NOVEMBER 1994

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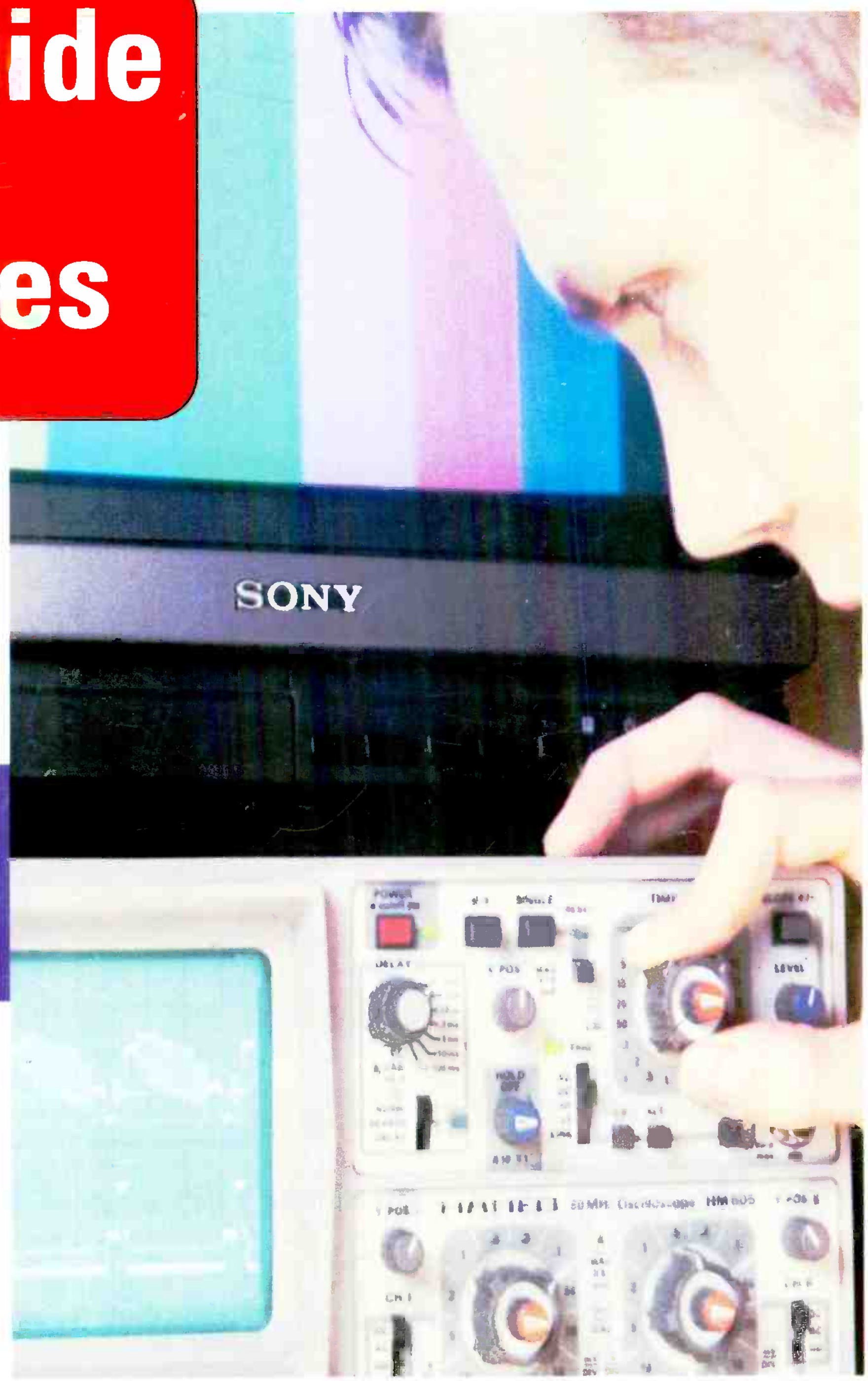

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TELEVISION

NOVEMBER 1994

On Sale October 19th

Vol. 45, No. 1

Issue 529

REGULAR FEATURES

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AC126	30p
AC127	30p
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AC176	22p
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ACY19	48p
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AF125	50p
AF139	30p
AF239	30p
BB105B	18p
BB205B	24p
BC107	8p
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BC109	8p
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BC140	20p
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BD240	40p
BD241A	40p
BD243A	50p
BD244	50p
BD245	50p

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BD246A	50p
BD265	45p
BD267	45p
BD269	45p
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BD311	100p
BD314	100p
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BD317	150p
BD331	40p
BD332	40p
BD361	60p
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BD370	30p
BD371	30p
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BD826	50p
BD828	50p
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BD899	50p
BD977	50p
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BDX65	80p
BDW24	55p
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BF615	30p
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BF760	40p
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BF870	22p
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BF964	38p
BFR90	85p
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BFX84	20p
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BFY52	14p
BFY56	25p

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BT100A	70p
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TIP3055	42p
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TIS90	15p
TIS93	20p
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VN10KM	60p
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ZTX108	11p
ZTX109	12p
ZTX212	20p
ZTX300	10p
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ZTX320	20p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
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2N698	40p
2N78	22p
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2N930	18p
2N1131	28p
2N1132	28p

Part	Price
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2N1711	24p
2N1893	30p
2N2102	50p
2N2218A	24p
2N2219	24p
2N2221	23p
2N2222	23p
2N2369	15p
2N2484	15p
2N2646	40p
2N2904	20p
2N2905	20p
2N2906	18p
2N2907	18p
2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3442	85p
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2N3819	29p
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2N3906	11p
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2N4401	12p
2N4403	12p
2N5061	20p
2N5088	20p
2N5192	50p
2N5241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5448	12p
2N6107	40p
2N6292	40p
2N6385	120p
2N6403	160p
RECTIFIER DIODES	
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY206	11p
BY207	9p
BY227	19p
BY228	28p
BY298	15p
BY299	18p
BY448	20p
BYX10	15p
BYX55/600	25p
BYX70/500	32p
OA47	10p
OA91	10p
OA202	10p
IN4001	3p
IN4002	3p
IN4003	3p
IN4004	3p
IN4005	3p
IN4006	3p
IN4007	4p
IN4148	2p
IN5400	8p
IN5401	8p
IN5402	8p
IN5403	8p
IN5404	8p
IN5405	11p
IN5406	12p
IN5407	12p
IN5408	12p
RGP15	25p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	100p
SR2M	60p
I.C. SOCKETS	
8 PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	16p
40PIN	18p
ZENERS	
400 mWatts 2V7 to 39V	5p
1.3 Watts 2V7 to 39V	9p
CRYSTALS	
Freq in MHz	
2.4576	180p

Part	Price
3.276	115p
4.0	110p
5.0	130p
10.0	140p
11.0	250p
12.0	120p
14.756	200p
15.0	160p
24.0	250p
VOLTAGE REGULATORS	
7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
LM309K	100p
LM317T	100p
LM323K	350p
78H08KC	800p
79H12KC	700p
79HGKC	800p
VALVES	
DAF96	100p
DY87	80p
EBF80	60p
ECC84	80p
ECH84	90p
ECL84	100p
EF183	75p
EF184	85p
EL500	100p
EY86	70p
EY87	70p
EY88	80p
PC97	100p
PCC85	60p
PCF80	100p
PCF801	110p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PFL200	110p
PL36	120p
PL83	60p
PL84	80p
PL95	180p
PY81	100p
PY500A	190p
LEDs	
3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p
RECTANGULAR LEDs	
5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
OPTO COUPLERS	
4N37	48p
4N38	68p
AN203	210p
BRIDGE RECTIFIERS	
W005 1A/50V	16p
W01 1A/100V	18p
W02 1A/200V	19p
W04 1A/400V	21p
W06 1A/600V	23p
W08 1A/800V	28p
BR81D 2A/100V	33p
BR82D 2A/200V	33p

Part	Price
BR84D 2A/400V	37p
BR86D 2A/600V	43p
BR83D 2A/800V	43p
BR32 2A/200V	43p
BR34 2A/400V	43p
BR36 2A/500V	44p
BR62 6A/200V	80p
BR64 6A/400V	72p
BR251 25A/100V	150p
BR252 25A/200V	165p
BR254 25A/400V	185p
BR256 25A/600V	200p
BR258 25A/800V	240p
BR351 35V/100V	185p
BR352 35V/200V	200p
BR354 35V/400V	220p
BR356 35V/600V	230p
ER358 35V/800V	260p
BY164 1.5A/100V	40p
BY176 1.5A/800V	40p
TRIACS	
TIC206D 4A/400V	60p
TIC225D 6A/400V	69p
TIC226D 8A/400V	68p
TIC236D 12A/400V	85p
TIC246D 16A/400V	105p
TIC253D 20A/400V	190p
TIC263D 25A/400V	205p
THYRISTORS	
2N5061 0.8A/60V	20p
TIC116C 8A/300V	59p
TIC116D 8A/400V	70p
TIC126D 12A/400V	75p
TIC126M 12A/600V	90p
C106D 4A/400V	28p
BR103	37p
BR303	85p
BT106	180p
BT119	100p
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG264	800p
SG613	1600p
COMPUTER ICs	
Z80ACPU	100p
Z80ADMA	200p
Z80ACTC	140p
Z80ASIO-1	210p
Z80ASIO-2	210p
75107	65p
75110	75p
75113	100p
75122	110p
75154	100p
75162	700p
75182	95p
75183	95p
75195	185p
2114	150p
2532	200p
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2732	200p
2732A	220p
2764	150p
27C64	200p
27128	150p
27256-25	150p
27512	300p
4116	40p
4164-15	80p
4164-12	90p
41256-15	80p
41256-12	100p
41256-10	110p
41464-12	150p
6116	80p
6264-10	210p
62256-12	300p

Part	Price
6502A	360p
65C02	930p
6522	280p
6800	210p
6802	220p
680	500p
36808	500p
6809	500p
6810	150p
6818	380p
6821	130p
6840	290p
6845	200p
6850	90p
8085A	300p
8086	500p
8088	480p
8156	300p
8224	240p
8226	240p
8250	750p
8251	200p
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8257	220p
8271	3400p
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8283	400p
8284	440p
8287	260p
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8748	700p
8755	800p
8T26	95p
8T28	110p
LINEAR ICs	
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AN210	165p
AN214Q	170p
AN228	280p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
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AN303	250p
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AN362	140p
AN366	150p
AN610	160p
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AN3821K	600p
AN3822K	600p
AN3990K	300p
AN3991K	400p
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AN7130	75p
AN7140	170p
AN7145	195p
AN7146	210p
AN7154	180p

Part	Price
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CX145	725p
CX150B	325p
CX175	325p
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2SD741	120p
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2SD756	100p
2SD757	120p
2SD758	140p
2SD762	100p
2SD763	140p
2SD768	180p
2SD772	200p
2SD773	20p
2SD774	30p
2SD777	400p
2SD784	650p
2SD786	100p
2SD787	20p
2SD788	30p
2SD789	20p
2SD792	400p
2SD794	33p
2SD795A	140p
2SD811	450p
2SD819	200p
2SD820	250p
2SD821	550p
2SD822	290p
2SD826	30p
2SD836	60p

Part	Price
2SD836A	60p
2SD837	55p
2SD838	300p
2SD841	110p
2SD844	200p
2SD845	250p
2SD850	170p
2SD856	48p
2SD858	250p
2SD863	23p
2SD864	200p
2SD866	120p
2SD866A	140p
2SD868	260p
2SD870	190p
2SD871	300p
2SD879	60p
2SD880	40p
2SD882	25p
2SD892A	100p
2SD894	35p
2SD895	200p
2SD896	200p
2SD900	400p
2SD905	450p
2SD916	130p
2SD917	300p
2SD921	320p
2SD923	360p
2SD946	120p
2SD947	100p
2SD950	300p
2SD951	290p
2SD957A	520p
2SD958	60p
2SD965	35p
2SD970	170p
2SD973	60p
2SD973A	70p
2SD985	120p
2SD986	120p
2SD1012	40p
2SD1020	40p
2SD1021	120p
2SD1022	400p
2SD1024	130p
2SD1030	75p
2SD1031	70p
2SD1046	200p
2SD1047	180p
2SD1051	130p
2SD1060	130p
2SD1062	150p
2SD1063	200p
2SD1064	250p
2SD1065	160p
2SD1069	150p
2SD1071	450p
2SD1073	350p
2SD1088	150p
2SD1094	520p
2SD1110	225p
2SD1111	20p
2SD1113	225p
2SD1128	200p
2SD1133	100p
2SD1135	75p
2SD1138	50p
2SD1140	40p
2SD1142	350p
2SD1148	175p
2SD1159	90p
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2SD1164	75p
2SD1168	270p
2SD1169	280p
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2SD1189	55p
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2SD1191	120p
2SD1192	90p
2SD1196	150p
2SD1197	150p
2SD1207	40p
2SD1210	280p
2SD1211	120p
2SD1218	75p
2SD1223	75p
2SD1225	120p
2SD1227	40p
2SD1229	250p
2SD1237	300p
2SD1246	20p
2SD1247	40p
2SD1248	270p
2SD1251	180p
2SD1263	90p
2SD1264	55p
2SD1265	75p
2SD1266	180p
2SD1267	55p
2SD1271	55p
2SD1271A	225p
2SD1272	200p
2SD1273	50p
2SD1275	50p
2SD1276	60p
2SD1277	190p

Part	Price
2SD1279	600p
2SD1288	175p
2SD1289	250p
2SD1291	400p
2SD1292	60p
2SD1297	300p
2SD1302	20p
2SD1308	80p
2SD1309	140p
2SD1310	140p
2SD1313	1000p
2SD1326	200p
2SD1328	60p
2SD1347	70p
2SD1348	65p
2SD1350	150p
2SD1376	125p
2SD1379	100p
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2SD1497	230p
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2SD1739	275p
2SD1740	125p
2SD1748	90p
2SD1760	80p
2SD1762	50p
2SD1773	160p
2SD1783	100p
2SD1796	180p

Part	Price
2SD1815	100p
2SD1825	60p
2SD1843	100p
2SD1846	350p
2SD1849	325p
2SD1850	325p
2SD1858	40p
2SD1877	250p
2SD1878	230p
2SD1879	275p
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2SD1910	280p
2SD1911	300p
2SD1913	50p
2SD1929	60p
2SD1939	75p
2SD1941	500p
2SD1959	280p
2SD1961	50p
2SD1978	50p
2SD1984	450p
2SD2012	50p
2SD2125	225p
2SD2333	300p
2SJ48	425p
2SJ49	425p
2SJ50	425p
2SJ56	700p
2SJ74	60p
2SJ75	280p
2SJ76	220p
2SJ77	350p
2SJ79	225p
2SJ103	75p
2SJ108	60p
2SJ115	525p
2SJ117	550p
2SJ119	700p
2SJ161	650p
2SJ162	680p
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2SK40	50p
2SK49	50p
2SK55	100p
2SK68	100p
2SK73	75p
2SK106	40p
2SK107	40p
2SK118	50p
2SK125	100p
2SK133	650p
2SK134	415p
2SK135	415p
2SK147	160p
2SK150	150p
2SK163	40p
2SK168	40p
2SK176	800p
2SK192	45p
2SK195	150p
2SK197	140p
2SK214	170p
2SK216	200p
2SK218	400p
2SK240	140p
2SK312	750p
2SK315	70p
2SK320	120p
2SK323	130p
2SK386	600p
2SK405	450p
2SK413	500p
2SK415	500p
2SK429	180p
2SK511	450p
2SK513	325p
2SK531	350p
2SK534	700p
2SK537	900p
2SK538	450p
2SK539	1100p
2SK555	400p
2SK556	500p
2SK557	400p
2SK566	475p
2SK695	550p
2SK719	300p
2SK724	600p
2SK725	600p
2SK727	1200p
2SK735	600p
2SK758	300p
2SK787	1100p
2SK794	500p
2SK872	650p
2SK903	500p
2SK1057	600p
2SK1058	800p
2SK1117	250p
2SK1118	225p
3SK45	100p
3SK51	100p
3SK59	100p
3SK74	50p
3SK77	50p
3SK81	50p
3SK85	160p
3SK88	70p
3SK121	150p

PINCH ROLLERS / VCR BELT KITS

Model — Price

AKAI
- VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77 — 200p
- VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9 — 200p
- VS105, 112, 115, 116, 126, 205, 220, 240, 244, 245, 247, 248, 250, 512, 515, 516, VSX9 — 200p
- VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82 — 200p
- VS125, VS155, VS165, VS220, VS240, VS250, VS512 — 200p
- VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, 485, 965, 967, VSA77 — 200p
- VSF260, 261, 262, 265, 270, 274, 280, 290, 410, 440, 450, 455, 480, 490, 497, 560, 599 — 200p

AMSTRAD
- VCR4500, 4600, 4700, 5200, 6000, 6100, 8600, 8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9340, DD8904, TVR1, 2, 3, 4 — 200p
- VCR7000 — 200p

AIWA
- AV66, AV77 — 200p
- G700, G900 — 200p

ALBA
- VCR3000X, VCR4000 — 200p
- VCR5000, VCR6000 — 200p

AUTHENTIC
- N850 — 200p

BLAUPUNKT
- RVT100, 200, 202, 222, 224, 301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 328, 404, 414, 434, 444, 478, 707, RTX100 — 200p
- RTV211, 214, 321, 322, 348, RTX250, 260 — 200p
- RTV324, 325 — 200p
- RTV330, 454, 520, 530, 535, 560, 660, 670, 720, 730, 740, 800, 810, 900, 910, 920 — 200p

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- VCR12, VCR32, VCR52 — 200p
- VCR30, VCR500 — 200

DECCA
- VR8300 — 200p
- VRH8495DK (Pressure Roller Assembly) PS403-40205 — 450p

FERGUSON
- 3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 — 200p
- 3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942 — 200p
- 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FV11, FV12, FV14, 8943, 8944, 8945, 8947, 8948 — 200p
- 3V52 — 200p
- 8950, 8951, FV10B, 11R, 13H, 14T, 20B, 21R, 26D, 31R, 32L, 41R, FV42L, 50B, 51R, 52L, VC141L — 200p
- FV44L, FV46T, FV43H — 200p

FISHER
- FVHP420, 520, 530 — 200p
- FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, 830, 840 — 200p
- FVHP905, 906, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, 5000, 5005, 5050, 5075, 5100 — 200p
- VBR330, VBS3500, 7000, 7500, 7600, 9000, 9900 — 200p
- FVHD250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, FVSD2095 — 200p

FIDELITY
- HQS200, VCR100, 600, 6100 — 200p
- VTR100 — 200p

FUJITSU
- HS760, VX715, VX720D — 200p

FUNAI
- V1, V2, VCR4000, 4500, 4530, 4540, 4600, 4800, 5200, 5400, 5600, 5800, 5840, 5843, 6000, 6400, 6600, 6800, 6803, 8007, 8103, VIP150, 3000, 5000, 6000 — 200p
- VIP1000, VIP1400 — 200p

G.E.C.
- V4004 — 200p

GRANADA
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- VHSAN3, VHSBP1, VHSVN1, VHSVN2 — 200p
- VHSAY3, VHSX42 — 200p
- VHSBH1, VHSCH1, VHSFS1, VHSFS2, VHSEH2, VHSEH3 — 200p
- VHSBY3, VHSCC1 — 200p
- VHSDS2, VHSXN2 — 200p
- VHSDP1, VHSFP2 (Pressure Roller Assembly) PS403-40205 — 450p
- VHSEY1, VHSEY2, VHSFY2 — 200p
- VHSFG2, VHSFG3, VHSFG4, VHSFH6 — 200p
- VHSFJ2, VHSFJ4 — 200p
- VHSF63, VBXAS1 — 200p

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- VHSWJ1, VHSWJ3, VHSXJ3 — 200p
- VBXYB3 — 200p
- VHSEH3, VHSES2 — 200p
- VHSF34 — 200p
- VHSFP2 — 200p

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- VS120 — 200p
- VS150 — 200p
- VS180, 200, 220, 226, 262, 265, 267, 300, 310, 315, 320, 326, 345, 380 — 200p

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- VXL2, VXL3 — 200p
- VXL4, VXL20, VXL35 — 200p

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- VR3908 — 200p
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- VR3917, VR3833 — 200p
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- HRS10 — 200p

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- VR6540 — 200p
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- VR6548, VR6648 — 200p
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- VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 — 200p
- VTC3000 — 200p
- VHR4100, 4150, 4200, 4300, 4350, 4770, 5100, 5200, 5300, 5350, 5700, 7100, 7200, 7500, 7530, 7540, 7800, 8100, 8200, 8250, 8500, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700, VHRS700 — 200p
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- VC220 — 200p
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- SV8000, SV8100 — 200p
- SV601, SV800, SV900, SV901, SV6910, SV9800, SV9900 — 200p
- SV6700, SV8710, SV8750, SV9700 — 200p
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- SVX301, 303, 305, 307, 319, 322, VB710, 770, 971, 8220, 8225, V1730, 1790, 18220, 18225, VX710, 712, 720, 730, 750, 770, 790, 825, 970, 971, 972, 8220 — 200p

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HR7200/7300/7350
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FE TX100 GREEN	1450p	LOT23
HINARI CT4/5 5113	1500p	LOT24
SELECO 6320410	1600p	LOT25
BLAUPUNKT 8667	1600p	LOT26
ITT COMPACT B1	1450p	LOT27
ITT CT3326 MUL	1500p	LOT28
ITT D066/37 EQ	1600p	LOT29
ITT 3546 EQ	1500p	LOT30
LUXOR 5810110	1600p	LOT31
SABA 849380920	1600p	LOT32
HITACHI 2434141 CP	1450p	LOT33
FE TX100 110 D	1700p	LOT34
HANTAREX 28021	1600p	LOT35
SHARP C3700 EQ	1600p	LOT36
HITACHI 2432981 CP	1500p	LOT37
FERGUSON 00D3-508-002 Fits Chassis TX99 41cm + 51cm Used On: 51K2, 51J8, 51J7, 41H3, 41H3, 41H2, 51K3	1650p	LOT38
PANASONIC TLF14567F Used On: TC2043, TC2243, TX300	1850p	LOT39
PANASONIC TLF14568F Used On: TX2231, TX2244	1850p	LOT40
PANASONIC TLF14584F Used On: TC2210, TC2160, TX1752, TX2112 TX2112, TX2162, TXC22	2350p	LOT41
PANASONIC TLF14586F TC1651, TC2051, TC2061, TC2253, TC2263, TX5500	2350p	LOT42
HINARI Used On: CT15	1600p	LOT43
HITCHI 2434274 CPT2174, CPT2176, CPT2178, 2434274	1400p	LOT44

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VS1-2, VS4-5, VS15	T-UP IDLER	BV327815	500p
VS3, 6, 12, 59, 59			
VS700	IDLER	BV321979	600p
VS125, 126, 155	IDLER ASSY	MZ366960J2	900p
VS165, 240, 244, 245, 247, 248, 250, 512, 515, 516			
VS22, 38, 105, 112, 115, 116, 205, 220			
VP7100, VS9300	T-UP IDLER	PU47752	£4.50
VS9500, VS9800			
VP7100, VS9300	UNLOADING IDLER	PU46381	£4.00
VS9500, VS9800			
VP7100, VS9300	REW IDLER	PU46380	500p
VS9500, VS9800			
VP88	IDLER	BV336067	£5.00
VS1, 3, 4, 9, 12	REEL TABLE	BR347731	450p
VS15, 58			
VS23, 35, 37, 53, 55	CLUTCH	ML373043	1100p
VS66, 75, VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	W321762	£4.25
AMSTRAD			
VCR7000	IDLER	150280	£1.50
TVR1, VCR4500	CLUTCH	150873	£3.75
VCR4600, VC5200, VCR9000			
TVR1, VCR4500	GEAR HOLDER	151284	£3.50
VCR4600, VCR5200, VCR9000			
TVR1, VCR4600	REF CLUTCH		£3.50
VCR5200			
VCR6000, VCR6100	CLUTCH	153202	£3.80
VCR4500, VCR9000	CLUTCH		£4.00
VCR4500, VCR4600	MOD KIT	(TAPE CREASING)	300p
VCR4700			
MOD KIT TAPE CREASING FOR AMSTRAD			
VCR4500, 4600, 4700			£3.00
FERGUSON			
3V00, 3V01, 3V16	T-UP IDLER	PU47752	£4.50
3V22, 3292, 8900, 8901, 8904, 8906			
3V16, 3V22	T-UP IDLER	PU49280	£5.50
8903, 8909, 8912, 8922			
3V23, 3V29 3V30,	REEL IDLER	PU48967	175p
3V31, 3V32, 3V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942			
3V23, 3V31	ROLLER ASSY	PU49042A	350p
3V29, 3V30, 3V31	T-UP IDLER	51402	100p
3V32, 3V35, 3V36, 3V38, 3V39, 3V49, 8930, 8931, 8940, 8941, 8942			
3V29, 3V30, 3V31	T-UP CLUTCH	PU51380	200p
3V32, 8930, 8931, 8940, 8941, 8942			
3V35, 3V36, 3V38	REEL IDLER	PU55374	200p
3V39, 3V49, 8943, 8944			
3V35, 3V36, 3V38	T-UP CLUTCH	PU55373	150p
3V39, 3V49, 8943, 8944			
3V58, 3V59, 3V64	IDLER ARM	PU58645	£2.25
3V65, FV10, FV11, FV12 FV13, FV14, FV20, FV21, FV22, FV26			
FV30, FV32, FV33, 8950, VC141L			
3V42, 3V43	CLUTCH ASSY	PU55822	1200p
3V43, 3V44, 3V45	CLUTCH ASSY	PU57658	1050p
3V48, 3V53, 3V54, 3V55, 3V57, 8947, 8948			
3V42, 3V43, 3V44	T-UP CLUTCH	PU56043-1-4	240p
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948			
3V42, 3V43, 3V44	SUPPORT CLUTCH	PU56044-1-5	160p
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948			
3V00, 3V01, 3V16	LOADING IDLER	PU43681	£4.00
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8912, 8922			
3V00, 3V01, 3V16	REW IDLER	PU46380	500p
3292, 8900, 8901, 8904, 8906			
3V16, 3V22, 8902	IDLER	PU49281	£1.70
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FVHP615, 618, 620	COMP. IDLER ASSY	FI1430420400300	£220p
FVHP622, 710, 711, FVHP720, 721, 722, FVHP725, 730, 830			
FVHP840, 905, 906, FVHP908, 910, 911, FVHP915, 916, 918			
FVHP615, 618, 620	GEAR IDLER ASSY	FI1430490400900	380p
FVHP622, 710, 711, FVHP720, 721, 722			
FVHP725, 730, 830, FVHP840			
FVHP615, 618, 620	REEL T-UP ASSY	FI1430410400900	£5.50
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FVHP725, 730, 830, FVHP840			
FVHP905, 906, 908	GEAR IDLER ASSY	FI1430490402400	275p
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FVHP975, 980, 990	IDLER	FI1430420400700	300p
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FVHP5050, 5075, 5100			
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FVHP975, 980, 990	CLUTCH	F12430510404200	£9.50
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FVHP990	LOADING GEAR		90p
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VBS3500	IDLER		250p
VBS7400	REW IDLER		95p
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GHV1221, 1232, 1240	IDLER		110p
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,			
GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			
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VXL3, VXL20	REEL IDLER	40000009	110p
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111, 113, 115, 118, 200		6886972	
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VT9300-9500, 6500	FF-REW IDLER	8681471	250p
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VT9300-9500, 6500	PLAY IDLER	6861482	230p
VT680, 6800, 9700		6861481	
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HR7600, 7610, 7650	ROLLER ASSY	PU49042A	350p
HR7655, 7700			
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650	T-UP IDLER	PU51402A	100p
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HRD110, HRD120-121,	T-UP CLUTCH	PU55373	150p
HRD225, HRD111,			
HRD110, HRD120-121,	IDLER ARM	PU55374-3-8	200p
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HRD160, 250, 257, 565, 566, 755, HRP50			
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HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56043-1-4	240p
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HSE70			
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HS306, 307, 318, 319	GEAR WHEEL	641D71001	£1.50
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N830, N831, N832, N833	REEL IDLER		200p
N895	TAKE UP IDLER SMALL		550p
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NV300, NV332, NV333	INTERMEDIATE GEAR	VXG0017	£0.65
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NV870, NV890, AG1000			
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NV780, NV830			
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NV230, NV250, NV370	LOADING GEAR	VXP0520	£1.50
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NV830, NV890, NVG7, NVG10, NVG12, NVG15, NVG30, NVG120			
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NV230, NV250, NV260	LIMITER ROLLER		£1.50
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NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70,			
AG1000			
ORION			
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VH404, VH555, VH700, VH704, VH708, VH712, VH780, VH844, VH900, VH3,			
VH33			
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VR3500, 3600, 3800	LIMITER POST		£1.30
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VHR3100, 3300, 3310	REEL DRIVE	143-0-662T-15621	350p
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VHRD600, VHRD700			
VPR5800, VTC5300	LOADING ROLLER	143-0-661T-03800	80p
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	IDLER	NIDL0006GEZZ	110p
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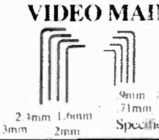

