check the field output transistors T8/9 and the bias diode D10 (BY133) – preferably by substitution.

GEC 2147

This set has the single-chip touch tuner circuit. The problem is that channel selection is erratic. The set works all right once a channel has been locked in, but changing channels is not positive. Also the neon indicators come on haphazardly – two or three at a time, with flashing from one to another.

The first step, which often clears this trouble, is to replace all six neons. If the fault remains, check voltages. There should be 190V at the junction of R675/R676, 33V at pins 1 and 8 of the i.c., and −33V at the junction of R678 and the 33V stabiliser. Suspect components are R663 (5MΩ) and R675 (12MΩ). Check also for 0-33V at pin 1 of plug 38 when each tuning potentiometer is adjusted. Suspect D674 if this is not obtained.

ITT CVC9 CHASSIS

There are two faults on this set. First, there's a ripple on the verticals when there is movement in the picture. This ripple is not accompanied by a hum bar and extends right across the screen. The degree of ripple depends on the brightness of the scene – the brighter it is the greater the ripple. The second fault is black smearing after anything bright. This varies with the contrast control setting.

Concentrate on the smearing problem first, checking around the luminance circuitry – check the decoupling capacitor C131d (0·01μF), the coupling capacitor C138d (2·2μF), and the d.c. conditions around transistors T21d and T23d. The TDA1327A demodulator/matrixing i.c. could be responsible, but this is unlikely. If the pulling effect is still present after curing the luminance problem check R330f (3·3MΩ) in the sync separator circuit and the following items in the a.g.c. circuit: the amplifier transistor T41d, the gating diode D45d, and the gating pulse coupling capacitor C235d (0·01μF).

JOINING TAPES

Your advice on joining tapes would be appreciated. I know that this is not recommended, as the heads can be damaged, but am thinking mainly of "cherished" tapes that would only occasionally be played.

We would only recommend tape joints where an undamaged section is to be connected to a leader. This ensures that the join does not pass through the transport mechanism or around the head drum. The reason for avoiding this is that the heads may be damaged or clogged by a joined tape while the join may not stand up to the sharp angles of the transport mechanism, leaving bits of adhesive etc. on the heads and guide rollers. A small piece of half inch Sellotape can be used, trimmed flush with the tape at the top and bottom. It's essential that none of the adhesive side of the tape shows. Make the join at 90° to the tape.

THORN 1591 CHASSIS

The problem is lack of width with hum on the sound – the picture is about an inch short at each side. Reducing the brightness control setting until the screen just about blacks out clears the hum. The l.t. rail is correct at 11·6V and the smoothing is o.k. The video supply line is low at 85V instead of 95V and the l.t. fuse has blown several times.

The fault is due to a heavily-loaded line output transformer drawing excessive current. The low video supply voltage suggests that W14/C11 could be responsible, but there are other possibilities. Monitor the 95V rail with the e.h.t. stick removed: if it returns to 95V the stick is suspect, especially if the stick feels warm after a run (switch off before feeling it!). Other things to check if necessary are the line output transistor VT26, the boost diode W11, and W13/C110 (first anode supply). If all these items are o.k., the line output transformer probably has shorted turns.

RANK T20 CHASSIS

There is a power supply fault on this set. The power supply module has been removed and is being tested with two 60W bulbs as a load. The h.t. fuse 7FS1, the chopper transistor 7VT2 and the control thyristor 7THY1 keep blowing however. Zener diode 7D13 was found to be short-circuit and 7R15 open-circuit, but I'm reluctant to proceed in case of blowing further components. Is there any equivalent for the crowbar thyristor 7THY2 (type S2062D)? And why is the h.t. fuse an HRC type?

