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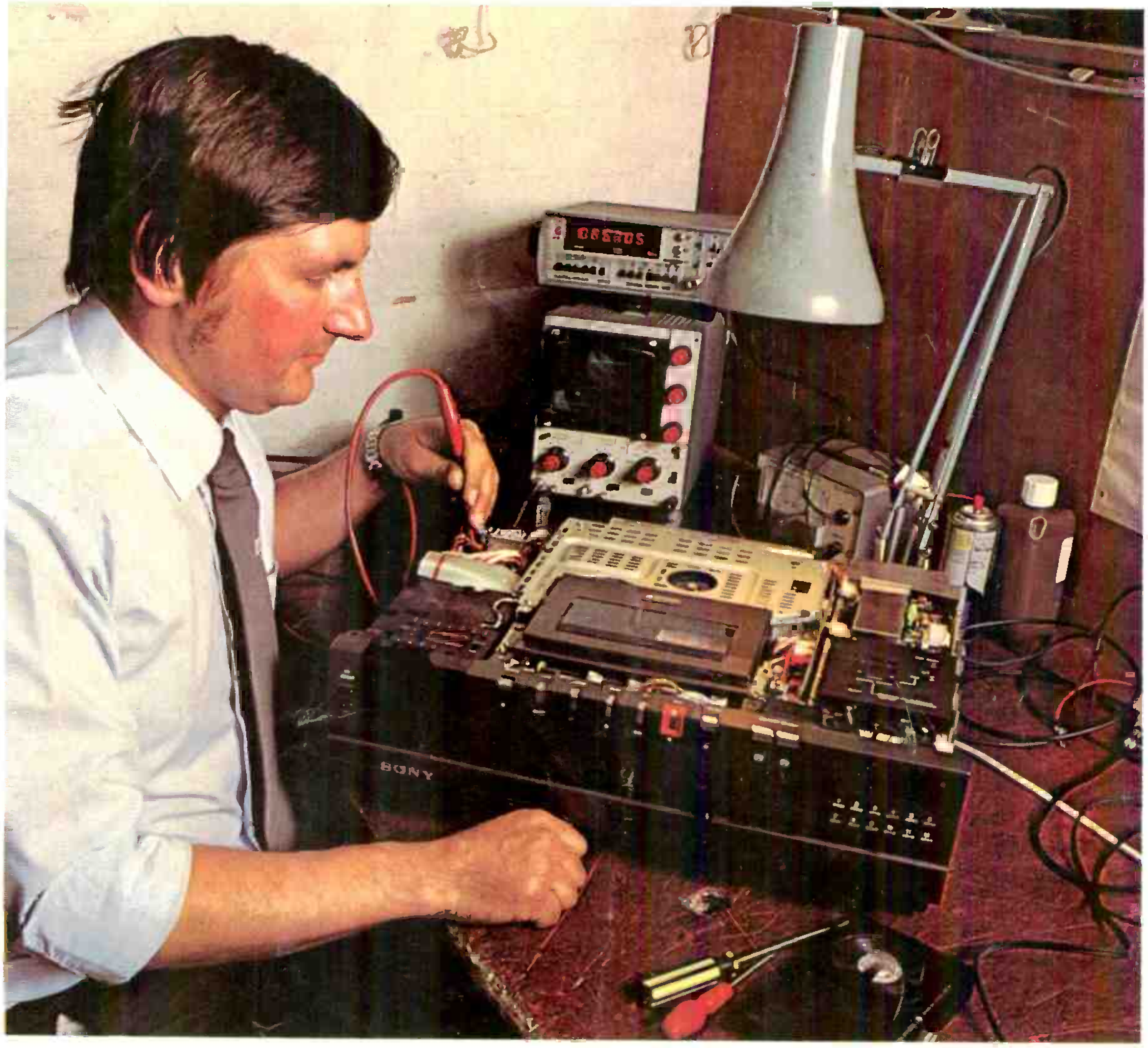
SEPTEMBER 1981

70p

TELEVISION

SERVICING · VIDEO · CONSTRUCTION · DEVELOPMENTS



New Series : VCR SERVICING

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RADIO & TV COMPONENT DISTRIBUTORS

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SEMICONDUCTORS

AA113	0.16
AA116	0.16
AA117	0.16
AA119	0.16
OA91	0.12
OA95	0.12
OA202	0.18
BA100	0.18
BA102	0.10
BA130	0.15
BA154	0.10
BA155	0.20
BA164	0.12
BAX13	0.16
BAX16	0.08
BAY38	0.16
BY206	0.20
IN4148	0.04
BY126	0.20
BY127	0.15
BY133	0.22
BY164	0.50
SK82/08	1.00
BY238	0.15
BYX10	0.18
IN4001	0.10
IN4002	0.10
IN4003	0.12
IN4004	0.12
IN4005	0.12
IN4006	0.14
IN4007	0.16
IN5407	0.33
BR100	0.30
BR101	0.60
BRY39	0.60
TIC1160N	1.50
BT119	2.00
BT120	2.00
BYX/71/600	0.80
2N444	1.50
TV106/2	1.50
BYX88 2V7	0.10
BZY88 3VO	0.10
BZY88 3V3	0.10
BZY88 3V6	0.10
BZY88 3V9	0.10
BZY88 4V3	0.10
BZY88 4V7	0.10
BZY88 5V1	0.10
BZY88 5V6	0.10
BZY88 6V2	0.10
BZY88 6V8	0.10
BZY88 7V5	0.10
BZY88 8V2	0.10
BZY88 9V1	0.10
BZY88 10V	0.10
BZY88 11V	0.10
BZY88 12V	0.10
BZY88 13V	0.10
BZY88 15V	0.10
BZY88 18V	0.10
BZY88 20V	0.10
BZY88 22V	0.10
BZY88 27V	0.10
BZY88 33V	0.10
BZX61 7V5	0.20
BZX61 8V2	0.20
BZX61 9V1	0.20
BZX61 10V	0.20
BZX61 11V	0.20
BZX61 12V	0.20
BZX61 13V	0.20
BZX61 15V	0.20
BZX61 16V	0.20
BZX61 18V	0.20
BZX61 20V	0.20
BZX61 22V	0.20
BZX61 24V	0.20
BZX61 27V	0.20
BZX61 30V	0.20
BZX61 33V	0.20
BZX61 36V	0.20
BZX61 39V	0.20
BZX61 47V	0.20
BZX61 72V	0.20
AC107	0.35
AC127	0.50
AC127/01	0.60
AC128	0.60
AC128/01	0.60
AC141	0.50
AC141K	0.60
AC142	0.40
AC142K	0.60
AC176	0.60
AC176/01	0.60
AC186	0.40
AC187	0.40
AC187K	0.60
AC188	0.40
AC188K	0.60
AD140	1.50
AD142	1.50
AD143	1.50
AD145	1.50
AD149	1.00
AD161/2	1.50
AD162	0.70
AD262	1.50
AF121	0.60
AF124	0.60
AF125	0.60
AF126	0.60
AF127	0.60
AF139	0.60
AF239	1.00
AL102	3.00
AU107	3.00
AU110	3.00
AU113	3.00
AL103	3.00
AY102	3.00
BC107	0.20
BC108	0.20
BC109	0.20
BC113	0.15
BC114	0.15
BC115	0.20
BC116	0.20
BC117	0.20
BC118	0.20
BC119	0.50
BC125	0.20
BC126	0.20
BC136	0.20
BC137	0.20
BC138	0.40
BC139	0.40
BC140	0.40
BC142	0.40
BC143	0.40
BC147	0.15
BC148	0.10
BC149	0.15
BC153	0.15
BC154	0.15
BC157	0.15
BC158	0.15
BC159	0.15
BC160	0.40
BC161	0.40
BC170	0.15
BC171	0.15
BC172	0.20
BC177	0.20
BC178	0.20
BC179	0.20
BC182L	0.15
BC183L	0.15
BC184L	0.15
BC184LC	0.15
BC186	0.30
BC187	0.30
BC203	0.15
BC204	0.15
BC205	0.15
BC206	0.15
BC207	0.15
BC208	0.15
BC209	0.15
BC212L	0.15
BC213L	0.15
BC214L	0.15
BC225	0.40
BC237	0.15
BC238	0.15
BC251A	0.15
BC301	0.40
BC303	0.40
BC307	0.15
BC308	0.15
BC327	0.15
BC328	0.15
BC337	0.15
BC338	0.15
BC547	0.15
BC141-10	0.80
BD115	0.50
BD124	1.80
BD131	0.70
BD132	0.60
BD133	0.70
BD134	0.70
BD144	2.50
BD159	0.80
BD238	0.50
BD380	0.70
BD441	0.70
BD537	0.70
BD538	0.70
BD507	0.70
BD508	0.75
16181	1.20
16182	1.20
BD709	1.00
BD710	1.00
BD442	0.70
BD379	0.50
BF115	0.60
BF118	0.60
BF152	0.40
BF154	0.20
BF157	0.70
BF158	0.40
BF160	0.60
BF163	0.60
BF167	0.50
BF173	0.50
BF177	0.50
BF179	0.50
BF180	0.50
BF181	0.60
BF182	0.50
BF183	0.50
BF184	0.50
BF185	0.50
BF194	0.20
BF195	0.20
BF196	0.20
BF197	0.20
BF198	0.15
BF199	0.15
BF200	0.15
BF224	0.15
BF240	0.45
BF241	0.20
BF256LC	0.50
BF257	0.50
BF258	0.50
BF271	0.60
BF273	0.20
BF274	0.25
BF336	0.50
BF337	0.50
BF338	0.50
BF355	0.80
BF458	1.00
BF459	1.00
BFT43	0.50
BFX29	0.50
BFX84	0.50
BFX88	0.50
BFX89	0.50
BFY50	0.50
BFY51	0.50
BFY52	0.50
BFY90	1.20
BF381	0.50
BFR39	0.30
BFR79	0.30
BFR81	0.30
BFR89	0.50
BF259	0.25
BDX32	2.50
BU206	1.60
BU208/02	2.80
BU326S	1.00
BU406	2.00
BU406D	2.50
BU407	1.70
BU407D	2.50
R2008B	2.50
R2010B	2.50
R2540	3.00
ME0402	0.20
ME0412	0.20
ME4003	0.15
ME6002	0.20
ME8001	0.20
MJE2955	1.50
MJE3005	1.30
MP8113	1.00
MPSU05	1.20
MPSU55	1.20
TIP2955	1.30
TIP3055	1.30
TIS90M	0.30
2N2904	0.50
2N2905A	0.50
2N2905	0.50
2N3053	0.50
2N3703	0.20
2N3075	0.20
2N3710	0.20
2N3055H	0.60
TAA350	0.80
TAA550	0.50
TAA570	1.80
TAA611	1.75
TAA630S	2.50
TAA661B	2.00
SN76540N	1.50
TAD100	2.00
TBA120AS	0.75
TBA231	1.20
TBA480Q	2.20
TBA520Q	2.00
TBA530	2.00
TBA530Q	2.00
TBA540	2.20
TBA540Q	2.20
TBA550	3.00
TBA550Q	3.00
TBA560C	2.20
TBA560CQ	2.20
TBA570	2.50
TBA570Q	2.50
TBA641BX	3.00
TBA641B11	4.00
TBA651	3.00
TBA720A	1.50
TBA730	1.50
TBA750	2.00
TBA750Q	2.00
TBA800	1.00
TBA810S	1.50
TBA820	1.50
TBA920	2.00
TBA920Q	2.00
TBA990	2.00
TBA990Q	2.00
TCA2205A	3.00
TCA900	1.00
TCA940	2.00
TDA1170	2.00
TDA1200	3.00
TDA1270	4.00
TDA1412	1.00
TDA2020	4.00
SN76115N	2.00
SN76227N	1.20
SN76530P	1.00
SN76651N	1.50
SN76003N	3.00
SN76013N	2.00
SN76013NO	2.00
SN76013ND	2.00
SN76023N	2.00
SN76023ND	1.00
SN76033N	2.00
SN76110N	2.00
SN76226DN	2.00
SN76227N	1.20
SN76532N	2.00
SN76533N	2.00
SN76544N	2.00
SN766504	1.00
SN76665N	1.50
SN76666N	1.20
SL901B	6.00
SL917B	8.00
TBA396Q	2.00
TDA440	2.50
SN76001N	1.50
TBA520	2.00
TBA120S	1.00
TBA396	2.00
TCA270SQ	2.00
TDA2030	8.00
TDA2140	6.00
TDA2150	6.00
TDA2160	6.00
TDA1230	3.00
TDA3089	2.00
TDA1054M	2.00
MC1349P	1.50
SAA661	0.60
SAS560S	2.00
SAS570S	2.00
SN7400N	0.40
SN7413N	0.90
SN74122N	1.00
SN74141N	1.00
TBA395	1.80
TBA395Q	1.80
TBA950	4.00
TCA800	4.00
TCA800Q	4.00
TDA1180	3.00
TDA1190	3.30
TDA20C2H	3.60
TDA2590Q	5.00
TDA2600	5.00
TDA2640	3.30
TDA3950	3.00
TAA621 AX1	3.30
TBA625X5	2.00
TCA83CS	2.00
TDA2020/A2	5.00
TDA2020P	5.00
TDA2030V	3.60
TDA2010/BD2	4.50
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DY/86/87	1.30
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ECC82	1.40
ECC84	1.20
ECH83	1.10
ECH84	1.10
ECL80	1.10
ECL82	1.10
ECL86	1.10
EF80	1.10
EF95	1.50
EF183	1.70
EF184	1.60
EL34	3.00
EL84	2.00
GY501	3.00
PC97	1.50
PC900	1.50
PCF80	1.74
PCF802	1.60
PCF806	1.10
PCL82	1.70
PCL84	1.80
PCL85/805	1.90
PCL86	1.90
PD500/510	5.00
PFL200	2.60
PL36	2.60
PL81	1.50
PL504	2.50
PL508	2.50
PL509	4.00
PL519	5.00
PL802	3.00
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PY500A	2.80
PY800/801	1.70
UCL82	1.10
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PCF805	1.20
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Bush A 774 Lopt	18.00
Bush Q823 Lopt	5.00
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A823 Bush Power Panel	20.00
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DECCA CS 1910/2213 Tripler	6.67
DECCA 30 Series Tripler	6.01
DECCA 80 Series Tripler	6.43
DECCA 100 Series Tripler	6.68
GEC Hybrid 2028 Tripler	6.43
GEC 2110 Tripler Pre JAN77	7.21
GEC 2110 Tripler Post JAN77	6.43
ITT CVC 5/8/9 Tripler	6.51
ITT CVC 20/25/30	6.45
Philips 520 Tripler	6.51
Philips 550 Tripler	6.42
Philips G9 Tripler	6.63
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RRI Z179/823	6.68
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DECCA 80/100 400/350 + 800/250	4.00
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GEC Philips G8 600/300	2.50
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PYE 1000 1000/40	0.90
PYE 731 800/250	2.50
RRI 2500-2500/30	1.30
RRI 600/300	2.50
RRI 300 + 300/300	2.50
TCE 950 100 300 100 16	1.00
TCE 1400 150 100 100 100 150	3.70
TCE 1500 150 150 100	2.10
TCE 3000/3500 175/400 + 100 + 100/350	2.70
TCE 3000/3500 600/70	1.00
TCE 3000/3500 220/100	0.70
TCE 8000/8500 2500-2500/63	1.50
TCE 8000/8500 700/200	1.00
TCE 8000/8500 400/350	1.00
TCE 9000 400/400	3.00
TCE 9500 220/400	2.20

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TCE 140 12R + 16, IK7 + 116 + 462, 126	1.16
TCE 1500 350 + 20, 128, IK5, 317	1.10
TCE 1600 18 Thermal Link 320 + 70, 39	1.10
TCE 3000/3500	0.80
TCE 8000/8000A 56 + 1K, 47, 12 5R + 1R + 100R	1.00
Philips G8 2.2 + 68	0.90
Philips G8 47	0.80
Philips 210 30 + 125, 2K85	0.70
Philips 210 118 + 118 + 148 (Link)	0.65
RRI 154 + 50 + 16 94	0.60
RRI A640 250 + 14 + 156	0.80
GEC 27840 10 + 15 + 19 + 10 + 63 + 188	1.00
GEC 2000	0.80
PYE 731, 735 36 + 27	1.00
PYE 11009 60 + 70 + 173 + 26 + 16 + 17 + 19	1.00
RRI823 56R + 68R	0.80

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Aeroklene	1.20
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SR3AS Mini Silver	7.00
SR3A Mini Orange	6.80
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Solder Mop Red	0.60
Solder Mop Brown	0.60
Side Cutters ORYX	3.20
TVTY 80/80 Transistor EQV A-Z or 2N	5.00 each
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TELEVISION

September 1981

Vol. 31, No. 11
Issue 371

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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 OCTOBER WILL BE PUBLISHED ON SEPTEMBER 23

P. V. TUBES

Telephone: Accrington (0254) 36521

38A WATER STREET, ACCRINGTON, LANCS BB5 6PX.

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TRADE COUNTER OPEN MON-FRI 9 a.m.-4.30 p.m. SAT MORN. 9.30 a.m.-12 noon.

INTEGRATED CIRCUITS

MC1307	1.00	ML922	3.29	SN76131N	1.30	TA7205	2.96	TBA120B	1.30	TBA570	1.00	TCA800	1.99	TDA2540	3.84
MC1327	1.00	ML926	2.18	SN76226(D)N	1.56	TAA350A	80	TBA120SB	1.30	TBA641-B11	2.40	TCA940	1.60	TDA2541	2.66
MC1330P	90	ML928	2.18	SN76227N	1.10	TAA300	58	TBA120U	1.00	TBA641 BX1	2.00	TDA440	2.20	TDA2560	1.90
MC1349	1.20	SA5560S	1.80	SN76532N	1.50	TAA310	2.83	TBA395	2.20	TBA690	1.50	TDA1004A	2.95	TDA2581	2.25
MC1350	96	SA5570S	1.80	SN76533N	1.30	TAA320	59	TBA396	80	TBA673	1.10	TDA2540	3.16	TDA2590	3.25
MC1351	1.00	SA5580S	2.90	SN76033N	1.53	TAA550	28	TBA440N/TBA1441		TBA700	2.12	TDA1170	1.99	TDA2591	2.75
MC1352	1.00	SA5590S	2.90	SN76544N	1.35	TAA570	1.60		2.75	TBA7200	2.12	TDA1190	2.60	TDA2593	2.50
MC1358PQ	1.60	SL901B	4.45	SN76650M	89	TAA630	2.50	TBA440	2.60	TBA750	2.05	TDA1270	3.73	TDA2600	3.25
MC1495L	1.00	SL917B	6.25	SN76660N	80	TAA630S	2.50	TBA480	1.20	TBA800	99	TDA1327	1.00	TDA2611A	1.95
MC14011BCP	42	SL1310	1.80	SN76666N	70	TAA621 AX1	3.00	TBA4800	1.20	TBA810AS	1.35	TDA1352B	1.60	TDA2640	2.25
MC14049BCP	43	SL13270	1.20	SW153	2.74	TAA840/S1	1.96	TBA500P	1.58	TBA820	1.70	TDA1412	1.20	TDA2690	1.00
ML231B/ETTR6016	2.20	SL76544	2.00	TA7141P	95	TAA700B	1.70	TBA510	3.00	TBA890	3.94	TDA2020	4.66	TDA3950	2.36
ML232/ETT6016		SN76003N	1.75	TA7050P	95	TAA700	1.70	TBA5200	1.20	TBA920	1.80	TDA2030	2.80	UPC566H	2.95
CA3065	2.20	SN76013N	1.50	TA7051P	95	TAA661B	1.20	TBA5300	1.28	TBA9200	1.80	TDA2521	4.17	UPC575C2	3.40
ML236	5.35	SN76013ND	1.50	TA7171P	1.80	TAA840		TBA530	1.20	TBA950(2X)	2.40	TDA2522	2.40	UPC1025HI	4.50
ML237	1.95	SN76023N	1.46	TA7172P	1.80	TBA120A	70	TBA540	1.49	TBA990	1.49	TDA2523	2.20		
ML238	4.20	SN76023ND	95	TA7173P	1.45	TBA120S	70	TBA550	1.58	TCA160	1.20	TDA2530	1.96		
ML239	2.50	SN76110N	89	TA7074P	1.00	TBA120SA	70	TBA5500	1.58	TCA760	2.30	TDA2532	2.46		
ML920	4.12	SN76115N	2.27	TA7176P	75	TBA120AS	70	TBA5600	1.59	TCA270SQ	1.25	TDA2524	2.26		

SOCKETS IC

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

WE NOW HAVE THESE SPECIAL CB INTEGRATED CIRCUITS

TA7205AP	3.72							
2SC1909	1.41	MSN5807	7.87	PLL02AG	9.89	LC7120	5.87	Please enquire for others
2SC495	1.10	AN7150	3.97	MC1351P	1.00	TA7204P	3.77	
LC7130	5.93	TA7222	4.07	AN2140	3.91	TA7130P	1.93	
AN240	3.84	TA7310P	2.78	LA4031P	3.21	UPC1156H	4.28	

SEMICONDUCTORS

AC126	22	AU110	2.00	BC171	9	BC261B	15	BD138	23	BF115	35	BF259	24	BFY90	75	OC79	20	2N3706	10
AC127	22	AU113	1.40	BC171A	10	BC262A	15	BD139	28	BF117	36	BF262	84	BR100	17	R2008B	1.80	2N3708	17
AC128	20	BC107	20	BC171B	10	BC262B	15	BD140	31	BF125	26	BF263	50	BR101	30	R2010B	1.80	2N2904	30
AC128K	32	BC107A	20	BC172	9	BC300	33	BD144	1.20	BF127	26	BF271	24	BRC4443	80	R2265	1.40	2N5294	48
AC141K	34	BC107B	20	BC172B	10	BC301	28	BD159	65	BF154	12	BF273	12	BRX46	40	R2322	58	2N5296	48
AC142K	30	BC108	20	BC172C	10	BC303	28	BD160	1.30	BF158	18	BF310	30	BRY39	30	R2323	67	2N5298	69
AC176	25	BC108A	20	BC173C	12	BC307	10	BD166	52	BF160	27	BF311	30	BRY56	57	R2461	1.50	2N5496	53
AC176K	32	BC108B	20	BC174A/B	10	BC308A/B	17	BD179	52	BF167	24	BF336	36	BT106	1.00	R2540	2.80	2N6107	75
AC187	26	BC108C	20	BC182	9	BC327	11	BD182	72	BF173	22	BF337	30	BT108	1.24	RCA16334	90	2SC643A	1.50
AC187K	28	BC109	20	BC182LB	10	BC328	9	BD183	75	BF177	35	BF338	34	BT116	1.21	RCA16335	80	2SC1172Y	2.20
AC188	25	BC109B	20	BC183LB	10	BC337	11	BD201	85	BF178	26	BF355	37	BU104	2.00	TIP29C	43		
AC188K	37	BC109C	20	BC184	9	BC338	9	BD202	80	BF179	28	BF362	37	BU105	1.25	TIP30C	43		
AD143	82	BC114	12	BC184	10	BC461	30	BD203	80	BF180	36	BF363	33	BU108	1.80	TIP31C	41		
AD149	79	BC116A	12	BC204	10	BC547	10	BD204	84	BF181	36	BF371	30	BU124	1.30	TIP32C	42		
AD161	42	BC117	20	BC208	13	BC548	10	BD222	46	BF182	30	BF457	35	BU126	1.49	TIP33B	75		
AD161/2	1.15	BC119	24	BC209	10	BC549	8	BD223	56	BF184	30	BF458	28	BU204	1.50	TIP41C	46		
AD162	42	BC140	32	BC212	9	BC550	7	BD225	47	BF185	30	BF459	35	BU205	1.34	TIP42C	47		
AF114	40	BC141	26	BC212L	9	BC557	8	BD232	45	BF194	11	BF639	28	BU206	1.80	TIP47	70		
AF118	62	BC142	21	BC213	9	BC558	9	BD233	35	BF195	11	BFT42	28	BU208	1.60	TIP2955	90		
AF121	56	BC143	24	BC213B	10	BCY72	13	BD234	37	BF196	10	BFT43	28	BU208A	1.65	TIP3055	63		
AF124	34	BC147	9	BC213L	9	BD115	32	BD235	33	BF197	11	BFW10	60	BU208/02	2.10	TIS91	21		
AF125	35	BC148	9	BC214	9	BD116A	65	BD236	40	BF198	18	BFX29	30	BU326A	1.42	TV106/02	1.55		
AF126	34	BC149	10	BC214L	10	BD124P	60	BD237	33	BF199	15	BFX84	27	BU407	1.25	2N696	21		
AF127	32	BC157	11	BC2378	12	BD131	33	BD238	35	BF200	30	BFX85	28	BU500	1.95	2N2905	28		
AF139	42	BC158	10	BC238A/B/C	8	BD132	35	BD410	55	BF241	15	BFX86	30	EI222	28	2N3054	60		
AF239	45	BC159	10	BC251A	12	BD133	40	BD434	56	BF256LC	28	BFX88	25	MJE340	40	2N3055	60		
AL102	2.00	BC160	25	BC252A	12	BD135	26	BD517	60	BF256	28	BFY50	20	MJE520	44	2N3702	11		
AU106	2.50	BC161	28	BC252B	12	BD136	27	BD520	75	BF257	28	BFY51	22	MJ3000	2.36	2N3703	10		
AU107	2.00	BC170B	15	BC261A	18	BD137	26	BDX32	1.50	BF258	26	BFY52	20	OC71	27	2N3705	10		

THERMISTORS

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

CRYSTALS

4.3Mhz	1.30
8.8Mhz	1.30

NEW VALVES

30FL2	1.21	EY500A	1.33	PCL85/805	79
DY802	72	EZ80/1	56	PCL86	81
DY86/7	66	GY501	1.45	PD500	2.93
ECC81	60	GZ34	1.56	PFL200	1.35
ECC82	68	KT66	5.00	PL36	1.15
ECC83	60	KT88	6.00	PL81	94
ECC84	80	PC86	81	PL82	46
ECC85	96	PC88	81	PL83	1.43
ECC88	1.36	PC92	80	PL84	84
ECF80	80	PC97	1.14	PL95	1.00
ECF82	88	PC900	80	PL504	1.32
ECH81	1.04	PCC84	70	PL508	1.43
ECH84	1.13	PCC85	65	PL509	2.39
ECL80	84	PCC88	82	PL519	2.78
ECL82	77	PCC89	79	PL802	2.15
ECL86	84	PCC189	1.02	PY33	61
ECF86	78	PCC805	1.40	PY88	81
EF80	68	PCF80	75	PY500A	1.40
EF85	68	PCF86	1.13	PY800/1	69
EF86	1.19	PCF200	1.23	UCF80	67
EF89	1.43	PCF800	1.38	UCH81	1.43
EF183	68	PCF801	1.13	UCL82	84
EF184	68	PCF802	86	UCL83	94
EH90	1.02	PCF805	1.63	UL84	1.02
EL34	1.63	PCF806	1.30	U26	1.30
EL81	86	PCF808	1.63	U191	95
EL84	68	PCH200	1.45	6F23	85
EL90	82	PCL82	78	UY85	80
EL509	2.22	PCL83	2.00	PL802T	2.50
EY86/7	68	PCL84	81		

All valves are new – boxed – guaranteed.

Please add 15% VAT to **ALL** items.

DIODES

AA119	9	BY298	22	IN5402	14
BA102	17	BY299	22	IN5403	12
BA115	13	BYX10	20	IN5404	12
BA145	17	BYX38/10	30	IN5405	13
BA148	17	BYX36/600	35	IN5406	16
BA154	6	BYX55/600	30	IN5407	16
BA155	14	BYX71/600	90	IN5408	16
BA156	15	OA47	9	ITT44	4
BAX13	4	OA90	5	ITT2002	11
BAX16	8	OA91	6	Y969	89
BB105B	30	OA95	6		
BB105G	30	OA202	11		
BY126	12	IN914	4		
BY127	11	IN4001	4		
BY133	15	IN4002	4		
BY164	45	IN4003	4		
BY176	85	IN4004	5		
BY182	87	IN4005	5		
BY184	55	IN4006	5		
BY223	90	IN4007	6		
BY199	28	IN4148	2		
BY206	14	IN4448	10		
BY210/800	33	IN5401	12		

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	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	3.85
THORN 1500 5 Stick	4.25
THORN 1600	3.45
THORN 2000	8.60
THORN 3000/3500	6.89
THORN 8000	3.56
THORN 8500/8800	5.40
THORN 9000	7.43
DECCA CTV 19/25	5.36
DECCA 1730/1830	3.88
DECCA 1910/2213 Bradford	5.92
DECCA 30	5.92
DECCA 80	6.28
DECCA 100	6.04
UNIVERSAL I.T.T.	5.40
GEC 2040/2028	5.64
GEC 2110 Pre Jan '77	8.95
GEC 2110 Post Jan '77	6.66
PHILIPS G8 Short Focus Lead	5.85
PHILIPS G8 Long Focus 550	5.85
PHILIPS G9	6.33
PYE 691/3	5.13
PYE 713 4 Lead	7.00
PYE 731/25	5.95
R.B.M. A823 (plug in) AV	5.98
R.B.M. A823	5.78
KORTING (similar to Siemens TVK1)	6.65
ITT K8 CVC5/9	5.35
ITT K8 CVC20/25/30 (Mullard Type)	5.35
RRI T20	6.80

RECTIFIER STICKS

TV11	74
TV18	81
TV20	95
TV13	76

TRANSFORMERS

L.O.P.T.

R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	19.50
R.B.M. T20A	11.30
PHILIPS 210/300 Mono	10.00
PHILIPS G8	10.00
PHILIPS G9	7.60
PHILIPS G11	13.50
PYE 691/3	14.60
PYE 697 (Printed)	14.50
PYE 731	10.00
PYE 725 90°	10.60
PYE 169	10.00
DECCA 80	8.58
DECCA 100	8.58
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	9.00
GEC 2040	9.50
ITT CVC 1-9	9.20
ITT CVC 25/30/32	8.00
ITT CVC 20	7.16
THORN 3000 EHT	6.38
THORN 3000 SCAN	6.38
THORN 8000	9.85
THORN 8500	10.00
THORN 9000	10.65
THORN 3000/3500 Mains Trans.	10.00
THORN 1591	8.88
THORN 1691	8.68

PANELS

I.F. Gain Module (Pye, Philips)	9.00
C.D.A PANEL (Pye, Ecko, Invicta, Dynatron)	20.00
CONVERGENCE PANEL Philips G8	17.85

NEW MONO TUBES

MULLARD A31/510 110° 12"	17.00
MULLARD A34/510 110° 14"	18.50
VEGA A50/120WR .20"	13.50
VEGA A61/120WR 24"	15.00
VEGA 12" 90°	15.00

REBUILT COLOUR TUBES

17"-18"-19"-20"-22"	£30.00
26"-25"	£34.00
26" 110°	£38.00

Glass for Glass exchange
2 year warranty

MULLARD COLOUREX TUBES OR THORN NEW LIFE TUBES

18" A47/342X-A47/343X	58.00
19" A49/120X	52.00
20" A51/120X	52.00
22" A56/120X	42.00
25" A63/120X	54.00
26" A66/120X	53.00
26" A67/120X	53.00

Glass for Glass exchange
1 year warranty or 4 year option.

CARRIAGE ON TUBES £5.50 incl VAT
(except) 12", 14" – £4
(£1 extra for N. Ireland).

