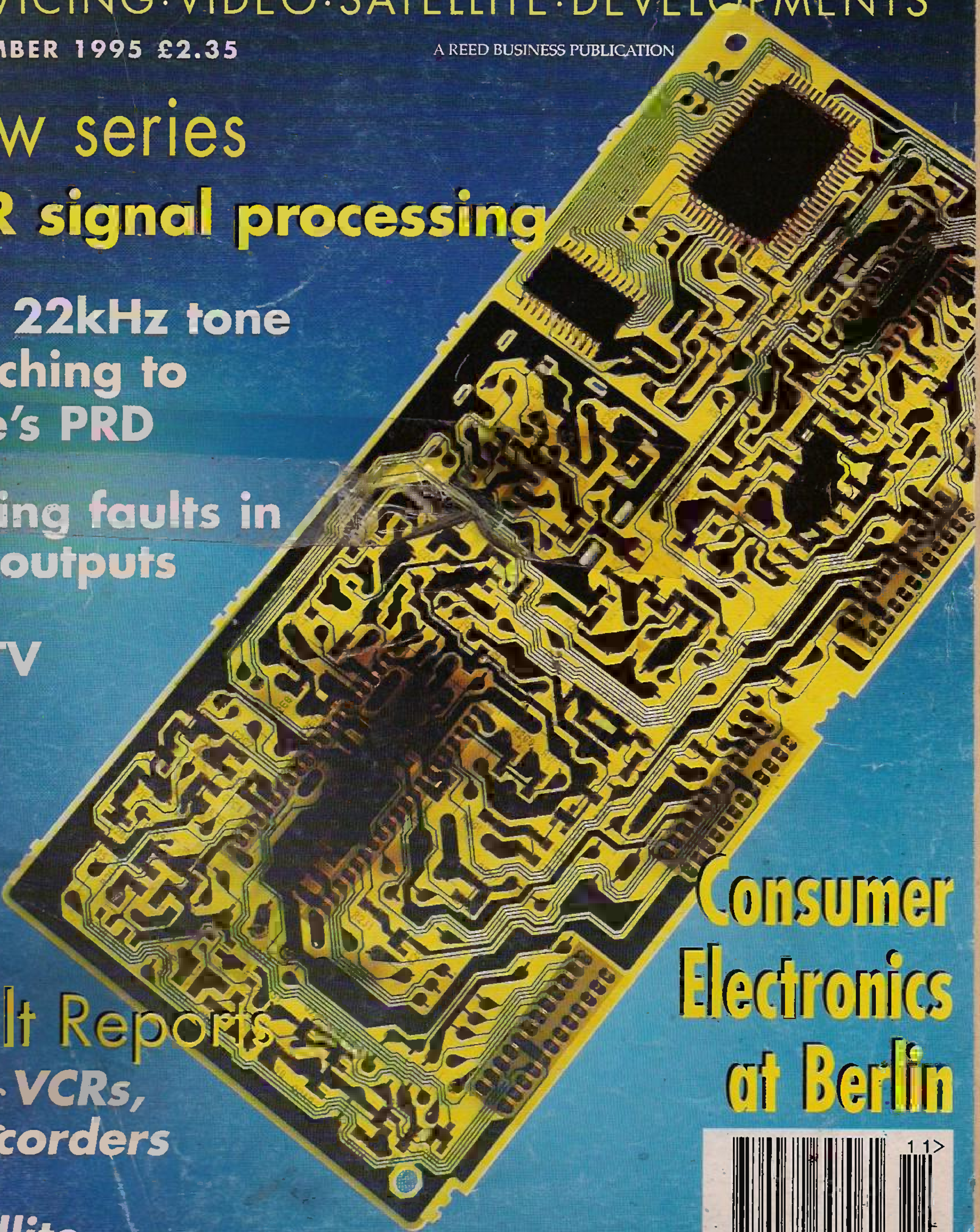
THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

NOVEMBER 1995 £2.35

A REED BUSINESS PUBLICATION



New series
VCR signal processing

Add 22kHz tone switching to Pace's PRD

Finding faults in line outputs

DX TV

Fault Reports
TVs, VCRs, camcorders and satellite

Consumer Electronics at Berlin

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TELEVISION

November 1995
On sale
October 18th

Vol. 46, No. 1

Issue 541

REGULAR FEATURES

The December issue will be published on November 15th

CORRESPONDENCE
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Indexes for Vols. 38 to 44 are available at £3.50 each from Video Interface Products Ltd., who can also supply a seven-year consolidated index on computer disc. For further details see page 55.
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Annual subscription rates (inclusive of postage) are as follows: UK £26.00; overseas £30.00 (airfreight); Europe £37.00 (airmail); rest of the world £48.00 (airmail). Send orders with payment (make cheques payable to Television) to Television, Subscriptions Dept., PO Box 302, Haywards Heath, West Sussex RH16 3YY (UK). Telephone 01444 445 566.

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NEWSAGENT DISTRIBUTION
Enquiries 0181 652 8171, fax 0181 652 8997.
Distributed by Marketforce (UK) Ltd., 247 Tottenham Court Road, London W1P 0AU. 0171 261 5555.

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LM741MET	45p
LM747	55p
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LM1894N	200p
LM3900	40p
LM3909	100p
LM3914	160p
LM3915	160p
LM3916	270p
L200	200p
M491BB1	500p
M494B1	700p
M50115P	320p
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NE565	110p
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STK439	500p

Part	Price
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STK463	950p
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STK501	550p
STK561	450p
STK563	415p
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STK760	600p
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TDA8178	400p
TDA8185	300p
TDA8190	200p
TDA8191	425p
TDA8192	275p
TDA8196	150p
TDA8214B	225p
TDA8215B	300p
TDA8303	350p
TDA8304	600p
TDA8305	500p
TDA8340	200p
TDA8341	250p
TDA8380	200p
TDA8390A	650p
TDA8405	550p
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TDA8245	500p
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TDA8433	600p
TDA8440	300p
TDA8442	200p
TDA8443	350p
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TDA9045	400p
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TDA9503	150p
TDA9513	300p
TEA1002	650p
TEA1007	120p
TEA1009	100p
TEA1017	280p
TEA1019	130p
TEA1024	150p
TEA1045	300p
TEA1060	225p
TEA1067	150p
TEA1080P	170p
TEA1087	40p
TEA1101	425p
TEA1330	65p
TEA1511	150p
TEA2000	275p
TEA2014A	80p
TEA2018A	200p
TEA2114	200p
TEA2117	450p
TEA5114A	200p
TL431	45p
TL061	40p
TL064	80p
TL071	38p
TL074	80p
TL083	55p
TL084	70p
TMS1000-041	400p
TMS1000NLPM	200p
TMS100-233	400p
TMS1024	300p
TMS1025	350p
TMS3617NS	350p
TMS3701BN	300p
TMS3712	350p
TMS3891	550p
TPU2732	1200p
TPU2735	900p
U111B	250p
U211B	300p
U254B	150p
U318M	350p
U321M	450p
U329M	350p
U338M	300p
U420B	70p
U427B	70p
U664B	175p
U2401B	125p
U2829B	130p
U4606B	600p
UC3842N	125p
UC3844	100p
ULN2002	70p
ULN2003	69p
ULN2068	270p
ULN2804	170p
UPC20C	220p
UPC554	130p
UPC555	80p
UPC556H	80p
UPC571	220p
UPC574	80p
UPC575C2	90p
UPC577	64p
UPC592	95p
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UPC596	190p
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UPC1016	170p
UPC1020	200p
UPC1023	80p
UPC1025	230p
UPC1026	95p
UPC1028	90p
UPC1031H	150p
UPC1032	60p

Part	Price
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UPC1186	80p
UPC1187	150p
UPC1188H	350p
UPC1197	140p
UPC1198H	200p
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UPC1225H	220p
UPC1230	200p
UPC1238	120p
UPC1270H	250p
UPC1274V	250p
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UPC1288V	230p
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UPC1370C	300p
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UPC1423CA	550p
UPC1470	200p
UPC1488H	150p
UPC1505C	400p
UPC1514CA	200p
UPC1515CA	250p
UPC1520CA	250p
UPC1536C	550p
ZN423	100p
ZN424	100p
ZN425	320p
ZN426	280p
ZN427	580p
ZN429	215p
ZN459	190p
ZN1040	640p
ZNA134H	2150p

JAPANESE TRANSISTORS

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2SA505	120p
2SA509	35p
2SA537	170p
2SA544	650p
2SA550	150p
2SA562	30p
2SA571	650p
2SA603	100p
2SA606	200p
2SA608	15p
2SA614	150p
2SA634	50p
2SA636	50p
2SA640	60p
2SA642	50p
2SA673	15p
2SA677	35p
2SA678	28p
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2SA699	100p
2SA708	240p
2SA711	280p
2SA715	50p
2SA719	50p
2SA720	20p
2SA725	80p
2SA726	20p
2SA733	15p
2SA747A	425p
2SA748	80p
2SA764	200p
2SA769	80p
2SA770	200p
2SA771	90p
2SA777	35p
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2SA907	650p
2SA909	500p
2SA913	100p
2SA916	30p
2SA921	40p
2SA933	30p
2SA934	30p
2SA935	40p

Part	Price
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2SA950	18p
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2SA953	60p
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2SA1009	200p
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2SA1321	80p
2SA1329	200p
2SA1346	20p
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2SA1356	100p
2SA1358	130p
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JAPANESE TRANSISTORS

Part	Price
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2SA1386	400p
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2SA1489	300p
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2SB647	20p
2SB648	45p
2SB649	35p
2SB688	90p
2SB703	90p
2SB705	200p
2SB707	200p
2SB716	20p
2SB718	60p
2SB727	200p
2SB754	80p
2SB755	310p
2SB772	25p
2SB774	50p
2SB775	100p
2SB791	280p
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2SC496	25p
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2SC515	100p
2SC535	30p
2SC536	20p
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2SC605	100p
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2SC641	80p
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2SC647	300p
2SC681	250p
2SC683	35p
2SC708	100p
2SC710	15p
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2SC761	110p
2SC762	150p
2SC783	85p
2SC790	50p
2SC792	380p
2SC805	225p
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2SC870	100p
2SC898	275p
2SC930	15p
2SC941	15p
2SC943	160p
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2SC945	10p
2SC950	40p
2SC959	225p
2SC980	40p
2SC982	20p
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2SC1000	20p
2SC1001	950p

Part	Price
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2SC1346	100p
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2SC1393	20p
2SC1394	15p
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2SC1400	50p
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2SC1413	150p
2SC1419	50p
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2SC1674	15p
2SC1675	90p
2SC1678	80p
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2SC1684	30p
2SC1685	30p
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2SC1829	500p
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2SC2061	75p
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2SC2237	540p
2SC2238	45p
2SC2240	15p
2SC2258	30p
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Part	Price
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2SC2278	70p
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2SC2291	40p
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2SC2484	185p
2SC2491	200p
2SC2495	1900p
2SC2498	50p
2SC2500	25p
2SC2502	200p
2SC2519	60p
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2SC2654	180p
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2SC2656	550p
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2SC2738	200p
2SC2740	450p
2SC2749	350p

Part	Price
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2SC2785	60p
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2SC2834	400p
2SC2837	250p
2SC2839	40p
2SC2853	70p
2SC2877	120p
2SC2878	20p
2SC2879	3200p
2SC2883	60p
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2SC2899	50p
2SC2909	60p
2SC2911	80p
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2SC2938	235p
2SC2939	400p
2SC2944	300p
2SC2958	50p
2SC2962	800p
2SC2979	160p
2SC2987	250p
2SC2988	150p
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2SC2999	50p
2SC3001	1400p
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2SC3075	150p
2SC3077	120p
2SC3086	150p
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2SC3122	50p
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2SC3150	125p
2SC3151	230p
2SC3152	130p
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2SC3259	350p
2SC3260	220p
2SC3261	230p
2SC3262	280p
2SC3263	280p
2SC3264	390p
2SC3269	50p
2SC3270	50p

Part	Price
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2SC3281	200p
2SC3284	600p
2SC3293	85p
2SC3298	50p
2SC3299	120p
2SC3300	400p
2SC3303	100p
2SC3306	130p
2SC3307	800p
2SC3309	150p
2SC3316	280p
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2SC3323	480p
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2SC3447	200p
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2SC3659	600p
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2SC3680	380p
2SC3685	450p
2SC3687	600p
2SC3688	550p
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2SC3715	480p
2SC3717	120p
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2SC3783	300p
2SC3787	100p
2SC3789	75p
2SC3790	120p
2SC3795	175p
2SC3798	220p
2SC3807	120p
2SC3811	80p
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2SC3833	250p
2SC3853	220p
2SC3854	250p
2SC3855	220p
2SC3857	500p
2SC3858	550p
2SC3870	200p
2SC3883	280p
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2SC3886A	400p
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Part	Price
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2SC3953	60p
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2SC3987	220p
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2SC4006	100p
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2SC4056	350p
2SC4106	200p
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2SC4124	250p
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2SC4301	550p
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2SC4769	300p
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2SD787	20p
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2SD789	20p
2SD792	400p
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2SD820	250p
2SD821	550p
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2SD836	60p

Part	Price
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2SD838	300p
2SD841	110p
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2SD866A	140p
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Part	Price
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Part	Price
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2SD1939	75p
2SD1941	500p
2SD1959	280p
2SD1961	50p
2SD1978	50p
2SD1984	450p
2SD2012	50p
2SD2125	225p
2SD2333	300p
2SJ48	425p
2SJ49	425p
2SJ50	425p
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2SJ74	60p
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2SJ76	220p
2SJ77	350p
2SJ79	225p
2SJ103	75p
2SJ108	60p
2SJ115	525p
2SJ117	550p
2SJ119	700p
2SJ161	650p
2SJ162	680p
2SK19	45p
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2SK49	50p
2SK55	100p
2SK68	100p
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2SK176	800p
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2SK415	500p
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2SK555	400p
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2SK566	475p
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2SK725	600p
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2SK735	600p
2SK758	300p
2SK787	900p
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

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REPLACEMENT VIDEO HEADS

Model	Price
AIWA	
AV66/AV77	1200p
G700	1100p
G900	1500p
AKAI	
VS105, 112, 115, 116, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82	1200p
VP7100, VS9300, VS9500, VS9800	650p
VP77, VP88, VP7100, VP7200, VS9700, VS9800	1200p
VS1, VS2, VS3, VS4, VS5, VS10, VSP1	1350p
VS33, VS35, VS37, VS38, VS53, VS55, VS66, VS765, VS767, VS768	2100p
VS512, VS515, VS516	2800p
VS465	2300p
VS11, VS12	1200p
VS6, VS8, VS9	2400p
VSX9	2250p
VSF600, VSF650	3600p
VS155, VS165	2300p
VS20, 22, 24, 25, 26, 27, 422, 426, 427, VSF10, VSP9	1250p
VSR9	1300p
VS109, VS603, VS606, VS607	2500p
VS75	2500p
ALBA	
VCR4000, VCR5000, VCR6000	1650p
AMSTRAD	
VCR4500, VCR5200, VCR9000, TVR1	900p
VCR7000	1000p
VCR6000, 6100, 6200, 8600, 8602, 8700, DD8900, 8904, TVR4	1100p
TVR2, TVR3, VCR4600, VCR4600 MKII, VCR4700	1100p
AUTHENTIC	
N850	800p
AWA	
ATVI	800p
BAIRD	
8900, 8901, 8902, 8903, 8906, 8922, 8928	650p
8904, 8923, 8924, 8925, 8929, 8935, 8943, 8944	650p
8909, 8912	800p
8930, 8931, 8933, 8940	800p
8942	2300p
8945	2000p
8947, 8948	1600p
8950	1700p
VC141L	3000p
VH582	7000p
BLAUPUNKT	
RTV100, 200, 202, 211, 214, 222, 224, RTX100, 200	800p
RTV301, RTX250, RTV333	800p
RTV306, 307, 310, 311, 315, 316, 520, 707	1650p
RTV310, 311A, 312, 317, 319, 320	1100p
RTV324, RTV325	1550p
RTV328	1850p
RTV424	3500p
RTX434, RTV444	3900p
RTX260, RTX720, RTV330	2300p
RTV454, RTV740	5000p
RTV478	3700p
RTV520, RTV530	1800p
RTV535, RTV560, RTV570	2000p
RTV635, RTV660, RTV670, RTV730	3000p
CR1000, CR1200, CR1500	4650p
CR1800	4100p
RTV321, RTV322	1700p
RTV338	2800p
RTV348	2700p
RTV404, RTV414	3000p
RTV640	3000p
RTV750, RTV800, RTV900	3500p
RTV810	4400p
RTV910	4500p
BOSCH BAUER	
VRH50	1000p
VRP20	1000p
VRP25	1000p
VRP30	3350p
CANON	
VR10	1000p
VR30A, VR30B, VR30E, VR40A	3350p
DAEWOOD	
912, VCR12, VCR30, VCR32, VCR50, VCR52	1800p
VCP11 RAF	1800p
DECCA	
8300	1000p
8400, 8500	650p
DUAL	
EVR101	2300p
VR70, VR71, VR74, VR81, VR90, VR91	650p
VR85, VR96	2300p
VR97	3300p
VR80, VR92	650p
VR93	2450p
EDISON	
VC2130, 2133, 2135, 2140, 2830, 2930, 2932, 2934, 3122	650p
VK2132, VK2512	2300p
VK2436, VK2340	650p
VK2530, VK2532, VK2631, VK2541	1600p
VK2632	1700p
VK2637	3050p
VKH2545	2450p
VKH2639, VKH2439	3300p
FUNAI	
E11, 1100, VIP1000, 1400, 3000, 5000, VCR4000, 4500, 4800, 5200, VCR5600, 5400, 6500, V1, V25	1100p
VCR4600, VCR5400, VCR5800	1200p
VCR5480, 5843, 8007, VIP2500A, 3000A, 6000, 150	2000p
VCR4530, VCR6000, VCR6100, VCR6800, VCR6803	1300p
VCR8103, VCR8107	2200p
VIP300A MKII	1900p
FISHER	
FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 720, 721, 722, 730, 830, 905, 906, 908, 910, 911, 915, 916, 918, 5000, 5001, 5005, 5050, 5075	1100p
VBS3500, 7100, 7500, 7600, 9900, VBR330	1800p
VBS7000, VBS7100, VBS9000	2000p
FVHP500, 711, 715, 721, 722, 730, 830, 5100, FVHD720	1100p
FVHP725, 830, 980	2500p
FVHP990	2700p
FVHP975	2400p
FVHD40, FVHD140, FVHP1, FVHP10, FVHP20	1150p
FIDELITY	
HQS200, VCR600, VCR6100, VR900, VR9100	1500p
VCR100	1100p
VTR1000	1100p
GOLDSTAR	
8000 3HSSDB	1900p
GVH51, GVH122, VCP4000, VCP4100, VCP4200	1100p
GHV1232, 1233, 1241, 1242, 1243, 1244, 1245, 1246, 1290, 1291, 1295, 1296, 1891, 8210, 8215, GVHP1240, 1241, 1247, 1248, VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4326	1100p
G.E.C.	
4000H, 4001H, 4002H	1200p
V4001H, V4004	1200p
V4005H	1500p
GRANADA	
CS1, DS2	1600p
VHSAH1	1100p
VHSAH3	2400p
VHSAN3	800p
VHSAY3	1200p
VHSBH1, VHSCH1	2100p
VHSBP1	850p
VHSBY3	2600p
VHSD52	1600p
VHSEH2	1800p
VHSEY1, VHSEY2	1400p
VHSFG2, VHSFG4	1300p
VHFS1, VHSFS2	1300p
VHSTJ1, VHSTJ2, VHSTJ3, VHSWJ3, VHSYJ2	700p
VHSVH4, VHSWH1, VHSXH1, VHSYH2	1600p
VHSWJ1, VHSXJ3	700p
GRAETZ	
4312, 4605, 4905, 4912, 4913, P4833, TR4605, TR4812, TR4905, TR4912, TR4913, TR4914, TR4943	650p
4935, 4943, 4963, 4985, 4993, TR4833, TR4935, TR4985, TR4993	650p
4920, 4927, 4930	1700p
4946, TR4906, TR4916	1600p
TR4954	2300p
TR4995	3300p
GRUNDIG	
VS410, 450, 460, 500, 505, 510, 520, 521, 530, 545	1600p
BARCELONA, MVS400, 440, 500, 600, SE5100, 6100, 6110, 9100, TVR4500, 4510, 5510, VS400, 440, 500, 505, 510, 518, 600, 610, 5180, VS6190, 700, 900	1400p
MADRID, SE5140, VS540, VS5480	3000p
MVS550, 620, VS550, 620, 630, 640, 790, 930, 940	2400p
VS120	2300p
VS680	4600p
VS160, VS740	4400p
VS170	4800p
MVS660, SE6160, VERONA, VS660, VS6680	3500p
MVS710, 720, 910, SE7120, 9120, VS710, 720, 800, 810, 910, 920	1700p
HINARI	
VXL2, 3, 4, 20, 35	1000p
VXL5, V20H	1050p
VXL6	1200p
VXL7	1300p
VXL8, 9, 10, 11, 90, VCR34H, VTV200	1100p
HITACHI	
VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30	1000p
VT7, VT17, VT18, VT19	2200p
VT35, VT38, VT39	2400p
VT100, 110, 111, 112, 113, 115, 118, 120, 125, 128, 220, 225, 400, 405, 410, 413, 414, 415, 418, 510, 518, 520, 525, 526, VTM625, 626, 725, 726, 728	1400p
VT3000	650p
VT4000, 4200, 5000, 5500, 5600	1100p
VT77, 680, 6500, 6700, 6800, 7000, 8000, 8030, 8040, 8100, 8300, 8500, 8700, 9000, 9300, 9500, 9700, 9900	1000p
VT8, 9, 56, 57, 570, 575, 576, 580, 585, 588	3200p
VT65	2400p
VT130, 135, 138, 145, 250, 255, 258, 420, 425, 426, 428, 430, 431, 435, 438, 535, 536, VTL30, 301, VTM630, 635, 636	1900p
VT52, VT60, VT61E, VT62E, VT63, VT64, VT640	1200p
VT168, VT150, VT260, VT498 (4 HEAD)	2300p
VT530	2050p
VT522, VTM620, VTM622, VTM720, VTM722, VTM822	1650p
VT660E	2600p
H.M.V.	
HV1000, HV2000, HV3000	650p
HV4000, HV7000, HV8000p	
I.T.T.	
VR3605, 3905, 3935, 3943, 3954, 3958, 3985, 3993, 4993	650p
VR3833, 3912, 3913, 3914, 3963, 3975, 4913, VRP3833	650p
VR3988	2000p
VP3826, 3906, 3916, 3926, 3946, 3948	1550p
VR3927	1400p
VR3976	2300p
VR3977	2700p
VR3984, VR3994	2300p
VR3995, 3997	1800p
VR3917	1400p
VR3730, VR3731, VR3749	2500p
VR3918, VR3919, VR3938	1500p
VR3520, 3701, 3719, 3720, 3721, 3759, 9720	2000p
VR3907, VR3908	1600p
VR3968	700p
J.V.C. & FERGUSON	
HR2200, 3300, 3320, 3330, 3350, 3360, 3660, 3750, 3860, 4100, 3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V06, 3V22	600p
HR3660, 7600, 7610, 7650, 7700, HRD110, 111, 120, 121, 220, 225, HRS100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944, 3V16, 3V23, 3V24, 3V31, 3V35, 3V36, 3V38, 3V39, 3V49	825p
BR1600, HRD140, 141, 142, 143, 150, 152, 156, 157, 158, 160, 5101, HRS10, 8947, 8948, 3V42, 3V44, 3V45, 3V46, 3V47, 3V52, 3V54, 3V55, 3V56, 3V57	1150p
HRD154, 170, 171, 210, 211, 217, 320, 321, 350, 521, 522, 525, 526, 527, 550, 8950, 8951, 3V64, 3V65, FV10, FV11, FV20, FV21, FV26	1300p
HRD565, HRD566, 3V48	2200p
HRD725, HRD755, 3V43, 3V53	2950p
8930, 8931, 8933, 8940, 3V29, 3V30	700p
8945	2400p
3V00, 8902, 8903, 8909, 8912, 8922	1000p
FV31	1500p
FV37, FV43H, HRD860	3500p
BR7000E, BR7000S	2600p
HR7200, 7300, 7350, 2650, BR6200	700p
HRD455	2000p
HRD520	1400p
HRD300, 400, 580, 600, 620, 650	2300p
HR4100	1000p
HRD750, HRD830	3300p
HRD250, HRD257	2500p
3V32, 8942, HR7655	2200p
HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L	2250p
HRD370, HRD430, HRD470, 3V58, FV13H	2300p
HRD530, HRD700, FV14T	3100p
GRC1, GRC2, 3V41	2800p
HRD330, 337, 440, 637, 641, 660, HRFC100, FV44L	2100p
KENWOOD	
KV901, KV903, KV905	650p
KV917	2450p
LOGIK	
VR960	1500p
VR950	1400p
LOEWE	
OC410, OC420, OC440	2400p
OC50, OC55, OC60, OC65	1500p
LUXOR	
9225, 9256	1800p
9245, 9251, 9254	1225p
9270, 9271, 9273	1800p
9272, 928217	2700p
9252	2500p
928017, 928077, 928097, 929107, 928117	1700p
9253	2500p
9281	2700p
9284, 9295, VR3701, VR3721, VR3731, VR3761	2100p
MATSUI	
VX500E, 800A, 810A, 820, 80A, 770B, 773B	1200p
VCRL3, VX730, VX750	1450p
VX735, VX755, VX990	1500p
VX735A, VX765, VX850	1750p
VX600	1100p
MITSUBISHI	
HS303, HS304, HS320, HS700	1500p
HS306, HS318, HS710	1500p
HS307	2300p
HS319	2300p
HS330	2400p
HS400	2250p
HS349, HSE31, HSE32, HSB31	2250p
HS411	2900p
HSE30, HSB30	2100p
HS338	2200p
HSE10, HSE11, HSE20, HSE21, HSE41, HSB10, HSB20	2100p
HS300, HS301, HS302, HS310, HS273	1450p
HS200	650p
HS337, HS347	1400p
HSE12, HSE22, MX1	2100p
HS411EZ, HS411GZ	2900p
HSB11, HSB21	2100p
HSE50	3300p
NATIONAL PANASONIC	
NV300, 322, 333, 390, 2000, 2010, 3000, 7000, 7500, 7800, 7850, 8170, 8200, 8400, 8600, 8610, 8620	625p
NV777, NV330	1500p
NV8050, NV8051	2800p
AG1000, AG1050, NV260, NV280, NV460, NV470, NV480	1600p
AG6010, AG6015	2500p
AG6840	2400p
NV100, NV200, NV370, NV380, NV630	725p
NVD80, NVH65	3400p
NVF65, NVH75	3200p
NVF51	4200p
NVG19	2300p
NVJ30, NVHJ33, NVL20, NVL21, NVG30, 31, 40, 130	1600p
NVJ35, NVG46	2100p
NVM1, NVM3, NVM5	4200p
AG2100, AG2200	700p
NV430	1000p
NV730, NV770 4 HEAD	1550p
NV366	1850p
NV180, NVD48	2300p
NV788	2600p
NV810, NV830	2400p
NV850, NV950	2750p
NV870, NV890, NV970	3600p
NVG33, NVG46, NVL23, NVL25, NVL28	1800p
NVG10, 11, 12, 14, 16, 120, NV250, 280, 450, 465	1500p
NVG18	1800p
NVG20, 21, 22, 25, 28, 200, NVD48	1800p
NVG50, NVG300	2650p
NVG45	1800p
NVH70	3600p
NV688	2400p
NV600	1600p
AG6800, AH6810	2600p
AG6100, AG6200, AG6300	2600p
NVG7, NVG9, NV230	1050p
NV780	2400p
NVG15, NVG400	2600p
NVM7, NVMC20	3800p
NVF70	5200p
N.E.C.	
N9011, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, 9034, 9040, 9053, 9054, 9055, 9063, 9065, 9066, 906, DX1000, 1600	1200p
N911A, 914C, 915A, 916A, 917, 9110, 9120	2400p
PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774	1650p
N380, N381, N830, N831, N832, N833, N834, N835, N836	700p
8261, AH1 (for model DX3000), DX4000, N9610	3000p
N895	3150p
N9052, N9530, DX2000	3400p
VCP1	1700p
PVC2300, 2400, 740, 744, 760, 764	1400p
DS6000	3500p
NORDMENDE	
460, 9-460, V100, 140, 200, 250, 304, 341, 450, 550	700p
V1001, 1005, 1015, 1025, 1035, 1041, 1055, 1065, 1105, 2005	1250p
V110, V333	2000p
V101, 102, 103, 112, 141, 142, 200, 300, 301, 302, 350, 500, 3005	700p
V1205, V1215, V1235, V1245	1400p
V1305	2450p
V380	2300p
V502, V503, V5005	3150p
ORION	
VH3, VH555, VH600, VH700, VH844, VH900, VH1000 (ALL MODELS)	1100p
VH1, VH2A	700p
PHILIPS	
VR6460, VR6520, 64VR60, VR6420	725p
VR6711 4 HEAD	1800p
6920, VR6440	2500p
VR6441, VR6540, VR6541, VR6640, VR6642	1300p
RANK	
BV6900AS	1800p
N830EA, RV300, RV310, RV320, RV330, RV340, RV350, RV380	700p
REDSON	
MR100	1700p
SABA	
2A10, 2A70, 2B20	1400p
4A10, 4B20	2450p
6A10, 6A70	2300p
8A10, VR6038	3150p
CVR6083, VR600, 66007, 6008, 6009, 7006, 7007	1250p
PVR6068, 6070, 8070, VR2000, 6000, 6010, 6012, 7000, 9010	600p
VHR7000, VR5005	1500p
VR6004, 6005, 6011, 6013, 6014, 6020, 6022, 6023, 6024, 7004, 7011, 7014, 7720, 7730, 8011, 8014	700p
VR6018, VR7018	2450p
VR6028	2300p
VR7016	2000p
SAISHO	
VR100, 605, 705, 805, 905, 1000, 1100, 1200, 1600	1200p
VR3300X, VR3600X, VR3650, VR3800	1400p
VR3200, VR3500	1400p
VR2000, VR3300, VR3600	1400p
SALORA	
6500, 6600	1600p
SV7300, SV8200, SV8300, SV9200	1500p
SV7400, 8400	1600p
SV8100	1200p
SAMSUNG	
SVX301, VB900, 910, VVT510, VT320, 5600, VX510, 511, 520, 616, 626, 627, 717, 614, 619, 629, 710, 712, 720, 730, 970, 971, 972, SV716, 717, SVX303, 305, VB510, 520, 610, 516, 617, 619, 620, 626, 627, 629, 710, 971, V1520, 616, 621, 626, 900, 910	1200p
VB770, V1730, V1770, VK8220, VX750, VK770, VK8225	1900p
VM1560, VN1561	2200p
SANYO	
VTC5000, 5400, 6000, 6500, VPR5000, VTC1500, VTCM10, 11, 20, 21, 25, VTC2000, 5100, 5150, 5300, 5400, 5350, 6370, VTCNX10, VTCNX15, 20, 30, VPR5800	1800p
VTC5500, 5550, 9100, 9300, 9350, 9355, 9455, 9500	1900p
VHR1110, VHR1150, VHR1300, VHR1700, VHR2300	1200p
VHR3200, 3270, 3100, 3150, 3300, 3400, 3310, VHRD500	1500p
VHR1100, VHR1200	1500p
VHR1500, VHR2500	2100p
VHR2700	2450p
VHR7900	3000p
SHARP	
VC390, VC393, VC496	2750p
VC488	4200p
VC779	1800p
VC789, VC790	2900p
VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, 483, 486, 3300, 8381, 9100, 9300, 9400, 9500, 9600, 9700	1100p
VC582, 583, 651, 681, 750, 780, 781, 683, 684, 402, 500, 571, 573, 580, 584, 600, 682, 693, 700, 772, 7810, 782, 7822, 783, 8481	1100p
VC6000, 6200, 6300, 7300, 7700, 7750, 8000, 8300	1800p
VC793	3000p
VC473, 785, 786	2200p
VC699, VCA501, VCA602	2800p
VC585, VC685	2000p
VC90ET	3900p
VFH815	2800p
SIEMENS	
FM350, FM352, FM355, FM361, FM362, FM363	1300p
FM364	1350p
FM391, FM392, FM461	1800p
FM394, FM464	2800p
FM462, FM561	1600p
FM468	2450p
FM484, FM485, FM602, FM604, FM622, FM624	1800p
FM585	1425p
FM600	1900p
SONY	
DSR-19R (FOR SL-T 9ME)	3100p
DSR-21R (FOR SLC 8-C9)	2600p
DSR-35R (FOR C20, C30, C40, SLF1UB, SLF1E) 2 PIN SLC24PS, SLC33E, SLC44PS, SLF30PF, SLF60PS, SLK85, SLT20ME, SLT30ME	1500p
DSR-43R (FOR SLC7 RANGE, SL5000, SL5100, SL3000) 1 PIN SLC6E, SL36ES, SL37E	1300p
SL3000, 8000, 8C80, SLC5E, SLT7ME	1600p
SLV201, 202	2000p
SLK95, SLT50ME	2900p
SLV373VB	2600p
TOSHIBA	
V63	1500p
V9680	3400p
V8600, V8700	3000p
V21, V31, V33, V50, V51, V53, V9600	1450p
V55, V57	700p
V71, V73, V74, V75, V77, V80, V81, V82, V83, V84, V85, V86, V87	1200p
V80, V93	1450p
V6470, V5480	1300p
V600	2350p
V880MS	2600p
V700G	3700p
V500G, V509G	2500p
V9680	2900p
V300G, V301, V305, V309G	2550p
V61, V63	1700p
V110, V120, V130, V140, V210, V220	1500p
TRIUMPH	
VR9500, VR9501, VR9525	1100p
TELEFUNKEN	
A890	2700p
A920, VR1970, 2920, 2925, 2930, 410, 7921, 7926, 7931, 7970, 970	1250p
VR400, 410, 450, 510, 519, 520, 529, 540, 610, 620, 640, 920, 1920	700p
A930, 932, 935, VR2931, 2935, 2941, 3935, 4935, 4940, 4942, 4945, 5935, 7932	1400p
A935, VR3945, VR3950, VR7959	2450p
A940, VR1925, 1930, 1940, 1950, 2960, 440, 449, 530, 535, 539, 549, 550, 630, 650, 925, 930, 940, 950	700p
VR1980, VR7980, VR980	3150p
VR2915	1100p
VR2970, VR7971, VR975	2450p
VR7979	2300p
THOMSON	
TX8000, V309, 316, 320, 321, 323, 326, 4100, 4200, 4300, VX305T, 306T, 309BL, 3301, 312T, 410T, 411T	650p
TX8500, V318, 342, 343, 351, 352, 353, 4210, 4230, 4260	1250p
V333	1100p
V340	1100p
V357, VK309LP	2300p
V360, V5500	2450p
V364, V4400	2000p
V368, V6000, V8540	3150p
V410, 510, 610, 630, 715, 4240	1400p
V430, 530, 4340	2450p
V450	2300p
VK300T, VK301T, VK302T, VK303T, VK308P	650p
VM10, VM20	2700p