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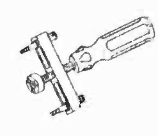

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TP660	RC 660	850p
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A617402/655602	RC 192	875p
A512120/230	RC 900	800p
A514790	RC 901	850p
A5088470	RC 902	800p
A518612	RC903	900p
SCL002	RC904	850p
C2096	RC 905	850p
A511940	RC 906	800p
655602H	RC 907	850p
ITT		
IFB13, 14, 15	RC 143	875p
FS4	RC 148	850p
RG305	RC 305	825p
RG306	RC 306	825p
FS9/1-10/1	RC 307	850p
VS5 RUK	RC 308	825p
VS4-1	RC 310	850p
MULTICONTROL (17C20)	RC 311	800p
KORTING		
18279, 18396, 18460, 18521 SE	RC 108	850p
40540 VTS	RC 108	900p
LOEWE		
DC11	RC 146	850p
MATSUI		
010270601	RC 889	850p
VX770	RC 892	850p
METZ		
JAVA COLOR (6890)	RC 166	850p
COLOR (7156)	RC 183	850p
JAVA (7180)	RC 184	850p
MITSUBISHI		
939P/03607, 939P/03609	RC 140M	850p
NOKIA		
SATELLITE	RC 550	850p
NORDMENDE		
TC2336	RC 351N	850p
CMC1, TC3519	RC 356	875p
OCEANIC		
390C9500	RC 339	900p
ORION		
RC53	RC 892	850p
PANASONIC		
EUR51200	RC 200	850p
TC2200	RC 201	850p
VSQ0357/NV730	RC 202	875p
TNQ1621	RC 203	900p
PHILCO		
CARVEL, CONCORDE, MERCURY, TELESTAR	RC 108	850p
TC10	RC 152	900p
PHILIPS		
RC5002,5154	RC 134	850p
KT3 NON TEXT	RC 135	825p
69117032	RC 178	875p
69117194	RC 180	875p
RC5991-UNIV	RC 300	850p
PHILIPS (continued)		
RC38	RC 301	875p
KT3 TEXT	RC 5301	800p
RC5352	RC 5352	800p
RC5375	RC 5375	850p
RC5 STANDARD	RC 5534	850p
RC5901	RC 5901	850p
RC5903	RC 5903	800p
SABA		
T6772	RC 149	900p
TC319-320	RC 328	875p
TC356	RC 356	875p
TC358	RC 358	850p
TC360	RC 360	800p
TC365	RC 365	800p
SALORA		
SERIES L	RC 190	875p
86173	RC 882	850p
SANYO		
RC218, RC222, RC228, RC238	RC 140M	850p
JXGE	RC 878	850p
JXDE	RC 884	850p
VHR2300	RC 890	850p
RC628	RC 865	900p
SHARP		
G0121CESA, 123CESA, 204, 251	RC 140M	850p
SIEMENS		
FC616	RC 130	850p
FC631	RC 132	850p
FC742	RC 164	900p
SONY		
RM604, RM605, RM606	RC 140	850p
32 CHANNEL	RC 140M	850p
RM613	RC 141	850p
RM632, RM636	RC 160	850p
TATUNG		
FXA	RC 877	850p
RC70	RC 883	750p
FX70 FASTTEXT	RC 894	850p
TELEFUNKEN		
FB632	RC 632 ST	850p
FB639	RC 639 ST	850p
THORN/FERGUSON		
3V35-42	RC 342	850p
3V31-32	RC 344	850p
3V57-58	RC 628	900p
TX10 TEXT	RC 732	750p
TX10 STEREO TEXT	RC 738	750p
TX9-90-100	RC 740	750p
3V55, FV11	RC 783	900p
TX100 FASTTEXT	RC 785	800p
TX100 STEREO FASTTEXT	RC 789	800p
PROFESSIONAL	RC 790	800p
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* RCA TYPE BACK TENSION TOOL	* 1.27mm
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* VCR ADJUSTMENT TOOL	* 1.60mm
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315mA	FUSE03	75P	FUSE19	60P
400mA	FUSE04	75P	FUSE20	60P
500mA	FUSE05	75P	FUSE21	60P
630mA	FUSE06	75P	FUSE22	60P
800mA	FUSE07	60P	FUSE23	60P
1A	FUSE08	60P	FUSE24	60P
1.25A	FUSE09	60P	FUSE25	60P
1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
3.15A	FUSE13	55P	FUSE29	50P
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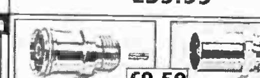

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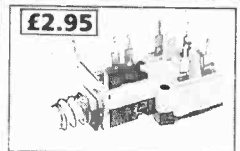

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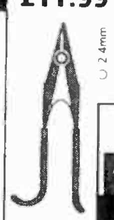

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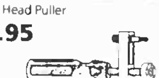

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TELEVISION

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Not so bad when it comes to it

I'm not that old to be able to recall TV installation work when it all started back in 1936. A lot of concern was no doubt expressed over the move from h.f. to v.h.f. transmission and the problems that it might bring. In practice the jump from the highest radio broadcasting band, at around 26MHz, to TV at 40MHz upwards in what then tended to be known as the ultra short-wave band was not all that great. It probably just seemed like a huge leap in the dark. But I can recall, quite vividly, the alarums that the prospect of Band III transmissions produced. We wouldn't be able just to stick up an aerial and link it to the receiver via a suitable length of cable. Oh no! Installations would have to be *engineered*. Standby Mrs. Jones for the arrival of the white-coated men with their signal-strength meters, reflectometers, wavemeters and goodness knows what else. There were profound mutterings about termination, standing waves and so on. And what happened? People stuck up aerials, connected them to receivers by lengths of coax (some not all that good) – and got signals. We had a repeat of all this when u.h.f. was about to be used for TV. Now this really would be dodgy, with signal strength varying from one side of the road to the other and such worries. Hmmm. And of course the same dire warnings of problems ahead came with the move to satellite TV.

The early days of satellite TV saw all sorts of specialists using sophisticated equipment to find the signals. Just stick up a dish and point it in the right direction? Good gracious, no one would ever be able to do that. Each individual location would require a computerised investigation into the angles required for reception. In practice, as usual, it turned out to be totally different.

Consistently over the years those who have forecast horrible technical problems ahead have been proved wrong. This is because they have tended to overlook the ability of manufacturers to come up with practical hardware and solutions. When it comes to the exploitation of higher frequencies, there is often a solution sitting on the shelf waiting to be adopted. Radar and various types of military technology will have evolved components that are horrendously expensive – when made and used in tiny quantities. Pass them over for mass market application and the price falls dramatically. So, for example, we get sophisticated transistors that give us very low-noise satellite front-ends. A big difference from the MSP4 h.f. pentode! Radar also, incidentally, gave us the early high-voltage switching transistors for line output stage use.

In the early days of satellite TV we were, of course, dealing with weak signals and untuned receivers. By the time that mass installations were required for Astra we had strong signals, metalwork with pre-stamped guidelines and pretuned receivers. So the practical, everyday world once again turned out to differ from what the theorists forecast.

All this is not to suggest that there are never any problems. If you are unfortunate, reflections, multipath signals and site problems can cause a great deal of trouble with terrestrial reception. But you have to be a bit unlucky. Most of us don't have to worry at all. In fact a silly old set-top aerial does because modern u.h.f. tuners are so good. When serious problems arise it does become a matter of careful system engineering. Many examples have been described in these pages over the years.

The coming of colour and the coming of video were other events that produced gloomy forecasts about what we were in for. You'd need a degree at least to understand all those colour vectors and what went on in a decoder. From the start the circuitry soon disappeared into a chip or two and people stopped having to think about it.

For a time the v.h.f. tuner, then the u.h.f. tuner, was considered to be forbidden territory. Enter at your peril! In practice once a few simple rules were learnt it became possible to work on them. Might the LNB be about to loose its aura of mystery? An article in next month's issue suggests that this could be so.

There are and always will of course be silly people who do silly things to anything from a sophisticated camcorder to the mains plug. They make life difficult, sometimes dangerous, for others. There seems to be no way round that. But readers of Television don't wear spurs, do they?!

Correction

A correction to our TV and video spares guide included with last month's issue: the Amstrad phone number should have been given as 0277 209 508. The fax number is correct.

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COVER PHOTO

This month's cover photograph shows a Hameg HM605 oscilloscope in workshop use. This model has been superseded by the HM604. See oscilloscopes article on pages 20-23.

What a Life!

Donald Bullock

Have you noticed how some BBC correspondents raise their voices at the ends of sentences, baying them so that they sound like questions? One of them, a Martin Sixsmith, is particularly adept at it. The trouble is that by the time you've sorted out such quirks what they are saying is lost on you. I wonder how they keep their jobs?

Now it's spreading to the public

A Troublesome Akai/ITT Receiver

A giant Akai Model CT2870 TV set waltzed into the drive the other day. It was wearing wrinkled trousers over a pair of moon boots. Then it came into the workshop and sat on the counter. As its trousers and boots walked sideways from it I noticed a chest and a head, also a pair of arms.

"Mr. Drip?" their owner asked.

"No one here by that name" I said, sensing trouble.

"I'm Mr. Drip" he said, and again it sounded like a question.

My razor-sharp brain told me at once that he was right. "What's up with the set then?" I asked, hoping that he didn't think I was trying to be funny.

It transpired that this monster telly was in fact an ITT Compact D2 FST set in heavy disguise. There was no sound or vision, just a faint flip-flopping, cloudy line across the screen accompanied by a shrill whine. Strange symptoms. Before Mr. Drip loped off I got him and Steven to help me get the set on to the bench. Then I settled down to try to isolate the faulty stage.

What did the symptoms tell us? Clearly there was field collapse and failure of the sound channel. The shrill whine suggested that all was not well in the power supply. Where to start? It seemed logical to check the power supply's output voltages, which were all as specified. Maybe there was some loading somewhere?

Checks showed that the supplies were missing at the field and audio output stages. So we didn't seem to have a loading problem, in these areas anyway. Back to the power supply. Though its outputs were – apparently – o.k., there was that whine.

A great deal of time was spent checking just about everything before I discovered that the reservoir capacitor for the 31V supply, C732 (1,000µF, 35V), was low in value at about 50µF. This value was apparently enough for the full voltage to be established, but not enough to meet the current demand. So we did have a loading problem, of a sort. Maybe if I'd carried out scope checks some ripple would have been apparent. But this odd situation didn't encourage clear thinking.

When a replacement capacitor had been fitted the whine had gone and the collapsed field was at full brightness, though lacking in width. The TDA3654 field output chip still had no supply at pin 9. After a good deal of searching along the wandering, mapping-pen thin print I found a hairline crack. Fitting a jumper lead restored the field scan and width, but there was still no sound. The newly repaired 31V supply was getting lost somewhere before it reached the audio output stage. Another hairline crack was the cause of the trouble, and another jumper cured it.

The set now gave excellent results. So I cleaned off the chassis, set it up and, after giving it a soak test, waved it out with a sigh of relief.

Incidentally I have to acknowledge the help of Pete Brook and his assistant John (Mr. ITT) Baker of Hoopwell Ltd. These kind people provided me with a manual and spares, and John suffered with me in sorting out the cause of the trouble. Hoopwell are nice people. They provide a good, efficient, courteous service, and their latest catalogue is a goldmine. Talking to their Julie is a bonus. I almost wish that I had another tricky ITT set to deal with. But not quite.

A Mitsubishi Euro 4

I then picked up a Mitsubishi CT2532 (Euro 4 chassis), another monster. "It works all right for hours, then the height reduces or the picture goes dark or both" the customer had said.

I connected a voltmeter to the AN5521 field output chip's supply pin, tuned in a picture and checked that the reading was 24V. The supply comes from the line output transformer, the feed to the rectifier and its reservoir capacitor being via an 0·82Ω resistor.

After a while I noticed that the voltage was falling. Also there was some field cramping a few inches from the top of the screen. Then, as the voltage decreased, the cramping got worse. Just as the field scan collapsed, the picture darkened. A glance at the meter showed that the reading was now 3V.

I opened the set up and checked the 0·82Ω resistor. It looked hot and bothered. A replacement cured the fault.

Mr. Crout's Hitachi

Mr. Crout struggled in with his arms wrapped around yet another monster. The TV set I mean – it was an Hitachi CPT2198 (G8Q chassis).

"Ven I switch on, noddings at all" he barked. "Only a ferry dim screen, fitch is no gut to me". Then he smiled and nodded at me.

"I will do my best" I said, and off he strode.

I tried to tune the set in and adjust the brightness but couldn't. Maybe the SAA1293 control chip was faulty. A replacement made no difference however. Next to it sat an MDA2062 memory chip, IC1502. This type of chip is programmed to meet individual chassis requirements and, I now know, is colour coded by means of a small spot label the size of an aspirin. This one had a white label. So we ordered a 'white-spot' MDA2062. When it came we fitted it, but this didn't make any difference either. By now a couple of days had passed by and Mr. Crout was getting impatient.

"Fi so long?" he asked. "Don't you onderstant der technicalities?"

I avoided a direct reply and studied the circuit. The voltages around the memory chip were all correct, and by now I was suspecting dry-joints or high-resistance plug and socket connections between the two interconnected main panels. Resoldering and checking the plugs and sockets didn't help, and I was beginning to wilt.

A phone call to Chas Hyde confirmed that this set should have a blue-spot chip. When we fitted the one they sent us all was well. I reckon that all processor and memory chips should come prepacked with a few aspirin tablets.

Enter Miss Chang

Ven – I mean when – Mr. Crout came to collect his set one of our favourite customers, the demure and shapely Miss Chang, was trying to explain to us what was wrong with her Matsui portable, which is a Bush T2114 in disguise.

"It is – er – it is. . . " She put her palms together and inclined her head to her hands.

"Let me interfere" said Mr. Crout, clicking his heels and bowing, "I speak seven languages". Miss Chang twittered to him and crossed her chest with her hand.

"Kaput!" barked Mr. Crout, and out he bowed.

We found that the set tripped at switch-on and made a bee-line for the BU508D line output transistor Q402. It was short-circuit, and a 1Ω resistor in the 24V supply was open-circuit. Vie – I mean why?

A check on the h.t. supply produced a reading of 145V instead of 110V. Adjusting the set-h.t. potentiometer VR801 made no difference. The power supply is the type that uses a TDA4601 chip (IC801) and was clearly running flat out. So we looked at the control circuitry, centred around pins 1, 2 and 3 of the chip. There are a couple of electrolytics here. C817 (10μF, 16V) had fallen in value to 5μF while C818 (1μF, 50V) was low at 0·3μF. We replaced them, turned VR801 to its mid-position and started the set up via a variac. The h.t. was now at exactly 110V. Pausing only to check that it was adjustable, we boxed up the set and called it a day.

Book Review

The Satellite Book, third edition, edited by John Breeds. Published by Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN (0793 750 620). Available from the publishers at £32 plus £2.50 postage and packing in the UK.

The third edition of this well-known book has been completely revised and updated, with an expansion of the contents. It covers a massive range of subjects relevant to the satellite TV trade and has an established reputation. The format is A4 and the presentation is all you could wish, with large, clear type and plenty of diagrams and photographs. As before, the book is made to stand up to workshop wear and tear.

It serves two purposes, being a valuable reference source for installers, lecturers, students etc. and also acting as an excellent tutorial on the subject. Those in the TV trade will find that everything they are likely to have to deal with is covered, from the practicalities of ladder use to the intricacies of digital transmission systems. Those who for the present have fewer practical needs, students for example, will find their questions about reception characteristics, transmission techniques etc. answered. As an example of the usefulness of the book, installers will find it an ideal way of developing an interest in the more technical side of reception. They will also benefit should they wish to move into SMATV signal distribution.

The section on handling customers is relevant and worthwhile. Some of the finer points mentioned are open to debate, but basically it's spot on. It is reassuring to find a detailed treatment of wall fixings. Many installers blindly go on using just one system regardless of different types of building construction. Rawlbolts are very popular, but their use can sometimes cause structural damage – where they are over-tightened for example. Essential reading then!

The one section I found disappointing was that on the tools of the trade. It struck me as over generalised and lacking in practical advice. Seasoned installers would question some of the points made here. Apart from this I'd highly recommend the publication to all those either involved in satellite TV or thinking of becoming involved. **Nick Beer.**

Camcorner

Reports from Brian Storm and David C. Woodnott

Panasonic NVMS4

This camcorder was accused of being unreliable when recording. Apparently it would sometimes stick in pause and sometimes shuffle and back space erratically. After some hours had been spent testing the machine sure enough when record pause was selected it unlaced, spooled backwards, laced up again and then finally, after back-spacing unsteadily, it obeyed the original command. Heating and cooling the various systems and servo chips had no effect on the fault condition. After another spasmodic display suspicion fell on the mechanism mode switch. A replacement, part no. VSS0193, cured the problem. **B.S.**

JVC GRA1

The symptoms produced by this machine gave the impression that the playback control pulses were missing: there were cyclic noise bars on the picture, and use of the tracking control wouldn't alter them. The machine's recordings played back all right in another machine.

We monitored the playback control pulse input to the digital servo chip IC101. This only confused us as the pulses were present, stable, of the correct amplitude and frequency etc. – at least as far as we could discern. We then recalled that these machines were amongst the first to have a 'reverse-tracking' feature. This is intended to ensure that the correct video head (A, A', B or B') reads the track being played back. Without this feature picture wobble effects can occur, when for example head A reads a track recorded by head A'. The system modifies the duty cycle of the recorded control pulses, thereby enabling the tracks to be identified during playback.

The servo chip, in conjunction with the mechacon chip, checks the duty cycle of the control pulses and adjusts the capstan phase to achieve correct tracking. In this case there was a control pulse input to IC101, as mentioned above, but no playback control output at pin 29 to the mechacon chip. IC101 was faulty, a replacement putting matters right – thank heavens! **D.C.W.**

Ferguson FC27/JVC GRA1/Telefunken VM4300

The reported fault was no tape transport. As with many of these JVC based machines, the loading rings had become misaligned. In addition – another common fault – the middle guide pole assembly had broken off. A damaged intermediate gear, which had to be replaced, was the cause of the misaligned loading rings. This is quite a job. The drum assembly and most of the deck guide rails etc. have to be removed, and the loading rings have to be lifted off the main deck to give access to the gear. Refitting involves complete mechanism alignment and timing. As with all mechanisms, the Sony Mode Box is invaluable when checking for correct operation. **D.C.W.**

Sanyo VMD9P

The complaint was of "intermittent and unwanted deck functions". This recent model uses the Sony A mechanism and required a new mode switch to settle down. The Sony mode box and leads help with this type of problem as incorrect mode-switch functions are indicated visually with LEDs. **D.C.W.**

Mitsubishi HSC35B

This is the model with the colour viewfinder known as the 'Truefinder'. The display is produced by a colour-filter disc that revolves in front of a monochrome c.r.t., not by an LCD panel. The disc is driven by a small motor and is synchronised to provide correct colour registration. A great deal of digital processing is involved: the circuitry used for this occupies most of the interior of the viewfinder case. The digital PCB sits above the monochrome c.r.t. and its scanning and video circuits.

The problem with this one was that the viewfinder picture occasionally shifted sideways and jittered. The E-E picture displayed on a monitor was unaffected: only the viewfinder picture 'twitched'. Various checks were carried out on the scanning and video PCB, to no avail. All the viewfinder circuits are supplied by a 5V line that comes from the main VTR power supply. This rail has to provide quite a heavy current, around 350mA. A check here showed that under the fault condition the voltage varied from its normal 5V by about 0·2V. So was the viewfinder overloading the supply, or was the supply faulty?

The answer was obtained by using a separate supply for the viewfinder. This proved that the cause of the trouble was in the power supply in the camcorder body. The main items in the regulator are IC901 and a large transistor, Q901. As the fault was intermittent I decided to replace all the components in this circuit. This put an end to the trouble. **D.C.W.**

Sanyo VAR30B

This adaptor is used with Model VMH100P. It had no output and wouldn't charge a battery. The faulty items that had to be replaced were F102, the 85°C thermal fuse RR201 (4A) and T1 (1·25A glass). Strangely the chopper transistor was all right. **D.C.W.**

Sharp VLC690

Playback was all right with this C-format camcorder but the E-E pictures were very weak – in fact there was an image only when the camcorder was used outdoors. A vectorscope check showed that colour information was present, but a scope display didn't show any luminance signal. So we checked through the luminance signal path and found that IC203 (MSM6850M) was the cause of the problem. This 1H delay line type of chip, like similar ones in other makes, seems to be a common cause of loss of signal. **D.C.W.**

Toshiba SK60P/JVC GRC7

There was no viewfinder picture, just field collapse. We found that the height control VR3 was open-circuit. **D.C.W.**

Teletopics

Satellite TV

Philips demonstrated a complete MPEG-2 standard digital video distribution system for broadcast use at the recent IBC: signals sent via the Telecom 1C satellite were decoded and played back in real time using standard IRDs. A digital IRD for cable use has also been developed.

European digital TV test transmissions via satellite are to start by the end of the year: SES (Astra), Eutelsat and Deutsche Bundespost Telekom have offered the Digital Video Broadcast group the use of transponders and facilities for the purpose.

The NTL VCS4000 MPEG-2 digital TV transmission system is now available commercially – the first of its kind. A joint venture between NTL and Pace expects to have domestic decoders for use with the system available early next year. Hong Kong based, News International owned broadcaster Star TV is to start a direct-to-home TV service using the system in mid-1995.

Toshiba has entered the UK satellite receiver market with Model TS540, which with 60cm dish is to retail at around £300. Grundig Satellite Communications has introduced a model that breaks away from the traditional black-box look: the GDR250P has a mahogany wood effect finish, user-friendly on-screen menus and handset for ease of use and a 6dB tuner threshold which ensures excellent performance regardless of weather conditions.

RTL Television is now available via Eutelsat II F1 at 13°E on transponder 33V (11·596GHz), in the clear with German-language sound.

Cable & Satellite 95 will be held in the Grand Hall, Olympia on April 3rd-5th 1995.

Discs and Disc Systems

Philips has signed a distribution deal with Video Collection International to release ten Video CD titles; CD Vision is to launch around fifty Video CD titles before Christmas, priced at £10-13 each; Philips has released, for the first time simultaneously, a VHS/Video CD title, *The Firm*; and a number of Japanese manufacturers are about to introduce Video CD players, in their home market initially. But the technology is moving ahead fast.

There was a brief reference in this column last month to the "next generation of video CDs". What Philips, Matsushita, JVC, Sony and the others have developed is a longer-playing CD-ROM known as High Density CD (HDCD). The discs have about four times the storage capacity of current discs and can store around 140 minutes of MPEG-2 video. Thus a single disc will have sufficient storage capacity for most films and will provide far better quality than Video CD, which uses MPEG-1 digital video compression. HDCD discs and players are expected to be available in about two years' time. Naturally you won't get all this extra for nothing. The players will be more expensive, since one technique that's being used to increase the storage capacity is a variable bit rate, 2-8Mbits/sec, depending on the scene content. Where there's little detail the lower rate can be used, while with fine, rapidly changing detail the faster rate is used. The average bit rate is 3-4Mbits/sec. Thus the disc speed has to be varied, complicating the servo systems. A red laser with a wavelength of 635nm is used instead of an infra-red laser (wavelength 790nm). So a better quality lens is required.

Looking farther ahead – a lot farther – Matsushita claims to have developed a CD-ROM disc with a storage capacity of 4Tbytes, about 6,000 times the capacity (650Mbytes) of current CD-ROMS. This would enable a full-length movie to be stored in a space of just 0·2 sq. cm. This high density has been achieved by adopting the technology used in atomic force microscope probes, which can build structures on an atomic scale. The storage technology is still in the experimental stage, and it could be a decade before commercial products that use it appear.

Meanwhile Pioneer has announced the development of a blue laser (wavelength 400-500nm) capable of reading high-density optical discs at room temperature. The blue output is obtained by passing the output from a red laser through a half-wavelength second harmonic generation element composed of phosphoric titanic kalium. This yields a 425nm output. It's expected to be four-five years before the laser becomes available commercially.

On the interactive disc front, the 3DO consortium has announced that the products are designed to be upgradable from the start. The first upgrade will enable MPEG-1 Video CDs to be played. Late next year a 64-bit microprocessor upgrade called the M2 Accelerator will boost the performance significantly. It will feature a customised PowerPC microprocessor and will have multiple custom graphics and sound processors designed by 3DO. Matsushita, IBM and Motorola are involved in the development work. The operating system remains the same, giving compatibility with current discs. 3DO points out that it is common to upgrade PCs and there's no reason why the principle shouldn't be applied to other products.

Developments

A paper delivered at the International Broadcasting Convention by researchers from De Montford University, Leicester described a full-colour three-dimensional TV technology that the team believes could be developed into a practical system. It should produce a full-parallax effect, i.e. by moving your head you can look round the image. The display would have a vertical resolution of 1,536 lines and a horizontal resolution of 2,048 pixels, requiring a transmission rate about one and a half times higher than that needed for conventional HDTV. A comparatively modest data compression ratio of 16:1 would enable this to be transmitted by current methods.