The fact that 7D13 was short-circuit and 7R15 open-circuit suggests that the output voltage could be excessive. We suggest you replace 7VT2 and 7THY1 (these should always be replaced as a pair), check the control transistor 7VT1, the crowbar components 7THY2/7R15 and the h.t. rectifier 7D1 (for leakage), turn down the set h.t. control 7RV2 and replace the components in the snubber network across the chopper transistor (7C9/7R11/7D10) before switching on again. It would be a great advantage to use a variac so that the mains input can be increased gradually whilst monitoring the current. A BRC4443, BT116 or OT112 will do in the 7THY2 position; 7FS1 should be an HRC type since being downstream from the h.t. reservoir capacitor it will provide faster protection than an anti-surge type.

TUNER TROUBLE

I've got much the same elusive trouble with three tuner units – two in Thorn 2000 chassis and the other in a Beovision 3400 chassis. The problem is that the tuners won't produce signals at the lower end of Band IV. They work reasonably at the higher frequencies, though the screen is flooded with noise at all frequencies (as if the aerial had been disconnected). With the Beovision set a weak, noisy signal is visible on say ch. 23 even though 2mV is going in: if the relevant pushbutton is adjusted slightly the unit will attempt to function normally (noise free) but reverts to noisy operation when the button is left alone. On the 2000s complete failure at the l.f. end of the band was preceded by occasional sudden loss of signals – operating the pushbutton would restore the signals. I've resoldered all joints and earthing points, confirmed correct voltages, cleaned the rotor earthing clips and relubricated them. Both transistors in the u.h.f. department of the 2000 tuners have been replaced.

The measures you've taken usually cure this type of trouble. Occasionally a cracked decoupling capacitor can be responsible – the surface mounting type such as C12 and C32 in the Thorn tuner. More often however attention to the rotor earthing will cure the problem – we've sometimes found it necessary to virtually remove the rotor, scrub the earthing springs in solvent, retension them then reassemble with a smear of silicone grease.

GEC 2040

There's lack of brightness on this set, with the beam limiter transistor apparently on. Disconnecting the slider of the brightness control from the PL802's control grid circuit (by lifting PC7 on the luminance/CDA panel) produces an over-bright picture. There's a 2V peak-to-peak waveform at the cathode of the PL509 line output pentode (the beam limiter sensing point).

That 2V peak-to-peak waveform indicates that the PL509's cathode decoupling electrolytic is open-circuit – this will lead to the symptoms described. The capacitor is C529 (200μF): it's not where you might expect to find it, being over on the timebase panel.

THORN 9600 CHASSIS

The picture is good and clear, but on dark scenes the ghosts of other channels can be seen, together with broad vertical bars and a slight horizontal line – the set has only recently been installed. I had to adjust the a.f.c. detector coil L111 to get the a.f.c. working properly (same picture with the defeat button in or out) and wonder whether this could be connected with the fault?

The fault is unlikely to be connected with your a.f.c. adjustment. The symptom is cross-modulation, and is usually due to excessive signal input. Remove any signal preamplifying equipment you may have, then try turning down the a.g.c. crossover preset R127 on the signals panel. If this doesn't remove the effect, fit a 6 or 12dB attenuator at the aerial input to the set.

NATIONAL TC85G

There's a good colour picture except on the left-hand side where there's a dark shadow about 3in. wide. On dark scenes this almost blocks out that part of the picture. The fault is also present on monochrome.

The 220V supply for the video output stages in this chassis is derived from the line driver transformer, via rectifier D504. It's likely that this rectifier's reservoir capacitor C514 (4·7μF, 350V) has failed. If replacement of this item fails to cure the problem, check the first anode supply reservoir capacitor C518 (0·1μF, 1kV) and the 24V supply reservoir/smoothing capacitors C523 and C524 (both 330μF, 35V).

BUSH BC6004

The problem with this colour portable is excessive e.h.t. – so much so that the final anode cap is burning up. A new tripler (exact replacement) has been fitted and the h.t. voltage reduced to minimum, but the trouble persists until the over-voltage circuit shuts the set down. All other line output stage derived voltages are about right, and the Aquadag earthing strap is in order. The e.h.t. lead on the original tripler was burnt to a cinder!