VCR BELT KITS / REPLACEMENT VIDEO LAMPS

Model	Price
HRD520, 600, 620, 637, 641, 650, 830	95p
HRD540, 550, 580, 880, 860, 960, HRS5800	130p
KENWOOD	
KV901	70p
KV903	90p
LOEWE	
OC11, OC40	95p
OC410, OC420, OC440, OC460	130p
OC50, OC55, OC60, OC65, OC70, OC75	120p
LOGIK	
VR955	180p
LUXOR	
9245, 9251	130p
9252	140p
9253	140p
9254	100p
9255	130p
9256	130p
9270, 9271, 9273, 9274	115p
9272, 9280	140p
9281, 9284, 9285, 9292, VR3701, 3721, 3731, 3761, 3781	95p
MATSUI	
VX850	75p
MITSUBISHI	
HS200	200p
HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, HSB10, 20, 30, HSE10, 20, 30, 70	150p
HS303, HS304, HS306, HS307, HS330, HS400, HS700	150p
HS318, HS319, HS410	130p
N.E.C.	
N830, N831, N832, N833	100p
N895	80p
PVC2300, PVC2400	180p
DX1000, 1600, 2000, 3000, N9012, 9013, 9014, 9016, 9033, 9034, 9053, 9054, 9055, 9066, 9110, 9120, 9510, 9520, 9530, 9810	95p
NATIONAL PANASONIC	
NV300, NV332, NV333, NV340, NV366	125p
NV777, NV788	100p
NV2000, NV2010, NV3000	130p
NV7000, NV7200, NV7800	95p
NV8600, NV8610, NV8620	145p
NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 730, 770, 810, 870, 890, AG1000, 1050	125p
NV370, NV380, NV480, NV630, NV780, NV830, NV850	100p
NV600, NV688, AG6010, AG6015	110p
NVG7, 10, 12, 14, 15, 18, 30, 130, 400, NVH70	70p
NORDMENDE	
V100, V140	70p
V1000M, 1005M, 1205, 1215, 1235, 1245, 1305, 1403, 1405, V1500P, 1503, 1505K, 1805K, 2000D, 2405, 2500H, 3000H, V3405H, 3105, 4405H, 5000, 8005, 900, 905	65p
V1001, 1005, 1016, 1025, 1035, 1041, 1055, 1065, 1105, 3005, 304, 5005, 502, 503	80p
V101, V102, V103, V112, V141, V142, V301, V302	90p
V110, V333	110p
V1500T, V2000B, V2000P, V400H	95p
V250, V460, V9460, V20035542, V20035543	130p
V300, V303, V380	75p
V500	75p
ORION	
COMBI15000, 16000, NEVHM, TVP230RC, 900MVH1012, VH1030, 1040, 1060, 1070, 1100, 1120, 1440, 1500, 1660, 1800, 2150, 2308, 2400, 2500, 2600, 2700, 2960, 300, 358, 360, 362, 4010, 4015, 4016, 4020, 4300, 5010, 5015, 530, 535, 536, 630, 635, 540, 730, 735, VP220, 225, 245, VR1032, 2966, 2980, 821, 925, VXL25	30p
NEVHL, VCP, VH1204, 2004, 2204, 3050, 3060, 4008, 400, 4012, 412, 512, 600, 666, 744, 774, 7905, 800, 820, 900, 974, VP200, VR2949, 2956, 2957, VXL20	90p
VC150, 180, VH1000, 200, 201, 205, 212, 250, 254, 288, 300, 303, 3030, 312, 33, 3312, 404, 566, 700, 704, 708, 712, 770, 780, 844, 900, VHF2, VH3	80p
VH1, VH2A	150p
PHILIPS	
VR6460, VR6920	170p
VR6540	100
DV186, 286, 291, 292, 468, 471, 562, 571, 781, VR201, 202, VR20DV1, 20DV2, 20RW7, 25801, 25802, 302, 303, 305, VR30DV2, 35802, 35803, 63587, 71584, 71585, 71588, VR86582, 91582, 92583, VR6180, 6185, 6285, 6290, 6291, 6293, 5367, 6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, 6676, 6760, VR68SB4, 86SB1, 92SB3	85p
VR6442, VR6542	70p
VR2025, VR2580	100p
VR44589, BR4458920, VR4458922, BR6843	100p
VR6548, VR6648, VR49SB620, VR644869S	110p
SABA	
VR6420, 6435, 6440, 6460, 6480, 6620, 6770, 7200, 8420, 2A10, 70, 2B20, 3820, 4A10, 4B20, 6A10, 6A70, 6820, 8B20	66p
VR6004, 6005, 6011, 6014, 7004, 7011, 7014, 8011, 8014, BERLIN	90p
VR2000, VR6000, VR6012, VR7000, VR7720, PVR6068	130p
VR5005, VHR7000	135p
VR6006, 6007, 6008, 6009, 6015, 9016, 9018, 6038, 7006, 7007, 7016, 7018, 9006	65p

Model	Price
VR6010, VR9010	70p
VR6020, VR6022, VR6023, VR6028, VR7730	75p
VR6024	75p
VR6520, VR6540, VR6560	90p
VR6710, VR6720, VR6735, VR8720	130p
VR6720, VR6730, VR6760, VR6775, VR6780	160p
SAISHO	
VR2000, VHL3	90p
VR3800	75p
SALORA	
SV6500	100p
SV6600	150p
SV8000	120p
SV8100	60p
SV8500, SV8520, SV9500	150p
SV7400, SV8400, SV8420, SV8550	120p
SV6700, SV8710, SV8750, SV9700	120p
SV6800, 6900, 8810, 8820, 8870, 8910, 8920, 8970	96p
SV8600, 8620, 8700, 8720, 8830, 9600, 9810	130p
SAMSUNG	
SV716, 717, V1616, V1621, V1626, VX616, VX617, VX619, VX626, VX627, VX629	85p
VB520, 510, 610, 616, 617, 619, 620, 626, 627, 629, VI510, 520, 611, 616, 621, 626, VX510, 520	100
VB900, VB910, V1900, V1910	110
PX960, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB770, 8220, 8225, V1770, 790, 8220, 8225, VK8220, VPX31, VX750, VX790, 8220, 8225	135p
SVX301, 303, 305, SX7301, VB710, 971, V1730, 710, VX712, VX720, 730, 970, 971, 972	230p
VX9880	110p
SANYO	
VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	75p
VTC5300, VTC5350, VTC5400, VPR5800	100p
VTC5500	95p
VTC9100, VTC9300	220p
VTC1100, 1300, 1500, 1100, 1150, 1200, 1300, 1500	90p
VHR2100, VHR2300, VHR2500, VHR2700	150p
VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700	110p
VHR4100, 4150, 4200, 4300, 4350, 4770, 5100, 5200, 5300, 5350, 5700, 7100, 7200, 7500, 7530, 7540, 7800, 7810, 8100, 8200, 8250, 8500, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700	90p
SHARP	
VC200, 384, 385, 386, 388, 390, 9300, 9500, 9700	100p
VC7300, VC7700, VC7750, VC7800, VC8000	150p
VC8300	150p
VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481	80p
VC402, 500, 571, 573, 581, 582, 583, 584, 585, VCSF3	80p
VC600, 651, 682, 684, 685, 693, 783, VC6F3, VC6V3	70
VC772, 779, 781, 782, 785, 786, 793, 800, 7810, 7822, VCA100, VCA102, 104, 131, 140, 170, 202, 203, 234, 501, 802, 5011, VCD806, 810, 815, VCH80, 865, 910, VC51000, VCT310, 410, VCT1314, VCTS312	115p
SIEMENS	
FM350, FM352, FM355	60p
FM484, FM485	55p
FM391, FM392, FM394, FM462	100p
FM461, FM464, FM468, FM561	150p
FM361, FM362, FM363, FM364	120p
SONY	
SLC6, SLJ10, SLT6ME	140p
SLC5, SLC7, SLJ7, SLJ9	140p
SLC9, SL8000, SL8080, SLT50	165p
SL8000E, SL8080E, SL8200, SL8600	175p
SLV256	95p
TELEFUNKEN	
VR400, VR410, VR440, VR449	130p
VR450, VR540, VR549, VR640	70p
VR520, VR529, VR620, VR920	70p
VR530, VR535, VR539, VR550, VR630, VR650	75p
A940, VR1925, 1930, 1940, 1950, 2960, 925, 930, 940, 950	90p
A920, VR1970, 1980, 2920, 2925, 2930, 2970, 7921, 7926, 7931, 7970, 7971, 7980, 970, 7981, 975, 980	65p
A1200, 930, 932, 935, 960, 980, 990, VR2931, 2935, 2941, 2871, 3935, 3945, 3950, 3965, 3975, 4935, 4940, 4942, 4945, 496, 6VR4970, 6000, 7932, 7959, 7979	85p
VR1935	100p
VR2915	90p
THOMSON	
SV1000, V410, 430, 450, 510, 520, 530, 640, 620, 630, 640, 4240, SV5540	65p
TX8000, V309, V357, VK411	75p
TX8500, V342, 343, 351, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, 5500, 6000, 8564	90p
V320, V321, V323, V326, V4200, V4300	90p
V333	100p
V340	90p
V4100, VK308, VK309, VK410	120p
VK300, VK301, VK302, VK303, VK305, VK3301	135p
VK312	65p
TOSHIBA	
V55, V57	85p
V33, V31, V51, V53, V9600, V9680	85p
V61, V63, V65, V66, V67	150p
DV80B, DV80D, V71, 73, 74, 75, 81, 83, 85, 86	120p
V108, V109, V199, V209, V609	120p
V91G, V95G	115p

Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES)	VL01	25p
PANASONIC VIDEO LAMPS	VL02	35p
SHARP VIDEO LAMPS	VL02	35p
HITACHI 5381682 (VT63, VT64) VIDEO LAMPS	VL04	135p
AIWA, AKAI, ALBA, AMSTRAD, BLAUPUNKT, FERGUSON, FIDELITY, FISHER, FUJITSU, FUNAI, G.E.C., GOLDSTAR, GRANADA, GRUNDIG, HINARI, HITACHI, ITT, JVC (HRD SERIES), MATSUI, MITSUBISHI, NEC, ORION, NATIONAL, PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP, SIEMEN, SONY, TELEFUNKEN, THOMSON, TOSHIBA	VL05	150p
AKAI, GRANADA (VHSTJ2), HITACHI (VT3000), ITT (VR3912, VRP3833), JVC (HR2200, 3300, 3330, 3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, 519, 610), THOMSON (VK300, 305, 306, 3301), FERGUSON (3V00, 16, 22, 24, 3292, 8900, 8901, 8902, 8903, 8909, 8912, 8922, 8925)	VL01	25p
BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200, 2010, 3000, 7000, 8150, 8200, 8400, 8600, 8610, 8620), SHARP (VC2300, 6000, 6200, 6300, 7300, 7700, 8000, 8300)	VL02	40p
AKAI (VS10), GRANADA (VHSXJ3), ITT (VR3993, 3994), JVC (HR2650, 7600, 7610, 7650, 7655), TELEFUNKEN (VR530, 535, 539, 550, 630, 650), THOMSON (V309, 316, 357, VK309, 411, TX8000), FERGUSON (3V31, 8941, 8942)	VL06	40p
AUTHENTIC (N850), DECCA (VR8300), GRANADA (VHSTJ3, WJ1, WJ3), ITT (VR3913, 3914, 3963), JVC (HT7200, 7300, 7350, 7700), TELEFUNKEN (VR450, 520, 529, 540, 549, 620, 640, 920, 1920), THOMSON (V4100, VK308, 309, 312, 410), FERGUSON (3V23, 29, 30, 8923, 8924, 8929, 8930, 8931, 8940)	VL07	40p
GRANADA (VHSAY3), SHARP (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700)	VL08	60p

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USED ON: CP0200, 0211F, 0323, 0323/1, 0341/14, 0345F, 0351/1, 0361, 0361/1, 9350, CT0500, 0500/1/T, 0500T
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USED ON: KV2022, KV2024
PRICE: £3.00
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USED ON: KV1810 MK1, KV1810 MK2, KV1820, KV1822, KV2000 MK1
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	6861482	IT04
	6886971	IT05
JVC/ FERGUSON	PU 48967B	IT06
	PU 51380	IT07
	PU 51402A	IT08
	PU 55373	IT09
	PU 55374	IT10
NATIONAL PANASONIC	VXP 0329	IT11
	VXP 0343	IT12
	VXP 0344	IT13
	VXP 0401	IT14
	VXP 0433	IT15
	VXP 0463	IT16
	VXP 0521	IT17
	VXP 0581	IT18
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FVHP905, 906, 908, FVHP910, 911, 915, FVHP916, 918	GEAR IDLER ASSY	R1430490402400	275p
FVHP975, 980, 990, FVHP999, 5000, 5005 FVHP5050, 5075, 5100	IDLER	F11430420400700	300p
FVHD40, 55, 140 FVHP1, 10, 20	REEL DRIVE ROLLER		£6.00
FVHP975, 980, 990	CLUTCH	F12430510404200	£9.50
FVHP420, 520, 530	IDLER		£2.80
FVHP420, 520, 530	TAKE UP IDLER		290p
FVHP990	LOADING GEAR		90p
VBS3600	REEL DRIVE PULLEY		£3.20
VBS3600	IDLER		250p
VBS7000	REW IDLER		95p
GOLDSTAR			
GHV1221, 1232, 1240 GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000, GHV8200, 8210, 8215, GHVP51, VCP4100, 4130	CLUTCH GEAR	435038A	£2.50
GHV1221, 1232, 1240 GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000, GHV8200, 8210, 8215, GHVP51, VCP4100, 4130	IDLER		110p
HINARI			
VXL2, VXL20	REEL IDLER	40000009	110p
VXL2	IDLER		110p
VXL4, VXL35	IDLER		£2.75
VXL4, VXL35	CLUTCH		£6.50
VXL4, VXL12, VXL26	LIMITER POST		£1.30
VXL30, VXL35, VTV300			
VXL5, VXL6	CLUTCH		£3.75
VXL5, VXL6	GEAR HOLDER		£3.50
VXL7, VXL8, VXL9	CLUTCH		£3.80
HITACHI			
VT11-33, VT63-64 VT14, 17, 19, 38, 57, 86, 88, 34, 35, 39, 52, 61 52, 85, 86, 330, 640, VT165	CLUTCH ASSY	6879615	£7.50
VT20-220, 100, 110 VT113, 115, 118, 200 VT125, 128, 130, 135, 138, 145, 150, 175, 225, 250, 255, 258, 260, VTL30	CLUTCH ASSY	6886824 6886972	£7.50
VT8000-8300, 7000 VT8500-8700	FF-REW IDLER	6413663	£2.80
VT8000-8300, 7000 VT8500-8700	PLAY IDLER	6414221	290p
VT8000-8300, 7000 VT8500-8700	FF-REW PULLEY	6383531	80p
VT8300-8500, 8500 VT8600, 9700, 9900	FF-REW IDLER	6881471	250p
VT9300-9500, 6500 VT6800, 6800, 9700	PLAY IDLER	6861482 6861481	230p
VT8300-8500, 9700	IDLER	681505	230p
VT6500, 6500, 680, 6800	IDLER	687043	£3.80
VT11-33, VT63-64 VT14, 155, 17, 19, 34, VT35, 38, 39, 52, 61, 62 VT85, 86, 88, 330, 640	FF-REW IDLER	6886971	125p
VT100, 110, 111, 113 VT115, 118, 119, 120, 125, 128, 130, 135, 138, 145, 150 VT215, 220, 225, 250, 255, 258, 260, VTL30	FF-REW ARM	6886792	240p
VT400, 405, 410, 413 VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435 VT448, 450, 496, 510, 518, 520, 525, 526, 530, 535 VT538, 540, 545, 546, 548, 570, 575, 576, 580, 585 VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85	FF REW ARM	6897084	£1.30
VT400, 405, 410, 413 VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435 VT448, 450, 496, 510, 518, 520, 525, 526, 530, 535 VT538, 540, 545, 546, 548, 570, 575, 576, 580, 585 VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85	CLUTCH BASE	6896951	£3.25
VT3500	T-UP IDLER (LARGE)		£4.50
VT3500	REW IDLER		£6.00

VT680, 6500, 6800 VT9700, 9900	FS-BRAKE	6861505	230p
HITACHI TV			
OUTPUT MODULE HM 6251			£5.50
OUTPUT MODULE HM 6232			£8
JVC			
HR330, 3660, 4100	T-UP IDLER SML	PU49280	£5.50
HR7200, 7600, 7650 HR7655, 7300, 7350, 7610	T-UP CLUTCH	PU53462A	220p
HR7200, 7300, 7350 HR7600, 7610, 7650, 7655, 7700	REEL IDLER	PU48967	175p
HR7600, 7610, 7650 HR7655, 7700	ROLLER ASSY	PU49042A	350p
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650 HR7655, HRD110, HRD111, HR7300, 7350, 7610, HRD120-121, 225	T-UP IDLER	PU51402A	100p
HRD110, HRD120-121, HRD225, HRD111,	T-UP CLUTCH	PU55373	150p
HRD110, HRD120-121, HRD225, HRD111	IDLER ARM	PU55374-3-8	200p
HRD170, 180, 210, 230 HRD320, 370, 400, 430, 470, 530, 700, 750, 950, 3000 HRS5000, HRS5500	IDLER ARM	PU58465	£2.25
HRD455, HRD725	CLUTCH MECH	PU568822	1200p
HRD140, 150, 157, 158 HRD160, 250, 257, 565, 566, 755, HRP50	CLUTCH MECH	PU57658	1050p
HR3300, HR3330 HR3660, HR4100	REW IDLER	PU46380	500p
HRD140, 150, 157, 158 HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50	TAKE UP CLUTCH	PU56043-1-4	240p
HRD140, 150, 157, 158 HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50	TAKE UP CLUTCH	PU56044-1-5	160p
MATSUI			
VX730, 735, 750, 755, VX810, 820, 850, 880, 990	CLUTCH	850A00005	420p
VX730, 735, 750, 755 VX770, 800, 810, 880 VX990	LIMITED POST LEVER ASSY		£1.30
VX800A, VX900	IDLER REEL		£1.50
VX800A, VX820	REEL UNIT CLUTCH		280p
MITSUBISHI			
HS306, 307, 318, 319, HS400, 410, 710	GEAR ASSY	522B00201	£6.25
HS337, 338, 347, 349 HS411, 412, 421, HS810, HS820, HS830, HSE10, HSE20, HSE20, HSE30, HSE70	IDLER	552B01701	325p
HS306, 307, 318, 319 HS400, 410, 710	IDLER	641C34301	£2.00
HS347, 349, 412 HS810, HS820, HS830, HSE10, HSE20, HSE30, HSE70	IDLER	522902002	£3.00
HS337, 338, 411, 421	IDLER	552B01801	320p
HS200	TAKE UP IDLER (LARGE)		£4.50
HS200	UNLOADING IDLER		£4.00
HS200	REWIND IDLER		£6.00
HS306, 307, 318, 319 HS400, 410, 710	SUPPLY REEL DISK	522A00101	£3.20
HS306, 307, 318, 319 HS400, 410, 710	TAKE UP REEL DISK	522A00102	£3.20
HS320	REEL DISK	522C06301	£3.00
HS337, 338, 411, 421	REEL DISK	522P00601	£5.00
HS300, 301, 302, 310	PULLEY	522C05201	£2.25
HS306, 307, 318, 319	GEAR WHEEL	641D71101	£1.50
HS306, 307, 318, 319 HS400, 410, 710	GEAR WHEEL	641D71001	£1.50
NEC			
N830, N831, N832, N833	TAKE UP CLUTCH		150p
N830, N831, N832, N833	TAKE UP IDLER		100p
N830, N831, N832, N833	REEL IDLER		200p
N895	TAKE UP IDLER SMALL		560p
N911, N915, N916, N917 N9012, 9013, 9014, 9016, 9033, 9034, 9054, 9055, 9086, 9110 N9510, 9520, 9530, 9610	REEL DRIVE PULLEY		350p
NATIONAL			
NV322, NV600, NV688, NV777, NV788, NV332, AG6100, 6200, 6800, 6810	IDLER UNIT	VXP0463	£2.75
NV300, NV333, NV340 NV366	IDLER ARM	VXL0997	£3.60
NV300, NV330, NV333 NV340, NV366	IDLER UNIT	VXP0401	60p
NV300, NV330, NV333 NV340, NV366, NV8620	PLAY IDLER	VXP0433	£2.75
NV300, NV332, NV333 NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000 AG6010, AG6015	ACTION GEAR	VDG0016	£0.60
NV333, NV688, NV2000 NV3000, NV7800	LOADING GEAR	VXP0325	£2.00
NV300, NV332, NV333 NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000 AG6010, AG6015	INTERMEDIATE GEAR	VXG0017	£0.65
NV330, NV333, NV340 NV366, NV777, NV788	CAM GEAR	VXG0158	£1.00
NV230, NV250, NV260 NV280, NV370, NV380, NV430, NV450, NV460, NV465, NV470, NV480 NV630, NV650, NV730, NV780, NV810, NV830, NV850, NV870 NVG7, NVG9, NVG10, NVG11, NVG12, NVG14, NVG15, NVG16, VG18 NVG30, NVG400, AG1000, AG1200, 1500, 1810, 2100, AG2200, NVH65, NVH70	IDLER ARM	VXP0521	110p
NV370, NV430, NV870, NV730, NV830, NV850, NVG10, NVG12, NVG18	CAM GEAR	VDG0200	£1.20
NV730, NV770	IDLER UNIT	VXP0581	£2.50
NV2000, 2010 3000	IDLER UNIT	VXP0331	80p
NV2000, 2010, 3000	IDLER UNIT	VXP0329	80p
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV7000, 7200, 7800	IDLER UNIT	VXP0344	75p
NV7000, 7200, 7800	CLUTCH	VXP0343	300p
NV8150, 8200, 8300, NV8400, 8600, 8610, 8620	IDLER UNIT	VXP0245	80p
NV8200, 8400, 8600 NV8610, 8620	PLAY IDLER	VXP0243	80p
NV8620	CLUTCH	VXP0343	250p
NV332, NV600, NV688	IDLER	VXP0488	300p
NVG20, NVG21, NGV25 NVG40, NVG45	PULLEY UNIT	VXP0767	400p
NV230, NV250, NV280 NV430, NV450, NV460, NV465, NV650, NV730, NV770, NV810 NV870, NV890, AG1000	WORM WHEEL	VXP0604	160p
NV370, NV380, NV630 NV780, NV830	IDLER	VXP0523	300p
NV370	CLUTCH GEAR	VXP0595	£1.00
NVG7, NVG11, NVG12 NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70	WORM WHEEL	VXP0691	£1.50
NV2000, 2010, 3000 NV7000, 7200, 7800, 8050	LOADING GEAR	VDG0035	£0.60
NV230, NV250, NV370 NV430, NV450, NV460, NV630, NV730, NV770, NV780, NV810 NV830, NV890, NVG7, NVG10, NVG12, NVG15, NVG30, NVG120 NGV130, NVG400, NVH70, AG1000	LOADING GEAR	VXP0520	£1.50
NV230, NV250, NV260 NV280, NV430, NV450, NV730, NV770, NV810, NV870, NV890 NVG7, NVG10, NVG11, NVG12, NVG14, NVG15, NVG18, NVG30 NCG120, NVG130, NVG400, NVH70, AG1000	CLUTCH GEAR		£2.50
NV230, NV250, NV260 NV280, NV300, NV333, NV340, NV366, NV370, NV430, NV450, NV460 NV465, NV630, NV650, NV777, NV780, NV788, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, 7200, 7800, NVG7, NVG10, NVG12, NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70, AG1000	LIMITER ROLLER		£1.50
SAISHO			
VR605, VR800, VR900 VR1100, 1200, 1800, 2500, 3200, 3300	CLUTCH	850A20000	420p
VR3500, 3800, 3800 VR1100, 1200, 1800, 2500, 3200, 3300, 3500, 3600, 3700	LIMITER POST		£1.30
VR605, VR800, VR900 VR2500, 3200, 3300, 3500, 3600, 3900	IDLER		280p
VR705, VR805, VR905	IDLER		110p
SANYO			
VHR1110, 1150, 1200 VHR1300, 1500	IDLER	143-0-662T-14730	£5.00

VTC5000, 5150, 6000 VTC6500, VTCM10, M11, M20, M21, M30, M31, M50	FF-REW IDLER	143-0-741T-20001	250p
VTC9100, VTC9300	IDLER	143-0-561T-01400	95p
VTC9300	FF ROLLER ASSY	143-0-547T-00200	200p
VTCM10, M11, M20, M21 VTCM30, M31, M50	REEL DRIVE PULLEY	143-0-662T-10350	£5.00
VHR2100, 2300, 2500 VHR2700	IDLER	6130374899	300p
VTC5000, 5150, 6000 VTC6500	PULLEY	143-0-662T-01201	£5.20
VTCM10, M11, M20, M21 VTCM30, M31, M50	PULLEY	143-0-662T-10350	£5.50
VHR3100, 3300, 3310 VHR3400, 3700, 3800 VHRD500, VHRD700	REEL DRIVE ROLLER	143-0-662T-15621	350p
VPR5800, VTC5300 VTC5400	LOADING ROLLER	143-0-661T-03800	80p
VTC3000	FWD LIMITER		£3.50
VTC3000	IDLER		750p
SHARP			
	IDLER ASSY	NIDL0005GEZZ	110p
	IDLER	NIDL0006GEZZ	110p
VC600, 651, 681, 682 VC684, 685, 693, 699, 700, 783, VC6FR, VC6V3	IDLER ASSY	NPLYV0107GEZZ	£8.15
VC7300, VC7700, 7750	PLAY IDLER KIT	NPLYV0041+ NDA1V1007	£7.50

JUST ARRIVED!!! NEW ITEMS

Satellite PSU Repair Kits

Experience shows that 50% of all receiver power supplies 'bounce' unless the correct precautionary measures are taken when being serviced. A kit of all the recommended parts is supplied for the 4 most popular models, which when fitted should overcome this.

MAKE & MODEL	ORDER CODE	PRICE
PACE PRD800, PRD900	SATPSU1	650p
PACE SS9000, 9200, 9010, 9020, 9220	SATPSU2	650p
AMSTRAD SRD510, SRD520	SATPSU3	650p
AMSTRAD SRD500	SATPSU4	650p

Replacement Video Heads

MAKE	MODELS	PRICE
HITACHI	VT570, VT575, VT576, VT580, VT585 VT588, VTF70	3100p
I.T.T.	VR3761	3100p
JVC & FERGUSSON	HRD950, HRD960, HRD980, FV46	5000p
LUXOR	VR3761	3100p
MITSUBISHI	HSE51	3000p
NATIONAL PANASONIC	NVFS200, NVFS90, NVV8000	4600p
	NVHD100, NVHO101, NVHF100	3100p
	NVSD	1400p
	AG7330, AG7350, AG7355, AG7450	5000p
	NVFS100	5000p
N.E.C.	D5600	3500p
SANYO	TLS1000P, TLS1001P, TLS1100	3100p
	VHR7800, VHR7810, VHR8000SP, VHR8801SP, VHRD4800	3100p
SHARP	VCH80, VCH81, VFH815	2800p
	VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
	VCA55, VCA63	2200p
SONY	SLV656, SLV715, SLV757, SLV777, SLV815, SLV825	4600p
	SLV353UB	3200p
	CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E	4800p

Original Video Heads

MAKE	MODELS	PRICE
NATIONAL PANASONIC	NVG20, NVG21, NVG22, NVG25 NVG25, NVG28, NVG200, NVD48 PART NO: VEH 0343	3000p
	NVG33, NVG45, NVG46, NVL23 NVL25, NVL28 PART NO: VEH 0417	2900p
	NVJ30, NVHJ33, NVL20, NVL21, NVG30, NVG31, NVG40, NVG130 PART NO: VEH 0416	2700p

Audio Control Head

AMSTRAD ORIGINAL NO: 150751
Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000
Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM **ORDER CODE: AH01 PRICE: 1350p**

AMSTRAD ORIGINAL NO: 153134
Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244
Also fits: ANITECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLDHAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEDIER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM **ORDER CODE: AH02 PRICE: 1450p**

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR 0050	NV300, NV340 etc	875p
VBR 0061	NV777 etc	875p
VBR 0103A	NV250, NV450 etc	625p
VBR 0125		625p

8 way Preprogrammed Universal Remote Control

A single remote control to operate Televisions, Videos and Satellite Receivers. Plus Auxilliary Options!!