NEW TELEVISION SETS

CASH AND CARRY ONLY

Philips 14" colour	£172.00
Philips 16" colour	£197.00
Philips 20" 933 colour	£205.00
Philips 22" 1002 colour	£235.00
Philips 26" 1009 colour	£297.00
Ferguson 20" TX9	£210.00
Ferguson 22" TX9	£230.00
Ferguson 22" TX10 30AX	£240.00
Ferguson 26" TX10 30AX	£300.00

P. V. TUBES

Telephone: Accrington (0254) 36521

REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.82
DECCA 80 (400/350V)	3.00
DECCA 100 (800/250V)	3.00
DECCA 1700 (200/200/400/350V)	4.80
PHILIPS G8 (600/300V)	2.11
PHILIPS G9 (600/300V)	2.11
PHILIPS G11 (470/250V)	2.58
PYE 691/7 (200/300/350V)	2.28
PYE 731 (60/300V)	2.20
RBM A823 (2500/2500/30V)	1.20
(2500/2500/25V)	1.10
RBM A823 (600/300V)	2.10
RBM Z146 (300/300/350V)	3.00
ITT CVC5/9 (200/200/75/25)	2.35
ITT CVC 20 (220/400V)	1.92
GEC 2110 (600/250V)	1.86
GEC 2040 (1000/2000/35V)	1.14
GEC 2040 (300/300/150/100/50)	3.90
THORN 3500 (400/40V)	28
THORN 950 (100/300/100/16/275V)	1.76
THORN 1400 (150/100/100/100/150/320V)	2.60
THORN 1500 (150/150/100/300V)	1.92
THORN 1500 (12/300V)	30
THORN 3500 (175/100/100/400/350V)	2.34
THORN 3500 (1000/63V)	62
THORN 3500 (1000/70V)	60
THORN 8000/8500 (2500/2500/63V)	1.47
THORN 8000/8500 (700/250V)	2.20
THORN 8000/8500 (400/350V)	2.44
THORN 9000 (400/400V)	2.80

WIREWOUND RESISTORS

PREFERRED VALUES

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

RESISTORS

A range of the following at Preferred Values

		Price per 10 pack
0.25W		20p
0.5W	3R3 to 8M2	20p
1W	10R to 10M	38p
2W	10R to 150K	62p
2W	10M	62p

ELECTRONIC TUNERS AND ASSEMBLIES

NSF173 Replaces ELC 1043/05/06	7.20
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	9.00
6 P/B PYE	10.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass. (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	8.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
U321 UHF Tuner	9.00

SUNDRY TUNER ACCESSORIES

RANK Tuner Push Button $1\frac{1}{2}'' \times \frac{1}{2}''$ dia.	30p
RANK Tuner Push Button 2" long × $\frac{3}{8}$ dia.	30p
RANK Tuner Push Button 2" long × $\frac{1}{2}$" dia.	30p
GEC Tuner Neons 2110 chassis.	14p
Drive Cams	10p each

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/push	62
Philips G8 Push On/Off Switch.	1.38
4A Double Pole Rotary On/off	62
A1 Beam Switch (THORN 3500)	50
A1 Controls 5m (THORN 3500)	69
GEC 2110 A1 Control IM5 (Red, Blue, Green)	each 58p
GEC 2040 On/Off Switch	each 68p

THERMAL CUT OUT

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

SUNDRIES

ANTIFERENCE Super Set Top	6.80
ANTIFERENCE Car antenna	7.80
ANTIFERENCE Xtra Boost UHF Amp.	15.40
ANTIFERENCE SB11 Splitter	2.40
Surface Mounting Aerial Outlets	80
Cable Clips per 100	1.18
Transductor 90°	2.08
EHT Final Anode Cap	53
Delay Line CTAV 82/DL50/5DL141	2.20
EHT Cable 30kV	25p per mtr.
Coax Plugs pack of 10	1.80
Focus control GEC/THORN	1.83
PVC Tape	35
FM Plugs	25
PL259 Plugs	40
DECCA 30 Series width control	50
DECCA 3.9R Modulohm	48
KEW Pocket Size 1000 OPV Meter	4.99
Line Connectors	35
6.3V CRT boost trans.	4.36
ANTIFERENCE XG8 High Gain Aerial (State Channel)	17.00
Reducers for PL259	18

N.B. We have a full range of aerials and accessories available from the trade counter.

SOLDERING EQUIPMENT

WELLER Iron Kit 15W	3.80
WELLER Iron Kit 25W (inc. tips)	4.80
WELLER Iron 25W	3.80
WELLER 3/16" Single Flat Tips	51
MIN Soldering Iron	5.00
WELLER Heat Gun Kit	14.00
WELLER Heat Gun	11.00
(Pair) Tips for Gun	38
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	4.88
Solder Remover Sucker	6.50
Solda Mop	70
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.60

MIXED DIELECTRIC CAPACITORS

Volts DC		
600V	0.1 mFd	38
1000V	0.01 mFd	20
	0.047 mFd	29
	0.1 mFd	32
	0.22 mFd	48
	0.47 mFd	75
1250V	0.1 mFd	45
1500V	0.0022 mFd	18
	0.0047 mFd	20
	0.022 mFd	24
	0.033 mFd	59

SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

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

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

PYE LABGEAR

CM6001 Power Unit (16V or 24V)	11.75
CM6019/WB UHF Masthead Amp(ch21-68)	8.50
CM6040/WB UHF Masthead (ch21-68)	18.06
CM6020 Power Unit (16V)	10.29
CM7025 UHF High Gain M.H.A. 24V (specify group A, B or CD)	14.81
CM7061 Power Unit (12V)	10.84
CM7065/WB VHF/UHF M.H.Amp (12V)	12.80
CM7073 VHF/UHF Dist Amp (8+1)	37.80
CM7053 'Behind the set' UHF Amp. (mains)	10.73
CM7043 'Behind the set' 2nd Set Amp. (UHF-2 outputs)	10.96
CM6006 UHF 6 way Passive Splitter	10.72
CM7042 TV Games Combiner	3.31
CM9003 Flush Mount Single Outlet Isolated	1.75
CM9009 Flush TV/FM Diplex Outlet Isolated	3.00
CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF	17.50
CM6038 VHF/UHF 625 TV Patt Generator	97.50
CM6052 UHF/VHF Pal Colour Bar Generator	210.50
7056 TELETEXT ADAPTOR (Converts any set to remote)	206.00
AMPLIFIED CARAVAN AERIAL (All Channels)	18.50

DATA BOOKS

Transistor Equivalent	
TVT 80 A-Z only	3.25
TVT 80 2N/2S series only	3.50
TVT 80/80 A-Z and 2N/2S together	6.50
LIN IC Books LIN 1	5.50
LIN 2	5.50

SERVICE AIDS

SERVISOL Freeze-It	80
SUPER SERVISOL	75
SERVISOL Foam Cleanser	70
SERVISOL Plastic Seal	69
SERVISOL Silicone Grease	78
SERVISOL Tubes Silicone Grease	1.80
SERVISOL Aero Klene	83
SERVISOL Aero Duster	76
SERVISOL Excel Polish	52
Penetrating Fluid	70
Fire Extinguisher 640G	1.88
Heat Sink Compound 25G	1.00
Silicone Rubber Tube	1.98

CAPACITORS

AXIAL TYPE

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

'MIDGET' CONTROLS

Insulated spindle length 44mm.

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

WITH D.P.S.T. SWITCH
Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M 61p
Lin: 5K-50K-500K

SLIDER POTENTIOMETERS

Lin or Log

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

MULTITURN POTENTIOMETERS

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

THICK FILM RESISTOR NETWORKS

THORN 3500 (5 pin connection)	1.98
PYE 731 (6 pin connection)	2.20
THORN 9000 (Circuit Ref R704/7)	1.98

FUSES

	Pack of 10
$1\frac{1}{4}$" QUICK BLOW	
100ma	48
250ma-500ma-750ma-1A	49
1.5A-2A-2.5A-3A-5A	40
$1\frac{1}{4}$" ANTISURGE	
250ma, 500ma 600ma, 630ma, 750ma, 850ma, 1A, 1.25A	
1.5A, 2A	1.41
2.5A, 3A, 5A	2.16
20m ANTISURGE	
80ma	3.11
100ma, 160ma, 200ma	2.06
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A	1.07
2.5A, 3.15A	1.43
20mm QUICK BLOW	
100ma	46
250ma, 500ma, 630ma, 800ma,	37
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	37
1" MAINS	
2A, 3A, 5A, 10A, 13A	84

ELECTROLUBE PRODUCTS

Electro-Mech lubricant	1.39
Elect. cleaning solvent	1.50
Freezer	1.39
Foam cleanser	1.00
Heat transfer compound	1.07
Silicone compound	1.81
Special contact fluid (Snorkel)	2.07
Permagard	1.43
Elec. mech. lubricant pen	69

DISC CERAMIC CAPACITORS

High Voltage

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

CONVERGENCE PRE-SET POTS

	each
3 Watt complete with knob 5R0-6R8-10R-15R-20R	35
50R-100R-200R-500R	35

METRIC CONVERGENCE POTS

Philips G8
5R-10R-20R-50R

MAINS DROPPERS

DECCA 20	2.20
R.B.M A823	77
R.B.M. 161	65
GEC 2000/2018	70
GEC27840	64
PYE 713/15 3R5/15/45R	1.45
PYE 725/31 3R0/56R/27R	94
PYE 725 56R/27R	82
PHILIPS 50501	68
PHILIPS 210/50511/LINK	84
PHILIPS G8/50832	65
PHILIPS G8 47R section	39
THORN 1500	95
THORN 3500	75
THORN 8000	98
THORN 8500	86

HOW TO ORDER

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

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

For Aerosol's please add 30p per can. (These are very heavy!)

Orders over £25 before VAT are Post Free except when the order contains AEROSOLS.

Carriage on Tubes is as stated on list.

ALL ENQUIRIES SAE PLEASE

VAT invoice on request.

We do regret any postal increases but we try our best to give a speedy, and efficient service, at a fair price.

TEST EQUIPMENT

Portable Oscilloscope	148.00
TF200 Frequency Metre	155.00
CRT Tester/Rejuvenator	150.00
LABGEAR Colour Bar/Cross Hatch	210.50
LABGEAR Pattern Generator (Pocket Size)	97.50

EAGLE PRODUCTS

Please send large S.A.E. for full EAGLE Catalogue.

Multimeters

KEW 7N	2,000 opv	4.99
EM5	5,000 opv	8.95
EM10	10,000 opv	10.95
EM50	50,000 opv	19.95
EMC321 Carrying Case for above		2.00
Digital Meter TS1000		42.50
KHP 30N Measuring Probe (30kV) (E.H.T.)		28.95
T1206 2 Station Intercom.		5.95

EAGLE PRODUCTS

SE500 Headphones	3.25
SE540 Headphones with Volume Control	4.85
SE600 Lightweight Headphones	6.95

TRANSISTORS, ETC.

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.68	BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63	BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63	BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.46	BC107*	0.1[illegible]	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	0.63	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	0.14	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*	0.14	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	0.65	MPS6523	0.36	TIS43	0.44	2N3705	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD184	2.30	BF194*	0.14	BFX29	0.38	MPS6566	0.44	TIS73	1.36	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC348A & B		BD187	1.20	BF195*	0.13	BFX84	0.42	MPSA05	0.30	TIS90	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14		0.17	BD188	1.25	BF196	0.14	BFY50	0.38	MPSA06	0.32	TIS91	0.28	2N3708	0.17	40429	0.88
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15	BFY51	0.37	MPSA55	0.43	ZTX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF198	0.29	BFY52	0.36	MPSA56	0.45	ZTX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BFY53	0.36	MPSA93	0.56	ZTX213	0.23	2N3772	2.08	40603	1.13
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BFY90	1.98	MPSL01	0.33	ZTX300	0.16	2N3773	2.90	40636	1.25
AL103	1.58	BC187	0.27	BC360	0.59	BD233	0.62	BF218	0.42	BPX25	1.62	MPSU01	0.61	ZTX304	0.26	2N3794	0.40	40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)	Type	Price (£)	Type	Price (£)
		SN76008KE	2.56	TBA240A	3.98
BRC1330	0.93	SN76013N	1.56	TBA281	2.07
CA810QM	2.44	SN76013ND	1.40	TBA395*	2.58
CA3005	1.85	SN76018KE	2.56	TBA396	2.40
CA3012	1.45	SN76023N	1.56	TBA400	2.20
CA3014	2.23	SN76023ND	1.40	TBA480Q	1.84
CA3018	0.71	SN76033N	2.20	TBA500*	2.21
CA3020	1.89	SN76110N	1.20	TBA510*	2.21
CA3028A	0.80	SN76115N	1.62	TBA520*	2.98
CA3028B	1.09	SN76116N	1.78	TBA530P	2.24
CA3045	3.75	SN76131N	2.10	TBA540*	2.88
CA3046	0.70	SN76226N	2.60	TBA550*	3.13
CA3065	1.74	SN70227N	1.61	TBA560C*	3.18
CA3068	1.90	SN76228N	1.80	TBA570*	1.29
CA3130S	1.57	SN76502N	1.92	TBA611B	2.68
FCH161	2.40	SN76530P	0.97	TBA641	2.55
FCJ101	3.32	SN76533N	1.38	TBA641A12	2.55
LM309K	1.98	SN76544N	1.85	TBA641B11	2.90
LM380N-14	1.65	SN76546N	1.85	TBA651	2.42
LM1303N	1.03	SN76570N	1.81	TBA673	2.31
MC1307P	1.82	SN76620AN		TBA700*	2.50
MC1310P*	1.84		0.99	TBA720AQ	2.38
MC1312P	2.34	SN76650N	1.48	TBA720Q	2.38
MC1327P*	1.86	SN76660N	0.64	TBA750*	2.18
MC1330P	0.83	SN76666N	0.96	TBA800	2.05
MC1350P	1.22	TA7073P	3.51	TBA810AS	2.00
MC1351P	1.42	TAA263	2.20	TBA920*	2.80
MC1352P	1.42	TAA300	3.85	TBA940	3.52
MC1357P	2.92	TAA320	1.10	TBA950	2.08
MC1358P*	2.30	TAA350A	2.48	TBA990*	2.90
MC1458G	1.43	TAA370A	3.18	TCA270A*	3.55
MC1496L	1.15	TAA435	1.70	TCA280A	1.43
MC3051P	1.39	TAA450	3.39	TCA290A	3.46
MFC400B	0.85	TAA521	1.10	TCA420A	2.10
MFC4060A	0.98	TAA522	2.09	TCA440	1.67
MFC6040	1.11	TAA550	0.35	TCA640	4.26
MFC8020A	1.10	TAA560	1.93	TCA650	4.26
ML231	3.57	TAA570	2.20	TCA660	4.26
ML232	3.57	TAA611A	1.67	TCA730	4.10
NE555	0.72	TAA611B	1.89	TCA740	4.04
NE556	1.34	TAA621AXI	2.33	TCA750	2.53
NE566	1.95	TAA630Q	3.91	TCA760	1.52
SAA1024	5.70	TAA630S	4.18	TCA820	3.29
SAA1025	10.35	TAA661A	2.39	TDA440	4.16
SAS560A	2.01	TAA661B	1.75	TDA1003	1.68
SAS570	2.01	TAA700*	2.80	TDA1004	2.73
SC9503P	1.40	TAA840	3.38	TDA1005	3.04
SC9504P	1.38	TAA861A	0.95	TDA1022	6.89
SL414A	1.91	TAA930A	1.43	TDA1024	0.97
SL432A	2.52	TAA930B	1.43	TDA1034	2.98
SL450	5.10	TAA960	3.20	TDA2610	2.86
SL901B	4.20	TAA970	2.81	TDA2640	2.86
SL917B	5.60	TAD100	2.66	ZN414	1.45
SL918A	5.95				
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 (£)
		BY114	0.60
AA113	0.17	BY118	1.10
AA119	0.21	BY126	0.20
AA129	0.28	BY127	0.21
AA143	0.18	BY133	0.35
AAY30	0.28	BY140	1.40
AAZ13	0.42	BY164	0.75
AAZ15	0.35	BY176	2.80
AAZ17	0.28	BY179	0.83
AY102	3.85	BY182	1.14
BA100	0.24	BY184	0.44
BA102	0.36	BY189	5.30
BA104	0.19	BY190	4.90
BA108	0.80	BY206	0.26
BA111	0.70	BY238	0.25
BA115	0.17	BYX10	0.30
BA116	0.56	BYX38/600	0.70
BA121	0.85	BYX70/500	0.53
BA129	0.45	ITT44	0.08
BA145	0.19	ITT210	0.63
BA148	0.19	ITT827	0.80
BA154	0.06	MCR101	0.48
BA155	0.17	MR854	1.10
BA156	0.12	OA5	0.88
BA157	0.25	OA10	0.58
BA158	0.28	OA47	0.20
BA159	0.40	OA81	0.19
BA164	0.14	OA90	0.13
BA182	0.27	OA91	0.15
BA201	0.13	OA95	0.20
BA202	0.14	OA200	0.13
BA203	0.14	OA202	0.13
BA216	0.08	OA210	0.89
BA219	0.11	TIL209	0.14
BA243	0.45	TIL211	0.18
BA317	0.06	TV20	2.25
BA318	0.07	IN914	0.06
BAV10	0.10	IN916	0.06
BAV21	0.18	IN4001	0.06
BAW62	0.06	IN4002	0.07
BAX13	0.07	IN4003	0.08
BAX16	0.10	IN4004	0.08
BAX17	0.19	IN4005	0.09
BAY72	0.16	IN4006	0.10
BB104B	0.52	IN4007	0.12
BB105B	0.33	IN5400	0.15
BB105G	0.30	IN5401	0.17
BR100	0.40	IN5402	0.20
BY100	0.35	IS920	0.09
BY103	0.35	IS921	0.11

ZENER DIODES

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

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
R53	1.75
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

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

BRIDGES

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

10A and 25A ranges also stocked.

RESISTORS

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

Wirewound (5%)

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

Presets (†)

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

0.2W (Vertical and Horizontal) Values as 0.1W — all 14p each

FUSES (all packs of 10)

20mm Time Delay (BEAB)

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

20mm quick-blow (BEAB)

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

LABGEAR (Details of full range on request)

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VIEWDATA ADAPTOR 7050. Prices and details on request.

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4n7F 1500V DC	60p	100nF 1000V DC	46p
10nF 1000V DC	22p	470nF 1000V DC	60p

H.V. Disc Ceramic (†)

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

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Investment

We must export or die, investment is the key to success, and so on and so forth. How often one's heard these perfectly truthful exhortations over the years. Yet as one looks around at the present state of industry in the UK one might be forgiven for thinking that they'd never occurred to anyone. Following many years of poor export performance, a lengthy period recently when the pound was grossly over valued seemed quite likely to put an end to mainstream exports. We then had the daft view put forward in all seriousness that oil wealth meant something else having to go, that something else being manufacturing industry. If views such as this can, with great sophistication, be propounded, it's not surprising that economics generally has got a bad name while the profession is in greater disarray than ever before.

At some point someone's going to have to pick up the pieces. The pound has already fallen to a more appropriate level – appropriate in terms of comparative UK and overseas costs – though it didn't do so soon enough to save several otherwise perfectly viable firms. Industry will end up leaner and in better shape it's said. Leaner maybe, but after a prolonged period of profit squeeze will it have the necessary funds to be able to get on with the job of producing competitive goods?

One could almost say that we've suffered from a surfeit of economic theories. As one after another has been tried, monetarism being the latest, we've ended up no better than and sometimes in a worse situation than when we started. They do things differently in that place across the seas of course. The trouble is that economic policy is but one component of the economy as a whole. The rest – ensuring that work gets done, that costs, including wages, are kept at reasonable levels, that the work done is what needs to be done, that it's backed by adequate resources and so on – is a mucky, awkward business that calls for a pragmatic approach. We haven't been very successful in these respects either.

There's a school of thought that considers manufacturing to be rather old hat. We're not very good at producing cars and cameras, TVs and audios, so let's get on with more glamorous things – high value-added equipment, the so called information age and so on. This looks like wishful thinking – the country that can't make nuts and bolts is not likely to be much good at producing the things that use them.

One has a horrible foreboding that at some stage this or another government will see investment as the answer to our problems (it is, partially), and will start shovelling funds (what's left) here and there regardless. We might end up with a field full of the twenty first century equivalent of Concorde, or several dozen nuclear power stations when coal-fired ones cost much less to run. Encouragement could be given to follow up all sorts of bright ideas regardless of their prospects in the market place.

Investment is a broad term that calls for some consideration. It often requires a surprisingly small investment to take an idea and show that it works. EMI for example needed only a modest investment to get electronic TV to a practical stage for the first time – with only a small team of engineers and technicians. In more recent times, teletext and viewdata have been developed at very little cost. We seem to be quite good at this sort of thing. The really large investment is required once a system has been found to work however – investment in developing products that will sell because they represent good value, in finding out how to manufacture them and in setting up the assembly lines, and in finding out how to build in reliability. This is what one might call bread and butter investment rather than innovative investment, and we seem to be rather bad at it. Perhaps this is due to the oft quoted shortage of trained engineers in the UK, and the failure of so many companies to give due weight to their views. After all, it's easier for management to understand the chief accountant's warning about the cash flow, or the personnel director's warning that the lads won't settle for less than 10%, than it is to appreciate the importance of spending money on finding out why a particular component has a failure rate of 1%.

We really have been atrociously careless when it comes to quality control, something that requires quite a lot of continuous investment if it's to be done adequately. This may have been due in part to some rather dangerous notions. The Rolls-Royce syndrome for example – that excellence is o.k. for a flag carrying product that doesn't sell on price considerations, but is not relevant to mass produced goods. Or the throw away approach that was once so fashionable – remember "built-in obsolescence"? What the Japanese have proved, with the help of substantial, well directed investment, is that mass produced goods need not be shoddy, that engineering quality is not irrelevant to ordinary consumer goods.

COVER PHOTO

Our cover photo this month was taken in the service department of Piercys (Electronics) Ltd., 56-62 Lupus Street, London SW1. Our thanks to this well known TV/audio/video dealer and to the proprietor Bob Piercy for his kind co-operation.

Teletopics

VIEWDATA DEVELOPMENTS

A European standard for alpha-mosaic viewdata has been ratified by the Telecom Commission of the Conference of European Post and Telegraph Authorities, representing 26 European countries. It's "upwards compatible" with Prestel, i.e. decoders built to the new standard will be able to work with the present system, and is also compatible with the French Teletel and German Bildschirmtext systems. Steps are being taken by British Telecom to see whether agreement on a compatible system can be reached with the US AT & T company (Bell telephones). AT & T, which controls 80% of the US telephone network, has proposed a hybrid system using both alpha-mosaic and alpha-geometric display techniques. The alpha-geometric technique, used in the Canadian Telidon system, gives improved picture displays at a higher cost. Unfortunately the alpha-mosaic coding scheme put forward by AT & T is not compatible with the European standard.

Following a two-year trial period the Deutsche Bündespost has decided to promote viewdata in a big way, with the hope of attaining a million subscribers by the end of 1986 – mainly business users.

An advanced graphics system that provides an alpha-geometric type display has been developed by Aregon International for use with the Prestel system. Another recent Prestel development is transform coding, for use with Picture Prestel. The idea is that a low-definition still picture is first displayed: if the user requires a more detailed picture, the display can then be progressively enhanced.

The Prestel system now has over 10,000 subscribers – the rate of connections is around 500 a month.

TELETEXT

The BBC and the IBA have been carrying out tests on the use of extra lines for teletext transmissions – lines 17 and 18 are at present used. The aim is to double this to four lines initially and eventually to use six lines. The BBC comment that their tests, on lines 15 and 16, have proved successful, but that financial constraints make it impossible to increase the service for the time being – extra lines means more pages, quicker access or both. ITV is hoping to be able to use two extra lines at an early date to provide regional services.

Deliveries of teletext sets to the trade during the first five months of the year were up by 50% on last year, at 36,600 sets. Thorn comment that the recent reduction in advance rental payments and hire purchase deposits has had a very positive effect on sales and rentals. Production of the Thorn TX teletext range is being increased by 40%, and an order for 120,000 teletext modules and chip sets, to be fulfilled by the end of the year, has been placed with Mullard.

EXPANSION AT FIDELITY

Fidelity Radio is to increase production at its North Acton factory in London. The TV side is doing well, with the entire production of the new 14in. portable colour TV set sold out to the end of the year – a production run of at least 40,000 sets. A larger-screen colour TV set is to be introduced next year, when the company will also be selling its first VCR. Exports during the coming year are expected to increase, especially to Africa and Europe.

COLOUR SERVICING COURSE

The South London College (Knights Hill, London SE27 0TX) is holding a short course on practical colour television servicing commencing on October 1st. The course of 16 lectures/practicals is designed to lead to a qualification which meets the needs of industry in providing a recognised certificate in colour television servicing. The lectures will be held in the college's Television Laboratory on consecutive Thursday evenings from 6.15 p.m. to 9.15 p.m. The course fee for London students is £16·50.

SERVICE BRIEFS: PHILIPS

G8 chassis: Intermittent loss of colour in sets fitted with the combined i.f./chroma panel can be caused by R3192 (27kΩ), which biases the chroma amplifier in the TBA560C i.c., going high in value. Replacements should be of the carbon film or metal film type.

G11 chassis: In the event of field bounce when used with a VCR, first check that C2039 on the timebase panel is 0·0039μF then if necessary reduce the value of R2003 to 1·8MΩ or possibly 1·5MΩ (keep the reduction as small as possible to preserve weak signal performance). Philips comment that a modification to the National Panasonic NV7000 VCR is available from the manufacturer (not Philips!) to improve the sync signal.

KT3/K30 chassis: In the event of C1567 in the diode modulator circuit going open-circuit the e.h.t. will rise sharply, with possible damage due to flashovers. The National Semiconductors TBA120SQ intercarrier sound i.c. is now being fitted in production to reduce the background noise on sound. Replacements should be obtained from Philips Service, Waddon, as they are selected for a low noise characteristic. Loss of red, green or blue can be due to R4250/R4266/R4282 respectively going open-circuit: check with an ohmmeter (a voltage check may be misleading).

K30 chassis: The value of C7336 on the power supply control panel has been increased from 220pF to 470pF to improve the line sync when cold – a few cases of poor line sync (horizontal displacement of successive lines) have been reported when a set is first switched on in a cold environment.

COLOUR BAR GENERATOR FROM WILLOW VALE

Willow Vale Electronics Ltd. have introduced a colour bar generator with a comprehensive specification and the added facility of a sound signal at a price of £98·50 plus VAT. The outputs available are crosshatch, peak white plus 1kHz sound modulation, linear grey scale, standard colour bars and a red raster. The unit is available from Willow Vale's three trade counters or directly from the Mail Order Department at Old Hall Works, Arborfield Road, Shinfield, Reading (part number 12-008).

CHOPPER WITH A DIFFERENCE

Yet another variation on the chopper switch-mode power supply theme has come to our notice, see Fig. 1. It's used in the latest NordMende type TCC2 chassis. The subtle difference this time is that the circuit is a step-up voltage regulator. The bridge rectifier is fed from a transformer which provides mains isolation, and produces 80V across

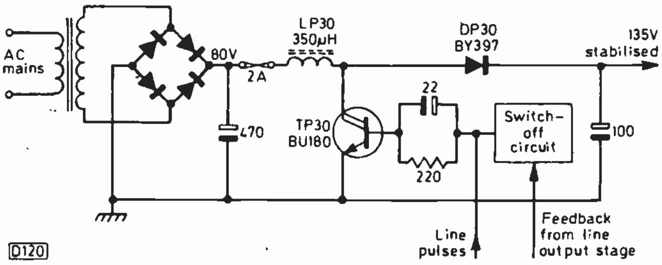

Fig. 1: The step-up chopper arrangement used in the latest NordMende colour chassis.

its 470µF reservoir capacitor. The following chopper arrangement produces a 135V stabilised h.t. line. As you can see, the chopper is of the series type, i.e. the reservoir inductance LP30 is in series with the load. The chopper itself, TP30, is a Darlington device. As it's switched on and off at line frequency it produces pulses which are rectified by DP30. The line frequency pulse switches TP30 on: regulation is effected by varying the time at which it's switched off. The switch-off circuit uses a thyristor whose triggering point is controlled by feedback from the line output stage.

BATC CONVENTION

The British Amateur Television Club will be holding its annual convention and exhibition at The Post House, Braunstone Lane East, Leicester on Sunday, October 4th. The exhibition will include demonstrations of both slow and fast scan television along with lectures, exhibits, trade stands, a free trade area and a chance to see the video tape the Club made of Dud Charmans' famous aerial lecture. Admission is free and all are welcome. The exhibition starts at 11 a.m., and there's a large free car park adjacent to the exhibition hall.

LATEST VIDEO EQUIPMENT

An easy to use VCR at a competitive price has been added to the Panasonic range. The new VCR, Model NV2000, is based on the more sophisticated NV7000 VHS format machine and has a 14-day, one programme timer and fast or slow replay. The suggested price is £555.

The latest domestic colour video camera from Hitachi, Model VKC800, is fitted with a saticon pick-up tube. This gives the camera a high standard of picture clarity and resolution even under dim lighting conditions and eliminates lag when panning from side to side. The camera is aimed at the serious video enthusiast and has a price tag of £799.

THYRISTOR TESTER

The simple thyristor tester idea shown in Fig. 2 was first published in that excellent US magazine *Radio-Electronics* (in the June 1981 issue). SW1 and SW2 are miniature momentary push-to-make switches, e.g. RS Components type 339-229. Momentarily closing SW1 should trigger the thyristor on, the LED then glowing. Momentarily closing SW2 so that the current is shunted away via the 10Ω resistor should result in the thyristor switching off. Stephen P. Weinrich, who suggested the device, comments "it's simple to make and hasn't lied to me yet".

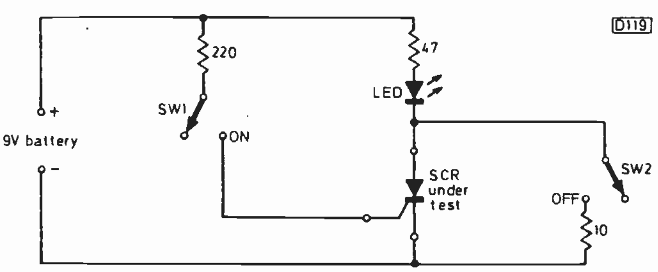

Fig. 2: Simple thyristor tester circuit. Use ½W resistors.

LOW COST REMOTE CONTROL SYSTEM

A new receiver/decoder chip, type ML923, has been introduced by Plessey. It's based on the ML920 but has a single analogue output, with sixteen channels available in 4-bit binary form and channel step, set on, a.f.c. defeat, recall, mute and analogue normalise functions. The chip forms a remote control system with the SL480 preamplifier and SL490 transmitter. The device comes in an 18-pin plastic DIL pack and is specified over the temperature range −10°C to +65°C. Further details of the SL490 and ML920 were given in an article in our November 1978 issue.

MORE LASERVISION DISC PLANTS

Philips LaserVision's network of video disc manufacturers is expanding, with the addition of Bertlesmann and Bavaria in West Germany. Both will manufacture discs under licence from Philips, and will join the Mullard Blackburn and Philips Eindhoven plants, which have already been commissioned, and the Sonopress plant in W. Germany. Universal-Pioneer and Sony are to produce LaserVision discs in Japan, while 3M and Discovision Associates (MCA and IBM) already have plants in operation in the USA.