The imaging system would use arrays of large and small lenses, the finest arrays having a lens spacing of 125 microns. The theory has been around for some time but it has only recently become possible to produce planar arrays with a sufficiently fine pitch. For display purposes an LCD system would be used in conjunction with a lens system that has a 1·25mm pitch.

All that is probably many years away, if at all. On a more practical level Sharp has demonstrated a 21in. wide thin-film transistor (TFT) LCD that has 640 x 480 (921,600) pixels with a dot pitch of 0·222 x 0·666mm and can display up to 16·7 million colours. No commercial launch date has been announced.

Sharp has launched on the Japanese market a video modem, called the Teleport, for use with its ViewCam camcorder. The Teleport enables users to send and receive still colour pictures via an ordinary telephone line. JPEG compression is used to reduce the data rate, and the user can select three transmission speeds (detail, normal and plain). These take around twenty, eleven and eight seconds respectively. The Teleport has a memory that can store up to ten images. Screen resolution is 384 x 240 pixels, with 8-bit colour (256 colours).

A Serviceman's Guide to Oscilloscopes

Part 1

David Botto

In the early days of radio few service departments possessed an oscilloscope – then usually called an oscillograph. These instruments spent most of their time on the shelf. Occasionally an engineer would dust off the oscillograph for a bit of signal tracing in radio circuitry or to check distortion in an amplifier. They were heavy instruments, massively built, and used valve technology.

The oscilloscope came into its own with the advent of television. Complex waveforms needed to be examined, and the scope was the only instrument that enabled them to be observed. Oscilloscopes made rapid headway in TV service departments.

Without an oscilloscope it's not possible to set up and service today's hi-tech TV sets, VCRs, camcorders and computers properly. Correctly used and understood, the modern scope enables the engineer to see exactly what's happening in the circuitry of these complex pieces of equipment.

The latest generation of scopes use improved technology, giving performance and value for money that would have seemed impossible just a few short years ago. If you're thinking of buying a new scope, this article should help you to select a state-of-the-art instrument that's right for your servicing needs.

Basics

Scopes use electrostatic deflection to control the position of the beam as it traces out the waveform displayed on the screen, see Fig. 1. The X plates control the horizontal scanning of the beam while the Y plates control its vertical movement. A signal being measured by an oscilloscope is displayed as a function of time, see Fig. 2. The waveform's vertical axis indicates the amplitude of the voltage applied to the Y plates while the horizontal axis indicates the time between successive cycles of the signal applied to the Y plates.

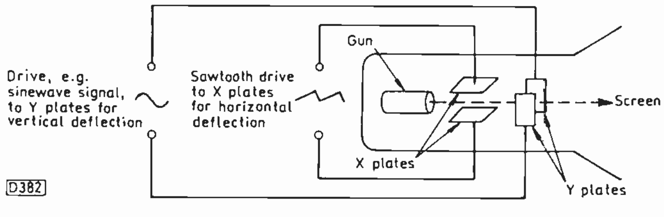


Fig. 1: The electrostatic deflection system used by scope tubes to display waveforms.

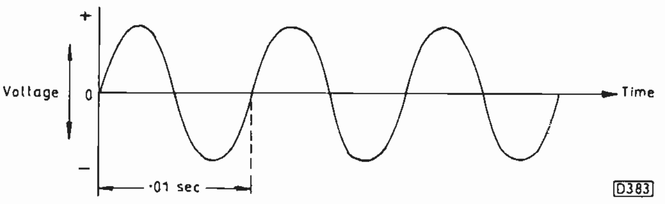


Fig. 2: The display is a function of time. A 100Hz sinewave is shown here.

In this way the oscilloscope provides a graphical representation of exactly what's happening in an electrical circuit, by responding to fast changes in signal levels and waveforms.

Regular readers will have a reasonable understanding of oscilloscope circuits. For the benefit of newcomers and those who may be a little rusty on some points however we'll provide a quick review of the basic principles.

Block Diagram

Fig. 3 shows in block diagram form the basic elements of an oscilloscope. It is largely self-explanatory. The operating principles remain the same whether valve or solid-state technology is used.

An alloy shroud, typically Mumetal, helps to protect the c.r.t. from disturbance by external magnetic fields. As Mumetal consists of approximately 78 per cent nickel, it has a high magnetic permeability. In our block diagram the e.h.t. is shown as –1kV, i.e. negative with respect to chassis. With up-to-date designs you'd expect an e.h.t. of 16kV or greater. VR3 is an astigmatism control, which is used to obtain the sharpest possible convergence of the electron beam at all points on the face of the monochrome tube screen. VR4 is the front-mounted brightness control and VR5 the focus control.

The calibrated horizontal sweep generator (timebase oscillator) can be adjusted to give different sweep speeds. Switch SW5 selects the range. The output is a linear sawtooth ramp waveform. As with a TV display, we don't want to see the horizontal flyback. A blanking circuit senses the falling edge of the sawtooth waveform and cuts off the beam during the flyback period.

The X output stage provides the required push-pull drive for the tube's X deflection plates. An external signal can be fed in via the X input socket: for some applications it's desirable to be able to deflect the beam both horizontally and vertically from external sources. VR6 enables the horizontal trace to be centred.

Note that there must be an ohmic path between each deflection plate and the tube's final anode. If there isn't, the scope produces strange, fuzzy waveforms.

The Y input socket is the normal signal input. This is followed by a.c./d.c. input coupling selection then switched attenuation.

The sweep generator can run freely at the frequency selected by the sweep range switch or operate in the triggered mode, and can be triggered from an external or internal signal source. SW3 and SW4 select these modes of operation. When the sweep generator is triggered internally, by the signal in the Y channel, each horizontal ramp will start at the same point along a repetitive input signal waveform. For clean operation the trigger signal requires some processing.

The arrangement shown in Fig. 3 serves to illustrate basic oscilloscope principles. Such an instrument would be easy to build but would be of little or no use in today's high-tech TV/video service department. Nevertheless the principles

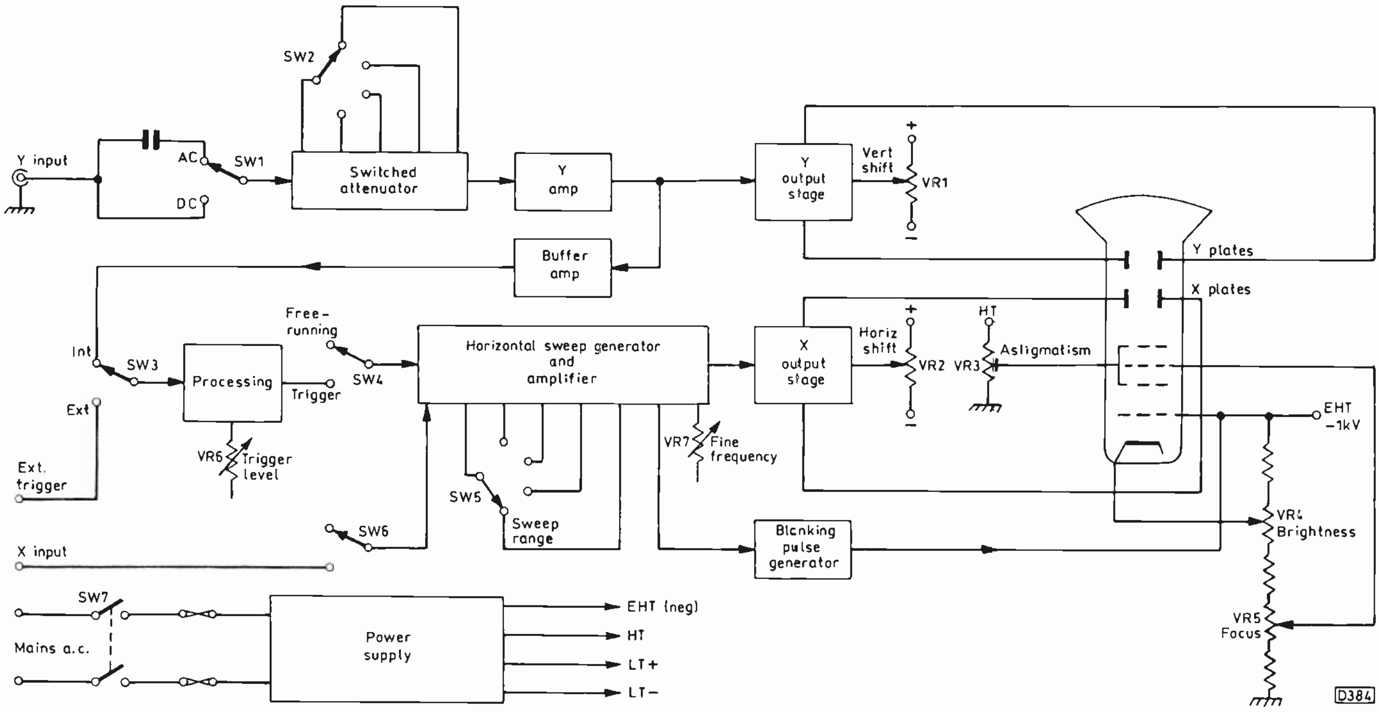


Fig. 3: The basic elements of an oscilloscope, shown in block diagram form.

outlined here are found in one form or another in the modern oscilloscope.

The Y Amplifier

Barely ten years ago a Y amplifier bandwidth of 6-10MHz was considered adequate. Today a virtually flat response from zero to 20MHz is generally considered to be the minimum requirement. An oscilloscope that meets this specification will, at present, handle satisfactorily most if not all of the signals found in today's TV sets, VCRs and computers. Bear in mind however the rate at which the technology is advancing. Because an oscilloscope represents a major investment it will have a long workshop life. So you may consider it worthwhile purchasing an instrument with a Y channel response of zero to 50MHz or better.

The input signal amplitude that produces one graticule of vertical deflection is defined as the vertical (Y) input sensitivity. For example a setting of 10mV per division (10mV/div) will produce one graticule division of vertical deflection for each 10mV amplitude change of the Y input. Accurately calibrated Y input attenuator switches enable the modern oscilloscope to handle signal input amplitudes ranging from a single microvolt to many volts per division. A high Y input impedance is desirable.

Another important factor to be considered in the design of a Y amplifier is its rise time, see Fig. 4. Rise time is defined as the time taken for the beam to rise from the ten per cent calibration mark on the graticule to the 90 per cent mark. If the rise-time response of a Y amplifier is poor the signal observed will suffer a degree of distortion. This applies especially with squarewave and digital signals. A top-quality modern analogue oscilloscope such as the Tektronix TAS465 has a Y amplifier rise time of less than 3·5 nanoseconds.

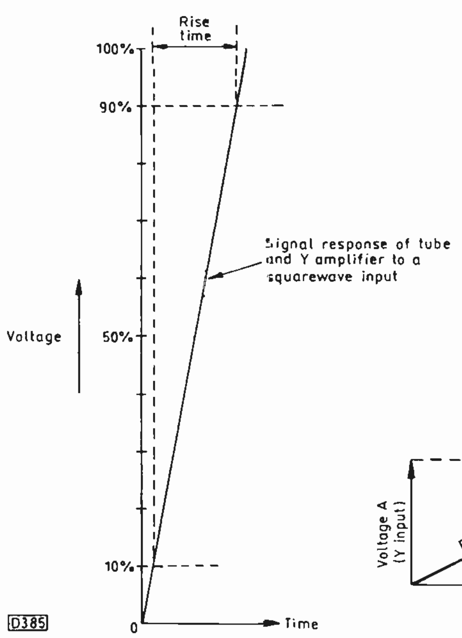
Scope Probes

The Y amplifier is connected to the circuitry being tested via an isolating probe. This prevents the Y amplifier loading the signal source, with possible waveform distortion. The purpose of the probe is to present a high input impedance to the signal. It normally incorporates a divide by one and by ten and maybe by a hundred attenuator switch. A quality probe will enable signals in the MHz range to be handled, sometimes as high as 300MHz or more.

It's vital to purchase probes that match your scope. A general rule is that the frequency range of the probes should be much wider than that of the scope. New scopes generally come complete with the necessary probes.

Dual- and Multiple-beam Scopes

The arrangement shown in Fig. 3 produces only a single trace on the screen. Often additional information may be required on the screen, or a simultaneous comparison of two



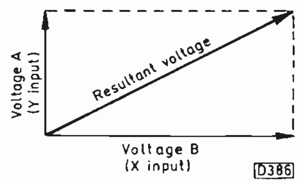


Fig. 4 (left): Illustrating rise time. Fig. 5 (right): XY operation produces a graph of two voltages.

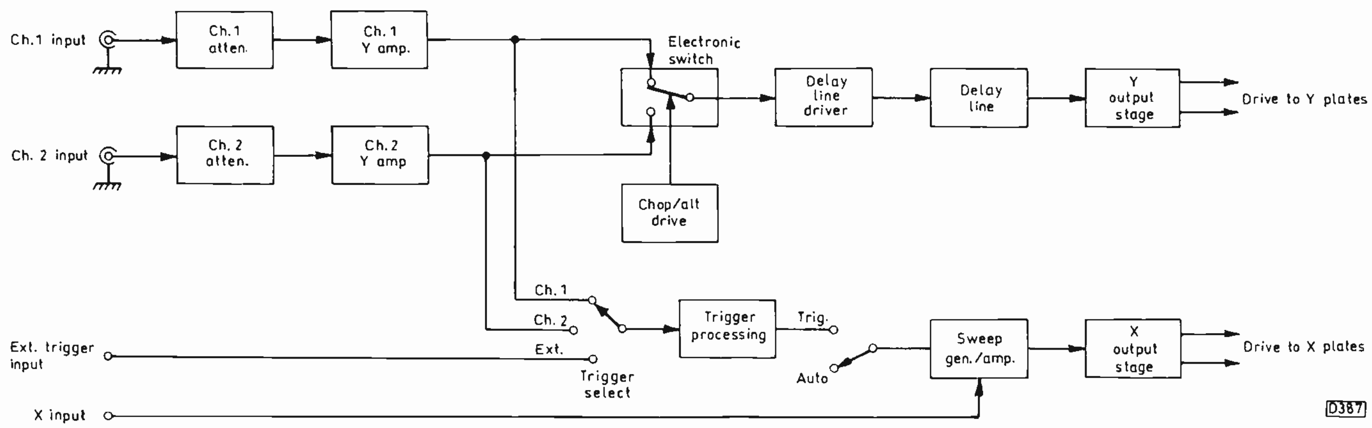


Fig. 6: Simplified block diagram of a two-channel analogue scope.

or more waveforms. Modern dual- and multiple-trace scopes use electronic switching between the outputs from two or more Y channels and the Y deflection drive system to produce extra traces. Because of the effect known as the persistence of vision, the traces produced by this switching between inputs can be viewed with no apparent flicker. Advanced instruments may produce multiple traces, but for normal servicing requirements two traces are sufficient.

A dual-trace scope has twin vertical (Y) inputs. There are two basic methods of switching the signals electronically, referred to as the chopped and alternate modes. At lower frequencies the chop mode, as it's usually labelled, is best. In this mode the electronic switching selects one input then the next then back to the first and so on at high speed to produce the two separate, distinct traces: in effect sections of each waveform are displayed in turn, the waveforms being 'chopped'.

At high frequencies the chop rate may be less than the velocity of the signals. As a result 'holes' appear in the traces. The alternate mode is then better: one complete trace is displayed, then the other complete trace, repetitively. Again the eye sees the traces as two distinct and permanent displays. Many models incorporate circuitry that can select either the chop or alternate mode automatically to suit the signals.

Features of Modern Oscilloscopes

The modern oscilloscope incorporates numerous sophisticated features that are invaluable when servicing advanced equipment. Laboratory-quality wideband Y channels, delayed and dual timebases, superior triggering circuitry and advanced plot and print facilities are examples. Instant function and range selection by push or touch buttons save the user much time. They eliminate the fiddling and messy setting up that was commonly required with older scopes. Models such as the Tektronix TDS544A and TDS644A show various waveforms in contrasting colours.

Until recently many of these features were available only at a cost that put them far beyond the resources of the service department. As a result of rapid advances in the technology and falling prices however this situation has changed: you can now get far more for your money.

Some top of the range scopes respond to inputs from zero frequency (d.c.) to an upper limit as high as 2GHz. But the high cost makes them uneconomic for servicing applications.

When choosing a scope it's a good idea to make sure that the Y channel bandwidth is at least five or six times greater than the highest frequency signal you would normally expect to encounter. If you display an 8MHz waveform using a scope with a 10MHz bandwidth for example the trace may appear to be clean: display it using a scope with a 20MHz or 50MHz bandwidth however and the trace may reveal distortion, overshoot and other problems not previously seen. Remember that when you can see the problem clearly it's much easier to find the cause of the fault.

X Deflection

The higher the frequency of the Y signal being displayed, the faster the horizontal sweep needs to be. Careful, precision design is an indispensible feature of the modern sweep generator. Older scopes usually calibrated the X deflection in terms of frequency: nowadays the calibration is invariably in terms of time. If the beam is set to move across one graticule division every 0·5msec for example the timebase speed is referred to as 0·5msec/div.

A delayed timebase enables you to view a single signal at two different speeds. It does this by expanding part of the waveform and starting at a point after the beginning of the main sweep. This is better than simply enlarging the display, since it enables any section of the main sweep to be inspected with any desired degree of horizontal enlargement.

Dual independent timebases enable you to view the same signal simultaneously at different sweep speeds. For example you can use one trace to view the complete video signal and simultaneously magnify the same signal to see just a part of it as the second trace.

A sweep magnifier enables part of the waveform to be magnified horizontally by times five, ten or more without the need to change the setting of the sweep time. This is better than simply increasing the sweep speed, which could mean that the part of the waveform you want to see is off the screen.

XY Operation and Z Modulation

In the XY mode one input signal is fed to the Y input and the other to the X amplifier. The display then produces a graph of the two signal voltages, see Fig. 5. The timebase oscillator is not used. This mode is handy for checking colour signal vectors: it's also needed for component tester use.

With Z modulation the signal is applied to the tube's grid or cathode to modulate the brightness. If properly synchronised field and line frequency signals are fed to the scope's Y and X inputs and a TV video signal is fed to the Z modulation input you'll see a monochrome picture on the screen.

The Modern Analogue Scope

The most popular type of scope for service use is the analogue type designed to view signals that vary smoothly and continuously. The latest examples offer an impressive range of functions: many contain a microcontroller chip for automatic setting up and ease of control, and instant push-button setting is now common. Some incorporate storage facilities, enabling a signal to be viewed after removing the input.

Fig. 6 shows a much simplified block diagram of a basic two-channel analogue oscilloscope. The outputs from the channel 1 and 2 Y amplifiers are electronically switched then fed to the delay line driver. The output from the calibrated delay line goes to the Y output stage. Without the delay line, the Y signals would arrive at the tube ahead of any signal fed to the X input.

With some modern scopes, for example the Hewlett-Packard HP54600 series, the input gain is automatically adjusted to match the signal level. Many scopes enable you to store the front panel set-ups in a memory chip so that they can be recalled at the touch of a button.

Triggering

Triggering enables the exact trace start time to be set. For example you might wish to observe only a section of the input waveform above a certain level, see Fig. 7. Front panel controls may enable the user to set the trigger level, the polarity of the triggering (on a positive- or negative-going signal excursion) and the source of the triggering signal .Triggering ensures that the signal(s) being displayed are locked and easy to view. Most engineers have experienced the annoyance of losing the trace when working with older triggered scopes. To avoid this nearly all modern scopes have a beam finder control: press a button and the trace position is instantly revealed.

V mode (or alternate) triggering enables each input signal to provide its own triggering.

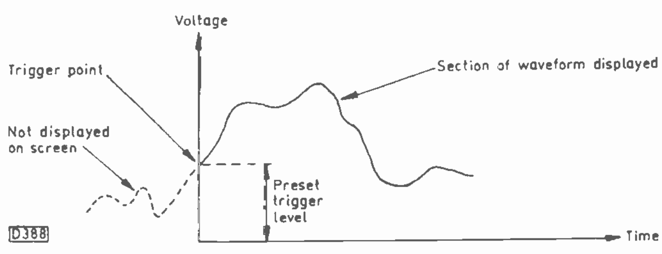


Fig. 7: Ilustrating triggered operation of the horizontal sweep. The trigger level is preset.

Scopes specifically designed for TV service department use sometimes feature TV horizontal (TV/H) and TV vertical (TV/V) triggering – this is simply a switch-selected timebase setting that's arranged to lock the scope to TV signals.

Conclusion

A basic principle is that everything in the Y signal path must operate exactly in step and at the same speed. With a modern wide bandwidth scope this means that the tube's response must be the same or better than the input bandwidth.

In Part 2 next month we'll look at the basic working principles of the latest digital storage scopes, weigh the pros and cons of analogue and digital instruments from the service engineer's point of view, and take a look at some of the superior features in current scopes of both types.

The Panasonic Z4 Chassis

Part 3

Ray Meadows

In this concluding article on the Z4 chassis we'll consider the main microcontroller chip, teletext and the scanning and protection arrangements.

The Microcontroller Chip

The main microcontroller chip IC1213 is a Matsushita MN1872419. It's similar to the MN1871611 used in the Alpha 3 chassis but has a few 'small-screen' set features added and a few 'top end of the range' features taken away. The device contains 16Kbytes of RAM, 24Kbytes of ROM, has twelve digital analogue control (DAC) outputs, i.e. the outputs are digital but they are used to control analogue functions, a voltage synthesis tuning DAC output, an I2C bus system and a full on-screen display generator. Pin functions are as follows:

Pin(s)	*Function*
1	Remote control input
2-4	Keyscan 1-3 (on-board function selection)
5-8	Options 1-4
9	Scart slow switch input
10	Sound info input
11	AFC input
12	Chassis connection
13	No connection
14	Bass DAC output
15	Treble DAC output
16	Balance DAC output
17	Loudness DAC output
18	Ambience DAC output
19	Secam white-balance DAC output
20	Secam L/not DAC output
21	Secam L' sound hi/lo DAC output
22	5V supply input
23	Colour DAC output
24	Contrast DAC output
25	Brightness DAC output
26	Sharpness DAC output
27	Chassis connection
28	Nicam info input
29	Scart fast blanking input
30	IF stop input
31	Video stop input
32	S-video info input
33	Bus switch output
34	Video mute output
35	PAL/Secam/auto mode output
36	Nicam/f.m. select output
37	Stereo/mono select output
38	5V supply input
39	Line pulse input
40	Standby control output
41	Blanking output
42	Blue OSD output
43	Green OSD output
44	Red OSD output
45	Volume DAC output
46	Tuning voltage DAC output
47	Select u.h.f. output
48	Select high-band v.h.f. output
49	Select low-band v.h.f. output
50	AV control 2 output
51	AV control 1 output
52	RGB contrast output
53	Mute 1 output
54	Reset input
55	Field sync input
56	Mute 2 output
57	50/60Hz scan sense input
58	AFC defeat output
59	I2C data to EEPROM and text circuit
60	I2C clock pulses to EEPROM and text circuit
61	5V supply input
62	Clock osc 1
63	Clock osc 2
64	Chassis connection

Three chips are closely associated with the microcontroller chip: the EEPROM chip IC1202, the reset chip IC1212 and the remote control receiver chip IC1131. An on-board push-switch control panel is connected to pins 2-4, and option-selection resistor networks are connected to pins 5-8. Some unused outputs are left unconnected while unused inputs are tied to chassis via resistors. Unused inputs include Nicam info, sound info and S-video info. S video is handled automatically by the AV switch on panel B in sets that incorporate this feature, so the microcontroller chip is not involved. The i.f. stop input is used to mute signals from the tuner when the AV mode is selected.

Most pins that are connected to the external circuitry are protected from flashover damage by means of in-line chokes. OSD output pins 41-44, being a little closer to the action, have a T-section LC filter each. The video mute output at pin 34 is tri-state, i.e. either logic high, logic low or high impedance.

To simplify the connections to the on-board control switches multiplexed key scanning is not provided. Instead, the switches are connected to resistor chains so that depression of different keys selects different resistance values. The keyscan 1 input monitors various user function keys (colour, contrast etc. and store), the keyscan 2 input monitors the tuning preset keys while the keyscan 3 input monitors the main user (volume and channel change) keys. Model variant options are set in the same way, i.e. by using resistors. These are read by the microcontroller chip to determine the set's 'identity', i.e. whether it is a PAL or PAL/Secam set, whether it has a single- or triple-band tuner etc.

At power on or at any time when the voltage on the supply line falls below 4·5V IC1212 feeds a logic low reset signal to pin 54 of the micro to clear any erroneous data from its internal memory. Tuning and consumer volume, colour etc. settings are stored in the EEPROM chip, which is connected to the micro via an I2C bus. The remote control receiver chip, which is mounted on a separate panel, is connected to the micro via a serial data line. These chips are all powered by the standby 5V supply so that they remain in operation in the standby mode.

There's three-speed sweep tuning, the sweep speed increasing when signals are not found. It can vary from 45kHz per step when search is initiated through 80kHz and up to 170kHz per step until a signal is detected. The video stop input (see Fig. 4 last month) then appears and the search sweep ends. When the digital value representing the selected frequency has been stored in the EEPROM a.f.c. is applied. The use of voltage-synthesis tuning means that direct channel access is not available.

The micro's 24Kbytes of ROM are more than enough for the programme code and self-test routines. Hence the inclusion of the on-screen calculator, calendar and 'mood light'. Personally I find a calculator that can be operated via the TV set's remote control unit rather useful, also the calendar. The mood light makes the Z4 the only chassis that can check its own purity! It makes for an interesting window display, especially if different sets are displaying different 'moods'.

The microcontroller chip is very reliable. If a fault is suspected, first check the clock module (X1210) connected to pins 62 and 63. Failure of the set to come on is more often caused by a fault in the standby supply. In this event check R1283 and D1208 (see Fig. 4, Part 1). The same fault occurs with the Alpha 3 chassis.

Teletext

The chassis uses the Philips IVT two-chip teletext decoder which consists of the IVT text decoder chip and a microcontroller chip. An external 8Kbyte static RAM provides four pages of text memory. The circuit is very straightforward and is shown in simplified form in Fig. 1.

The video input, with text, is amplified, peaked and buffered by Q3513/4/5 before being fed to pin 8 of the IVT chip IC3501. This device contains all the processing necessary to produce RGB text signals from the composite video input. Control is provided by a Philips MAB8461PW216 text controller chip (IC3507) which is connected to the IVT chip via an I2C bus. This bus is also linked to the main microcontroller chip IC1213, but is isolated from it by the CMOS chip IC3508. Connection occurs only when text functions are selected. When this happens, IC1213 produces a low output at pin 33 to switch transistor Q3523 off and the I2C link is made via IC3508. Bus isolation reduces the risk of interference being conducted back to the main panel – this can be a problem with sets that have a v.h.f. tuner. It also prevents address contentions.

While the teletext interface circuitry is similar to that used in the Alpha 3 chassis, the method of presetting the text contrast is different. Q3506 and preset control R3514 set the internal RGB reference voltage in the text character generator ROM in IC3501. To improve text legibility in the text mix mode Q3502, which shunts R3915, is switched on by a signal from pin 20 of IC3501, adjusting the reference level. The same control signal simultaneously reduces the video contrast level by pulling down the output from the sub-contrast control.