- Replaces up to 8 remotes with one * Simple 4 digit setup routine
- Controls 1000s of models * Teletext functions with Fastext
- Clear (large key) layout * Code Search Facility
- Stylish and easy to operate * Replace broken or lost remotes
- Original Remote not required

Order Code: 8 WAY Price 1450p + VAT

Replacement Video Cassette Housings

MAKE	MODELS	CODE	PRICE
AKAI	VS35, VS53, VS55, VS56, VS7	CH18	2600p
GRANADA	VHSDP1	CH05	1100p
	VHSYJ2	CH01	2600p
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316,4320, 4321, 4325	CH25	2000p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2600p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2600p
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2600p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2600p
	FV31R	CH19	4300p
	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2400p
	HRD540, 580, 830, 860, 910, 960, HRD970, HRDX20, FERGUSON FV57H	CH27	2400p
I.T.T	VR3605, VR3905	CH01	2600p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
NATIONAL PANASONIC	NV730	CH06	4300p
N.E.C.	N830EG, N831EG, N832, N833EG	CH01	2600p
	N895	CH02	2600p
PHILIPS	CASSETTE LIFT ASSEMBLY (69120366) DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p
	VR6443	CH22	2900p
	VR6448	CH23	2500p
	49SB6	CH24	2500p
SHARP	VCA100, VCH851, VCH852	CH22	2900p
	VCA103, 103GV, 106, 106GVM, 254GVM	CH23	2500p
	VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610	CH24	2500p
TELEFUNKEN	VR2970	CH02	2600p
THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2600p
	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH02	2600p
TOSHIBA	V55, V57	CH01	2600p
	V65, V66	CH02	2600p

Service Aids

DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	140p
SWITCH CLEANER	176ML	SP02	150p
SILICONE GREASE	200ML	SP03	170p
FREEZE IT	170ML	SP04	220p
FREEZE IT	400ML	SP16	350p
FOAM CLEANER	400ML	SP05	170p
ANTI STATIC	150ML	SP06	170p
AEROKLEANE	135ML	SP07	200p
AERO DUSTER	150ML	SP08	220p
AERO DUSTER	400ML	SP17	425p
PLASTIC SEAL	200ML	SP09	200p
GLASS CLEANER	250ML	SP10	160p
COLDKLENE	250ML	SP13	200p
EXCEL POLISH 80	250ML	SP18	150p
ADHESIVE 120	400ML	SP19	190p
LABEL REMOVER 130	200ML	SP20	240p
REFURB 140	400ML	SP21	240p
TUBE SILICON GREASE	50 GRAMMES	SP11	200p
TUBE SILICON SEALANT WHITE	75ML	SP22	280p
TUBE SILICON SEALANT CLEAR	75ML	SP23	280p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	150p
COMPUTER CARE KIT	—	SP26	2100p

All the above items are manufactured by Servisol

If you purchase more than one Servisol Product, postage & package will be charged as follows:
300p for 5 cans 450p for more than 5 cans

CD Pick Ups

SONY OPTICAL PICK UP
PART NO: KSS210A SONY CDPC 301M, CDPC 305M 2200p
Fits most Sony, Akai & J.V.C. Portable Hi-Fi and Midi Systems

PART NO: KSS210B
USED ON MODELS:
CFD100, 105L, 120, 300, 440, 454, 455, 50, 500, 55, 58, 60
CFD68, 750, 755, 760, 765, 770, 775, 440S, W100, 100S 2200p

Cassette DC Motors

MOTOR TYPE	PRICE
6V MOTOR	170p
9V MOTOR	170p
12V CW MOTOR	170p
12V CCW MOTOR	170p
13.2 CCW MOTOR	290p

Cassette Tape Heads

HEAD TYPE	PRICE
MONO HEAD	90p
STEREO HEAD	110p
MINI HEAD	150p
AUTO REVERSE HEAD	200p

Soldering Accessories

DESCRIPTION	CODE	PRICE
ANTEX SOLDERING IRONS		
25 WATT 240 VAC (XS25W 240V)	S101	900p
15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
SOLDERING STAND & SPONGES		
SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	S109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
DESOLDERING AIDS		
SOLDER MOP STANDARD GAUGE 1.2mm x 1.5M	S107	70p
SOLDER MOP 1.2mm x 10M	S113	400p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p

Transistors & ICS

BU 508A (PHIL)	80p	MJE 13009	100p	2SC 3885A	350p
BU 810	110p	MJE 18004	125p	2SD 633	70p
BUZ 90A	180p	STK 6982H	600p	2SD 1680	225p
CXA 1044P	550p	STK 7253	450p	2SK 793	400p
HA 13408	350p	TDA 2030H	100p	2SK 956	1400p
IRFBC40	400p	TEA 2019	200p	2SK 1023	550p
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TELEVISION

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Then and Now

A significant anniversary occurred this month while we were preparing the current issue of *Television* for press: forty years ago, on September 22nd 1955, regular ITV broadcasting began in the UK. The Croydon transmitter started to do its stuff, and Associated Rediffusion was on air. As with the BBC's services, ITV started in London then spread gradually across the UK.

By 1953, boosted by the Coronation, some three million TV sets had come into use in the UK. On that day in September 1955 about 190,000 sets could receive the new transmissions. TV was slowly becoming a major part of people's lives in the UK, but the real growth in TV set ownership and viewing was still to come.

Looking back at the technical writings of the time, one might today be puzzled by the sense of alarm at what was in store. Would the 'small' Band III aerials be able to pick up enough signal? Would what was picked up be lost during its passage down the coaxial cable? Would sets be stable enough at such frequencies? Would everything be drowned by all sorts of horrible radiation and interference?

There was in fact some cause for concern. Sets were then incredibly primitive by today's standards – not only with respect to the circuitry but also the quality of the components. Flywheel line sync was just about to appear, and in many areas you required a 'fringe' receiver with an extra i.f. stage. Even the valveholders could do nasty things (though some chip holders in later generation sets weren't all that hot either). The broadcasters were also struggling with primitive equipment. Cameras had to be set up individually before use, and the transmitters required continuous attention. Looking at contemporary pictures of the Croydon station, one wonders how anything was kept going at all. Just a few weeks after the start of ITV, the transmitter lost its sound output for over an hour. Would you believe it, a screen grid feed resistor in the tetrode sound modulator output stage had gone open-circuit? Those on duty spent the best part of that hour checking the power supply.

But to have got anything up and going in time was an achievement. The Independent Television Authority, which was responsible for the transmitters, couldn't be set up officially until the Television Act, which established independent television, became law in July 1954. That didn't leave much time to undertake the design and engineering of the equipment required for the new services at the new, higher frequencies. It was fortunate for ITV that it could acquire engineering knowledge and skill from those who had learnt it at the BBC.

The start of ITV had greater social than technological consequences however. It helped bring about a change from the cultural stuffiness that predominated in much of the media up to that time. You might not think that an extra channel could make all that much difference. But with TV still in its infancy, it did. The debate on the Television Act had been long and bitter. Those who felt they had the right to set the cultural tone of the time were justifiably apprehensive about what might lie in store for them.

The forty years since 1955 have seen extraordinary changes in consumer electronic technology. One wonders what those who worried about oscillator stability in Band III would have thought of the idea of today's stable LNB oscillators, and of the current situation and the wonders on the immediate horizon? There was then no video recording even for the broadcasters: now we are about to have hand-held digital camcorders. A digital anything other than a one-off computer was inconceivable in 1955. Yet now we have the domestic PC and 32-bit games systems. F.M. as a transmission technique had been around for some years in 1955, but no one would have anticipated digital transmissions. For video this remained impossible until the communications boffins started to work on signal compression techniques. In 1955 the start of a second TV channel was a major step forwards. Today we are blazé about the prospect of hundreds of channels, with interactive operation on some, coming to us from satellites and via fibre-optic cable systems.

It will be interesting to see what the next forty years bring!

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COVER PHOTO

This month's cover photograph shows the YC signal processing PCB used in the Mitsubishi HS-M50VB, a Hi-Fi VCR with auto-tuning, Video Plus and teletext.

Satellite Workshop

Jack Armstrong

Although I don't install satellite systems now I often receive calls about installation faults. Sometimes I can help while sometimes I provide the number of a local installer. On this particular occasion I was intrigued, because the system concerned had been installed by a firm that always does an excellent job. Here's how the customer described the problem to me over the telephone:

"I can't get Sky One, though everything else is all right."

I asked him to tell me what he saw instead of the Sky One picture. "Nothing" he replied firmly.

Getting Nowhere

Now some customers exasperate me, and I could tell that this was going to be one of them. "I need to know exactly what you see on the TV screen when you select Sky One" I explained, as patiently as I could. "Nothing" he maintained.

A woman's eyesight is sometimes better than a man's. Having established that his wife was present, I asked whether I could speak to her. Although suspicious, he passed the handset over.

"Your husband has problems with describing colours" I said kindly, "so I want you to tell me exactly what colours you see on the TV screen right now."

"Just black and white lines and the whole picture keeps jumping" she replied.

"Any decoder messages?" I asked hopefully. "Does it say 'Please insert card' or anything like that?"

"No – oh, yes – but it's gone again."

"And the other channels are all right?"

"Yes, but he wants his Star Trek, so you've got to fix it quick."

As this particular customer lived only half a mile away, I suggested that the receiver was brought along to me for testing.

The husband arrived within minutes, clutching a Nokia SAT1700 to his chest. It was still warm.

I connected it up and selected Sky One. The message 'Please insert card' immediately appeared. When I did so the picture cleared, producing a nice, stable picture with no obvious fault. Since it was almost lunchtime, I offered to call at the house to see the actual problem.

An Extension

When I arrived we reconnected the receiver and, sure enough, the Sky One channel gave every appearance of a very weak signal. The other channels were almost perfect, with just a few sparklies on Sky News. This was unusual, because in the UK Sky News is one of the strongest signals.

I connected my spectrum analyser and found that a marked dip in the signal level was apparent with some transponders.

"When did the problem start?" I enquired.

"Last week, after we moved it from the dining room to here."

"Who actually moved it?"

"Harry did. The cable wasn't long enough, but he used the proper stuff – with 'satellite' written on it."

I could visualise the problem and knew exactly what I was going to find before I entered the dining room. Sure enough, the cable had been extended by soldering an additional length to the original. The joint caused a massive impedance mismatch – in fact I was amazed that any signal reached the receiver.

As a temporary measure I fitted an in-line threaded barrel with F connectors to join the two lengths of cable. This improved the picture enormously. My final advice was to call in the original installers to replace the entire cable length if they were still unhappy with the signal quality.

Thankfully, with only the first five minutes of Star Trek missed, the customer was happy to pay my call-out fee.

Another Call

I'd just arrived back at the workshop when the telephone rang again. "You've got to help me – my neighbour has threatened violence."

Apparently whenever the caller moved his dish it caused interference to his neighbour's television receiver. A lengthy discussion suggested that the dish actuator motor was the cause of the intereference, to both the caller's and his neighbour's TV set.

"Are you sure that you've connected the cable screens to earth at the back of your positioner?" I asked.

"Of course! I've done everything right."

The receiver/positioner combination was, he said, of Uniden manufacture. I offered to inspect the installation for a nominal call-out fee and we arranged for an evening visit.

Pace PRD800/900 Receivers

A Pace PRD900 receiver came into the workshop recently with a curious fault. The picture obtained via each scart socket was perfect. It was very dim when the r.f. output was used. I noticed that tapping the receiver changed the brightness.

I carried out all the usual checks around the modulator, looking for broken joints and cracked tracks. As visual examination didn't reveal anything amiss I resorted to the scope. The level of the video input at the modulator was seen to be very low. But why? It was a fairly simple task to trace the signal back to buffer transistor Q105 in the feed to the modulator. This is a surface-mounted npn device near the centre of the board. A good, healthy signal at its base contrasted with a very low one at its emitter. Replacing the transistor cured the fault, but why should tapping the unit have had an effect?

Since then two other receivers with the same problem have come in. One produced no video at all from the r.f. socket. The other one would work for a while but would then start to modulate the picture, turning it from bright to dark as though someone was scrolling through the contrast settings. In both cases replacing Q105 cured the fault.

A subsequent call to Pace produced the advice that when Q105 fails in a PRD800 or PRD900 receiver with a serial number above 345100000 the 330Ω surface-mounted resistor R559 in Q105's emitter circuit should, if fitted, be removed. Only PCBs with part numbers that end in 204, 214 or 224 (printed on the top of the panel, next to the card reader) are affected. Removing R559, which was originally added to meet a particular setmaker's requirements, reduces Q105's dissipation by increasing its emitter load resistance.

A Pace SS9200

A Pace SS9200 IRD that was brought in would flash its LEDs in sequence, but that was all. The flashing slowed down when the LNB was disconnected and the decoder was removed. This suggested that there might be a current overload somewhere.

The usual cause of this problem is the 0·22Ω fusible current-sensing resistor R13 being of incorrect value. People often fit a 2·2Ω resistor by mistake. This unit had not received any previous service attention however. I replaced R13 to be on the safe side, but this made no difference. I then measured R11, which was correct at exactly 4·7Ω, and checked all the diodes in the power supply. As C11 (1µF) sometimes causes the problem I replaced it and made sure that its connecting tracks were all right. Next I measured the value of the 100Ω surface-mounted resistor that takes current from the feedback winding on the chopper transformer to the control chip. It was fine.

I measured all the tracks on primary side of the power supply circuit and disconnected the diodes on the secondary side. The power supply still pulsed. I recalled that on one occasion the fault had been caused by an open-circuit feedback winding on the chopper transformer. So I replaced the chopper transformer, though the original one measured all right. Still no luck

I then thought hard about this. If there wasn't a short across one of the outputs, and the feedback circuit was definitely working, the only other possibility was the resistance that sets the output voltages. This consists of two parallel-connected surface-mounted components with values of 1kΩ and 15kΩ. When measured, the value of the combination was 1·8kΩ. Bingo! Replacing R7, the 1kΩ resistor, cured the fault.

Back to the Uniden

After tea I drove to the house of the man with the Uniden system. On arrival I was somewhat surprised to find that the nearest neighbouring house was some twenty metres away. Quite a distance to be suffering from interference radiated by screened cable. Inspection of the wiring made the cause of the problem obvious however. Four-core caravan cable had been used for the motor and reed switch feeds, with twin bell wire for the polariser.

"It loses its position too" the man said helpfully. I wasn't surprised. Without any screening, the cable would not only radiate motor interference to any nearby equipment, it would also interfere with the positioner pulse-count circuitry.

I offered to replace the entire cable run – about fifty metres – with properly screened motorised ribbon cable. The owner quibbled about my price – until he spotted his neighbour peering over the hedge. As I don't do installations I arranged for an installer I know to do the job, and still make a profit.

At least the man had the courtesy to phone me the following week to say that the new installation had cured his problems and that the picture was actually better than before. I can't say why, though screening the polariser wires had probably helped matters. Dithering the skew at 50Hz wouldn't do anything for the picture quality!

Line Output Stage Fault Diagnosis

Ray Porter, M.Sc., C.Eng., M.I.E.E.

The line output stage is a common cause of set failure. Sometimes the faulty component is readily identifiable. Often however components are changed on spec and then either fail immediately when power is applied or during a soak test. To be better equipped to deal with such situations, it's desirable to understand basic line output stage operation and the limitations of the various components involved.

Line Output Stage Operation

Fig. 1 shows the essential elements of a line output stage. It doesn't include a line output transformer, because in modern sets the transformer is primarily a convenient way of generating extra voltages, in particular the e.h.t.: it does not play a part in the actual c.r.t. scanning.

When the line output transistor Tr is switched on by its drive signal, the current that flows through the line scan coils

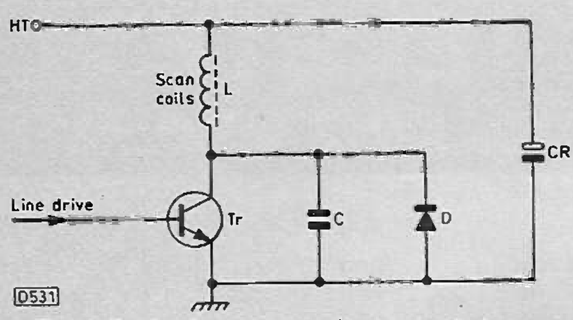

Fig. 1: Basic elements of a line output stage.

L increases linearly with time. The corresponding linearly increasing magnetic field in the coils deflects the spot on the screen from the centre to the right-hand side as viewed from the front.

After about 26μsec (depending on the transistor's switch-on time) the current, with a 110° set, has reached about 2·2A. The output transistor is then switched off. Because of the inductance of the scan coils, a declining current continues to flow. As a result capacitor C, which with L forms a resonant circuit tuned to the flyback speed, is charged. At the point when the transistor is switched off the coil, which has an inductance of about 1·8μH, has stored about 4·4mJ of energy (calculated from energy = $0{\cdot}5LI^2$). This energy is transferred to C. L and C form a parallel tuned circuit, since CR behaves as an a.c. short-circuit.

While the circuit energy is being transferred to C, the spot moves back to the centre of the screen. This is the first part of the flyback, which ends when the current flowing in L falls to zero. At this point the voltage across C (and the transistor) has risen to about 1·2kV, and all the energy is stored in the capacitor. Because of the resonant action, the capacitor now starts to transfer its energy back to the coils. After 6μsec the current through the coils has again built up to 2·2A, but this time the current is flowing in the reverse direction – from L to C. The spot is thus deflected from the centre of the screen to the left-hand side.

The flyback is now complete, having taken 12μsec, and C is fully discharged. Since L and C form a resonant circuit, the energy would next be returned from L to C, with C recharging, this time with reverse polarity. When the voltage at the junction of C and L tries to swing negatively however the efficiency diode D switches on, providing a clamp action. The declining current in L passes through D and CR. Since the efficiency diode shorts out C, the current decreases linearly. After about 26μsec the energy stored in L has been dissipated and the spot is back at the centre of the screen. The drive circuit now switches the line output transistor on again, and the cycle is repeated. The relevant waveforms are shown in Fig. 2. Note that because of losses in the circuit the timing departs slightly from the ideal. The transistor's switch on time is adjusted to compensate.

The arrangement shown in Fig. 3 takes us a couple of steps towards practical circuitry. The scan coils are capacitively coupled to the rest of the circuit, and the supply current flows through the primary winding of the added line output transformer. The line output transformer's inductance is about 4mH, and at the end of the forward scan about 1A is flowing through its primary winding. As a result energy is stored in the transformer and is subsequently used to produce the e.h.t. and various other supplies. All the energy used to generate these supplies is stored in the line output trans-

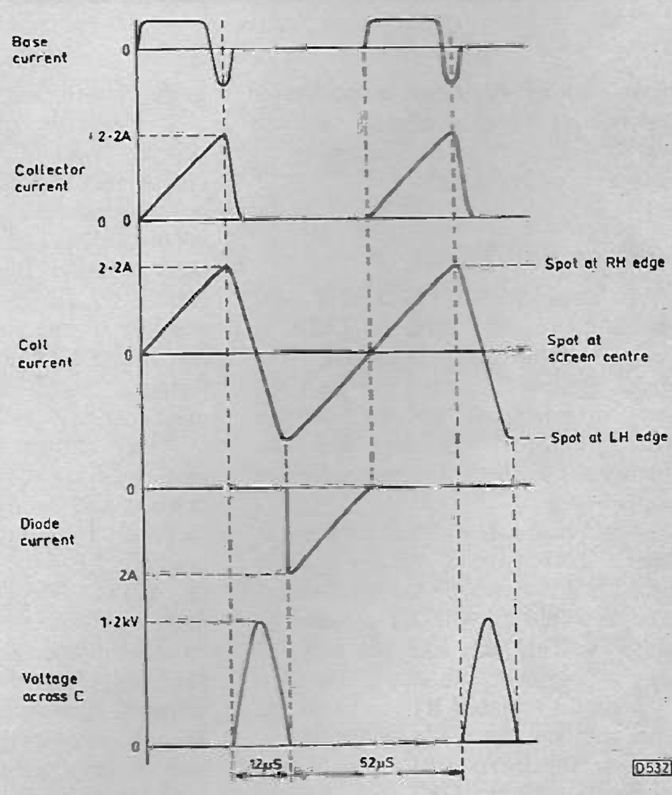

Fig. 2: Basic line output stage current and voltage waveforms.

former's inductance during the 26μsec centre screen to right-hand side part of the forward scan, since this is the only time when current is taken from the main power supply in the set.

The line output transformer delivers the energy stored in it to the auxiliary loads during the following 38μsec period.

The line output transistor's supply voltage is about 150V, its average current being about 0·5A with a duty cycle of 40 per cent. Thus about 30W is delivered to the transformer's load circuits. The polarity of the e.h.t. winding is arranged to take advantage of the highest rate of change of flux in the transformer, during the flyback: thus the e.h.t. is generated using

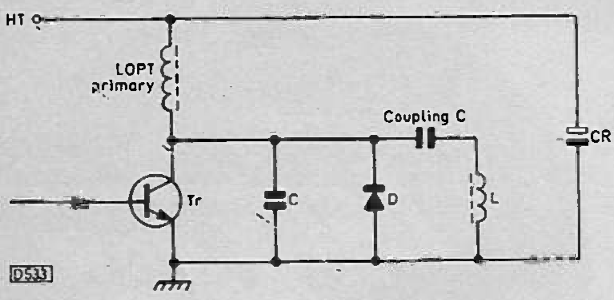

Fig. 3: Addition of a line output transformer and scan coupling capacitor to the arrangement shown in Fig. 1.

one quarter of the turns that would be required if the forward scan was used instead.

Line Output Transistor Operation

The line output transistor has to be able to pass the full current of 4A and withstand the 1·2kV peak voltage that occurs across the tuning capacitor during the flyback. Junction heating in the transistor occurs mainly when it is switched off, i.e. as the flyback begins, and is caused by switching losses. The other time when the transistor can heat up is when it's switched on, but it is driven rapidly to saturation. Once in this condition there is virtually no voltage across the transistor and thus very little dissipation. Averaged over the full 64µsec scan cycle, the transistor's dissipation is less than a watt. A critical factor is the transistor's Safe Operating Area Characteristic (SOAC). This takes into account all circuit conditions.

Besides over-current, over-voltage and excessive junction temperature, transistors fail when they are subjected to excessive instantaneous power pulses. These initiate second breakdown failure. This is a thermally triggered avalanche effect that's similar to the results which would be obtained if several transistors were operated in parallel, some having a lower voltage drop for the same current than others: these would pass more current, overheat, pass even more current (thermal runaway) ending in device destruction.

Fig. 4 shows a typical SOAC curve. It indicates how the instantaneous power must stay within strict duration limits. Transistors with similar current and voltage ratings won't always survive in power switching circuits if their SOACs differ.

Base Current Turn Off

The speed at which the transistor's base current is turned off when it is brought out of saturation at the end of the forward scan has to be carefully controlled to reduce stress in the transistor. A very rapid base current switch off will result in rapid but only partial collector current switch off, as current carriers will be trapped in the high-resistance collector region. As a result there will be maintained collector current flow at the time when the collector voltage is rising rapidly, and thus excessive dissipation. To prevent this, the base current switch off is slowed down by adding an inductor in series with the base – generally the driver transformer's secondary winding fulfils this function.

The components used in the line output transistor's base circuit are always of low value, as the base current can be as high as 2A in a 110° set. The transistors are not guaranteed to have a gain of more than about two when saturated with a high current flowing. It follows that all base circuit components must be robust and well soldered.

The Line Output Transformer

It's well known that the line output transformer, particularly the e.h.t. section, operates under high-voltage stress. Remember that the primary winding carries pulse voltages in excess of 1kV. All this is taken into account in the design and construction of the transformer. Yet line output transformer failure is still quite common. Internal heating produces mechanical stress in the winding insulation and at the terminals, because of thermal expansion. As some of the heat is conducted to the PCB via the soldered joints, these must be properly made. Otherwise the result will be further increase in temperature and stress.

The Efficiency Diode

The efficiency diode is also a highly stressed component, as it has to withstand a reverse voltage of 1·2kV. Again it's important that the soldered connections are good. The diode's average forward current is 1A, with peaks up to

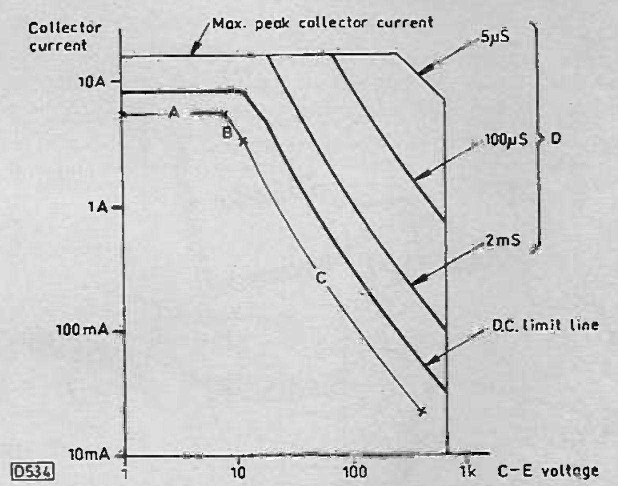

Fig. 4: Safe operating area characteristic for the BU508 line output transistor. D.C. operation must be below the line ABC.
A: Operation limited by the maximum d.c. collector current.
B: Operation limited by the maximum power rating (125W).
C: Operation limited by d.c. second breakdown.
D: Permitted limits for pulses, with one per cent duty cycle and the durations shown.

2·2A. If the connections are not good the resistance introduced will lead to overheating, making reverse breakdown more likely.

In some practical arrangements the efficiency diode is encapsulated with the line output transistor. In circuits that use an EW diode modulator, the efficiency diode function may be accomplished by the two high-voltage diodes in series.

Capacitors

The flyback tuning capacitor was once a notorious component. Experience has taught manufacturers how to make reliable ones. Since the peak charging current is 2·2A, good soldered joints are also essential here to prevent overheating which could result in failure of the highly stressed dielectric.

The reservoir capacitor CR is a medium-value electrolytic. It must be robust and well soldered, otherwise the 2A ripple current will dry it out prematurely.

Causes of Soak Test Failure

If the values of relevant components have drifted from their nominal ones, the voltages and currents in the line output stage will differ from their design values. The new stress level will result in failure of the weakest part.

If the value of the flyback tuning capacitor falls by twenty per cent for example, the peak voltage across it will increase by ten per cent (the energy stored – $0{\cdot}5CV^2$ – will remain the same, as it comes from the scan coils). Another example is the extra stress caused by excessive h.t. voltage: the result is higher than normal scan coil current and thus more stored energy.

Failures that occur during a soak test are likely to be the result of a component value change with time or temperature. The resulting alteration to operating conditions could for example push the output transistor to its SOAC limit, or increase its switch-off dissipation, leading to its destruction.

Inadequate attention to heatsink compound or tightness of fitting will contribute to overheating and subsequent failure.

Diagnostic Procedure

When dealing with a dead line output stage, the following procedure is suggested:

(1) Check the line output transistor for shorts.

(2) Check that the h.t. voltage is correct. If the power supply has shut down, disconnect the feed to the line output transformer and see if it works when loaded with a 60W bulb instead.

(3) Check whether there are any shorts across the line output transformer's secondary windings. The first things to test are the rectifier diodes and their reservoir capacitors.

(4) Check whether any of the line output transformer windings are open-circuit and whether there are any shorts between pins other than earth pins – there can be shorts between windings or to the core. Check the soldering to the pins. Then use a line output transformer tester to check for shorted turns.

(5) Check the components in the output transistor's collector circuit, e.g. the flyback tuning capacitor(s) for shorts or value change, and the efficiency diode(s) for the short- or open-circuit condition. These high-voltage components are often best checked by substitution – they may read normally but fail when power is applied. Check that all soldered connections are good.

(6) Check the value of the components in the output transistor's base circuit. Look for damaged base circuit inductors and for poor quality soldering – this includes the condition of the line driver transformer and the soldering to it.

After carrying out these checks the magnitude of the failure can be assessed and all suspect parts replaced before switching on again.

Teletopics

HD Disc Agreement

A systems war between the Philips/Sony MMCD and the Toshiba consortia's SD high-density disc systems has been averted. Both sides have agreed to adopt a common format for high-density digital discs. The new discs will use the basic SD technology and error correction system with MMCD's EFM Plus signal modulation system. No definite launch dates for the discs or equipment have so far been announced. It is unlikely that systems will become available until late next year at the earliest. Players at about £700 initially have been suggested, with the discs at around £15 for a recorded film. The initial systems will be playback only.

The new discs will be available in single- or double-sided versions with each side having one or two data layers, the storage capacity being 4·7Gbytes per layer. This is slightly less than the basic SD system (5Gbytes per layer). The slightly reduced storage capacity is expected to offer better backwards compatibility with existing audio CDs, Video CDs, CDi and CD-ROM discs.

Later versions of the system will include record facilities, but this could be some time off. Apart from the need to perfect an erasable record phase-change disc, for full system compatibility the player/recorder would need to incorporate an MPEG-2 encoder. This is at present an expensive proposition.

PLASMA TV DISPLAYS

We reported in the September issue (page 780) on the Sony Plasmatron, a plasma-based display system for TV use. Sony plans to launch sets that use the screen next year, in Japan. Since then announcements have been made by several other companies.

Matsushita has unveiled prototype 26 and 40in. plasma displays and expects to introduce sets using them next year. The panels have been developed in conjunction with Du Pont, Texas Instruments and NHK.

Fujitsu has demonstrated a 42in. plasma display and plans to start production in October 1996, at an initial rate of 10,000 a month. The intention is increase production to 100,000 a month by the year 2000. Sets fitted with the Fujitsu devices are expected to sell for about £3,400 initially, falling to around £1,700 by 2000.

NEC has also announced that it expects to start producing plasma display panels mext year, in sizes up to 60in. Plans are for production to increase to 150,000 a month by 2000.

Fujitsu expects one in ten widescreen TV sets on sale in 2000 to use plasma display technology, representing sales of 3·3m a year.

Although plasma, an electronic discharge in gas, is the common element in these various displays, several quite distinct technologies are involved. Matsushita uses d.c. plasma technology while Fujitsu and NEC use a.c. plasma technology. Sony's approach is quite different: the plasma discharges are used for switching, in conjunction with an LCD system.

It's likely that the life of a plasma display panel would be inherently less than that of a c.r.t.

Video News

Sharp has launched, in Japan, a couple of VCRs that can record two programmes simultaneously on a single tape. Models VCBF70 and VCBF80 incorporate three tuners, two terrestrial and one satellite, and two timer systems. The user can view the two programmes at the same time either by splitting the TV screen vertically, or in picture-in-picture form. Alternatively the programmes can be watched at separate times. Apparently prices start at around £520, which seems remarkable.

Olivetti has launched Envision, a box that looks like a VCR but contains a 486 or Pentium microprocessor chip, a hard disc and a CD-ROM drive. It plugs into a domestic TV set and can be used for playing CD audio, Video CD and CD-ROM discs. Operation is via a wireless keyboard. Owners can also use Windows programs and a modem. Princes start at around £1,300.

Apple Computer and Compaq are the latest companies to launch computers with built-in tuners and an MPEG video board.

Digital TV

The BBC carried out digital terrestrial TV engineering tests from the Ogmore Vale relay transmitter in Mid Glamorgan during September. The transmitter serves viewers in the Ogmore Vale and Nantymoel areas. It was hoped to be able to visit every residential and business address to check whether the temporary test signals affected picture quality with VCRs.

Pace began production of MPEG-2 digital Pay-TV receivers during the summer. The company is thought to be producing some 15,000 units per week.

Catalogues

CPC's new 1996 catalogue was introduced on September 1st. It has over 1,600 full-colour pages covering everything from OEM spares to the latest electronics and mechanical components and accessories. There are over 39,000 products, including nearly 10,000 new items. Several new product sections have been added. These include opto-electronics, PCB prototyping, surface-mounted devices, motor control, and datacomms/networking. The catalogue is available free of charge to CPC account holders. To open an account, ring one of the telephone sales operators on 01772 654 455.

The 1995/1996 Wizard Distributors catalogue is now available free of charge to trade customers. This latest edition has been expanded to include many new items and illustrations. Existing customers will receive a copy automatically. Those who have not previously dealt with the company can obtain a copy from Wizard Distributors, Empress Mill, Empress Street, Manchester M16 9EN – telephone 0161 872 5438, fax 0161 873 7365.

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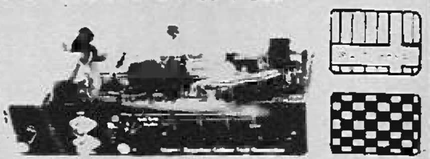

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Inside the Ferguson TX90E Chassis

Part 2

Mark Paul

This month we'll look at the video processing circuitry in the chassis. There are two chips involved, the bus-controlled TEA5040S video processor IV01 and the TEA5640F colour decoder chip IC01. Their links with the rest of the circuitry used in the chassis can be seen from the block diagram shown in Fig. 1 last month. We will look at each of these chips in turn and the functions they perform.

The Video Processor

To simplify matters we'll describe the various sections of this chip separately.

Fig. 6 shows, in block diagram form, the composite video inputs and outputs and the associated switching and switch control arrangements. The off-air composite video (CVBS) signal is fed to pin 39 via a sound trap, buffer transistor TV03 and the 10µF coupling capacitor CV28. External composite video from the scart socket enters the chip at pin 37, again via a 10µF coupling capacitor (CV02). Pin 41 receives a composite sync input from the teletext module.

Switching is controlled by the two-way, three-line serial data bus. The lines are for the clock signal, the data and an enable signal. These inputs have to be decoded to carry out the required switching. The selected composite video signal appears at pin 42. It's passed via an external buffer transistor (TV02) to a high-pass filter to separate the chroma signal and a combined chroma trap and delay line to separate the luminance signal. The chroma signal is fed to pin 25 of the colour decoder chip IC01, while the luminance signal is returned, via another external buffer transistor (TV09), to pin 12 of IV01. The composite video output to the scart socket is taken from pin 40, via internal and external (TV01) buffer stages.