TRANSMITTER OPENINGS

The following transmitters are now in operation:
Cerrigydrudion (Clwyd) HTV Wales ch. 23, BBC-2 ch. 26, Sianel 4 Cymru (future) ch. 29, BBC Wales ch. 33.
Dolwyddelan (Gwynedd) HTV Wales ch. 41, BBC-2 ch. 44, Sianel 4 Cymru (future) ch. 47, BBC Wales ch. 51.
Kettlewell (Yorkshire) BBC-1 ch. 39, TV4 (future) ch. 42, BBC-2 ch. 45, Granada Television ch. 49.
Lauder (Borders region) BBC-1 ch. 22, Border Television ch. 25, BBC-2 ch. 28, TV4 (future) ch. 32.
Llanarmon-yn-Ial (Clwyd) BBC Wales ch. 21, HTV Wales ch. 24, BBC-2 ch. 27, Sianel 4 Cymru (future) ch. 31.
Monmouth (Gwent) BBC Wales ch. 55, HTV Wales ch. 59, BBC-2 ch. 62, Sianel 4 Cymru (future) ch. 65.
Stow (Borders region) Border Television ch. 23, BBC-2 ch. 26, TV4 (future) ch. 29, BBC-1 ch. 33.
Sunderland (Tyne and Wear) BBC-1 ch. 40, Tyne-Tees Television ch. 43, BBC-2 ch. 46, TV4 (future) ch. 50.

The above transmissions are all vertically polarised.

A new edition (dated May 1981) of the IBA's Pocket Guide to Transmitting Stations has been published. Copies can be obtained from the IBA Engineering Information Service, Crawley Court, Winchester, Hants, SO21 2QA.

RADIO AND TV SERVICING

The latest (1980-81) volume of *Radio and Television Servicing* has been published by Macdonald (Paulton House, 8 Shepherdess Walk, London N1 7LW) at £17·50. There's a mass of data on recent radio/audio/television models (but not VCRs) in this volume of over 800 pages, and one's only complaint is that chopping some of the circuits into so many sections makes it tricky to follow the overall circuit and check up on particular interconnecting paths.

Crossed Lines

Les Lawry-Johns

SOME time ago I reported on the condition of Laura Lovitt's loose legs. On her dicey Decca of course. Also her collapsed frame which was restored to full working order after a quick visit to the bedroom – to plug in the iron as there isn't a plug point in the adjoining lounge, which surprised me.

I'm easily surprised, and my eyebrows seem to be permanently arched over something or the other, usually the latter but sometimes the former. I mustn't chatter on however or the editor may edit. Look what he did to my gravestone: he cut out "he he". If there's one thing that should be seen more on headstones it's more he he and less poor buggers. Never mind, one day he'll realise he's erasing some of the world's finest literary efforts, and without a passing thought at that.

Anyway, Laura had phoned to say that her set wasn't working, and I'd said I would call during the afternoon if she'd nothing on. So I nipped up to the bathroom for a quick shave, shower and shampoo while my wife looked on in amazement. This annoyed me for three reasons. First because she seemed to think it unusual for me to have a clean up. Now I'm not the scruffy type. It's just that I don't like wasting water and razor blades, so I normally clean up in the evening after the toil of the day. Secondly because she was also laughing. I haven't been too good lately and I've been under the doctor for a funny thing and the pills haven't done much good either. And finally because she wasn't annoyed.

"Give my love to Laura" she said. "After you've fixed her set I hope she'll find something worth looking at."

I ignored that remark. "I wonder whether she's still keen on that telephone chappie" I mused.

"Oh, you mean Eric. He's thirty years younger than you and he's coming here this afternoon to run an extension into the bedroom."

It was my turn to be amazed. "You Jezabel" I bawled with righteous indignation. "Planning to get me out of the way when that fancy fellow calls. No wonder you were laughing at me when I was having a shower."

"I wasn't laughing. It's just that I don't like to see dead horses being flogged. Laura said that Eric is an up and coming young man." It was all too much.

"Right. I'm going to nip down to Laura's to fix her set before you can say knife, then bring the knife back here to cut the telephone communications in the bud."

"All right love. Don't rush about though. You know it's bad for you."

It was under this cloud of torment and suspicion that I called to put Laura back into working order. Knowing these Decca hybrids fairly well, I'd packed into my case everything I thought I might need. Except one thing that is. The yellow van just had to be outside when I arrived.

The Dicey Decca

There they were laughing and chatting away. Blockheads. What these women see in Eric escapes me. He must keep it hidden. I decided to give him a lesson in advanced technology. Instant diagnosis and immediate remedy would really shake him. And give him an object lesson on the advantages of private enterprise over these top-heavy nationalised industries with their multilayer layers of layabouts all passing the buck to one another and getting nothing done. So I whipped the back off the Decca.

"Can you make it snappy Les?" asked Laura. "I've got a lot to do today."

The h.t. fuse had failed, and a test between the top cap of the PY500 and chassis revealed an almost dead short. "Nothing to it Laura. Just a shorted capacitor. I'll just check the suspects and stick another one in." So I confidently clipped the boost capacitor on the lower panel and connected the meter across it. No short.

"Bloody disc on the tranny" I thought out loud. The harmonic tuning disc ceramic was also blameless however, and it then dawned on me that there was a real possibility of the line output transformer having a short between its windings. This was the item I'd not brought along of course.

"Sorry Laura, I'll have to run it back to the shop to fit a new transformer. Should have it back by five o'clock with a bit of luck." Laura looked at Eric and then said it would be fine.

"Aren't you coming to our place this afternoon Eric," I asked.

"No. The new fellow Desmond's doing that one. Probably done it by now. Fast worker. We don't waste much time on this job – we carry all the gear we need with us you see."

So I shoved the Decca in the van and hot-footed it back to the shop. That little demonstration of 100% efficiency hadn't quite worked out as intended.

Back at the ranch, Honey Bunch was looking as bright as a new pin. The nice chappie had called, done the job and departed. "Quite a dishy young man" she said. "In and out before you could say stud." The torture continued without a pause. "You didn't have much luck with Laura then?"

Bush Rangers

We seem to have quite a few of the little white Bush monochrome portables coming in – the ones fitted with the T16A chassis. The common failing is that the BF257 (BF337 or whatever) video output transistor has a high casualty rate, leading to a picture with an empty plastic look or no picture at all. The answer is to fit a new output transistor plus a heatsink – one of those nice round ones with fins is ideal. If you can't put your hands on a heatsink of the approved variety you can use the shell of a coaxial plug, clipping the side to make it fit if necessary. We refer to the metal type of plug of course, not to the part plastic ones, some imported examples of which don't even fit our standard coaxial sockets let alone a transistor . . .

8500 Focus Fault

We often have trouble with the thinner, square type of thick-film focus unit used in the Thorn 8500 etc. chassis. So it came as no surprise when Mr. Piddlewell turned up again with his set. You will remember that we had a certain

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Z45	TO220 Mounting kits (TIP33)	10 for 60p
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*Axial. All others are Radial.

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"1600" Dropper 18 + 320 + 70 + 39Ω	3 for £1.50
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amount of trouble with its start-up problems a little while ago. "Tube's gone" he announced flatly.

"No it hasn't" I announced, having had a look. "It's either the focus unit or the 100kΩ resistor on the tube base."

"I knew it was something to do with the tube" he said.

So we checked the 100kΩ resistor (in series with the focus electrode). Nothing wrong here. While next removing the focus unit screws I explained what happens when the thick-film track in the unit becomes practically open-circuit. I showed him the effect of having no focus voltage by removing the lead from the unit to the c.r.t. base panel. To my amazement the focus improved enormously – the picture was quite watchable, though we watched it for only a very short time.

To cover my confusion I switched the set off and proceeded to fit a new unit, mumbling something about the focus electrode borrowing some potential from the final anode for a short time. When the new unit was fitted I switched the set on and found the picture back in the grossly out of focus condition (at all settings of the control).

"It's better off without the bloody thing" said Mr. Piddlewell.

"That's silly" I said, "everyone knows you've got to have a high focus voltage with this type of tube."

"I don't. All I know is you've got to have a little adjustment to get good focus" said Mr. Piddlewell.

"How can we adjust something that's not there?" I argued reasonably. Having almost made my point I made the final diagnosis. "The e.h.t. rectifier unit must be up the creek."

"What's that got to do with the focus?" asked Mr. Piddlewell, sipping his coffee which No. 1 supplies for all potentially awkward customers.

"The focus unit receives its supply from the rectifier unit – this lead here" I said. "The rectifier's not providing sufficient output you see."

"How come it's better with none at all then?"

"Ah, that's the rub you see. If the focus electrode is not connected at all it floats, taking up a potential somewhere between that of the first and the final anode" I said.

"Sounds like a load of old bull to me" said Mr. Piddlewell unkindly.

"All right then, wait and see what it's like with a new rectifier." I was hoping I hadn't got one, but there it was on the shelf. In it went and I crossed my fingers, legs and eyes.

Perfect. "There you are you see. Faultless diagnosis."

"No it's not. You said it was the focus unit or that resistor thing on the tube base. I bet the thing you've just put in is dearer than those." Mr. Piddlewell's thoughts were becoming wonderously concentrated as he sorted out his priorities. "With the troubles I've had with this set lately I don't think I should pay anything at all."

"Don't then. Go somewhere else and see if they'll give you coffee while they sort out your clapped out old set."

"What do you mean, clapped out?" demanded Mr. Piddlewell indignantly.

"Well, the tube's going for a start."

"Right then. Now I'm not going to pay, and what's more you won't get your milk tomorrow morning."

The sooner the common market does away with our milkmen the better I say.

Anne's Troubles

Anne is a local character who can't see why the world should be a different place from what it was fifty years or so ago. Her age is a secret, and she's a little woman with a loud voice, very fond of a flutter on the horses. She goes into the bookies and puts sixpence each way on this horse and sixpence each way on that. The bookies don't hesitate to accept her money, even though she moans about two bob being a lot to pay out. Anyway, she popped into tell me that her sound had gone off.

"I'll be up this afternoon, Anne."

"You can't come this afternoon mate, I'm having my hair permed. I'll borrow a set from the pub tonight. You can come tomorrow. Make it two o'clock. Don't be late: I go down to the bookies at half past."

So next afternoon at precisely two o'clock we pulled up outside. The set needed a new PCL82 and a couple of resistors.

"I suppose you're glad of the work, the way things are" said Anne.

"Yes thank you Anne."

"That's all right mate. Now what do I owe you?"

"Seventy five pence please Anne."

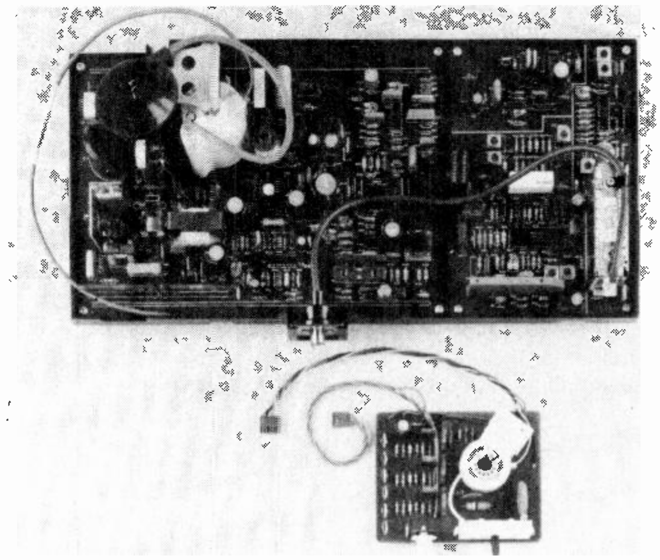
"Here's a pound. Keep the change – I believe in paying a man his worth. You can put the plug back on the set I borrowed from the pub before you go, it'll save them having to do it later."

Test Report

We've just taken in our first batch of Fidelity CTV14R colour sets – and very nice little sets they are. British made and fitted with a 14in. Toshiba black-stripe tube. The picture strikes us as being exceptionally bright and well defined.

The hand-held infra-red remote control unit changes the six selected channels positively, and the off button switches the set off when depressed for a few seconds. Removal of the rear cover (sensible screws for a change) exposes the well laid out horizontal panel, with everything easy to get at and the presets clearly marked. If servicing is required, it looks as if this is not going to present any problems. One of the sets had a tendency to jitter vertically, but only when the tuning cover was up to close the a.f.c. switch. The a.f.c. coil was clearly marked on the front right-hand side, and a slight turn of the core of this instantly cleared the instability.

Full marks Fidelity. This set looks a winner, and has a very reasonable price.



The main panel and c.r.t. base panel used in the Fidelity CTV14R 14in. colour transportable. The low component count and neat layout should make any servicing required easy.

VCR Servicing

Part 1

Mike Phelan

THE domestic video recorder is now well and truly with us. As a result, many service engineers who've never seen the inside of one before are going to be called upon to service them. In fact in view of the present video boom it's likely that no one involved in television servicing will be able to avoid getting caught up somehow in video servicing – remember the start of colour?

Where do you go for information? Very little has been published in book form on basic servicing, while half the battle is in recognizing the symptoms. Don't let this put you off the subject however – video recorders display their faults quite well on the screen, they are light and easy to handle, and don't have e.h.t., boost or even h.t. rails – 30V or so is usually the highest voltage. There's no c.r.t. to flash over and destroy dozens of semiconductor devices – so all in all it's not that bad!

The aim of the present series is to outline the basics of VCR operation and to take a look at the things that can go wrong and the symptoms and action required. Let's start by going back briefly to the principles of audio recording.

Recording on Tape

To record a signal on magnetic tape, the tape must travel at a constant speed past a magnetic head in whose winding the signal current is flowing (see Fig. 1). It doesn't matter whether the signal is an audio or a video one, a computer programme or whatever. Unfortunately, the relationship between the magnetising current and the magnetic flux produced, known as the B–H curve (see Fig. 2), is not linear. If things were simply left at this, the signal would be severely distorted. For audio, the problem is overcome by adding an h.f. bias signal – at a frequency much higher than the highest audio frequency, typically around 35–50kHz. As Fig. 3 shows, the result is that the audio signal is moved to the linear portions of the B–H curve. The oscillator that provides the bias signal also doubles as the erase oscillator. The reason, incidentally, for going into this is to be able to see later why h.f. bias is *not* necessary when recording a video signal!

Next, what sort of frequency response is required for recording video information? The bottom limit is d.c. (or should we say zero frequency?) to take care of slow changes in scene brightness. The top limit needs to be in the region of 5MHz, to achieve reasonable picture definition and to be able to include the chrominance subcarrier at 4·43MHz and its sidebands within the bandwidth. This sounds nice and straightforward until we come to examine the capabilities of a magnetic tape system.

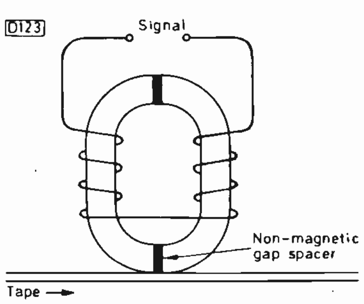


Fig. 1 (left): Tape, head and signal winding arrangement.

A good audio tape recorder might have a frequency response of say 20Hz to 20kHz. It's easy to design an amplifier with a much greater bandwidth than this, so why the limitation? Say we have a prerecorded tape with signals of gradually increasing frequency recorded on it. When we play it back, the lowest frequencies will be audible when the amplifier's gain etc. is suitably adjusted. As the frequency rises, the *rate of change* of the magnetic flux increases and the alternating voltage developed across the playback head increases – because, as you should know, the voltage produced across an inductance is proportional to the rate of change of the current flowing through it – the current which, in this case, is generated by the changing magnetic flux from the signal on the tape as it passes the head. Were this not true, we could not derive the e.h.t. from our line output stage! To put it briefly, if the frequency is doubled the output voltage is doubled – this is conveniently stated as an increase of 6dB per octave, an octave being the interval between any frequency and double or half that frequency.

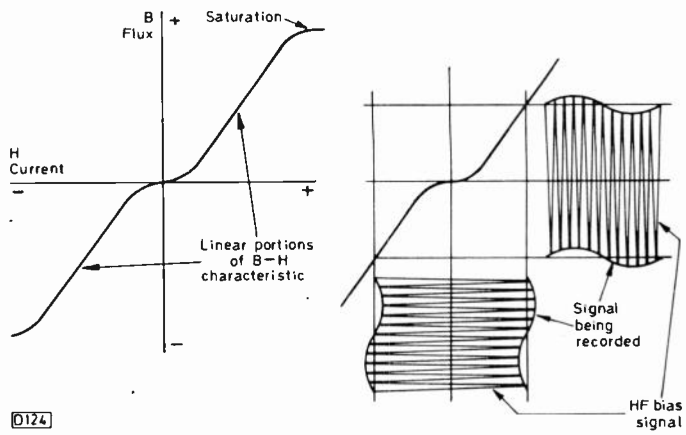


Fig. 2 (left): Recording characteristic of magnetic tape.

Fig. 3 (right): Use of an h.f. bias signal to keep the signal being recorded on the linear portions of the tape's BH characteristic.

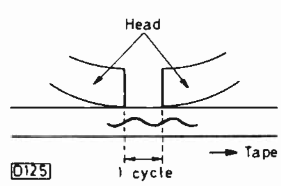


Fig. 4 (left): When one recorded signal cycle equals the width of the head gap the output drops to zero.

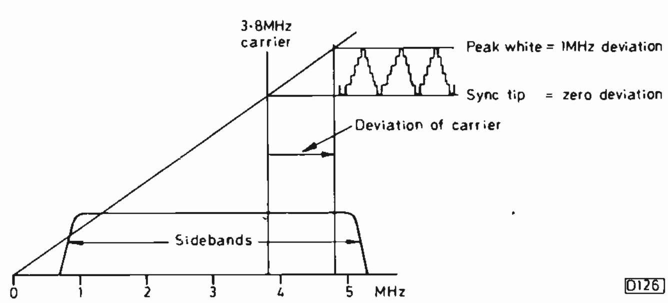


Fig. 5: Use of frequency modulation, with a carrier' at 3·8MHz, to record the luminance signal.

So far so good then: as we play back the tape, the output rises at 6dB per octave and we design our playback amplifier with a falling gain/frequency characteristic to compensate. This is all right provided we do not want to span too many octaves.

There's another problem. As the frequency increases, the length of each cycle of magnetic flux on the tape becomes shorter: when it equals twice the head gap, the output starts to fall rapidly, reaching zero when one cycle equals the width of the head gap (see Fig. 4) as there is then no change of flux. If we reduce the head gap by half, the upper frequency limit is increased by an octave. At lower frequencies however the output is reduced, because the narrower the gap the less effect the tape has on the flux in the head. So the lower frequencies will be lost in the noise, and as we get an extra octave at the top by halving the head gap so we lose an octave at the bottom.

Recording Video

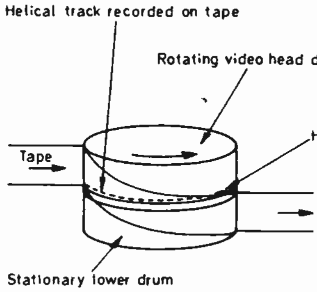
Where does this leave us? Our good audio recorder with a bandwidth of 20Hz to 20kHz has a response of nearly ten octaves. If we want to record a video signal with a bandwidth of say 50Hz to 5MHz we are concerned with nearly 17 octaves. One solution is to increase the tape speed – by this means we increase the output from the head and the upper frequency cut-off point, since one cycle then occupies a longer section of tape. So we could record our 17 octave video range if we had a playback amplifier whose gain varied with frequency over a range of 100dB or so and a tape speed of several metres per second. But for a reasonable playback time we'd need reels of tape the size of dustbin lids – not the sort of thing to have in one's front room, and mightily expensive. Clearly we need some means of reducing our 17 octaves to ten or less. This is done quite simply by converting the video information to f.m.

Amplitude modulation of a carrier wave produces sidebands that are the sum and difference of the carrier and modulation frequencies. The situation with frequency modulation is a little more complex, but we're not concerned with mathematical theory here. Suffice it to say that if we limit the upper frequency of the video information to about 3MHz and use it to frequency modulate a carrier between 3·8MHz and 4·8MHz, we will have to be able to handle sidebands from about 1MHz to 5MHz. This is what's done, and the octave range is reduced to less than three (see Fig. 5).

If we used a lower carrier frequency, the lower sideband would be too low or would get cut off altogether. If a higher frequency carrier was used, a much higher tape speed and/or a microscopic head gap would be required – 5MHz is bad enough! But if we cut off the video at 3MHz, what about the definition and how do we manage to get the chroma in? Without going into detail here (we'll have more to say on the subject later) the chroma is separated and converted to a lower frequency before being recorded. As for the loss of definition, this is partially compensated for in some (though not all) machines by including a circuit that enhances the h.f. response on playback.

At this point it should be stated that we shall be using the VHS system to illustrate these articles, in particular the basic JVC/Ferguson machine (HR3330/3V00/Baird 8902 etc.). Other machines and systems use similar principles and the important differences will be pointed out as we go along.

So there we are then: we've converted the chroma to a lower frequency, limited our video to 3MHz, and used it to frequency modulate a carrier, with 3·8MHz corresponding to the sync tips and 4·8MHz to peak white. H.F. bias is not



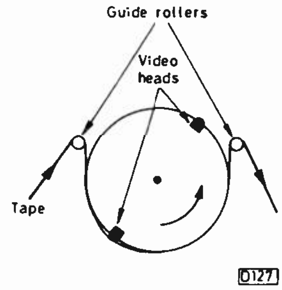
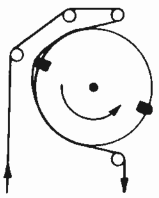


Fig. 6 (left): Helical scanning.

Fig. 7 (right): Tape wrap system used with VHS machines.



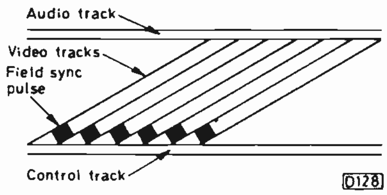


Fig. 8 (left): Betamax and Philips N1500/N1700 tape wrap arrangement (simplified).

Fig. 9 (right): Layout of the tracks on the tape.

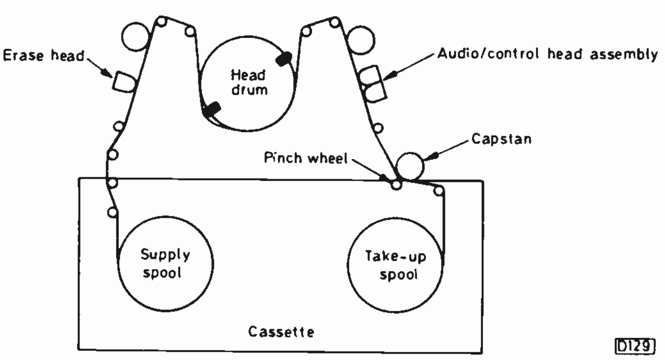


Fig. 10: VHS tape deck arrangement (simplified).

needed – as the signal is in f.m. form, distortion doesn't matter, while any a.m. noise can be removed by limiting on playback (the same principle as with an f.m. i.f. strip). Also, we don't have to bother too much about over recording, or the amount of gain on playback.

Helical Scanning

To play back a frequency of 5MHz, we still need a very small head gap and a high tape speed. The latter problem is overcome by mounting the video head (two in practice) in a rotating cylinder around which the tape is wrapped for just over 180° (see Figs. 6–8). Since both the heads and the tape are moving, the relative head-to-tape speed is quite high though the actual tape speed is similar to that used in audio machines.

As Figs. 6 and 9 show, the information is recorded on the tape as a series of long diagonal stripes. With the head drum rotating at 25 revolutions per second, the stripes recorded or played back by each of the two heads comprise one complete field ($312\frac{1}{2}$ lines). As one head leaves the tape, so the next head comes into contact with it. There's an overlap of a few lines, which may appear as a slight horizontal disturbance at the bottom of the picture, though this will not be seen with correct setting of the height control. In most machines (though not the Philips N1500/N1700 series) the head that's not in contact with the tape is switched off. With the head drum rotating in contact with the tape there's no need for pressure pads, and as the heads project slightly from the drum intimate contact with the tape coating is ensured.

Stationary Heads

The tape passes a stationary erase head (see Fig. 10) before the video heads, and another stationary head between the drum and the capstan. This latter head records the audio signal on the top edge of the tape and control pulses, derived from the field sync pulses, on the bottom edge – we'll explain about these later. Since the audio record/playback part of the machine is just like an audio only tape recorder, we'll not have much more to say about this.

Track Layout

Fig. 9 shows the layout of the information recorded on the tape. Head switching occurs just before the field sync pulse, so each video track starts with the sync pulse. Great care has to be taken to synchronise the head and tape movement with the video information on record and playback. This is done by the head and tape (capstan) servo systems, which we'll consider as soon as we've looked at the chroma signal.

Chroma Signal Processing

As the frequency response on playback drops off rapidly above about 5MHz, video frequencies above about 3MHz cannot be reproduced. This means that if the chroma information was left at 4·43MHz when recording it would be lost on playback. Even if it wasn't, consider this: each line of the picture contains 283·75 cycles of chroma (4·433619 divided by 15,625) and each field recorded on the tape contains 283·75 × 312·5 cycles; an error of half a cycle will reverse the colour, and even a 45° phase shift is totally unacceptable.

The answer to this is to convert the chroma signal to a much lower frequency (still a.m.) and add it to the f.m. being recorded on the tape. Since the chroma uses a.m. instead of f.m., what about h.f. bias? Fortunately the f.m. video signal acts as the bias for the chroma signal, simplifying things considerably. What frequency can we use for the chroma? It must fall into a vacant space in the f.m. passband (outside the limits 1–5MHz), and as above 5MHz is out below 1MHz it must be. A frequency of 36 or 40 times the line frequency is chosen – 40 times with the VHS system.

An oscillator running at 40 times the line frequency (40H for short) is used, and to compensate for tape speed variations it's locked to the line sync pulses (off tape on playback). The output from this voltage-controlled oscillator (VCO) is mixed with the 4·433619MHz output from a crystal oscillator (see Fig. 11) to give an output of approximately 5·06MHz which when mixed with the 4·43MHz chroma signal on record gives a signal at 625kHz, and when mixed with the 625kHz signal on playback gives us back the 4·43MHz chroma information. This is an approximate picture and we'll fill in more detail later.

Block Diagram

Fig. 11 provides a simplified block diagram of the signals side of the VCR, on record and playback. The tuner and i.f.

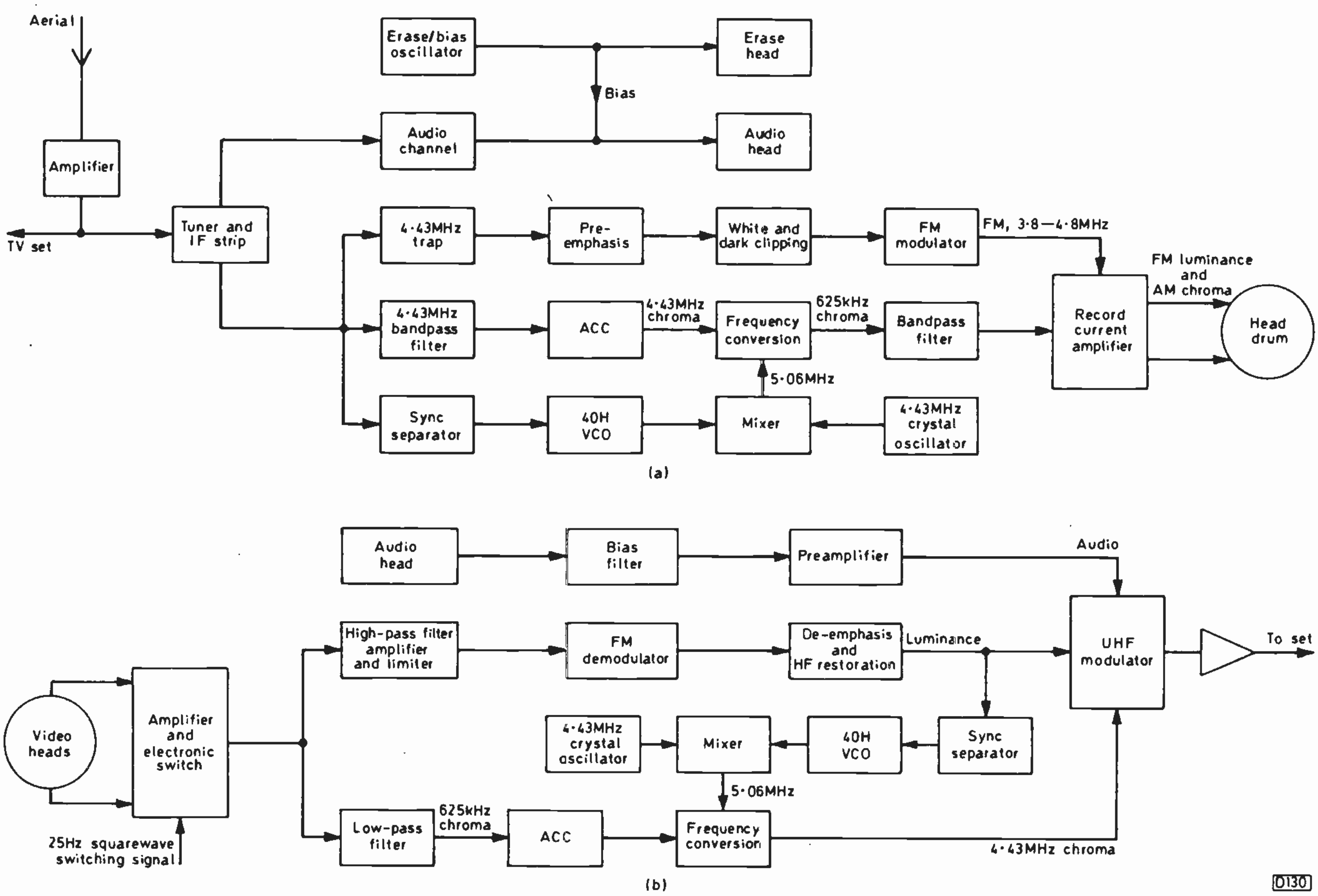


Fig. 11: Block diagram of the signal circuits, (a) when recording and (b) on playback.

strip are necessary so that recording is completely independent of the TV receiver – indeed you don't even need one. As one requirement is for the viewer to be able to watch one channel whilst recording another, the aerial is plugged into the VCR, the signal being amplified and then split, one output going to the TV set's aerial socket and the other to the tuner and i.f. strip in the VCR. This circuitry is all quite conventional.

The composite video output from the i.f. strip passes to the luminance and chroma channels and to a sync separator. Pre-emphasis is included in the luminance channel to give greater gain to the higher frequencies – as is done with other f.m. systems, e.g. TV sound, f.m. radio etc. This improves the noise performance, as the de-emphasis used on playback (reducing the gain at the higher frequencies) reduces h.f. noise correspondingly. There's a snag to this however. As Fig. 12 shows, spikes are produced by overshoot. If these are not removed, over modulation will occur, giving rise to black streaks on highlights etc. Hence the white and dark clip circuits

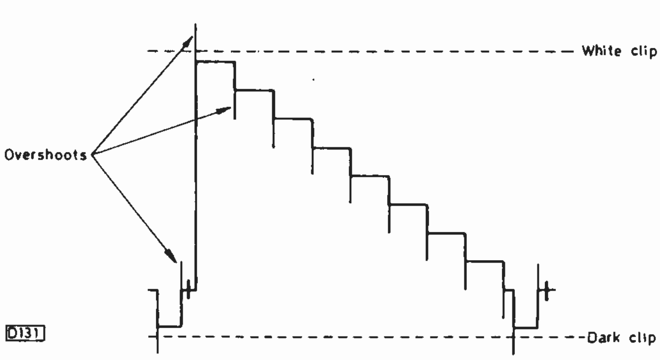


Fig. 12: Use of white and dark clipping.

following the pre-emphasis.