While the line output transformer could be faulty, it seems more likely that the flyback tuning is incorrect. Suspect capacitors are C688 (0·0013μF), C839 (0·0075μF) and C840 (0·036μF).

THORN 9800 CHASSIS

The colour gradually deteriorated, becoming flat and washed out with incorrect blue, while at about the same time colour was lost over a three inch band at the left-hand side. Resetting the reference oscillator frequency control R210 corrected the flat, incorrect colour, but the monochrome strip remains. The decoder i.c.s have been replaced, and the fault has been isolated to the signals panel since fitting this in another set takes the fault with it. No voltage discrepancies can be found.

We suspect a problem with the decoder's line pulse phasing circuit – transistor VT115 and the associated components. The key waveform is no. 13 at TP6: if it's distorted, check W105/6, C213 etc., and if necessary set up L116 according to the instructions in the manual.

DECCA 100 CHASSIS

The trouble with this set is weak field hold. The TBA920 sync/line oscillator i.c. has been replaced but the problem remains.

The most likely suspect is R302 (1·2MΩ) which provides the sync separator within the i.c. with bias. Other suspects are C322 (100μF) which decouples the supply to the field oscillator stage, and Tr301 (BC147B) and D302 (1N4148) in the field sync pulse integrating stage.

ITT CVC2 CHASSIS

There are two faults on this set. First lack of width, with poor e.h.t. regulation – replacing the line timebase valves has failed to improve matters. Secondly the focus is poor. The focus control has some effect, but not enough, operation of the brilliance control making the whites flare even more. The voltage at the c.r.t.'s focus pin seems to be only about 1·5kV – the resistors in the focus network are of the correct value however.

For the width fault, check the two 8·2MΩ resistors Rh40 and Rh44 in the PL509's control grid circuit. They are on a subpanel by the line output transformer. If necessary check for shorted turns in the shift choke Lh18.

For the focus fault, reduce the brightness and attempt to focus the picture. If you do not pass through a point of focus (look at the scanning lines), check resistor Rb1 and clean the focus spark gap – these items are on the c.r.t. base. If you can find a point of optimum focus, your

1·5kV reading will be due to meter loading and the cause of the poor picture will be elsewhere: excessive flaring to the right suggests that the luminance output transistor TXf1 is working under the wrong d.c. conditions.

TEST CASE

234

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.

A while ago we were asked to pay a home visit to an Ekco colour receiver. Now an Ekco colour receiver can mean many things, depending on the vintage of the set concerned. The model number quoted by the customer, CT822, didn't mean much without a model/chassis chart, but we were encouraged to hear that the set was dead – dead sets are the easiest to put right, aren't they?

Hoping that he wasn't going to get involved with PD500s and cable-operated system switches, a junior technician departed for the address given. He was relieved to find a relatively modern set awaiting his attention, and soon recognised it as a Pye 725 chassis, one with which he was reasonably familiar.

He switched on and confirmed that there were no signs of life. So out came the trusty neon for a quick check on the readily accessible h.t. surge limiter/filter resistor assembly (the "dropper"). The neon lit brightly on all tags, but not on the downstream side of the h.t. fuse F971, which is rated at 800mA. The technician switched the set off and removed the open-circuit fuse from its holder – his first mistake! The reservoir and smoothing electrolytics were fully charged, and in the few moments since he'd switched off they'd had no time to discharge via the only path available (R920 47kΩ and the 7·5V zener diode D884). So it was that he received a violent shock, which did little for his composure or the customer's confidence.

After some minutes the process of diagnosis was resumed, by connecting a meter on its 0-1A range across the now feared and hated fuse clips. The mains was reapplied, whereupon the meter banged over to its stop at full-scale deflection. A check of the resistance across the h.t. line was the next step. The result: between 1 and 2kΩ one way round, high and rising the other way round. Having confirmed that there were no shorts, the technician went on to check the two zener diodes in the BU208 line output transistor's emitter circuit and the EW modulator/l.t. rectifier diode D585. All was well here, so the awkward screening can over the line output stage assembly was removed and, as a first step in line output transformer load shedding, the tripler was disconnected.