The timebase chip IL01 receives an input from pin 42 of

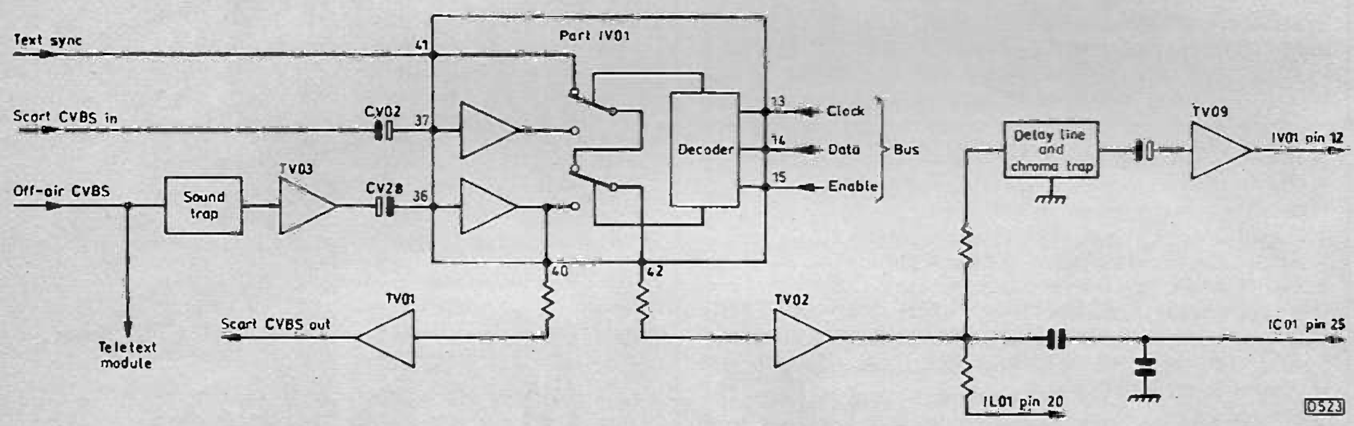


Fig. 6: The composite video switching arrangement used in the video processing chip IV01.

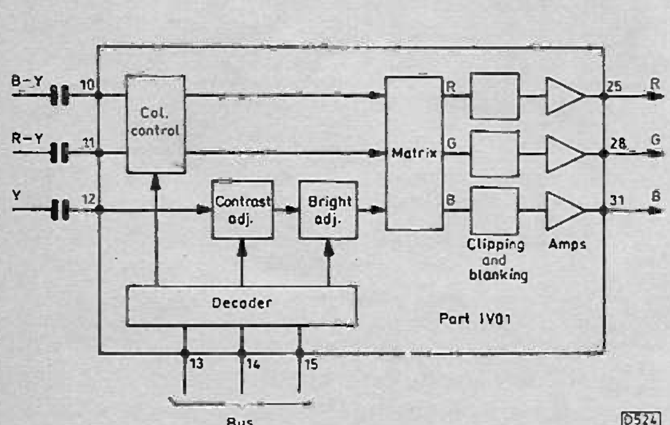


Fig. 7: The contrast/brightness/colour control, matrixing and RGB output sections of the chip.

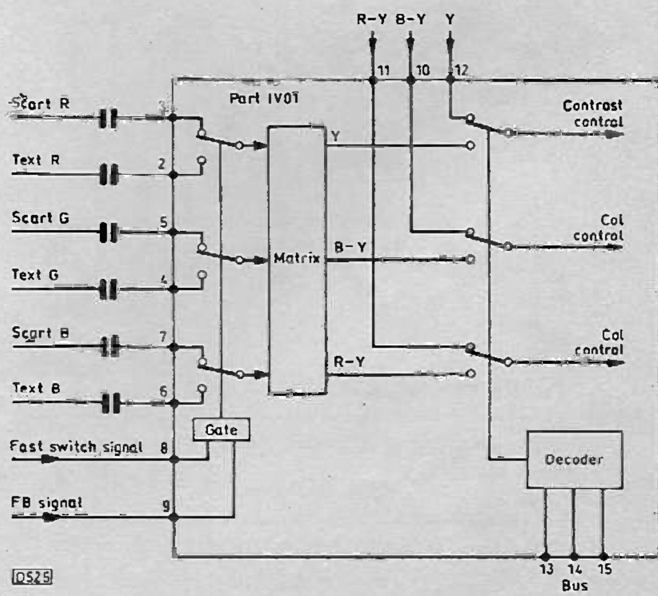


Fig. 8: The RGB inputs are converted to luminance and colour-difference form for feeding to the contrast etc. control section of the chip.

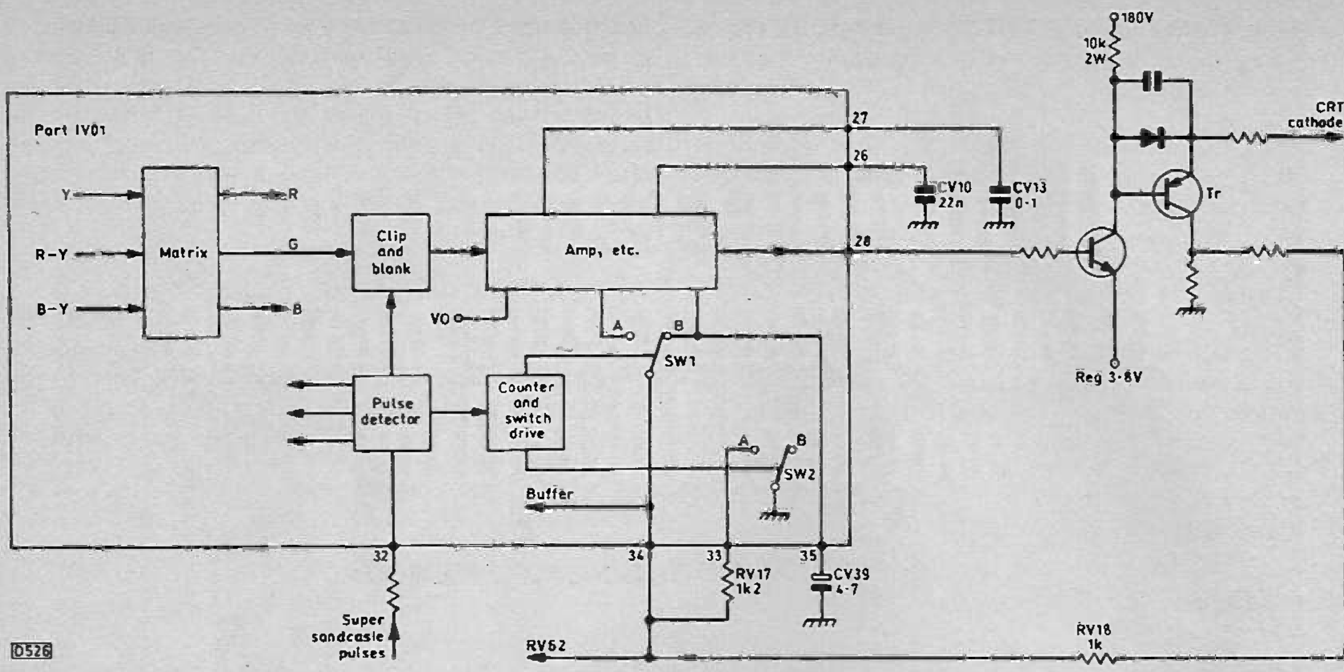


Fig. 9: One of the RGB channels, showing the auto grey-scale tracking system.

IV01, the tap-off point being after buffer transistor TV02: this input may be the off-air or scart composite video or the sync signal from the teletext module.

Fig. 7 shows the section of IV01 that receives the delayed luminance signal (at pin 12) and the decoded chroma inputs from IC01. The latter are now in colour-difference signal form, and are fed in at pins 10 (B – Y) and 11 (R – Y). This is followed by colour, contrast and brightness adjustment as required, again under bus control. The actual control action is carried out by internal digital potentiometer circuits. The colour and contrast levels are ganged electronically to avoid desaturation when the contrast is adjusted.

This is followed by matrixing to produce the RGB signals for the output stages on the c.r.t.'s base panel. Peak beam limiting is carried out by high-clip circuits in the output section of the chip. The R output is at pin 25, the green output at pin 28 and the blue output at pin 31.

As shown in Fig. 8, there is provision for feeding two sets of RGB signals into the chip, scart RGB at pins 3, 5 and 7, or text/on-screen display RGB at pins 2, 4 and 6. Which signals are selected is determined by the fast blanking inputs at pins 8 and 9, assuming that the bus has carried out RGB/CVBS mode selection. When pin 8 is active, the scart RGB signals are routed through: when pin 9 is active either teletext or an OSD appears on the screen.

An important input is the super sandcastle pulse at pin 32, see Fig. 9. The SSC pulse detector circuit produces burst blanking pulses, line flyback and composite line and field blanking pulses from its input.

A new, longer blanking signal is generated from the composite blanking section of the SSC pulse – field blanking lasts for 23 lines, to overcome the line counter effect used in the now standard automatic form of grey-scale adjustment. We'll now turn to this.

Automatic Grey-scale Adjustment

With the current generation of video processing and colour decoder chips the traditional six tube cut-off and drive controls are no longer necessary. These chips use sample-and-hold feedback loops to set the basic level of the RGB drive signals applied to the tube. The RGB channels right up to the tube itself form part of these loops.

The technique involves the insertion, during the field blanking period, of a sequence of check pulses in the tube's RGB drives. Fig. 10 shows the pulse arrangement used here. Drive and quasi cut-off pulses for each primary colour (G, R and B) are inserted on lines 17, 18, 19 and 21, 22, 23 respectively. The pulses on lines 17 and 21 are used to check the tube's green gun conditions, the pulses on lines 18 and 22 the red gun conditions and lines 19 and 23 the blue gun conditions. All three channels are blanked during line 20.

A pnp emitter-follower transistor is included between each RGB output stage and the relevant tube cathode. Fig. 9 shows the arrangement, for one channel, with transistor Tr the emitter-follower. This transistor's collector current is used as the measure for automatic grey-scale correction.

During lines 17, 18 and 19 one cathode's current is about 500μA. The resultant voltage at the relevant emitter-follower's collector appears at pin 34 of IV01, where it's

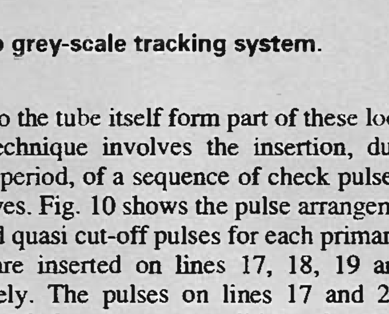


Fig. 10: The pulses used for auto grey-scale tracking. They are generated within IV01 and added to its RGB outputs.

compared with an internally generated voltage (VO) of 0·5V – switches SW1 snd SW2 are both in position A. The relevant 'drive memory' capacitor (CV09 red, CV10 green, CV11 blue) then receives a charge which determines the gain of the relevant channel.

During line 20, the RGB outputs from IV01 are blanked. Thus only c.r.t. leakage currents flow. As the impedance at pin 34 of IV01 is now high (SW2 is in position B), even a low total leakage current produces a measurable voltage. Since SW1 is in position B, a charge is developed across CV39 at pin 35.

During the following lines 21-23 SW2 remains in position B while SW1 returns to position A. The three 'cut-off' cathode currents are measured in sequence, at pin 34, each voltage being compared with that previously stored by CV39. The relevant 'cut-off memory' capacitors (CV12 red, CV13 green, CV14 blue) are then charged, subsequently providing a black-level clamp action.

Note that SW1 is in position B on only line 20, while SW2 is in position B on only lines 20-24. At all other times the switches are in position A.

As a result of the action of these sampling feedback loops, carried out once per frame to set up the RGB drive levels, correct grey-scale tracking is maintained throughout the life of the tube.

Beam Current Limiting

There is 'average' beam current limiting and the usual beam current limiting based on the voltage at the earthy end of the e.h.t. section of the line output transformer. Fig. 11

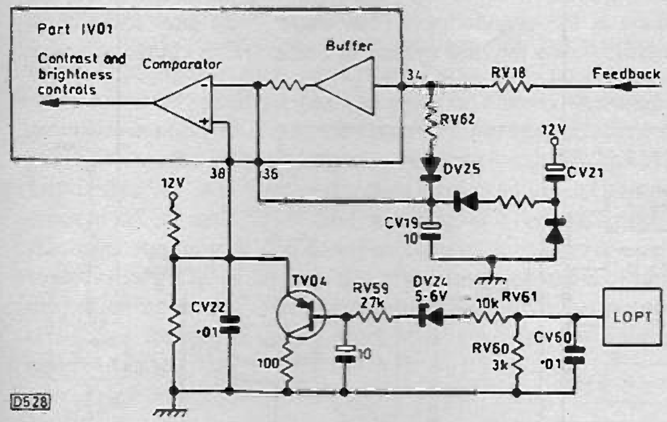


Fig. 11: The beam current limiting systems.

shows the relevant details. The integrating circuit RV62/DV25/CV19 develops across the capacitor a voltage that corresponds with the total instantaneous beam current. This voltage is applied via pin 36 of IV01 to a comparator whose other input, at pin 38, is obtained from the 12V line. When the voltage across CV19 reaches a level that corresponds with 78 per cent of the maximum permissible beam current, the RGB drives are reduced via the contrast and brightness control circuits.

Conventional beam current limiting is carried out by transistor TV04, whose base is linked to the earthy end of the e.h.t. generator system via RV59, zener diode DV24 and RV61. Should the voltage across RV60 reach DV24's zener voltage TV04 will switch on, reducing the voltage at pin 38 of IV01. The action is again via the comparator – whether one input is increased or the other decreased the result is the same.

The Colour Decoder Chip

The TEA5640F colour decoder chip IC01 incorporates a digitally controlled PAL/SECAM signal identification system. At switch on it operates in the SECAM mode, with an external bandpass filter that's tuned by internal capacitors to the 4·286MHz SECAM carrier. If it doesn't detect a SECAM signal by the end of a set waiting period it switches to the PAL mode, with the bandpass filter now tuned to 4·43MHz. Again, if no colour signal is detected by the end of the waiting period it switches back to SECAM. This sequential signal scanning continues until a signal is recognised. The waiting period is derived from a 62·5kHz signal that's fed in at pin 15. This reference signal comes from the microcontroller chip IR01.

Colour decoding is carried out conventionally, with system switching as necessary. A separate regulator circuit provides an 8V supply for the chip at pin 9. The series regulator transistor TC01 is external while its control circuit is internal. TC01 receives a 13V supply derived from the line output stage at its collector. Its emitter supplies pin 9 of the chip. An internal comparator and current source transistor control TC01's base via pin 10.

THE SATELLITE BOOK

A thoroughly revised and updated fourth edition of *The Satellite Book* has been published by Swift Television Publications, 17 Pittsfield, Cricklade, Wilts SN6 6AN – telephone 01793 750 620, fax 01793 752 399. The large A4 format book, with 302 pages, provides information on all aspects of satellite TV theory and practice and is copiously illustrated. The new universal LNBs are covered, also how to switch satellites without any moving parts. There are chapters on such subjects as digital compression techniques and MPEG-2 broadcasts. The book costs £32 plus carriage – £2.50 UK, £5 Continental Europe, £16 to the rest of the world – from the above address.

BPL BRAND TV SETS

We understand that spares and service information on BPL brand TV sets are available from Falmouth Hi Fi, 14 Market Strand, Falmouth, Cornwall TR11 3DE. Telephone 01326 313 412.

ECONOMICALLY PRICED SCOPES

A new range of economically priced scopes has been introduced under the Mr Analog name. There are at present five models, with frequency responses up to 100MHz, sensitivities down to 2mV/div and timebase speeds from 500msec/div to 20nsec/div, all with an accuracy of ±2 per cent. A x10 multiplier reduces the shortest timebase speed to 2nsec/div, with an accuracy of ±3 per cent. All models have a six-inch screen. Three models have auto set-up on all three input channels. There is also a full on-screen parameter display, a frequency counter and cursor measurement capability. Further models are expected shortly, including a 200MHz version. For further details and current prices, apply to Hesing Technology, 41 Bushmead Road, East Socon, St. Neots, Cambs PE19 3BT. Telephone 01480 386 156, fax 01480 386 157.

OZAN TELETEST KITS

Ozan has launched a range of Custom Teletests – TV test pattern generators that you can build yourself. With full features, the prices start at £69.95 plus VAT. They can be upgraded to suit your needs. An ideal Christmas present for all TV engineers! For further details Freecall Ozan on 0500 009 070 – or refer to the advertisement on page 15 of this issue.

Domestic Multi-channel TV Distribution Systems

Part 2

Bill Wright

In Part 1 last month I described the TV/video arrangements at the Clutter household – the system that had been giving them such poor results. It had evolved gradually over the years as various additions had been made. This time we'll describe the design and installation of the new system, based on current best practice.

Off-air Reception

The first thing we did was to check whether good reception could be obtained from the local high-power transmitter (Emley Moor). Unfortunately it couldn't. This was a great pity, because the use of strong local signals, including the correct regional ITV, would have greatly simplifed matters.

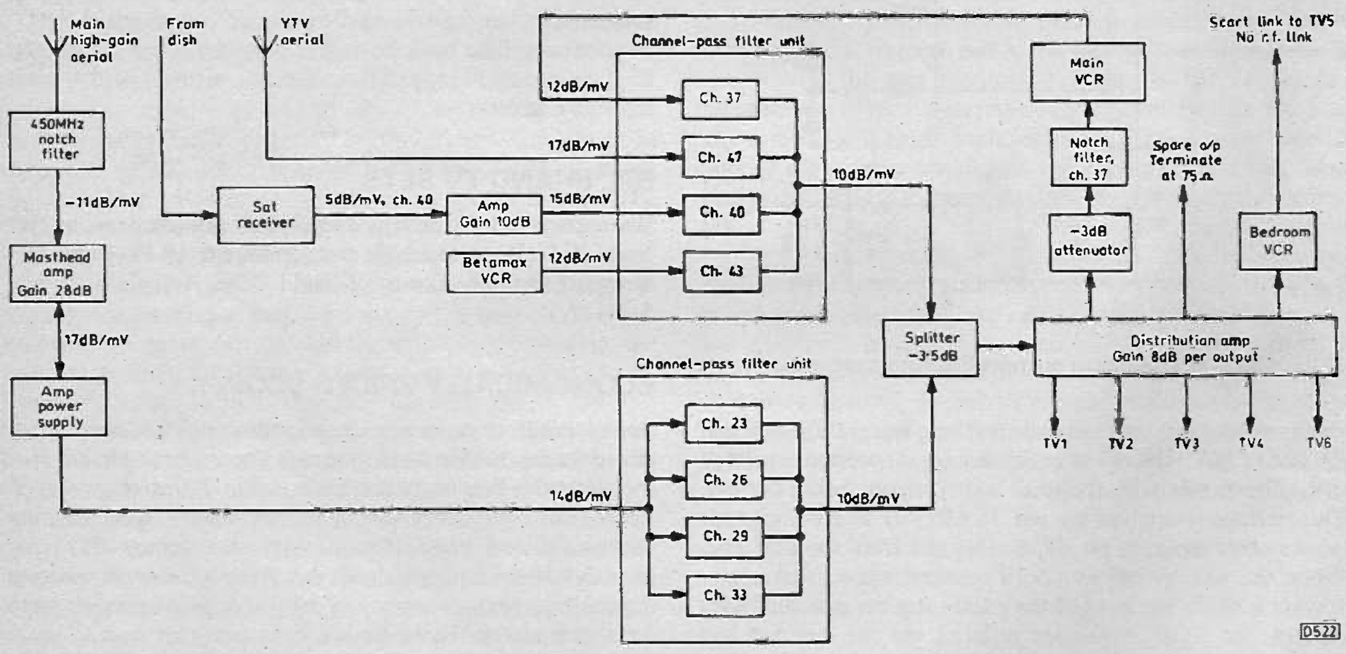


Fig. 1: New distribution system for the Clutters. Compare with Fig. 1 last month.

Use of a third possible transmitter, Belmont, was considered but was ruled out. The field strengths were little better than those from Bilsdale, the transmitter we decided to use, while in this area reception from Belmont is susceptible to co-channel interference from Europe – an aerial that points at Belmont also points at Holland and Belgium.

A good-quality, high-gain aerial was duly installed, pointing due north to Bilsdale some sixty miles away. This provided signals of –9dB/mV to –11dB/mV, with which I was happy. Because Bilsdale is to the north we can use it without fear of interference from Europe, even when the field strength is low. So –11dB/mV is o.k.

A standard Band IV notch filter was used to remove the police transmissions, 450MHz being just within its tuning range. But because the police transmissions were of short duration and not very frequent, it was not possible to tune the filter to them directly. Instead, a frequency analyser was used to determine the exact frequency: the filter was then connected between a broadband noise source and the analyser and tuned to produce a notch at the relevant frequency. The filter had to be fitted ahead of the masthead amplifier of course. Its through loss was about 1dB on ch. 23.

The Clutter clan insisted on reception of Yorkshire TV, but seemed to be oblivious to regional differences on BBC-1 and BBC-2. Of the local channels therefore I decided to put only Yorkshire ITV on the system, removing the others. This was done at the channel-pass filter stage – see later and Fig. 1, which shows the new system in outline. This course of action has several advantages. First, the fewer channels there are on the system the better, because the cross-modulation ceiling rises 3dB every time the number of channels is halved. As the Emley Moor signal levels varied widely, reducing them to one channel greatly reduced the potential for intermittent cross-modulation. Furthermore, had I left dodgy versions of BBC-1, BBC-2 and Channel 4 available, the Clutters would undoubtedly have tuned in to them – and then moaned. As it was, I stressed to them that YTV should be regarded as a secondary service, to be used only when there was a different programme on Tyne-Tees from Bilsdale.

Careful positioning of an 18-element aerial for Emley Moor produced a YTV signal of 17dB/mV. This was about 12dB below the line-of-sight figure. The aerial was aligned with reference to YTV reception only. There was noticeable ghosting on YTV: the other channels were very poor, one being virtually unwatchable.

Channel-pass Filters

With a difficult system like this one, where the available off-air signals are not good and there are a number of domestic modulator derived signals, each and every signal input must be filtered before it is combined with the others. Since we are dealing with 8MHz wide TV channels, the filters used should have a bandwidth just sufficient to accept one such channel without distorting the signal.

Channel-pass filters are available from a number of sources. The types with which I am most familiar are imported by Taylor Brothers of Oldham and are sold as the TCFL series. They come in units that contain one, two, four or six separate channel-pass filters. Each channel is passed through three tuned stages and a variable attenuator. Through loss is usually 2 or 3dB. Fig. 2 shows a typical frequency response for a four-channel unit. With all units the channels accepted appear at the same output socket, though any input configuration is possible. With a four-channel unit for example you can have four separate inputs, two inputs each with two channels, or one single-channel input and one three-channel input.

The input configuration required should be specified when ordering, but altering it is easy enough. The channels should also be specified, but can again be altered afterwards – within a limit of about ±7 channels. Further retuning is possible, but the through loss may become excessive. As it's impossible to stock every conceivable filter, a certain amount of re-configuring and retuning is often necessary. Accurate retuning is not possible without a spectrum analyser and a noise generator. Simply retuning for maximum output using a signal-strength meter will give very poor results, as the tuned stages must be aligned for the correct bandwidth.

Signal-level Planning

The signals that pass through an amplifier or other active device must do so at a level that is within the device's operating range. With a domestic system, a single broadband amplifier will be used to bring the signals up to the correct level for distribution. If the signal levels are too low, excessive noise will be introduced; if they are too high, cross-modulation and other undesirable effects will appear. As a rule of thumb, run the amplifier at a maximum gain of about 10dB below the level where cross-modulation becomes visible.

The distribution amplifier will usually be of the multi-output type, with separate cables run between the amplifier and each outlet socket. I'm in the habit of planning my signal levels backwards; that is, I start at the outlets and calculate back towards the signal sources. At no point should the signal level in the system drop below 3dB/mV, or noise will be introduced. To allow the level to become really low at some point and then increase it by using additional amplification is no good at all.

When calculating the input signal level required by the distribution amplifier, take into account the loss introduced by the longest downlead and the gain at each amplifier output. Although it's supposed to be acceptable to provide a TV set with a signal level of 0dB/mV, I always plan for no less than 8dB/mV at each outlet. The amplifier input required, plus the filtering and combining losses, give the signal level that should be provided by each signal source. In the Clutters' system the Amstrad satellite receiver provided an output of only 5dB/mV, which was not sufficient. A small set-back booster amplifier with a gain of 10dB was used to bring the level up to 15dB/mV. It's most important to incorporate any such gain before the relevant channel-pass filter. Where several inputs to a filter unit are low it's tempting to fit one amplifier after the filter rather than several before it, but this negates the whole point of using channel filters, which is to keep each channel clean, without noise and interference contamination from other sources.

Use the variable attenuators in the filters for final signal-level adjustment. Normally all outputs will be set at the same level, but if cable runs are long, and channels at both ends of the band are used, some slope might be applied – say 4dB across the whole band.

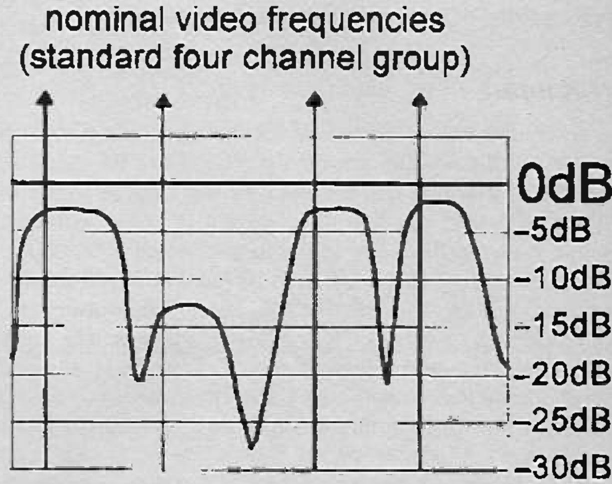


Fig. 2: A four channel-pass filter unit frequency response. One channel has been set at –12dB.

With this particular system I was concerned that the ch. 47 Emley Moor signal might rise sufficiently to affect reception of the other channels. Careful aerial alignment had produced a signal 12dB below the line-of-sight figure, so I was confident that in practice the level was unlikely to rise by more than about 6dB. Accordingly I set the ch. 47 level at –4dB relative to the other channels. What if the off-air level was to drop dramatically? Well, in this case the Clutters don't get to watch YTV – unless they want to pay me to move the aerial to suit the changed reception conditions. Make sure your customer understands that reception cannot be guaranteed when the incoming signal is unreliable.

If your signal-level planning is about right, it's likely that you will use the variable attenuators to reduce each channel by about 4dB. If you have to leave any channel at maximum you are obviously pushing your luck. If you have to reduce any previously amplified signal by more than about 10dB you are using unnecessary amplification which will add noise, introduce the potential for instability and be a waste of money. Always use just enough amplification. Do not for example use a two-stage masthead amplifier only to discover that a 12dB attenuator is required at the distribution amplifer's input: plan your signal levels, and in this example use a single-stage masthead amplifier.

Signal Combination

Because each path within a block of channel-pass filters consists of a series of tuned filters, the outputs can be connected together inside the unit without impedance mismatching. Up to six channels can be combined in this way with virtually no loss. Compare this with the alternative – the use of a six-way inductive splitter to combine the signals, with losses of about 10dB.

In many cases all the channels can be passed through a single block of filters whose output can go straight into the distribution amplifier. Two filter blocks were used in the Clutters' system, so an inductive splitter was required to combine the two outputs. The splitter used should be a top-quality item in a metal case. The ones with F sockets are ideal. There's no point in using a diplexer, even where this is possible. Three-, four-, six- or eight-way splitters can be used where necessary, but the lowest signal losses will be achieved by using the smallest possible number of channel-pass units, each carrying the maximum number of channels.

VCR Input

When the output from a VCR is fed into a distribution system a difficulty can arise if the VCR takes its aerial input from the system, as will normally be the case. A signal loop will exist, and if the overall loop gain is unity or more the system will oscillate. For this reason a notch filter tuned to the VCR's output channel should be fitted between the distribution amplifier and the VCR's input. The unsuppressed lower sideband of the VCR modulator's output will need to be notched out, even though it will have been attenuated somewhat by the channel-pass filter. Because of this a double notch is best, with the tuning slightly staggered, as shown in Fig. 3.

As an additional precaution, ensure that the signal levels at the VCR's input are not unnecessarily high. Also ensure that the notch filter doesn't affect the VCR's reception of the channels just above and below its output channel. This is easy to arrange with the use of a spectrum analyser, not so easy without one. If channel space allows, it's helpful to have two unused channels rather than one at each side of the VCR's output channel. This makes notch filter adjustment less critical. The VCR's r.f. output will include all the other channels in the system, but these will be removed by the channel-pass filter tuned to its output.

If the system carries nothing but off-air terrestrial channels which are all received via one aerial, there's no need to feed the VCR from a distribution amplifier output. It can be fed from the aerial directly, via a splitter. This avoids the complications just described.

Channel Planning

There are 47 channels in the u.h.f. TV band. This sounds a lot when your system requires only six or eight active channels. So what's the problem? There are various constraints that must be observed in order to avoid various types of interference. It's in fact surprisingly easy to 'run out of channels'.

No two signals should be present in the same channel of course. But I've seen it done, more than once! Adjacent channels shouldn't be used. You may feel that you can get away with adjacent-channel working, but in a domestic situation don't do it.

As far as possible avoid five- and nine-channel spacing. Some TV sets are very prone to image interference and other spurious responses. Local oscillator interference can also be a problem, though this is less common. In practice it's not necessary to consider the finer technical details: you will keep out of trouble 99 per cent of the time by simply avoiding n ± 5 and n ± 9 channel spacing. If there is a real shortage of channels, risk five-channel spacing: this is less likely to cause problems than nine-channel spacing.

All signals should be on exactly the nominated channel. When setting the carrier frequency of the modulator in a VCR or whatever, tune it to a known reference frequency. This usually means using the frequency-synthesised tuner in a spectrum analyser.

The frequencies we normally can't alter are those of the terrestrial broadcast channels. So these form the fixed points in the channel plan. In an extreme case it might be necessary to use a channel changer to translate a channel to another frequency. This is common practice with commercial systems, but is best avoided in a domestic installation – if only because of the cost.

When planning a system it's my practice to draw up a u.h.f. band chart – see Table 1. The first things to insert are

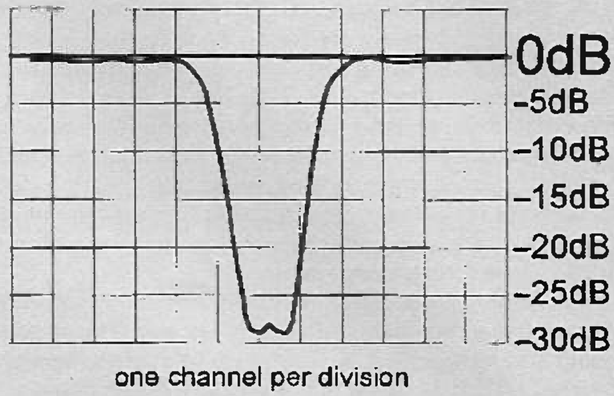


Fig. 3: Double-notch filter frequency response with the tuning slightly staggered. A deeper and narrower notch is obtained when the two stages are tuned to precisely the same frequency.

the terrestrial channels to be carried, and all their n ± 5 and n ± 9 relations. Include any strong local signals that are not to be carried, and any other channels that represent an obvious interference possibility. A spectrum analyser scan will often reveal these.

You can then slot in the channels to be used by VCR etc. modulators, making sure that you obey the rules just outlined. If at all possible, VCRs and satellite receivers at distribution system outlets should be connected to the accompanying TV set via a scart lead, with the r.f. output tuned somewhere where it will do no harm.

With the Clutters' system, the chart (Table 1) showed that in theory there was no available channel for the bedroom VCR. Had it not been possible to connect this to the TV set via a scart lead I would have used ch. 31 or 35, checking for n ± 5 or n ± 9 problems (channels 26 and 40) with the TV set.

Modulator Frequencies

It's unfortunate that the modulators in most VCRs and satellite receivers will tune across only a limited range of channels in the middle of the band – roughly from ch. 30 to ch. 40. Because of this it's often difficult to find suitable channels where they are required, while vast tracts of unused space are present at the top and bottom ends of the band. The Clutters' system is a good example, with nothing above ch. 47 but a problem in finding a spot for the second VCR within its modulator's tuning range. The channel chart showed up this problem immediately. I thought I was going to have to put the Betamax machine's output on ch. 31, which would have constituded an n ± 5 clash with Bilsdale BBC-2 and an n ± 9 clash with the satellite receiver's output on ch. 40. To my surprise and delight however I found that the Betamax would tune up to ch. 43 – just. Otherwise I would have had a problem.

A great advantage with Pace satellite receivers is that the modulator output can be tuned to any channel in the range 21-68. About a month after Mr Clutter's system had been installed he rang up to say that the satellite reception was very poor. During the installation period I'd avoided discussion of the merits or otherwise of the aged Amstrad satellite set-up. But I was fairly sure that a satellite sale would materialise in due course.

When I called round 'to have a look' I found that reception of the terrestrial channels was extremely good. This meant that the Clutters now knew what good reception looked like, and was the main reason for the dissatisfaction with satellite reception – together with a week of very rainy weather. Mr Clutter eventually decided to fork out, and the possibility thus arose of installing a Pace receiver with its r.f. output set to a channel at the top end of the band. In the event I decided to keep to ch. 40. This had been entirely satisfactory, and I didn't feel like fitting a new channel-pass filter. Had a Pace receiver been installed at the start, I would certainly have put its output on ch. 58 or thereabouts.