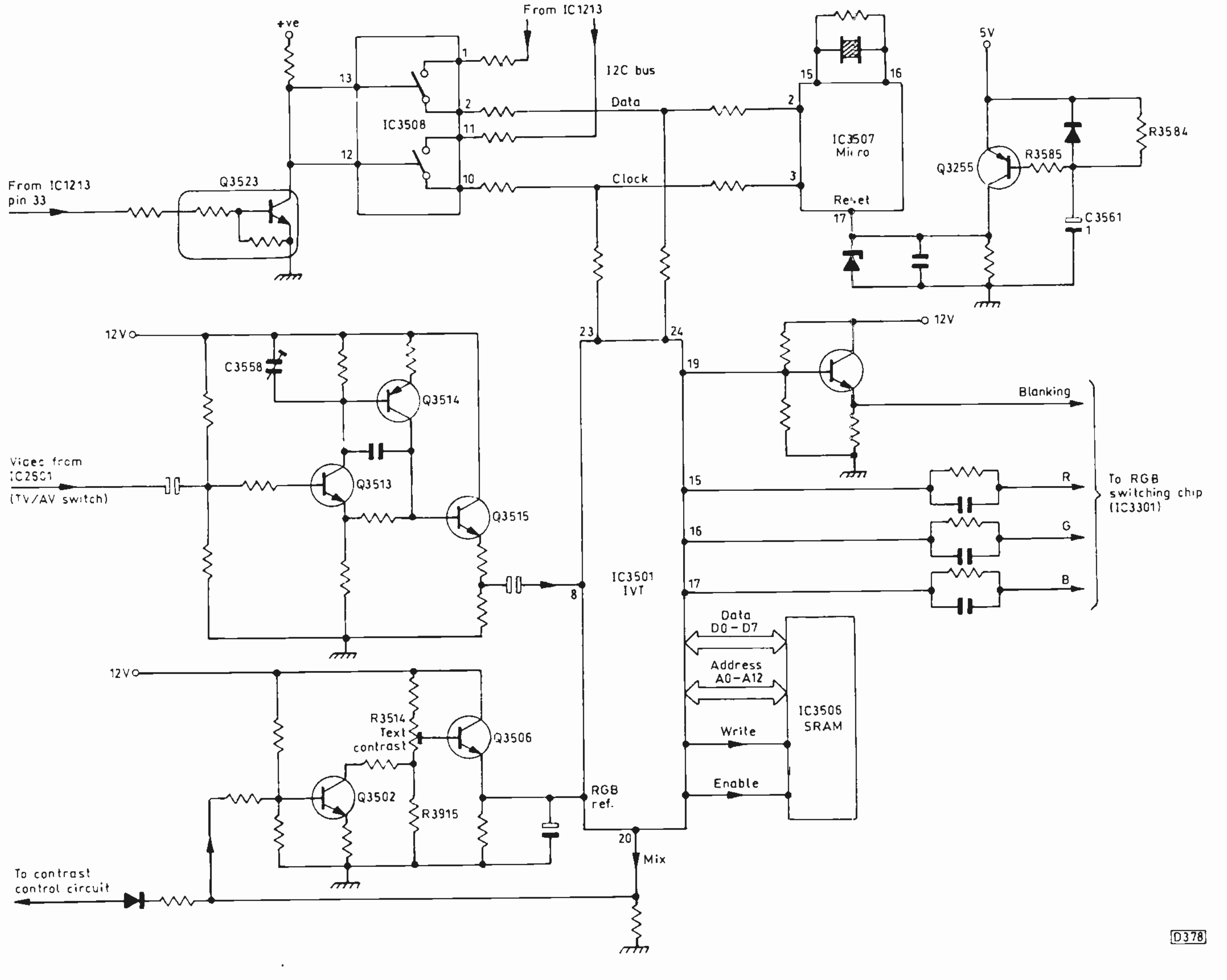


Fig. 1: Simplified circuit showing the basic teletext decoder arrangement.

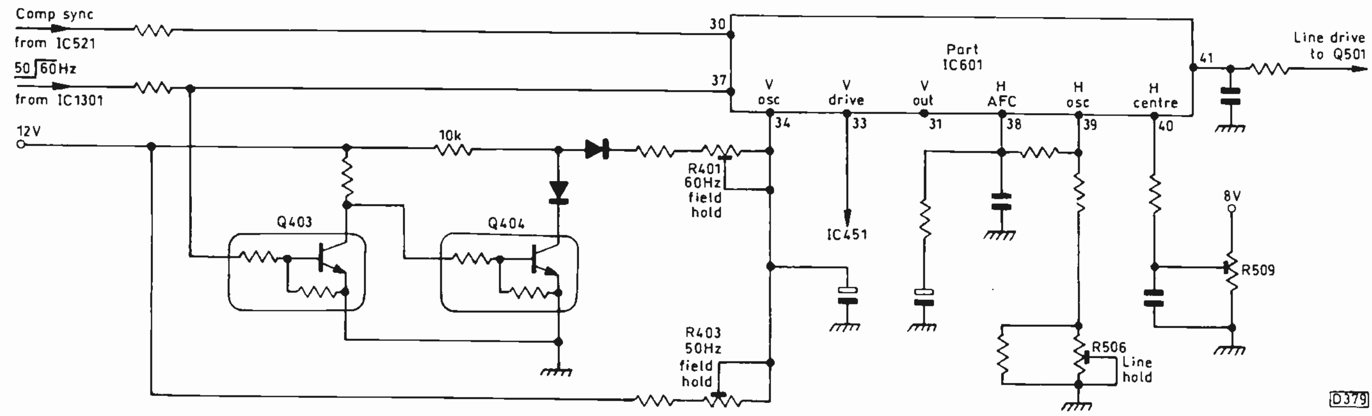


Fig. 2: The sync circuitry.

Synchronisation

Composite sync signals from the sync separator chip IC521 are fed to pin 30 of the video processor/timebase generator chip IC601, see Fig. 2. This device strips off and separates the line and field sync pulses internally. A control signal from the 50/60Hz switching chip IC1301 is buffered by Q466 (see Fig. 4, Part 2) and fed to pin 37 of IC601. Pin 37 is low for 50Hz operation, changing to high when a 60Hz signal is detected. IC1301 determines the field scan frequency on the basis of the timing of the field sync pulses it receives from IC521. Depending on the voltage at pin 37 of IC601, its line-frequency output at pin 41 will be at either 15,625Hz or 15,750Hz.

External *RC* networks connected to IC601 control the line frequency and phase: they are mounted away from IC601, on panel E. There's no pulse feedback from the line output stage. The line drive output at pin 41 of IC601 is taken to driver transistor Q501 on panel E.

There are two field hold presets, one for 50Hz and the other for 60Hz operation. They determine the voltage at pin 34 of IC601. Switching transistors Q403/4 control this, in accordance with the state of the 50/60Hz signal from IC1301. Although IC601 has a low-power field amplifier built in it's not used: instead the field drive output from pin 33 is used to control the field timebase chip IC451 on panel E.

Line Driver and Output Stages

The line driver and output stages are conventional. As the 15 and 21in. models all use 90° tubes there is no need for EW correction, which simplifies the circuitry. The line output transformer T551 generates all the high-voltage supplies for the tube. It also produces an 8V supply which is fed to a 5V regulator to power the teletext circuit.

Some early sets suffered from e.h.t. regulation problems because of insufficient capacitance within the line output transformer. All text models now have a new transformer with a built-in capacitor.

The Field Timebase

The field timebase is also conventional. It's designed around a Sanyo LA7837 chip (IC451), see Fig. 3. The drive signal from IC601 is fed to pin 2 of IC451, where the *RC* network R452/C462 provides a pulse as the field drive signal falls. This pulse is stretched by a single-shot multivibrator within the chip and is then passed to an internal ramp generator which charges C453 to produce the field frequency sawtooth waveform.

Height stabilisation to counter the effect of heavy beam current demand is provided by linking pin 6 via R450 and R471 to the beam sensing point (pin 3 of the line output transformer). Overall height control is provided by R455 which adjusts the gain of the sawtooth generator.

For PAL operation the voltage at pin 5 of IC451 is held low by transistor Q466 (see Fig. 4, Part 2). When the 50/60Hz switching chip IC1301 decides that an NTSC, 60Hz signal is being received Q466 is switched off and the voltage at pin 5 rises. This is again connected, internally, to the sawtooth ramp generator which switches the gain of the

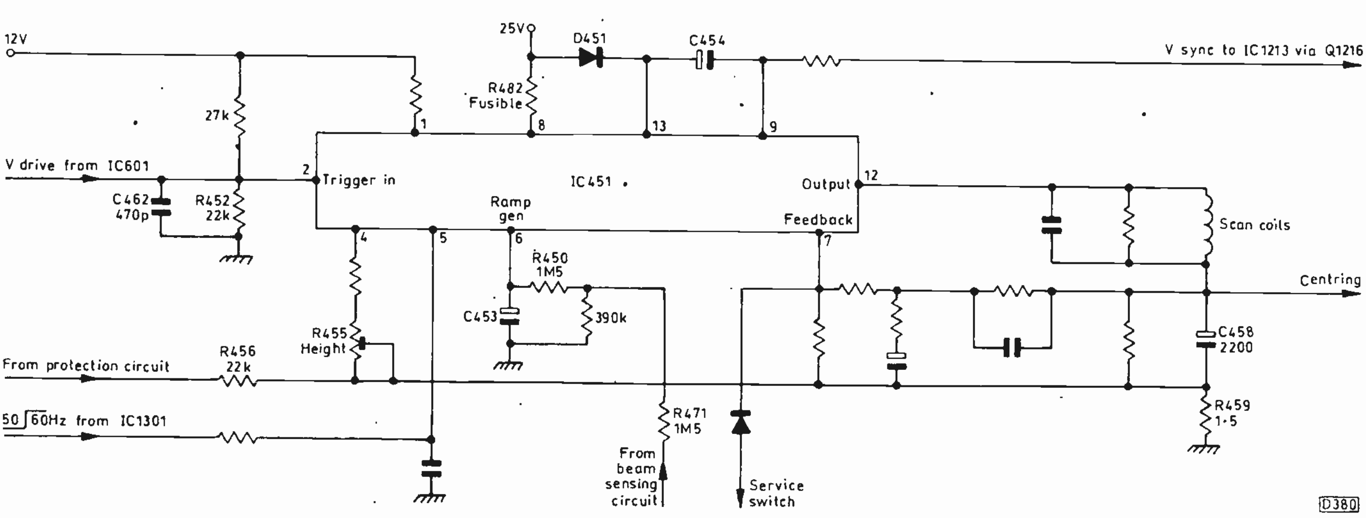


Fig. 3: Circuitry around the field timebase generator chip IC451.

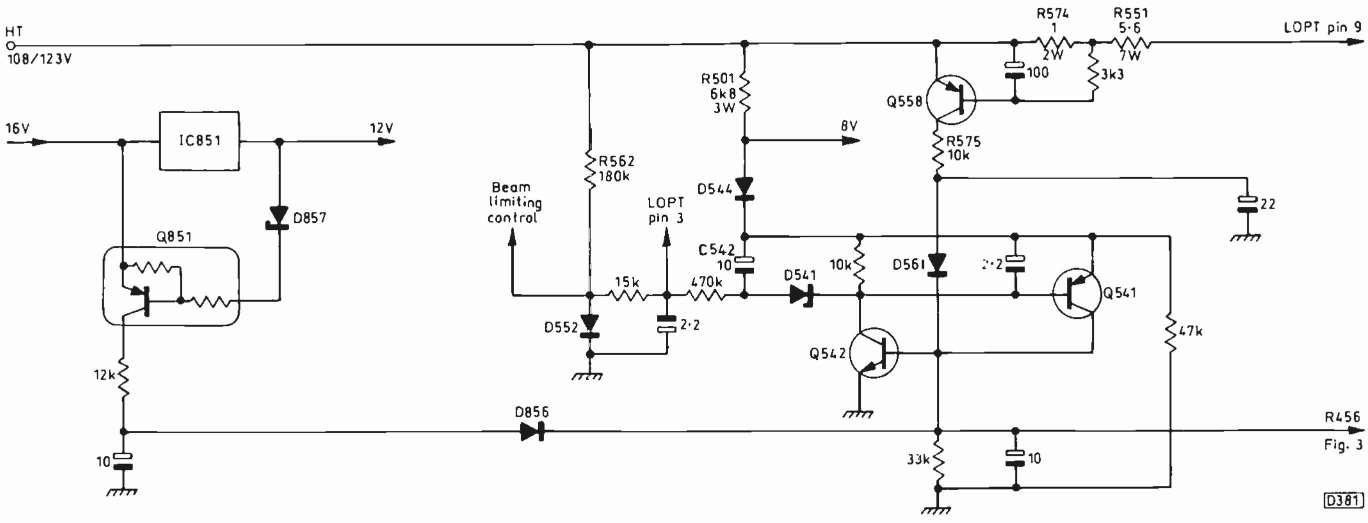


Fig. 4: The protection circuitry.

vertical amplifier. As a result the height remains the same for both PAL and NTSC operation.

As usual with this type of circuit a charge pump connected to the main supply (25V) generates a higher supply (50V) for the field flyback. The pump components here are D451 and C454. The Sanyo chip has built-in thermal foldback, so that under extreme overheating conditions the output is limited. Pin 12 provides the output to drive the field scan coils. There's both a.c. and d.c. feedback to pin 7. This adjusts the gain and linearity of the output amplifier.

Protection Circuitry

Fig. 4 shows the protection circuitry. In the event of an excessive load on the 12V line, the voltage will fall, zener diode D857 will conduct and Q851 will switch on. As a result a voltage will be applied to pins 4 and 7 of the field timebase chip. This will mute the scan. The same voltage is applied to the base of Q542, which switches on. Q541 in turn conducts. As Q541's collector is connected to the base of Q542 the two transistors form a latch, both remaining on. Q542's collector is linked via zener diode D541 to the beam limiting circuit (D552, R562 etc.). Thus when Q542 and Q541 latch on beam quenching is applied (via the sub-contrast and sub-brightness control networks).

R574 is connected in series with the supply to the line output stage. Q558 senses the voltage developed across it. In the event of excessive current demand the voltage across R574 will rise sufficiently for Q558 to switch on, activating the latch via R575 and D561. Beam quenching then occurs.

Conclusion

This completes our coverage of the Z4 chassis. Although still in production, it's being rapidly replaced by the new, cheaper Z5 chassis and some later versions of the Z3 chassis. While the Z4 chassis has been compared to the Alpha 3 large-screen chassis it also has similarities with the Alpha 4. This will be covered in our next article on Panasonic chassis.

Help Wanted

Wanted: Source of the Uniden UC1012B, Sharp IR3N06 and PC814 chips for the BT Freeway cordless phone (or scrap phones for spares). R. Harrison, 19 Southey Way, Larkfield, Aylesford, Kent ME20 6TS. 0732 849 301.

Wanted: Original basic/assembler ROMs for the Epson HX20, with basic reference manual. Circuit diagram/technical information also required. Richard Matthews, 117 Cliff Road, Felixstowe, Suffolk IP11 9SA.

Wanted: H.V. multiplier, part no. 152-0495-00, for the Tektronix 7403N oscilloscope. C. Cress, 14 Copse Wood, Iver Heath, Iver, Bucks SL0 0PT. 0753 652 902.

Wanted: Service manual for the Allegro 125 electronic organ, made in Italy. F.C. Hughesdon, 19 Lower Road, Higher Denham, Uxbridge, Middx UB9 5EA. 0895 883 774.

Wanted: Circuit diagram for the Heathkit IG37 f.m. stereo generator (copy would be o.k.). Also complete lens assembly for the Panasonic WV3030E video camera (part nos. believed to be YW61 421B and YW61 4222) or alternatively a lens mechanism. Graham Seward, 2 Orchard Close, Severn Stoke, Worcester WR8 9JJ. 0905 371 504.

Wanted: Service manual for the Amstrad Studio 100. Also a 350μF, 350V capacitor for the Matsui 2060 CTV. D.C. Gordon, 54 Burtt House, Aske Street, London N1 6LE. 071 739 1034.

Wanted: Second-hand teletext PCB for Tatung Model 8821 CTV, serial no. 2606234. Also circuit diagram or copy. M. Smith, 18 Malvern Close, Peterlee, Co. Durham SR8 2JN. 091 518 4140.

Wanted: Mecha control PCB assembly, part no. PU49564, for the Ferguson 3V23 VCR. J. Austin, 5 Cranwell Road, Greasby, Wirral L49 3PP. 051 677 9048.

Wanted: Circuit diagrams for the GoldStar Model GHV1240I VCR and ITT Model CT3306 CTV. Could copy and return. G. Plaxton, 6 Pasture Court, Sherburn in Elmet, Leeds, N. Yorks. 0977 681 745.

Wanted: Line linearity coil (L505) for the ITT CVC800 series chassis. T.J. Steel, 185 Charter Road, Chippenham, Wilts SN15 2RF. 0249 448 796.

Wanted: 1986-87 volume of *Radio and Television Servicing*. L.C. Dilke, 106 Coldbath Road, Kings Heath, Birmingham B13 0AH. 0121 441 2449.

Wanted: Manual or circuit diagram for a YRH8495 DK WD11 8736 102000 Decca VCR. Problem is wow on sound – belts and pinch roller have been replaced and the capstan motor checked. J.M. Ridge, 9 Turner Street, Swindon, Wilts SN1 5EU. 01793 532 787.

Wanted: TDA2800 chip (IC925) for the Grundig GSC100 (or any equivalent) chassis. D.H. Kidston, 102 Fergus Avenue, Livingston, West Lothian EH54 6BG. 0506 433 371.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Nick Beer, Gerald Smith, David Belmont, Ronnie Boag, Graham Richards and John Edwards

Sony SLV777

For intermittent tape damage when a cassette is ejected, or failure to play because the tape is not taken across to the capstan, check whether the half loading arm is stiff in operation. **P.B.**

Grundig VS500

For inoperative tape start and end sensors check the drive to the tower LED. R285 (47Ω safety) can go open-circuit, as can CT285 (BC848C).

If the clock display flickers (the flicker gets worse if you put your hand near the display) change the fluorescent display itself. **P.B.**

JVC HRD180

This machine wouldn't record new video signals. Sound was recorded and the previous video was erased, but the new video information was missing (if the full erase head was disconnected temporarily, the previous video was left). A check on the pre-rec board showed that the /REC line didn't go low. The cause was a dry-joint at the ribbon cable link (CN2) between the mechacon board and the video board. **P.B.**

Philips VR231

When a known good tape was inserted and play was selected the display consisted of a monochrome picture with field jitter. If forward search was tried the fault cleared and the display remained o.k. when you went back to play. Scope checks around the LA7191 luminance/chroma chip IC7051 showed that the video signal was being corrupted by the CCD delay line chip IC7504. The video input at pin 6 was all right but the output at pin 4 was 'chopped up'. The CCD clocking signal at pin 7 was similarly chopped up. It comes from IC7051, where the VXO crystal 1601 wasn't producing a clean oscillation. A new crystal solved the problem. **P.B.**

Hinari VXL9

This machine wouldn't tune. The BT line was permanently high, and altering the channel number (FS tuning) had no effect. The clock and data lines at pins 53 and 52 respectively of the flat-pack, surface-mounted microcontroller chip IC601 seemed to be o.k. but the supply 'load' at pin 51 was low as it was dry-jointed. **N.B.**

Hinari VXL9

This machine caused us a series of problems, one after another. I finally got down to the last two faults, which seemed to be linked. The machine would intermittently go into the external input mode of its own accord - replacing the channel number with an E. Even more intermittently it would for no apparent reason go into pause. This happened only in the play mode, never during record. As scope checks showed that the spurious commands weren't coming from the local keys, checks were carried out around the IR amplifier. The supply was found to be slightly low at 4·7V and had a 1V p-p ripple on it. This supply also powers the microcontroller chip. So over to the power supply where both C505 (2,200μF) and C507 (220μF) were low in value. Replacements restored a clean supply at the correct level and the mysterious happenings ceased. **N.B.**

Samsung SI3240/3260

Cassette loading problems are quite common with these machines. There's a modified side plate for the carriage as well as a different connect gear (the front loading drive comes from the main mechanism loading motor). These parts are available from a number of sources – but beware, they are sometimes up to 400 per cent more expensive than from Samsung, which charges just over a pound for the side plate! **N.B.**

Panasonic NVL20EG

This Continental machine wouldn't tune. It wouldn't search, let alone find anything. The tuning system is far more involved than that in the equivalent UK model, as there's a multi-band facility as well as switchable a.f.c. and fine tuning. A d.c. check showed that the 5V supply to pin 11 of the TV demodulator PCB was low at 1·08V. But it was not being loaded excessively. It was present at source, and most of the way to this destination. The cause of the fault was a faulty through-the-board link between C7407 and L7405. When this was linked across we could tune limitlessly. **N.B.**

Samsung VI611/621

There was intermittent hum on the E-E and playback sound and vision. We initially suspected defective capacitors in the power supply, but the fact that the fault occurred when the machine was hot suggested otherwise. The cause of the trouble was a superb dry-joint at the positive leg of C8 in the power supply. **N.B.**

Grundig VS400

There was no tuning: the BT supply at pins 15 and 16 of the tuner was permanently high at 32V. The bus lines to the tuner appeared to be o.k., and disconnecting the link between pins 15 and 16 then injecting a varying d.c. voltage proved that the tuner itself worked. So there was a fault in the tuner's PLL/synthesis circuit. We sent the tuner to MCES who speedily put matters right. Incidentally this machine uses the Panasonic D1 mechanism. **N.B.**

Panasonic NVG21/25

One of these machines came in dead save for the fact that the cassette-in LED was on. Checks in the power supply showed that the unregulated 45V line was low at around 25V. The 47μF, 50V reservoir capacitor C1018 was open-circuit.

As many of you will know, C1023 (1,000μF, 10V) in the power supply commonly fails, causing various servo and chroma faults. These are sufficiently severe to lead to a service call, but if the capacitor is left to deteriorate the display and other features will be lost and regained rythmically. **N.B.**

Panasonic NV788

This machine's remote control system didn't work. The IR commands were being inhibited because the machine thought that the timer was on. Timer inhibit is introduced by the MA165 diode D7554 on the timer PCB. A check showed that the diode was leaky. **N.B.**

Nokia VR3722

This machine had no stored channels and wouldn't tune any in. I found that the pulse-width modulation at pin 52 of IC301 was of low amplitude. C6003 was short-circuit and had damaged IC301. Everything was all right when these two items had been replaced. **G.S.**

Sharp VC481HM

"Tape stuck" it said on the note attached to this machine. On test rewind, fast forward and eject all failed intermittently. A new mode state switch cured the problem. **G.S.**

Matsui VX2000Y

This machine appeared to be dead although the power supply was working. The culprit turned out to be TC01, the orange trimmer capacitor that sits near the microcontroller chip in part of the clock circuit. A replacement trimmer restored the machine to life. **D.B.**

Akai VS75EK

The cause of very intermittent failure of the drum to rotate was traced to dry-joints on the power supply PCB. **D.B.**

JVC HRD660

Tape playback in the SP mode was good but the pause, search and LP modes were poor. I found that the LP heads were not being switched on because one end of R19, a chip component on the head amplifier PCB, had never been soldered. **D.B.**

Matsui VX755A

There were two faults with this machine: no display and no remote control operation. The former was caused by D1005 in the 5V supply to the timer chip going open-circuit, the latter by a faulty remote-control sensor. **D.B.**

JVC HRD750

When this machine was switched on from cold it appeared to work, but after a few minutes the display would dim and then go out. A check showed that the –30V supply dropped to –10V. The cause was soon traced to IC3 on the tuner board. **D.B.**

Philips 31DV3

This machine caused a lot of problems for the customer and the local video hire shop: it would intermittently erase the tape, sometimes for a fraction of a second. I monitored the record 12V supply and found that it occasionally switched on during playback. The service manual is a little unclear, but tracing the print back brought me to T141 which was going leaky. A replacement cured the fault and, I guess, brought relief to all concerned. **D.B.**

Matsui VX6000A

This machine wouldn't accept a tape, the carriage moving only very slowly. The loading motor had to be replaced as it had partially seized. **D.B.**

JVC HRS6800

This top-of-the-range JVC S-VHS machine has a full range of features including PDC control. But it would record only one minute of the programme. The cause of the fault was the MV1820 PDC chip IC201. **D.B.**

JVC HRD880

This machine would sometimes fail to accept a tape. The cause was a broken tooth on the lift gear. We had to replace the lift assembly as lift parts are not available separately. **R.B.**

Toshiba V309

A problem we've had with this model is the drum running too fast intermittently. Check for dry-joints at P509 on the main video PCB, also IC501 for bad connections. **R.B.**

Sanyo VHR7250

Failure to accept a tape and the drum not turning at switch on has in our experience always been because the 13V supply is low. Check for dry-joints at D5105, D5106 and D5107. **R.B.**

Toshiba V110

There was no fast forward or rewind operation. We found that the pin had broken off the white lever in the loading block. The complete loading block had to be replaced as the part is not available separately. **R.B.**

Sanyo VHR235

This machine wouldn't accept a tape and there was no drum rotation at switch on. A check on the voltages at pins 6 and 8 of CN541 showed that the voltage on the always 13V line was low. The fault was cured by replacing the STK5446 chip IC521. **R.B.**

Sharp VC481H

This machine caused us many headaches. When it first appeared in the workshop it needed a new upper drum assembly. Not long afterwards it came back because of an intermittent low gain tuner. A replacement cured that. The next complaint, not long after we'd returned the machine, was that the E-E picture would vanish or go milky, with poor sync. But we saw this fault only once. We decided to change IC402 (HA11745NT). As it does nearly all the video processing, why not!

A week later it was back with the same complaint, but at least the fault was there most of the time. Freezing and heating got us nowhere, but scope checks showed that the video signal was going missing at pin 5 of IC402. I phoned Sharp Technical who, after a lengthy examination of the circuit, suggested that we replace Q403 (2SC2308) – we were told that a BC546 would be suitable. Spot on and thanks Sharp Technical! The fault returned when the original transistor was put back. We were later told by the customer that the fault had been present, on and off, since the machine had been bought new! **G.R.**

JVC HRD520/HRD560/Ferguson FV42L etc

You sometimes get strange mechanism behaviour with these machines, for example the pressure roller not engaging properly or too soon, or the half loading arm positioning itself wrongly. The cause is likely to be that the cam assembly is misaligned or has a tooth missing at its outer edge – check carefully, as this can be overlooked!

If the machine tries to load without a cassette being inserted, or there's a cassette already jammed in the housing assembly, the optical switch at the right side of the housing is faulty. You can usually prove this by removing the housing assembly and linking pins 2 and 3 of connector CN601 on the main PCB. This enables the machine to be run without the housing, which is handy when servicing the mechanism. When refitting the housing make sure that the small wheel which drives the housing – it's on the mechanism floor – is engaged, i.e. flick it closer to the mechanism wall. Also remember to remove the service link at CN601.