The f.m. modulator consists of a simple voltage-controlled multivibrator with a low-Q tuned circuit at its output – the latter is omitted in some makes of machine.

We've already outlined the technique used in the chroma section, the sync separator providing off-tape sync pulses to lock the 40H voltage controlled oscillator.

On playback the u.h.f. modulator is fed with the video and audio signals and modulates these on to u.h.f. carriers somewhere between channels 30 and 40, to which one channel position on the TV set is tuned. The modulator can be tuned up or down a few channels in case its output lands on top of one of the local channels, giving rise to patterning.

The Mechanics

The mechanical part of the tape deck is similar to that of an audio machine. The video head drum is usually driven by its own motor, and the capstan, which drives the tape in conjunction with the pinch wheel, by another. In the simpler VHS machines the latter motor also drives the spool carriers on fast forward and rewind, and the take-up spool through a slipping clutch on record and playback. When the play key is depressed, the tape must be drawn from the cassette and wrapped around the head drum. This is achieved by a rather complicated system of levers driven by a large nylon wheel which is driven from the capstan. Other types of machine use separate motors for loading (threading) and for the spools, eliminating the mechanical idlers and slipping clutch. The Betamax system laces up when the cassette holder is closed and unlaces when the eject key is pressed. The Philips N1500 and N1700 series machines lace up when switched on. Both these systems (Philips and Betamax) have guides attached to a metal ring below the head drum, the whole assembly rotating during lacing and unlacing.

It will be apparent by now that the speed of the tape and of the head drum must be very accurately controlled. Both must run at a constant speed, the same during record and playback. In addition, on record each video head must start its scan of the tape just before the field sync pulse arrives, and on replay the head must scan the tracks centrally to give maximum output to the head amplifier. In the VHS system the head motor has its speed and phase controlled to achieve this, the capstan motor being locked to a reference frequency from a crystal (a tuning fork was used in earlier machines). Feedback for the servo systems comes from magnets on the head drum and capstan flywheels – the magnets pass pick-up heads which produce feedback pulses. These are compared with a reference, the servo systems producing d.c. outputs to drive the motors. We'll examine these servo circuits in detail later.

Finally we have a stop solenoid, which is operated by the tape end sensors, and protection circuits which sense if the drum or capstan stops rotating or the take-up spool stops – all these will cause the stop solenoid to operate.

Tuner Coupling with SAWFs

Ted Barrett

THE Surface Acoustic Wave Filter (SAWF) is here to stay. Virtually every setmaker now uses them, including the Japanese who are sometimes slow to adopt new technology. The advantages of SAWFs are well known, and when coupled with competitive pricing due to multisourcing they become the obvious choice for use in a modern i.f. strip design.

In order to use a SAWF successfully, two parameters need to be considered. First the loss introduced by the SAWF itself (between 20 and 26dB). This has to be made up by including a preamplifier between the tuner and the filter. Secondly, most tuners currently available have an i.f. output circuit which is tuned about halfway between the vision and the chroma carriers (i.e. about 36MHz), yielding a given bandwidth at a specific load. Since all the bandshaping should be left to the SAWF, a system of providing a flat frequency response between the sound and vision carriers *without loss of tuner conversion gain* is required. The necessary bandwidth could be achieved by damping the tuner's i.f. output circuit with a resistor, but of course this will reduce the tuner's gain.

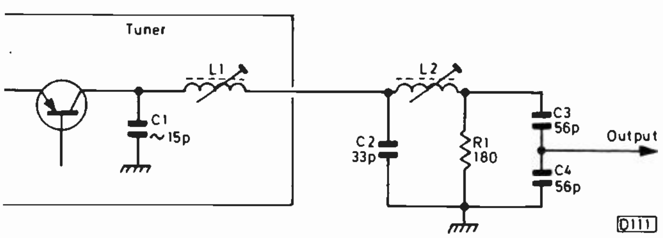


Fig. 1: Typical bandpass tuned circuit between the output stage in the tuner and the preamplifier. C1, L1, C2, L2, C3 and C4 form a two-section pi-filter, with R1 providing a d.c. path for the collector of the output transistor and a degree of damping. C3 provides a d.c. block as well as contributing to the tuning, and with C4 provides a tapping point to give the correct impedance matching to the following circuit.

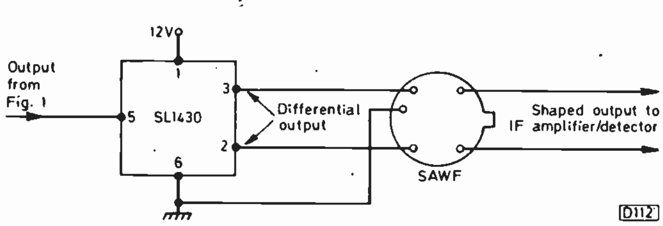


Fig. 2: Use of an SL1430 i.f. preamplifier i.c. to drive a SAWF. The i.c. provides a differential output at pins 2 and 3. The SAWF also provides a differential output.

The usual way of achieving a wide bandwidth without loss of gain is to use an external tuned circuit as part of a multipole coupling network between the tuner and the i.f. preamplifier. A typical arrangement is shown in Fig. 1. The output is fed to either a discrete component or an i.c. preamplifier which must meet the following requirements. (1) Gain equal to the loss introduced by the SAWF. If the gain is higher than is necessary, direct breakthrough may occur between the input and output of the SAWF. (2) The preamplifier's input impedance must be high compared to the coupling circuit's output impedance – say four times.

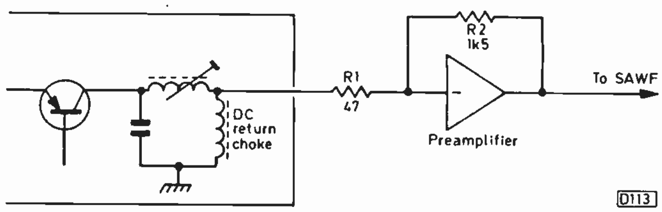


Fig. 3: An interesting variation. The preamplifier's gain is set by the ratio of R1 and the feedback resistor R2. The use of feedback gives "virtual earth" conditions at the preamplifier's input, the low impedance at this point being used to damp the tuner's output circuit to get the required bandwidth. With the values shown for R1 and R2, the voltage gain contributed by the preamplifier is about 32 (30dB).

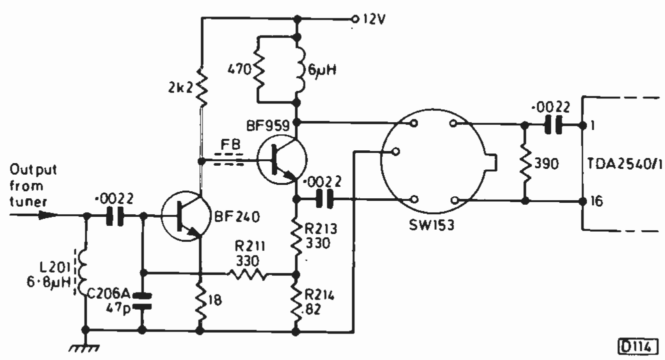


Fig. 4: Discrete component preamplifier circuit used in the latest ITT chassis, employing the technique shown in Fig. 3. R211 with R213 and R214 provide the effective feedback resistance shown as R2 in Fig. 3 – the value is 1·66kΩ, given by

$$\frac{R213 + R214}{R214} \times R211.$$

The impedance shown as R1 in Fig. 1 is formed by the combination of L201, C206A and the tuner's output coil, and works out at around 50Ω.

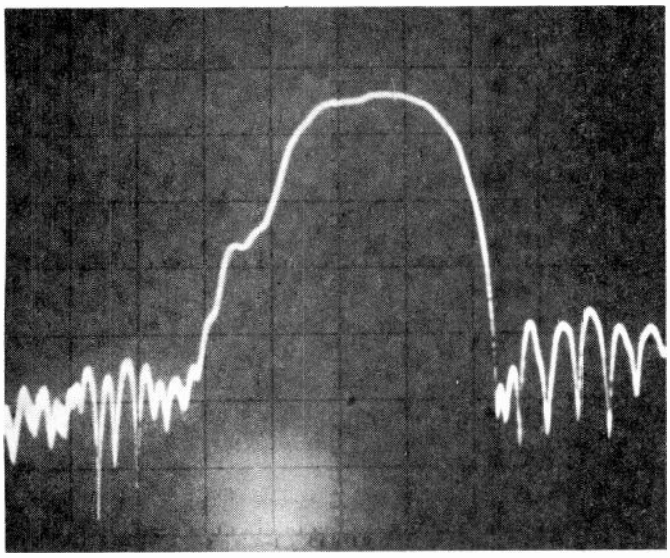


Fig. 5: Correct SAWF bandpass response, achieved with good screening.

(3) Good overload capability is required to avoid signal distortion. (4) Low intermodulation is required at high signal levels to avoid the production of beat signals. (5) Low cost.

These conditions would be easier to fulfil if all this circuitry was incorporated in the tuner itself, so that the output drove the SAWF directly. We know of one Japanese manufacturer of such tuners, but European companies have been rather reluctant to offer such products. Perhaps the situation will change with the next generation of tuners.

In the meantime, the widely used Plessey SL1430 preamplifier i.c. fulfills the requirements outlined above: a typical application circuit is shown in Fig. 2.

An interesting variation is shown in Fig. 3. Here the tuner's i.f. output circuit is damped by the input impedance of the preamplifier. Since the amplifier is connected in the "virtual earth" configuration, its input impedance is determined by R1, i.e. the value of R1 is (within a few ohms) the amplifier's input impedance. This value is chosen so that the damping it provides gives the required bandwidth. The value of R2 is then calculated so that the required gain is achieved. This method is used by ITT, Fig. 4 showing the circuit.

So far we've concentrated on the circuitry before the SAWF, but the physical layout, screening and termination characteristics need to be looked at just as carefully if the complete i.f. system is to function correctly.

The TDA2540/TDA2541 i.f. i.c. is nowadays very commonly used in i.f. strips, though virtually any other similar i.c. may be substituted, the same considerations applying.

Breakthrough

Let's take a closer look at the problem of breakthrough – that is, when some of the signal finds a direct path from the preamplifier to the i.f. i.c. without first passing through the filter. The effect this has on the i.f. response is quite devastating. If the time taken for the i.f. surface wave to travel through the filter from the input to the output is 1·5µs (this is known as the transit time), any signal bypassing the filter will cause a ghost image 1·5µs to the left of the correct image. The screening must therefore be adequate to suppress this ghost – manufacturers provide some 40dB isolation between the SAWF's input and output.

The transducers within a SAWF are not perfect matches, and waves launched in the wrong direction are never perfectly absorbed. This gives rise to a ghost which travels three times through the filter, i.e. 3·0µs to the right of the main image. The attenuation of this image is twice the insertion loss plus 6dB, so there is no need to try to minimise the insertion loss: allowing it to be of the order of 20-30dB will cut the "triple-pass response" by some 46-66dB.

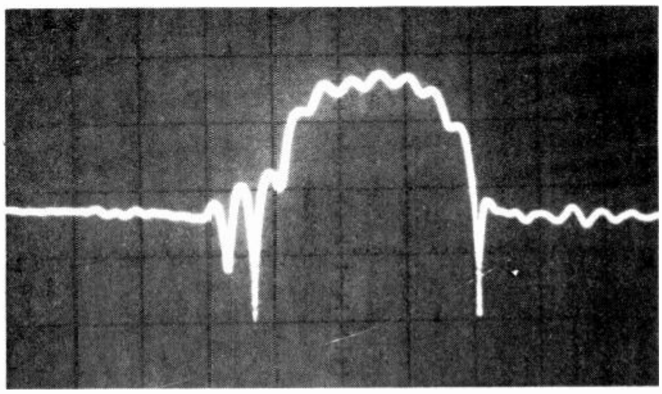


Fig. 6: Inadequate screening has a drastic effect on the SAWF's bandpass characteristic. The effect of adding direct signals and indirect signals delayed by the transit time of the SAWF is to produce ripple on the response and other undesirable effects.

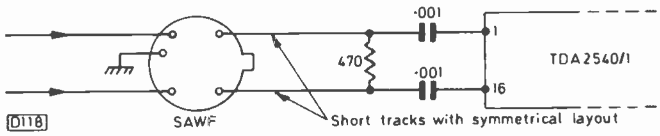


Fig. 7: Matching between a SAWF and a TDA2540 i.f. i.c., with a damping resistor and coupling capacitors. A symmetrical layout between the SAWF and the i.c. is important.

A transit time of 1·5µs means that there will be 59 complete delayed waves at 39·3MHz and 58·5 waves at 39MHz. Suppose that the breakthrough due to poor screening is 20-25dB down on the input, i.e. at the same level as the intended output. At 39·3MHz the waves will reinforce, while at 39MHz the waves will cancel. This will be repeated every 666kHz, giving deep notches in the bandpass response and poor rejection outside. This effect is illustrated by the response curves shown in the accompanying photographs.

Fig. 5 shows the correct response with good screening – the scales are 10dB/division vertically and 2MHz/division horizontally, with a centre frequency of 36MHz. Fig. 6 was taken under identical conditions, except that a piece of insulated wire was laid across the filter, passing close to but not touching the input and output pins. The performance of the filter has been totally degraded, with ripple in the passband and undesirable notches at the edges.

As the transit time depends on temperature (by 90 parts per million per degree Kelvin), the position of the notches will vary with the ambient temperature, giving rise to curious changes in picture quality.

SAWF Output Capacitance

The output capacitance of some SAWFs upsets the TDA2540 i.c. This problem can be overcome by using a damping resistor of 470Ω or so, but since the input pins of the TDA2540 must be at different d.c. levels d.c. blocking is required as well. The best way to arrange this is to use two blocking capacitors, one for each input pin, thus maintaining a symmetrical physical layout. A typical circuit is shown in Fig. 7.

Although SAWFs simplify the outward appearance of i.f. strips, considerable effort is required to get a practical design right. ■

Fault Report

Dewi James

I'VE been involved in the retail side of the radio/TV trade for many years now, and recently started to think "where's everyone gone?" So I counted the businesses I've known in my little corner of the world, a supposedly hassle free country district with sandy beaches, mountains and several nature reserves, and worked out who had gone where and why. Here's the list:

(1) The first proprietor walked out of his shop one morning, never to be seen again.
(2) The second sold out to someone who'd not been in the trade before.
(3) The third attempted suicide.
(4) The fourth sold out.
(5) The fifth sold off his rentals, reduced his shop by half and his staff by two thirds.
(6) The sixth attempted suicide, failed, then sold out.
(7) The seventh, who bought from sixth, has had two heart attacks but still carries on.
(8) The eighth has had a stroke but carries on and has in fact increased his substantial business.
(9) The ninth is now a pork pie salesman.
(10) The tenth, who bought out from the third, would sell if he could but can't find a buyer so hasn't yet.

What a litany of woe and failure. I doubt whether any insurance company would give very good terms with odds like these. The TV set is not a luxury – in fact nowadays it seems to be a necessity, on a par with food and shelter. But trying to make a living out of it is something different. I don't know how I manage to cope, but suspect that draught Bass has a lot to do with it.

Sony KV1800UB

Anyway, what's come our way recently? Let's take the Japanese sets first, plenty of them around here. The complaint with a Sony set, an elderly KV1800UB, was "please come and check the set, the on/off switch has gone". What he should have said was that the set doesn't always come on, which is a completely different kettle of fish. It just refused to start up periodically, and when I called on a Saturday afternoon was just one such occasion. Now most of the supplies in this set are obtained from the converter stage, which is between the line driver and output stages. As a result, the line oscillator has to have a start-up arrangement so that things can get going. The start-up system consists of a capacitor (C531) and a resistor (R555) which are connected in series between the main, regulated 110V rail and the 18V rail. The 110V supply was present, but little else was happening. In an effort to entice the line oscillator to oscillate, we bridged the kick-start circuit with a 15kΩ resistor. The set then sprang to life – predictably C531 (10μF, 160V) was open-circuit.

Various Hitachis

Several Hitachi sets have come our way recently. The first was a newish set, Model CTP213, fitted with the NP8C chassis. It had, to put the description in non-technical terms, "gone off with a hell of a bang". The set uses a self-oscillating chopper circuit, and the destruction was quite extensive. The mains fuse had shattered, the bridge rectifier had given up the struggle, the chopper transistor Q901 and the driver Q903 were short-circuit, the error detector transistor Q902 was open-circuit, and module CP901 (sample voltage divider plus reference voltage source) was damaged. Which was the chicken and which the egg in this situation I don't know.

The next set was a nice little portable (CWP132) fitted with the NP6C chassis, the problem being that it intermittently refused to come on whilst on other occasions it came on then went off. Disconnecting R941 so that the over-voltage circuit could not operate made little difference, but shorting out C910 which provides a kick-start supply for the start-up multivibrator restored life. The culprit turned out to be the 12V rectifier diode CR705 (type V09C).

A much older set (Model CEP180) suffered from no e.h.t. This was traced to an open-circuit line oscillator coil (T701). The other two Hitachis were both suffering from transistor trouble. The symptom with a CTP200 (PAL-4 chassis) was low gain, with a blank, noise-free raster when the aerial was disconnected: the first i.f. transistor TR201 (2SC682) was faulty. The symptom with a CNP192 (PAL-2 chassis) was no R–Y signal, due to failure of TR31 (2SC460) to conduct (no emitter voltage) – this transistor provides the reference signal drive to the R–Y demodulator circuit.

A Couple of Mitsubishis

The other two Japanese sets we've dealt with recently were both Mitsubishis. The first (Model CT205) originally had a field fault, but in the meantime someone had borrowed the power supply, replacing it with one that produced a small picture accompanied by what looked like a hum bar. The error amplifier transistor Q902 (2SC711E) was responsible for this. The field trouble was a little more difficult to diagnose since it took some time to show up and when it did the symptoms were misleading – the field would roll intermittently, but was this due to loss of the sync pulses or a change in the oscillator frequency? The latter as it turned out, the fault being due to Q432 (2SC711A) in the field oscillator circuit (it's a multivibrator).

The second Mitsubishi set was one of those excellent but now ageing CT200s. A gentleman phoned to say that it had been going off for the past few weeks, but that when he banged the top it came on again. No amount of banging would now restore it to life however. The on/off bit was due to a high-wattage resistor that had burnt itself a hole in the board because it had been chattering in and out. After cleaning up and cutting out the burnt bit, the set came on, with normal sound but a small picture (all round). Those familiar with this set will know that the fault is not uncommon – it's due to the 12V zener diode D923 in the error amplifier circuit. Possibly on this occasion the diode had been damaged through the set offing and oning once too often.

Finlux Peacock

Now to the continentals. A set I'd never actually seen before turned up recently – a Finlux Peacock. There was no field scan, and although there was the usual no signal rushing noise on the sound it was not possible to tune in any stations. After removing the back etc. I discovered that the

30V line was missing. "How did he discover that without the manual?" I hear you ask. Simple, "30V line" was written on the chassis and there was no voltage at that point. By tracing along the print I discovered that the supply comes from diodes D603/4 (type BYX55-350) in the line output stage. Replacing these restored the sound and a full scan. (These two diodes, which are fed from a winding on the combi coil in the thyristor line output stage, seem to be one of the main causes of trouble in these sets – *editor.*)

The Telefunken 711 Chassis

The other continentals we've dealt with recently have all been Telefunkens fitted with the 711 chassis – five of them. The first one had a hiss on the sound but no raster, and was stuck on channel one. In fact the h.t. (U1) supply was missing. The h.t. rectifier/regulator thyristor TY421 was open-circuit, diode D425 which is in series with it was short-circuit, as was T424 which produces the trigger pulses. These points were put right and after making thorough checks we switched on. H.T. was present, but there was a strange, distorted raster on the screen. Replacing the h.t. reservoir capacitor C428 (1,000μF) put that right.

The next one had no e.h.t. due to R566 (15Ω) in the h.t. feed to the line output stage being open-circuit. The line output stage had apparently been overloaded since D563 (BYX55), one of the EW modulator diodes, was found to be open-circuit and very charred. This in turn was probably due to the fact that the output transistor T503 (BD177) in the NS correction circuit was short-circuit, with its emitter resistor R519 (8·2Ω) open-circuit – the NS driver and output transistors are powered from the EW modulator derived 28V (U4) rail. The next two were easy. On the first, extremely poor focus was found to be due to the 33MΩ resistor R578 in the feed to the focus control being virtually open-circuit. The second stuck on channel one, the fault being cleared by replacing the SAS560 i.c. in the channel selector circuit. The final one was rather more awkward, the fault being intermittent loss of the top of the raster. This was eventually resolved by replacing the field flyback diode D451 (1N4001).

Little Local Difficulties

We get many home produced sets as well of course. A Philips G8 for example, whose line shift control was burning up due to the shift voltage reservoir capacitor C5553 (400μF) being open-circuit. This was swiftly followed by a G11 which displayed a blank screen though the e.h.t. was present. Not an uncommon fault, due to the zener diode D4090 in the beam limiter circuit going short-circuit. Note however that exactly the same symptoms can be caused by TR2164 (BC148) in the field flyback blanking circuit going open-circuit. Other recent experiences with the G11 have been no results due to R4059 (15kΩ) in the power supply going open-circuit so that the thyristors don't get triggered, pincushion distortion due to a variety of causes, often simply dry-joints on the line scan panel, usually in the top right-hand corner of the chassis (also check the EW modulator driver pair TR2150 (BD238) and TR2149 (BFX85) as necessary), a case of intermittent field flyback lines due to a dry-joint on C2165 (0·0022μF), and finally an unusual case of field collapse due to C2060 (0·0022μF) being short-circuit.

On examining a dead Thorn 8500 we discovered that R704 (51Ω) in the power supply was overheating. This resistor is in series with the MJE520 25V supply series regulator transistor, which was short-circuit, the result in turn of the SN76227N demodulator/matrixing i.c. in the decoder being short-circuit. On replacing these components there was sound but no raster, with no voltage at the collector of the line output transistor. This was simply due to a dry-joint on SKT10/7 on the power board – it had no doubt been disturbed when we changed the regulator transistor. During the summer months the servicing of holiday makers' monochrome portables brings a welcome injection of cash into our business. One of the first to come along was a Thorn 1613, which had a weak picture, poor sync and a contrast control that didn't operate properly. When the aerial was removed, we had a blank white raster with no snow. Replacing the final i.f. transistor VT3 (BF197), which was open-circuit, restored things to normal.

In two cases recently we've had field collapse, in sets fitted with the ITT CVC20 chassis, due to the TIP33 output transistor being short-circuit. This seems to be quite a common occurrence. A CVC8 came along with no colour. Overriding the colour killer by connecting the 20V line to the positive side of C162 via a 12kΩ resistor failed to restore any semblance of colour, while a quick scope check revealed that the reference oscillator was working. Attention was turned to the chroma amplifier therefore, where the first transistor T27 (BC172X) was found to be open-circuit.

The trouble with a Decca colour set fitted with the 30 series hybrid chassis was lack of colour sync. The burst signal was o.k. at the collector of the final burst amplifier/phase detector driver transistor TR211, but the d.c. amplifier transistor (TR212, BC148) in the reference oscillator control loop was turned hard on. Its base bias resistor R272 (1·2MΩ) was the culprit. On another of these sets the problem was an intermittently poor B–Y signal. The fault here was a dry-joint on L204, the summing coil at the output from the choma delay line. On the last of these sets to come along the focus spark gap had burnt out and disappeared: examination of the focus voltage chain revealed that the earth return resistor R470 (4·7MΩ) was open-circuit.

Fuse Blowing: Decca 80 Series

Finally, a couple of Decca sets fitted with the 80 series solid-state chassis, both with blown mains fuses. There were no obvious shorts, so to check whether the crowbar trip was operating we disconnected the link (TP600/TP601) in series with the crowbar thyristor and fitted a 15W bulb in its place (this enables the operation of the trip to be observed without the fuse necessarily blowing). The bulb promptly lit up, indicating that the trip was tripping. Disconnect the line output stage from the power supply and the bulb goes out. So we'd an overloaded line output stage. The usual cause is the tripler of course; but disconnecting this and trying again failed to cure the overload. We next disconnected R400, removing the load from the line output transformer derived 37V line. This time success. The main suspect was the TDA1170 field timebase chip, and this was confirmed by open-circuiting R342. So we replaced the chip and did the modification (fitting a short wire link from the earthy end of C332 to the earthed copper land under the TDA1170) to provide flashover protection. That was the easy one.

The next one was put on the bench, a 15W 250V bulb and a new fuse were fitted, and the set was switched on. Bulb lights up. Disconnect line output stage and bulb goes out. So far so good. Check with tripler disconnected and R400 disconnected, but bulb stays alight. Try fitting another line output transformer and transistor. Still no luck. Fault must be on the line output panel, but just about everything likely has been isolated and/or eliminated. Try disconnecting line output stage again, just to make absolutely sure, and yes the bulb goes out. Look at line timebase again. Disconnect scan coils. Bulb stays alight. Are both transformers faulty?

Consider the symptoms. With the bulb connected and the set switched on, we get good sound with a pulsating, locked and fully scanned coloured picture and normal h.t. But our bulb is glowing brightly, pulsating in unison with the picture. Is the power supply faulty? It shouldn't be, since the bulb goes out when the line output stage is disconnected. Anyway, try another panel generously lent for ten minutes by an engineer from one of the large rental companies – he'd called in for a cuppa. Symptoms exactly the same. Could it be the smoothing electrolytic (C801, 800μF)? Well, as I'm sure you'll all have guessed by now, it was. Isolate power supply panel from smoothing components, connect 600μF and 200μF in parallel across C801, connect up again: out goes the bulb and the picture stops pulsating. I'll remember next time.

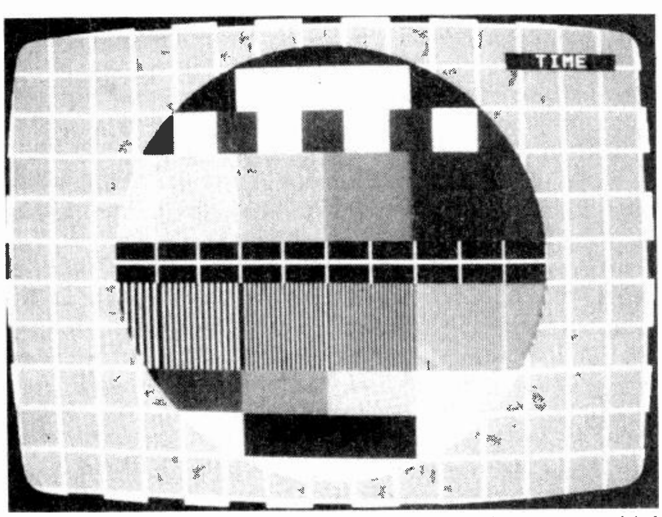
Amateur Television

John L. Wood, G3YQC
(editor, CQ-TV)

AMATEUR radio, as with many things nowadays, has become somewhat commercialised. Gone are the days when most equipment was home built, and the desire to construct, experiment with and operate better equipment was what amateur radio was mainly about. The era of the Japanese "black box" has overtaken us, with the result that many radio amateurs tend to be appliance operators. There are still some who like to build their own gear of course, but the sophistication of today's techniques and hardware, coupled with the need for expensive test equipment if results comparable with commercially built equipment are to be obtained, means that construction is fast becoming out of the question for most enthusiasts.

All is not lost however. Many amateurs are turning to television, a field that's received little commercial attention. Apart from the use of domestic TV sets and VCRs, almost all the rest of the equipment has to be built or adapted for amateur purposes. Amateurs transmit both monochrome and PAL colour pictures to CCIR System I specifications, so there's no problem with using domestic TV sets for reception.

A typical amateur TV station incorporates a tuner for the 70cm. (432–440MHz) amateur band – either a modified commercial varicap unit with a home-built preamplifier, or a home-built up-converter whose i.f. output is in the domestic u.h.f. TV spectrum so that it can be fed into the aerial socket of a standard TV set without modification. Aerials may be home constructed, but the majority are commercially made and are relatively cheap. The transmitter is invariably home built and is usually solid-state, running at a few watts. Individuals who desire high power (up to 150W d.c. input) of necessity still employ valves in the high-power amplifier stages. The video modulation is generally carried out in the transmitter's low-power stages, the signal then being amplified to the required level.



The BATC electronic test pattern – a pity we couldn't reproduce it in colour.

Station identification takes various forms. A common method is to use a drawn caption card, transmitting this using a TV camera (the camera is generally home built, or an ex-surveillance vidicon type purchased second hand). Alternatively, the call sign may be electronically generated, using a home constructed digital character generator – the caption can be inlaid in any other available vision source. The great benefit of using this system is that there are no cameras or lights to set up.

These items are basically all that's needed in an amateur TV station, though many enthusiasts go on to build quite elaborate studio systems, employing several vision sources, vision switching and effects generators, together with a mixing desk etc. – the scope is limitless.

This brief description merely scratches the surface of amateur TV, which can be as simple or as complex as you wish to make it. The beauty is that it can be tailored to suit all levels of interest, expertise and size of wallet!

In the UK, amateur television is officially represented by the British Amateur Television Club (BATC), which was founded in 1949. Membership is £3 per year, and details can be obtained from Mr. B. Summers, 13 Church Street, Gainsborough, Lincs (please enclose a stamped, addressed envelope). The club has over a thousand members throughout the world and issues a quarterly magazine, *CQ–TV*, which is sent to all members. The magazine usually has between thirty and forty pages, and is packed with practical articles and projects covering the full range of amateur TV equipment.

The BATC has its own publications department, library, and sales department which sells hard to get bits such as camera tubes, scan coils, lens mounts, test cards, etc., all at special members' prices. The club recently published the third edition of the *Amateur Television Handbook*, which is available from BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN at £2 (to non-members) plus 35p postage. This paperback volume has over a hundred pages and contains a wealth of information on amateur TV, with practical designs for, amongst other things, a full electronically generated test card (see photo) and a PAL colour coder. Printed circuit boards for most of the projects are available from the club. ■

Maintaining Telefunkens

Keith H. Gould

MANY readers will be aware that one of the oldest names in consumer electronics, Telefunken, seemed set to disappear from the UK scene in the Autumn of 1980, when the UK sales and servicing facilities were closed down. Fortunately, following the trade shows earlier this year, the name is now back in the limelight here with the new 415/615 chassis. Since the new agents are starting with a "clean slate" however so far as servicing is concerned, they will not be stocking spares for the earlier chassis. Spares are still available from AEG's UK headquarters, but as a result of the reduced stocking levels, increased prices and lack of the previously excellent technical back-up service there's an obvious risk that a number of sets that would formerly have been serviced without hesitation may now be considered as candidates for the chop. This is a great pity, since when properly serviced Telefunken sets are, in this writer's opinion anyway, amongst the finest of all TV receivers (after all Telefunken invented PAL, and Hanover bars are named after the location of their German headquarters!).