Four-channel Groupings

Another cause of channel congestion is the broadcasters' use of the standard four-channel groupings – n, n + 3, n + 6, n + 10 and n, n + 3, n + 7, n + 10. This came about because it was felt that adjacent-plus-one channel spacing would cause problems. The next option was n, n + 3, n + 6, n + 9: this was rejected because of the n + 9 clash. The groupings used thus spread across eleven channels. Had adjacent-plus-one spacing been used, the four transmissions could have been accommodated within a bandwidth of seven channels.

This would have greatly simplified channel planning with multi-channel distribution systems where fully tunable modulators are used because, in cases where only one four-channel group is carried, the adjacent-plus-one sequence could be extended across the entire band. With the standard groupings, a sequence of adjacent-plus-one channels can be added but where these clash with n ± 5 or 9 transmitted channels the channel has to be left out. Aerial performance would also have been better with adjacent-plus-one channel spacing.

The standard groupings allow the insertion of one channel per group, for example ch. 29 can be added to the group 21, 24, 27, 31, and channel 28 can be added to the group 23, 26, 30 and 33. But there will always be an n ± 5 channel clash.

In Conclusion

The complexity and cost of domestic TV distribution systems varies greatly. At one end of the scale there's a simple multi-outlet amplifier in the loft, supplying terrestrial signals to three or four TV sets. At the other end there are systems that carry the outputs from say three VCRs, three satellite receivers and a couple of surveillance cameras (via modulators) as well as a variety of terrestrial channels, supplying a number of outlets. Most jobs fall somewhere between these extremes.

The first steps are to find out what the customer wants and requires; if necessary to make him aware of the possibilities; and to establish how much he is willing to spend. Because of the many possible permutations, it's a good idea to have a separate rough price in mind for each part of an installation. In this way you can add up a total price quite easily. A decent job can be worth ten or more simple aerial rigging jobs. The heyday of aerial rigging is now long gone, and today those active in the field of domestic installations are a bit short of work most of the time. Domestic TV distribution system work is thus a valuable source of extra income.

If you go about each job methodically, plan in advance exactly what you are going to do and use good test equipment, the jobs should be trouble-free and profitable. I know of no other aspect of our trade where recommendations come so readily.

Table 1: Channel plan for the Clutter System

Channel	*Situation*	*Channel*	*Situation*
21	X	37	VHS VCR
22	Adjacent ch.	38	Adjacent ch. + X
23	Ch 4 Bilsdale	39	Adjacent ch.
24	Adjacent ch. + X	40	Satellite TV
25	Adjacent ch.	41	Adjacent ch + Emley Moor ch.
26	BBC-2 Bilsdale	42	X
27	Adjacent ch.	43	Betamax VCR
28	Adjacent ch. + X	44	Emley Moor ch.
29	ITV Bilsdale	45	X
30	Adjacent ch.	46	Adjacent ch. + X
31	X	47	ITV Emley Moor
32	Adjacent ch. + X	48	Adjacent ch.
33	BBC-1 Bilsdale	49	X
34	Adjacent ch. + X	50	Free ch.
35	X	51	Emley Moor ch.
36	Adjacent ch.	52	X

X = n ± 5 or n ± 9 clash.
Chs. 53-68 not used. Ch. 56 is an X clash.
Three Emley Moor chs. not carried.

Camcorner

Reports from David C. Woodnott and Simon Bodgett

Sony CCDF555E

The customer had complained about the viewfinder picture: it could almost be focused, but wasn't quite up to standard. After checks in the relevant circuitry proved fruitless we decided to replace the line output transformer. This did the trick. Note that some Sony viewfinder tubes are electrostatically and others magnetically focused. **D.C.W.**

JVC GRC1E

This oldie would power up for a few seconds then power down. There were no noises from the mechanism or other clues. As a start we checked the various power supply circuit protectors. They were all in order. We then noticed that one of the tape guides was positioned incorrectly, the unit being in the stop mode. As a result the loading motor had jammed and the mechacon decided to abort the start-up sequence. Loading gear realignment restored the unit to working order. **D.C.W.**

Orion CMV392

This VHS-C model wouldn't function, the message "EMG. CYL" being present in the viewfinder. A quick look showed that the middle guide pole had broken off, something that's not uncommon with this type of mechanism, which is based on a JVC model. Simply fitting a replacement guide didn't cure the problem of course. Further investigation revealed several dry-joints in the drum-drive PWM circuit, around the 37·5Hz filter. The circuitry here is very similar to that in JVC models of the same period. After carrying out the resoldering required we gave the machine a long soak test. All was well. **D.C.W.**

Sanyo VMD6P

Intermittent autofocus operation was the problem with this one. Board TC1 receives a 4fsc input at pin 1 of CN952. It was missing, because of a faulty connector at board CA1 (the source of the 4fsc signal). Remaking the connection put matters right. **D.C.W.**

Canon A10E (Sony FL Mechanism)

A tape would load until the LS deck moved to the point where the tape comes into contact with the head drum. At this instant the tape would be ejected. It wasn't immediately obvious that the brakes within the cassette weren't being released. When we realised that this was the situation it took only an instant to see the cause – the cassette brake release pin was missing from the mechanism. A replacement put matters right. **D.C.W.**

Sony TR105E

The cause of the reported fault, cutting out after a few seconds in any mode, was lack of the capstan FG signal. It's not uncommon for the capstan waveshaping/amplifier/etc. chip IC159 in this model to fail, producing this symptom. But it had already been replaced! The FG signal from the capstan motor was correct at IC159's input pins, but was missing at pin 25. As the chip had been replaced we decided to carry out some cold checks around pin 25.

The resistance between pin 25 and chassis was 350Ω, which was patently incorrect. But what was the cause? Pin 25 feeds the FG signal to the syscon and servo chips: checks at the relevant pins confirmed the low resistance reading. We then noticed that the capstan FG signal takes one other path, to the check pin of socket CN002. An inspection at this socket revealed a solder bridge between pins 2 and 4. When this was cleared all was well with the capstan FG signal. **D.C.W.**

JVC GRS99

There was no output from the camera section, playback was in mono only, there was no viewfinder display and noise on playback. Very few will touch this camcorder, as you can't operate it with the cover removed – unless you have the Bodgett set of special extension leads. Action: replaced an open-circuit protector in the camera head, sussed out that mono meant no colour and not mono as opposed to stereo, and set the YC switch to CVBS. **S.B.**

JVC GRS707

This machine powered up but there was no picture in the viewfinder or via any of the outputs. The 8V regulator transistor had failed and, by the looks of the soldering, someone had replaced it before. I'll bet it fails only when the owner is copying. Make phone call to owner to check. He's astounded that Bodgett knew what had happened. Owner told in no uncertain terms to get a new JVC AV lead and stop using crap pattern accessories. Write out large bill to include AV lead. **S.B.**

JVC GRAX2

"Cracked and a smell of burning" it said. I think you have to be psychic to be able to decipher some of these fault reports. We replaced the burnt out d.c.-d.c. converter and associated circuit fuse (the cause of the 'crack' when it blew up), then the loading motor which had been the cause of it all. Added psycho levy charge to the bill – for a new crystal ball. **S.B.**

JVC GRAX5

The picture was negative and out of focus. This meant that there was little or no luminance, just chroma and syncs. The usual cause is the CCD delay line chip in the camera head. Replacing it cured the trouble. **S.B.**

JVC GFS1000

The record on/off button was broken, the lens and PCBs were pushed back, the lens frame was warped, there was no iris control, a PCB support pillar had broken and the camera operation PCB connector was also broken. Had it been dropped? "Understatement" is probably the word to use here, along with "pillock" to describe the owner. Anyway we were able to put matters right. We replaced the camera frame, the iris amplifier's drive transistor and the PCB connector, then glued the damaged stop/start switch. **S.B.**

TV Fault Finding

Reports from Philip Blundell, AMIEEIE, Chris Watton, John Edwards, Mike Leach, Andrew Tebbutt, Robert Marshall, Michael Maurice, Paul J. Charlton and Stephen Leatherbarrow

Philips GR2.4AA Chassis

A dead set with the power supply producing a weak beep-beep sound usually means that there's a fault in the line output stage. Disconnect plug M71 and check the voltage at coil L5631. If it's steady at around 150V, the next place to look is the line output stage. So far we've had the following: the BU508AF line output transistor leaky; the line output transformer faulty; or, if fuse F1534 is open-circuit, diode 6546 (BY226) is probably leaky. If D6546 is leaky it will have damaged diodes 6560 (LL4148) and 6561 (BZX79C68) as well. **P.B.**

Tatung 165 Chassis

At switch on the power supply seemed to be tripping. But a check showed that the 117V supply was steady. The set could be switched in and out of standby with the remote control unit, but in the on condition the display pulsed bright then dim. We soon found that there was no line drive because the 11·5V supply was missing at pins 7 and 22 of IC101. It comes from transistor Q501, whose base is biased by R507, R508 and the 12V zener diode D503. R507 (12kΩ) was open-circuit. **C.W.**

Matsui 2590

This set was dead with the standby LED out. H.T. was present at the collector of the line output transistor but there was no 24V supply at the line driver stage. It was switched off because the 5V standby supply was missing. Replacing D807 (BY299) restored normal operation. **C.W.**

Finlux 3000 Chassis

This set produced a weird display: there was a bar down the screen and the picture was split and superimposed on another picture that was twice the correct width. When teletext was tried the characters were about three inches wide. Scope checks in the line output stage showed that the flyback pulse signal, from the collector of the line output transistor to the base of transistor TZ1, was missing. The cause of the trouble was RZ21 (220kΩ) which was open-circuit. **C.W.**

Hitachi CS2852TA (Salora Digital Chassis)

This set was dead because the S2000AF line output transistor was short-circuit. The whole line output section appeared to be dry-jointed, so a good solder up was carried out. This restored the set to life. **C.W.**

Panasonic Alpha 1 Chassis

The mains input circuit and rectifiers were o.k. as there was 320V across the reservoir capacitor, but the power supply produced no output voltages. Checks on the outputs revealed that the h.t. rectifier D851 was short-circuit. **C.W.**

Hitachi CPT2888 (Salora K Chassis)

This set wouldn't start up when asked. Various checks were made in the power supply circuitry, but the cause of the fault turned out to be in the line output stage. C509 was dry-jointed. **C.W.**

Sanyo A1-A14 Chassis/Datsuri

This Sanyo set was found under the Datsuri guise – where do they get these names from?! It was dead apart from the standby LED, which went off when the remote control was operated. The line output stage was receiving its 130V supply and the line driver stage its 24V supply, but there was no 12V supply at pin 8 of IC201 which, amongst other things, produces the line drive. When we traced back from this point we came to a three-legged regulator which was getting quite hot. There was only about 12V at its input. Checks for heavy loading on this supply soon brought us to C422 (0·0033μF) which was as leaky as a collander. **C.W.**

Telefunken A415 Chassis

The BU208D line output transistor had gone short-circuit. When we disconnected the scan coil plug and connected a 60W bulb as a dummy load between pin 2 and chassis we obtained an h.t. reading of 180V, which is much higher than it should be (122·5V is the specified figure). Checks in the power supply revealed that D528 was open-circuit. Replacing it restored the correct h.t. voltage, so a new line output transistor could be fitted with confidence. I crossed my fingers and switched on – perfect! **C.W.**

JVC AU21F1

The signals would disappear intermittently, leaving the screen covered in snow – as if the aerial had been disconnected. We found that the fault came and went when the large metal heatsink that's mounted across the centre of the motherboard was flexed and twisted. All three legs of the 5V regulator IC522, which is fixed to the heatsink, were dry-jointed. Resoldering restored normal operation. **J.E.**

Sanyo CTP6131

Several equally-spaced horizontal flyback lines covered the top quarter of the picture. The cause was C440 (4·7μF, 250V) which was open-circuit. **J.E.**

Hitachi G8Q Chassis

The complaint was no picture. When the first anode control was turned up we found that there was field collapse. Checks around the TDA2579A timebase generator chip showed that there was no field drive at pin 1 though there was a linear sawtooth waveform at pin 3. Just about every component that could have caused the loss of field drive was checked, but no faults were found. What now? On switching the set back on again I was amazed to find that there was a full picture. No amount of tapping or heating/freezing would make it misbehave. Perhaps a poor joint had unwittingly been repaired? I hate not knowing!

I then noticed that the raster had some pincushion distortion. Not a lot, but it was there. The presets altered the raster geometry, but not by enough. Again every possible component was tried, even the TDA2031A correction chip.

After soak testing the set for two days to make sure that the field fault had been cleared we returned the set. The customer didn't seem to be too bothered about the pincushion distortion but said that it hadn't been there before. It was one of those sets you can't help feeling you'll see again. Has anyone out there any ideas in case we do? If so, please write in to the editor. **J.E.**

Grundig CUC52KT Chassis

This set was dead with a blown mains fuse. Bridge rectifier D621 and C633 (220µF), which is connected between pins 6 and 9 of the TDA4600-2 chopper control chip, were both short-circuit. **J.E.**

Hitachi NP81CQ Chassis

The standby indicator was on but the set was otherwise dead. We found that the main board fuse was blackened though there were no obvious shorts in the chopper circuit or the line output stage. A small voice in the back of my mind told me to check the 98009 posistor. Sure enough when it was removed and shaken it made the give-away rattling noise. With a new posistor fitted the set burst into life. I do wish that small voice would put in a more frequent appearance. **J.E.**

Grundig M95-490 (CUC3850 Chassis)

This giant of a set was dead. The h.t. supply was present but there was no drive at the base of the line output transistor. We then found that there were no voltages around the TDA8140 line generator/driver chip IC550. This took us back to the chopper circuit, which provides the required 12V suppy. The 0·2Ω surge limiter resistor R661 was open-circuit. A replacement burnt out immediately when power was applied. We checked the associated BYW72 rectifier diode D661 and checked it again, using both digital and analogue meters, but it insisted on its innocence. The set nevertheless worked when a replacement was fitted. We found that the original diode had slight but definite reverse leakage when checked with our scope component tester. **J.E.**

Sanyo CTP2180

If the customer complains about varying brightness and an occasional fizzing noise, check for a dry-joint at the focus control's earthing tag. I've had several of these sets with this fault. **A.T.**

Tatung Series A Chassis

This set was dead with a squeal that came from the direction of the power supply. Suspecting that a faulty line output transistor or transformer was loading the power supply heavily, I turned the chassis over to make some measurements. As there were no shorts I decided to check the h.t. When the set was switched on again the cause of the trouble became obvious. The large, wirewound resistor in the snubber circuit had become dry-jointed.

It then dawned on me that I'd had a problem with this component, in a portable version of the chassis, some two years back. On that occasion however the symptom had

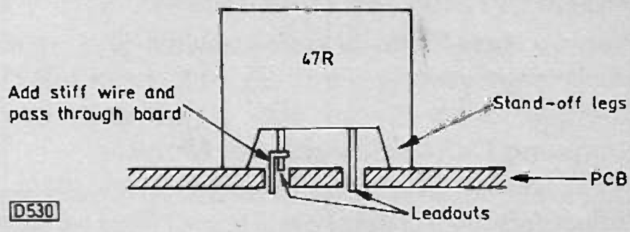


Fig. 1: Improved method of mounting R808. Add a piece of stiff wire to its shorter leg and pass this through the board. You may have to do this with both leadouts, though in most cases only one will need attention.

been varying h.t. The resistor concerned (R808) is stood up off the chassis by means of built-in legs (see Fig. 1). Its leadouts are rather short. To improve the reliability, and the connection quality, I adopted the approach shown in Fig. 1. **A.T.**

Salora 24L5H

A blank raster with no snow and no sound is often caused by failure of the multi-purpose TDA4505 chip ICB101. A set that came in recently produced similar symptoms, but this time the chip wasn't responsible for the fault. No great technical wizardry was involved in finding the cause, just a hairdryer and some freezer. The culprit turned out to be CB117 (22nF), which is connected between pin 10 of ICB101 and chassis. It was intermittently leaky from cold. A replacement restored reliable pictures and sound. **M.L.**

Hitachi CPT2524T

We've had total power supply failure with several of these sets. If the 6·8Ω surge limiter resistor is open-circuit, you can usually assume that the chopper transistor is short-circuit. The over-voltage protection diode is also usually short-circuit, due to a sudden rise in the h.t. voltage. If the power supply again blows up after replacing all the usual components (see below), including the 39kΩ resistor, check and if necessary replace the 2·2Ω resistors connected across the base and emitter of Q760.

In short, if the power supply has suffered a major failure it will usually be o.k. after replacing all the following components: Q903, Q904, R909, R912, R902, R903, ZD903, R760, R761, R762, R766 and R901 if it's open-circuit. Before switching on, check Q781, D781 and D782 in the line output stage. **M.L.**

Hitachi CPT2578

The MDA2062 (blue spot) memory chip IC1502 is usually the cause of channel tuning problems. If the complaint is no teletext however suspect the memory chip first, not the teletext decoder which is very reliable. **R.M.**

Amstrad CTV1410

We noticed that occasional field roll coincided with a bright picture. A scope check showed that the TA8701N i.f. chip produced a good output waveform at pin 19. After passing through a 6MHz crystal filter (CF301) the signal is coupled by C304 (2·2µF) to an emitter-follower stage.

When checked this capacitor was found to be very low in value, causing the loss of field sync. Most TV designs don't use a coupling capacitor here. R.M.

Hitachi CPT2198 (G8Q Chassis)

Complete failure was caused by cracked print at the chopper transformer. R.M.

Samsung CVB4587 Computer Monitor

The problem was no blue output. I checked every component in the blue channel on the tube base before I found the faulty one: R708 (1·8kΩ) was open-circuit. It's a base bias resistor and was nestling under a swathe of brown glue. R.M.

Telefunken MR25

This set thought it was a night-club lighting effects generator: instead of a picture there was a bright screen of one colour or another. The colour decoder is on a separate plug-in board. We found that the U4646B output chip was the cause of the trouble. The circuitry is similar to that in the Ferguson ICC5 chassis, which uses a U4647B chip. That's where the similarity ends – the two chips are not pin compatible. R.M.

Amstrad TVR3

The TV section of this unit was dead. We found that the 3·3nF snubber capacitor C310 and the STK7348 chip in the power supply were both short-circuit. As the replacement capacitor supplied by Amstrad didn't look capable of withstanding 100V, let alone 1kV, I made up a replacement consisting of two 1·5nF capacitors connected in parallel. The set bounced within two weeks.

This time we obtained the chip from another source. After a long soak test the set was pronounced fit. It could be that there's a bad batch of STK7348s around. M.M.

Matsui 1436

The customer's report said "loud fizz then went pop!" On investigation I found that the degaussing posistor had exploded, taking with it the standby mains transformer, relay RL650 and the degaussing coils. All was well after replacing these items. M.M.

Sony KVX2172

This set would select only ITV. If any other channel was tried it would be displayed for a couple of seconds then the set would revert to ITV. The cause of the trouble was the ST24C16 EAROM, which had become corrupted. As with all the new sets that have digital control, everything has to be set up after replacing the chip M.M.

Hitachi C2858

This set had a strange colour fault: the picture would go red and green after about twenty minutes. The TDA3562 colour decoder chip was the cause, a replacement clearing the trouble. M.M.

JVC AV28S1EK

The picture had come right in at the sides and it seemed that the EW correction system wasn't working. Before diving into the circuitry I realised that this is a JVC example of electronic screwdriver technology. There are two memory chips, one of which takes care of tuning and customer preferences while the other is the electronic screwdriver. For good measure I replaced both chips. After setting it up the set then performed faultlessly. M.M.

GoldStar CIT2170F

We've had a few calls to these sets when they won't power up from standby. The cause has in each case been dry-joints on the main relay. As you find that the pins have charred, the relay has to be removed and the pins cleaned prior to refitting. P.J.C.

Mitsubishi CT3703STX

This monster had to be dealt with in the customer's home! The symptoms were intermittent tuning memory loss together with all the picture adjustment values going to maximum. The set would tune but not store. We eventually traced the cause of the problem to T951. The –31V read/write supply to EAROM IC702 was missing. P.J.C.

Amstrad TVR2

The TV section of this combined TV/VCR unit wouldn't come out of standby. We found that C1507 (1μF, 50V) on the main transformer was open-circuit. P.J.C.

Mitsubishi CT21A3STX

This set had forgotten that it had teletext! The cause was the EEPROM chip, which had become corrupted. You can prove this by reprogramming it, but Mitsubishi recommends fitting a replacement. IC702-KIT contains the EEPROM, a few additional components and fitting details. It's wise to note the option and VCJ settings before you remove the suspect chip – this helps with reprogramming.

The EEPROM can also be reponsible for intermittent picture geometry faults, loss of Nicam sound, and occasionally loss of audio playback from a mono VCR! P.J.C.

Goodmans CTV2T

The complaint with this set was very severe ringing which was particularly noticeable at the top of the screen, the effect diminishing slowly as the scan developed. A scope check on the field output waveform revealed a characteristic ring that was superimposed on the scan. The obvious thing to do was to check the damping components across the field scan coils. C483 and R448, which are connected in series, are the items to go for. In this case R448 (1·2kΩ) was open-circuit. S.L.

Ferguson TX10 Chassis (1515H Remote Panel)

There was no ch. 3 LED display with this venerable set. Otherwise it worked perfectly. We found that the MC14493P chip responded to freezer/heating and a replacement cured the fault. S.L.

Ferguson 59K4 (ICC5 Chassis)

EW distortion is a common problem with this chassis. You usually find that RL44 is open-circuit and burnt. It consists of two resistors connected in series, a 120Ω section and a

56Ω safety type. It's the latter section that fails, as it is designed to do. The next thing you will find is a large dry-joint on the line scan coupling capacitor CL44 (0·3μF in this particular model). This can result in the capacitor bubbling up because of the heat at the joint. The TDA4950 EW correction chip IG01 always fails, taking its feed resistor with it. It is also worth checking the EW coil LG11, which has been known to fail. S.L.

Panasonic Alpha 2 Chassis

The video would disappear intermittently, leaving only the sound. As I've had similar problems before I carried out a quick check on the waveforms around the M51326P scart switching chip IC2601. Video should enter at pin 5 and reappear at pin 12. In the fault condition it didn't. Temporarily linking the two pins proved the point. S.L.

Ferguson IKC2 and ICC7 Chassis

A set fitted with the IKC2 chassis came in dead. The outputs from the power supply were correct at switch on, but there was no line output stage operation because the line drive was missing. After a few seconds the power supply outputs decayed and it seemed that the set was in the trip mode.

In this situation pin 40 of the TA8659CN signal and timebase processing chip IV01 is the place to check: 9V = on, 0V = standby/trip state. The voltage comes from TR17 (BC558C) which turned out to be open-circuit.

The same symptom in the ICC7 chassis tends to be caused by a faulty TDA8178F field output chip. The line drive is then removed by the trip action. You would think that merely disconnecting the field output chip would override the trip action, producing a nice white line. As the trip senses the field current however the diagnosis isn't as clear cut. Replacing the chip is sometimes necessary to prove the point. S.L.

Ferguson TX90 Chassis

This set incorporated the PC1139 remote control panel. It wouldn't power up unless the on/off switch was held on. If the switch was released, the set lapsed back to standby. Checks revealed that the 9V supply to the TMS1000N2LL microcontroller chip IC901 was missing. Of the components involved in providing this supply, TR901 was short-circuit and TR906 open-circuit. S.L.

Sony KVFX29

The problem with this set was field foldover at the top. As we didn't have the manual we had to rely on cold checks. We eventually found that diode D506 (GI08D) was leaky, giving a reverse reading of 30Ω. S.L.

Orion 14ARX

A dead set or one that fails to be awakened from the standby state would probably have you giving the power supply suspicious looks, especially as it uses an STR50103 chip. Before you change this item however, take a look at the supply to the 5V regulator (IC105) at the front of the chassis. It's derived from the mains supply via a half-wave rectifier and a suitably substantial resistor, with C530 (3·3μF, 250V) to provide decoupling at the hot end. On a couple of occasions recently we've found this capacitor to be open-circuit or very low in value. S.L.

Long-distance Television

Roger Bunney

August produced a return to relatively quiet propagation conditions. There were some low-level tropospheric lifts during the very hot weather, with signals mainly from the Benelux countries and, for those in the south west, Spain. The Perseids meteor shower produced few signals in Band I and III, and there were just a few Sporadic E sparkles. The SpE log is as follows:

5/8/95	TVE (Spain) ch. E2.
7/8/95	TVE E3.
8/8/95	TVE E2, 3; RAI (Italy) IA.
9/8/95	RAI IA; TVE E4; NRK (Norway) E4.
12/8/95	DR (Denmark) E3; SVT (Sweden) E3.
13/8/95	RAI IA, B; TVE E2, 3.
16/8/95	TVE E2, 3.
18/8/95	SVT E2, 3, 4; NRK E2, 3, 4.
19/8/95	SVT E2, 3, 4.
20/8/95	TVE E3; RAI IA, B.
21/8/95	TVE E2.
26/8/95	SVT E3; DR E3.
29/8/95	DR E3; TVE E2, 3.

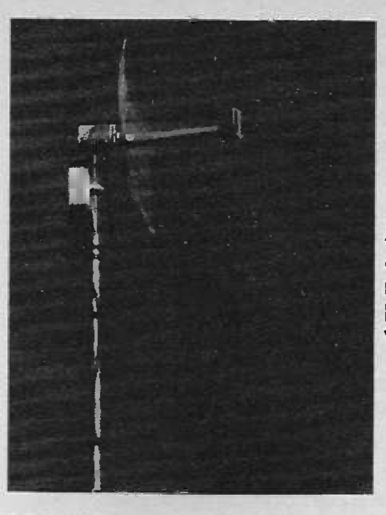
In a previous column I mentioned a report from Cyril Willis (King's Lynn) of North American reception, across channels A2-5, on July 7th. This was perhaps the best day of the year: record SpE conditions were present in the 50MHz amateur band, with contacts between Europe and North America over a twelve-hour period. The ham publication *Six News* also mentions an historic SpE opening between the US West Coast and Japan on July 1st, for around four hours between 0550-1000. During both openings the signals reached levels 5 and 9, which is very strong.

Satellite TV Receiver

Bandula Gunasekera, Colombo, Sri Lanka is marketing an inexpensive but very effective L band (u.h.f.) receiver for the Russian 1/Apna TV services via the Ekran satellite at 99°E. It employs a helical aerial that feeds an LNA and in turn a receiver (via F sockets). There's switch selection between the two channels. Output is video and audio via phono plugs or a modulated ch. E3 carrier. The compact unit is a.c. operated. It's simple to install and easy to operate. We will be happy to pass any enquires on to Bandula.

News Items

MMDS: The Kenyan Broadcasting Association (KBA) has started a second pay-TV channel using MMD. Three scrambled channels will eventually be available to subscribers. Senegal recently hosted a broadcasting fair at which a new, inexpensive MMD system was demonstrated, offering three-channel capacity with a radius of 15km.



A 2·5GHz MMDS aerial and down-converter recently installed by Nicholas Early in Victoria, Australia.

Malaysia: A fourth TV network, TV12, has opened in Kuala Lumpur with plans to go nationwide.
Finland: The regional TV operation PTV hopes to become the fourth national network.
Belgium: BRTN should by now have started widescreen TV transmissions. The old 4:3 test pattern will be discontinued. The Wavre transmitter radiates only BRTN-1, on ch. E10: BRTN-2 is transmitted from the St. Pieters, Leeuw site.
Poland: The ch. R2 TVP-2 service from Warsaw has closed down. Channels at present available in Warsaw include TVP-1 ch. R11, TVP-2 ch. R27, WOT ch. R51, Polsat ch. R35, Canal Plus Polska ch. R36 and TV Ostankino ch. R41. The latter continues to use SECAM: all the others use PAL.

Satellite Reception

An increasing number of satellite users are adopting MPEG-2 video compression. Unfortunately no receivers or decoders are at present available in the UK. If anyone knows of a source of equipment, please write in to me via the magazine.

The EBU continues to use sound in sync (SIS) for news feeds despite an announcement some time ago that there would be a change to digitally encoded transmissions. SIS sync inserter units that produce steady and fairly clear pictures, though with no sound, have been available for a long time. A Dutch company, Satellite Supply Point, Spakenburg, has now released an SIS decoder that produces sound as well. I've seen an advertisement for this unit at £145 inclusive. I you are thinking of buying one however, bear in mind that the SIS system may not be around for long.

The Netherlands Satellite Festival was held on August 10-12th. It was a short-notice, fifty-hour live event run from The Satellite Shop, sponsored by TESUG and Chaparral. The European downlink was via Orion Atlantic 1 at 37·5°W, using the 11·497GHz horizontal transponder vacated that day by TV10 Gold/Music Factory, which have moved to Eutelsat II F3 at 16°E (apparently at 11·015GHz horizontal, with MPEG-2 compression. Goonhilly was also involved, dual beaming the programme via Intelsat 601 at 27·5° W on a similar frequency. The programme content was a satellite enthusiast's dream, including a trip around the Chaparral factory.

Answers have been received from C. Stephens (Uckfield) and Bandula Gunasekera (Colombo) to my query in the August column about the CPT CARAJEGO identification seen via Eutelsat II F4 at 7°E. They both confirm that in Cyrillic letters this stands for SRT SARAJEVO. My thanks for this help.

Bob French is re-equipping for C band reception, with an integrated heavy-weight motor that gives tracking down to the horizon. He received the SSVC programme feed via TDRS-4 at 41°W (3·720GHz, horizontal) recently, dual beaming with Intelsat 601 at 27·5° (11·15GHz, vertical). Apparently SSVC is to adopt MPEG compression via TDRS-4, with the 601 feed ending once all the receiving sites have been suitably equipped.

There seem to be fewer news feeds from the Yugoslavia area, though the Newsforce digital SNG is still operating from Split and is seen at 7°E via the EBU leased link. UKI 71 often uses this circuit. Starbird, another SNG facility company, is operating from Zagreb with links via Eutelsat II F1 at 13°E in the telecom band.

Roy Carmen (Reigate) reminds us that there is still life aboard Eutelsat I F5 at 21·5°E. He recently saw dog racing at 11·504GHz (vertical), an OB link that normally uses I F4 at 25·5°E.

Intelsat K at 21·5°W seems to carry many sports offerings. The NTV Reuters lease at 11·499GHz horizontal is a good one to check out.

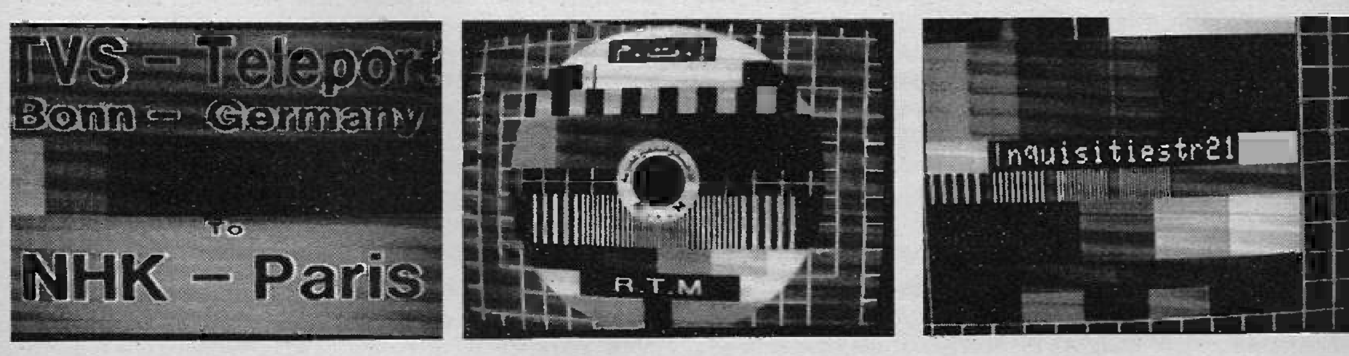
Although most of the occasional news and OB feeds are seen between Eutelsat I F4 at 25·5°E and Orion at 37·5°E there are other possibilities, including Turksat at 42°E which often carries sports OBs. Ian Waller (Lincoln) recently saw football via this satellite at 10·970GHz vertical.

Arabic Radio and Television (ART) is now running a full European service. Check Eutelsat II F3 at 16°E, on 11·095GHz vertical, for more information.

The Overmoded/Elliptical Waveguide

A recent newsletter from RFS (UK) Ltd., High Wycombe describes the company's new overmoded and elliptical waveguide technology. The losses introduced by a waveguide system depend on the material used, the design and the connections/terminations involved. They range from 1-2dB/100m at 2GHz to 60-100dB/100m at 40GHz. The RFS Flexwell elliptical waveguide has a similar performance to standard rectangular waveguide: its advantages are greater flexibility and the fact that it can be cut to the length required, so there are no joins.