To remove a jammed cassette disconnect the belt drive then turn the housing cam clockwise until the cassette is ejected.

The part number for the optical switch (phototransistor) assembly is PN268V1. The complete housing PCB part no. is PB40061. These part numbers are for the JVC HRD560EK.

Finally a word of warning. When checking for the cause of a tape transport fault don't connect an external power supply to the transport motor. The drive chip is mounted with the motor on the same PCB and will be destroyed. If you have to test the mechanism with an external power supply, isolate the drive chip from the motor connections. Better still, operate manually by hand! **G.R.**

Hitachi VT520

This machine tried to load a cassette without one being inserted and the wording "Code 1" appeared in the clock display. We suspected the start and end sensors: fortunately both pins of the rewind sensor were dry-joinyed. After soldering this up the machine worked perfectly – and the wording "Code 1" disappeared as well. Phew! **G.R.**

Logik VR950/Samsung VI611

For tuning drift with the 33V line being low and unstable, replace C2 (47μF, 63V) in the power supply and the 33V regulator IC901 which is on the PCB behind the clock. **G.R.**

Toshiba DV90B

There was no clock and no tuning. The cause of the trouble was the d.c.-d.c. converter circuit reference Z802. **G.R.**

Amstrad TVR1

This unit played tapes but wouldn't record. The record button had no effect because the switch was leaky between pins. A replacement from a scrap panel cured the fault. The customer had been using the timer override instant record button for ages to delay repair, but had finally got fed up with having to press the button every half hour to continue recording! **J.E.**

Hitachi VTF770

This machine was lifeless apart from the clock display, and had a fully laced up tape inside. When the power button was pressed the channel indicator came on but the machine shut down again two seconds later. Fuse F852 (1·6A) in the supply to the 14V bridge rectifier on the power supply PCB was open-circuit. As it hadn't blown, a replacement went in. This restored normal operation. **J.E.**

Sharp VC9300

Rewind and fast forward were o.k. When either play or record was selected however there was motor noise but the tape remained unlaced, the machine entering the forward mode at a slightly faster speed than normal playback. Fortunately the cause of the fault was nothing more than a stretched lace-up belt. It's under the deck assembly, at the front left-hand side. **J.E.**

Sharp VCA105HM

Playback was o.k. but there was just snow in the E-E mode. When the up/down channel search button was pressed there was a normal pulse-width modulated squarewave at the base of Q1451, but there was no voltage at its collector (or the tuner's VT pin) because the 33V regulator chip IC951 was short-circuit. **J.E.**

Logic VR960

Rewind and fast forward were o.k. When play was selected however the machine laced up then, after a few seconds, unlaced and shut down. It wasn't the limiter post this time but the loading belt, which was slipping. Normal operation was restored when a new belt had been fitted. We noticed that a slight crack was developing in the limiter post so this was replaced as well – we didn't want a "same symptom as before" situation. **J.E.**

Matsui VX880/Saisho VR1600/Hinari VXL4

One of these machines would accept a tape and its display showed the functions selected, but it wouldn't carry out any of the functions and refused to give the tape back. We found that circuit protector ICP201 in the 18V supply was open-circuit. A replacement plus resoldering of Q02's connections restored normal operation. **J.E.**

Sharp VC381

There was an intermittent loading fault. Sometimes the cassette would be lowered only half way and remain there. If the eject button was then pressed the cassette would be returned. A meter connected across the carriage motor during the loading process showed that the voltage at the earthed terminal would fluctuate then rise to 12V, thus stopping the motor. The cause of this was soiled contacts in relay RY802 on the main panel. We carefully prized off the cover and gave it a squirt of switch cleaner. This cured the problem. **J.E.**

Inside the Ferguson ICC6 Chassis

Part 2

Mark Paul

In this instalment we'll take a look at the signals side of the chassis.

Tuner and IF Section

The tuner and i.f. sections of the receiver are contained in screening boxes at the left-hand side of the chassis. They are of the same type that's used in the IKC2, ICC7 and ICC8 chassis.

Frequency-synthesis tuning is used, the frequency being selected by the PLL within the tuner unit under the command of pins 40 and 41 (data and clock respectively) of the microcontroller chip IR01 via the I2C bus. A point to note here is that the 5V supply for the PLL circuit is fed via transistor TH02, which is biased on by the line output stage derived 13V supply. Thus in the standby mode TH02 is off and the PLL is inactive. The tuning voltage supply is derived from the h.t. (Usys) rail and is stabilised in the usual way by a 33V zener diode (DH04).

The i.f. section is straightforward as only mono sound is required. Thus the conventional intercarrier sound demodulation technique is used. The audio demodulator, a volume-controlled preamplifier and a TV/AV sound switch are incorporated in the i.f. box, the AV enable input being at pin 9A. The logic here is 0V = TV, 10V = AV. An input at pin 12A mutes the audio when the set is not synchronised, i.e. there's no tuned-in off-air signal. We'll return to this later. There are direct audio input and output feeds between the i.f. box and the scart socket.

Composite video (CVBS) leaves the box at pin 6A and after filtering to remove the sound signal goes to the TEA2014 TV/AV switching chip IX01. The video signal is of 2V peak amplitude, sitting on a 2V d.c. level.

The Audio Section

Fig. 1 shows the audio circuit, which is based on a TEA2006 power operational amplifier chip (IA01). When an external speaker is connected to socket BA01 the drive to the internal speaker is switched off.

The gain of the audio amplifier chip is set by RA18 and RA19, with CA18 to provide d.c. decoupling. RA01, CA01, RA02, CA03, RA16, CA16 and CA22 all affect the audio frequency response. The audio output coupling capacitor CA22 also suppresses the lower frequencies. RA16 and CA16 provide an h.f. roll-off while the combination of RA01, CA01, RA02 and CA03 reduces the response by about 2-3dB at around 1kHz. Maximum gain is at 100Hz and 10kHz.

CA24 and CA26-29 provide output harmonic filtering and correction. RA21, CA21, CA17 and CA08 provide damping to suppress the tendency to oscillate inherent with a high-gain amplifier.

IA01 is muted in the standby mode by applying a zero d.c. bias to pin 1. This action is carried out by transistor TA02, whose base is biased from the 5V supply while its emitter is connected to the PO (power on) line. In the standby mode TA02's emitter is grounded via transistor TR96 (the PO source). It is thus conductive, pin 1 of IA01 then being linked to chassis via RA16, RA12, RA11, TA02 and TR96. Note that the chip's 24V supply is still present in this mode.

When the receiver is brought out of the standby mode the PO line rises to 5V and TA02 switches off. CA11 then charges slowly from the 24V line via RA08 and RA11. Meanwhile the tuner and i.f. section become active as their line output stage derived 13V supply is now present, so an audio signal appears at the emitter of TA01. The conduction of TA01 is controlled by CA11's charge and discharge time: it is included to prevent the switch on and off plops that would otherwise occur with such a high-gain amplifier.

The audio demodulator muting signal mentioned when we looked at the i.f. section is generated by the STV2110 colour decoder, video processing and timebase synchronisation chip IV01. When the receiver is not synchronised by an off-air signal this chip's saturation control input pin 27 is

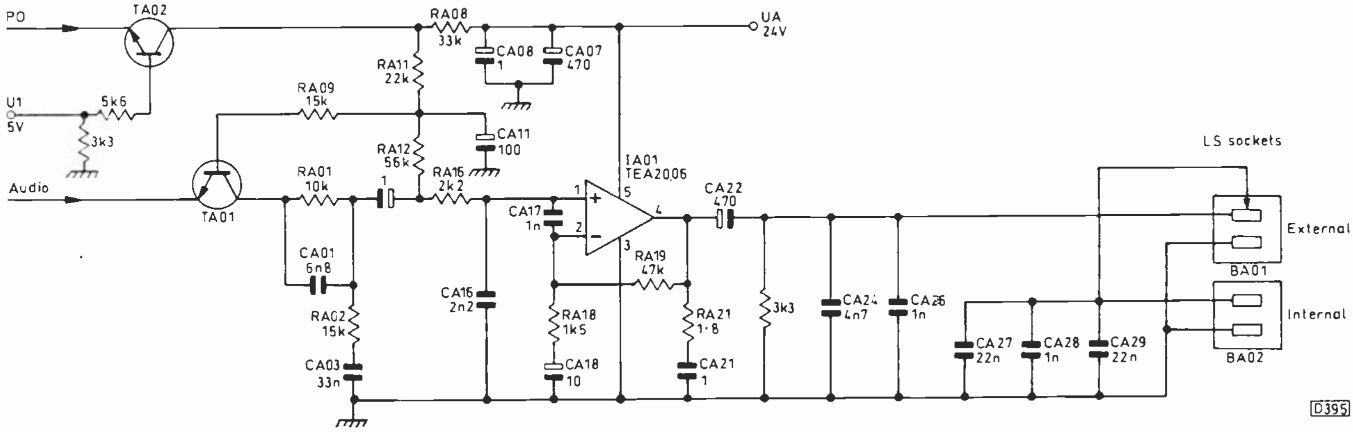


Fig. 1: The audio circuit.

switched low internally. This pin is connected to transistors TV82 and TV86, see Fig. 2. When pin 27 of IV01 is low TV82 will be off: TV86 will also be off as its emitter and

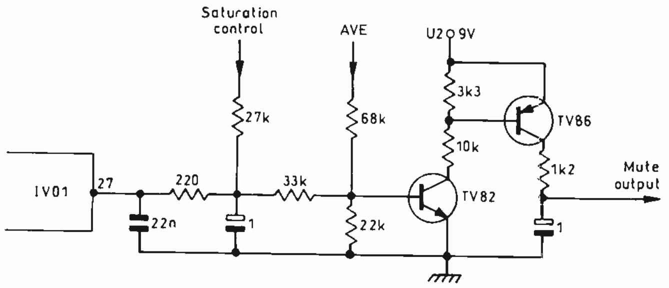


Fig. 2: The mute circuit.

base will both be at 9V. The muting 'low' is thus also present at the collector of TV86, which is connected to pin 12A of the i.f. assembly and also pin 36 of IR01.

The Video/Chroma Circuit

The STV2110 chip IV01 carries out most of the video/chroma signal processing, including both PAL and Secam decoding and RGB switching. It also synchronises the timebases, producing a field sync pulse output to control the TDA1771 chip and the line drive output. Most of the chip's internal functions are conventional while the peripheral circuitry is straightforward. In this section we'll just highlight one or two features that differ from previous Thomson chassis.

The input signals are internal/external composite video, S luminance and chroma, and RGB from the scart socket and as an OSD from IR01.

IV01's luminance input passes through VV01, which

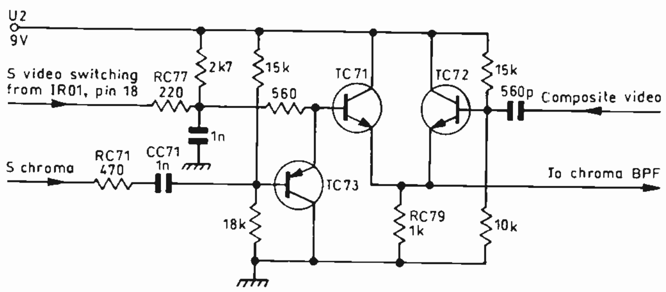


Fig. 3: The composite video/S chroma switching circuit.

provides the luminance delay and incorporates chroma, sound and i.f. rejectors. Because this introduces group delay distortion, the signal passes through a compensation circuit before it arrives at pin 9 of the chip. This circuit consists of transistor TV01, a bandpass filter whose response is centred around 2·2MHz and resistors which reduce overshoots and improve the signal's symmetry.

The chroma input to pin 18 of IV01 is routed via a switching circuit, see Fig. 3. Composite video is fed to the base of transistor TC72 which is simply an emitter-follower. The usual chroma bandpass filtering is done between here and the chip. S chroma from pin 15 of the scart socket arrives at the base of TC73 via RC71 and CC71. Transistor TC71 selects which input is to be passed to IV01. To disable the S video mode the microcontroller chip IR01 connects RC77 to chassis. TC71 is thus switched off and the S chroma path is open-circuit. When TC71 is switched on by IR01 for S chroma input its emitter voltage rises to the point where TC72 is cut off. Thus only S chroma can pass to IV01.

The luminance and colour-difference signals are matrixed internally in IV01 to produce RGB signals. IR01 feeds a control signal to pin 35 of IV01 for selection of internal or external RGB signals. There are contrast and brightness control inputs at pins 36 and 16 respectively, both subject to beam current limiting action.

IV01 provides tube cut-off current measurement. It also has a warm-up detection circuit which inserts pulses into the RGB outputs. Pin 42 receives feedback from the c.r.t. base panel to monitor the tube's cathode current. At switch on IV01 produces a series of pulses which are applied to the tube's cathodes. The idea is to blank off the tube during warm up to its normal running conditions. The cathode current is constantly monitored and at a predetermined level, set by IV01, three things happen: (1) The warm-up pulses cease. (2) The blanking is removed and the video signals are applied to the cathodes. (3) IV01 switches to its running mode and initiates cut-off current measurement. This is carried out during the field blanking period, d.c. offsets being applied to the RGB signals to compensate for any black-level drift.

The Scart Interface

The scart interface circuitry is shown in Fig. 4. IX01 selects composite video (CVBS) from either the i.f. strip or pin 20 of the scart socket and feeds the demodulated CVBS signal to pin 19. It's controlled by the AVE signal from IR01, which in turn initiates the switching as a result of a user command or the logic state at pin 8 (AVS – AV sense) of the scart socket.

IX02 operates as follows. RGB inputs from the scart socket are clamped by DX22/3/4 to the voltage across CX08 and then fed to pins 11, 4 and 1. The internal switches either pass the signals through to IV01, via emitter-followers TX12/13/14, or cut them off. Transistor TX38 controls the switching, the TVE (TV enable) signal being applied to its base via RX41.

The external fast blanking (FBe) signal at pin 16 of the scart socket is fed via emitter-followers TX32/34 and resistor RX43 to IV01 (two transistors are used to compensate for the Vbe offset). The internal fast blanking signal (referred to as FBo), coming either with the text RGB signals or the OSD signals from IR01, is coupled in via DX37. DX31/2 limit the signal to ensure that IV01's blanking threshold isn't exceeded.

If external RGB signals are being used as the signal source and an OSD signal is to be inserted, IX02 switches off the external RGB inputs as required. The switching is controlled by TX38, which receives the FBo signal at its base via RX38. DX38 is an anti-saturation diode.

If the viewer wishes to watch TV for a brief period while the receiver is operation with scart RGB inputs, IR01 feeds a TVE (TV enable) signal to TX42 and TX38. As the TVE signal is high, TX42 and TX38 switch on. The FBe signal at the emitter of TX32 is then earthed while TX38 opens the switches in IX02.

The RGB Output Stages

The RGB output stages, mounted on the tube base panel, are conventional wideband amplifiers with an active load (a transistor in parallel with the load resistor). The active-load technique provides a high-level output voltage swing with low distortion and a symmetrical overshoot. Its advantage is that the maximum output voltage can reach the supply

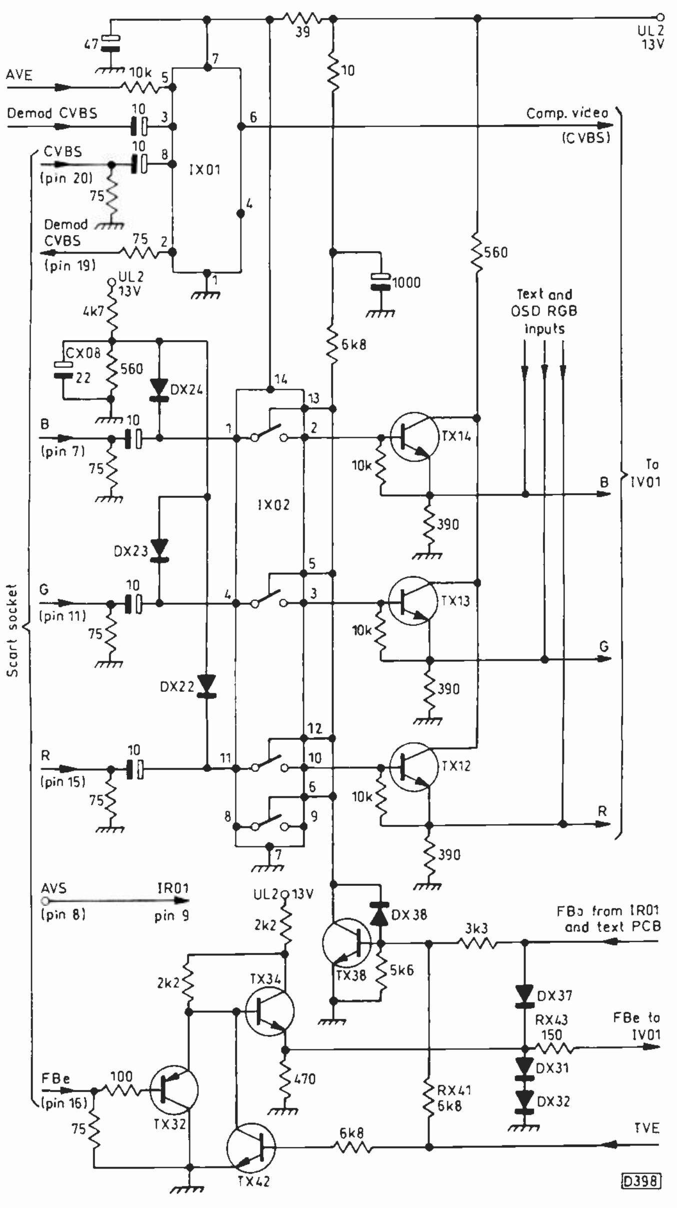


Fig. 4: The scart interface circuit.

voltage figure without the output transistor saturating and producing a smearing effect.

Fig. 5 shows the red output stage. White-level adjustment is provided by PB31. There's an equivalent control in the green channel but the gain of the blue channel is fixed. The ratio of RB34 to PB31 + RB31 sets the stage gain. Emitter-follower TB11 supplies the emitter bias voltage to all three output transistors, determining the symmetry of the black-level adjustment range.

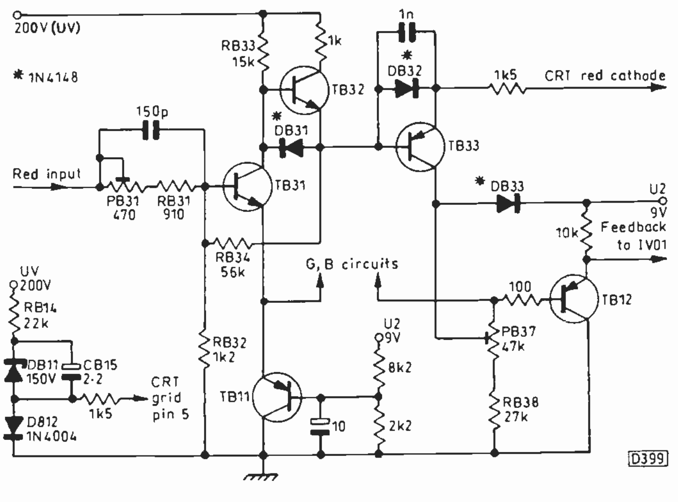


Fig. 5: The red output stage and switch-off spot suppression circuits.

TB33 and its equivalents in the other two output stages act as current 'mirrors', being used for warm-up/cut-off beam-current measurement. The RGB cut-off currents are added and produce across PB37/RB38 and the equivalent resistor networks in the blue and green output stage circuits a feedback voltage for pin 42 of IV01. PB37 and its equivalent in the green channel (fixed resistors are used in the blue channel) affects the cut-off current level so that 'grey' adjustment is possible. Emitter-follower TB12 acts as a buffer to reduce any potential interference reaching the circuit, e.g. r.f. disturbances.

RB14, DB11, CB15 and DB12 provide switch-off spot suppression. When the receiver is switched on CB15 charges to 150V from the 200V line via RB14. The voltage at the tube's grid pin 5 is then about 0V – actually 0·7V because of the presence of DB12. At switch-off the declining supply line voltage and CB15's charge produce a negative-going voltage at the grids (DB12 cuts off when the voltage at its anode falls to 0·7V). This negative grid voltage prevents the appearance of an 'after switch-off spot'.

Next Month

In the concluding instalment next month we'll look at the timebases and the watchdog circuit.

Trade News

The European Commission may shortly announce provisional anti-dumping duties on colour TV sets from five Asian countries and Turkey.

CHS is distributing its new 602-page 1994/5 catalogue. For further details contact CHS, Prospect House, Barmby Road, Pocklington, York YO4 2DP (telephone 0759 303 068, fax 0759 303 620).

Visions Video Productions has released a 50-minute video on the Panasonic G mechanism, which is also used in Philips, Sony and Grundig VCRs. The video, which provides comprehensive guidance on servicing the mechanism, is available from **Willow Vale Electronics** (11 Arkwright Road, Reading, Berks RG2 0LU – 0734 876 444) at £24.99.

Philex PLC, Philex House, 110-124 The Broadway, West Hendon, London NW9 7BP (081 202 1717, fax 081 202 0014) has published a supplement to its remote control catalogue featuring new models, updates and additions, also a complete cross-reference list.

The Institution of Electronics and Electrical Incorporated Engineers (IEEIE) has published an enlarged and updated second edition of its book *Electrical Safety at Work*. Copies are available from the IEEIE, Savoy Hill House, Savoy Hill, London WC2R 0BS (071 836 3357, fax 071 497 9006) at £8.50 each (for orders from outside the UK add £4 for air mail postage).

Pace has been holding a series of technical training seminars around the country for those in the trade. They start at 7.00 p.m. and are free of charge. Those still due to be held by the time we go to press will be at Isleworth, Mildenhall, Newtonabbey, Edinburgh, South Shields and Wakefield. For further details apply to Tricia Payter, Pace Micro Technology Ltd., Victoria Road, Saltaire, W. Yorkshire BD18 3LF (0274 532 000).

CD Player Servicing

Les Austin

This time we'll look at Philips' CD players, some of which come in disguise.

An Official Modification

Matsushita for example has used a Philips mechanism in various Panasonic players. Skipping is a not uncommon problem with these and has been reported in the house magazine *Panacea*. The ones in question, for example the Panasonic SLPJ24A, use the CDM4/19 (mini) mechanism and usually have the suffix A at the end of the model number. Problems with reading the TOC, or simply skipping during play, may be encountered.

The cure involves locating connectors CN401 and CN34. Snip out the wire that joins pin 14 of CN401 and CN34. Then add a shorting link between pin 14 of CN401 and pin 5 of CN12, on the print side of the board. Some players have this modification from original manufacture. It's another of those modifications that need plenty of publicity, as we mere mortals would otherwise never be able to cure the problem.

The complaint with two Philips-equipped Panasonic players that arrived recently was of skipping. The first was an SLP202A. I carried out the modification and cleaned the lens, but there was still some skipping. The laser power and focus bias were then adjusted. This seemed to improve the performance, but it was still not satisfactory. A new CDM4 mechanism was required to obtain correct operation.

The second player was an SLPG100A. After carrying out the modification, cleaning the lens and adjusting the focus bias the results were perfect. Manufacturer's mods rule o.k.!

Jim's Bargains

I've known Jim for about fifteen years. The first time we met I bought from him some Grundig tuners at a very reasonable price. I bump into Jim at least twice a year, and each time we part I seem to have less money and more bits and pieces than when we met. I'm not sure whether I buy things off him or he sells them to me, but the net result is the same. Last year I came away with some audio unit remote control handsets and a Toshiba XR9318 CD player, which uses the Philips CDM4/19 rafoc mechanism. This one had a severe rattle. On investigation the PCB was in about four pieces and the transformer was on the loose. Oh well, what can you expect for a fiver?!

This year Jim decided that he had another super bargain for me. When I had parted with an agreed sum of money I found myself the owner of another two Grundig VCRs (one V2000 type, one VHS) and a couple of Philips CD players. Will I never learn? Somehow the two players worked their way, out of turn, to the top of my massive pile of jobs to be looked at – much of the pile is ex-Jim.

The Philips CD472

The first was a CD472 that was fairly straightforward to deal with. The drawer wouldn't open or close when asked to do so, so there was no way it would play. I dismantled and glued up the front of the drawer, then reassembled it – with rather less EvoStick than the last person to touch it. After that I reconnected the lead to the tray motor and had a general look around inside to see whether I could spot anything else before trying again. I went over the regulators to make sure that there were no dry-joints, then saw that the microcontroller chip was inserted the wrong way round. When I managed to borrow a manual I discovered that Philips had marked the board incorrectly. The chip was in fact the right way round. Must make a note of it in case there's a next time. Pin 1 is towards the inside of the PCB, not towards the corner: as a further check, the little blue resonator is closest to pins 34-36.

Time to apply mains power. The drawer was now happy to open, but when asked to close it would do so briefly then start to open again. The small tact switch at the base of the drawer was not making because the white plastic lever failed to maintain its correct position. A quick raid on the Toshiba player from last year's deal with Jim and replacement of the white plastic bit brought success. The drawer now behaved as instructed and when a disc was inserted the machine read the TOC and played as it should. All that was left to do was to adjust the laser power and reset the focus bias, then wrap the job up. Hold on, there's a bonus: one of those remote control units seems to be correct for this player. All I need now is someone with a bit of spare cash and a desperate need to own a CD472.

An AK791

The second Philips player was a six-disc cartridge multiplay machine, Model AK791. It was less straightforward. Initial examination confirmed that a few bits were missing. There was no on/off button, no actuating rod and no flap to cover the cartridge slot. When I fed in some discs they were checked one at a time and were all rejected. At least the multiplay changer section seemed to be working correctly.

Time to try fault-finding on the laser side of the machine. This was the point where I realised that the rafoc unit had been fixed in place with Superglue. The view in the manual showed that a fixing piece was missing, but the manual failed to assign a part number to it. After removing the rafoc unit and tidying up where the Superglue had been I used a suitably bodged speednut to make up something to replace the missing piece.

Though the rafoc unit was now aligned in the correct plane, it still failed to play. So the next move was to go into the test mode. From the power-off condition you hold three buttons (next, fast forward and time/track) on simultaneously then apply power. This is service position 0. Successive presses of the play button take you to subsequent test positions. After various LCD checks, position 5 enables disc loading and position 6 allows a radial arm check by using 'next' and 'previous' to move the arm to either limiting stop. The seventh play press fires up the laser and enables focus search. With no disc inserted the search is repeated a number of times. With a disc present and no other problems to prevent it, focus will be found. Play press eight starts disc rotation, and after a period of up to one minute audio will be heard.

All seemed to be good when Stravinsky was heard, but it didn't last. After a while the sound disappeared and the player went to stop. I concluded that the rafoc was faulty, and that the problem may have been caused by the flexible lead. The type of rafoc unit used in this model is the CDM4/20 (mini), which is very similar to the type used by Panasonic and, more importantly, the ex-Jim Toshiba player. These machines in fact use the CDM4/19 (mini) version, which appears to differ only in the type of turntable for the disc. Anyway, using an extension (Philips' part no. 4822 322 40066 plus 4822 267 50676) and a disc hold-down clamp (4822 582 60906) I came to the conclusion that the rafoc in the Toshiba machine was o.k. while the one in the AK791 was faulty. Decision time. Do I spent money on a new rafoc mechanism, or do I try some transplant surgery?