When power was restored, the current consumption returned to normal and the tube's heaters lit up (they are fed from a winding on the LOPT). Gold first time! With extreme caution, and a stick of firewood lent him by the customer, our technician removed the e.h.t. cap (not a volt on it, as it turned out!) and the old e.h.t. tripler. In went a new "universal" type, taking great care not to transpose the connections to SK630. Reassemble, fit new fuse and switch on. Within a second the new fuse blew. Our man rechecked his tripler connections, and then confirmed that the current consumption returned to normal when the new tripler was disconnected. Was the new tray faulty? Or the LOPT dud? See next month!

ANSWER TO TEST CASE 233 – page 381 last month –

Our confidence took a knock last month when we had to spend the best part of a day in and around the field timebase section of an ITT colour set fitted with the CVC5 hybrid chassis. The symptoms, as you may recall, were weak field sync and poor, temperature-dependent linearity. We'd started off by being logical about it, subsequently sank to the point of changing various possible suspect components on spec, and in the continuing presence of the fault finally became desperate and started measuring in-circuit resistance readings around the timebase with an ohmmeter. This was in fact our salvation! Why hadn't we started by muddling around like this?!

With the PCL805 removed, we found that the resistance between pin 9 of the base (pentode control grid connection) and chassis was about 500kΩ. This was the clue. The grid leak resistor R347 is 1MΩ, and we'd already checked him and the three capacitors which could have been leaky to upset this reading. There's only one other significant connection to this point – the screened lead to the "field collapse" section of the service switch. This lead had been leaning up against the hot envelope of the PCL805 and was charred: a temperature-dependent leak of about 1MΩ had developed between the inner conductor and the braid. It's strange to think that a moment's carelessness in manufacture or servicing could lead to so much trouble later. Another item for our little black museum ...

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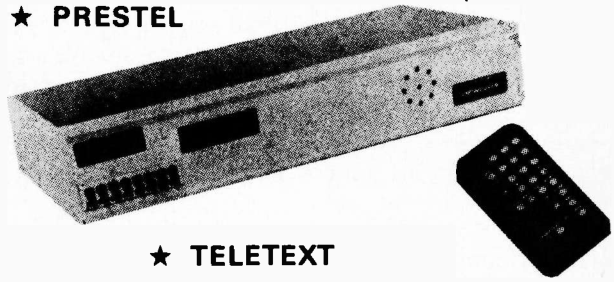

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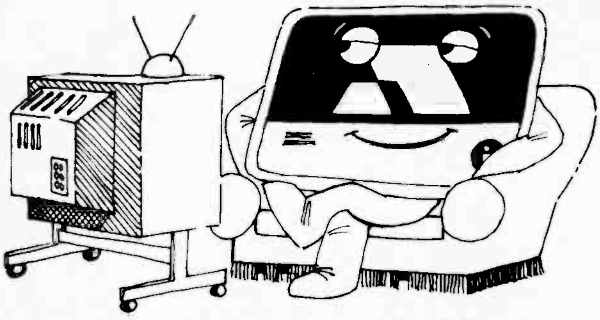

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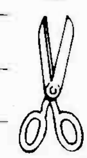

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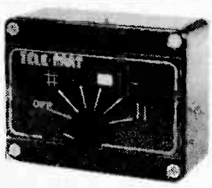

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But if you find one that, in your opinion, is wrong in some way, please write to us at the address below.

We'd like you to help us keep advertising up to standard.

The Advertising Standards Authority.
A.S.A. Ltd., Brook House, Torrington Place, London WC1E 7HN.

DISPLAY ELECTRONICS

LEADERS IN TUBE TECHNOLOGY SINCE THE 60's.

REGUNNED COLOUR TUBES
2 YEAR GUARANTEE

Up to 19″	£33.00
22″	£36.00
26″	£39.00

The above prices are for standard 38mm Delta Gun Types. Add £3 Gun surcharge for 20AX Types. Other in-line & P.I.L. Types, prices on application.