The purpose of this article is to indicate various ways in which the active life of some of the more common earlier Telefunken colour chassis may be prolonged – the 709, 710, 710B, 711 and 711A chassis. We are not concerned with those Telefunken sets fitted with Decca chassis, nor with the more recent 712 and 712A chassis with in-line gun tubes – these will for the most part still be under the charge of the original supplying dealer, who hopefully has a reasonable stock of spares. It's perhaps worth mentioning at the start that Telefunken sets are blessed (?) with a somewhat greater than average number of presets, and that correct setting up of these in accordance with the service manual is vital. English-language manuals are still available from AEG, Slough, at prices that represent good value considering their detailed content.

Hybrid Chassis

The 709 90° hybrid chassis dates from 1969–70. These sets are now getting just a bit long in the tooth, but if the tube is in a reasonably healthy state they are probably worthy of further care and attention. Many of them were fitted with u.h.f. tuners which covered only up to channel 60, so if you live in a group C area you may well be missing a station or two. If wide rolling hum bars are your problem, check that socket 27 (fluorescent strip power supply) hasn't been accidentally reversed, failing which the l.t. supply bridge diode block Gr521 (B40C800) is the chief suspect. If greater gain is required, a useful increase can be obtained by bridging the a.g.c. preset R172 with an 8·2kΩ resistor (always assuming that someone hasn't beaten you to it!).

By and large, these sets are reliable and trouble-free "old faithfuls". The four valves used are the ECH84, PL509, PY500A and PL508. An unusual feature by UK standards is the use of a regulated h.t. supply (U1, 260V). This is obtained from a voltage-doubling rectifier circuit which employs a thyristor as the second rectifier/regulating element. The 24V l.t. supply is stabilised by a series regulator.

The 710 was one of Europe's first 110° chassis. Some of these hybrid sets were imported without the 240–220V autotransformer, which means that just about every component will have been constantly overrun. If yours is one of these, you might be wise to wave it a fond goodbye. If the model number on the cabinet is suffixed "–GB" however you're in with a good chance. Again, models without the –GB suffix were mostly fitted with tuners with a restricted u.h.f. coverage. The following comments on the 710B apply in the main to the 710 also.

Although the 710B is on the face of it little different from the 710, sets fitted with the 710B chassis have been consistently more reliable and even now, when well set up, many of these delta-gun hybrid sets are capable of displaying a picture which will put much more recent sets to shame! The printed circuit boards are reasonably durable, but as a matter of course you should check for dry-joints and possible damage by overheating around the bases of the PL508, PL519 and PY500A valves, and around the PL519's 2·2kΩ wirewound screen grid feed resistor R704. The one and only really weak spot seems to be the mains transformer, which is prone to intermittent breakdown. The transformer is now horribly expensive, as well as being something of a swine to change, so if you are unfortunate enough to be confronted by an arcing one you will be able to draw your own conclusions quickly . . .!

The 710/710B chassis use the same voltage doubling rectifier/regulator system as the 709 chassis, but this time the U1 line is 290V. The l.t. supply circuit is also the same as in the 709 chassis.

There's an unusual field timebase in these sets – a self-oscillating circuit with a switching diode. Fortunately it's reliable. Note however that the field charging capacitor C424 (0·33μF) charges from a negative potential derived from the line output stage. In the 709 you should find –48V and in the 710 –36V across C430 (2·2μF). If this voltage is missing (no field scan) check back to the appropriate rectifier diode (Gr490 in the 709 chassis, Gr703 in the 710 chassis). If the voltage is low (lack of height), check the 1·2MΩ series feed resistor (R431 in the 709, R470 in the 710).

711/711A Chassis

The 711/711A were Telefunken's 110° delta-gun solid-state chassis. They use a BU108 line output stage and a rather unusual bridge field output stage. The 190V h.t. supply (U1) is obtained from a thyristor rectifier/regulator circuit which is followed by an active filter. A bridge rectifier and series regulator provide a stabilised 12V supply (U3). The only major difference between these chassis is in the i.f. unit below the tuner. They are not quite as reliable as the 710B, but nice enough all the same, and were covered in detail from the servicing angle in the July-September 1976 issues of *Television*. The h.t. reservoir capacitor C428 (1,000μF) has a tendency to loose its capacitance, and is therefore worth changing in the interests of long-term reliability.

In cases of intermittent loss of signal, don't immediately blame the tuner – instead, look carefully at the i.f. board's double-sided print, especially around point 142 where the 12V supply comes in. Run over the plated holes and allow solder to pass through: you should then be home and dry (though hopefully your joints won't be!). If the tuner really is faulty, see the comments on tuners below.

Faults in the supersonic remote control system fitted to some of these models are almost guaranteed to turn your hair grey! Telefunken used to suggest that repairs to these boards should be confined to "first aid" level only, and even

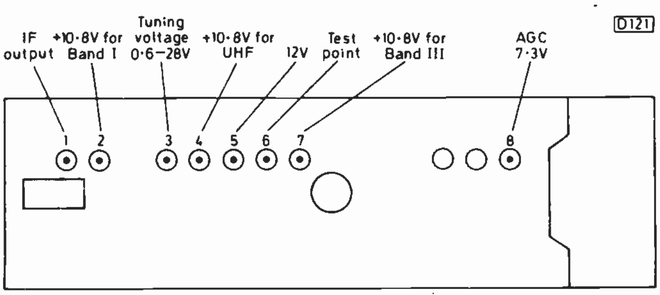


Fig. 1: Pin connections, tuner type ET176K.

now it may be less painful in the long run to opt for a service exchange from Slough rather than to delve too deeply. In the event of an unsympathetic bank manager however the following notes may assist:
(1) Locate a "known good" supersonic transmitter to prove whether it's your transmitter or receiver that's faulty.
(2) Assuming that the fault lies in the receiver board (it usually does), proceed as follows. (a) Check microphone socket Bu1200 for poor contact (internal and external). (b) Ensure that R1312 is set to give exactly 12·5V at test point M1302. (c) If the fault is an incorrect or non-existent analogue function (colour, brightness, volume), check transistors T1222/T1223/T1240/T1241/T1242/T1243/T1244. Note that the TBA120S intercarrier sound chip on the signals panel can be responsible for no control of volume however. (d) If the brightness or colour levels "creep", change IC1281 or IC1282 (both type TL3741) respectively.

Tuners

Finally tuners. Many different types of varicap tuner have been used over the years, and one pitfall for the unwary is that many of the "Telefunken type" tuners available on the surplus market are *not* suitable for use in Telefunken TV sets. The surplus units are generally of the two-transistor u.h.f. type, whereas a three-transistor type with an integral i.f. preamplifier stage is required. "Official" exchange units, although still available, are now very expensive. One excellent solution however is to use the ET176K v.h.f./u.h.f. type (with full coverage) which is available from Sendz Components at around £4. With a little mechanical ingenuity the ET176K will replace the original tuners in all the chassis mentioned, while at the same time improving the band coverage and gain in earlier sets. Fig. 1 shows the pin connections. ■

Test Report: Sadelta Pattern Generator

Eugene Trundle

To those of us used to getting our patterns out of a large, elaborate, mains-powered box, and tracing them with such machinery as an Avo Model 8 and a five-inch screen oscilloscope, modern test equipment comes as something of a surprise. Small is beautiful these days it seems, and thanks to the silicon chip all manner of TV test equipment is coming in smaller and smaller packages. In the last year or so we've come across examples of miniature oscilloscopes, multimeters and so on, to the point where a few hundred pounds will buy a complete colour TV servicing outfit – with sufficient change to pay for a small attaché-type case to put it all in. The spotlight this month is on a state-of-the-art colour TV pattern generator, produced by the Spanish firm Sadelta. A couple of versions of this have been released, the MC11B, which we had for review, and the MC10I, a version "specifically designed for System I" (to quote the manufacturers) and with a slightly different front panel.

Features

Whatever the version, it's a pocket-size instrument that generates eight patterns for setting up and checking TV sets. It operates from an internal, rechargeable nickel-cadmium battery, and provides outputs at v.h.f. and u.h.f.

Pattern selection is by a single push button which steps through the available patterns sequentially, with a LED display indicating which pattern is being generated. A 650Hz sound signal is also provided.

The instrument can be used in the field on its internal power supply (about eight hours' intermittent use from a fully-charged battery). For workshop use there's a mains adaptor which also acts as a charger for the battery. For further details, see the accompanying specification.

On receipt of the instrument I started by taking it apart. I was immediately impressed, as I usually am with this type of equipment, by the sheer volume of technology packed into it. Nineteen i.c.s and six transistors, beautifully laid out on two plugged fibreglass panels, and an r.f. modulator scarcely bigger than my thumbnail.

The battery is not charged while the generator is being operated from the mains – charging starts when the off switch is operated. I found that one overnight charge was sufficient for my review. A feature I'd have appreciated is a low battery warning device, since a low battery voltage can have rather subtle effects. The first sign of this is when the battery voltage falls to 7·8V: the colour saturation is then reduced and the colour bars look decidedly wrong. At 7·5V the line sync starts to fail when operating with colour bars, and at 7·2V all syncs are lost. When a monochrome pattern is being used all is well down to 7·4V, which could lead to false accusations against the decoder in the set being tested unless one is aware of what's happening!

Patterns

I found the range of patterns provided useful and comprehensive. The colour bars were checked for accuracy on a vectorscope, and were found to be within 4% in all cases. The red raster (slightly marred by vertical striations, but no worse than that provided by many other pattern generators) is bright and cheerful, and the crosshatch and dot patterns are well spaced. The single cross and centre dot facilities are ideal for static convergence. The white field is a useful back up to the red raster for checking, if not adjusting, purity, but I find greater use for this pattern in setting up beam limiter circuits.

The eighth pattern left me at something of a loss. The specification says it's vertical bars in monochrome at half subcarrier frequency: in fact I counted 56 vertical bars across the screen, which means that with an active (picture) line period of 52μsec the frequency of the bars is at a quarter of the subcarrier frequency, i.e. 1·1MHz.

One small criticism at this point. As the patterns are selected sequentially by a single push button, it would seem logical to arrange the sequence in the order that the patterns are required, say when setting up a c.r.t. after replacement. On the other hand, maybe the sequence has been arranged in order of decreasing usefulness, in which case certainly the first pattern (colour bars) and the last (vertical lines) are in the right places.

Before leaving the video side of the instrument, I checked the line generator frequency. It can't go far wrong, being derived by division from the crystal-controlled subcarrier oscillator. I found it to be 15·556kHz, about 0·5% out. This is an important point, since some of the later delta-gun c.r.t. chassis use critically tuned circuits in the convergence correction networks, usually in the blue line convergence department. These are tuned to the second or third harmonic of the line frequency, and it doesn't need much deviation from 15·625kHz in the line frequency of the crosshatch pattern being used for the convergence to be upset when reverting to a broadcast signal. No problems with the Sadelta generator however.

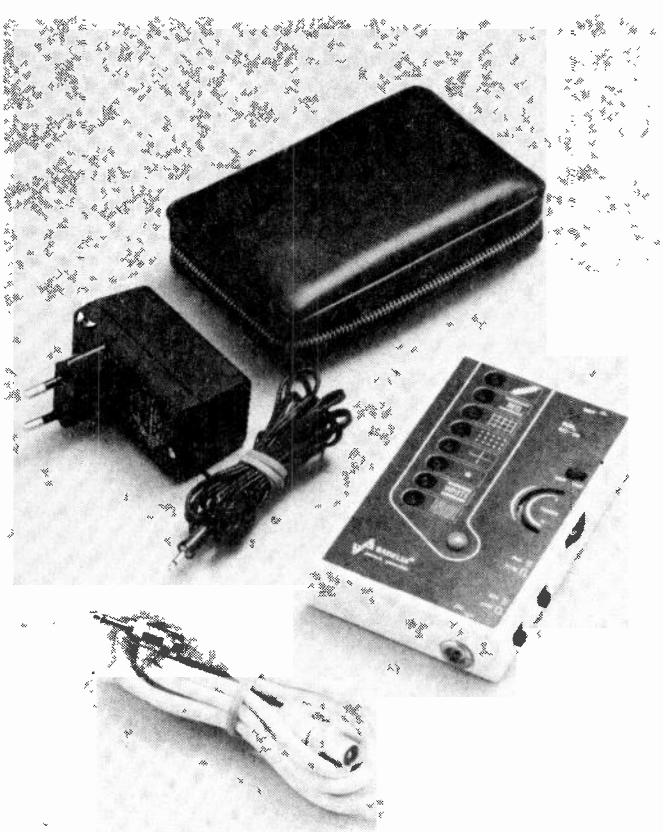
Specification.

System: CCIR I, PAL.
Subcarrier frequency: 4·433619MHz, crystal controlled.
Lines: 625, derived from the subcarrier.
Sound: F.M., +6MHz, modulated at 650Hz.
Video modulation: Negative, double sideband.
Vision carrier: V.H.F. channels 5-9, u.h.f. channels 21-41.
Output level: V.H.F. 12mV ±6dB, u.h.f. 10mV ±6dB.
Output impedance: 75Ω.
Patterns: (1) Colour bars, switchable to grey scale; (2) red raster, switchable to grey; (3) crosshatch; (4) dots; (5) central cross; (6) central dot; (7) white raster; (8) vertical lines at half subcarrier frequency (see comment in review).
External supply: 125V or 220V a.c., ±10%.
Internal supply: Fitted with 9V rechargeable battery, 90mAH.
Power consumption: Monochrome 20mA, colour 28mA.
Recharging current: 9mA for 14 hours.
Battery life: 8 hours with intermittent use.
Size: 131 × 81 × 23mm.
Weight: 250g with battery.
Accessories supplied: Nickel-cadmium battery, mains power unit, padded carrying case, r.f. output lead, instruction book.

Modulator

I next looked into the r.f. department. There's not a lot of point in measuring the r.f. output level of these double-sideband modulators on an ordinary field strength meter, and I found the output sufficient over the available band to invoke tuner a.g.c. on all the sets I tried. With some combinations of generator and receiver an attenuator in the aerial lead may be required – the onset of picture noise occurs with 12dB of attenuation, which suggests that a four-way split of the r.f. output could be tolerated.

Spurious r.f. outputs are quite low, with none that could be mistaken for the fundamental. As with all double-sideband generators, it's important that the correct (upper) sideband is tuned in on the receiver under test. On the u.h.f. band, our review model covered the channels from below 21 to about 39. In the v.h.f. band, coverage of certain channels in Band I and III is available (CCIR System I, as on u.h.f.).



The Sadelta TV pattern generator type MC11B with its various accessories.

Sound

The sound signal provided is a 650Hz tone, frequency modulated on to a 6MHz carrier. I found that both frequencies were spot on. The reproduced audio had a rough sound, with the effect of heavy harmonic distortion: an oscilloscope test confirmed that the audio signal consisted of a distorted quasi-squarewave with a mark-space ratio far from 1:1, while spurious spikes, probably remnants from the pattern, were present. Unless the set is carefully tuned to the correct sideband, the sound signal gives rise to sound-on-vision, in the form of horizontal bars in the background of the picture – this happened on all the sets we tried.

On the credit side, the sound signal is as free of pattern breakthrough as any pattern generator I've come across. It has to be said that this modulator business is not an easy design point, as witness the price and complexity of professional and broadcast standard modulators. This is no excuse for the piercing sound signal however. The sound facility is a rather mixed blessing on this generator, though it's adequate for the alignment of intercarrier i.f. transformers where these are encountered!

To Sum Up

Our engineers were clamouring for these instruments – one for each vehicle they said, and one to each bench. This echoes my feelings about this little instrument. Within the odd constraints mentioned, I was happy with all but the sound. The price quoted for the MC10I is £149·50, which includes post and packing, a padded carrying case, aerial flylead, mains power unit/adaptor and instruction manual. VAT is extra. The instrument is marketed by The House of Instruments (Anglia) Ltd., Clifton Chambers, 62 High Street, Saffron Walden, Essex CB10 1EE (telephone 0799 24922). There's a one year guarantee, and out of guarantee service will be available.

Colour Portable Project

Part 5

Luke Theoidossiou

THE basic receiver is now complete apart from the interconnections and degaussing. As previously mentioned, the design includes remote control as a standard feature, and it's time to turn to this. The remote control feature can be omitted however, and we shall be providing some guidelines on this in a later issue.

The remote control system we've chosen is the latest ITT Semiconductors' one which is in current use by a number of setmakers. The basic principles of operation were covered in some detail in the December 1979 issue of *Television*.

Fig. 1 shows the circuit of the infra-red preamplifier. The coded infra-red signal is picked up by the TIL100 photodiode D1, and is then fed to pin 13 of IC1. This is a multistage preamplifier i.c. designed specifically for this type of application. It has a gain of 80dB (10,000 times), a.g.c., and a "wanted signal" separator stage which separates the coded signal from noise and spurious signals, thus achieving a high degree of interference immunity.

Capacitors C1 and C5 are used for signal coupling, whilst C2 and C3 are a.g.c. reservoirs. Due to the very high gain of this circuit, it's important that a metal screen is used to house it, with a small window area cut out for D1. Fig. 2 shows a suitable design which may be fabricated in thin gauge tinplate material. The completed board, including the lead-out wires, is soldered at several points around its periphery on to the sides of the screening box, the lid then being pushed into place.

The TIL100 is housed in a black moulded case which reduces its response to visible light, though not sufficiently. It's necessary to place a small piece of filter material such as Kodak type 87C in front of the diode window therefore. The effect of failing to do this is reduced operating range – down to less than 1m in the presence of fluorescent lights or sunlight.

The complete assembly is fixed to a convenient point on the back of the cabinet fascia, using a few drops of cyanoacrylate adhesive (read the instructions carefully). Figs. 4 and 5 show the copper pattern and component location respectively.

Fig. 6 shows the circuit diagram of the remote control interface board. The SAA1251 (IC1) receiver i.c. is responsible for decoding the received signal and providing the necessary control signals for adjusting the receiver. In our application the following facilities are available:

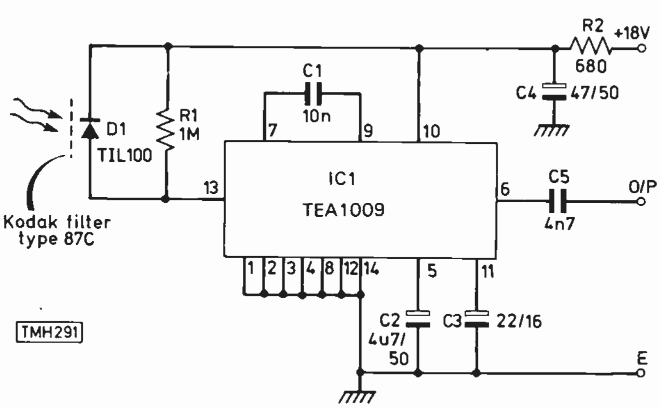


Fig. 1: Circuit of the remote control preamplifier.

(1) Selection of any one of eight pretuned channels, with automatic selection of channel 1 at switch-on.
(2) Step-through channel selection either via the remote transmitter or from a switch on the receiver. When either switch is *kept* depressed, a continuous step-through facility is offered.
(3) Four analogue outputs which are used to control the volume, brightness, contrast and colour saturation levels: a "normalise" command returns all outputs to the preset settings.
(4) A "mains off" command which activates a relay switch to totally isolate the receiver from the mains. Switch on is manual.

The master clock pulses for the receiver i.c. are generated by a 4·43MHz crystal, XL1. The analogue outputs have their ranges set by resistive dividing networks (e.g. R3 and R4), and with the exception of the volume control circuit have a network comprising two diodes and a preset control which effectively sets the output d.c. voltage on a reservoir capacitor from around 1·5V to 4V. In the case of the volume control, the required range is much less and a simpler network using a variable potential divider is used.

The mains control pin 19 is used as both an input and an output. At switch-on, the i.c. automatically assumes a standby mode until this pin is momentarily connected to the supply rail. This is achieved by the circuit comprising R15, R16, D9, C8 and Tr2. At switch-on, whilst C8 is being charged via R16, the base of Tr2 is pulled low so that the transistor is turned on, connecting pin 19 to the +18V rail. When C8 has fully charged, the base of Tr2 is at the same potential as its emitter (i.e. +18V). It therefore switches off. Resistor R15 supplies a very low 'top-up' charging current for C8 to compensate for the capacitor's leakage current – this would otherwise be supplied via the transistor, with the subsequent danger of it being triggered on. At switch-off, diode D9 ensures a very rapid discharge path for C8.

The latched programmed code appearing at pins 8, 9 and 10 is shown in Table 1 – L is approximately 0V and H is approximately +17V.

In conjunction with the input circuit of IC3, resistors R17, R18 and R19 reduce the amplitude of the outputs to around 4V, driving both IC3 and the channel display module (via connector D). The SL470 is a BCD to 1 of 10 decoder/varicap driver. In our application, the first eight outputs only are used. The i.c. is supplied with a stabilised +33V supply and simply acts as a switch to connect the

Table 1: Latched programmed code.

Programme no.	PA (pin 8)	PB (pin 9)	PC (pin 10)
1	L	L	L
2	H	L	L
3	L	H	L
4	H	H	L
5	L	L	H
6	H	L	H
7	L	H	H
8	H	H	H

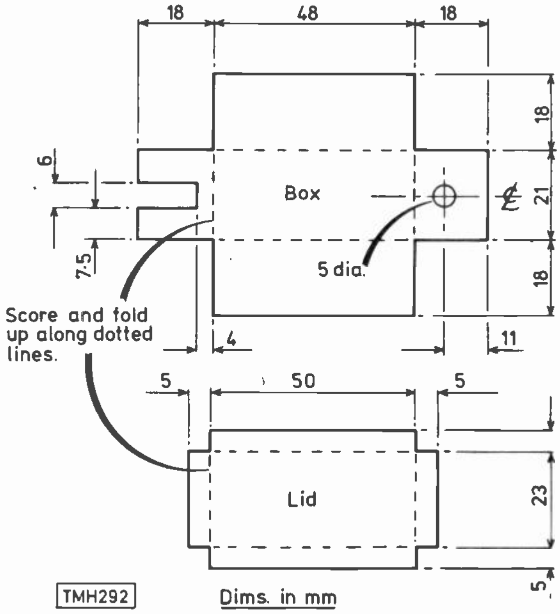


Fig. 2: Preamplifier/detector module screening can.

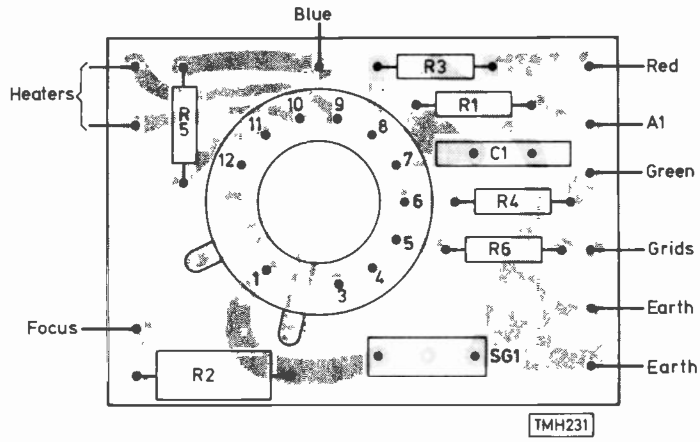
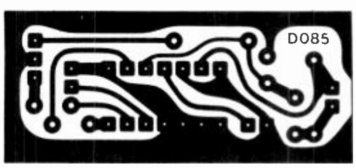


Fig. 3: C.R.T. panel component layout.



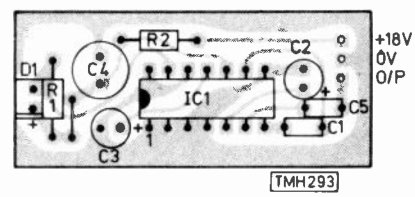


Fig. 4 (left): Preamplifier board print layout.

Fig. 5 (right): Preamplifier board component layout.

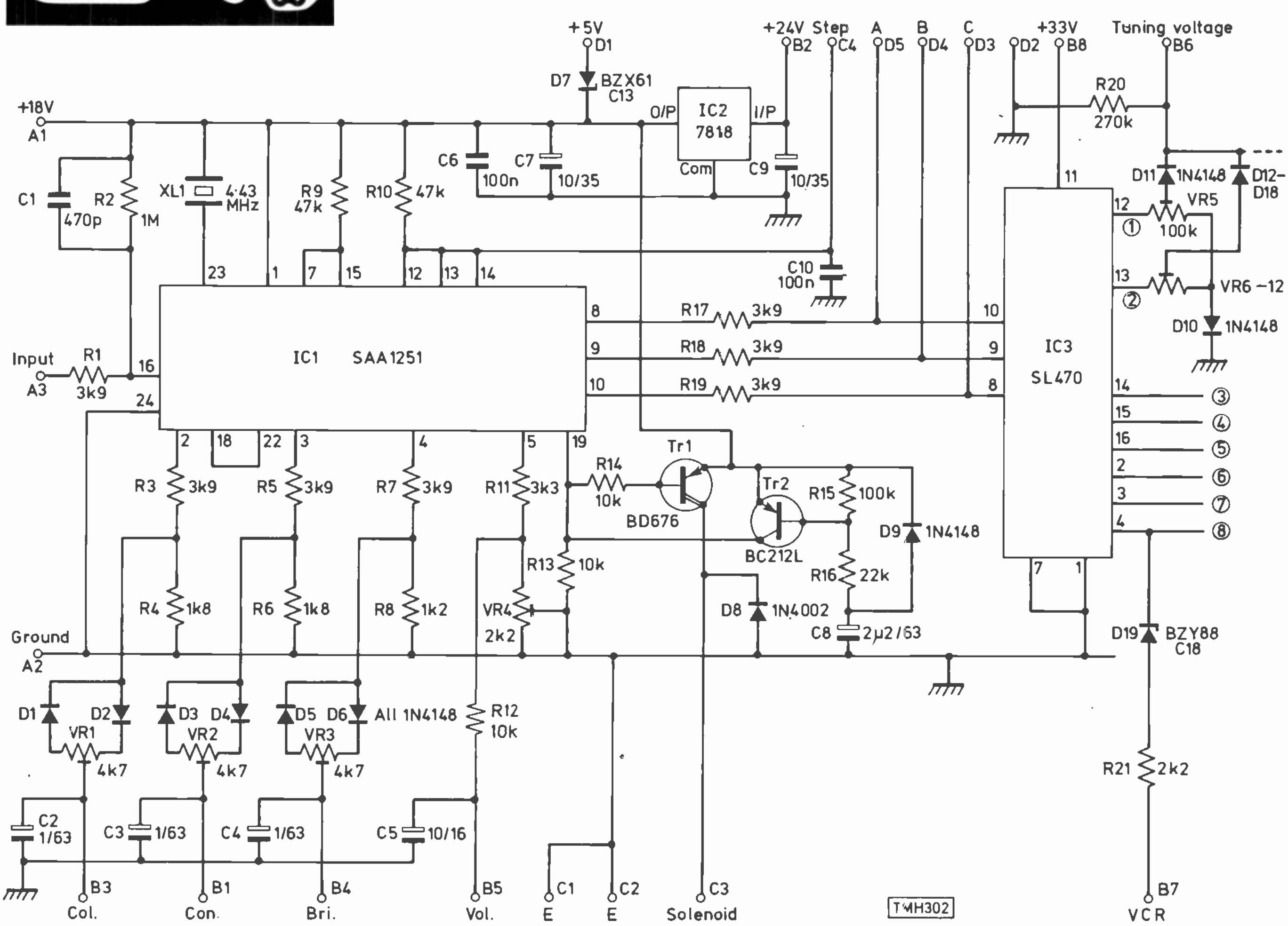


Fig. 6: Circuit of the remote control decoder/interface board.

appropriate tuning potentiometer to this supply. Blocking diodes on the wipers of the potentiometers ensure that the non-selected potentiometers don't interfere, imposing a resistive load to ground. Diode D10 provides temperature compensation, and R20 allows a small current to pass through the selected circuit to ensure that the respective diode is switched on.

When channel 8 is selected, the zener diode D19 is switched on to provide a switching voltage for the line processor i.c. on the timebase board for VCR operation.

★ Components list

Remote Control Preamplifier

Resistors: 0·25W carbon film, ±5%

R1 1M
R2 680R

Capacitors:

C1	10n	ceramic plate
C2	4μ7	50V radial electrolytic
C3	22μF	16V radial electrolytic
C4	47μF	50V radial electrolytic
C5	4n7	ceramic plate

Semiconductors:
D1 TIL100
IC1 TEA1009

Miscellaneous:
P.c.b. ref. no. D085
Screening box (see text)
Small piece of Kodak filter type 87C

Remote Control Interface Board

Resistors: All 0·25W carbon film, ±5%

R1	3k9	R12	10k
R2	1M	R13	10k
R3	3k9	R14	10k
R4	1k8	R15	100k
R5	3k9	R16	22k
R6	1k8	R17	3k9
R7	3k9	R18	3k9
R8	1k2	R19	3k9
R9	47k	R20	270k
R10	47k	R21	2k2
R11	3k3		

VR1-3 4k7 } miniature horizontal-mounting
VR4 2k2 } skeleton presets
VR5-12 100k tuning diode-law 20-turn potentiometers

Capacitors:

C1	470pF	ceramic plate
C2	1μF	63V radial electrolytic
C3	1μF	63V radial electrolytic
C4	1μF	63V radial electrolytic
C5	10μF	16V radial electrolytic
C6	100n	ceramic disc
C7	10μF	35V radial electrolytic
C8	2μ2	63V radial electrolytic
C9	10μF	35V radial electrolytic
C10	100n	ceramic disc

Semiconductors:

D1	1N4148
D2	1N4148
D3	1N4148
D4	1N4148
D5	1N4148
D6	1N4148
D7	BZX61 C13
D8	1N4002
D9	1N4148
D10	1N4148
D11	1N4148
D12	1N4148
D13	1N4148
D14	1N4148
D15	1N4148
D16	1N4148
D17	1N4148
D18	1N4148
D19	BZY88 C18
Tr1	BD676
Tr2	BC212L
IC1	SAA1251
IC2	7818
IC3	SL470

Miscellaneous:
Heatsink for IC2: Staver F9-4-220
P.c.b. ref. no. D090
XL1 4·43MHz crystal
P.c.b. pillars
Molex 0·2" pitch connectors
Mains on-off switch: Preh type 70040-028/7/0000

Channel Display Module

ICI MC14493 Display TIL702 P.c.b. ref. no. D095

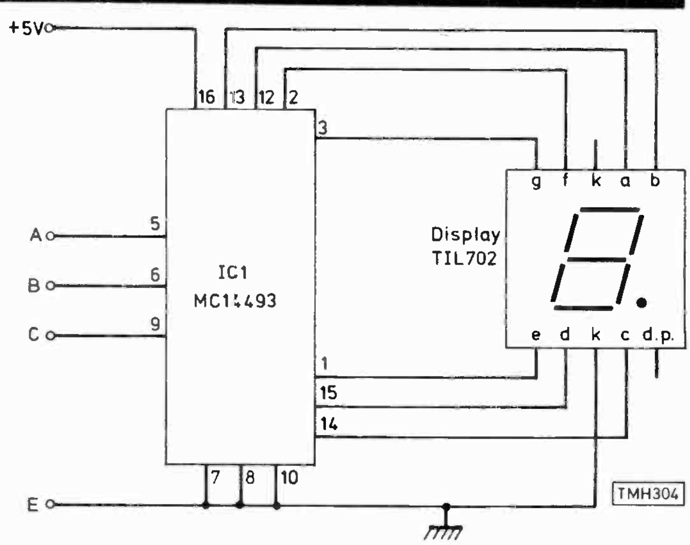


Fig. 9: Channel display module circuit.