Problems can arise when a waveguide is used to feed a relatively small dish (to keep the wind loading down) on a high mast, or when a very low transmitter power is used. A form of internal resonance can occur, producing higher frequency modes within the wavgeuide. The result is distortion of the fundamental signal because of ripple – a form of multipath ringing/standing wave is set up along the waveguide and is imposed on all the signals present. The problem can be reduced, at the cost of slight attenuation, by mode filtering at the waveguide terminations. The Flexwell overmoded waveguide has been introduced to reduce this problem within the 12·7-38GHz spectrum. Figures provided by RFS quote attenuation of 14dB/100m at 14·5GHz and 28·3dB/100m at 22·4GHz with standard single-mode Flexwell waveguide, falling to 7dB/100m and 13·7dB/100m at the same frequencies



Left: The standard TVS (Germany) NHK identification – the TVS feed is to NHK's Paris office via Eutelsat II F1 at 13°E. Centre: The RTM (Morocco) test pattern, received via Eutelsat II F3 at 16°E. Right: An unidentified test pattern caption received via Eutelsat II F1.

when overmoded waveguide, with mode filters, is used.

Keeping water out of waveguide is a science in its own right. I'll provide a few lines next month on how the professionals keep the insides of their waveguides dry!

Satellite TV News

PanAmSat's PAS-4 satellite is now operational at 68·5°E. A UK enthusiast first saw signals on August 19th, at 11·578GHz vertical.

There are moves to adopt a standard European digital TV decoder. Deutsche Telekom, Canal Plus and Bertlesmann are amongst those involved in the project.

JSAT-3 was due for launch in late August carrying a full load of C and Ku band transponders: the orbital position is 128°E, a prime location for coverage of SE Asia and the Pacific basin as far as Hawaii.

Thomson is to produce broadcast MPEG-2 equipment and domestic decoders for France Telecom, which intends to transmit forty programmes in five conventional channel bandwidths starting in early 1996, intended mainly for cable head ends.

Asianet, which is New York based, has changed its Orion Atlantic transponder from 11·622 to 11·594GHz. No mention of going digital yet with this service.

Intelsat K at 21·5°W is to be used to transmit the Emirates' Dubai Television service across South America.

The Australian Galaxy Pay-TV operator is now testing set-top decoders prior to distributing them to its subscribers – at least 40,000 up to early August. Galaxy seems to have cornered the world market for digital decoding chips for the present time.

Test Case 395

At this time of the year the Test Case workshop deals with about twenty jobs a day. Most of them pass through quite quickly: some get stuck for a day or two; and some seem to take up residence for one reason or another. Our tale this month concerns a TV set that fell into the second category. It was a 20in. rental set fitted with the Tatung 170 chassis.

The cause of the fault seemed to lie somewhere in the sync or line timebase sections of the receiver. It took an hour or two for the symptom, line tearing across the middle of the picture together with a slight sideways displacement of the image, to appear. Cathode Ray, who's luck it was to be in charge of the repair, noticed that the effect disappeared at low brightness and contrast levels. As the picture was turned up, the symptom became progressively worse – until, at maximum brightness and contrast settings, the line scan began to collapse, with a squiggly vertical line down the centre of the screen in some sections of the picture.

Ripple on a supply line, because of faulty smoothing, is sometimes the cause of this sort of thing. Ray checked the h.t. feed to the line output stage (at C425) when the fault was present, also the 18V and 12V supplies at each side of stabiliser I802. Each voltage was at the correct level, with no significant ripple or hash. As the severity of the fault seemed to depend on the beam current, attention was next turned to the e.h.t. generating department. These days there's very little that's visible or accessible here. Ray checked the e.h.t. connector, the earthing of the tube bowl's outer conductive coating and the components at the earthy end of the line output transformer's e.h.t. winding – C427, R432 and zener diode D503. Everything was o.k. Time to replace the line output transformer then.

But a new line output transformer made no difference. There followed a long and weary session of trial-and-error component substitution tests in and around the line output stage. A new line output transistor (Q403) altered the nature of the symptom a little, but didn't remove it. The situation with the efficiency diode D401, which was suspected of breaking down under load, was the same. Other items that were replaced included the scan coupling capacitor C422, the flyback tuning capacitor C421, and the two parallel-connected resistors R435 and R436 which are in series with Q403's base drive. The PCB was closely examined. C425 which smooths the supply to the line output stage was replaced. The point was reached where there was a cat's cradle of wires and components under the board. The picture's horizontal instability persisted.

What to do now? Cathode Ray got the scope out and started again. With the brightness and contrast settings turned up to produce the fault, Ray could see the effect of the disturbance when he monitored the pulses produced by the line output transformer. The line drive output from the timebase generator chip was relatively free from any disturbance, and the drive pulses at the base of Q403 were, as far as he could see, all right – the waveform here is always a 'messy' one. Ray thought that it was time to enlist the help of Television Ted.

TV Ted knew about Tatung TV sets. Within a few minutes, using Ray's meter and oscilloscope, he'd found the culprit. It wasn't in the line output stage, nor the power supply, and had nothing to do with the timebase generator chip. Its cost is measured in pennies. What was it? For the solution, turn to page 59.

Satellite Notes

Hugh Cocks

Coaxial Cable Troubles

High-quality coaxial cable should of course be used for satellite TV installations – especially since the arrival of Astra 1D has increased the higher end of the band by 250MHz.

I remember that some years ago there was a brand of coaxial cable we used to refer to as 'Pro 7 Special'. It would be happy enough with most channels but would more or less remove Pro 7 at an i.f. of around 1,407MHz. Neighbours, Sky News and Sky Movies could look distinctly sparkly too. Frequencies above and below these channels were o.k.

We occasionally get call-outs to fairly old installations because of complaints that one or two channels are poor while the rest are o.k. If reception of the higher-frequency channels is much worse, this often indicates cable trouble. Sometimes reception of just a particular frequency block is poor. If the LNB and receiver seem to be o.k. when checked by substitution, run a new length of coaxial cable from the dish to the receiver. This invariably restores normal results.

Sometimes a small nick occurs in the cable's outer sheath: water gets in slowly and all sorts of strange effects are seen across the band. Beware of connectors in the line done up with tape: sooner or later poor contact introduces a voltage drop that either removes the higher channels or leads to their intermittent appearance. Cable trouble will become much more common as systems age.

Black Museum

Perhaps someone should start a black museum for long (thankfully) dead relics of what we had to put up with in the early days of satellite TV.

One exhibit would surely be the made in Taiwan servo motor (usually black) that used to drive the old mechanical Polarotor assemblies. They would buzz, hunt and jitter as the internal cogs wore. The 'party trick' was when the motor would start to rotate continuously, giving simultaneous reception of the horizontally and vertically polarised channels.

I recall having to decouple the 5V supply at the motor end, because with most receivers the servo pulse drive is present for only a few seconds after changing channels. Any mains spike that came along meanwhile turned the servo motor a little, gradually ending up 90° out until a channel change restored normal polarisation. Inserting a lowish-value resistor in the line assisted with the decoupling and slowed the motor down, helping the dubious gearing mechanism to last longer – though the time taken to change polarisation could be a bit on the slow side!

A larger bodied model appeared a little later. It behaved better mechanically, but was very susceptible to any electrical storms in the area and would then refuse to work at all – often only a few days after being installed. At least the earlier ones never did this! Don't confuse these motors with the Chaparral type, which is very reliable.

The loss introduced by Polarotors seemed very bad, despite the impressive specification sheets. As there wasn't much signal to start with in those days, tough remedies were called for. I recall removing the existing signal probe and replacing it with a piece of coaxial cable inner conductor, bent appropriately to give the greatest signal pick up when inserted into the waveguide. This helped matters no end! Why not use another type? Well few were available, and the magnetic type was still a year or two away.

With very early installations the viewer had to go and turn the LNB manually, which is remarkable when you look back on it now!

The least lossy solution was the use of an orthomode transducer (OMT) coupled to two LNBs, with a changeover switch. But this was costly at the time.

Another item in the museum would have to be the CX2450 satellite receiver dating from 1985-6. Old hands will remember it. Perhaps some will even have fond memories (it did produce constant servo motor drive). I remember nothing but a running battle to keep them going however – even to get them started out of the box!

Any more ideas for suitable exhibits? How about the Skyscan K1 receiver-positioner?

LNB Covers

Moisture causes a lot of LNB trouble. One way to prevent this is to fit a cover over the LNB, leaving the front and underneath open. This prevents rain falling on the LNB, and has the additional advantage with an offset dish that the cover slightly shields the front feed. Thus with light to medium drizzle less rain builds up on the feed cover and there is less attenuation of the incoming satellite signal.

A cover also helps to keep a magnetic polariser dry. Our experience is that these have a habit of going open-circuit: rain falling on them can't help. The cover also overcomes the problem of water getting into the LNB/polariser flanges.

Until recently we manufacturered dishes and made a fibreglass feed/cover for MTI/Marconi type LNBs. The covers reduced LNB and F connector water ingress problems to nil. We still make the covers, and when carrying out an installation fix one to the top of the LNB with hot glue and some plastic spacers. It has always puzzled me why no manufacturers have ever produced LNB covers.

Connexions 8520R

Though they are becoming a little long in the tooth quite a few of these upmarket, motorised receivers that date from 1988-89 are still around. They were also sold under the Tee Com name.

They seem to suffer from a software bug however. After a while it's quite common to find that there is a problem with storing certain audio carriers. Frequencies above 7·56MHz, either mono or stereo, can be stored quite happily. Below this exact frequency the carriers can be tuned in but the receiver may not remember them – it happens with only some channels, others being o.k.

To restore normal results the settings for the satellite concerned have to be erased then everything reprogrammed. To do this, go to the parental lock mode, enter the four-digit pin number then keep pressing the parental lock button until 'erase sat?' is displayed. Enter the pin number again and the receiver will return to the factory reset for that satellite. Don't select 'erase all?' If you do, all the programmed satellites will disappear!

Finally, reprogram all the channels for the satellite concerned. Audio carrier storage problems seem to occur only when the frequencies have been changed. The video settings are not affected. You don't have to do anything specific with this receiver to store the channels: the action of channel changing seems to store new information.

This receiver isn't at all keen on Astra 1D converters but will tune from about 920MHz to 1,880MHz, which allows direct tuning as far as the CNN frequency with a 1D LNB.

USE YOUR ACCESS OR VISA ☏ TEL 0902 773122 FAX 0902 29052

15/80H	3.83
1N4001	0.04
1N4002	0.07
1N4003	0.05
1N4004	0.07
1N4005	0.00
1N4006	0.06
1N4007	0.06
1N4148	0.06
1N5061	0.00
1N5062	0.51
1N5400	0.07
1N5401	0.14
1N5402	0.12
1N5404	0.13
1N5406	0.12
1N5408	0.09
1N914	0.04
2N2222	0.22
2N2222A	0.23
2N2369A	0.18
2N2907	0.20
2N3053	0.38
2N3055	0.50
2N3440	0.35
2N3442	1.00
2N3707	0.12
2N3773	1.34
2N3819	0.55
2N3904	0.32
2N3906	0.00
2N4123	0.30
2N5296	0.69
2SA1013	0.35
2SA1015	0.11
2SA1015GR	0.11
2SA1016	0.26
2SA1020	0.44
2SA1029	0.26
2SA1048	0.19
2SA1286	0.60
2SA1370	0.43
2SA1489	2.40
2SA1706	0.52
2SA562	0.17
2SA564	0.33
2SA608	0.24
2SA673	0.12
2SA684	0.43
2SA733	0.18
2SA769	1.29
2SA844	0.26
2SA872	0.35
2SA872A	0.35
2SA916	0.57
2SA933	1.00
2SA940	0.82
2SA950	0.18
2SA965	0.52
2SA966	0.54
2SA970	0.19
2SA984	0.38
2SB1010	0.35
2SB1012	0.77
2SB1143	0.77
2SB1243	0.60
2SB560	0.35
2SB562	0.26
2SB600	8.54
2SB633	1.31
2SB641	0.21
2SB642	0.37
2SB644	0.35
2SB646	0.23
2SB647	0.43
2SB649A	0.96
2SB686	2.05
2SB688	1.61
2SB698	0.35
2SB740	0.36
2SB772	0.48
2SB774	0.36
2SB793	0.43
2SB891	0.52
2SB892	0.35
2SC1008	0.24
2SC1096	0.54
2SC1162	0.31
2SC1213	0.14
2SC124	0.48
2SC1306	1.16
2SC1318	0.19
2SC1383	0.32
2SC1413A	2.57
2SC1473	0.21
2SC1573	0.35
2SC1675	0.09
2SC1685	0.21
2SC1730	0.26
2SC1740	0.16
2SC1741	0.31
2SC1815	0.17
2SC1826	1.03
2SC1827	0.98
2SC1845	0.26
2SC1923	0.14
2SC1942	7.48
2SC1959	0.18
2SC1969	2.48
2SC1983	1.07
2SC2001	0.23
2SC2060	0.29

2SC2073	0.77
2SC2078	0.86
2SC2120	0.23
2SC2166	1.29
2SC2229	0.28
2SC2230	1.66
2SC2235	0.36
2SC2236	0.36
2SC2240	0.16
2SC2271	0.67
2SC2274	0.35
2SC2314	0.38
2SC2335	1.12
2SC2458	0.14
2SC2482	0.35
2SC2570A	0.38
2SC2581	3.08
2SC2603	0.25
2SC2625	2.94
2SC2655	0.31
2SC2705	0.22
2SC2724	0.19
2SC2979	2.74
2SC3117	0.60
2SC3153	2.40
2SC3156	6.61
2SC3179	0.82
2SC3182	2.49
2SC3199	0.43
2SC3225	0.60
2SC3242	0.19
2SC3310	2.12
2SC3311	0.29
2SC3330	0.26
2SC3355	0.96
2SC3358	0.69
2SC3420	0.55
2SC3423	0.60
2SC3502	0.45
2SC3656	0.18
2SC3679	4.45
2SC3788	0.77
2SC3795	1.97
2SC3795B	2.63
2SC3807	0.84
2SC3883	5.92
2SC3892A	4.79
2SC3953	0.72
2SC4106	2.05
2SC4242	2.31
2SC4517	4.70
2SC4517A	2.52
2SC458	0.12
2SC4742	4.70
2SC536	0.30
2SC639	0.56
2SC710	0.12
2SC828	0.29
2SC867A	7.13
2SC945	0.12
2SD1071	4.31
2SD1128	1.02
2SD1191	1.49
2SD1207	0.33
2SD1246	0.30
2SD1265	1.08
2SD1266	0.82
2SD1275	1.23
2SD1276	1.39
2SD1292	0.60
2SD1330	0.31
2SD1376	0.60
2SD1379	0.39
2SD1397	2.31
2SD1398	2.14
2SD1409	2.57
2SD1426	1.54
2SD1427	2.91
2SD1432	5.04
2SD1439	3.76
2SD1441	5.98
2SD1453	2.05
2SD1497	7.20
2SD1497-02	13.96
2SD1541	4.96
2SD1548	5.95
2SD1554	3.25
2SD1555	2.57
2SD1577	4.64
2SD1609	0.43
2SD1649	2.05
2SD1651	2.38
2SD1680	3.85
2SD1710	2.52
2SD1877	2.14
2SD1878	3.59
2SD1884	3.16
2SD1911	5.98
2SD2012	0.85
2SD2125	4.70
2SD350A	1.97
2SD362	1.02
2SD400	0.34
2SD401A	0.77
2SD438	0.35
2SD468	0.24
2SD555	8.54
2SD592	0.21
2SD613	0.94
2SD636	0.19
2SD637	0.16
2SD638	0.41

2SD639	0.60
2SD667	0.38
2SD669A	0.64
2SD716	1.46
2SD718	2.21
2SD734	0.26
2SD762	1.80
2SD820	5.06
2SD837B	1.12
2SD856	1.03
2SD863	0.35
2SD869	5.18
2SD870	3.81
2SD871	5.08
2SD880	0.36
2SD882	0.43
2SD898B	6.41
2SD965	0.67
2SD973	0.38
2SJ115	7.69
2SK1117	3.06
2SK192A	0.36
2SK794	6.41
3SK88	2.57
74LS247	0.62
7805	0.78
7806	0.60
7808	0.72
7809	0.69
7812	0.52
7815	0.82
78L05	0.35
78M05	0.35
7905	0.35
7915	0.82
AA119	0.36
AA143	0.13
AC127	0.52
AC151	0.52
AC153K	0.40
AC187K	0.53
AC188	0.40
AC188K	0.82
AD149	0.52
AF124	1.75
AF125	0.82
AF126	2.23
AF127	0.77
AF139	0.29
AN5265	1.76
AN5435	1.46
AN5512	1.01
AN5515	1.29
AN5521	1.66
AN6610	0.94
AN7161N	3.47
AN7171K	4.74
BA154	0.06
BA157	0.09
BA158	0.07
BA159	0.11
BA5406	2.14
BA5410	2.57
BA5412	2.48
BA6109	1.85
BA6209	1.46
BA6209N	1.27
BA6219	1.76
BA6219B	1.46
BA6222	1.70
BA6247	1.95
BA718	1.08
BAT43	0.11
BAT85	0.19
BAV20	0.26
BAV21	0.21
BAW62	0.17
BAX13	0.12
BAX14	0.17
BAX16	0.09
BB105B	0.24
BC221	0.09
BC107B	0.20
BC108	0.16
BC108A	0.26
BC108C	0.15
BC109A	0.28
BC141	0.36
BC143	0.36
BC147A	0.06
BC148A	0.06
BC148B	0.04
BC149	0.04
BC157	0.13
BC161	0.27
BC182L	0.06
BC182LB	0.06
BC183L	0.09
BC184L	0.06
BC204	0.14
BC212B	0.06
BC212L	0.14
BC213	0.11
BC214C	0.08
BC214L	0.09
BC237B	0.08
BC237C	0.18
BC238	0.11
BC238A	0.06
BC238B	0.07
BC238C	0.07
BC239	0.04

BC252B	0.07
BC258	0.09
BC300	0.48
BC301	0.28
BC303	0.24
BC307	0.06
BC307B	0.14
BC307C	0.15
BC308	0.06
BC308A	0.09
BC308C	0.06
BC309	0.04
BC309C	0.14
BC327	0.10
BC327B	0.17
BC328	0.07
BC337	0.14
BC337L	0.22
BC338	0.06
BC368	0.11
BC369	0.17
BC372	0.47
BC461	0.31
BC517	0.14
BC546A	0.07
BC546B	0.12
BC547	0.11
BC547A	0.04
BC547B	0.11
BC548A	0.11
BC548B	0.06
BC548C	0.06
BC549B	0.11
BC550	0.15
BC556C	0.09
BC556A	0.06
BC557	0.05
BC557A	0.15
BC557B	0.06
BC558B	0.08
BC560C	0.06
BC635	0.19
BC636	0.14
BC637	0.11
BC639	0.09
BC640	0.06
BC879	0.40
BCY71	0.27
BD131	0.26
BD132	0.26
BD135	0.33
BD136	0.20
BD137	0.46
BD139	0.18
BD140	0.24
BD203	0.47
BD232	0.45
BD233	0.23
BD234	0.24
BD237	0.31
BD238	0.24
BD239	0.29
BD243	0.45
BD243C	0.44
BD244A	0.34
BD244C	0.42
BD245C	0.92
BD246C	0.97
BD433	0.29
BD434	0.34
BD435	0.38
BD436	0.41
BD437	0.28
BD438	0.38
BD441	0.34
BD529	1.61
BD530	1.71
BD675	0.32
BD677	0.32
BD678	0.51
BD681	0.47
BD839	0.38
BD901	0.52
BD902	0.52
BD911	0.47
BD912	0.63
BD939F	0.74
BDT64C	1.10
BDT65C	1.66
BDW93C	0.64
BDW94C	0.60
BF194	0.22
BF197	0.52
BF199	0.04
BF244	0.43
BF244A	0.60
BF245A	0.19
BF245B	0.41
BF256C	0.00
BF258	0.04
BF324	0.12
BF337	0.34
BF338	0.43
BF355	0.48
BF393	0.21
BF420	0.21
BF421	0.29
BF422	0.19
BF423	0.14
BF458	0.31
BF459	0.29
BF469	0.34

BF470	0.33
BF493	0.36
BF494	0.12
BF757	0.43
BF758	0.32
BF759	0.38
BF760	0.26
BF762	0.30
BF788	0.52
BF869	0.25
BF870	0.29
BF871	0.41
BF959	0.18
BF960	0.30
BF966	0.26
BF970	0.30
BFR34A	0.78
BFR90	0.59
BFR90A	0.68
BFR91	0.60
BFR91A	0.92
BFR96	0.55
BFY51	0.39
BR100	0.21
BR103	0.53
BR303	1.22
BRX44	1.02
BRX49	0.43
BRY55	1.20
BRY56	0.43
BSR50	0.75
BSS38	1.77
BT139600	1.29
BT151/500R	1.44
BT151800	1.15
BU104	1.43
BU205	1.07
BU208A	1.44
BU208AT	1.25
BU208D	1.61
BU326A	1.36
BU406	0.69
BU406D	1.02
BU407	0.53
BU407D	0.98
BU426A	1.03
BU500	1.41
BU505DF	1.35
BU506DF	2.31
BU508A	0.95
BU508AF	1.08
BU508APH	1.99
BU508D	1.32
BU508DF	1.88
BU508V	1.51
BU526	1.61
BU536	1.65
BU608	1.46
BU801	1.37
BU806	0.82
BU807	0.51
BU826A	1.06
BU908	1.68
BUK444500B	1.51
BUK454600C	2.57
BUK455600B	2.54
BUT11	1.71
BUT11A	1.51
BUT11AF	1.18
BUT12A	0.84
BUT12AF	1.08
BUT18AF	1.37
BUT56A	1.19
BUT56AT	2.65
BUV46A	0.84
BUV48	2.05
BUW11	1.51
BUW11A	1.63
BUW13A	2.80
BUW41B	1.03
BUW81A	2.31
BUW84	1.03
BUX84	0.60
BUZ11	1.54
BUZ71	0.89
BUZ71A	1.03
BUZ80A	2.57
BUZ90	3.90
BUZ90A	2.55
BY127	0.14
BY133	0.08
BY164	0.67
BY179	0.77
BY184	0.42
BY206	0.20
BY210400	0.19
BY226	0.16
BY227	0.08
BY228	0.26
BY229600	0.92
BY229800	1.02
BY238	0.43
BY252	0.14
BY255	0.14
BY298	0.15
BY299	0.14
BY359	1.86
BY398	0.18

BY399	0.11
BYD14J	0.26
BYD33D	0.43
BYD33J	0.27
BYD33M	0.21
BYV10-40	2.55
BYV95B	0.19
BYV95C	0.21
BYV96D	0.27
BYW56	0.31
BYW95C	0.65
BYW96E	0.94
BYX55600	0.23
BYX71600	1.45
BZT03C120	0.62
BZV10	1.34
BZV85C5V1	0.15
BZX6110	0.19
BZX6112	0.12
BZX61120	0.09
BZX6113	0.11
BZX6120	0.19
BZX6127	0.19
BZX6133	0.19
BZX615V6	0.11
BZX616V2	0.07
BZX617V5	0.09
BZX618V2	0.19
BZX619V1	0.09
BZX7910	0.30
BZX7912	0.10
BZX7915	0.09
BZX7930	0.11
BZX7936	0.10
BZX794V7	0.07
BZX795V6	0.05
BZX796V2	0.08
BZX79C3V9	0.09
BZX79C5V1	0.05
BZX83C6V2	0.13
BZY8810	0.11
BZY8811	0.11
BZY8812	0.07
BZY8813	0.11
BZY8824	0.11
BZY8827	0.11
BZY882V7	0.11
BZY8833	0.11
BZY883V6	0.11
BZY883V9	0.03
BZY884V7	0.06
BZY885V1	0.13
BZY886V2	0.11
BZY888V2	0.27
BZY889V1	0.11
CARBB	9.95
CD4001	0.21
CD4008	0.31
CD40106	0.52
CD4011	0.38
CD4013	0.45
CD4016	0.14
CD4017	0.47
CD4024B	0.23
CD4049	0.26
CD4050	0.31
CD4053	0.69
CD4060B	0.76
CD4066	0.30
CD4070	0.21
CD4081	0.15
CD4093	0.32
CD4094	0.36
CNX62A	3.83
CNX82A	1.12
CNX83A	0.94
CRO2AM	3.16
DTA114ES	0.24
DTA124EF	0.13
DTA144EF	0.63
DTA144ES	0.18
DTC124ES	0.19
DTC144ES	0.19
HA11423	2.84
HA13001	1.47
HA13108	2.57
HA13117	2.05
HA13118	1.88

HA13119	2.05
HA13403	3.59
HA1377	2.62
HA51338SP3	7.69
HM6232	10.46
HM6251	9.57
J08	0.00
KA2206	1.32
KA2223	0.60
KA2263	0.55
KA8301	1.46
KBL08	1.42
KIA6210AH	6.15
KSR1001	0.14
KSR1004	0.14
KSR2001	0.14
KSR2004	0.14
L200CV	2.19
LA1230	1.95
LA1503	1.29
LA4261	2.29
LA4270	2.73
LA4282	8.89
LA4422	1.36
LA4440	1.80
LA4445	2.99
LA4460	2.31
LA4461	1.71
LA4475	2.99
LA4476	2.99
LA4508	2.77
LA4700	4.27
LA6358S	0.60
LA6510	2.94
LA7520	4.80
LA7800	2.41
LA7801	1.41
LA7820	2.71
LA7830	1.88
LA7835	1.80
LA7837	1.63
LC7132	4.70
LED3G	0.10
LED3R	0.10
LM1203	10.47
LM1303N	0.88
LM317T	1.29
LM324N	1.48
LM339N	0.50
LM340T5	0.41
LM358	0.60
LM358N	0.42
LM380N	1.03
LM386N	0.57
LM3914N	2.74
LM393N	1.19
LM741	2.96
M104B1	5.30
M192B1	1.88
M293B1	23.49
M491	7.94
M494B1	5.65
M51387P	10.68
M51393AP	4.64
M5218L	1.59
M5231L	0.94
M54519P	1.17
M54543L	1.97
M54544L	1.87
M54548L	3.63
M54648L	6.87
M58655P	4.96
MB3730	3.85
MB3732	14.89
MC13002P	7.69
MC1310P	0.85
MC1377P	7.51
MC1391P	2.02
MC14426P	1.71
MC3357P	2.14
MDA2062	4.54
MJ15003	4.02
MJ15004	5.08
MJ2955	0.98
MJ3001	1.56
MJ4502	1.84
MJ802	2.40
MJE13005	0.86

MJE18004	1.80
MJE2955	0.68
MJE2955T	0.68
MJE3055	0.52
MJE3055T	0.74
MJE340	0.50
MN650	5.98
MPSA06	0.35
MPSA42	0.23
MPSA43	0.15
MPSA55	0.26
MPSA56	0.12
MPSA92	0.18
MR854	0.65
MR856	0.11
NE545B	3.20
NE555N	0.40
NE556	0.43
NE592N	1.91
NE646N	4.45
OA200	0.22
OA90	5.23
OC71	1.03
P600A	0.33
PC814	1.29
PIC16C57XTSO	6.61
R2M	0.67
R4050	3.04
R4051	4.80
RB156	2.40
RC4558	0.46
REGBABY10	17.56
RGP10G	0.26
RGP15G	0.33
RGP15J	0.24
RGP15M	0.44
RGP30M	0.30
RM11C	1.71
S2000A	1.98
S2000A3	1.54
S2000AF	1.68
S2055AF	2.02
SAA129302	8.20
SAA129303	10.25
SAA5012	3.34
SAA5243PE	10.87
SAB3035	1.71
SG264A	11.57
SGSIF344	7.28
SL1430	1.92
SL1431	2.40
SL1432	6.19
SL471	1.70
SN76705AN	1.70
STA341M	3.35
STA441C	2.82
STK4122II	6.70
STK4132II	10.00
STK4141II	8.29
STK4141V	11.03
STK4142II	9.40
STK4152II	10.68
STK4171II	13.20
STK4192II	14.64
STK4392	6.43
STK463	10.87
STK5211	16.12
STK5331	2.87
STK5332	3.59
STK5333	13.57
STK5338	3.16
STK5342	4.07
STK5372	3.51
STK5372H	6.84
STK5421	2.62
STK5466	5.66
STK5471	4.87
STK5473	4.70
STK5476	5.03
STK5481	8.01
STK5482	4.51
STK5490	7.69
STK6962	2.60
STK7226	8.14
STK7253	6.49
STK7308	5.13
STK7348	4.65
STK7356	5.66

STK7358	5.81
STR40090	6.28
STR4211	12.63
STR441	28.40
STR451	23.50
STR50020	9.02
STR50103	4.10
STR54041	4.36
STR5412	3.68
STR58041	6.41
STR59041	6.67
STR6020	5.38
STR6020KIT	15.05
STRD4420	11.16
T6064V	2.63
T6076V	5.04
T9053V	0.93
T9064V	1.51
TA7109AP	3.23
TA7205AP	1.68
TA7217AP	1.46
TA7222P	1.28
TA7227P	2.29
TA7233P	1.97
TA7240P	2.74
TA7250	4.07
TA7250BP	3.74
TA7270P	1.59
TA7271P	11.33
TA7273P	4.10
TA7274P	2.74
TA7280P	2.74
TA7281P	2.98
TA7288P	2.04
TA7299P	2.65
TA7317P	3.44
TA7609P	2.19
TA7680AP	4.55
TA7698AP	4.60
TA7769P	3.01
TA7784P	2.25
TA8201	3.93
TA8205	3.93
TA8205AH	4.50
TA8207	2.74
TA8210H	5.28
TA8215H	5.73
TA8216H	8.01
TA8220H	7.69
TA8221H	6.56
TA8221L	7.19
TA8410K	4.27
TA8691N	7.01
TAA550B	0.26
TAA550C	0.30
TBA120	0.53
TBA120C	0.65
TBA120S	0.89
TBA120T	0.51
TBA120U	0.40
TBA800	0.51
TBA820M	0.23
TBA920	2.75
TBA950	1.68
TCA440	2.75
TCA800Q	1.65
TDA1004A	4.35
TDA1011	1.27
TDA1013A	1.56
TDA1015	1.37
TDA1035T	2.48
TDA1044	1.43
TDA1060	1.03
TDA1082	4.27
TDA1085C	1.88
TDA1170	1.85
TDA1170N	1.35
TDA1170S	1.54
TDA1180P	1.69
TDA1270	1.79
TDA1420	3.04
TDA1510	3.40
TDA1515A	2.57
TDA1516Q	3.59
TDA1518Q	4.27
TDA1519	4.23

TDA1519A	2.74
TDA1520B	2.48
TDA1521	3.36
TDA1524A	1.88
TDA1553Q	4.79
TDA1554Q	8.12
TDA1670A	2.98
TDA1675A	3.85
TDA1701	2.65
TDA1770A	30.29
TDA1872A	4.83
TDA1905	2.12
TDA1908A	2.14
TDA1950	1.86
TDA2002	1.12
TDA2003	0.90
TDA2004	2.57
TDA2005	1.63
TDA2006	1.06
TDA2030H	0.74
TDA2030V	0.74
TDA2040H	2.11
TDA2170	7.08
TDA2270	2.45
TDA2540	1.12
TDA2541	0.72
TDA2576A	5.95
TDA2577A	2.99
TDA2578A	2.91
TDA2579A	4.91
TDA2581	4.27
TDA2581Q	2.99
TDA2582	2.05
TDA2593	0.76
TDA2594	2.21
TDA2595	3.19
TDA2600	4.86
TDA2611A	0.64
TDA2611AQ	1.32
TDA2653A	2.99
TDA2655B	19.93
TDA3190	1.27
TDA3301B	6.75
TDA3330	12.29
TDA3505	2.40
TDA3541	0.98
TDA3560	2.96
TDA3561A	5.30
TDA3562A	3.90
TDA3562ATF	3.34
TDA3565	3.40
TDA3566	6.41
TDA3576B	11.31
TDA3640	5.92
TDA3650	9.91
TDA3653B	1.18
TDA3653C	1.37
TDA3653CQ	2.57
TDA3654	1.34
TDA3654Q	2.82
TDA4420	0.32
TDA4427A	3.98
TDA4500	4.66
TDA4501	7.43
TDA4501H	5.69
TDA4502A	5.47
TDA4503	4.00
TDA4505E	6.46
TDA4505M	8.97
TDA4580	10.05
TDA4600	1.88
TDA4600/2/3	1.46
TDA46002D	4.27
TDA4601	1.66
TDA4601D	1.54
TDA4605	6.10
TDA4950	1.76
TDA7052	1.70
TDA7240A	2.36
TDA7350	5.98
TDA8140	2.38
TDA8153	14.63
TDA8170	1.97
TDA8172	2.65
TDA8175	6.41