MONO TUBES
2 YEAR GUARANTEE

20″	£12.00
24″	£14.00

BUDGET CORNER

Buy any 5 mixed types Cash 'n Collect – Take 20% discount.

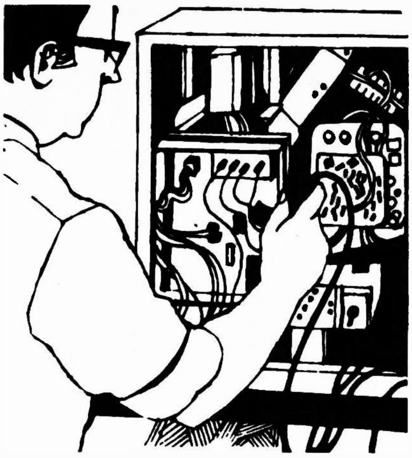
PRICES EXCLUDE VAT

CALLERS WELCOME

Late night Thursdays until 8pm
Saturdays until midday.

N.B. Customers intending to collect orders are requested to telephone in advance:— even popular types may be out of stock for short periods.

WATERLOO ROAD, UXBRIDGE, MIDDLESEX
Telephone: Uxbridge 55800



SMALL ADS

The prepaid rate for classified advertisements is 29p per word (minimum 12 words), box number 60p extra. Semi-display setting £5.64 per single column centimetre (minimum 2·5 cms) All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

Whilst prices of goods shown in classified advertisements are correct at the time of closing for press, readers are advised to check with the advertiser to check both prices and availability of goods before ordering from non-current issues of the magazine.

When replying to Television Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.

(B) That you have enclosed the right remittance.

(C) That your name and address is written in block capitals, and

(D) That your letter is correctly addressed to the advertiser.

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

SETS & COMPONENTS

SETS & COMPONENTS CONTINUED

TELEVISION

Trade Supplies of Good Quality Colour & Mono TV's. Most Makes available, suitable for Sale or Re-Rent.

GENERAL FACTORS
UNION STREET
DONCASTER
(0302) 49583 68416

GOOD MOTORWAY ACCESS

SERVICES

WOODSPRING TV SERVICES

Selling or want to sell video but worried about after-sales service?

WE CAN HELP

We provide a fast, efficient and reliable service for VHS, Beta and V2000 throughout the Midlands and South West

For details write to:
Box No. 170.

WANTED

WANTED! Tube regunning plant. Complete system with full training. Yosipovich, 106 Morkel Rd., Lyndhurst 2192 JHB. South Africa.

WANTED TELEVISION MAGAZINES Jan 1972 to Feb 1982. Must be in good condition. Telephone Rotherham 548334 evenings.

TELEVISION ENGINEER (40) seeks position in West Country, Bradbury, 7, Millpool Road, Heannesford, Staffs. (05438) 71932.

WANTED AVO 8, B8K Rejuvenator, colour bar generator etc. Phone Malcolm Watson, Cambridge 68210 or evenings 249913.

COMPONENTS, EQUIPMENT, Spare parts etc. to start a television and V.C.R. repair business. Please Telephone Letchworth 2655.

TRANSISTORISED DUAL TRACE OSCILLOSCOPE 10/15 meg wanted. Tel. Newcastle 0632 857997.

COURSES

VIDEO RECORDER TRAINING COURSES. Due to overwhelming demand, Mrs. Beeching has had to quickly organise yet another two more courses. On 24th and 25th July, and 18th and 19th Sept. 1982. Those people who did not get on the April course, please book immediately. All others please contact her at: Newark Video Centre, 108 London Road, Balderton, Newark, Notts. Tel. (0636) 71475.

MISCELLANEOUS

BRISTOL WHOLESALE TELEVISION Mono T.V.'s from £5. Colour T.V.'s Pye, GEC, Philips, RBM, ITT, from £25. Phone Bristol (0272) 556735. 47 West Street, Old Market, Bristol.