In view of various comments about cowboys and bodgers in recent issues I was tempted to withold the next part from publication. But since I've never been famed for discretion you shall know the details, and I'll throw myself on your mercy.

Philips used to supply things like flexible cables as replacement parts. Nowadays only complete mechanisms are available. So the only source of the smaller items is another scrap rafoc. The task of removing and exchanging the flexible cable looked as if it would be rather a pain however. So I thought I would try something else.

In my junk box I had the remains of an older CDM2/10 mechanism, with its motor parts missing. The laser could well be o.k., but could it be transferred to the CDM4/20 body? A successful operation took place, and this time the patient didn't die on the table. All was well. Nearly. The TOC was usually read, but sometimes it wasn't. Play was always perfect. It took a lot of head scratching before I found the cause of the problem. The complete CDM2/10 has a Hall-effect motor, whose casing includes a cylindrical plastic magnet. When the radial arm is sent to the innermost disc position in readiness to read the TOC, the magnets in the lens part are attracted by the motor casing magnet and the arm is held there until the TOC has been read. The servo then powers the arm out to the start of the audio track and stays in control thereafter.

The CDM4 mini has a more common d.c. motor however, with no surrounding field. So there's no reason for the radial arm to bother to wait at the inner stop to ensure that the TOC is always read. And so to the bodge. A vacant hole at the opposite side of the radial arm is a convenient home for a ferrite bead measuring about 3 x 5mm and a bit of adhesive to keep it there. A magnet could be fitted at the rear of the rafoc unit's housing, if I could find a suitably small one. A few days previously I'd thrown a dead Sony KSS150 laser unit in the bin. It was rescued and one of the small, flat magnet squares on which the focus and tracking coils expend their energy was brutally removed and then carefully glued in such a position that it would exert enough 'pull' on the ferrite bead to ensure that the radial arm was held at its innermost position for the duration of the TOC reading time. All that I now have to do is to order the power button etc. and then find a willing customer with a few pounds to spare.

Some Technical Details

If any of you think that this sort of transplant might be useful occasionally, here are a few notes I have made while playing about with the CDM2 (CDM2/10 etc.), CDM4 (CDM4/11 etc.) and the CDM4 mini (CDM4/19 etc.).

(1) Most CDM2 decks have Hall-effect motors. Some CDM4 units have Hall motors, others have normal d.c. motors. All CDM4 mini decks have normal d.c. motors.

(2) The disc turntables may be magnetic or have mechanical hold-down. There are different types of mechanical turntable hold-down.

(3) The FPC cable can be long or short.

(4) Some rafocs have a plastic 'bumper' on the swivel (radial arm) moulding. There's a corresponding groove in the main moulding. Incompatibility will occur where this groove is absent.

(5) The radial arm must be hard against the inner stop when the TOC is being read. A method of ensuring this may be required.

Finally, how do these Philips mechanisms work? The more common three-beam system is like a foreign language to most of us: the Philips single-beam arrangement must surely therefore be double Dutch! If you want to find out more, you may be interested in a Philips training aid. A large, zipped plastic wallet is available: it contains a booklet on error correction techniques, another that explains the Philips chip sets, with an update added, information on the I2C system bus, and last but certainly not least an audio cassette that reviews all the bits we need to know. At around £1 it's a bargain. Part no. 4822 737 10157 should identify it to the Philips computer.

The Soap. Episode 4

During the next few months spent on the Isle of Man I learnt a bit about simple computer repair and fixed a few car radios and some other audio equipment. When a couple of CD players arrived I hid in fear, allowing Alan to prove that he did indeed understand compact disc technology.

I returned to the UK about once a month to check on my Valuable Asset, tidy up, cut the grass and so on. During one such visit I found, just as I was about to set off to catch the boat, that rain had leaked into a wardrobe in a bedroom. Assuming that it was simply a loose tile, I rang a pal I've known since we were at Tech together over thirty years ago. He has also escaped from management in British industry, and now earns his daily bread as a bricklayer.

Next month I found that although Graham had removed and replaced a large section of tiles the rain was still getting through. After some investigation we discovered that it was coming through a flat roof some distance away, then running along under the tiles before it appeared in the wardrobe. Another flat roof also looked bad. I had them both relaid, but realised that my VA was in the process of becoming a derelict property. The only sensible tactic seemed to be to move back and live in it again, thereby keeping things warm, dry and under control.

In order to earn some money to keep the expensively suited bank manager at bay, I obtained a job as a commissioning combustion technologist. A little over a year later I found myself redundant. Thoughts of the ESBM stealing my VA were a worry – it happens to many redundant people. Thus an advertisement for an engineer to repair CD players caught my attention and demanded a reply. Admitting my total lack of acquaintance with CD technology apparently failed to act as a disqualification and that, dear reader, is the answer to the question posed by John in the prologue some months ago. An epilogue will follow in due course. But you'll have to wait for that.

Satellite Faults

Reports from John C. Priest and Robert Philpot

Amstrad SRD400

If there's an OSG readout saying that "your card is invalid" when the card is known to be o.k., check the 5V "VCC Card" test point on the VideoCrypt decoder board before condemning the decoder. The test point is just in front of the 10-pin connector CNM1: the supply should switch on when the card is inserted and switch off when the card is removed.

If the supply is missing check whether the 5·6V zener diode DP16 on the main board, close to regulator TP05, is short-circuit. TP05 is visible to the left of the decoder board. If this is not the cause of the problem, check the rest of the "VCC Card" supply components – TP05 (2SD1667), TP6 (2SA933), TP07 (2SC1740), DP13 and 14 (both 1SS133) and DP15 (5·6V zener diode). In most of the cases I've come across however DP16 has been the culprit. **J.C.P.**

Pace PRD800

We were told that this receiver was dead, and so it proved to be on our field call. Instead of the usual major power supply blow up however replacement of the BUT11A chopper transistor and the mains fuse got the box up and running without any problems. A note on the job card said that the power supply had had the usual rebuild/modifications a couple of months previously, so we left the receiver running on test while a couple of other calls were made.

On our return we found that everything was o.k. apart from the fact that the loop-through u.h.f. signal produced a noisy picture. A fault in the satellite receiver's r.f. amplifier was confirmed when we connected the u.h.f. aerial directly to the TV set – the picture was excellent. This led to suspicions that the fault that had given rise to our initial call had been caused by a kiss from one of the recent, frequent thunderstorms here. The PDR800's r.f. amplifier/modulator is built as a component part of the main PCB, all the parts involved being surface-mounted devices. So the receiver was uplifted for repair in the workshop.

When we had it on the bench we first confirmed that there was indeed loss of gain in the r.f. amplifier, then turned our attention to the two amplifier transistors Q10 and Q11. Surprisingly, they were o.k. Moving back towards the u.h.f. aerial input we discovered that the two 12Ω SM resistors R564/566 were open-circuit while D22 (BA519) was short-circuit. Replacing these items restored normal u.h.f. loop-through signals, and after a suitable soak test the receiver was returned to the customer. **J.C.P.**

Ferguson SRV1

My stomach sank when this unit appeared on the bench: maybe it was because we'd sold it only a week before, as our 'reconditioned bargain of the week', after fitting a modified Sharp tuner that had been supplied very promptly by Pace. Here it was back on the bench, producing just an unsynchronised mess on the monitor's screen. Suspicions that the new tuner had failed were discounted when I found that the cartoons and the unscrambled German channels came through loud and clear. So we had a decoder fault – and a very irate pensioner in the shop!

I reasoned – and hoped – that the cause of the unsynchronised picture was failure of the decoder clock. The manual includes the decoder circuit, which I was just about able to decipher beneath the anti-copying lines. I could see that a clock signal passes through the quad two-input nand gate IC13: scope checks showed that there was a good pulse input, but only a mess came out. IC13's type number is not shown on the circuit diagram, and I didn't have a manufacturer's replacement in stock. Only two of the four gates are used however, the others being grounded. A little rewiring sent the clock pulses through the unused gates, restoring a locked picture on Sky Movies. I've ordered a new chip, part no. 80160700, in case my bodge doesn't last. **R.P.**

Marconi BSB LNB

Being on the south coast, we seem to have more than our fair share of French expatriates who watch terrestrial transmissions from 'home'. When the Telecom satellites started to provide signals, we were able to offer them extra channels at a very reasonable price by using modified ex-BSB equipment. This equipment proved to be very reliable – until the summer heatwave that gave rise to masses of "intermittent no signals" calls. In every case the cause was poor joints at the 78M05 regulator in the LNB. Repair involves drilling out the case, resoldering and re-riveting. **R.P.**

Salora SRV1150

It took almost three minutes to tune across the band – if you could keep pressing the button without letting go for this long! The cause of the trouble was the 4016 quad analogue switch chip ICA8. It alters the a.f.c. to change from low- to high-speed scanning, but was stuck at slow.

A no sound fault in one of these receivers was caused by another 4016 chip: ICA3 had failed internally. **R.P.**

Pace SS9000

There was a very nasty type of interference: five or six diagonal lines travelled slowly up the screen. Its cause was not unexpected: the 24V reservoir capacitor C29 (100µF, 35V) had dried up. It's mounted too close to the mains transformer for its own good. **R.P.**

Decca/Tatung 1000 Series

This Astra receiver was brought to the market at great speed and was originally sold at quite a high price. So customers are reluctant to part with them – they seem to be used as spare receivers or in the children's room. Very common faults are overheating, caused by the underrated mains transformer, and a dead set because the 12V regulator has failed. You can't do anything about the transformer apart from keeping newspapers off the top of the receiver. The 12V regulator however can be replaced with a 2A version that runs much cooler.

The no signals symptom is often caused by the TEA1014 switching chip IC203, which fails for its own reasons. If you can't get a replacement, a 4053 works fine. This calls for some rewiring, but the circuit is simple and the diagram is easy to follow. **R.P.**

Test Case 383

The satellite business seems to be perking up, in this neck of the woods anyway. Whether there is a general trend or whether it's due to the special efforts being made here by our shop staff is hard to know for sure. The fact is however that we've had to rig up a mobile satellite service outfit. It's generally operated by Real Technician, in his new guise of Assistant Satellite Serviceman. But as we can't call him ASS it'll have to be RT as ever.

Much of RT's workload consists of dish and receiver installations, jobs done in this area up to now by the likes of Stick-Em-Up Ltd. and Wild West Satellite Co., whose doings were recounted in the August 1990 Test Case. Their charges are high, their standards low, and we found that we were very often paying them to rework their own bounces. Hence the emergence of Test-Case SuperSat.

Climbing ladders and banging in cable clips is only part of RT's workload: repairs and servicing also figure in his daily round. The first two such jobs will be recounted here, to see how many *Television* readers might like to apply for RT's job when he leaves us, as he has sworn to do after his first week on the road.

As with last month's saga, the first story relates to a strange problem with brand-new equipment. Mr. Wickens, a great twiddler and button pusher, had suffered a burglary. His VCR and satellite receiver had been stolen but, for practical and physical reasons, the villains had left his 29in. TV set and the dish on the wall outside. Thanks to the insurance company a new VCR and sat-box, both of JVC manufacture, now stood gleaming in his lounge. They had been brought home and installed by Mr. Wickens himself.

RT and SuperSat Service got involved because the JVC satellite receiver wouldn't tune. It was supposed to be preset to the Astra channels, but they didn't seem to appear when the relevant handset buttons were operated. Undaunted by this, Mr. W had got to twiddling and tuning, searching and seeking. He had found most of the transponders and programmes but, he told RT, the frequency readout was all wrong. He wanted a replacement: the box and packing were ready to be taken away, and great was his ire when our man insisted on checking the gear out on the spot. RT soon had this one sorted out – a new receiver would have done just the same! What was the trouble, and how was it solved?

On then to the second call, to Mrs. Trotter. The picture produced by her Pace SS9200 integrated receiver-decoder (IRD) was reported to be flickering. Mrs. Trotter had disconnected the receiver from the mains, robbing herself of terrestrial reception (via the loop-through) until her husband had plugged the aerial into the VCR directly. When RT had sorted this out he was dismayed to find that the picture was steady and free of flicker. One cup of tea later there was a slight flickering effect with the space-borne pictures. RT took off the top cover and established that a warm blast of air from a hairdryer resulted in more marked flickering. The effect was similar to that produced by very old cine films or an ancient TV receiver with a field-hold problem – the field timebase running at half its correct speed. A substitute receiver produced good pictures, so this looked like a workshop job.

With the IRD on the bench there was again no apparent fault at switch on from cold. But as the IRD warmed up, the picture started to flicker. The flickering became worse when a hairdryer was used to increase the board temperature: bad enough in fact to trip the field hold of the TV set being used as a monitor. When the video output signal was viewed at line rate some sort of hum seemed to be superimposed on it. It was more visible with the scope's timebase switched to the field scan rate. There was no hum on the outputs from the power supply however. So where did it come from?

For the answers to these conundrums, turn to page 48.

Mains Isolation and Workshop Safety

Eugene Trundle

All practising technicians know that for safety an isolating transformer is required at the service and repair bench so that the equipment being worked on is isolated from the live mains potential. The presence of the isolating transformer eliminates the risk of a mains-to-earth shock, but several questions remain. What about test equipment and tools like soldering irons? How should the installation be fused and protected? Is it dangerous to work near earthed metal, such as a radiator? This article aims to clarify the situation and suggest safe working practices and wiring set-ups, based on the Electricity at Work Act, the Factories Act, RETRA recommendations – and common sense! Nick Beer covered the safety testing of appliances and installations in an excellent article entitled the Electricity at Work Act in the September 1992 issue of *Television*. In this follow-up I'll concentrate mainly on the wiring, isolation and arrangement of the repair bench and its immediate surroundings.

Need for Mains Isolation

Although switch-mode power supplies that provide isolation on the secondary side of the chopper transformer have largely overtaken the earlier 'live' TV chassis and there never was a VCR with a live chassis, the need for the mains isolation of equipment being repaired remains. The primary side of the chopper or mains transformer is still very much alive in any equipment, while possible leakage in isolating components and 'man-made' faults can result in the rest of the circuitry being live, with a resultant risk of electrical shock. It must always be remembered that there are still thousands of live-chassis sets around, and that not all sets with a switch-mode power supply have an isolated chassis.

The Mains Isolating Transformer

Because the secondary winding of a mains isolating transformer (ITX) is 'floating', nothing connected to it can pass significant current to earth. Thus the mains live-to-earth shock risk is minimised. There remains the potential hazard of the bench technician completing an internal circuit in the equipment on which he is working, in particular connecting himself across a charged reservoir capacitor or between an h.t. or e.h.t. point and chassis, but this hazard cannot be eliminated – we have to rely on training, knowledge and experience to minimise it. The old "keep one hand in your pocket" rule avoids the risk of a through-the-heart shock, potentially the most dangerous.

Each bench or service station must have its own ITX, and the benches or technicians should be beyond arm's reach of each other, with insulating (e.g. wood or plastic) barriers between each service station when they are arranged along the same bench. An ITX should ideally be rated at 500VA (500W if you prefer the old way of referring to it) or more to provide a good 'stiff' supply with a low source impedance. This caters amply for inrush and surge currents, and avoids spurious effects with certain types of power supply. The low source impedance of a 500VA transformer is also useful when dealing with today's high-power audio equipment, which makes surprisingly high demands on the a.c. mains power supply.

All good ITXs incorporate a metal screen between the primary and secondary windings: it should be earthed at the point where the ITX is connected to the mains. The rating of the fuse on the secondary side of the ITX is a vexing question. It should be 2A to match the transformer's 500VA rating, but this can lead to nuisance blowing. I compromise by using a 3·15A, 250V 20mm time-lag fuse in a fully-insulated (but readily accessible!) holder.

The output from the ITX should be wired to two fully-insulated (plastic) switched 13A sockets (see Fig. 1), one with its earth pin (E) connected to earth and the other with this pin left disconnected. For equipment that's temporarily without its mains plug a third (unearthed) connector of the 'safeblock' type is usually necessary. It should be labelled ISOLATED TEST SUPPLY 500VA MAXIMUM. Only one such connector should be in use at any time, to feed a single item of equipment under test or repair. Use the earthed 13A socket only for gear that has a three-core mains cable, and even then only when the earth line is essential for stable operation – sensitive audio amplifiers and some telephone equipment are possible examples. We'll return to this 'earth-free environment' shortly.

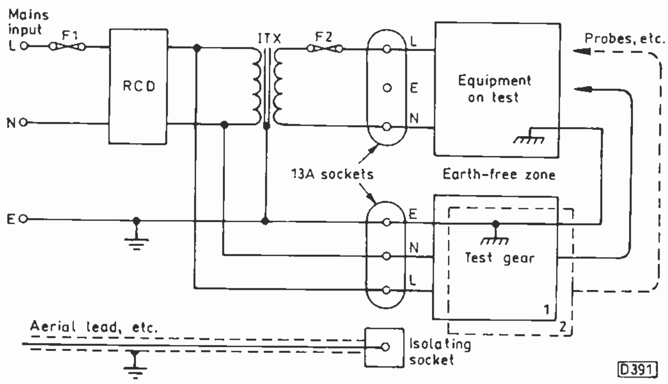


Fig. 1: Wiring arrangements for earth-free zone operation, using a single mains isolating transformer (ITX) and earthed test gear. Contact between the technician and earth (radiators, pipes, the floor etc.) must be made impossible. F1 represents a fuse or an MCB.

The primary winding of the ITX should be connected to the workshop's 240V ring mains supply via its own RCD (residual current device) rated to trip at 30mA/30msec or less and a fuse or MCB (miniature circuit breaker) rated, for use with a 500VA ITX, at 5A. An alternative name in use for RCDs is ELCB (earth-leakage circuit breaker).

At one or more easily accessible places known to everyone who works on the premises there should be an emergency tripswitch (generally associated with the mains RCD, MCB or fuse bank) that cuts off the power to the bench(es) but not the overhead lighting.

Earth-free Zone

To be safe, the casing (which usually means the 0V test line) of all metal-cased test gear must be earthed so that internal insulation breakdown cannot 'light up' the technician. This introduces a new risk: the 0V (chassis) line of the equipment on test (EOT) will become earthed whenever it's connected to such test gear, presenting a shock risk between any live point within the EOT and any earthed conductor in the vicinity. This includes radiators, concrete floors, conduit pipes, water pipes and similar things. Most signal distribu-

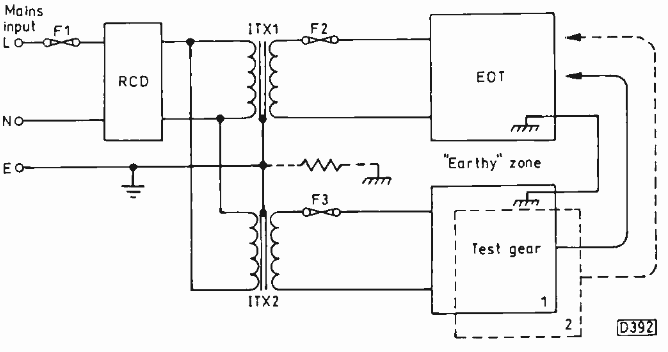


Fig. 2: Use of two isolating transformers means that all conductors at the bench float: thus earthed objects nearby present no shock danger since there is no d.c. return path. It's a good idea to connect a high-value (say 2·2MΩ, 2W) resistor from the chassis line to true earth to prevent the build up of a static charge. It's shown with broken lines here.

tion systems have an earthed screen – they should have in fact, so that they cannot acquire a high potential or distribute interference or radiation around the workshop.

It's thus necessary to ensure that there are no earthed objects within reach of the bench or beyond – to a range of two metres all round. This means the need for non-conductive or covered flooring, walls and bench structures as well as the more obvious things. It also means that the bench aerial socket(s) must be isolating types to BS415/EN60065.

This is what might be called Plan A: the EOT isolated, test equipment earthed and everything within an earth-free zone. Fig. 1 sums this up. With this mode of working you have to be careful not to introduce an earth into the working area. Thus it's dangerous to run a wire from Joe's pattern generator to Pete's bench, or to rig up an electric fire or metal-cased fan when the weather is cold or hot.

It's sometimes not possible or practical to set up an earth-free zone. There may be radiators nearby to supply much-needed heat or a concrete floor that's not easily insulated. In such situations Plan B can be implemented (see Fig. 2). Its principle is that because you may be earthed whilst working, all the equipment (EOT and test gear) floats, i.e. is mains isolated. The ITX that supplies the EOT cannot also feed the test gear, so a second ITX, which can be smaller and cheaper, must be used to feed the test gear, suitably fused. It can share the same RCD. This eliminates the risk that the technician may complete a circuit from a live point within the EOT to earthed surfaces on or near the workbench and is outlined in Fig. 2. Even with this arrangement isolated aerial sockets should be retained and the bench should have a non-conductive working surface.

Tools and Lights

So far we've considered test gear in general – pattern and signal generators, oscilloscopes, vectorscopes, mains-powered frequency and multimeters etc. Some of it, especially modern gear, is double insulated, eliminating any need to worry about the potential of its case and/or the 0V test line. All test equipment and other electrical appliances (including ITXs) must, in accordance with the Electricity at Work Act, be regularly safety tested anyway.

Soldering irons and bench lights should ideally be run from their own low-voltage, isolated supplies via special sockets that you can't plug anything else into by mistake. While the lighting supply for a group of benches or the whole workshop can be a common one, typically at 12V or 24V, each soldering iron should be fed from its own on-the-spot isolating transformer. This is common with the soldering stations now available. Mains-powered soldering irons are not recommended for bench servicing work on consumer equipment.

Static-free workstations for use with CMOS and similar semiconductor devices have been described in these pages several times, so I won't reiterate the details here. From a personal safety point of view the main thing to remember is that to remove static charge you don't have to be earthed 'hard': the earth path can contain a resistor of sufficiently high value to limit even a live-to-earth current to a safe (for people) value. Commercially available wristbands for instance contain a 1MΩ resistor.

Returning for a moment to lighting, if the bench light is a 240V type it should, ideally, be double-insulated. If not, and if it has any exposed metal in its construction, it must either be earthed as part of Plan B or, if it's going to be included in a Plan A earth-free zone, fed from a separate ITX. It's probably better to replace the light with a more suitable type!

Soak Testing

Special isolating precautions are not required for soak-testing benches provided the EOT is not worked on there, its covers remain on and it has been safety-tested in accordance with the Electricity at Work Act. If work is required, the set must be brought back to the proper service bench before it's undertaken.

Safe Working

Although the precautions described so far will minimise the risk of shock to technicians, the ever-present one of getting a belt from within the equipment on which you're working cannot be eliminated. For this reason it's recommended that no one ever works on mains-powered or high-voltage equipment unless they are within the sight and hearing of someone else who can trip the supply, give assistance and raise the alarm in case of an accident. This applies in the field as well, for example in a customer's home, in cases where the key is left for the outside engineer or the customer goes out while the job is in progress.

On the subject of field servicing, the best approach is to have with you and use a portable isolation transformer and a large rubber mat – and use battery-powered test equipment. The difficulty of maintaining servicing safety in a wide range of unpredictable conditions is one of the main reasons for the growing trend to removing equipment to the workshop for all but the simplest repair and adjustment jobs.

Finally a few words on general workshop safety. Always keep handy a fire extinguisher that's suitable for electrical fires, and have electric shock and resuscitation charts clearly displayed near the benches. When handling or transporting a picture tube, use a conductive strap to link its Rimband, e.h.t. cavity socket and outer conductive coating together, and lift it by its bowl, screen down. Before tackling a switch-mode power supply circuit remember to disconnect the equipment from the mains supply and discharge the main reservoir capacitor, using a resistor of say 1kΩ value.

TV Fault Finding

Reports from Chris Avis, K. Wright, Adrian Farnborough, John G. Bennett, Michael Dranfield, David J. Whilding, Keith Evans, John Edwards and Chris Watton

Hitachi CPT2071, CPT2226 etc

Just for a change field collapse with one of these sets wasn't caused by the field output module or an electrolytic capacitor. D601, the field blanking diode connected to pin 9 of IC701, was short-circuit. Yet another 1N4148 was pressed into service and was happy to oblige. **C.A.**

Philips CTX-E Chassis

For persistent line tearing/pulling when showing videos, even on the VCR compatible channel, check the setting of the a.g.c. preset R3144. It might save you a wasted morning! **C.A.**

Sony KV211XMTU (AE1 Chassis)

The whole picture was covered by fine, shimmering horizontal black lines. A scope check on the field output waveform showed that there was a lot of h.f. oscillation present. The 330Ω scan coil damping resistor R544 was found to be open-circuit. **C.A.**

Philips VSS2440 Monitor

This 12in. monochrome unit is part of the Philips Basic Observation System which we purchased recently to improve shop security. It's easy to install and the tiny CCD camera with its wide-angle lens provides Tom and Tony in the back workroom with a perfect bird's eye view of the shop, including the back of my head! Unfortunately two days after we installed it the picture vanished, although sound was still present.

Faced with the choice between a lengthy and expensive return under guarantee or a DIY attempt, I opted for the latter and removed the back. The line output transistor was hot and the line output transformer was also quite warm. Deep in my memory, something stirred. I disconnected the e.h.t. lead from the tube, switched on and with my insulated screwdriver drew from the connector a neat little a.c. arc. Yes the e.h.t. stick, inconveniently burried in the LOPT, was short-circuit – just like the Thorn 1690 chassis of earlier days. Finding an old stock BY176 rectifier (15kV, 2·5mA) in the drawer, I'm afraid I cut the e.h.t. lead near the transformer, soldered and sleeved the diode and restored the picture – so pretend you never read this. . . **C.A.**

Alba CTV55

This set was a nightmare. After defying previous repair attempts elsewhere it landed on my bench with the complaint "no picture". On this model the momentary contacts to bring the set on manually from standby are not in the on/off switch but in a separate button switch just above it. Pressing the mains on/off switch immediately powered the set however, but with no sound or picture! After removing the fusewire that had been soldered across the standby relay contacts and pressing the standby button I found that channels could be tuned in with sound and an on-screen status display. But the only 'picture' that could be obtained, when the first anode control was turned up, was a blotchy coloured one – there was no luminance. (The relay and remote control functions were o.k., so the fusewire remains a mystery.) A common cause of a dark or absent picture with this chassis is an increase in the value of one of the resistors R429 (180kΩ) or R423 (100kΩ) in the beam limiter circuit, usually the latter, but both were spot on.