TDA8178FS	3.81
TDA8180	4.87
TDA8190	2.91
TDA8305	7.21
TDA8380	2.53
TDA9503	2.13
TEA1014	1.87
TEA1039	2.14
TEA2018A	1.70
TEA2029C	5.69
TEA2031A	3.40
TEA2164	2.96
TEA2165	4.27
TEA2165A	9.58
TEA5101A	3.95
TEA5115	2.91
TIC106D	0.82
TIC106M	0.75
TIC225M	1.02
TIC2260	0.68
TICP106D	1.95
TIL111	0.64
TIP110	0.36
TIP112H	0.95
TIP121	0.42
TIP127	0.47
TIP132	0.65
TIP137	0.48
TIP2955	0.94
TIP29C	0.31
TIP29E	0.47
TIP3055	0.94
TIP30C	0.17
TIP31A	0.33
TIP31C	0.77
TIP32A	0.41
TIP32C	0.40
TIP35C	1.39
TIP36C	1.37
TIP41C	0.43
TIP42A	0.35
TIP42C	0.35
TIPL761A	1.59
TIPL791A	1.20
TL062	0.60
TL071	0.69
TL071CP	0.60
TL072	1.03
TL072CP	1.03
TL074	1.15
TL082CP	0.21
TMP47C432AP8188	15.19
TMP47C432AP8189	15.19
TPU2732	10.05
TPU2735-45	12.30
UA741CN	0.28
UAA2001	12.50
UC3842	1.46
UC3844	1.00
UC3844N	1.91
ULN2003AN	1.58
UPA81C	1.12
UPC1188H	5.08
UPC1230	2.82
UPC1230H	3.95
UPC1238V	1.44
UPC1278H	2.66
UPC1335V	3.95
UPC1363C	2.13
UPC1365C	1.70
UPC1378H	1.47
UPC1394C	1.58
UPC1420CA	7.69
UPC1488H	2.99
UPC4558C	0.65
UPC574J	0.86
UPD1937C	3.85
X0065CE	3.42
X2402	4.62
X2402P	5.16
ZPD5.6	0.07
ZTK33B	0.12
ZTX300	0.37
ZTX650	0.51

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VCR Clinic

Reports from Philip Blundell, AMIEEIE, Michael Dranfield, Eugene Trundle, David Belmont, Steve Hague, Terry Lamoon, Michael Harris, Stephen Leatherbarrow, Richard Newman, John Pitt-Francis and Simon Bodgett

Philips VR231

If the power supply is dead and the start-up voltage for the control chip is low, check whether diode 6115 is leaky. The type fitted in this position depends on the model. If it's a UG06B, the part no. is 4822 130 83307. **P.B.**

Panasonic NVG21

When replacing post P5, make sure that you use the correct part for the machine on which you are working. After fitting a new post we found that it caught on the securing screws for the capstan motor. This resulted in a tape loop on eject. The new post looked identical to the old one but was about 1mm thicker. It would seem that different ones are used in the deck. **M.Dr.**

Panasonic NVG7

Stations could be tuned in and stored, but on channel change they disappeared. We suspected the MN1220 memory chip, but checks took us to the –30V supply which was rather high at –57V! Q1101 and D11 in the power supply were found to be short-circuit. Despite this high voltage the memory chip was perfectly o.k. **M.Dr.**

Sanyo VHR3300

The effect produced by this fault suggested that its cause lay in the i.f. or a.g.c. circuits. Symptoms were a grossly distorted, soot-and-whitewash E-E picture with patterning and loss of sync. In fact the signal that emerged from the vision detector was perfectly good! The cause of the trouble was a faulty vision switching chip, IC1001 (LA7223). **E.T.**

Sanyo VHR190

To all intents and purposes this machine was completely dead. When we checked around in the power supply section with an oscilloscope however we found that there were needle pulses at the chopper transformer. The cause of the failure was the 14V rectifier D5101 which was short-circuit. **E.T.**

Panasonic NVG21

This machine originally came in for a service. In addition to replacing all the gears, the pinch roller and the mode switch we had to replace the side plate and connection gear. Two months later the machine came back, the complaint being that when it was switched on the carriage moved forwards then ejected, repeating this until the machine went back to standby. You often get this fault when there's a worn carriage mode switch or a bent lever. Not this time however. The cause of the trouble was that all the joints of the new carriage's connector were dry-jointed. Resoldering put matters right. **D.B.**

Sanyo VHR135

There was intermittent failure to take up in play or rewind. The cause of the problem was that the idler was sticking on its shaft. A drop of oil on the pivot shaft was all that was required to restore correct operation. **D.B.**

Matsui VX730/Saisho VR3200

This machine appeared to be dead. The power supply was working, but there was no AT6V supply because of a break in the ribbon cable that connects Q505 to the power supply. A new cable loom put matters right. **D.B.**

Ferguson FV70

This machine had a tape stuck in it. As the loading motor had partially seized, its drive chip had a large hole in it. Replacing the chip and the loading motor enabled us to retrieve the tape. **D.B.**

JVC HRD580

We seem to be getting quite a few of these machines in which a previous engineer has replaced the mode switch but fitted the wrong type. The symptoms are that the tape laces up and the machine then plays for a few seconds before shutting down. The part number for the mode switch, which has a black body, is PU60973. Don't fit the red type. **D.B.**

Sanyo VHR251

The E-E and playback pictures were poor, with what appeared to be hum bars and a rolling effect. A check via the scart lead showed that the video signal was good. When we opened the r.f. converter we saw two small 1μF capacitors. Replacing them restored a good picture. **D.B.**

Aiwa HVG110K

This machine went dead intermittently. When we examined the power transformer we found that pins 15, 16 and 17 were dry-jointed. Resoldering them restored reliable operation. **D.B.**

JVC HRD910

This tip could save you a lot of heartache – as well as money! The symptom we had was an unstable picture in the top half of the screen and just snow in the bottom half. Scope checks showed that the output from one head was greatly reduced. Replacing the upper drum marginally improved the top half of the picture, but had no effect on the snow. . . Logically, the cause of the problem had to be the lower drum. But before we frightened the customer with the price of a new one we rung JVC Technical. We were told that there's a 3·3μF capacitor, which is not shown in the service manual, on the lower drum PCB. Replacing this cured the fault. **S.H.**

Ferguson 3V23/JVC HR7700

It's not often that one of these venerable machines turns up, but this one was extremely clean. Its noisy picture was simply the result of worn out heads, which the owner thought it worth replacing. He also said that the machine didn't always load, especially with a timed recording. A new loading belt cured that. We also replaced the cassette lamp as it appeared to be the original one. **M.H.**

Fisher FVH715

A nice easy one: this machine produced a picture with two hum bars that tripped the field lock each time they arrived at the bottom of the screen. Two bars indicates 100Hz hum, so we had a quick look around the main electrolytics. C906 (1,000μF, 35V) turned out to be almost open-circuit. It took longer to take the cover off the machine and find the power supply than to do the repair! **M.H.**

Saisho VR1200/Matsui VX800A

This machine had no eject, fast forward or rewind operation, though it would load. We noticed that there was no capstan rotation, and a quick check showed that there was no 16V feed from the power supply. This led us to the good old circuit protector ICP201 which was open-circuit. Replacing this and giving the machine a good clean up completed the repair. I love the easy ones! **T.L.**

JVC HRFC100F

This model is unusual in that it will work with both normal VHS and VHS-C camcorder tapes. Its loading mechanism is therefore slightly more complicated, and this is where you get most of the problems. The machine I had in recently was no exception – there was a tape jammed in it.

I managed to extract the tape, and on inspection noticed that the half-load arm was quite badly twisted and in need of replacement. It is always worth checking that the carriage is not sloppy in its down position: it might also need to be replaced, and is an expensive item. Fortunately in this case the carriage was o.k. and replacement of the half-load arm and the gear assembly was all that was required. **T.L.**

Matsui VX1100

There was intermittent E-E sound. Getting out my faithful old screwdriver, I did some highly technical fault tracing by tapping around the boards. This soon led me to a very sensitive scart panel, and on closer examination I noticed that C4513 was dry-jointed. Resoldering it cured the fault. **T.L.**

Hinari VXL6

In both the E-E and playback modes the video signal was very crushed and distorted, and of low amplitude. Not having a manual, I was forced to follow the print. This brought me to Q306 (2SC1740), whose base voltage was too low for it to switch on properly. The cause of the trouble was C353 (47μF, 16V) which was short-circuit. We've had problems with other 16V electrolytics in these machines. Symptoms have included no drum rotation and excessive capstan speed. **S.L.**

Amstrad VCR4600

There seemed to be two problems with this machine, but they proved to have the same cause. If any deck mode was selected while the machine was in the E-E mode, the sound would be either muted or its level would vary momentarily. Deck mode changes also produced video signal level variations. The obvious thing to do seemed to be to check the supply voltages. When I did this I found that the AL12V supply was at 18V and varying. This supply is produced by Q802, along with the 5V regulator IC801 and the 8·2V zener diode D810. The culprit was Q802. **S.L.**

Sharp VCA46 – Video Plus Handset

There was a problem with this machine's Video Plus remote control handset. If a Video Plus code for any previous day was entered, the LCD would display the correct start/stop day/month. If a code for the current or any subsequent day was entered, the wrong start/stop day etc. would be displayed. The cure was to remove the handset's batteries then discharge the internal capacitor by shorting the battery terminals together for a few seconds. The problem had arisen after fitting replacement batteries. **M.Dr.**

Ferguson 3V36/JVC HRD225

Playback of a prerecorded tape was o.k., but when a recording made by the machine was played back the capstan speed was slow. Checks showed that the capstan FG comparison signal was missing at pin 6 of IC408 (BA6305) though the input to this section, at pin 5, was o.k. The obvious thing seemed to be to replace the chip, but this made no difference. After checking the chip's peripheral components I did what I should have done in the first place – check the amplitude of the pulses at pin 5. It was low of course (200mV). When I checked back to pin 1 I found that the signal from the capstan flywheel FG coil was also low.

An inspection of the flywheel revealed that the two screws which hold the bracket were chewed up, and that someone had already fitted a new set of belts. The cause of the trouble was excessive clearance between the flywheel and the FG coil. I think that whoever had fitted the belts was unable to undo the screws and bent the flywheel bracket to get the new belt on. **M.Dr.**

Philips VR6462

There was no playback sound though the E-E sound was normal. I like to use a signal tracer. So I lifted out audio panel P502 to make checks. There was plenty of signal from the head, at the base of transistor 7010, but nothing at its collector. A few further quick checks showed that although there was 11V at the top end of R3037 (3·3kΩ) there were no voltages around transistors 7010 and 7009. The decoupling electrolytic C2027 (330μF, 16V) was dead short, a replacement restoring full sound. **R.N.**

Philips VR6585

There was neither E-E nor playback sound with this Nicam machine. Initial checks were carried out around the audio switching panel, but everything seemed to be o.k. here. What I did notice was that the level indicator on the front panel barely moved. It's driven by the f.m. audio panel, where there was no supply to the audio processor chip because the 80mA Wickman fuse F1201 was open-circuit. All that was required to restore the sound was a new fuse. **R.N.**

Sharp VCA113HM

This machine belonged to a heavy smoker and needed a good clean up. I was told that it had failed quite suddenly while playing back one of the soaps. On test it was found to be reluctant to thread, with the arms going only about half way; the half-load arm moved in odd jerks, and the machine wouldn't wind tape back into the cassette. The mode switch was the cause of all this. When I removed it and took it apart the contacts were seen to be suffering badly from nicotine poisoning. They cleaned up all right, and the machine worked when reassembled, but I decided to change the switch to be on the safe side. **R.N.**

Philips VR6462

There were no signals, either E-E or playback, nor was it possible to obtain a test signal as there seemed to be no output from the modulator. Mechanically the machine was o.k. A substitute i.f. panel failed to restore the signals, so I checked the voltages at pins 4 and 6 of socket P5 on interface panel P005: these are the supplies to the modulator. The switched 12V supply (12b) at pin 4 was missing. It comes from transistor 7002, which had correct voltages at its base and emitter but nothing at its collector. The 'on' line to IC7150 seemed to be working correctly.

Component replacement on panel P005 can be carried out only after removing it. Remove the i.f. and chroma panels, then the three screws that secure the mains transformer. After unplugging the transformer, release the plastic clips that hold the panel, raising it gently as you do so. The panel can be worked on by resting it on its side, and you can plug the transformer back in. All deck functions will then remain operational. Once transistor 7002 had been replaced normal operation was restored. It's a BD678 Darlington type transistor. **R.N.**

Toshiba V309B etc

This machine would stop in playback or record after anything from twenty minutes to two hours. The cause was high reel motor current, though the motor rewound very fast and wasn't particularly noisy. We've also had the fault with the V109B and V209B. **J.P-F.**

Panasonic NVG20

No power up with this machine was caused by C39 in the power supply. It had gone low in value. **J.P-F.**

Ferguson 3V35/JVC HRD120

The tuning department wouldn't light up, behaving as though it was in the camera mode. The tuner/camera switch was o.k. however. Replacing the HD552-088C chip cured the fault. **J.P-F.**

JVC HRD580/Ferguson FV43H/44L/46T

This machine stopped intermittently, usually at start up. As a replacement clutch unit failed to restore reliable operation I removed the deck terminal PCB and cassette housing in order to give the deck a thorough inspection. While looking for a foreign object I noticed that the brake pad on the sub-brake assembly was dislocated. A replacement, part no. PQ43583A, cleared the fault. **J.P-F.**

Hinari VXL90 etc

No fast forward or rewind, everything else working normally, is becoming a stock fault with the deck used in this machine (and many others, see note at end). The cause is unreliable trigger lever action (item 260, see Fig. 1). In order to engage the fast forward/rewind action after a command, this lever must have returned to its rest position. Instead, it tends to remain protruding about 1mm towards the front of the deck. To improve reliability:

(1) Carefully round off the sharp edges of the trigger lever and brake plate mouldings in the areas indicated by an X in Fig. 1, using a sharp knife in a scraping action.

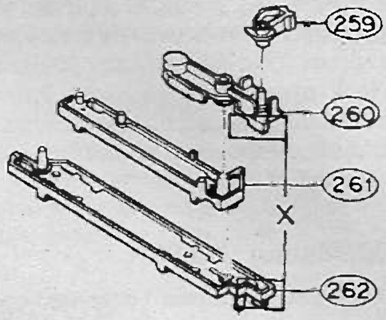


Fig. 1: Trigger/brake components, 259 trigger hook, 260 trigger lever, 261 brake plate, 262 brake actuate base. Round off the edges of items 260 and 262 in the areas marked X.

(2) Increase the spring torque by bending the bottom end of the spring an extra 60°.

(3) Clean off all dirt and reassemble, lubricating the rubber parts with a *small* amount of *plastic* grease such as Electrolube or Mycote.

Note: Other machines that use the deck include the Hinari VXL8/9, Sentra VX8500/8600, Amstrad VCR6000/6100, Tashiko VVF933/934, Proline VCR9100, Goodmans TX1100, Osaki VCR35 and many more. **J.P-F.**

JVC HRS5800

This machine came in with a list of faults: intermittent sound; picture not stable; and the left VU meter not working. There was no sample tape, and I had little to go on as the machine had come from another dealer. I checked the tape path and set it up. This cured most of the problems. I then braced myself for a complicated VU meter drive problem. There was relief when I discovered that it had been selected as a tracking indicator. **S.B.**

Grundig VS340

Sound warble was the complaint. It was caused by tight capstan motor bearings, a new motor curing the trouble. Unlike some who would strip the motor down and lubricate it, "to save the customer some money", I prefer to work to manufacturers' standards. **S.B.**

JVC HRS4700

Faulty functions. What a brilliant fault report! Says it all, doesn't it? Normal operation was restored by replacing the CAT chip. To non-JVC types, that's the memory i.c. **S.B.**

JVC HRS5800

Loading difficulties was the complaint with this machine. Its cause was a broken spring in the idler/brake control. All suspect gears and cams were replaced to restore reliable operation. **S.B.**

Consumer Electronics at Berlin

George Cole

This year's Berlin consumer electronics show, known as the Internationale FunkAusstellung (IFA), was held in late August. It was dominated by digital playback, recording and broadcasting systems. A number of interesting technological developments for the future, including flat-screen TV sets and tapeless audio and video recording systems, were also on show.

Digital TV

Digital TV conforming to the European Digital Video Broadcasting (DVB) standard should reach much of Europe next year, via satellite or cable distribution. DVB receivers were being demonstrated by a number of companies, including Philips, Hitachi, Pace and Thomson. Pioneer's DVB IRD (no model number has been assigned to it) is designed for satellite or cable TV systems: it can handle MPEG-2 audio and video, has a DVB descrambler and an IOS smart-card slot, is 4:3/16:9 capable and incorporates a modem and a computer and peripheral interface. Nokia's DVB9500S is designed for digital TV and many other digital services and systems – more on this when we come to multimedia equipment.

Dr Helmut Stein, vice-president of Nokia's technology division, provided an interesting insight into the DVB strategy for HDTV broadcasting. Apparently the original plan was to introduce an hierarchical, or 'scalable', transmission system: a standard-resolution picture would be incorporated within an HDTV picture in such a way that owners of ordinary digital sets would receive the standard picture while those with HDTV sets would see the high-definition images. But this approach has been deemed a waste of valuable transmission resources, also putting up the cost of digital TV sets for little or no immediate benefit. No broadcaster plans to offer HDTV during the next five years or more, there are no HDTV chip sets in production, and a scalable system would involve transmitting twenty per cent more data. Thus the present plan is to offer standard/HDTV simulcasting when appropriate. This would require only some 6Mbits of extra data capacity.

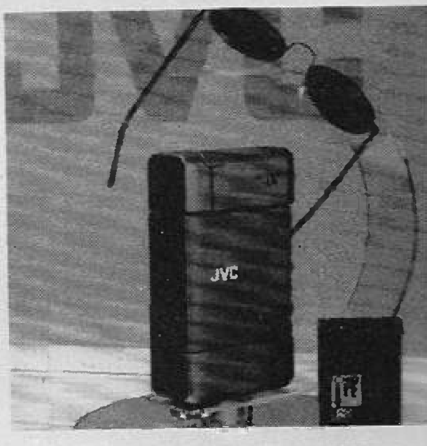
Non-digital TV

Despite the growing interest in digital TV, there were plenty of interesting analogue TV developments on show in Berlin. A combined TV and telephone was included amongst some novel technology being demonstrated by Philips. The 32PW977A is a 32in. widescreen TV receiver incorporating an analogue cordless telephone base station that conforms to the CT1 (900MHz) standard. When a call is received the screen displays a message. The call can then be answered by pressing a button on the remote control handset to mute the TV sound. A built-in microphone and speaker provide the phone operation. Other features include caller ID, a 150-name directory and an alphanumeric keypad. Up to six handsets can be operated from the base station. There were no launch or price details however.

Level 2.5 teletext was also demonstrated by Philips. This offers a number of improvements. Each Level 2 page can contain up to 32 colours, chosen from a palette of 4,092. There can be up to 56 characters per line (the present system has 40), and the graphics are better. It's also possible to mix letters of different colours on the same line. The Level 2.5 system is designed for 16:9 sets but can also be displayed by 4:3 sets that use Level 1 or 1.5 teletext. This is possible because the first 40 characters in a line are used for the text, the remainder for graphics that can be displayed on panels at each side.

The Philips Widescreen Plus system improves the picture quality with 432-line letterbox pictures that are expanded to fill a 16:9 screen. It uses line interpolation to generate extra lines to form a 576-line display.

Philips has also improved the picture quality with 100Hz displays, which can produce judder with moving objects. A system called Natural Motion works by analysing the picture in real time. This enables it, using measurements based on the speed and direction of an object, to predict where the object should be in the next frame. An intermediate picture based on these calculations is then created. The system cannot operate where the object is too small or is moving too fast however. It will be built into Philips' widescreen sets as a switchable option. From what I saw, Natural Motion works well. Another system, called Dynamic Contrast, analyses the luminance picture content forty times a second to improve the contrast ratio.



JVC's prototype digital camcorder, which measures just 150 x 80 x 45mm and has been designed for left- or right-hand use.

Other products shown by Philips included a prototype 20in. widescreen set due for launch in 1996, and a 32in. PALplus set, Model PW9761.

There were plenty of other widescreen sets at the IFA. Panasonic's TXW28D1F has a 71cm super-flat black-matrix tube, a 100Hz display and PIP. Panasonic also announced an interpolation-based system to improve expanded letterbox pictures. It's called Wide Digital Plus. Sony showed a family of new widescreen sets with screen sizes ranging from 16 to 32in. Some include a PALplus decoder.

Although PALplus at present has a low profile in the UK (between them, Channel 4 and Granada TV will transmit only around 500 hours this year), the format is in much wider use in mainland Europe. The German ZDF network for example will have transmitted some 1,000 hours by the end of this year, while across Europe some 10,000 hours of PALplus broadcasts will have been transmitted.

Nokia showed 28 and 32in. PALplus home cinema sets while Samsung is to introduce a 32in. PALplus set, Model WS3220, this month (November). Smaller screen versions

(24 and 28in.) will be introduced next year. These sets will all include PALplus Motion Adaptive Colour Plus Processing and Film Mode Processing systems to remove interference effects such as cross-colour.

Miscellaneous TV Developments

Other TV developments on show included Hitachi's VT-CCD1 closed caption decoder. This displays subtitles hidden in prerecorded video tapes – the system is designed to help deaf and hard-of-hearing viewers. The decoder is PAL and NTSC compatible and includes caption positioning (at the top or bottom of the screen) and see-through captioning.

Sharp showed sets with its AFS (Automatic First Start-up) system. This includes automatic tuning and an on-screen help system for setting up. A double-screen set was shown by Samsung. It's a widescreen set that can provide two separate displays. There were also combi products, including Nokia's VideoTV which is a combined 20in. TV set with a two-head mono sound VCR that features ASO Plus. Its features include two tuners, front AV sockets and teletext. Samsung's CDT2500 combines a 25in. TV set with a CD player that can handle CD audio, CD Plus Graphics and Video CD discs.

Future TV Developments

For the last quarter of a century the large, flat-screen TV has always been 'just around the corner'. It looks as if such sets really will be with us during the next two or so years.

The show gave us the opportunity to see Sony's flat-screen, Plasmatron sets for the first time. This technique was described in the September issue of *Television*. To recap briefly, it uses a system known as Plasma Addressed Liquid Crystal (PALC) which was first developed by the US company Tektronix. Plasma discharges are used instead of an array of thin-film transistors to switch on the screen's LCD cells. Several Plasmatron sets were on display, each with a screen of about 25in. across. They looked very impressive. The biggest problem is that, being LCD sets, the viewing angle isn't as good as with conventional displays. Despite this the sets caused much comment. Sony plans to start selling Plasmatron sets in Japan next year. They probably won't reach Europe until late 1997 or early 1998.

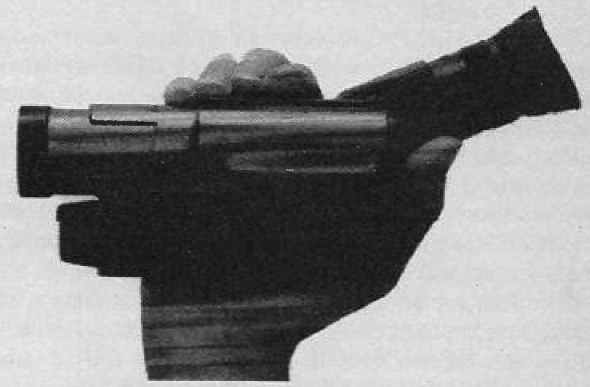
As part of its future technology show, Thomson demonstrated a 50in. plasma display. But there are no plans so far to market sets using it.

Sanyo generated a lot of interest with its 3D TV system that doesn't require the viewer to wear glasses. It works by projecting images from two LCD sources on to a lenticular lens screen which acts as an image splitter to keep the images separate. Because the eyes are presented with two separate images, a 3D effect is created. It's pretty effective, though your position in front of the screen is critical and you have to keep your head still.

Nokia has signed an agreement with Texas Instruments to use a projection TV technology called Digital Light Processing (DLP). The heart of the system is a digital micromirror device (DMD). This is a large chip (about 1·5 x 1cm) whose upper surface is covered by an array of half a million digitally-controlled micromirrors. These produce the display pixels. Each mirror is mounted on a hinge that enables it to be tilted, at a rate of 1,000 times a second. The mirrors are controlled by digital signals via memory cells – one per mirror, positioned beneath it.

Light from a 100-120W metal-halide lamp is directed on to the DMD, which reflects it via a projection lens to form the image. A colour wheel that rotates at around 70Hz is positioned between the lens and the screen. It uses two colours, red and blue, to produce a complete range of colours by additive and subtractive mixing.

Nokia plans to introduce rear-projection sets using DLP technology in 1997. A 50in. set would measure only 15in. from the front to the back and weigh around 35kg. A prototype 4:3 set was shown, but production models will use the 16:9 format. The picture quality was impressive, though not quite as bright as the pictures produced by a c.r.t. There was no sign of line structure, mainly because the DMD's mirrors are only one micron apart, and the viewing angle was good. Computer images were also displayed, and again the text and graphics were clear and sharp.



This prototype tapeless camcorder shown by Hitachi can record up to half an hour of video in its 400Mbyte multilayered flash memory. Weight is just 350g.

VCRs

JVC showed a Super VHS PALplus VCR, Model HRS9200, whose recordings can be watched using either a 16:9 or a 4:3 set for the display. The VCR is able to record the vertical helper signal that's transmitted with PALplus broadcasts, being used by PALplus sets to build up the 576-line widescreen display. Other features include hi-fi VHS, insert editing, a flying erase head and a jog-shuttle dial. Samsung also has an S-VHS PALplus machine, Model SV200X. JVC was also showing its Data VHS (D-VHS) system, which enables VHS machines to record digital data.

The Philips Video Index system is designed to make it easier for users to find out what's on their tapes. It works by scanning a cassette that uses VASS (VHS Address Search System) then storing its contents in memory. When programmes are added or erased, the information is updated. To use the system you press a remote control handset button: the information is then displayed on screen.

The information shown depends on how a programme was recorded. When a programme is recorded using PDC or VideoPlus, the programme title, date, time and length are shown. When a recording is made manually, or with a timer, the channel name replaces the programme title. Users can edit the tape information however, replacing the programme with the channel name for example. Each cassette has its own on-screen contents page: programmes can be selected by scrolling up and down the page. Once a programme has been selected the VCR winds to it and begins the playback. Up to a hundred cassettes can be indexed.

DVC

A number of companies showed camcorders that conform to the new Digital Video Cassette (DVC) format. More details of this system will be provided in a separate article next month. Briefly, DVC camcorders can record up to an hour of digitally-compressed video on quarter inch metal evaporated tape. The cassette is smaller than the DAT type. The picture quality with the camcorders on show conformed to the standard rather than the high-definition DVC standard, but is still an improvement of Hi-8 and S-VHS – the horizontal resolution is over 500 lines. Twelve-bit PCM is used for the audio.

Sony had two DVC camcorders on show, the top-of-the-range DCR-VX1000E which has three CCD image sensors and the DCR-VX700E which is aimed more at 'mainstream' consumers. Both incorporate an image stabilisation system called Super Steady Shot and have a digital output jack cable for both the audio and video data. The video data can be transferred to a digital VCR or a PC. Model DCR-VX1000E also offers Photo-Mode shooting, which records a seven-second still image.

The demonstrations were good, with stunning picture quality, but the camcorders are going to be on the expensive side – the DCR-VX1000E will probably sell at around £3,500 and the DCV-VX700E at over £2,000. There is also concern as to whether the new camcorders will be compatible with existing edit decks, with respect to time codes for example. The answer to this seems to be that the camcorders will work with other equipment from the same manufacturer, but if for example you buy a Sony DVC camcorder it may not work properly with say a Panasonic edit deck.

JVC showed a lovely prototype DVC camcorder whose size was just 150 x 80 x 45mm with a weight of less than 500g. It has an 0·5in. colour viewfinder and is designed for both right- and left-handed users.

Panasonic had its Model DVC NV-DJ1 on display and Samsung also announced plans to launch a DVC camcorder.

Tapeless Recording

Hitachi had on show an interesting prototype camcorder that records up to half an hour of video in a 400Mbyte multilayered flash memory system. This retains its memory when the power is switched off. Weight of the camcorder is 350g.

Samsung's AVC2 tapeless audio recorder can reproduce up to seventeen minutes of CD-quality music from a 24Mbyte flash memory card or record the same amount of music from a PC. The snag is that flash memory is not cheap – a 24Mbyte card at present costs around £173. According to Samsung the price should fall to about £70 within the next three years. A MASK ROM card, which can be used for playback only, costs about £40. This should fall to around £10 over the same time scale. Samsung plans to introduce a record/playback version of the AVC2 by 1998.

Digital Video CDs

At a press conference a couple of days before the opening of the show Sony and Philips demonstrated their dual-layer Multimedia CD (MMCD) system using, for the first time, video material – previous demonstrations had used audio tracks. I was unable to attend this, but other reporters said that the results were excellent, with a seamless switchover between the two video layers.

The press conference held by the competing SD disc system developed by Toshiba revealed some interesting information. There's a whole series of SD discs, ranging from the SD5 which holds up to 5Gbytes of data or 142 minutes of MPEG-2 video to the SD18 which stores up to 18Gbytes of data on a double-sided, dual-layer disc. There are also recordable and rewritable discs. The discs can store entertainment material (Digital Video Discs) or be used as high density ROMs for computer data or as rewritable CDs. Although SD is a digital format, there will be PAL and NTSC players and discs. Discs intended for NTSC markets will use Dolby AC-3 sound while European discs will have MPEG-2 Surround sound. Thus European DVD users will

Sony's digital camcorder Model DCR-VX700, which is expected to be available in Europe this November.

not be able to import titles from the USA in the way that they can with with the Laser Disc, Video CD and VHS.

According to the SD Alliance DVD players will include systems to prevent digital-to-digital and digital-to-analogue copying, while consumer players will not be able to handle recordable or rewritable discs.

Thomson announced plans to launch an SD player in mid-1996. Toshiba, Thomson and Hitachi displayed prototype players while Pioneer had a prototype that also plays Laser Discs. The SD alliance expects some twenty million players to be sold by the year 2000. This will depend on whether consumers are prepared to fork out for a video disc system that cannot record, even if it does offer broadcast quality pictures. Interestingly, the SD alliance believes that its system will have a marginal effect on the VCR market.

During the course of the show the MMDS and SD groups announced agreement to a common standard.

Multimedia Developments

The Nokia DVB9500S Multimedia Terminal is an add-on box designed to send data to or receive it from a variety of digital sources. These include digital TV broadcasts, PCs, printers, games consoles, digital radio, digital video discs and players. It can link up to a telephone line for access to computer networks like the Internet.

The DVB9500S incorporates some clever technology. It can for example adapt automatically to different satellite bandwidths (from 2-54MHz). Its video decoder can handle data rates from 1·5 to 15Mbits/sec, i.e. MPEG-1 and -2. It also caters for the 4:3 and 16:9 formats and pictures that are not full sized, e.g. Photo CD. Other CD formats that are compatible with it include CD audio, CD-ROM-XA and Video CD.

The electronics include a Motorola 68340 processor that runs at 16MHz, 1·5Mbyte of RAM and 1Mbyte of flash memory. The system hardware is stored in the flash memory instead of being held in RAM or ROM. This means that it can be updated by downloading from a cable or satellite source. This helps to ensure that the terminal is future-proof.

TV connections include scart with RGB, composite video and audio options while the VCR connection is via another scart with composite video. There is also a decoder scart socket with RGB and composite video connections. Two phono sockets offer left and right audio connections. Other connectors include an RS232 data interface, a high-speed SCSI-2 port and a telephone socket. There's a VCR control interface and slots for smart cards, used by conditional access systems, are provided. The multitude of connections would enable someone to watch a digital TV broadcast while, for example, downloading into a PC extra programme data.

Nokia wants the DVB9500S to become the European standard for multimedia terminals and has already signed an agreement to supply a million terminals by next spring to the German service provider BetaTechnik. They will be used by BetaTechnik to offer new digital services. A taste of these was presented at Berlin. Viewers could for example select the camera angle during a Grand Prix race or even the driver to follow. Another idea is near-video-on-demand, which makes the same film available on a number of channels at different start times.

Nokia demonstrated the DVB9500S's electronic programme guide, an on-screen menu system that will make it much easier to select channels from the hundreds that digital TV is likely to bring.

Philips showed a number of interesting CDi developments. Philips Media has formed CD-Online, an Internet service provider, and has launched a starter pack which will enable a CDi player equipped with a digital video cartridge to explore the Internet via a TV set. The £99 pack consists of a 14,400 modem that plugs into any CDi player and a CD-Online disc that contains the software required to get into the Internet. Users can also send and receive electronic mail, though typing involves letter selection from a virtual keyboard displayed on the screen. Philips intends to introduce a small plug-in keyboard. Also on show were the 21TCD130, a combined 21in. TV set and CDi player; the CD-470 mid-sized player; the FW380i CDi/mini hi-fi system; and a PC CDi card that enables CDi discs to be played on a CD-ROM drive. The card includes MPEG-1 playback.