SECOND HAND COLOUR TV SPARES AND TUBES
MOST MAKES
Telephone:
Southport (0704) 74411
anytime

BURGLAR ALARM EQUIPMENT. Latest Discount catalogue out now. Phone C.W.A.S. Alarm. 0274 682674.

CENTURION BURGLAR ALARM EQUIPMENT. Send SAE for free list or a cheque/PO for £11.50 for our special offer of a full sized signwritten bell cover, to: Centurion Dept. T.E.L., 265 Wakefield Road, Huddersfield, W. Yorkshire. Access & Barclaycard telephone orders on 0484-35527.

TELETEXT (Oracle/Ceefax) and viewdata (Prestel) add-on adaptors for your existing television or microcomputer. Mail order. Trade enquiries welcome. Tel. Bristol (0272) 502008.

EDUCATIONAL

TELEVISION COMPUTER RADIOCOMMUNICATIONS & RADAR SERVICING

2¼ YEAR full-time Modular Diploma course to include a high percentage of practical work.

- ELECTRONIC PRINCIPLES (1st)
- ELECTRONIC PRINCIPLES (2nd)
- MONOCHROME TV
- COLOUR TV, CCTV & VCR
- MICROELECTRONICS & DIGITAL TECHNIQUES
- MICROPROCESSORS & COMPUTERS
- RADIOCOMMUNICATIONS & RADAR

Each of the above Modules are 13 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.

Subject to approval, students will be awarded a TEC Diploma in Electronics & Communication Engineering on completion of the full course.

Next session starts September 13th.

Prospectus from:

LONDON ELECTRONICS COLLEGE

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

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

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

NAME..
ADDRESS..
....

Send to: Classified Advertisement Dept.
TELEVISION
Classified Advertisement Dept., Room 2612, King's Reach Tower, Stamford Street, London SE1 9LS. Telephone 01-261 5846.
Rate
29p per word, minimum 12 words. Box No. **60p** extra.

SERVICE SHEETS

Thousands of different full size service sheets **Thousands of different manuals of all kinds in stock.**
(Many of above are unique to us and obtainable nowhere else.) Any published single service sheet still only £1 + s.a.e.
British CTV circuit/layouts from dual to latest from Decca, G.E.C., ITT, Philips, Pye, Rank, Thorn, etc.
Continually updated – 3 giant binders only **£39.50** – latest update includes Thorn 9200 to 9800.
Revised foreign C.T.V. Repair System in 2 huge binders plus 3 Repair Manuals for £39.50.
Contains chassis from Grundig, Hitachi, Korting, Kuba, Luxor, Mitsubishi, National P., Nordmende, Sharp, Skantic, Toshiba, Zanussi.
Any Repair Manual only £6.50 for the first – £6 each thereafter.
Save £6.50 on complete set of 11 unique TV repair manuals – only £60. Mono +colour from dual standards to recent sets, McCourt & Tunbridge.
***NEW* Tunbridge Portable Mono TV Repair Manual – Pre Publishing Offer at £5.50 each (save £1).**
***NEW* Full details HOW TO BUILD YOUR OWN TRANSISTOR/DIODE TESTER – price £1.50 post free.**
S.A.E. any quotation, also price lists, newsletter, bargain offers, details of our unique TV repair systems. Service sheets and all stock manuals by return of post.
Phone: 0698 883334, anytime. Callers 4–6 pm. weekdays, Saturdays 11 am.–1pm only.

G.T. TECHNICAL INFORMATION SERVICE
76 CHURCH ST., LARKHALL, LANARKSHIRE ML9 1HE.