The luminance signal passes from the video processing chip IC301 to the matrixing circuit on the tube base via the emitter-follower transistor Q303, which is used for blanking purposes. A scope check showed that the luminance signal was not getting through this stage. Various diodes are connected to the base of Q303. When D309 was disconnected normal luminance was restored. The other (anode) end of D309 is connected to the collector of Q304, where the voltage was high because the transistor's base voltage was low. The value of the base bias resistor R366 had risen from 22kΩ to 80kΩ. **C.A.**

Samsung CI338X (P50 Chassis)

Very erratic and sudden tuning drift could be affected by moving or tapping the tuner. But the cause of the fault was elsewhere. The tuning voltage feed from the remote control board comes via a screened lead to connector SN01, one pin of which had a hairline crack around it. Resoldering put matters right. **C.A.**

Bush 2020/2114

There was no channel display and no sound or vision. Brightness could be obtained by slightly advancing the setting of the first anode control. We first suspected the SAA1293 remote control decoder chip, but a replacement made no difference. Subsequently we found that replacing transistor TR2 produced normal operation, though the set failed again after some hours. The final cure was to replace both TR1 and TR2. They are both type BC237, and control the reset action. When tested the original transistors seemed to be perfectly all right. **K.W.**

Toshiba 2939DB

This receiver, with Dolby Pro Logic sound, is a rather imposing set to tackle. The first one to come into the workshop was stuck in standby and refused any command from the remote-control handset. We found that the power supply was producing the nominal 45V output, which it does in standby to eliminate breakdown in the line output stage. Next we checked at the microcontroller chip ICA01 to see whether its 5V supply and 4MHz oscillator were o.k. Both were correct. But the on signal from the chip to the power supply was permanently high: it should go low to switch the set on from standby.

Scope checks showed that there was nothing on the serial data and clock lines. Was the data being shorted out? Resistance checks seemed to indicate that all was well. Further, the data and clock lines are connected to the central bus via the emitter-follower transistors QA12 and QA02, providing a degree of isolation. So with some apprehension we ordered a replacement micro chip from Toshiba. After all a customer who pays £900 for his TV set expects it to be repaired promptly and efficiently, particularly when it's only a few weeks old!

Happily the new chip did provide the answer. And, interestingly, it's a Sony device. **A.F.**

Mitsubishi CT2534TX (Euro 4 Chassis)

Failure of the 0·82Ω protection resistor in the supply to the field timebase is a common fault with this and similar models. This set produced a raster however, but there was no sound or vision. When the tuning mode was selected the green display was at its limit at the right-hand side of the screen. Tuning adjustment enabled stations to be selected, but they couldn't be memorised.

We suspected the supplies to the EAROM chip IC702. The standby power supply provides it with 5V and –30V. The 5V feed was present but not the –30V feed. Not much to check – just a rectifier circuit. The culprit was the standby chopper transformer T951 however. It was open-circuit between pins 4 and 2. **A.F.**

Hitachi C15-P108 (Salora L Chassis)

Since technical advice is no longer available from Hitachi unless you have an account we engineers need all the help we can get in solving some of the more obscure faults.

A C15-P108 portable came in recently with perfect text but the ordinary pictures blanked out. The TDA3301B colour decoder chip was suspected and checks showed that the voltage at pin 31, the black-level clamp, was at 0V instead of 3·5V. We replaced the clamp reservoir capacitor CF07 to no avail, then the chip itself with the same outcome. Further checks showed that the voltage at pin 34 didn't vary when the 220Ω preset PF01 was adjusted. This control affects the luminance contrast level and is part of the RGB drive setting up procedure. It was open-circuit, a replacement restoring the picture.

A fault you get from time to time with these sets is slow start up. The cure is to replace CN10 (1,000μF, 35V) in the power supply. **J.G.B.**

Matsui 1450

At switch on the e.h.t. surged up violently and the X-ray protector within the line generator chip shut the set down. By disconnecting the feed to the line output stage and running the power supply with a 100W bulb as the load we were able to check that the h.t. was close to 160V instead of 107V. The cause of the fault was traced to the 47μF, 25V capacitor that couples the base drive to the chopper transistor. It had dried up.

Q605 (2SA1013), the h.t. supply switch on the secondary side of the chopper circuit, had also been damaged. The set wouldn't go into standby. **M.Dr.**

Sony KVM2120U (BE1 Chassis)

This set led us a bit of a dance. It was dead with only about 25V at the cathode of the h.t. rectifier D604 – the voltage here should be 119V. Not being familiar with these sets I disconnected all the outputs on the secondary side of the power supply and operated it with a 60W bulb across D604 as the load. Still no go. I won't go into the long list of things that were replaced. Just about everything on the primary side of the power supply, also the chopper transformer. There was little left to check, only a couple of capacitors on the secondary side of the circuit. The culprit turned out to be C608, a 680pF disc capacitor that's connected across D604 for protection. It had a leak of about 2kΩ. The lesson to be learnt is that when lifting rectifiers to unload rails don't forget any protection capacitors present. By the way, anyone want a chopper transformer going cheap?! **M.Dr.**

Ferguson 51A3 (TX100 Chassis)

There was no channel display, channel numbers or tuning. We found that the regulated 9V supply to the remote control panel was missing because TR7 (ZTX650) on the main panel had failed. **D.J.W.**

Finlux FN2144

We've had several faults with this model. No sound and vision was traced to the fusible resistor R44 being open-circuit because D20 (BY299) in the power supply was short-circuit.

No sound with ICP2 open-circuit was caused by the TDA4935 sound output chip having failed.

Excessive width, with the width control having no effect, was caused by D28 (BY299) in the line output stage being short-circuit. **D.J.W.**

Ferguson 20H3 (TX100 Chassis)

Intermittent switch off was the symptom with this set. The cause was the M494 chip IC241 on the remote control panel. **D.J.W.**

Ferguson TX85 Chassis

We've had no sound and vision with several of these sets recently. One with remote control had no unregulated 16V input to the 12V regulator because TR902 (ZTX753) on the remote control/sweep tune board was open-circuit. In other sets the 12V regulator IC6 has been dry-jointed or open-circuit. **D.J.W.**

Ferguson TX99 Chassis

There was no sound or vision and a quick check showed that the h.t. supply to the line output transformer was missing. The smoothing choke L21 in the power supply was open-circuit. **D.J.W.**

Ferguson TX100 Chassis

A faulty line output transformer has been the cause of no sound or vision in a number of these sets. You find that the voltage on the 119V line, which feeds the line output stage, is low and that the line output transistor gets very hot. **D.J.W.**

Ferguson TX90 Chassis

There was no sound or vision and the bases, emitters and collectors of the transistors in the boost voltage regulator circuit were all at about 95V. The T9064V line output transistor TR112 was open-circuit. **D.J.W.**

Philips CP110 Chassis

At switch on this set would pulse in and out of standby for up to ten minutes. During this period the audio would also pulse in and out, remaining for progressively longer until the picture appeared and all was well. Voltage checks showed that the outputs from the chopper circuit were all on the low side, though the rectified mains voltage was o.k. Favourite culprits for this type of problem are the TEA1039 chopper control chip and the CNX62 optocoupler, but replacements made no difference.

Attention was next turned to the electrolytics. Be warned! Avoid the practice of bridging any capacitors directly connected to the TEA1039 chip while the set is operating. This will quite likely result in the destruction of the BUT11AF chopper transistor, the TEA1039 chip and other components.

After fruitlessly checking all the electrolytics on both the primary and the secondary side of the circuit we noticed a small subpanel that's not shown in our service data. This board, located adjacent to the chopper transformer, is a modification that provides over-voltage protection associated with the 15V supply. As this is the supply that's monitored for regulation purposes, it seemed logical to suspect that a component on this panel could be the cause of the trouble. A small 100µF capacitor looked a likely suspect, being mounted just a few millimetres away from a large wire-wound resistor. Bingo! Replacing it provided a complete cure. To avoid a repeat performance it's a good idea to fit the replacement capacitor on the print side of the subpanel. **K.E.**

Hitachi CPT1646R (NP84CQ Chassis)

Here's a good one for the unwary. On being called out to retune a customer's TV set and VCR we discovered that the TV set wouldn't search/tune stations. The front panel buttons were found to be misbehaving, which seemed to indicate a system control problem. After checking on the price of a replacement SAA1293H remote control decoder chip we decided to look elsewhere before committing the customer to great expense. Our notes on this model suggested that memory corruption could be the cause of the trouble. An excellent article in the August 1991 issue of *Television* explained how to reprogram the memory. When we carried out this procedure things returned to normal. **K.E**

Philips K40 Chassis with Teletext

The normal off-air picture was fine but teletext was very dim with hardly any contrast. Preset R046 (2·2kΩ) on the text PCB was open-circuit. When this had been replaced the text contrast could be easily adjusted. **J.E.**

Matsui 1420A

This set was dead although the power supply was trying to work. The h.t. was very low and R434 (10Ω, 7W), which is in series with the emitter of the line output transistor, was very hot. When the h.t. feed to the line output transformer was disconnected (pin 4) the h.t. rose to its normal 103V. A new line output transformer restored normal operation. **J.E.**

Harwood CT14

The sound was o.k. but there was a blank screen. When the first anode voltage was increased we saw that there was field collapse. As the supply to the TDA3651 field output chip was o.k. we fitted a replacement. This produced field scan, but it was a third short at both the top and bottom of the screen. After spending a long time checking the components around the TDA3651 chip to no avail we decided to replace the TDA4503 chip, which amongst a multitude of other things provides the field drive at pin 2. Success at last. I noted that the waveform at pin 2 was 2V peak-to-peak: the faulty chip had provided a 1V p-p output. **J.E.**

Akai CT2870

This large set has developed a stock fault. One leg of the PCB-mounted on/off switch becomes dry-jointed and as time passes burning and carbonisation of the PCB occur. The eventual result is the dead set symptom. The switch itself is rarely damaged, so a thorough clean up of the board and switch, followed by resoldering all the switch connections, is all that's required to restore normal operation. **J.E.**

Matsui 1422

This portable was dead. Fortunately the cause was very obvious. C617 (4,700pF, 1kV) in the chopper circuit had split in half. When a replacement had been fitted the set worked normally. **J.E.**

Bush 2114T

These little teletext portables, with a TDA4602 type power supply, are quite often poor at starting. The cause is usually faulty electrolytic capacitors in the power supply. In this particular set however the small choke L801 in the chopper transistor's base drive circuit was intermittent. **C.W.**

Philips CP110 Chassis

The power supply in this set had failed. We found that the fuse was intact and the BUT11AF transistor was o.k. So a check was made at pin 9 of the TEA1039 chopper control chip. The start-up voltage here should be 9V but was only 2V. A new chip brought the set back to life. **C.W.**

ITT Compact 80R 110° Chassis

The electronic fuse in the power supply had operated. Disconnecting the scan coil plug and fitting a 60W bulb between pin 5 of the connector and chassis brought the h.t. back up to about 120V. As is often the case with these sets, the cause of the fault was a defective line output transformer with shorted turns. **C.W.**

Vega 542

The picture displayed by this delightful little monochrome set wouldn't stop rolling. We found that C15 (1μF, 100V) which couples the input to the base of the sync amplifier transistor TR8 had fallen in value to just a few nanofarads. **C.W.**

Hitachi CPT2808 (G7P Mk II Chassis)

This set was dead. The mains fuse was intact but the 3·9Ω, 7W surge limiter resistor R901 was open-circuit. Did it fall or was it pushed? Checks on the rectifiers and the chopper transistor Q901 didn't show any shorts, and there was a high-resistance reading across the mains bridge rectifier's reservoir capacitor. A scorch mark was noticeable on C919 (4·7nF, 1kV) however, and a check showed that it was leaky. It's in the snubber circuit across the chopper transistor. Since we first came across this fault we've experienced it with a number of other sets. A faulty capacitor will give readings of a few ohms to a few hundred ohms. **C.W.**

Matsui 2185

The width was short by about a quarter of an inch at each side of the screen. A check showed that the h.t. was dead on at 110V, so we took a look at the width circuit. Everything here was o.k. Full width was restored when the 1·2nF, 2kV flyback tuning capacitor C428 had been replaced. **C.W.**

Rediffusion/Doric Mk 4 Chassis

This set produced a crinkle-cut picture when cold. It was o.k. when the set had been running for about five minutes. A shot of freezer on 4C6 (1,000μF, 16V) in the power supply proved its guilt. It's the reservoir capacitor for the l.t. supply used by the chopper control circuit, and can also be responsible for the dead set symptom. **C.W.**

Samsung CI5013T

At random intervals the picture would blank, leaving sound and a dark raster. Pressing the text button would bring up a text display, then pressing the return to TV button would restore the picture. The cause of the trouble was traced to the 27MHz crystal on the text panel. **C.W.**

Matsui 2580

A look in the back of one of these sets for the first time can be a bit worrying, as they are full of huge digital chips much like the ones used in some ITT models. The power supply is a fairly basic TDA4601 type however, and this set was dead. After checking some resistors I found that R808 (270kΩ) was open-circuit. When this and the chip had been replaced the set worked normally. **C.W.**

Matsui 2580

The cause of a dull red on the screen with red flyback lines visible in only the darkest areas of the picture was traced to IC101 (VCU2133). **C.W.**

Sony KV2000 Mk II

At first sight this looked like a blanking fault. The top of the picture, to about four inches down, seemed to be dark: then it began to brighten until it became normal. Actually the problem was that the lower part of the picture was too bright, the top part being correct. The cause of the fault was the reservoir capacitor for the supply to the RGB output stages, C827 (4·7μF, 250V). Note that there were different versions of this set, with variations in this area. **C.W.**

ITT 7180

Only a loud white noise came from the left-hand speaker of this stereo set. The APU2470 chip IC3201 turned out to be faulty. It's on the audio/scart panel, next to the h.f. module. **C.W.**

Philips CP110 Chassis

All the remote control functions operated correctly – but only if you stood within two feet of the set. The cause of this was C2967 (100μF, 10V) inside the remote control receiver can. It decouples the supply to the receiver chip. **C.W.**

Long-distance Television

Roger Bunney

Conditions remained very quiet during August. Only one Sporadic E opening was noted, at midday on the 13th, when RAI (Italy) was received on channels IA and IB and Canal Plus (France) was received in channel L3. The tropospheric conditions reflected the less than wonderful weather, with few enhancements. During the middle of the month the Perseids meteor shower produced an increase in Band I signal pings, though nothing has been reported in Band III. It was perhaps one of the worst months I've reported on for some years, though of course many correspondents were away on holiday.

My own holiday was spent in a Devonshire cottage near Coombe Martin. The local TV signals came from Wenvoe and suffered from deep fading at dusk across the sea path. With S4C and BBC Wales offering varying quantities of Welsh programming, the evening entertainment was bleak. I had hoped for some reception from Ireland, having taken with me a Triax active aerial and DX-TV receiver, but the weather was not on my side – despite our being 800 ft up.

Bud Bennet has sent me a copy of the *Gulf News Tabloid*, an English-language paper published in Dubai. The TV listings are interesting, with satellite TV, terrestrial and local MMDS (Bahrain) services. Dubai has a ch. E2 transmitter which was often received in the UK during the most recent sunspot peak. Under Bahrain ch. E55, E57 and E2 transmitters are listed. The latter station is called Ptv2 and transmits mainly Arabic-language programming, from 1200 till close down at 2350 during the dates covered. I'll try to find out more about this transmitter.

Satellite Sightings

Ian Waller (Lincoln Satellite) reports that his revised application for permission to install a largish Band C dish has been turned down by the local planning authority. He is now appealing to the DOE. One tip from his scanning of the far horizons: the 11·525GHz downlink from Gorizont at 53°E often carries the CIS Channel 6 programmes, while out-of-hours a St. Petersburg identification has been seen on colour bars. The C Band uplinks from Rwanda/Zaire to Intelsat at 18°W are in clear PAL and use the identifications SU10007G and G00031G respectively.

There's a new channel, La Television Algerienne, on Eutelsat II F3 at 16°E, frequency 11·678GHz (horizontal). Another new but this time unidentified (so far) signal comes from Telecom 2B at 8°W: the PM5544 test pattern has been seen with the French Telecom scrolling ident from "Sainte Assise".

The NATO airstrike against the Bosnian Serbs in early August led to careful monitoring of the usual uplink frequency via Intelsat at 34·5°W: nothing doing as the link this time was via Eutelsat II F1 at 13°E, in the telecom band.

Intelsat K at 21·5°W is at present the main North Atlantic carrier for news/sports feeds. It's extremely active during the day. The best frequencies to check are 11·532 and 11·559GHz vertical, and 11·472, 11·499 and 11·665GHz horizontal. The satellite also carries pan-European OB sports transmissions.

One of the most interesting satellites for trans-UK activity is the elderly Eutelsat I F4, which is now in an inclined orbit at 25·5°E. Users include Channel 4 with its breakfast offering and several horse racing services, the latter being back-linked to the bookies' feed via 27·5W.

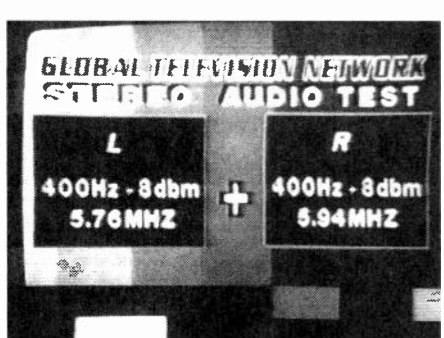
News Items

Ireland: RTE is planning changes to the TV transmission network which at present uses Bands I, III and u.h.f. The third network Telefis na Gaeilge will use u.h.f. exclusively: where new transposers are installed, RTE-1 and -2 will be transmitted from the same mast at u.h.f. The aim is to end the Gort Band I transmissions and reduce the use of Band III, services moving to u.h.f.

Sweden: Two more commercial services, M4 and M5, are being planned and are expected to be in operation some time next year. The existing commercial channel TV4 is planning to launch a second, this time satellite-delivered, service.

Switzerland: The German-language S+ channel is to cease at the end of the year, to be replaced by S4 on January 1st. This will vary its language depending on region. A new ch. E54 service, Hasli TV, is now in operation for four hours a day in Zurich.

Chile: Canal Plus is to start a subscription service early next year, with transmissions initially in Santiago, Valparaiso



Left: The European Parliament feed via Eutelsat II F3 at 16°E, in the telecom band. Centre and right: Test patterns photographed by Andrew Sykes during a recent holiday in Canada.

and Concepcion. A joint venture, Comertel, has been set up with the Chilean company Austral.

Palestine: The Voice of Palestine transmitter is at last in operation, for some four hours a day on ch. E21.

Gibraltar: George Gaskin reports that a weak ch. E3 signal is being seen daily. The transmitter is at Ronda, a small Spanish town high in the hills some 80 miles distant.

Amateur TV: Contest activity in all bands. Autumn Vision 94 November 12th at 1800 GMT till November 13th 1200 GMT; Winter Vision 94 from December 10th at 1800 GMT till December 11th 1200 GMT.

Satellite TV

Intelsat 702 at 1°W has taken over from 512, with more channels and greater signal strength in the UK – TV Norge for example can now be received noise-free in southern UK using a small dish. Sirius at 5°E is now transmitting very strong DBS-band signals tightly beamed at Scandinavia. CNNI has introduced selective Swedish and Finnish subtitling for its services via the Thor satellite at 0·8°W. Scandinavian services, courtesy the *Transponder* bulletin, are at present as follows:

Thor: CNNI 11·785GHz; Eurosport Nordic 11·862GHz; TCC and Discovery 11·983GHz; Fimnet 20·015GHz; MTV Europe 12·092GHz. All RHC polarisation and D2MAC Eurocrypt.

Intelsat 702: TV Norge 11·016GHz (clear); TV3 Norge 11·096GHz; NRK 11·176GHz; TV2 Norway 11·555GHz; TV1000 11·054GHz. All except TV Norge D2MAC Eurocrypt. TV3 Denmark and TV3 Sweden frequencies to be announced later.

Sirius: TV3 Sweden 11·785GHz; TV6 Sweden 11·862GHz; TV4 Sweden 11·983GHz; Filmax 12·015GHz (D2MAC Eurocrypt); ZTV (a music channel) 12·092GHz. All except Filmax RHC polarisation and in the clear.

Tele-X (5°E): Femman 12·476GHz LHC clear. This is not a happy satellite technically.

There are new transmissions from the Middle East. Orbit Satellite Television has introduced six more radio channels, all material being sourced from ABC. Arabsat has bought Canada's ageing Telsat Anik D1 as a stop gap until a new satellite is launched in the spring of 1996. Anik is estimated to have a further three years' life though the on-board fuel will last for only a year, after which the satellite will be in inclined orbit.

Eutelsat has decided to drop digital satellite radio after tests showed that the noise level in many LNBs was too high to support the high-quality, low-noise programming.

When in orbit at 8°W Telecom 2D will be using 11 transponders in the same spectrum as Astra 1B (top end of the FSS band). It's intended for digitally-compressed MPEG-2 transmissions only, with at least 52dB e.i.r.p. aimed at the south of the UK and France.

The Chinese have launched Apstar 1 at 131°E – next to Rimsat at 130°E and the Japanese Sakura 3A at 132°E, so there could well be interference problems. CNN, ESPN Asia, Viacom, HBO, Discovery, TVB and Reuters have all booked Apstar transponders.

Thaicom 1 and 2 are now almost fully booked: owner Sinawatra is to order two more satellites which could come into operation in late 1996.

Getting Started with Satellite Reception

Last month we considered the dish and LNB/polariser. The next thing is choice of receiver. Several factors need to be taken into account: is the receiver to be used for hobby purposes only, or will it also provide domestic entertainment; what can be afforded; and programming/operation complications once you venture beyond Astra.

The first two factors overlap. A tracking dish system that would bring a world of entertainment and education into the home could well be of interest to other members of the household.

Complication is another matter entirely. Modern production receivers can be very time consuming to programme. Most satellite zappers tend to use a single receiver, I suspect not too efficiently. It can take a minute or so to tune across 970-1,750MHz: the Echosphere LT730 for example takes 100secs to tune from 950 to 2,050MHz, so to tune across both the vertically and horizontally polarised channels from a single satellite will take 200secs – excluding use of the telecom band.

The front panel readout must be able to display the frequency that is being tuned, both for the main tuning and audio subcarrier tuning. Beware of tuners that display only a channel number or a ramping voltage: they can be inconvenient.

Though not essential a variable i.f. bandwidth is very useful with weak signals – say 26MHz wide bandwidth, 16MHz narrow. Threshold figures determine the ability to maximise picture quality. I would look for a 6dB figure, which if threshold extension is available should drop to 3-4dB. Audio may also have a variable bandwidth: often receivers have switched 50μs/J17 characteristics with various stereo options. The amount of audio complication relates to receiver cost of course.

Decoder looping is essential. As a very minimum there should be one out/return path but two is better. Such looping will be additional to any built-in decoder, such as VideoCrypt or Eurocrypt options.

Most current production receivers have magnetic output polariser connections, though some imports may have the less convenient three-wire mechanical polariser outputs. With these you can fit an in-line interface box to convert from three-wire mechanical to two-wire magnetic operation.

Not being involved in the retail satellite trade, I can't provide a definitive list of selected receivers. Personally I've used many Echosphere receivers, and apart from the now discontinued LT530 can recommend them. Enthusiasts speak well of the Pace range. The MRD920 is capable of excellent results, is reasonably priced and is available in PAL, D2MAC Eurocrypt or VideoCrypt versions with outboard options for motor controls. Other decoders are available.

The Amstrad SRD550 is still cheaper and is a remarkable receiver, capable of excellent weak-signal performance with variable i.f. bandwidth. It comes fully loaded for the European and Asian channels and has on-screen graphics to provide details of frequency etc. But a word of warning here: on-screen graphics are often shown on an otherwise blank screen, only the strongest signals being seen with inlaid graphics. This is of little use for transponder zapping with weak signals. Raw video less graphics can usually be obtained at a scart output. This is another point that needs to be considered.

Still cheaper and available in the second-hand market is the Uniden UST7007, an early receiver that is well regarded.

My own approach to satellite DXing is to use two receivers, an older manual type and a modern one with remote control (the Echosphere SR1000 and LT730 respectively). These are fed from the LNB via an active splitter. The manual receiver gives rapid tuning – it takes five-ten seconds to tune across the band for vertical polarisation and another ten seconds for horizontal polarisation. An i.f. bandwidth filter in the manual receiver's 70MHz i.f. loop makes it possible to seek out all signals. The modern receiver can be used for frequency logging if required.

Older manual receivers can usually be found at surplus outlets. Satellite dealers are usually only too pleased to part with an otherwise unsaleable trade-in. The Zeta 1000 and SR50 were other popular manual models. Such receivers are still being made and are popular in the developing satellite regions – the Middle East, Asia and Africa. They feature useful controls such as bandwidth reduction. Aerial Techniques import these specialised receivers: few UK dealers can supply the more basic manual units.

I strongly suggest checking the advertisements in magazines such as *What Satellite TV* which have hundreds of ads. for equipment.

Answer to Test Case 383

– see page 39 –

Here are the SuperSat Solutions! Mr. Wickens' problem seemed to be incorrect tuning. You'll recall however that the new receiver was being used with an older dish assembly – all that was left of the outfit after a burglar had made off with the indoor unit. The original LNB was still in place at the focal point of the dish. It had a 10GHz local oscillator – the usual frequency until the latest generation of equipment.

The latest receivers are Astra 1D ready. They are intended to be used with an enhanced type of LNB, i.e. one with a wider bandwidth and a local oscillator that runs at 9·75GHz. Factory programming of the control software is geared to this. While the receiver will work with an older style LNB, the tuning and indicated frequencies will be 250MHz out. All that's required is to use the handset to reprogram the receiver for use with a 10GHz LNB. There's a simple menu choice and the operation was easily carried out by RT. Mr. Wickens continues to twiddle and zap.

Mrs. Trotter's Pace SS9200 IRD was a different matter altogether. No button-pushing software solutions here! To avoid interference problems, an energy-dispersal signal is superimposed on satellite f.m. picture transmissions. It consists of a 25Hz triangular waveform, which the receiver removes by line-rate clamping after the vision detector. The transistor in the clamp circuit, Q23, was faulty. A replacement restored steady pictures.

Test Report: The Ozan Teletest Pattern Generator

Eugene Trundle

There is less need these days for a pattern generator for field servicing than a decade or two ago, when purity and convergence setting up were part of the regular routine with sets and five or six twiddlers were provided for grey-scale adjustment. There are also far fewer decoder adjustments nowadays. Nevertheless the field/installation technician still requires a test-pattern generator to help with fault diagnosis, setting up and testing.

The Ozan Teletest is a hand-held, PAL colour test-pattern generator with a 1kHz audio test-tone facility. It can produce four patterns: a plain red raster for checking purity; 95 per cent saturation (BBC specification) standard colour bars; an eight-level step wedge for grey-scale tracking adjustments; and a crosshatch grid that consists of 17 x 23 white lines on black with black and white border castellations. The audio and video signals are available separately, at standard levels, from phono sockets or together, modulated on to a ch. 36 u.h.f. carrier, from a coaxial socket for connection to the aerial socket of a TV set or VCR.

The unit can be powered by an internal PP3 battery or a mains power unit that comes with it and is included in the price. As supplied, the sound carrier spacing is 6MHz (System I). For use elsewhere in Europe 5·5MHz spacing (System G) is available to order. Likewise EBU and 100 per cent specification colour-bar versions can be supplied if required. There's a brief specification in the accompanying box.

Evaluation

I started my evaluation of the instrument by taking it to pieces to examine its internal construction. Within I found a good-quality double-sided PCB with eleven assorted i.c.s, two crystals and a total component count of over a hundred. Design and construction look reliable and rugged, sufficient to give many years' service. Having made sure that all was present and correct, I got on with testing the unit.