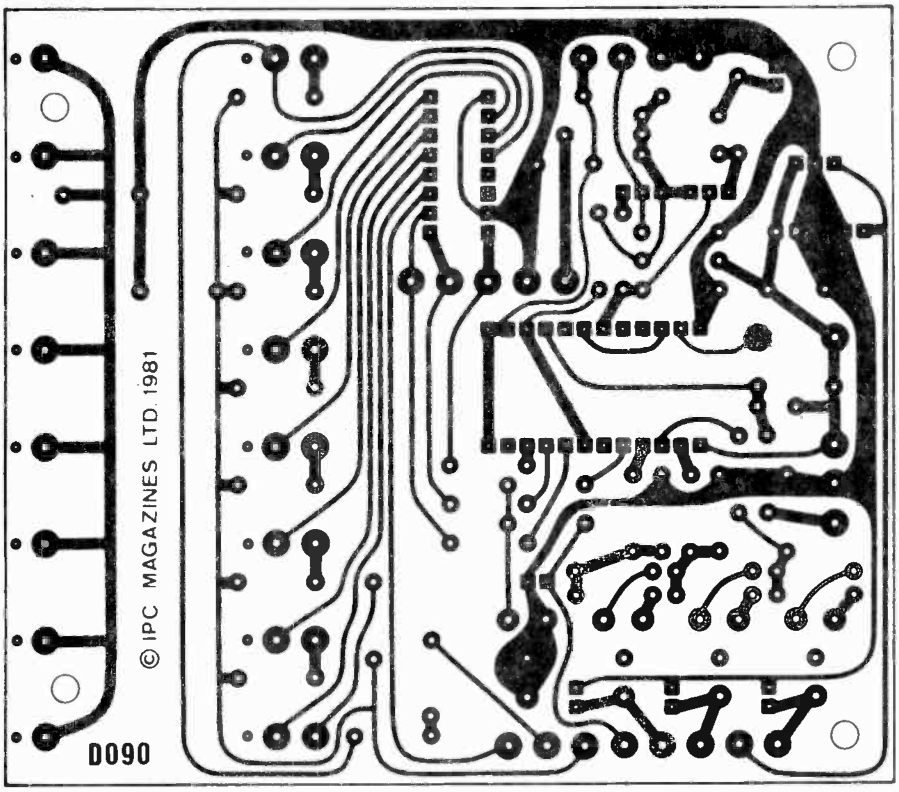


Fig. 7: Interface board print layout.

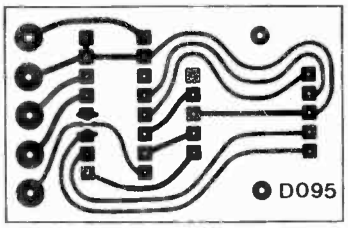


Fig. 10: Channel display module board.

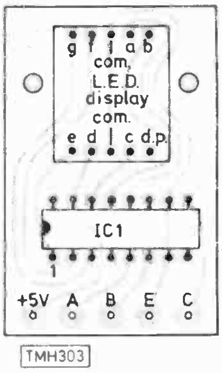


Fig. 11: Channel display module component layout.

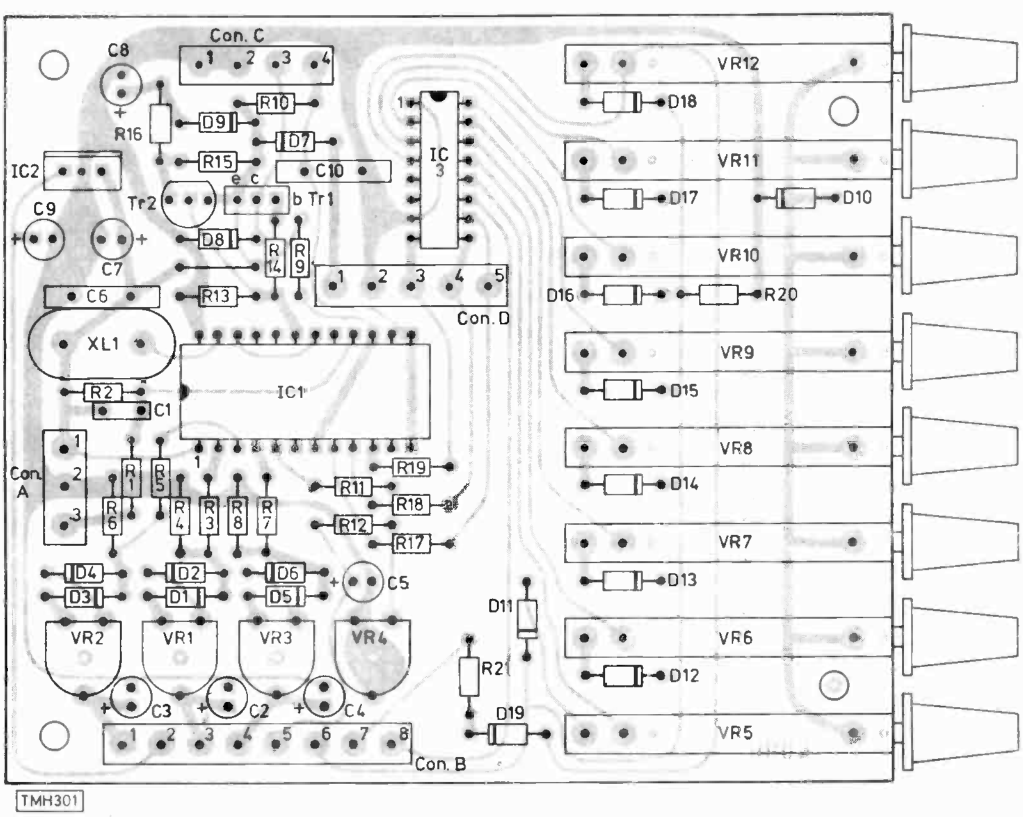


Fig. 8: Interface board component layout.

The power supply circuit is straightforward, using a 7818 regulator with a small clip-on heatsink to provide the +18V rail, the 13V zener D7 providing the +5V supply required by the display module.

Construction of the printed circuit board is very easy, but be careful with IC1 – it's an expensive device and it's a good idea to use an i.c. socket for it. Fig. 7 shows the copper pattern for the board, whilst Fig. 8 shows the component locations.

The channel display module uses a Motorola BCD to 7-segment decoder/driver. It drives a 0·5in. common cathode 7-segment l.e.d. display without any external components.

The circuit diagram is shown in Fig. 9; the copper pattern in Fig. 10, and the component orientation and connections in Fig. 11.

Next month we'll describe the remote control transmitter.

Vintage TV: Etronic

Chas E. Miller

THIS particular vintage piece comes in response to a friendly challenge from the editor who asked me to unearth what I could about the Etronic brand of radio and TV sets which were on sale in the late 40s and early 50s. That normally rich goldmine of information *Radio and Television Servicing* has nothing to offer on the television side, though the radio models are well covered. I got somewhat confused myself to start with, since though remembering the name well enough I mixed up the chassis with those of another long defunct manufacturer. Thanks to some very welcome assistance from various sources however all can now be revealed. In particular some data sheets published by *British Radio and Television,* an earlier name for the monthly trade magazine *Radio and Electrical Retailing,* came to light.

Etronic sets were produced by the Hale Electric Co., Ltd. of West Ealing, an established if not spectacular setmaker of the 40s. It would appear that much of their output was sold under other names, though at least one radio set bore the company's own name. This was the Hale Model PWR2/3 of 1947, a fully tropicalised a.c.-only receiver intended for export and having medium and two short wavebands. Shortly after this the Etronic brand appeared, the range being developed to include everything from small portables to large radiograms. It was inevitable therefore that TV sets should in due course be produced to complete the product line-up.

Models ECV1523 and ECV1527

The most noteworthy TV sets were a couple of consoles, Models ECV1523 and ECV1527, which had 10 and 12in. tubes respectively. There were London and Birmingham versions. The circuitry was straightforward and economical, just fifteen valves being used. There were, as was usual in those days, dotty aspects however, giving the impression that the works manager and his staff were using a badly creased blueprint. For instance, although the valve complement included two 7C5 audio output tetrodes, neither was used for this purpose, the job being done by a tiny r.f. pentode instead.

The metal chassis was of the then popular cheese shape, the thin end supporting the c.r.t. bulb while the thick end suported the neck. This approach was not renowned for easy servicing, since the components living in the deep end were difficult to get at and replace. Six of the fifteen valves were located on the main chassis, the other nine (including the sync separator) being on a small r.f. unit which was mounted vertically, just within one side of the main chassis.

Perhaps the oddest looking feature was the mains transformer, which was again mounted vertically, but on long extension pillars that held it well clear of the rear of the chassis where no doubt its magnetic field would have the least disastrous effect on the scan coils. It provided 6·3V for the valve heaters, which were all connected in parallel except for the 53KU h.t. rectifier which had its own 5V supply. The primary had an overwinding to give the h.t. rectifier 280V a.c., and a third secondary winding provided 2V or 6·3V to suit the type of c.r.t. fitted.

There were minimal differences between the London and Birmingham r.f. units, both being superhets with i.f.s of 10·5MHz sound and 14MHz vision. The signals subchassis employed seven 6AM6 (EF91) r.f. pentodes and a couple of 6AL5 double diodes. These fulfilled the functions you'd expect, the video output 6AM6 being d.c. coupled to the cathode of the c.r.t. An eighth 6AM6 was mounted on the main chassis, where it undertook the decidedly out of character role of audio output valve. Puzzle: why wasn't this job allocated to one of the two 7C5 valves used, in particular the one used as the field blocking oscillator? Hence my creased blueprint theory. If it's really felt necessary to use a 4·5W output valve in the field oscillator stage there's nothing to stop one of course – maybe they'd a lot of 7C5s left over from the radio side of the factory.

The field oscillator stage was, apart from the choice of valve, conventional. The output stage however (see Fig. 1) was distinguished by an unusual method of linearising the scan. The cathode of the field output valve (the other 7C5) was returned to chassis via the secondary winding on the output transformer and a combination of fixed and variable

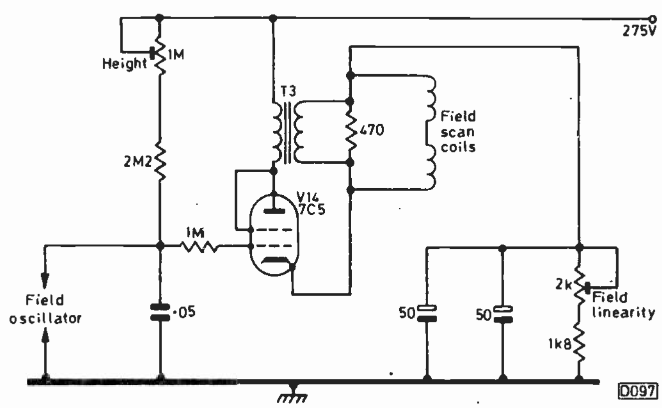


Fig. 1: Field ouput circuit, Etronic Models ECV1523/7.

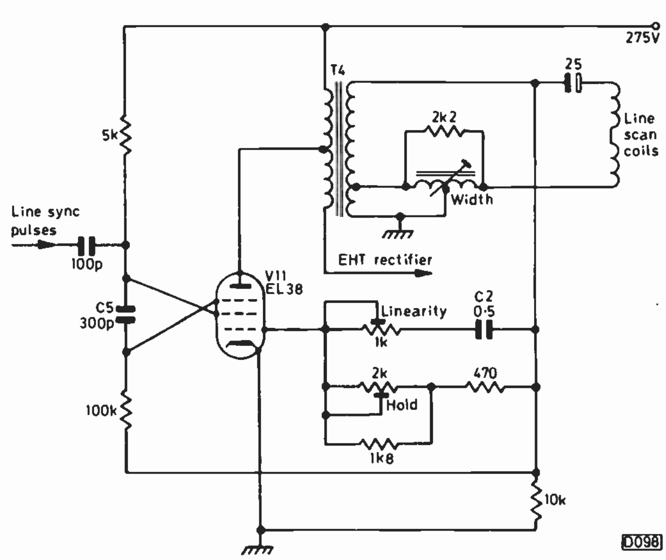


Fig. 2: The Miller-transitron line timebase circuit used in the Etronic Models ECV1523/7.

resistors which were decoupled by a pair of 50μF electrolytics (another case of having a lot of spares?). The valve was triode connected by the way, a common ploy of the period to reduce the valve's internal resistance, an advantage where low-frequency amplification is concerned.

The line timebase was an economical design using a self-oscillating EL38 pentode valve (see Fig. 2). The circuit is similar to that used by Plessey in their ubiquitous standard TV chassis of the time. As an oscillator, the valve employed the Miller-transitron circuit, with feedback between the suppressor and screen grids via C5 and between the anode and control grid via T4 and C2. The operation of the basic Miller-transitron circuit was described in greater detail in the March issue earlier this year (see Vivian Capel's article on the Ekco Model TS105). Linearity control was achieved by including a preset in series with C2, while the hold control adjusted the time-constant of the control grid circuit. The interdependence of these controls must have made setting up difficult.

The e.h.t., 6kV or 7·5kV depending on the c.r.t., was provided by an EY51 rectifier fed from an overwinding on the line output transformer.

Projection Receivers

To my own knowledge these sets sold in reasonably large numbers – certainly many passed through my workshop at the time. I don't ever recall seeing the contemporary Etronic projection receiver however, Model ECS2231, which is a pity since from the circuit it would appear to have been a much more compact and tidy design than many of the projection sets of the period. A total of 21 valves was used, five in the standard Mullard 25kV e.h.t. supply unit.

The c.r.t. protection circuit required (to blank out the screen and prevent damage to the tube in the event of failure of either of the timebases) was simpler than most but appears to be perfectly adequate. A lone EB91 double diode rectified pulses from the two timebases to provide the potential for the brightness control. Thus both the field and the line timebase had to be operating normally before the screen could be illuminated. The only, very minor, drawback to this system was that large alterations to the picture height or width would affect the brightness level. This would obviously not be a problem in normal service however.

The projection unit itself was the standard Mullard type employed in all British projection sets of this type.

The rest of the design was straightforward enough, the r.f. unit being only a little more complex than that used in the direct viewing sets – there was a second r.f. amplifier stage. EF91 valves were employed for most purposes, but the newer EF80 put in an appearance in the video output and sync separator stages. Three ECL80s were recruited to do duty as audio amplifier/output, field blocking oscillator/output and line blocking oscillator/field sync pulse clipper (the use of the latter expression always puts me in mind of five-masted sailing ships beating around the Cape in gale force winds, bearing heavy cargoes of sanitary ware for the colonies: my wife has a terse and highly derogatory comment for such little conceits, but I won't repeat it here). An EL38 was again the line output valve, with simple transformer coupling to the scan coils.

H.T. was supplied in much the same way as before, but the mains transformer primary overwinding was modified to give 350V at the anodes of the GZ32 h.t. rectifier. The full whack was delivered to the EL38, but the supply to the field timebase was dropped by 100V via the focus coil. The video output valve was also fed from the 350V rail, since the MW6-2 projection tube needed a goodly voltage swing for correct modulation. This in turn called for some hard work on the part of the video amplifier valve, and in due course Mullard introduced the more powerful PL83 valve, whose characteristics suited it to the job. By that time however the projection boom was already on the wane.

Etronic sets seemed to sell quite well, so why did the name disappear so quickly? The answer is probably bound up with the state of the industry at the time. There were dozens of firms (well, some three dozen anyway) competing against each other for sales, using production techniques that had remained unchanged since pre-war days and producing sets in microscopic quantities by today's standards. The profits generated by most of these firms must have been barely adequate. In this kind of situation it's a question of the survival of the fittest. If the then mighty EMI decided to back out of TV receiver production in the mid-50s, what chance was there for the many smaller manufacturers?

Footnote: There were apparently some earlier Etronic sets using t.r.f. circuitry, Model numbers HV203, HV204, CV1050 and CV1250. I've yet to track down any information on these, though research is proceeding . . .

Letters

RANK T20/T22 CHASSIS

I found the fault articles on the Rank T20/T22 chassis in the June issue very informative, and would like to mention a fault symptom I've had trouble with. The problem was white lines across the screen – the same as the common black lines fault on these sets. To start with the trouble was intermittent. It then gradually got worse over a period of two-three weeks, by which time the white lines appeared in a block of about three inches long by an inch, randomly anywhere on the screen – there would sometimes be two or three of these blocks, accompanied by coloured flaring.

The fault could be overcome by very careful adjustment of the contrast, colour and brightness controls, but after a while this approach resulted in an unwatchable picture: I also found that turning these controls to minimum then increasing the setting of the contrast control produced the fault symptom. Replacing the TCA800 colour demodulator/matrix/clamp i.c. cleared the problem completely.

F. D. Kemplay,
Cleadon, Nr. Sunderland.

ACTIVE RIPPLE FILTERS

I read with interest the article on active ripple filters in the August issue. It might be worth mentioning that T506 in the NordMende F IV chassis is actually a Darlington transistor – so the circuit is a triple Darlington configuration. The MJ3000 has a collector-emitter voltage rating of 60V – hence the need for the switch-on protection arrangement. The similar FC 25 and FC1 25 (this one uses an in-line gun tube) chassis use an MJ3001 transistor in this position. The voltage rating of this device is 80V, and the shunt diode is included within the common encapsulation. Hum problems on these sets have been traced to these Darlington devices becoming leaky.

A. Mole,
Chiswick, London.

VCR Clinic

Notes from Mike Phelan and Mick Dutton

It's a sad fact of life that there are many folk who wouldn't dream of removing the back from a TV set under any circumstances yet delight in twiddling presets, tape guides etc. in VCRs. The resultant "faults" account for a goodly proportion of the machines that come our way. Other "man-made" troubles arise from sheer misuse – the favourite one is quite common on the Ferguson 3V00-3V16 series (JVC HR3300 etc.). The story goes like this. On the right-hand side of the cassette compartment there's a small V-shaped spring whose function is to press in the latch on the cassette when it's inserted, so that when the cassette is pressed down the flap is opened by the bracket shown (see Fig. 1). Unfortunately the spring loses its tension, and as a

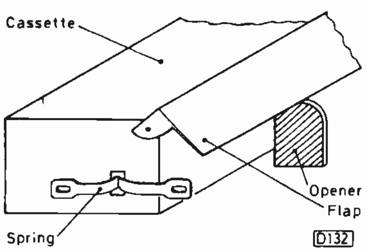


Fig. 1: A common source of faults in JVC/Ferguson machines – the small V-shaped spring in the cassette compartment. When the spring loses its tension, the cassette flap won't open.

result the flap won't open. The owner then (we think) jumps on the cassette cover. Surprisingly the flap on the cassette doesn't break, but bends the opening bracket around the plunger of the pinch wheel solenoid.

A new spring, straighten the bracket, and everything is o.k. – usually anyhow. Not so however with the last 3V00 we had in with this fault. When we tried the machine after repairing the bracket, the colour kept being displaced and sometimes line lock was completely lost, suggesting a drum servo problem. The first thing to do in this event is to connect a scope to TP9 on the audio/servo board. A trapezoid with a pulse sitting half-way up the slope should be seen. If the drum speed is varying, the width of the trapezoid will vary – it's derived from the pickup head and magnets associated with the drum flywheel. The pulse on the other hand comes from the control track on the tape. Since these pulses have been recorded on the tape, any trouble with the capstan servo or tape path will cause drum speed variations. Note that capstan servo faults will cause wow on the sound – a useful thing to remember. If the pause key is depressed the pulse at TP9 will disappear, since control pulses are no longer being obtained from the tape. If the trapezoid is no longer varying in width, the drum is running at a constant speed and the trouble is probably mechanical.

On the machine in question it was noticed that the tape was wrinkling as it passed the control head, due to the pinch wheel not being exactly parallel with the capstan. After carefully bending the pinch wheel lever everything was o.k.

Another cause of this sort of trouble is insufficient pinch wheel pressure – on JVCs, replace the pinch wheel spring with the later (black) type. **M.P.**

Check the Replay Signal Envelope

The next fault, on a JVC HR3300, was a real headscratcher. A prerecorded tape would play back all right, but a tape recorded on the machine played back with a noise bar ten lines or so deep near the bottom of the picture – on this or any other machine. This sort of fault is usually caused by the right-hand guide roller not entering into the V-notch in its locating block correctly (see Fig. 2). With this fault the symptom would show up on a prerecorded tape as well of course, nevertheless we checked it.

The next thing to do is to look at the f.m. signal envelope at TP7 on the pre/record board. We found that, as shown in Fig. 2(e), there were definite gaps with straight sides in the envelope – the gaps were not tapered as they would be with a tape guide fault. Very strange. Even stranger was the other thing we noticed – that the noise bar disappeared three seconds before the end of any recording! This in fact was a good clue – it takes about three seconds for the tape to pass from the video drum exit guide to the audio/control head, i.e. the last part of the recording had no noise bar because it had not reached the audio head. The light then dawned – someone had screwed the audio head down about 2mm., enough for the h.f. bias used in recording the sound to erase the top ends of all the video tracks! **M.P.**

Slipping Clutches

We've found that many Ferguson/JVC 3V00/HR3300 machines need the take-up clutch renewing as the machines chew up the tape for no apparent reason after playing for an hour or so. What happens is that the clutch slips excessively,

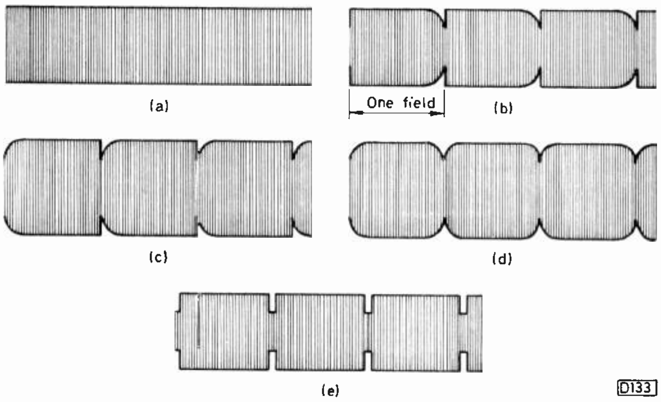


Fig. 2: Examining the f.m. replay signal envelope (at TP7 on the pre/record board in the JVC/Ferguson HR3300/3V00 series) will reveal the cause of a number of faults. (a) Correct f.m. signal envelope. (b) Envelope obtained when the right-hand tape guide is faulty (noise at bottom of picture). (c) Left-hand tape guide faulty (noise at top of picture). (d) Tape guides badly out of alignment. (e) The f.m. signal envelope on the faulty machine described.

the take-up spool revolves sporadically and the tape wraps around the capstan. More recent machines have a modified clutch and belt arrangement. **M.P.**

Toshiba V5470

A Toshiba V5470 came in with the complaint that the still frame was no good. We tried our test tape in it and found that whilst normal playback was perfect, on still frame the picture rolled and bounced vertically. The same thing happened on cue and review.

On the TV set we use as a monitor, we have the height turned down so that the position of the head switching can be seen at the bottom of the picture. On this Toshiba machine, in the still frame and cue and review modes a pulse is inserted to compensate for the weakened field sync (Toshiba call it a VD pulse . . .). This can be observed on the screen as a white band several lines deep near the bottom of the picture. On our problem V5470 the pulse was missing – we traced this to a defective i.c. on the speed logic board (ICH01, type TC4528P). The i.c. contains two monostables which produce the VD pulse from the head switching waveform. **M.P.**

Hitachi VT5500

An Hitachi VT5500 was brought in for attention because it was producing very unstable pictures – the effect on the screen was as if the line hold was going out of lock. There was a rattling noise from inside the machine, so we decided to strip it down and investigate this first. As the noise seemed to be coming from the drum motor, we disconnected the drive belt. The noise then stopped. The head drum itself was running freely, so we concluded that the motor had a faulty bearing and ordered a replacement: fitting this provided a complete cure. **M.D.**

Long-distance Television

Roger Bunney

WHEN I finished writing the last column, on May 27th, we were all wondering where the signals had gone! From the 28th onwards however that question was answered. Long Sporadic E openings have occurred, some of great intensity and very long duration, reaching into Band II and beyond.

Before plunging into the happenings in general during June 1981, mention must be made of an important event on June 7th, when the m.u.f. rose to in excess of 200MHz during an SpE opening. Unfortunately several enthusiasts, including Hugh Cocks and myself, were attending a radio exhibition near Storrington at the time. We missed the opportunity therefore, and it seems from the many letters received that most other enthusiasts didn't look into Band III, which was rather unfortunate on this occasion. An exception was Cyril Willis (Cambridge) who logged TSS (USSR) chs. R8 and R11 at 1630 BST, with typical slow-fading signals but of good quality at times though rather directional, picked up on his fourteen-element array. He made the obvious check to ensure that this wasn't some form of Band I overloading (it wasn't): the signals lasted for just over a quarter of an hour. In Holland, Ryn Muntjewerff and others received similar SpE signals from approximately 1640-1720 GMT (1540-1620 BST), but on *all* Band III channels! With the ch. R11 video being 215·25MHz, the ionisation density must have been extremely high. It suggests that whenever a really intense Band I/II opening occurs a quick check should be made in Band III. Congratulations anyway to all concerned on this record reception.

Meanwhile more conventional SpE openings have kept everyone busy. Here's a brief log of reception generally in the UK.

28/5/81 Southerly signals during the late afternoon from RTVE (Spain), RAI (Italy) and RTP (Portugal).

31/5/81 RTVE again from 1740, but at 1810 JTV (Jordan) ch. E3, first logged by Hugh then here at Romsey, with confirmation via the sound channel (using the new SX200N receiver here). As a floater with JTV there were pictures of a football match with English commentary. Any ideas?

2/6/81 An excellent prolonged SpE opening with RTS (Albania) ch. C, MTV (Hungary), RAI, JRT (Yugoslavia), TVP (Poland), RTVE, ORF (Austria), RTP, DDR (East Germany) and ARD (W. Germany). During the late afternoon Band I jammed up! TVR (Rumania) was seen in Cambridge.

5/6/81 RTVE, RTP, NTV (Nigeria) ch. E3 logged here at Romsey, Hugh logging an African ch. E2 transmitter at the same time.

6/6/81 RTVE, RAI and JRT.

7/6/81 Apart from the Band III opening mentioned above, there were Band I/II signals from most of Europe for much of the day, causing general signal jamming. Signals noted included RTVE, RAI, MTV, JRT, TSS, RTP, SR (Sweden), RUV (Iceland), TF1 (France), YLE (Finland) and TVR.

8/6/81 A similar day to the 7th, but with no Band III signals. Band I was open all day.

9/6/81 Similar again to the 7/8th, with signals for over twelve hours. An Italian "free" station was generally noted, operating *between* ch. E3/IA – probably NCT Udine. A new station for me was ORF ch. E3.

10/6/81 All Europe was again present through much of the day. When I left for work at 0810 NRK (Norway) and TSS were present, and on arrival back at 1900 the Band I spectrum was still wide open.

11/6/81 As on previous days, plus additional short-skip SpE – DR (Denmark) and DDR were received at Wigan. Signals were received at up to Band II (f.m.). JTV ch. E3 was logged at Norwich at 1515 and 1700. The Italian NCT "free" station and RTS ch. C were other notable receptions.

12/6/81 Again as on previous days, including JTV ch. E3 (at 1038) and RUV ch. E4. The opening lasted from 0730 until the evening.

13/6/81 A lower level of SpE activity. TSS signals were received.

17/6/81 A good daytime SpE opening, with TSS in the evening. JTV E3 logged at Cambridge.

19/6/81 Excellent SpE again all day. Most European Band I stations were present. NCT ch. IA seen again.

20/6/81 Southerly SpE during the afternoon, with RTVE and RTP.

23/6/81 Southerly SpE during the evening, with RTVE, RTP and RAI.

24/6/81 Late morning SpE with RTVE, RAI and JRT.

25/6/81 Evening SpE with RTVE and RAI plus unidentified signals on chs. R1/2.

27/6/81 Early morning SpE with unidentified E. European R channel signals.

28/6/81 RTVE from 1800 onwards. Hugh logs NTV ch. E3 at 1840.

29/6/81 A largely north/south SpE opening with NRK, RTVE and RTP.

ZTV (Zimbabwe) ch. E2 was noted on several occasions being carried into the UK via SpE on its last hop – this signal normally arrives via F2 or TE. ZTV was seen on the 29th and 31st of May, and on June 1/2/7/8/9/11/12, via either direct F2/TE propagation or with SpE assistance. On two occasions Hugh Cocks (East Sussex) received a system M, 525-line signal on ch. A2 from the south east via SpE – could this be the Iraklion (Crete) transmitter still in operation? On June 7th Clive Athowe (Norwich) received Band II (88·2 and 91MHz) f.m. signals from TRT (Turkey) via SpE. John Tellick (Surbiton) noted a film with Arabic subtitling on ch. E2 from 2142 onwards on the 11th: I suspect that this could be Dubai (UAE) despite the late hour.

RTVE has been seen using a new test pattern, fortunately with the transmitters identified: James Burton Stewart (Milton Keynes) sent the accompanying photograph, showing the La Muela ch. E3 identification. A large number of patterns with varying location identifications have been seen during June. RTVE are also carrying out teletext tests. The Czechoslovakian PM5544 top identification has been seen to change from SR-TV to CST prior to programme commencement. The TSS letterbox electronic pattern now carries a six-figure digital clock.

Tropospheric reception also improved during the period under review. An evening tropospheric duct occurred on May 28th, between Southern England and the Low Countries/W. Germany, giving good f.m. radio reception in Band II on a very narrow path heading. Further enhanced tropospheric reception occurred on the 13/14/15th, with really intense French v.h.f./u.h.f. signals, also signals from W/E Germany. Hugh logged several RTVE Band III/u.h.f. and Swiss Band I/III/u.h.f. signals. One mystery was a 625-line Band III French signal carrying the Antiope teletext service: this was just below ch. E11 (their new ch. 6?), received by Hugh from the Paris direction. June 22nd produced W/E German, French and Low Countries' signals, both television and f.m. radio. Clive Athowe is building an OIRT tuner for the 58-74MHz band, including the E. European 68-73MHz f.m. radio band, using an Ambit DM7 i.f. module with 5804 tuner head.

To summarise – an extremely active month! My thanks to the following for sending in extensive logs: Hugh Cocks (Sussex), Clive Athowe and Ray Davies (Norwich), Arthur Milliken (Wigan), Reg Roper (Torpoint), James Burton Stewart (Milton Keynes), Edward Baker (Northumberland), John Tellick (Surbiton), George North (Walton on Thames), Brian Fitch (Scarborough), Jim Cook (Newcastle), John May (Ashford), Mark Baldwin and Nicholas Brown (Rugby), Cyril Willis (Cambridge), Paul Barton (Harrogate), Petri Pöppönen (Finland) and Ryn Muntjewerff (Holland).

Conditions have also been active overseas. Geoff Perrin (Oman) has been logging strong ch. E4 signals from India. Nanda Kumar reports from Madras that Madras AIR are testing v.h.f./f.m. radio at 107·1MHz from 1700-2230 local time. Manufacture of f.m. receivers locally has just started.