30,000 SERVICE SHEETS IN STOCK. COLOUR MANUALS ALSO AVAILABLE

TV Monos, Radios, **£2.00**. Tuners **£2.00**. Tape Recorders, Record Players **£2.00**. Transistors, Stereograms & Music Centres **£2.00** + SAE. Also Colour Available. Car Radios **£3.00** + SAE. All Radiograms **£2.00**. State if Circuit will do if sheets are not in stock. All TV Sheets are full-length 24×12, not in Bits & Pieces. All other Data full-lengths.
TV Catalogue with order. All Sheets **£2.00** except Colour. Old Valve Radios
MAIL ORDER S.A.E.
C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX. 01-458 4882

SANDHURST PUBLICATIONS

Television Service Sheet Specialists

Workshop Manuals, large selection of Japanese and European TV Sheets. Callers 5.30-7.00 pm. Send S.A.E. for Catalogue and Enquiries:

49C Yorktown Road,
Sandhurst, Camberley, Surrey GU17 7AG.

FOR SALE

AVO VALVE CHARACTERISTIC METER later model. Good working order. Highest offer. 01-907 1026

EX EQUIPMENT TV PANELS and spares. SAE to: 3, Rosebery Road, Smethwick, Warley, West Midlands B66 3RY.

THORN 3000 PANELS, complete untested £3 each. 01-673 6621 after 4 p.m.

AVOMETER MODEL 8 MARK 5 in case, in perfect condition £40. Telephone 021-421 6512 evenings. M. Bradley, 10, Stenmels Avenue, Lopal, Halesowen B62 8QJ.

PERSONAL

T.V. ENGINEER, 27, presently service manager, seeks position coastal/country area, eight years experience all makes of T.V. Video/Audio, own car, some capital. Wife able to assist if necessary, full/part time. Box No. 169.

FREELANCE Colour Service Engineer available for Contract work in West/South Yorkshire. Own w/shop and equipment. Mr. Pearson. 0484-863489.

BOOKS & PUBLICATIONS

ANY PUBLISHED SERVICE SHEET £1 + S.A.E. Thousands different repair/service manuals/sheets in stock. Repair data your named TV £6.50 (with circuits £8.50). S.A.E. Newsletter, price lists, quotations. AUST, 76 Church Street, Larkhall, Lanarkshire. (0698 883334).

VETERAN & VINTAGE

"SOUNDS VINTAGE"

The only magazine for all vintage sound enthusiasts, packed with articles by top writers, covering gramophones, phonographs, 78s, wireless, news, history reviews, etc.
All back numbers to No. 1 available. Send 75p for sample copy.
28 Chestwood Close, Billericay, Essex

PLEASE MENTION TELEVISION WHEN REPLYING TO ADVERTISEMENTS

EMO – EUROSONIC – GRUNDIG – TELETON + ALL BRITISH MAKES ETC., ETC. ● ALL SPARES READILY AVAILABLE ●

IMMEDIATE CREDIT AVAILABLE—TRADE ONLY
(Written details on application)

Almost any TV Component supplied by return "off the shelf" e.g. LOPTX – EHT trays – droppers – OSC coils – switches – cans – smoothers – I.C.'s, etc., etc.

YOU CAN BE 95% SURE WE CAN SUPPLY ANY TV COMPONENT BY RETURN
IF YOU NEED SPARES FAST – RING NOW!
Applies to U.K. only.

ACCESS AND BARCLAYCARD ACCEPTED. S.A.E. FOR FREE WALL CHART

TELE-PART (WTON) THE TELECENTRE, WORCESTER ST., WOLVERHAMPTON (0902) 773122

MAIL ORDER ADVERTISING

British Code of Advertising Practice
Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfill orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

Mail Order Protection Scheme
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:
(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.
Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.
We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.
This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded."

N.G.T. COLOUR TUBES

First Independent Rebuilder with

B.S.I. CERTIFICATION
(Certificate No. 004)

2 year guarantee: 4 year option

All Colour Tubes are debanded, high temperature pumped and rebanded using new adhesives and new tension band.
19" **£30,** 20" **£32,** 22" **£33,** and 26" **£38.**
No exchange tube required on delta types.

N.G.T. ELECTRONICS LTD.,
120, SELHURST ROAD, LONDON S.E.25
Phone: 01-771 3535.
20 years experience in television tube rebuilding. *add VAT at 15%*