The first thing was to examine the video waveforms. I found that the line frequency was within 2Hz of 15·625kHz, which is very good. The field blanking interval, line sync pulses and colour bars are all to CCIR PAL broadcast standards and, when terminated at 75Ω, the video signal was found to be very close to the specified 1V peak-to-peak.

When a scope was used to examine the 1kHz audio tone it was seen to be very rounded and pure. This is in marked contrast to some pattern-generator designs, which produce a rough approximation to a sinewave derived by simple frequency division from a clock pulse train. A good-quality sinewave is useful, in conjunction with an oscilloscope or even when listening carefully, for locating sound distortion, clipping and similar effects – whether the sound is injected via the u.h.f. tuner or directly into the line input socket. The choice of phono sockets for the baseband output signals is a good one as they interface easily, using commonly-available leads, with the types of AV sockets used in consumer TV and video gear.

Regarding the patterns themselves, the four provided are certainly the most useful ones for testing, diagnosis and setting up. There were no signs of the spurious white or black bars to the left or right of the colour bars and grey-wedge I've seen with some inexpensive generators. A particular virtue of the crosshatch pattern produced by this little instrument is the castellations at the picture borders: they enable picture centring and line phasing checks to be carried out, while the crosshatch itself checks not only convergence but also scan linearity, focus performance and definition.

In field service use I felt very much the need for a protective case: rugged though the housing, switches and terminals are, they deserve protection from the rough and tumble of field service life.

One slight problem did crop up in everyday use: the factory setting of the u.h.f. output is bang on ch. 36. This is of course the one to which all VCRs are preset. The consequence, when feeding a test signal to a VCR with an r.f. link to the TV set, is in most cases a spectacular clash of carriers and thus patterning. The output can be retuned, but you have to break a seal and remove the case to do so. Since satellite receivers are factory-tuned to ch. 38, I would have been happier to have had this little generator preset to ch. 34 – with a small, bung-protected hole in the case to permit easy resetting.

Apart from these minor niggles, I found the Teletest to be handy, useful and trustworthy, with many uses I haven't room to describe here. With respect to value for money, if the unit lasts for ten years its ownership cost is twopence a week. Sounds a bargain to me! This calculation is based on the limited period offer price of £99 plus VAT, to which £2.50 must be added for post and packing.

Availability

The Teletest pattern generator has a one-year guarantee and is available from Ozan, 37 Haviland Road, Ferndown Industrial Estate, Poole, Dorset BH21 7SA (telephone no. 0202 877 270).

Brief Specification

Composite video output: PAL 4·433MHz 95% chroma (bars), 1V p-p, 75Ω.

Audio output: 1kHz sinewave, 1V p-p, 1kΩ nominal.

U.H.F. output: Ch. 36 PAL I, 75Ω (PAL G available as an option).

Sync: 15,625Hz/50Hz fully interlaced to CCIR specification.

Size and weight: 155 x 80 x 40mm, 265g.

Power: 9V internal battery or from mains unit supplied. Operating current 120-140mA.

Toshiba Service Briefs

The following notes are based on information contained in recent issues of the Toshiba Technical Bulletin.

TV RECEIVERS

Model 1720RB

Line tearing after two about hours' use: Q801 (STRD4412) in the power supply can fail because of increased temperature. To confirm, apply freezer and heat. The replacement part no. is 23314510.

Model 2103TBG

No line or field sync: The usual cause is failure of the 5V supply (CCT 5V) to arrive at pin 12 of the teletext module because the 10Ω, 0·5W fusible safety resistor RF80 has gone open-circuit. After confirming that there's no fault in the teletext module replace RF80, using the correct safety type resistor (part no. 24531100).

Models 2112DB 2512DB 2527DB 2539DB 2812DB 2927DB 2939DB 3327DB and 3339DB

Black flashing lines run up the screen. Symptom gets worse as the set warms up: Cause is a temperature sensitive fault in the TA8777N AV switching chip ICV01. To confirm, apply freezer to the chip. If this clears the fault, replace the chip (part no. B0383941).

Model 2500TB

Picture visible for a few secondly only, then goes to blue mute. While the picture is visible the top third of the screen consists mainly of flyback lines and the lower section is stretched out: Cause is increase in the value of R448 from 2·7Ω to around 23Ω, as a result of which the 12V supply to pins 6 and 61 of the TA8659AN colour decoder and timebase generator chip falls to about 8V. R448 is a safety resistor, part no. 4984279. Note that if the audio plug P602 is pulled out the set won't blue mute, so the symptom can continue to be seen.

Vibration from the front of the cabinet: This is caused by the channel and volume buttons rattling against the case. The cure is to refit the button assembly, adding a felt tape along the bottom edge of the cabinet between the cabinet and the buttons. A small length of suitable tape is available from Toshiba's Technical Department on request.

Models 2527DB and 2927DB

Hum from front speakers at low volume (second segment): Cause is hum pickup on the loom. To cure, remove the grey screened lead (with blue sleeve) from the main loom which is positioned across the back terminal PCB. Move the lead, which connects to PA03A, taping it to the top of the PIF can.

Models 2535DB and 2835DB

Set dead. Power supply is in the over-voltage protection mode, with the voltage on the main h.t. rail at 11V instead of 125V: Circuit protector ZP81, type PRF5000 part no. 23144451, is open-circuit. Replace it and check whether any of the following items are short-circuit: IC670 type TA8218AH part no. B0377305; diodes D670-675, all type 1N4148 part no. 23115599.

Note that in the fault condition the voltage at pin 9 of IC801 varies between 5-8V and the output voltage control loop is inoperative as the photocoupler IC826 has no supply.

VCRs

Models V210B and V211B

Machines that have the letter M following the model number are fitted with a new type of head drum. Parts are not interchangeable with the earlier drum.

Model V312B

In the standby mode the clock display goes off, the head drum spins, then the display comes back when the drum stops. The cycle repeats: Cause is poor power supply regulation because of failure of the BCP53 transistor TP91, part no. 70010941.

Models V312B V412B V423B V513B V703B and V813B

All these models incorporate an automatic head cleaner. Replacement of the sponge roller will be necessary from time to time. Its part no. is 70353164 and the present trade price is 48p plus VAT.

Models V800SC and V880MS

No operation (display heaters glowing) or machine completely inoperative: The power supply is in the over-voltage condition, with all power supply output voltages high. The cure is as follows: fit a 100μF, 25V capacitor in position C812; remove C813 and fit a jumper lead in its place; fit a 10μF, 50V capacitor in position C809.

TDA4601 POWER SUPPLY

The August 1994 issue (AH49) of the *Toshiba Technical Bulletin* provides a detailed account of the operation of Toshiba CTV power supplies that are based on the TDA4601 chopper control chip, which has improved switching and better protection than its predecessor type TDA4600. It's also cooler running. The following models use this type of power supply: 255R7B, 255T7B, 256T9B, 284T8B, 285T8B/BU, 1721TB, 2100RBG, 2100RBT, 2100TB5, 2100TBT, 2101TB2, 2101TB5, 2102TB5, 2103TB5, 2103TBG, 2112DBT, 2500TBT, 2501TB2, 2512DBT and 2812DBT.

Points of interest are as follows. The chip goes into the over-voltage mode when the voltage at pin 3 (error sensing) exceeds 2·3V. The mark-space ratio of the chopper drive waveform then becomes 244 (off time) to 1 (on time).

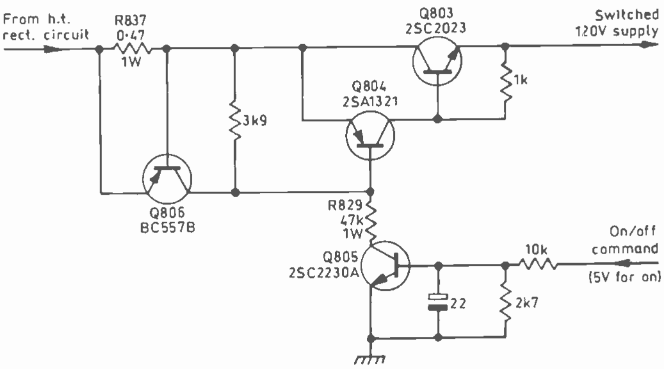


Fig. 1: Standby switching circuit used in Model 2100TBT. The circuit incorporates current limiting.

Under excess-current conditions the ramp waveform at pin 4 reaches an amplitude of 4V and the mark-space ratio of the chopper drive is 13:1. In the event of a short-circuit across the h.t. line on the secondary side of the chopper circuit the power supply simply squegs quietly. The TDA4601 chip consumes typically 135mA. The voltage at pin 9 (supply) is approximately 9V in the start-up state and 16V under normal running conditions. It must reach 6·7V for the chip to start up. The chopper frequency varies between 20-70kHz according to load.

Associated Circuitry

For standby operation with this type of circuit Toshiba incorporates a switching transistor in series with the h.t. line. Circuit details vary with different models. Fig. 1 shows a typical example, used in Model 2100TBT. The on/off command from the microcontroller chip is fed via an inverting transistor to the base of transistor Q805 which switches on to bring the set out of the standby mode. Q804 and the series switching transistor Q803 in turn switch on to apply power to the line output stage.

Current limiting is a feature of this circuit. Transistor Q806 senses the current flowing via R837. At 1A the

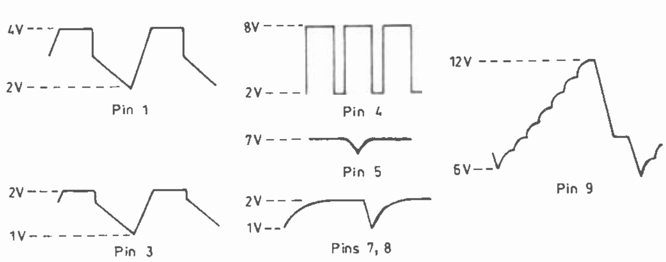


Fig. 2: Waveforms around the TDA4601 chopper control chip with the drive to the chopper transistor shorted out by linking its base and emitter together.

voltage developed across R837 is roughly 0·5V. An increase in the current will increase the voltage across R837 with the result that Q806 switches on, shorting together the base and emitter of Q804 which then, along with Q803, switches off. In this way the h.t. current is limited to 1A. In some models a second transistor senses the voltage developed across the resistor in the equivalent position to R837, removing the line drive via the X-ray protection circuit in IC501 (pin 52) in the event of a high h.t. condition.

The 2112/2512/2812DBT range incorporates additional circuitry, centred around a multivibrator, to increase the width of the drive pulses to the chopper transistor in the standby mode. The circuit consists of seven transistors (Q810-13 and Q815-17), an optocoupler plus various resistors etc. It ensures that the chopper transistor switches on and off reliably in the standby mode, improving the reliability of the circuit.

Fault Finding Hints

As an aid to fault finding the power supply can be operated with a 60W bulb as the load, with the feed to the line output stage disconnected. If the set is dead, a check on the voltages at the collector and emitter of the transistor in the Q803 or equivalent position will quickly prove whether the fault is in the remote control section of the set or the power supply. Remember that the remote control system switches only the 120V (or 145V, depending on tube size) rail: all the other power supply outputs will be present as long as the set is plugged in and switched on (this does not apply with the 285T8B/BU however).

The TDA4601 chip can be checked as follows. Short-circuit the base and emitter of the chopper transistor. The waveforms shown in Fig. 2 should be present at the specified pins of the chip. If they are all correct the chip and the components immediately connected to it are usually o.k.

Adding Extra LNBs

Bian William Ewan

Provided the satellite positions are neither too close nor too far apart it's possible, by mounting an extra LNB on the support arm, to use a single offset-focus dish to receive signals from two satellites. For example signals from Eutelsat II F1 at 13°E can be received using a dish aimed at the Astra position (19·2°E). The principle can be extended, with three LNBs mounted on the support arm.

A Second LNB

We'll assume that you wish to add an extra LNB to an Astra installation to receive Eutelsat II F1. It's important to avoid any alteration to the existing dish position. Remember also that working on a ladder is inherently dangerous. The greatest care should be taken to avoid accidents.

Fig. 1 shows the general arrangement. You'll need the following to add a second LNB:

4 support arm clamps
2 LNB clamps
2 through bolts
4 nuts and washers
1 long LNB support arm clamp bolt
1 cross-head LNB clamp bolt
2 nuts and washers for the above.

Proceed as follows:

(1) Fit a nut and washer to one end of each of the two threaded through bolts. Slide two clamps on to the bolts to form the new arm support – the curved ends should face each other.

(2) Slide a third clamp on to the bolts, with the curved end away from the two clamps already fitted.

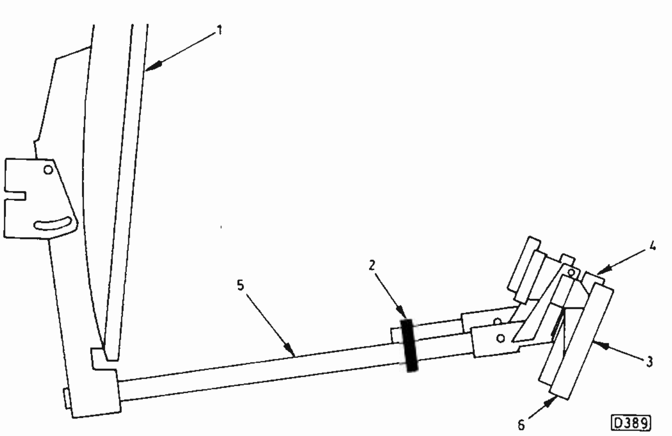


Fig. 1: Offset-focus dish with a second LNB fitted. 1 dish; 2 support arm clamp for second LNB; 3 original LNB; 4 position of extra LNB; 5 main tubular LNB support arm; 6 LNB lip used as support.

(3) Position the third clamp against the existing LNB support arm. Slide the fourth clamp on to the remaining lengths of the two bolts.

(4) Fit the washers and nuts to the through bolts. Don't tighen them at this point.

(5) Fit the LNB clamps around the neck of the second LNB. If in doubt about this, refer to the existing LNB. Feed the cross-head bolt through the top of the clamp. Fit nut into the nut recess and tighten.

(6) Slip LNB clamp on to support arm and feed bolt through hole. Fit washer and nut then tighten.

(7) Slide LNB and its support arm into the clamp assembly just fitted to the existing dish support arm.

(8) Position the second LNB to the left of the existing one, as viewed from the dish, so that the blue cap is sitting in front of the existing LNB. The back of the cap should just touch the front of the existing LNB cap.

(9) Slide new arm support clamps to about half way along the new support arm, keeping the new LNB in the position just established.

(10) Lower the front of the new support arm so that the new LNB sits slightly higher than the existing one.

(11) Tighten the nuts on the support arm clamps to secure the LNB in this position.

(12) Fit new cable run or fit a masthead switch and use the existing cable for both LNBs.

(13) Tune in additional channels. Euronews is at 11·575GHz (V) for example, Eurosport at 10·972GHz (H), MTV Europe at 11·658GHz (V) and Super Channel at 10·978GHz (V).

Alternative Arrangements

Fig. 2 shows various alternative arrangements. The addition of a second LNB as just described is depicted at (a). Where reception of the extra satellite is weak the arrangement shown at (b) may give better results. Mount the second LNB to the right of the original one. Align the dish so that the original LNB receives Eutelsat II F1 then adjust the added LNB for Astra reception.

Fig. 2 (c) and (d) show three-LNB arrangements, the idea being to receive signals from Eutelsat II F4 at 7°E as well. In this case you'll need two more support arm clamps, two more LNB clamps, another long LNB support arm clamp bolt and cross-head LNB clamp bolt and two more nuts and washers. Pre-assemble the LNB support arm then fit by slipping the additional LNB support clamps on to the end of the through bolts. Put the new support arm in place. Again remember to keep the added LNB slightly in front of the original one, using the small lip near the bottom of the original LNB to support the rear corner of the lip of the new one.

Dish realignment will be required. Select a channel allocated to one of the transponders at 13°E. Loosen the large single bolt that runs down through the adjustment bracket. Move the dish to the right, slowly, observing the results on

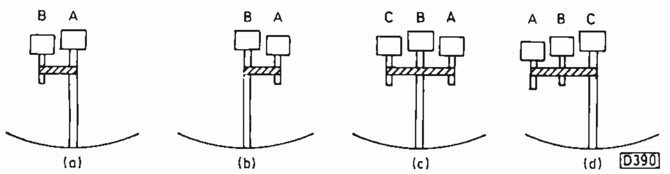


Fig. 2: Alternative arrangements when adding two/three extra LNBs. A LNB for Astra (19·2°E), B LNB for Eutelsat II F1 (13°E), C LNB for Eutelsat II F4 (7°E).

a monitor – or have someone do this for you. Once the signal has been found, some slight left-right adjustment might be necessary to obtain the best results on all channels. Do not adjust the up-down position of the dish. Tune in signals from Eutelsat II F1 and F4 as required.

Finally, it's possible to use two LNBs to receive Eutelsat signals from 7°E and 13°E. Or, with careful adjustment, to align the dish so that the original LNB receives signals from Eutelsat II F2 at 10°E and the added LNB, on the right as shown in Fig. 2 (b), receives Astra signals.

Letters

ADVICE TO NEWCOMERS

To work in the radio and TV trade in the Fifties, Sixties and Seventies was intersting and satisfying. There was some rubbish around of course. But to the customer it was their pride and joy. TV sets were expensive, and repairs were priced accordingly. Many retail shops that sold these products had their own service department. Spares were usually available off the shelf, and were common to many makes. Service information was readily available, and manufacturers were helpful when there was a problem. Component companies sent reps around frequently to prompt orders.

The mid-Eighties saw the start of the trade's decline, though VCRs and then video libraries produced a boost. Then shops started to close down, manufacturers became reluctant to stock spares for products even five years old and component companies made their reps redundant. The lower price of new TV sets and VCRs led to cheaper and uneconomic repairs. Some service manuals are, when available, too expensive for a one-off repair, and some manufacturers are no longer helpful. The rising cost of overheads and the lower replacement price of new equipment mean that a lot of work is required to bring in a reasonable wage.

Large service companies linked to large retail/rental/discount organisations are probably the safest bet for the newcomer to the trade, and possibly also for customers. The self-employed working from home will get some business but will be regarded as being a part timer, the customer expecting to pay him less than 'shop prices'.

The key to success in this business is to have some capital, shop premises in a good location and a good range of reconditioned colour TV sets and VCRs. A good working knowledge of servicing a large range of products is also necessary. Ideally you'd be a young but not inexperienced person prepared to work hard for long hours against stiff competition from the discount houses etc. and the cowboys who can charge £25 for changing the video heads and carrying out a full VHS machine service.

Do not borrow money to start your business, otherwise you'll be working for the bank. The tax man will take a fair chunk of your income and so will your accountant. Rates and the rent/mortgage payments for the shop premises will relieve you of another large lump. Telephones, stationery etc. some more. In this era of vandalism and burglary, security and insurance will be costly. When your turnover reaches the VAT level you will have to register. That will mean charging an extra 17·5 per cent more for your repairs than the chap who works part time from home.

If you can handle all this, with a regular turnover to cover all overheads, tax etc., and still have enough to pay yourself a reasonable wage with some money over to invest in your business, then go ahead. Don't forget the 'closed' period for holidays etc.: you will have to cover the cost of this from your open times.

Believe me, I would be the first person to rejoice if TV/video repair shops made a comeback, with good honest competition.

Eric Edwards,
Barry, South Glamorgan.

COWBOY STUDENTS?

There have been many letters in your pages about cowboys. As a mature student with a family, studying for the City and Guilds 224 electronic servicing certificate on very little income, I am constantly looking for work within this industry – and find it very difficult. To supplement my income in order to support my dependants I install satellite equipment for family and friends etc. and also do small repair jobs on TV sets, VCRs and so on. When I say "small" that's what I mean, i.e. belts, heads etc. I would never dream of undertaking a large or complicated repair, because I have neither the knowledge nor practical experience – which I feel is more important than the qualification.

Every one of my fellow students supplements his income in this way. Probably every service engineer who started at college had to do the same thing.

Would I call myself a 'cowboy'? I think not. I'm simply a hard-working student trying to gain my qualification and some practical experience with very little money.

David Jones,
Bury, Lancs.

WE ALL NEED HELP

I was pleased to find that there are still companies out there who help us in this game. Without help from Toshiba Technical one of their sets would still be on the workbench. It's nice to know that when I sell Toshiba products I get Toshiba Technical help. I've had to stop selling the products of several manufacturers who won't provide technical data.

May I also mention Willow Vale's technical information man Alan Dyson? If you've an account with WVE, all technical help is free and covers most makes. Thank heavens for Toshiba, Panasonic, JVC and all the other companies who provide technical back-up – and let's not forget Alan Dyson.

M. Cordner, M & M Videos,
West Norwood.

BACK INJURIES

I wish to make available to all in the trade the full ergonomist's report on back trouble caused by lifting TV sets. It states in simple English why no one should lift a TV set on his own. The law is on the side of the employee in this matter: you don't have to lift a TV set on your own without help or one of the aids available for the purpose.

I can supply the eleven-page report at £25 a copy. It will be sent direct on receipt of a cheque payable to H.J. Todd. Solicitors acting for an injured person will be supplied.

Harry Todd, c/o 12 Oakhurst Close,
Snaresbrook, London E17 3PZ.
Telephone 081 520 8003.

A WARNING

In February we received from the Edinburgh area an Amstrad PCW9512 that suffered from intermittent crashes. As with so many similar faults in the 8000/9000 range, the cause was the usual dried-up reservoir capacitor in the 5V supply. The customer sent a cheque to cover the repair plus return carriage, which was done by a well-known intercity courier.

The customer subsequently called to say that when he opened the package the computer's case was broken and it didn't work. We contacted the courier who said that they had a clean signature for the package. We were nevertheless asked to examine the computer and provide a repair estimate which would be passed to the insurers.

The damage was consistent with the computer having dropped on one corner from a great height. We sent our estimate to the courier.

There followed a demand from the insurers, via the courier, for a copy of the original receipt. We contacted the customer, who supplied the information.

A 'without prejudice' offer of 50 per cent of the estimate was sent to us. So we telephoned the courier to point out that the matter was really between them and the customer. We were only 'piggy in the middle' so to speak.

Wrong! We had asked the company to return the goods, so the contract therefore exists between us and them. Furthermore couriers provide liability insurance that's calculated at so much per kilo regardless of the contents. If a clean signature exists, the onus is on the claimant to prove negligence.

So we had to accept or get involved in a no-win legal battle. The cheque was received in the middle of August!

There are two lessons. (1) Let your customers arrange their own transport. (2) Always write 'unexamined' under your signature when accepting a package.

Gus Cusick,
Preston, Lancs.

A SIDELINE

For the last four years we have been carrying out Safety and Function tests on behalf of a local second-hand business. Anything electrical or electronic that they buy at auction is brought to us before being put up for sale. We inspect the item, repair it where necessary to make it safe, carry out the approved tests and make sure that the thing works as it was designed to do.

The horrors exposed by this sideline have been an eye-opener to myself and everyone else here. Why there aren't more fires and deaths from electrocution I will never know. Truly some people's guardian angels must be on overtime.

The table lamp with damaged flex and a single-pole in-line switch in the neutral side of the supply is only par for the course. Fuses are made from tin foil and in one case we found a one-inch nail. Cable clamps? "Oh, so that's what the thingy with the two screws is for!"

We've had a spate of plug wiring faults recently. I find it difficult to imagine the sort of mind that will make the connection to the neutral side by pushing the pin up, inserting the wire so that it's trapped between the pin and the side of the plug when the pin is pushed down again, then taking the lead across the top of the pin to where it should have been to start with. The practice of supplying leads with equal lengths of earth, live and neutral wires, all carefully tinned, is thankfully no more. It merely made the more naive amongst the populace fold all this excess wire into the plug. This ensures that the plug manufacturer's careful safety design is totally nullified, since in the event of the cable clamp losing its grip the live instead of, in a correctly wired plug, the earth connection will be the last one to break.

How about an electric iron with bare wires in a lead covered with Elastoplast and Sellotape? Or the very nice 3kW, two-bar fire that had been in daily use until the death of its owner, from natural causes we were surprised to learn, a week previously: the lead was so old that when it was moved the rubber insulation showered from it like sand, leaving bare, very tarnished wire.

We occasionally come across a real beauty. For example a very clean, new-looking microwave oven. It was perfect except for the fact that someone had parked his spurs alongside and replaced the three-core lead with a two-core one, leaving the chassis and case unearthed.

The worst excesses seem to occur in the white goods field. This is perhaps because things stay with the family for so long, and there's always the relative or friend who knows all about electricity and won't charge half as much as 'them down the road'. Brown goods seem to be relatively free from real nasties. The occasional badly-wired, cracked or damaged plug is about average, though we get the odd VCR that has had WD40 squirted into it before being hurriedly sold to our second-hand dealer.

If anyone feels like getting involved in this type of work, there are a few principles that should be followed. First, always start with the mains plug. Look inside it. You never know, the live and neutral leads may be crossed or there may be part of a six-inch nail acting as a fuse. Secondly, check the lead. Ask yourself whether it should be a three- or two-core cable? Has the proper one been replaced with a lighter type? Thirdly, once you are satisfied that the plug and the lead are o.k. open the thing up if possible and inspect the interior thoroughly before you start your safety tests. Don't forget to use your nose. It will detect WD40 and the like even where no visible trace of it remains.

Always remember that you are engaged in a contest with Wild West Repairs Unlimited, and that they will get you if you don't keep your wits about you. And always use an isolation transformer when applying power for the first time. After all you don't know where the equipment has been, and have no idea of its history.

I hope that I've not made it sound too fraught. You just have to be careful. It's then a steady little earner.

P. D'Alquen,
Pickering, N. Yorkshire.

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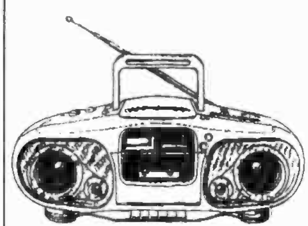

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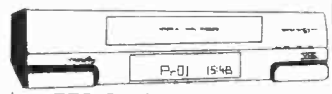

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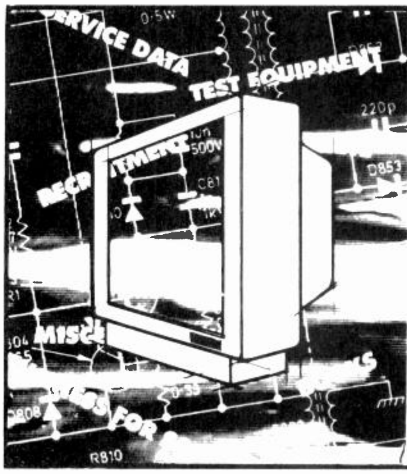

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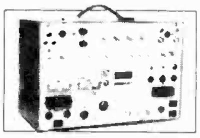

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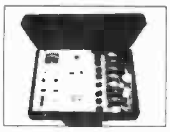

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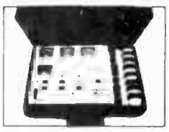

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