DX-TV Club

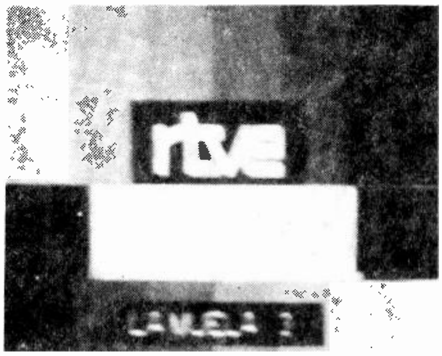
George Grzebieniak (c/o 185 Fleet St., London EC4A 2HS) has formed a DX-TV club that holds regular meetings with a view to encouraging a flow of ideas, advice and practical assistance. Data sheets covering the basic techniques of v.h.f. DXing are available to members. I feel that it's time for the DX hobby to increase its social activities. For further information on meetings etc., write to George at the above address, enclosing an s.a.e.

News Items

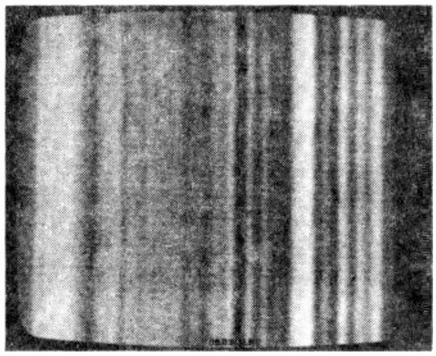
Eire: Trevor Plowman (Dublin) reports that a pirate station called "Channel 3" commenced operations on June 19th. A test card is transmitted from 2100-2400, followed by late night films on Fridays, Saturdays and Sundays. Increased transmitter power is expected from early July (assuming that the station is not shut down!). Presumably channel 3 is in fact ch. C, with 61·75MHz video and 67·75MHz sound.

Australasia: ABC have started teletext tests. A correspondent reports that the 477MHz CB spectrum in Australia is "very full". A go-ahead for f.m. radio in New Zealand has been announced. Australia's ethnic service seems to be a success, and Wenlock Burton (Melbourne) reports that a ch. 28 transmitter carrying the ethnic service is to be opened in Hobart, Tasmania.

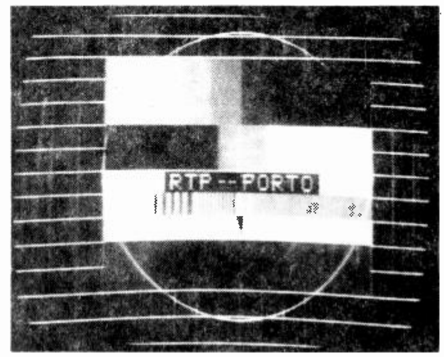
West Germany: ZDF is to commence dual-sound transmissions, using the two-carrier system (see *Teletopics* last month), from September. 32 transmitters will be modified for the new service, the second sound carrier being at 242kHz (half line offset) above the present one. Both channels use f.m., with the full 15kHz bandwidth. The cross-talk with independent signals (e.g. bilingual) is better than 76dB and the stereo cross-talk better than 38dB. Information to make the receiver switch to stereo or dual-



The new RTVE pattern (ch. E3), photo courtesy James Burton Stewart.



GBC (Ghana) ch. E2 received via F2 in Holland. Photo courtesy Henny Demming.



RTP (Portugal) ch. E3, received in Derby. Photo courtesy Keith Hamer/Garry Smith.

sound mono is carried on line 16. Several setmakers are introducing suitable receivers.

ZDF intend to use the Franco/German direct broadcast satellite for an additional TV service starting in 1986.

In brief: Uruguay has adopted the PAL-N colour system ... Sweden hopes to launch its own satellite, "Tele-X", by 1986/early 1987, and Finland hopes to use one of its channels ... The Liberian ship Odelia is anchored off Ashdod, Israel and intends to commence transmissions to Israel on ch. E59 – the project is being run by a Greek commercial organisation which hopes to provide five hours of programmes daily, in colour.

Italian Free Stations

I've recently received an "official" listing of the various "free" TV/f.m. stations now in operation in Italy (as of May 1st). The private stations are located in hundreds all over Italy, and there seems to be little official regulation – stations pick and change channels quite freely, often overnight. In some areas the u.h.f. band is literally jammed! Most stations rely on film or one-inch VTR material, and to stop the poaching of RAI (the official Italian broadcasting organisation) material the letters RAI are now inserted on their programmes. "Adult" type programmes seem quite common. The technical and production standards are generally low, the programme material often being "video wallpaper". The following stations operate in Band I (no transmitter powers are given in the list):

Venezia Giulia district, NCT (Udine) ch. A.

Campania district, Tele Spazio Campano (Sant Agata dei Goti) ch. A.

Puglie district, Tele Bari (Bari) ch. B.

Calabria district, Radio Sud Television (Reggio Calabria) ch. B.

Isle of Sicillia, Tele Radio Centro (Canicatti) ch. B.

Isle of Sardegna, T.O. Sardegna (Sassari) ch. B.

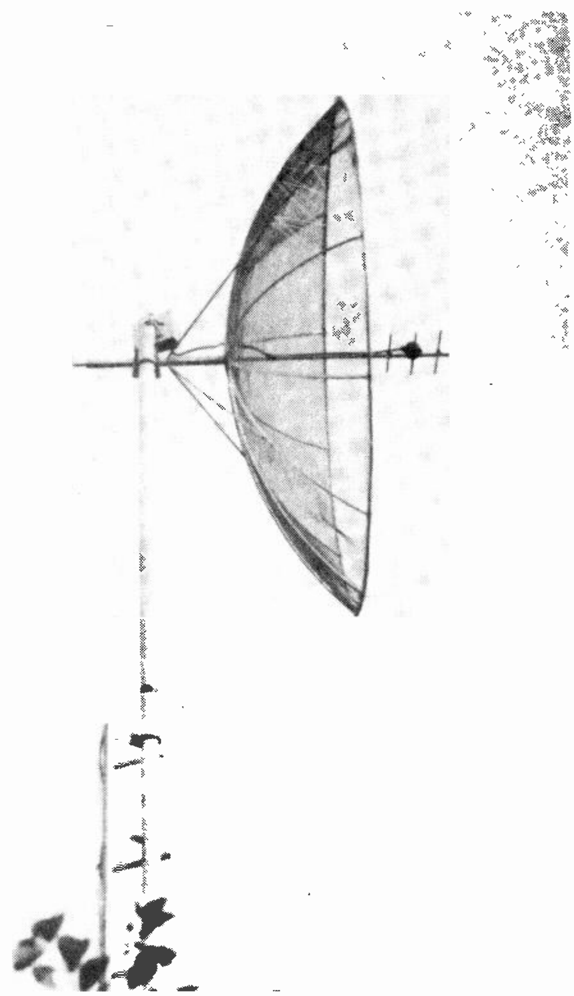
My thanks to C. Grima (Malta) for this information.

VHF Radio

A number of enthusiasts have enquired about a small pocket radio currently selling at between £12-£20 and covering the "Air/TV/CB" bands. At this price you can't expect too much, but in view of the v.h.f. coverage it was felt worth getting a specimen and trying it out. The unit was obtained from a mail order CB firm (they all seem to have them) and carries the model number HH857 and the name "Flight Multiband Radio".

There are three bands, one covering the accepted albeit illegal CB band, calibrated simply ch. 1-40, a second covering 108-176MHz and the third 54-108MHz, the latter two being for f.m. The tuning scale is approximately 2¼in. long, so accurate tuning and calibration are not the order of the day. The telescopic aerial extends to a length of 20in. – it's ineffective for CB monitoring, and further wire should be added to increase the gain. At v.h.f. the results from aircraft etc. were surprisingly good. The range that includes part of Band I just takes in the ch. E2 sound. There are separate front-end units, each with an r.f. amplifier and self-oscillating mixer, feeding a common three-stage i.f. strip.

A check was made on the Band I section, and an audible note was produced with a 1μV input – just. The selectivity is poor, but if the unit is to be used for TV sound only this may not be too important. There's an earphone jack for feeding into an auxillary amplifier. I would suggest



Five foot diameter 714MHz dish aerial used by John Abbott in South Africa for receiving the Russian Stat-T satellite. The u.h.f. head amplifier mounted behind the dish has a gain of 38dB and a noise figure of 1·8dB.

removing the telescopic aerial and connecting a coaxial feeder to the input point on the chassis, with the feeder terminated by a coaxial socket so that an external aerial can be used.

Briefly, it's a cheap Hong Kong type radio, but perhaps gives a limited means of resolving TV sound or acting as a signal monitor if left tuned to a known video frequency (despite it being for f.m., it does resolve a.m.). A slight realignment downwards to cover chs. E2/R1 would be helpful. Despite reservations, you may find it useful – but don't expect Eddystone standards!

From our Correspondents . . .

Various letters have been mentioned, but due to the amount of news etc. this month the correspondence section has had to be held over. Sorry, and please keep writing in!

CB Interference

CB operators are presenting increasing problems as their transmissions intrude into the broadcast bands. Nicholas Brown for example reports that the 27MHz transmissions are spreading through Bands I/II/III and also affect his hi-fi system. Cyril Willis describes the activities of "The Fen Ranger", whose signals have caused breakthrough problems with his DX-TV equipment, his domestic u.h.f. TV receiver and Band II radio set, and his disco gear (100W audio!). Similar problems have been described in other letters. Perhaps Keith Harmer is suffering the most, his road in Derby housing some ten "breakers". The following notes describe simple methods of reducing the problem, but I hope that readers who are experiencing difficulties will write in to me with details of their problems and any successful steps taken to resolve them, the aim being to report back further in due course. The main source of breakthrough seems to be second (or third etc.) harmonic radiation from the offending CB equipment, or alternatively overloading due to excessive signal from equipment being operated nearby.

Harmonic radiation is perhaps the most difficult problem since the solution is to fit a low-pass filter to the CB transmitter, which means you've got to find the operator. Amateur low-pass filters that can carry several hundred Watts cost around £20, but low-power filters are available at around £6-£10. It's essential to optimise the earth connections and links – harmonic radiation is often caused by poor inter-unit earth connections. New equipment made to meet the official requirements should not cause problems, but from comments in CB magazines it seems that those using illegal equipment intend to go on doing so. If you can't trace the user of a rogue transmitter, contact with a local CB club may help – some clubs have been known to go to a lot of trouble to identify specific rogue equipment.

Where CB interference is experienced at a receiving site it's essential to remove any high-gain outside/masthead amplifiers, particularly in Band I. Filtering must be inserted prior to the amplifier's input, since nearby transmissions can saturate the unit with the result that CB signals may appear at 54MHz, giving the impression that the trouble is due to second harmonic interference from the CB transmitter. Other effects may be spreading of CB signals throughout Bands I/II/III and even breakthrough on some audio equipment. The latter can be confusing where for example the left-hand channel of a tape deck is affected but not the right-hand one.

In the case of TV breakthrough, the first action required is to insert filtering at the input from the aerial to the first active stage. A 27MHz band-stop filter providing say 26dB attenuation at 27MHz, or a high-pass filter which provides 45dB attenuation below 40MHz with an insertion loss of only 2dB, can be used. Examples of the latter are the PO filter types 38 and 45A. Simple filters can be made, and in severe cases a combination of several filters may be necessary to obtain sufficient rejection at 27MHz.

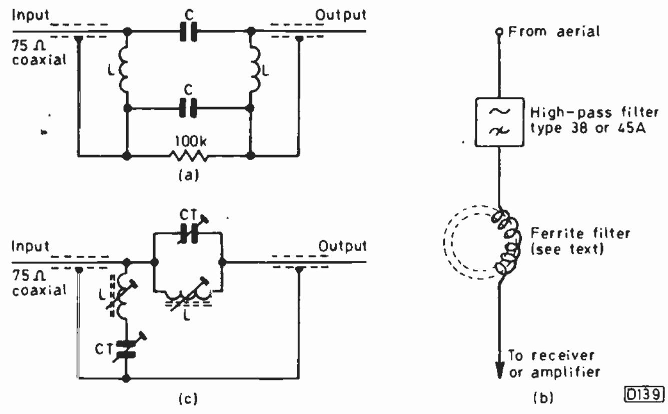


Fig. 1: Filters for reducing interference. (a) Simple u.h.f. high-pass filter. Suitable values for C 3·9/4·7pF. The coils are three-turn u.h.f. chokes. (b) Simple v.h.f. high-pass filter system for TV-DXing. (c) Band-stop filter for 27MHz. Trimmer values 3-30pF. Coils consist of 18 turns of 26 s.w.g. (approximately) wire wound on a ¼in. former with dust core. Tune to attenuate a 27MHz input.

If the problem remains after trying in-line filtering, the trouble could be due to harmonic radiation or pick-up via the braiding of the coaxial downlead. In the latter case, fit a ferrite braid filter – this consists of two FX1588 Ferroxcube toroids held together with five turns of coaxial feeder looped around them. This works at above 40MHz: for interference below 40MHz, use the same toroid assembly with thirteen turns of the coaxial cable. The ferrite filter must be fitted as close to the receiver as possible of course. Experimentation with quarter- and half-wave stubs connected across the feeder could also prove useful. A quarter-wave open-ended stub using feeder with a velocity factor of 0·85 would have a length of 7·74ft (75Ω coaxial feeder of course).

Cheap filters called "CB High Pass Filters" are available at prices of around £4-£7. We recently obtained one (type HP3A) from Waters and Stanton Electronics (Warren House, Main Road, Hockley, Essex). The circuit consists of coaxial inner conductor filtering and a braid break filter. The attenuation at 50MHz was found to be 45dB, at 200MHz 18dB and at 500MHz upwards 2dB. CB filters such as this are intended for u.h.f. use and will undoubtedly prevent breakthrough on domestic u.h.f. TV receivers. Peter Waters has since advised us that the filter has been superseded by the improved type HP4A. This company can also supply an equivalent to the FX1588 at 30p each plus 30p postage (any quantity) – they are known as type 8A filter cores. The HP4A costs £4·95 inclusive.

For effective attenuation of interference in Band I a combination of ferrite braid filtering plus high-pass v.h.f. filtering may well be necessary, or maybe braid filtering plus a 27MHz notch filter.

Another form of illegal radiation is becoming a problem – there's an increasing flood of imported walkie-talkies operating in the 49·1MHz region and selling at under £30 a pair. Added to this is the rise of the cordless phone, also operating at 49MHz and around 71MHz. None of these items are GPO approved. In the USA where the use of these devices is legal a small band at around 49MHz is allocated for domestic communications – this band is free from TV transmissions in the USA.

Practical TV Servicing: The Line Output Transformer

S. Simon

IF there's one item that gives an engineer pause for thought in a TV set it's the line output transformer: when to condemn it that is, and when to judge it free from blame. The decision is not always easy, and is often taken almost as a last resort. The reason for this is not hard to understand – expense, and the often time consuming business of fitting a replacement.

To the beginner, it may seem that the line output transformer has little more to do than the field output transformer, primarily being asked to contribute to driving the spot from one side of the screen to the other rather than from the top to the bottom. It has to do this approximately fifteen thousand times a second however instead of fifty times. Now from our previous ponderings we've noted that the rapid build up and sudden cessation of current in a coil can induce in it a higher voltage than that supplied to the stage of which it forms a part. In the line output stage this induced voltage can be very high indeed (the famed line flyback pulse). This imposes a stress between the windings – a difference of some 5kV may be present between windings on the same section (leg) of the transformer. Such stresses increase the possibility of breakdown.

Apart from insulation failure between windings, there's the more common (or once more common) failing of shorted turns in the same winding – it's this fault in fact that causes most trouble. Basically the line output transformer is an extremely efficient device. As a result, any defect that causes a drop in its efficiency, however small, has a most marked effect on the operation of the TV set. There's always an element of doubt however, since the symptoms displayed may be caused by the various items fed from or connected to the various tags on the transformer, and whilst it's easy to disconnect some of these as a check the disconnection of others will result in the timebase ceasing to function altogether, thereby largely defeating the object of the exercise (unless you happen to be monitoring the current flowing via the line output stage). Let's consider some practical examples.

Some Examples

Shorts between windings don't leave much room for doubt as the effect is more drastic. For our examples, we'll consider the Philips 210-300 series hybrid monochrome chassis and the Philips G8 solid-state colour chassis. The former employs a fairly typical valve line output stage, with the h.t. fed to the anode of the PY800 efficiency diode valve (see Fig. 1). The cathode of this valve (top cap connection) is at a higher voltage (the "boost" voltage), since the diode charges the boost capacitor C2064 during part of the scanning cycle. The anode of the PL504 line output valve is also connected to the boost supply. Thus if there's a short or leak between the boost line and the h.t. line the timebase cannot operate properly. If this is suspected, it's a matter of seconds to remove the efficiency diode's top cap. This should remove all traces of h.t. from the timebase, i.e. from the anode (top cap) of the PL504 line output valve. It should also result in the PL504's screen grid feed resistor R2158 overheating, since without h.t. at its anode the valve's cathode current will flow via the screen grid instead of the anode.

In other words, removing the PY800's top cap should result in nothing at the top cap of the neighbouring PL504. If however something continues to happen when this action is taken, even if it's only a feeble attempt at normal working, then there must be another d.c. path that shouldn't be present between the anode of the PL504 and the h.t. line. In most cases one would immediately accuse the boost capacitor of being short-circuit, and since it stands erect to the left of the screened line output stage section this point can be checked simply by snipping its top leadout wire. If there is then no h.t. at the anode of the PL504, the capacitor has been proved to be short-circuit and a replacement (which must be of at least 1kV working voltage) will restore normal operation.

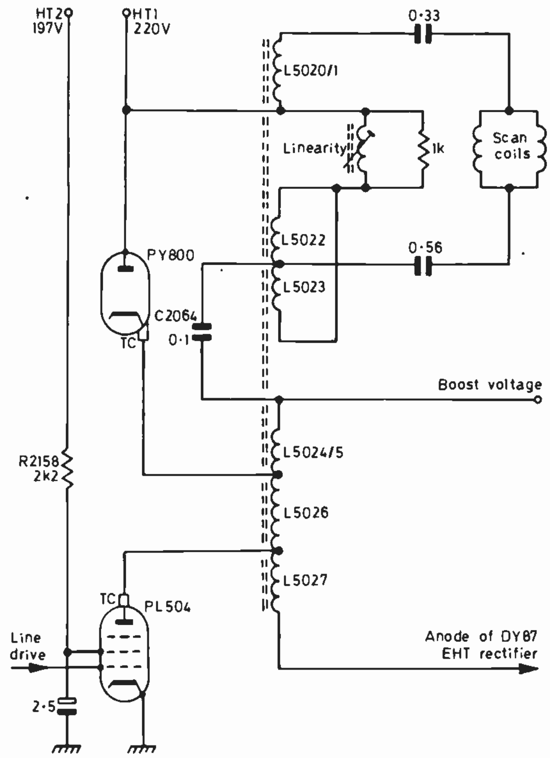
There's a distinct possibility however that snipping the boost capacitor's leadout wire will leave the output stage working (well sort of working). This means that there's still a d.c. path from the anode of the PL504 to the h.t. line: the route is between windings L5024/6 and L5020/3. Obviously in this event there's no alternative to transformer replacement. Don't think that this type of fault is confined to one particular type or make of set: it does seem to afflict some more than others however.

A different approach is called for with sets using solid-state circuitry. For a start the protection circuit (excess current trip) may operate, shutting down the supply to the line output stage. Or a fuse may have failed, indicating the approximate area in which the fault lies. In an earlier article in this series we considered the procedure to adopt in the case of the G8 chassis, but it'll do no harm to recap a bit.

We'll assume that the G8 has been brought in with the complaint "no results". If the tube heaters are glowing we know that the mains fuse is intact, so the first check should be made at the two fuses on the upper left-hand side power supply panel (the h.t. fuses). If some 200V is present here, we know that the "mains dropper" resistor is intact (it's a frequent cause of no results if there's no h.t. at the fuses) and that the h.t. rectifier/regulator thyristor is functioning. The lower of these two fuses may or may not be intact (normally it is).

We then shift our attention to the right-hand side line timebase section and check the 800mA fuse here (see Fig. 2). It may or may not be intact. Normally it isn't under the fault conditions we've outlined. If it is intact, check for 200V at either end of the front mounted 47Ω wirewound resistor R5535 which could well be open-circuit. If it is, the search for the cause of the trouble is over almost before it has begun. If the fuse is open-circuit on the other hand the plot thickens.

The cause could be one of lots of things – shorted diodes, capacitors, output transistors or a faulty tripler for example. Where do we start? As it happens, no difficulty is presented in this set. The tripler is connected to the line output transformer via a rubber capped connector which is easily (usually – but don't rip it off and damage the panel)



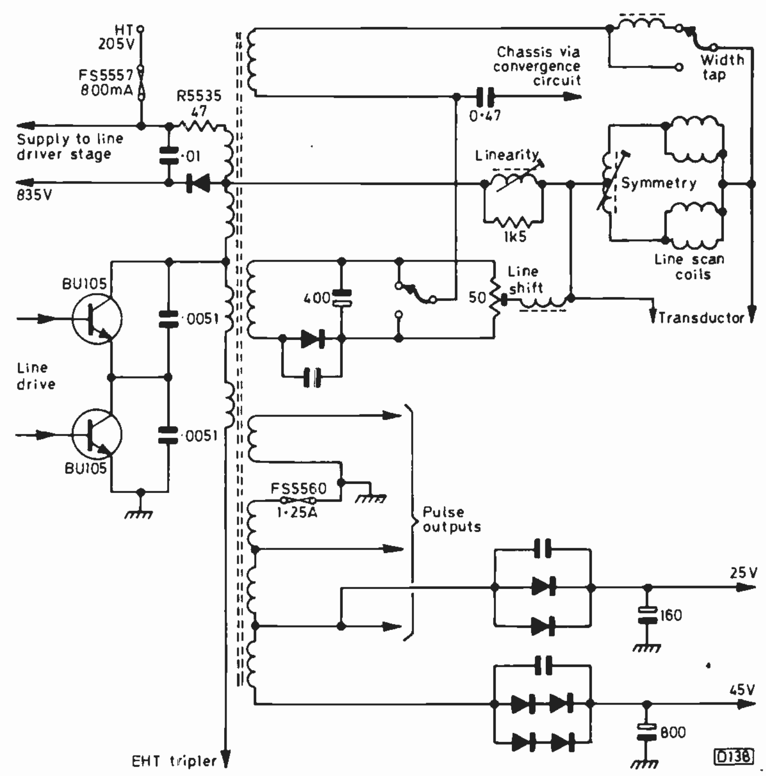


Fig. 1: Line output stage circuit (simplified), Philips 210-300 series monochrome chassis.

Fig. 2: Line output stage circuit, Philips G8 chassis. Note that a number of modifications were introduced during the production run.

removed. Ease it off if necessary.

One might think that resistance checks would be the next obvious step. Possibly, but the chances are that they will be inconclusive. Our method is to switch the meter to the 1A or 2A range and connect it across the 800mA fuse's holder, via hand-held probes (quickly removed). This serves two purposes. One to ascertain the current flowing – this should be between 400mA and 500mA – and secondly to see what happens. What normally happens is that the transformer gives an audible or visual indication that it doesn't feel well. Audible with a click that is, and/or visible with a spark from the windings.

If it does neither and the reading is as expected, reconnect the tripler and try again. If the reading is still normal, fit a new 800mA fuse and put the set on a soak test.

If the reading is high, the tripler could be at fault and a new one should be tried. It's just possible that there's an excessive current demand and that the beam limiter is out of action, but we mustn't get side-tracked. It's a good idea however to check the tube base voltages to ensure that the cathodes are fairly high in relation to the control grids – funny things do happen on occasions.

The G8 is one of those sensible designs with a liberal provision of fuses associated with the various supplies derived from the line output transformer. This serves two purposes – even if the wrong value fuses have been fitted by persons unknown. Apart from providing circuit protection, the fuses can be lifted to clear sections of the circuit from suspicion. Furthermore, once a fuse has been lifted a meter can be connected in its place to see if the current taken in that particular branch of the circuit is excessive.

Another suspect in the G8 is the pincushion correction transductor – it's a frequent cause of fuse blowing, and the simple check is to remove the red plug H. The receiver will function quite happily without the transductor, though the raster will have a slight pincushion shape. The transductor is mounted on the lower timebase board.

So if the line output transformer gives no obvious indication that it's at fault, we've the means in the G8 chassis of simply unloading many of the possible causes of fuse blowing. If the problem remains, we're left with the line output transistors and something we've not yet mentioned, the line driver stage, since this is also fed with h.t. via the 800mA fuse. Happily the driver stage is not often responsible for no results in this chassis, but it's something to keep in mind.

The driver and line output transistors can be checked with a meter (resistance checks with the collector isolated) to see whether there's any leakage. If there's any doubt about the line output transistors they should be replaced. In the G8 however it's the line output transformer that's the most frequent cause of the failure of the supply fuse. Despite that, the Philips G8 is still my favourite set from all points of view.

Other Makes and their Habits

Experienced engineers used to dealing with a variety of makes are able to assess the probability of the line output transformer being at fault merely by looking at the exterior of the receiver or being told the model number. Not the make. If this sounds confusing, we'll explain.

If we have two Bush colour sets on the bench, one fitted with the Z718 chassis and the other with the T20, the engineer will not suspect the transformer in the Z718 because experience will have shown him that this type of transformer rarely breaks down unless the e.h.t. stick rectifier has shorted to present a heavy overload, though even then the chances of the transformer being defective are not high. In the case of the T20 however he'll suspect the transformer together with the tripler, and if he doesn't he has a long haul ahead of him. With the Z718, he'll first check the two EW modulator diodes (5D5/6) associated with the transformer and soldier on from there, having first removed the e.h.t. stick to clear this of suspicion. If he's presented with a pair of ITT colour sets, one fitted with a hybrid chassis (CVC5-CVC9) and the other with a solid-state chassis (CVC20-CVC30), he'll not suspect the transformer in the hybrid chassis, though he'll check the soldering of the leadout connections on the subframe. In the case of the CVC20 however he'll have grave doubts about the tripler unit and the transformer and will replace both if either is found to be at fault. Read that again. Ah, you might say, but we're not that experienced. Which is why you're reading this little article, isn't it?

Shopping List

If you have a variety of sets coming in for service, or if you go out to them for that purpose, you may like to have a list of the transformers which it will pay you to carry and won't gather dust on the shelf. Here it is.

Monochrome sets: Bush TV161 series (A640 chassis), wired. Bush TV181 series (A774 chassis), panel mounted. Indesit Model T24. Philips 210-300 chassis.

Colour sets: Bush T20 chassis. ITT CVC20 and CVC32 chassis. Philips G8 chassis.

A modest list, but one that will stand you in good stead.

What about Thorn sets (Ferguson, HMV, Marconiphone, Ultra etc.) you may ask? The only trouble, apart from isolated cases, arises with those monochrome sets which have combined transformer/e.h.t. stick units. The stick tends to short, and it's possible to fit an external (fully insulated) stick as a "get you home" remedy.

Modifying Older Transformers

Sometimes a transformer may not be available, and if the fault is shorted turns in the e.h.t. overwinding the possibility of doing away with this and fitting a tripler may be considered (we're talking about valve line output stages). There are one or two points that have to be taken into consideration before this is done. First, merely disconnecting the winding is not enough. Even though it's not connected, it's still there with its shorted turns damping the rest of the transformer. It has to be removed, if possible by dismantling the transformer and sliding the winding off. This is not always as easy as it sounds, and the less elegant method of cutting away the faulty winding may have to be adopted.

Once this has been done the tripler can be fitted, with its input lead connected to the anode of the line output valve, any earth lead linked to chassis and the output applied to the tube's anode. Insulate any other leads well, the exception being the focus facility if this is being used. The resulting picture may be a complete disappointment however, which brings us to the second consideration. The point here is that a flyback tuning capacitor is required (the self-capacitance of the overwinding took care of this previously). Use a high-voltage disc type, rated at 12kV. The value will have to be found by experiment, but will be around 100pF. Fit it between the line output valve's top cap connection and chassis. Some other adjustments may then have to be made (width etc.) to obtain optimum scanning with the correct e.h.t.

Since there may well be a pulse winding on the transformer, with the pulses operating the burst gate in a colour set, the appearance of green streaks across red areas will indicate that the setting up of the width and timing has not been carried out correctly.

Where a PD500 shunt stabilizer valve is removed, add a 22Ω 4W wirewound resistor in its place in the heater chain.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 605 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

RANK A816 CHASSIS

The line output transistor in this set went short-circuit. I used a BU205 as a replacement and the set works perfectly apart from a thin line, like a piece of rope, down the right-hand side of the screen – about two inches from the edge. I've tried using a BU105/01 as originally fitted, but the fault is still present.

We suggest you try threading a ferrite bead on the base and emitter leadouts of the replacement transistor. Also ensure that the aerial lead is properly wired, and doesn't pass too near the area of the line output stage.

THORN 9000 CHASSIS

The set itself works all right, but the remote control unit won't change the channel unless it's held within a foot of the receiver. I've replaced the battery and tried a new remote control transmitter, but this has made no difference.

We suspect the receiving transducer (microphone) within the set. These sometimes go low-gain or insensitive. Ensure that a replacement is the correct Thorn-approved type.

DECCA 80 CHASSIS

The picture suddenly reduced to a thin vertical line down the centre of the screen – movement of the picture can just be seen in the line. The picture has returned on a couple of occasions at switch on, but collapses to a line within a few minutes.

The line scan circuit is going open-circuit. Check the scan correction capacitor C403 for being open-circuit, then look for dry (burnt!) joints around the line linearity and width coils, plugs A/B etc. The scan current path is as follows: line output transformer, C403, L401 (linearity), PLA1, the scan coils, L705 (line balance), PLA3, PLB8, PTA7, T301 (raster correction transductor), PTA8, PLB5, L400 (width), chassis.

THORN 9000 CHASSIS

The Syclops transistor VT701 has been replaced five times during the last year. This seems to be necessary every time the set is knocked, but I can't find any intermittent short-circuit or dry-joint. Are there any adjustments that should be carried out after replacing VT701?

The most common sites of bad joints in this chassis are around the heavy wound components in the Syclops/line output department, i.e. the two transformers T701, T702 and maybe T705. Run over the joints to all these, also replace the h.t. rectifier diode W701 and the isolating diode W702 (in series with VT701). The adjustment required is to set R606 for 720V peak at TP708. This can be done using a 20kΩ/V meter shunted by an 0·01μF, 1kV capacitor, feeding these via a diode such as a BYX10 or 1N4007.

TELPRO C671

The chassis used in this set is basically the Decca 30 series chassis. The fault is an image a quarter to half an inch to the right of the picture, especially noticeable on yellow lettering against a deep blue background. The image is then a lighter shade of blue, but is not always present. It's not ghosting, and there's only one image which remains in the same position. The aerial has been carefully aligned and the luminance delay line appears to be in order.

A single reflection of the sort described suggests a "bounce" in the luminance delay line. This is best seen on a test card. The line itself is unlikely to be defective, and if it's earthed correctly the terminating resistors (R202/5/6) and their connections should be checked. That the delay line is responsible for the trouble can be checked simply by removing it and shorting across the panel – this will upset the chroma/luminance registration of course.

THORN 1615 CHASSIS

The problem with this set is to do with the vertical linearity – about once a month I have to adjust the field linearity control R102 slightly to restore good linearity. Something seems to be changing value slowly, but it's difficult to guess what it could be.

The problem could be due to leakage in any of the four transistors that follow the field charging circuit – the amplifier VT20, driver VT21 or class B output pair VT22/3. It's more likely however that a capacitor is to blame, and all the electrolytics associated with these stages will have to be checked – C93/95/99/102.

RANK T20 CHASSIS – VCR OPERATION

The problem is field judder when this set is used with a VCR – it works perfectly all right off air. Is there a modification that can be made?

The suggested modification is to change 2C16 in the i.f. a.g.c. circuit from 0·01μF to 3·3μF.

HITACHI CNP190

After a couple of hours the picture becomes very grainy, while a small increase in the setting of the colour control produces over saturation with the colours trailing and glittering. Slight adjustment of the a.g.c. control gives marginal improvement.

The grainy picture suggests that the tuner is working at less than full gain. Wait till the fault appears, then apply an external bias of about 4V to the a.g.c. pin (at C266). If this has no effect, the tuner is suspect. If normal reception is restored, check back to the a.g.c. circuit – CR7, C258 (3·3μF), TR7, CR6 etc. and their associated joints and connections.

ITT VC300 CHASSIS

The raster is present but there's no picture. On the sound side the signal seems to be from a radio station – it comes through clearly but faintly, the volume increasing noticeably when a hand is held near the intercarrier sound i.c. and the surrounding circuitry.

The fault seems to be endemic with these sets, and is invariably due to failure of the video detector i.c. – IC6, type TDA1330 or MC1330.

PYE 368 CHASSIS

The problem with this dual-standard hybrid monochrome set (Dynatron TV201) is lack of width – about five inches in on each side. Also the picture expands and disappears when the brightness is increased. The e.h.t. rectifier and the valves in the line output stage were replaced without curing the fault, but replacing C111 restored full width. Is there anything else that should be changed?

You seem to have taken the action required. C111 (0·047μF) couples the drive to the line output valve. Use a 400V type.

THORN 8000 CHASSIS

There's no raster, though a vertical white line appears when the line scan coils are unplugged. The first anode supply (TP27) is low at 350V instead of 630V, and the voltages in the line driver stage are wrong though the transistor itself seems to be o.k. and no faults can be found in this area.

A faulty line output transistor can cause these effects, and a replacement should be tried as a first step. Otherwise the scan correction capacitor C407, the scan coils and the line output transformer are suspect.

NATIONAL TR542G

There are a number of symptoms on this set as follows: the left inch of the picture is white, the brightness is high even with the control at minimum, there's bad horizontal pulling and blurring and spreading of whites on advancing the contrast control setting, there are flyback lines and a long warm up is sometimes required.

First check the video output stage supply – there should be 110V across C420 (3·3μF, 160V) which could be faulty. Then check the video output transistor TR15 (2SC1012 – a BF179 should do), the coupling capacitor at its base (C141, 33μF), and if necessary the video emitter-follower TR14 (suitable replacements BC107 or BC171). Also make sure that the l.t. line is correct at 11·5V across C705 (set by VR71).

DECCA 30 SERIES CHASSIS

The problem is a vertical green band at the left-hand side of the screen, about half an inch wide, present only on colour. There are also slight Venetian blinds, noticeable when the picture contains large areas of one colour.

Get the right trimming tool and carefully adjust the ident coil L205 to eliminate the green band. Trim out the blinds on a test card with VR249 and if necessary *slight* adjustment of L204.

PYE 697 CHASSIS

There's a good monochrome picture but no colour. With a colour bar input, the waveform at the vision test point on the i.f. panel consists of a luminance staircase with no colour information. In view of this the i.f. panel and tuner were checked by substitution, but the problem remains.

There's never much colour to be seen at the vision test point, even when a X10 probe is used. Try overriding the colour killer by shorting out diode D21 on the decoder panel. You will then probably find that unlocked colour appears, indicating that adjustment of the reference oscillator preset control RV10 is required.

PIL TUBE

Something that's not supposed to has happened – the scan coils have come unstuck from the tube! I've temporarily fixed them with insulating tape, but would like to know what type of glue to use.

Epoxy resin (Araldite) should do the trick, provided the glass surface is clean. Before fixing the coils however it will be necessary to align them carefully for optimum convergence. If further trouble is experienced, you may have to use one of the more expensive specialised adhesives.

ITT CVC32 CHASSIS

There's an intermittent field fault on this set – the top quarter of an inch or so of the picture is lost, while about half an inch down from the top of the screen there's a quarter-inch band of white lines.

This sounds like slow field flyback. The most likely cause is slight leakage in one of the FT3055 field output transistors T8/9 or diode D10 (BY133). If proving these by substitution doesn't resolve the problem, the most practical course of action would be to obtain an exchange CMF30 field timebase module.

HITACHI CNP860

The focus on this set is poor, but there doesn't seem to be any focus adjustment.

The c.r.t. used in these sets has a unipotential gun, so no focus adjustment is necessary or provided. If the h.t. is correct at 120V, and the boost voltage at pin 1 of the three-pin connector L is correct at about 520V, the c.r.t. is probably soft. After some eight years this could well be the case.

GEC 2114

The trouble with this mains-battery monochrome portable is no e.h.t. or any other medium/high voltages, while the main l.t. rail is at about 15·5V instead of 11V. I've checked the transistors in the series regulator circuit, but can find no fault here. The line oscillator transistor seems to be warm, while its base bias resistor R240 is quite hot.

The fact that the main supply line is high indicates that it's unloaded, due to the line output stage not functioning. Whilst the line output or driver transistor could be at fault, or the supply to either could be missing (check D208 and R243/T201 respectively), the warm oscillator transistor suggests that the line oscillator has stopped. Check the two transistors (Tr211 oscillator, Tr210 reactance transistor), the connections to the oscillator coil L201, and the coupling capacitor C228. Also ensure that Tr210 is receiving base bias from the line hold control P201 (the base voltage should be about 1·6V).

THORN 3500 CHASSIS

There's an intermittent colour fault. The colour depth sometimes varies randomly between two levels of intensity: on other occasions the colour is completely lost, leaving a good quality monochrome picture. The loss of colour sometimes occurs on changing channels, but the colour then usually returns after a few minutes. The loss of colour is sometimes accompanied by loss of colour lock, i.e. horizontal bands of weak colour bars across the screen.

The problem could be an a.c.c. fault, in which case the a.c.c. smoothing capacitor C173 (2·5μF) should be checked by substitution as a first step. Then suspect that the amplitude of the gated burst signal is varying at the collector of the second burst amplifier transistor VT302. Check this with a scope if you have one. Make sure that the reference oscillator control loop is correctly set up, and note that the correct setting of the line hold control is important for correct decoder operation in this chassis.

ITT VC400 CHASSIS

There are flyback lines on all lighter scenes; there's also line foldover on the left-hand side of the screen.

These symptoms can occur if the line hold control R83 is incorrectly set. Try it to see whether the fault clears. If not, check the flyback blanking diodes D1 and D19, then if necessary concentrate on the flywheel sync discriminator circuit, around D10/D11, also the following f.e.t. reactance stage transistor T14 (BF244B). The line oscillator circuit itself is rather unusual – a complementary squarewave generator. The 8·7V zener diode D12 might also be worth checking.

SABA F CHASSIS

The trouble with this set is centre compression – the band of compression is about two inches high, across the centre of the screen. The compression is not too severe, but is annoying on some shots.

A fault in the linearity circuit can cause this sort of trouble. Check the linearity control P676 (1MΩ), and the feedback capacitor C694 (0·022μF) which tends to suffer from leakage problems. The usual PCL805 pentode cathode bias components should be checked – R696 (680Ω) and C686 (100μF). These often fail, especially the resistor which changes value.

TEST CASE

225

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.

Back to monochrome this month, in the form of an old and tatty set fitted with the Thorn 1500 chassis – one of the most common monochrome chassis around in its day. Most of these sets are now getting on in years, and this particular specimen was brought in by a disgruntled field engineer at the end of a rainy and frustrating day. Everything we touched in the set seemed to fall to pieces, and after tidying up a few odd faults we were left with the main problems – a tired c.r.t. and lack of width. The line scan was almost two inches short on each side of the screen.

The technician assigned to the job first tried replacing the line timebase valves (PL504, PY801 and 30FL2). This produced no improvement, so the width control circuit was next examined. The width control and the associated high-value resistors all measured o.k. on the ohmmeter, and replacing the VDR and the pulse feedback capacitor made no difference. The width control was in fact working, but unable to correct the underscan. Leakage in the line drive coupling capacitor C100 maybe? Replacing this left the fault exactly as before.

At this point the chief technician appeared, cup of tea in hand, and passed his opinion. "The scan-correction capacitor C90 is probably short-circuit" said he. Together they checked C90, which was perfectly o.k.! "Must be the harmonic tuning capacitor" said the oracle – "check C95, and make sure no one's fitted the wrong tripler." After some research, since there are many similar looking types of e.h.t. tray for this series of Thorn monochrome receivers, it was established that the correct unit was fitted – a doubler actually, since it was a 19in. set. Suddenly realising he'd missed an important point, the technician checked the h.t. voltage, which was found to be correct at 245V. This brought us to the harmonic tuning capacitor C95, but replacing it made little difference.

The e.h.t. was checked and found to be high at 21kV, while the boost voltage was roughly correct at 680V. The high e.h.t. increased our suspicion that there was something wrong with the harmonic tuning, so an experiment was carried out – a 100pF capacitor was added in parallel with C95 (150pF). This restored normal width! We couldn't leave the set like this however. The culprit was found and replaced – what was it? See next month for the answer and another item in the series.

ANSWER TO TEST CASE 224
– page 548 last month –

Patience is a virtue in our business, and we had great need of it with the fault described last month! You will recall that an Hitachi VT8000E VCR was on the operating table, and that its very intermittent fault was video noise on the upper half of the raster. The heads had been checked by substitution, likewise the head amplifier etc. chip IC201. We eventually found that the trouble was due to intermittent absence of the head switching pulse, and carried out tests on the servo panel.

The i.c. (IC502) containing the 25Hz flip-flop proved to be o.k., so where was the pulse disappearing to? In fact the pulse never got started: careful checks during the increasingly rare presence of the fault condition revealed that the pulse from the head drum tachogenerator went missing each time the trouble occurred. After checking its connections, we decided that the tachogenerator must have been going open-circuit intermittently. A new tachogenerator head completely cured the fault, but many hours had been spent on the machine by the time it left the workshop . . .

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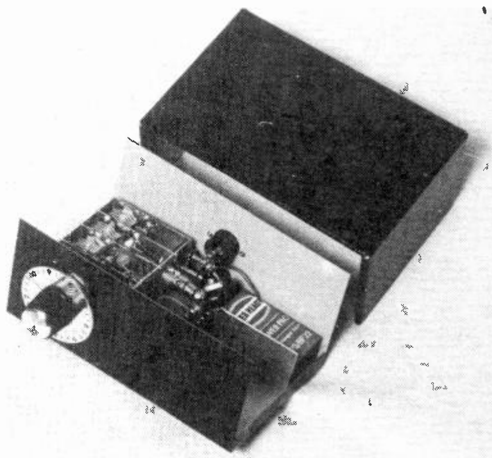

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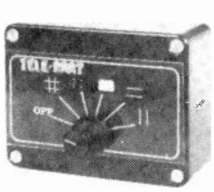

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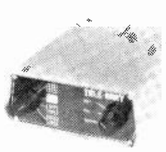
- *Pocket size for outside service*
- *PP3 battery power source*
- *Five different test patterns for colour and mono TV*
- *Cross hatch grid*
- *Dot matrix*
- *White raster*
- *Horizontals*
- *Verticles*

A lightweight, extremely portable and versatile pattern generator for black/white and colour T.V. alignment and service at the customers home. At the turn of a switch, the generator can provide five essential test patterns for correct installation, fast checks and repairs. Pattern stability is first class and compares favourably with other more costly bulky generators only suitable for bench work. The generator is pocket size measuring 10×7.5×4 cm and weighs only 190 grams.

PRICE £14.95 (Subject to V.A.T.)
POST & PACKING £1.04



Telepart Colour Bar Generator

- *Exceptionally light & durable*
- *Compact 13×17.5×5.5 cms*
- *Battery powered for mobility*
- *Cross hatch grid*
- *White raster*
- *Grey scale*
- *Colour bars*
- *Sound*

A Versatile Generator for Servicing or aligning mono or colour TV receivers. Lightweight and very compact for outside service. Features sound facility often not found on more costly generators.

PRICE £49.95 (Subject to V.A.T.)
POST & PACKING £1.04

Power Supply

A Power Supply can be supplied for the Telepart COLOUR BAR GENERATOR. This compact unit mounts by 2 screws into the Battery compartment and converts the unit to a bench instrument.

PRICE £5.50 (Subject to V.A.T.)

CELTEL

22″ G8	£45	26″ 3500	£25
22″ 3500	£45	20″ GEC	£20

ALL PLUS VAT @ 15%

Thorn 3000 Panels all at £5
Spares available for all models

WARNERS MILL, SOUTH ST., BRAINTREE, ESSEX (0376) 43685
UNIT 5A, KEMPS SHIPYARD, QUAYSIDE ROAD, BITTERNE, SOUTHAMPTON 0703 331899

COLOUR TV

from £10.00 (complete but not working) **from £30.00** (working)

MONOCHROME TV

from £1.00 (not working) **from £5.00** (working)

ROBINSON'S

89 High Street, Huntingdon, Cambs.
Tel (0480) 56311.

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."

COLOUR BAR GENERATOR
UHF AERIAL INPUT PATTERN GENERATOR

- ★ GREY SCALE
- ★ WHITE
- ★ HORIZONTALS
- VERTICALS ★
- DOT MATRIX ★
- CROSS HATCH ★

★ ADD ON PAL COLOUR BARS ★

Send SAE for full specifications.
Batteries not included.

PG6RF	Kit **£28.75**	Built **£37.95**
C6	Kit **£20.75**	Built **£29.90**
CPG6RF	Kit **£48.30**	Built **£72.45**

ACCESS ORDERS ACCEPTED

Price includes P&P and 15% VAT.
VHF versions available.
Full 12 month guarantee on built units.

MAIL ORDER ONLY FROM

TECHNALOGICS LTD. (Dept TV),
394 SCOTLAND ROAD,
TAYLOR STREET INDUSTRIAL ESTATE,
LIVERPOOL, 5.
051 207 3799

CARDIFF CENTREVISION
EX RENTAL T/V's

*In stock now. Philips G8 Thorn 3500

Philips K9 26" 110° VCR Position from **45.00**
Capacity to supply 300 working sets weekly.
Large range of spares. Call and see our 4000 sq. ft. warehouse, you won't be disappointed.
Over 1,000 sets in stock
Unit 2 corner of Penarth Road and Hatfield Road.
Tel. Cardiff 0222 44754

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

IMMEDIATE CREDIT AVAILABLE—TRADE ONLY

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!

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

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

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NEW TUBES AT CUT PRICES

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A31-120W/300W	17.95	2.69
A31-410W/510W	17.95	2.69
A34-100W/510W	18.50	2.77
A38-160W/170W	17.50	2.63
A44-120W	27.00	4.05
A50-120W	17.95	2.69
A59-23W	21.50	3.22
A61-120W	19.95	2.99
Rigonda 6"	14.00	2.10
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9AGP4	21.82	3.27
190AB4/C4	23.00	3.45
230ADB4	28.50	4.28
230DB4/CT468	26.60	3.99
240AB4A	17.95	2.69
CT507 equiv	21.95	3.29
CT512	27.50	4.12
310DGB4/DMB4	23.00	3.45
310EUB4	19.95	2.99
310EYB4	18.75	2.81
310FDB4	27.50	4.13
310FXB4	17.50	2.62
310GNB4A	27.50	4.13
310HCB4	27.50	4.13
340AB4	22.50	3.38
340AYB4	30.00	4.50
340RB4/CB4	26.00	3.90
340AHB4	26.00	3.90
TSD282	8.00	1.20

Some Rebuilt Japanese & European Types Available from £14.00 + VAT £2.10

COLOUR TUBES
New and Mullard Colourex*

12VARP22	62.50	9.37
330AB22	73.50	11.03
A44-271X	60.00	9.00
A47-342X	63.00	9.45
A47-343X	63.00	9.45
A49-120X/191X	53.00	7.95
A51-161X	67.00	10.05
A51-500X/510X	64.50	9.68
A51-220X	64.00	9.60
A56-120X	54.00	8.10
A56-500X/510X	63.00	9.45
A63-120X	69.50	10.42
A66-120X	65.00	9.75
A66-140X/410X	70.50	10.57
A66-500X/510X	65.00	9.75
A67-120X	65.00	9.75
A67-140X/200X	69.50	10.42
A67-150X	75.00	11.25

****Old Bulb Required for Colourex****

ALL TUBES TESTED BEFORE DESPATCH & GUARANTEED FOR 12 MONTHS. 4 YEAR GUARANTEES AVAILABLE ON MOST TYPES

CARRIAGE
Mono £3.00 Colour £10.00
Mainland only. Overseas Rates on Application.

TELEVISION TUBE SHOP LTD.
52 BATTERSEA BRIDGE RD., LONDON, SW11.
Tel. 228 6859/223 5088

SETS & COMPONENTS

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 Manager, Television, Room 2337, 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.

QUALITY REBUILT TUBES

HIGH TEMPERATURE PUMPING

COLOUR (2 year Guarantee)

90° up to 19"	**£33**
90° 20" – 22"	**£35**
90° 25" – 26"	**£36**
110° and PIL	**£40**

MONO (including thin necks) from **£14.**

All prices + VAT

Delivery UK Mainland £6.

4 year Optional Guarantee

Send or phone for full list and terms.

WELTECH PICTURE TUBES
Unit 3-10 Wembley Commercial Centre, East Lane, Wembley, Middx.
01-908-1816

TRIANGLE TELEVISIONS, Coleraine, N.I. Quality working sets. Clean cabinets, Decca, Bush, Kirting. Phone Coleraine 3600.

VALVE BARGAINS

BOXED & TESTED 30p EACH

ECC82, EF85, EF183, EF184, PFL200, PCF80, PCF802, PCC84, PCC89, PC97, PC86, PC88, PCL84, PCL805, PCL86, PY800, PY88, PL36, PL504, 6F28, 30PL13, 30PL14.

COLOUR VALVES 65p EACH

PY500/A, PL508, PL509/519, PL802.

Postage & Packing 30p, no VAT

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

BUSH 20" and 24" S/S mono's. Working order £10. Each minimum 10. C.O.D. available (0706) 623404.

★ TELEBEST ★

Good quality sets always available, working – non working.

G8 • 3500 • 8500 • Grundig etc.

Discount on quantity.

841 Romford Road, Manor Park, London E.12
Tel: 01-514 1333.

SUFFOLK TUBES LIMITED

214 Purley Way, Croydon, Surrey.
Tel: 01-686 7951/2/3/4

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

ALL COLOUR TUBES HOT PUMPED AT 385c AND REBANDED TO BRITISH STANDARD. 415 1972 CLAUSE 18-2.

19" and 22" TUBES APPROVED. OTHER TYPES PENDING.

BRITAINS LARGEST INDEPENDENT REBUILDER FOR 21 YEARS.

TVDX EQUIPMENT. Vhf to Uhf converter, 12V supply required £10·50. Band I double notch filter, 40db plus attenuation £18·30 (state Channel). BI mosfet preamplifier, high gain, low noise, mains powered £25·95 BI/II version (to 88MHz) £1 extra. Tunable set side mosfet Uhf preamplifier, mains powered £25·95. Band III type £25·50. Sae date, lists, H. Cocks, Cripps Corner, Robertsbridge, Sussex. Tel. 058083-317.

EVS

PHILIPS VIDEO CONVERSIONS

UP TO 5 HOUR DUAL SPEED RECORDING

FROM N1700 - 02 VIDEOS

EASY FIT KIT £65 OR FITTED £83 inc

EXCELLENT PICTURE QUALITY

USES EXISTING TAPES - SEE DEMONSTRATION

VIDEO - AUDIO IN -OUT FACILITIES £85 inc

N1500-01-02 L.P. CONVERSIONS FROM £105

LVC150's £15 EACH – TAPES REPAIRED

EVANS VIDEO SERVICES 061 439 8696

Video Engineering Specialists

THORN 8500 working with polished cabinets £47 or with regunned tube £65. Minimum order five. Tel. 0484-643273 (W. Yorks).

CAMPBELL ELECTRONICS LTD.
COLOUR T.V. PANEL EXCHANGE/ REPAIR SERVICE

THORN, RANK, PHILIPS, GEC, DECCA, TELPRO, GRUNDIG etc.

90 Day Guarantee on all repairs – same day postal service.

Telephone Telford (0952) 502422
for catalogue and price list.

CAMPBELL ELECTRONICS LTD.,
Unit 5, Heath Hill Estate, Dawley, Telford, Shropshire.

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

GOOD WORKING CTV's: Thorn 19" 3K £55, 22" 3K5 £67. ITT CVE5 20" £65. Thorn 4K 22" £85, 26" £85. Bush 2718 20" £75. (No VAT) Tele-Q, Preston (0772) 792547.

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WE HAVE WAYS OF MAKING YOU BUY. WE ARE GOING TO THUMP YOU WITH BARGAINS, MAKE YOU SQUEAL WITH PAIN AT THE BIG DISCOUNTS, TWIST YOUR ARM WITH LOW PRICES.

NOW YOU'VE HAD ENOUGH, GET YOUR CASH AND A WAGON & COLLECT (OR YOU'LL BE SORRY!).

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GOOD MOTORWAY ACCESS
EXPORT ENQUIRIES

UNION ST, DONCASTER DN1 3AE
TELEPHONE (0302) 49583–68416

OPEN MON to SAT

T.V. PATTERN GENERATOR

UHF output plugs straight into aerial socket no other connection required.

Features:

- ★ Crosshatch
- ★ White Raster
- ★ Grey Scale
- ★ UHF Output
- ★ Battery Powered
- ★ Pocket sized 100 × 75 × 40mm

Built ready for use **£17.75.**
Price includes P&P and VAT.

C. L. JERVIS
15 Mercer Grove,
Wolverhampton, WV11 3AN.
Tel. (0902) 736606.

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TV–TUBE TEST INSTRUMENTS.

Tests emission & auto. reactivates colour/in line/mono/port. mono. +
Now with p.c.b. base adaptors.
TX80S – **£49.85** inc.
Send s.a.e. for information pack.

FREEPOST.
P.O. BOX 9, MARPLE, STOCKPORT, CHESHIRE. SK6 6YE.

WERNETH ELECTRONIC PRODUCTS · WINNINGTON RD · MARPLE · STOCKPORT · CHESHIRE

LOOK!

THORN 3000/3500 & 9000 TRIPLERS

High Quality Silicon Replacement Units
T3500 only **£4.95** inc. P.P. Add 74p V.A.T.
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Quotes for 50+. *1 Year Guarantee*

WING ELECTRONICS
15, Waylands, off Tudor Road, Hayes End, Middlesex.

TRADE ONLY

N. W. ELECTRONICS

Have for disposal large quantities of good class

COLOUR TVs,

Bush, Pye, GEC, Thorn, Hitachi, Philips, etc, (Ex Co-op). Not junk, very clean cabinets.

Genuine change over TVs and repossessions.

From only £20. Delivery arranged.

We export large quantities of TVs weekly, can we help you?

Call now and see our selection, over 1000 TVs to choose from.

N. W. Electronics, Bolingbroke Buildings,
Bolingbroke Street, Bradford 5.
3 Mins from Motorways.
Tel. 0274 390121.

BUSH 24"/20" single standard mono's, good working! Clean! £10 each. Minimum ten. Delivery anywhere. C.O.D. (0706) 623404.

Southern Valve Co.,

2nd Floor, 8 Potters Road, New Barnet, Herts.

Tel: 01-440 8641 for current prices & availability, all popular valves stocked. SAE Lists. Cash with order. Same Day Postal Despatch. (Lunch 12.30-2p.m.) Not Thurs.

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter. NO COD. Speedy Despatch assured. No order under £1.

Philip Bearman, 6 Potters Road, New Barnet, Herts.
Tel: 01-449 1934/5 (1934 Recording Machine).
Closed Thurs. Please phone for opening hours.

G.E.C. 2040 working with polished cabinets £32 or with regunned tube £50. Minimum order five. Tel. 0484-643273 (W. Yorks).

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Back in the U.K. Schraders Aerial amplifiers. UHF, RB45/45a masthead, remotely controlled, tunable amp.ch 21-65/17-65. Gain 22-26dB. Noise ratio 3,5dB. Overload 7,5-10mV. Price **£33.00.**
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2nd line amp. SBB268-V ch 2-68. Gain 15-12dB with DC bypass. Price **£14.50.**
UHF ch.amp (state) with 2nd unamplified UHF input. Gain 26dB. Bandwidth 10-15mH. Price **£31.00.**
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Power-tuning supply VR12/01 2 outp. Price **£11.50.**
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All prices include P&P. Trade enquiries welcome.

Robert van Reysen, 28 Pemberton Road, East Molesey, Surrey. Phone: 01-979 7380.

STS

FOR QUALITY USED T.V.s

200 EX RENTAL
COLOUR AND MONO TVs
ARRIVING WEEKLY

GOOD CLEAN CABINETS

THIS MONTHS SPECIAL OFFERS

Thorn 3000 25" £17·25
Thorn 3500 26" £23·00
Many other makes £17·25
Good Mono sets from £3·45

ALL SETS COMPLETE WITH GOOD CABINETS.

DELIVERY IF REQUIRED

Call or phone now to:

SOUTHERN TRADE SERVICES
21 COLINDALE AVE.,
LONDON NW9
TEL 01-200-7337.

EXCELLENT QUALITY
USED COLOUR TV's
CHOOSE UNTESTED
OR FIRST CLASS
WORKERS ENGINEERED
IN OUR WORKSHOP.

TELFURB T.V. LTD.
WHEATLEY, OXFORD.
08677 3849

TUBES £24

Re-gunned colour A56 & 120 (22" only) 1 year guarantee. No need to spend £5 returning old tube. No. V.A.T. for return delivery. Send P. Orders plus £5 delivery U.K. mainland to:

U. VIEW (TUBES)
29, Warmsworth Road, Doncaster,
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T.V. SPARES, PANELS AND MANUALS

PHILIPS · GRUNDIG

TELEVIEW 01-994 5537
194, Acton Lane, London W.4.

TELEFUNKEN. We buy/sell T.V.'s, Hi-Fi and components (Supersonic receiver boards especially wanted). Turn your surplus items into cash, or contact us for that elusive component. K. H. GOULD, Ladburn Lane, Shilton, Oxford. Tel. (0993) 841999.

T.V.s FOR EXPORT

We have a selection of Bush and Ferguson colour T.V.s in good working order.

VHF/UHF suitable for countries using PAL system. We also supply The Home Market.

Write:
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(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.

COLOUR PANEL EXCHANGE SERVICE

BRC 3000/3500, 8000/8500
GEC 2110 series
Philips G8, G9 and G11

Three months guarantee on all Exchange Panels.
Free delivery in London area.
Also large stock of ex equipment panels Thorn 3500 Decca Bradford. Thorn 8500 for sale.
All guaranteed Perfect Working Order.

S.A.E. for Catalogue (Trade Only) or phone for prices of Panels.

KAY JAY TV SERVICE,
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Northolt, Middlesex.
Phone 864-0350.

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Distributors of specialist spares to radio and television service depts.

We stock semiconductors, I/Cs, special T.V. and audio spares, service aids, rebuilt CRTs etc.

Fast off the shelf delivery of stock items.

Send S.A.E. or telephone for full catalogue and price list.

CAMPBELL ELECTRONICS LTD.,
Unit 5, Heath Hill Estate,
Dawley, Telford, Shropshire.
Telephone Telford (0952) 502422.

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OUT OF PRINT BOOK SERVICE, 17, Fairwater Grove (E), Cardiff. Send S.A.E. for details.

ANY SINGLE SERVICES SHEET £1. L.S.A.E. Thousands different repair/service manuals/sheets in stock. Repair data your named TV £6 (with circuits £8). S.A.E. Newsletter, price lists, quotations. AUS (T), 76 Church Street, Larkhall, Lanarkshire. (0698 883334).

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GET QUALIFIED WITH ICS IN:
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COLOUR & MONO TV ENGINEERING
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PLUS: Telecommunications, radio, electronics, electrical engineering, technical communications, radio communications, etc., etc.,
NEW: Self-build radio courses with free kits
Train in your own home, in your own time with ICS, the world's most experienced home study college.
RETURN THIS COUPON TODAY FOR FREE BROCHURE!

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Address ....

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

- ELECTRONIC PRINCIPLES
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- COLOUR TV & 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.

Tuition fees (UK & Overseas) £1500 per year (i.e. £500 per Module).

Next session starts September 14

Prospectus from:

LONDON ELECTRONICS COLLEGE

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

AERIALS

OLYMPIC 2 WIDEBAND set top aerial for all U.H.F. transmissions. Special price £2·33 + 50p P&P. Refundable. H.T.C. 48, Broadford Court, Heywood, Lancs.

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.
Bi-monthly. Annual subscription £6.60 (airmail extra). Send 75p for sample copy.

28 Chestwood Close, Billericay, Essex

COURSES

STEVE BEECHING is holding another VCR training course, on 26th & 27th Sept. Course fee £30·00. Hotel accommodation for weekend £8·47. Ring for details Newark 71475.

BE A COLOUR TV ENGINEER

Two years full time Higher Diploma Course in Electronics, Colour TV and V.C.R.
Next course commences Sept 81 and Jan 82.

APPLY:
Registrar, Reeswood College,
299a Edgware Road,
London W2 1BB.
Tel. 01-402 9985.

MISCELLANEOUS

EX EQUIPMENT TELEVISION SPARES, S.A.E. for lists. P. N. Discount Supplies, Electric House, Suttons Lane, Hornchurch, Essex.

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

T.V. REPAIR TOOL KITS

Impress your customers with our smart executive case containing, radio side cutters, and pliers, small and large screw-drivers, pencil bit iron, cross point screw-drivers, B.A. nut spinners, large component box and spare space for your own electronic meter.
PRICE £52.00 p.p. inclusive.
Money refund in disatisfied.
KITONICS
7 The Meadows, Berwick-Upon-Tweed.

PRE-PACKED. Screws, nuts, washers, solder tags studding. Send for price list. A1 Sales (TV), P.O. Box 402, London SW6 6LU.

RIGONDA AGENTS. For all spares and repairs. Fast despatch trade service available. 01-476-1298. STAR RADIO, 272 Barking Road, London E.13.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

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

NAME ....

ADDRESS ....

....

Send to: Classified Advertisement Manager,
TELEVISION,
Classified Advertisement Dept., Rm. 2337, King's Reach Tower, Stamford Street, London SE1 9LS. **Telephone 01-261 5846.**
Rate
29p per word, minimum 12 words, Box No. **60p** extra.

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

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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.)
Updated collection of British colour TV circuits/layouts etc. Contained in 3 huge binders – special price **£39.50.**
Revised foreign C.T.V. Repair System in 2 huge binders plus 3 manuals for £39.50.
(Rep. Manuals 3 – £6.)
Contains chassis from Grundig, Hitachi, Korting, Kuba, Luxor, Mitsubishi, National P., Nordmande, Sharp, Skantic, Toshiba, Zanussi.
Complete set of 11 unique TV repair manuals – only £55. Mono + colour from dual standards to latest models, McCourt & Tunbridge.
S.A.E. any quotation, also price lists, newsletter, bargain offers, details of our unique TV repair systems. £1 + large S.A.E. any single service sheet.
Phone: 0698 883334, anytime. Callers 4–6 pm. weekdays, Saturday from 10 am.

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

30,000 SERVICE SHEETS IN STOCK COLOUR MANUALS ALSO AVAILABLE

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