GoldStar was showing a portable CDi player, Model GPI1200, which includes a 4in. LCD screen.

Despite the interest in high-density CDs, several companies were demonstrating Video CD players. Panasonic had three: the SLVP50 portable; the SCVC1180 mini hi-fi; and the SLVM500 five-disc changer. Samsung's range of Video CD machines included the CDT2500 TV, DVC650 Video CD player, DVK350 LCD/Video CD portable, and several Video CD audio systems. The Samsung Multi-CD player connects with a TV set and plays CD audio, CD+G, Video CD, CD-ROM, Photo CD and CDi movie discs!

Panasonic and GoldStar had 3DO players on show. The new generation of 32-bit computer games systems were represented by Sony's PlayStation and Sega's Saturn.

Finally, to demonstrate that the computer and consumer electronics worlds are converging, Philips showed the 29PX8001, a 29in. TV set that can also display VGA computer graphics. Hitachi had a similar product called PC Vision. Panasonic's Woody PD, Model CF32GP, is a multimedia PC with a built-in tuner and fax/modem. It incorporates a 15in. monitor, a 486DX4 processor, 8Mbytes of RAM and a 540Mbyte hard disc and sound card. It also offers PD drive, which can play CD-ROM and Video CD discs and rewritable PD optical discs. The CF32GP is already on sale in Japan and could reach Europe next year.

Next Month in TELEVISION

SERVICING THE PHILIPS G110 CHASSIS

The G110 chassis was used in many Philips models released during the period 1989-91. It was one of the first to make extensive use of surface-mounted components. There are a number of them in the power supply, and because of this these sets are not looked upon favourably in the servicing trade. Problems should not arise however if you follow the advice given in Richard Newman's coverage of the chassis. A look is also taken at the projection version.

THE DIGITAL CAMCORDER FORMAT

The consumer electronics industry is about to offer us a new wonder, the digital camcorder. Agreement on a domestic standard for recording video digitally on tape was reached in early 1994. Now the hardware is about to appear. George Cole describes the basic features of the system.

MTI LNB TROUBLES

MTI LNBs provide above-average performance and have therefore been quite widely used. They can however give trouble, mainly in the local oscillator section. Hugh Cocks explains how to check and repair these units, also how to upgrade them for Astra 1D reception.

BLACK AND WHITE DAYS

As Christmas approaches you'll want to settle down for a good read. Amongst the seasonal offerings next month is Malcolm Scott's evocation of the servicing world in the early Seventies.

VCR SIGNAL PROCESSING

In Part 2 of his new series Joe Cieszynski will start to investigate the luminance signal processing aspects of VCR operation.

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What a Life!

Donald Bullock

It's over twenty years since I was last in the United States, in Connecticut to be more precise. One day I wandered from my favourite bar – the one where every fourth drink was free – and into Fran's Radio and TV shop on Main Street, Southington. He was a Zenith dealer – "Selling the Best, Servicing the Rest" was his motto. I was given a great welcome and wonder how Fran is fareing today. Coming across his card in some old papers reminded me of the visit.

Apart from the genuine friendliness and helpfulness of the folk there, from the television point of view I remember that visit for two reasons. First, the awful quality of the colour reception – I watched a cow in a field turn from brown to purple to red all within a minute. And secondly the equally awful programmes. There seemed to be little of a cultural nature, and there was no way of escaping the advertisements. These occurred constantly during sponsored programmes.

A Bang and Olufsen 7733

I could see that Mr Thesp was an oddball as soon as I caught sight of him trotting towards the shop carrying a B and O 7733.

"You'll be Mr Bullock" he bawled, "I know all about you."

"Good God" I said, "let's talk about your set."

"Keeps cutting out. And when it does work the colour keeps disappearing."

When he'd departed I pulled his set on to the bench. The mains lead was only about a foot long, so to work on the set I'd no choice but to replace it. Getting the back off wasn't easy, and when I did it fell on to my foot, half crippling me.

The chroma panel nestled in the centre left of the chassis. It was full of dry-joints. I reached for the soldering iron and Steven's reel of romantic solder. This led to a double achievement: I cured the intermittent colour fault, and made the workshop smell like a Casablanca ladies' powder room. At this point Phyllis Puke came in carrying an Hitachi VT150E VCR.

"Good heavens!" she sniffed, "that smell won't get into my machine, will it?" I filled in one of Steven's job cards, then waved her out and returned to the B and O.

The second fault was that the vision would disappear, leaving a snowy raster. But the sound remained! At this point I almost felt like searching for the manual, but decided not to because I can't read B and O circuit diagrams. Nor Philips ones, come to that. Instead, I tapped about on the signal panels and found that this produced and cleared the fault. There were a number of dry-joints, which I resoldered, in the area. But this didn't cure the fault. I eventually found, on the control panel, a 1kΩ potentiometer with a wiper that made intermittent contact with the track. A new one put matters right. It was R33. Next time I'm feeling really spry I'll look out the circuit diagram and try to find out what it does.

Phyllis's Hitachi VT150E

Then I picked up Phyllis's VCR, when smelt like Phyllis. It was dead and kept blowing the 2·5A power fuse F851. The last time I had this the cause had been capstan motor failure. So I sniffed around the one in this machine. It smelt all right, but it was very stiff to turn. When I'd cleaned and lubricated the motor the machine still blew the fuse. I found that the M54648L-D motor driver chip IC602 was the cause of the trouble. It had probably died trying to drive the tight armature.

Bud's Decca

Bud Blowfly came in next. He's an inveterate hoarder who buys strange things for which he has no need. Then he spends money on them before finally storing them away. He boasts that if he keeps this up long enough his wife will divorce him. This time he'd got a Decca DV1259 with him.

"Cost me twenty five quid" he said, "but the colour, brightness and volume controls only work sometimes."

Because I like old Bud, I took a look at his set while he produced clouds of St Bruno from his pipe. There were some dry-joints at plug/sockets MR11 and MR12 on board 306A, to the left of the chassis. As I soldered them Bud skipped about, coughing.

"Where's that poncy smell coming from?" he enquired, looking under the bench and into the corners of the room.

A Ferguson 3V55

Cuthbert Wirewound came in next, with a Ferguson 3V55. "It just died on me" he announced.

When he'd loped off I opened the machine and looked towards the power pack. Fuse 1 (315mA) was open-circuit. As we've had some awful thunder storms recently I fitted another fuse and started the machine up, gingerly, via the variac. The fuse stayed intact, but no current was drawn. Then I noticed a plasticy smell, mixed with the smell of the solder flux, Phyllis and the St Bruno. The mains transformer was cooking.

The clock lit up when a replacement was fitted, but there were no functions and the machine wouldn't accept a cassette. So I took a look at the main board where I found that C605 was short-circuit. After replacing this the machine powered up but the E-E picture was poor. A tap on the tuner PCB brought it up to full strength. One of the joints was starved of solder.

Gladys's Fergie

My last visitor that day was Gladys Winegum. "Me little Fergie has turned into a tiny line" she complained.

"Sorry to hear that" I replied. "This might be a silly thing to say, but, er, have you got it with you?"

"It's in the car" she said.

When I'd brought it in I found that it was a TX100 with field collapse. As the 12V line was low I disconnected it and checked the regulator, IC8. It was o.k. Then I took out the TDA3652 field output chip, which doesn't seem to be available any longer. So I fitted a TDA3654, making sure that pin 7 was left disconnected, and changed R96 to 3·3kΩ. When I switched on again there was a full frame and an excellent picture.

My Own Problem

Finally to my own problem. It took me three attempts to produce this article. I lost the first two about half way through, by selecting the 'save and continue' option in order to save what I'd written while I slipped into the house for a cup of tea. Each time when I returned the screen said "disc format not recognised". When I selected 'retry operation' or 'ignore error and continue' I lost the output of the disc, which then refused to reload.

I'm not yet sure what's gone wrong. This third attempt is being written on another machine, a PCW9512, with a different set of discs. If any Amstrad word processor buffs are reading this and could throw any light on these happenings, I'd like to hear from them – write in via the magazine. The machine that gave me the trouble is a PCW8512, and at present I don't know whether it's the discs, the disc drive or a problem with the memory board.

I've been wondering lately whether to upgrade to another word-processing system, but I'm not sure of my way around the jungle out there. In addition it took me about three years to get the hang of Locoscript, though I think a great deal of the trouble here was with the presentation of the original manual.

Letters

MONITOR REPAIRS

As a former TV engineer currently working for a major monitor refurbishment company I'd like to appeal for coverage of monitors in your columns. There are plenty of PC glossy magazines that can tell you everything about price, availability and delivery of particular display products, but nothing about how the circuitry works and certainly not on how to fix it! This is where *Television* could help.

The need for monitor circuit analysis has never been greater: today's computer apprentices/trainees receive next to no instruction on how analogue circuitry operates, the emphasis being placed on digital electronics. And there seem to be no regular fault reports on monitors anywhere.

Many business PCs have now been passed on for domestic use, where they replace typewriters and games machines. As a result, the number of faulty monitors being taken to small repair shops is increasing significantly. Hence the need for fault information. There is also a need for documented fault reports in a firm like mine, with a warehouse full of processor-driven SVGA multi-mode monitors.

I hope you will be able to give us some help!
Donald M. Henry,
Kirkcudbright.

Editorial note: We'd be happy to expand into this field and are already aware that our readers are increasingly being asked to repair faulty monitors. But to get going we depend on fault feedback. We'd like to hear from any readers with experience in this field.

HI-FI COMPATIBILITY ETC

I'd like to add by views to the comments on hi-fi compatibility and Macrovision protection in previous letters.

The burbling noise problem experienced with these tapes is related to the inherent weakness in using depth multiplexing to record hi-fi sound on a VHS cassette – the low signal-to-noise ratio, which will always be at least 12dB less than with the corresponding video signal. This is the reason why hi-fi recorded tapes provide a much more critical way of assessing a machine's performance. If the head azimuth is even slightly off, almost any machine will produce these noises. The same goes for tracking errors and head wear. I have measured the noise figures with my own machine during each yearly service, and can see the noise level increase year by year as the heads wear.

To my mind the main cause of the trouble is incorrect head azimuth setting at the copy houses, in conjunction with the same errors with domestic machines. I know that the copy houses take a lot of care over their machines, but it's impossible to believe that all their recorders can be perfectly set up all the time. This is borne out by checking machines that have partly worn heads and are noisy with even their own recordings. What I do with such a machine is to adjust the head azimuth for minimum noise (headphones are brilliant for this!) using a reference tape. I then do the same while playing back a prerecorded cassette. When I've done this in the past there have been differences in the azimuth settings on more than one occasion.

As Steve Beeching says (September), there are no problems with these noises until the time when the signal level is at or below the threshold level. The point here is that with incorrect azimuth setting there will, even with spot-on tape tracking, be reduced signal (hi-fi or video) at the two ends

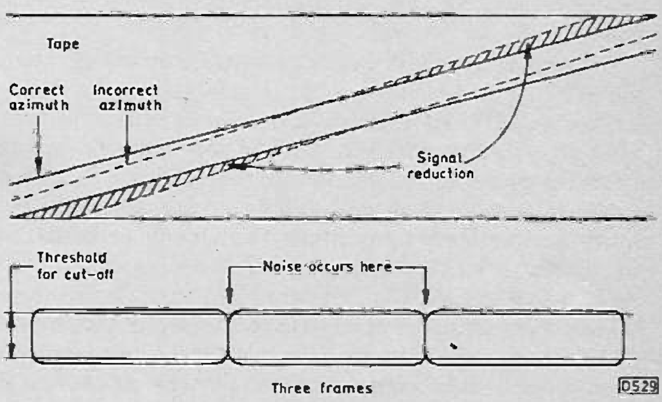

Fig. 1: Signal reduction caused by azimuth errors.

of the track – see Fig. 1. This can in some cases cause those burbling noises. The problem is made worse by the lower signal level to start off with and the ear's ability to pick out transients.

There are many other possible causes of this problem (recorded video level too high, incorrect head switching points, hi-fi level too low, etc.), but VCRs are mechanical devices and most of the problems associated with them are mechanical in origin.

Incidentally the reason why my own VCR (a Ferguson FV57H) has increased noise levels is increased susceptibility to dropouts as the head wears. The point has been reached where even its own recordings burble sometimes. I think it's time to buy and fit a new head!
Tony Fitzpatrick, Service Director,
Television Services, London NW5.

CORRECTION

My attention has been drawn to an error in one of my VCR Clinic fault reports – in the August issue (page 727). There is no 47µF chopper base coupling capacitor in the Grundig VS510. The cause of the symptoms described is the chopper chip's 47µF supply smoothing capacitor C1326. I was confusing this model with the later VS540 which does have a chopper base coupling capacitor (C420, 100µF) that causes the dead machine symptom when it fails. My apologies to all concerned.

In reply to R.J. Goodman's letter (October), I can't think of any transmission signal that could cause the fault he mentions (a 'purring' sound with some types of tape). According to Sony – the machine was an SLV777 – the cause of the problem is wear in the upper drum. Presumably the tapes that cause the trouble provide a slightly lower output than other types. Low output would certainly cause crackling.

David Belmont,
Wembley, Middx.

A REMOTE CONTROL PROBLEM

A customer complained that the sound volume produced by his GEC C2004 TV set would intermittently increase to maximum. In the workshop however the set behaved itself no matter how much tapping, freezing or heating I inflicted on it. So the set and the remote control unit were returned.

I switched on and, while I was chatting to the customer, the volume suddenly increased to maximum. But operation of the handset had no effect – the sound still blared out. I then noticed at the side of the channel display the flickering dot that told me a remote command was being received. From where?

On my way to the set's on/off switch I knocked against a coffee table on which a couple of remotes for the VCR, satellite receiver etc. had been left, and noticed that the set's indicator stopped flashing. One of the remotes was a universal type. It was intended for use with the VCR, but according to the customer it was "never any good". It was, in fact, intermittently transmitting a volume-up command to the TV set. After taking it apart and removing gunge from the PCB it at last worked only when told to do so. Needless to say it had been programmed for the TV set, not the VCR!

After reprogramming his VCR handset the customer was pleased that he could now control it remotely while the TV set's sound remained stable. But he took a very dim view that a no-charge delivery had turned into a chargeable repair. You just can't win.

John Edwards,
Welling, Kent.

ELECTROLYTIC CAPACITORS

I cannot agree with much of what Martin Pickering has to say on the subject of electrolytic capacitors in his article on Designing for Reliability (September). For many years I was in charge of electrolytic capacitor development at the Dubilier company, so I feel well qualified to comment on the subject.

Martin Pickering stated that to prevent loss of capacitance aluminium electrolytics are best operated at close to their rated voltage. This is quite untrue. Any derating of the operating voltage will considerably increase the working life, just as reducing the working temperature will generally extend it.

In the Fifties and early Sixties we carried out many life test trials on Japanese electrolytics. We usually found that when they were operated under their rated conditions they failed within a week. At this time it was normal for UK and European electrolytics to last for between six and ten thousand hours when operated at their rated values. As a result, the Japanese were forced to derate their components in order to get equipment out of the factories. They then found that the reliability of their derated components exceeded that of their European competitors.

Many of us in the industry at that time had tried to persuade set manufacturers to at least partially derate in order to improve the reliability of their products and reduce servicing costs. As Martin Pickering will recall, in those days the average TV set was operated at such high temperatures that we used to say you could fry an egg on them! Until the Japanese latched on to the concept of reliability, our entreaties fell on deaf ears – any component derating might increase the cost of a set by a few more pence.

We carried out many tests on derating during this period, and in all cases operation at lower voltages increased the working life. At that time there was a theory that derating the working voltage would result in an increase in the capacitance of electrolytics, but our tests proved that the tendency for the capacitance to increase was reduced as the original anodisation voltage was increased. We ran some of these tests as low as 0·5V d.c.: only the 6-12V types showed any significant capacitance increase. The 500V capacitors were extremely stable. Only when a ripple current was applied did we find that there was an improvement in working life, which increased initially as the ripple current was increased. The reason for this improvement was related to the rule that the capacitor should not be operated under conditions where the peak of the applied ripple, plus the d.c. bias, exceeds the capacitor's nominal rated voltage. Thus the average applied voltage amounted to a derating. As the ripple current was progressively increased, a point would be reached where the increased working temperature caused by the ambient conditions combined with the ripple power dissipation would counter the beneficial effect of reduced average voltage. From this point on the working life of the capacitor would begin to fall.

When a capacitor is left on the shelf for a long time the leakage current shows a progressive rise. This calls for an applied d.c. voltage to reform the barrier layer. This is why the application of the rated voltage for a short period can return the capacitor to its original low leakage current condition. This may not be effective with a poor quality device: the leakage current may remain high and, with a high-voltage capacitor, the result may be a runaway temperature rise. Poor shelf life is usually the result of contamination, either in the electrolyte or the aluminium electrodes.

R.J. Everitt,
Epsom, Surrey.

LIGHT BULB TIP

I wonder why the humble domestic lamp bulb is so little appreciated as a means of protecting faulty equipment? An incandescent bulb has a low resistance when cold and a high resistance when hot. A suitable-wattage bulb connected in series with the a.c. supply will stop those 'blinding flashes' and avoid the need to replace all those fuses, diodes and chopper transistors. When there's a short the lamp will light and its increased resistance will protect the circuit under test.

An immediate TV receiver degaussing circuit check is provided by the lamp lighting to full brilliance at switch on, then dying to less than half brightness as the posistor heats up.

H. Keighley,
Riddlesden, West Yorks.

22kHz Tone Switching for Pace PRD Series Satellite Receivers

John Woolman

It's some three years since the Pace PRD series satellite receivers and their clones were first introduced. They give good service apart from the occasional power supply problem.

Some of the design features are not used in Astra only models. An option that's not included and was not really thought about was the provision of a 22kHz switching signal on the LNB's supply.

Now, as Universal LNBs are becoming available, there's a growing demand for 22kHz tone switching. Universal LNBs have two local oscillators, which run at 9·75 and 10·6GHz. Local oscillator selection is controlled by the 22kHz tone. The result is a tuning range of 10·7-12·75GHz (Astra 1A-G) when used with a 2GHz bandwidth tuner. It seemed worthwhile to see whether these Pace receivers could be adapted to operate with 22kHz switching. The result is the circuit shown in Fig. 1.

The microcontroller chip U2 in the receiver has various options that are not used in standard receivers. These options can be obtained by fitting resistors R550-R556. When R555 (4·7kΩ) is fitted, U2 thinks it has control of a dual-bandwidth tuner. Pin 26 of U2 drives pin 3 of the buffer chip U3, whose output at pin 14 controls pin 14 of the tuner. As the vast majority of receivers are not fitted with a dual-bandwidth tuner, this option can be used to control the 22kHz tone.

H/V switching in the receiver is carried out by adjusting Q2's base bias. The control line comes from pin 28 of U2, via pin 1 then pin 16 of U3. Q2 will not be used when the modification described below is carried out.

New LNB Power Supply Circuit

The circuit shown in Fig. 1 takes as the source of power for the LNB the H supply produced by the rectifier circuit D15/C23 in the receiver. This is at approximately 20V. It's fed via IC1, which is switched for H/V polarisation and adds the 22kHz tone, then L3 (in the receiver) to the LNB(s).

The LNB supply from IC1 must be fed back into the receiver. This can be done by desoldering the leg of L3 at the junction of D17/Q2 and connecting it instead to the output from IC1.

Setting up and using the new arrangement is very easy. You will have gained an extra feature in the tuning menu – option 4, 'i.f. bandwidth'. In the normal setting pin 14 of U3 is low, and the 555 timer chip IC2 in the new circuit is off. When the selection is changed to 'narrow', pin 14 of U3 (with the pull-up resistor R511 fitted) goes high, turning on IC2 which runs at 22kHz. Its output is fed to the base of Tr1 in IC1's adjustment circuit.

The LM317 chip IC1 is a standard variable regulator whose output depends on the voltage at its adjustment pin. This is set by the resistor network R1-4. With Tr2 and Tr3 both off, the output from IC1 is 17V.

If Tr2 is switched on (via Tr3) the resistor network consists of R1, R2 and R4. IC1 then gives the vertical polarisation output (13V).

When Tr1 is driven by the 22kHz output from IC2 the voltage across R4 is varied. As a result the output from IC1 will be modulated at 22kHz – the variation is about 600mV peak-to-peak.

Before you carry out this modification it's as well to check the receiver's software by fitting R511 and R555 and then checking the menus and the functions of pins 1 and 14 of U3.

The circuit can be laid out on Veroboard and fixed to the top of the modulator can by the two mounting holes shown in Fig. 2.

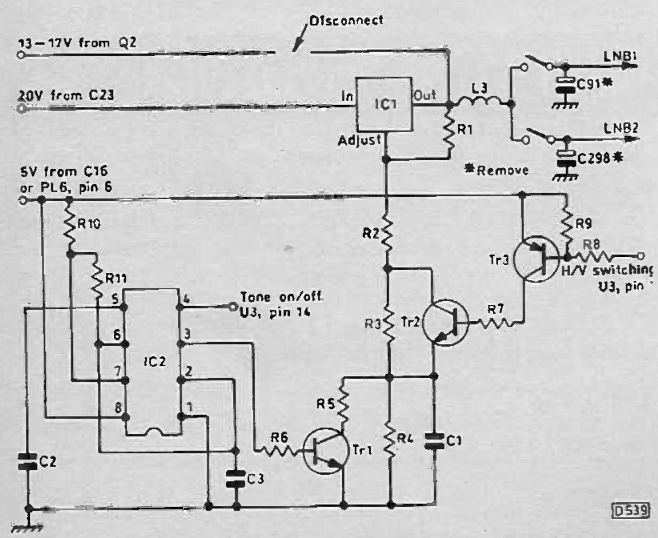

Fig. 1: Circuit diagram of the Universal LNB power supply for Pace PRD series receivers.

Use

When using a Universal LNB with receivers that have only the 10GHz FSS band on-screen display, the frequency conversion is as follows:

No 22kHz tone: LNB oscillator at 9·75GHz, i.e. 250MHz lower. Tuning ranges are 950-2,100MHz i.f., 10·7-11·8GHz r.f. So when tuning to a station, add 250MHz to the tuning frequency, i.e. for CMT at 11·567GHz dial in 11·817GHz.

Tone on: LNB oscillator at 10·6GHz, i.e. 600MHz higher. Tuning ranges are 950-2,100MHz i.f., as before, and 11·55-12·7GHz r.f. When tuning to a station subtract 600MHz from the tuning frequency, i.e. for CMT at 11·567GHz dial in 10·967GHz.

COMPONENT DETAILS

IC1	LM317 regulator chip with heatsink
IC2	555 timer chip

Q1	BC547	C1	10nF, 25V
Q2	BC547	C2	10nF, 25V
Q3	BC557	C3	1nF, 1%, 25V
R1	220, 1%	R7	4·7kΩ, 5%
R2	1·4kΩ, 1%	R8	10kΩ, 5%
R3	910Ω, 1%	R9	4·7kΩ, 5%
R4	560Ω, 1%	R10	1kΩ, 5%
R5	2·2kΩ, 5%	R11	33kΩ, 1%
R6	10kΩ, 5%		

All 0·25W. R1-4 and R11 can be selected or made up.

Add 4·7kΩ surface-mounted resistors R511 and R555 in the receiver, the former at pin 14 of U3, the latter at pin 18 of U2. Also remove C91 and C298 (both 100μF) which decouple the LNB supplies.

A piece of 0·1in. Veroboard with 14 strips 23 holes long can be used for the new circuit.

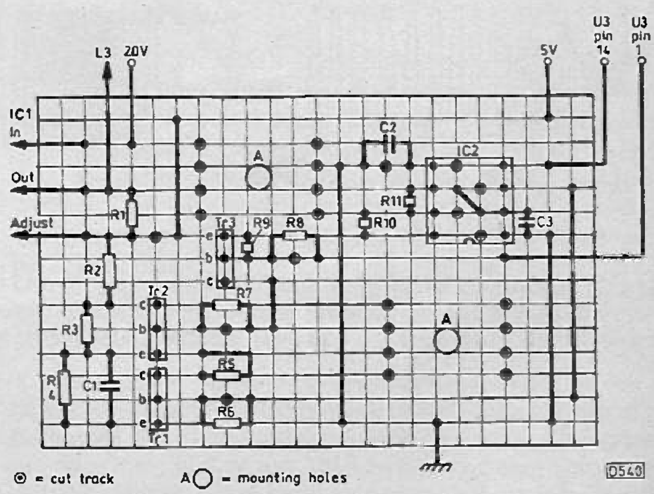

Fig. 2: Layout of the circuit on Veroboard.

VCR Signal Processing

Part 1

Joe Cieszynski

In this series we shall be taking a detailed look at the signal processing carried out in domestic VCRs. Many engineers are familiar with such terms as 'dark and white clip' and 'carrier balance'. Often however the familiarity has come from making these adjustments: what we aim to do in this series is to establish why such things are necessary and explain what the circuitry involved actually does. Where possible we shall mention fault symptoms relating to specific circuits and explain why the symptom appears in the way it does.

We will deal mainly with the standard VHS format, since this remains the most widely used one. Comparisons with the other current domestic VCR formats, S-VHS and 8mm, will be included where relevant.

To start off we'll consider magnetic tape recording basics and frequency modulation, as these determine the reasons for much of the signal processing circuitry used in a VCR.

Magnetic Tape Recording

The principles of magnetic recording on tape have been established for a long time. Video signal recording on tape was being carried out as far back as 1958, using equipment such as the BBC's VERA (Vision Electronic Recording Apparatus). This machine recorded the signal on 0·5in. magnetic tape, the all-important head-to-tape speed being 200in./sec. With 1,500ft of tape per reel, each one had a playing time of 15 minutes.

The working life of this machine was extremely short. Six months after its introduction it was upstaged by the far superior Ampex VR1000A, which offered such features as long play (one hour!). The BBC was so impressed with this format that by 1961 it had invested in the portable version, which came complete with a three-ton chassis on which to move it! Note that these machines recorded in monochrome only, and were designed for use with the 405-line system.

Such equipment forms a strange comparison with today's domestic VCRs, yet it's a fact that many of the techniques adopted all those years back are still in use. Perhaps the two most fundamental are the rotating video head drum and the use of f.m. to record the luminance signal. VERA used f.m., though not for the full bandwidth recorded. The Ampex VR1000A used f.m. and a four-head drum that scanned the tape transversely, from the top to the bottom edge, so that the tape speed could be reduced while still having a high tape-to-head speed. Meanwhile helical tape scanning with a two-head drum was being developed by Toshiba in Japan: a colour capable machine was first demonstrated in 1962.

Helical scanning is now the norm for all video tape equipment. As with transverse scanning, it is used to provide a high tape-to-head speed with a manageable basic tape speed. Why is tape speed so important? With any magnetic tape recording system the upper cut-off frequency, which is known as the extinction frequency (*F*ext), depends on two factors: the width of the record/playback head gap, and the speed of the tape past the head. In a modern VCR the width of the head gap is typically 0·2-0·3μm. This means that, even with a tape speed of 30cm/sec, the maximum frequency that could be recorded on and recovered from the tape would be about 1·5MHz, which is far short of the 5·5MHz bandwidth signal transmitted with the UK terrestrial TV system I.

It was clear to the early developers of video tape recording that a high tape speed was not a practical solution to the problem. The answer was obvious: if the tape can't be moved at sufficient speed, move the head as well. Hence the rotating head drum. With the basic VHS system, the tape-to-head speed is in the order of 4·8m/sec.

Frequency modulation was adopted for luminance signal recording to overcome two problems. The first was constant signal variations caused by irregulatities in the thickness of the tape's oxide coating. Back in the late Fifties someone

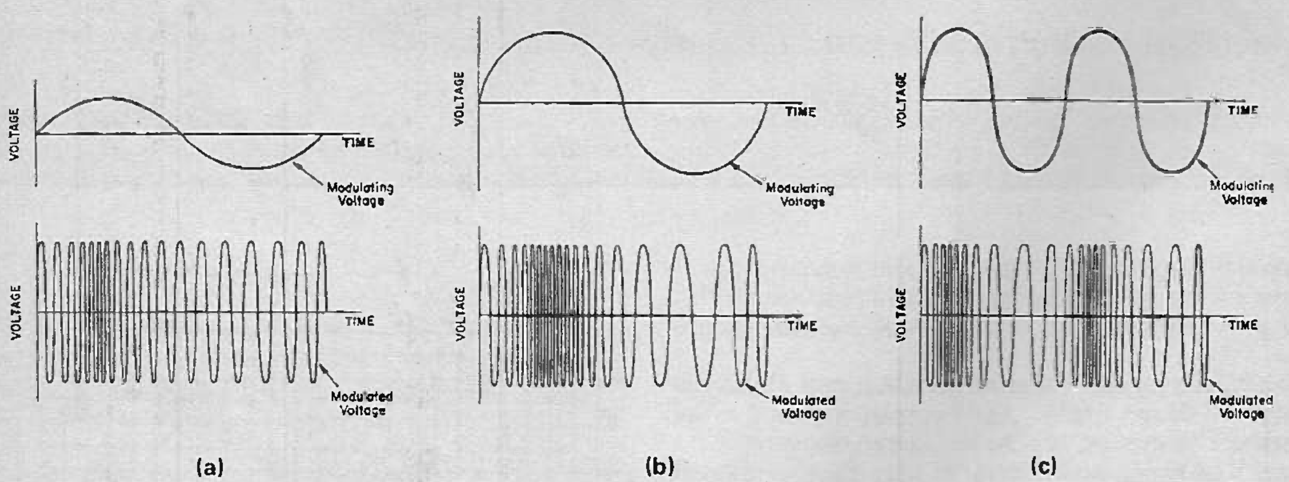

Fig. 1: The effects of different modulating signals on an f.m. carrier. The modulating signal frequency is the same in (a) and (b), but the modulating signal amplitude is greater in (b). In (c) the modulating signal amplitude is the same as in (b) but the frequency has been doubled. The result is an increase in the rate of deviation.

was given the task of developing an a.g.c. system that could compensate for these variations with an analogue, luminance signal waveform. After three years he came up with an answer: forget the idea of recording baseband luminance signals, use an f.m. carrier instead.

The second problem was that of the bandwidth required. Because of basic physical laws, a magnetic recording system can have a bandwidth of only ten octaves, i.e. ten times a doubling of frequency. An alteration to the tape speed or head gap will move *F*ext, but the lower cut-off frequency will move as well and the octave bandwidth will remain ten.

A bandwidth of 25Hz-3·277MHz is 17 octaves, which cannot be handled. If however we use the video signal to modulate the frequency of an h.f. carrier, the octave range is greatly reduced.

Frequency Modulation

We'll start with the basic principles. With frequency modulation (f.m.), the *frequency* of the modulating signal (video in this case) governs the *rate of deviation* of the carrier, while the *amplitude* of the modulating signal governs the *amount of deviation* of the carrier. This is illustrated in Fig. 1.

When described in this way, f.m. doesn't seem to be very

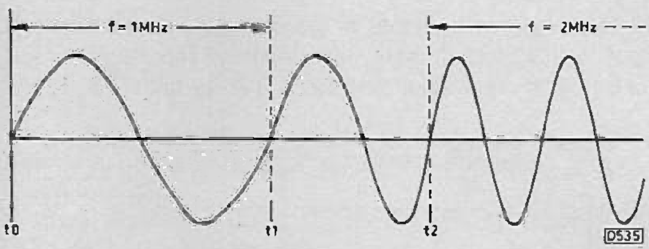

Fig. 2: Between time t0 and t1 the carrier frequency is 1MHz. At time t1 it is asked to rise instantly to 2MHz. As this is impossible, what happens is that a number of frequencies between 1-2MHz are generated between times t1 and t2, when the carrier frequency becomes 2MHz.

complicated. In practice however nothing could be farther from the truth. When a carrier at a certain frequency is deviated, an infinite number of sinusoidal frequency components (sidebands) is produced. The f.m. process can be analysed mathematically. This would produce expressions that would fill a quarter of one of these pages. We've no intention of looking at f.m. from the mathematical point of view, but it's worth mentioning this point in order to highlight the complexity of the process.

First, let's see why f.m. results in a theoretically infinite number of sidebands. Fig. 2 shows a 1MHz sinewave whose frequency is increased to 2MHz. The period of interest is the time between t1 and t2, when the carrier is in the process of being deviated. During this period, the sinewave is never at the same frequency for more than an instant. Thus a range of frequencies between 1MHz and 2MHz, the sidebands, is being generated. This is still a finite number of sidebands however.

The infinite number of sidebands is best explained by considering the shape of the waveform between times t1 and t2. Because the signal frequency is increasing continuously, at no time is its waveform sinusoidal. In other words, it's a distorted sinewave.

How is a sinewave distorted? By adding harmonics, i.e. multiples of the fundamental frequency, to it. In theory there could be an infinite number of harmonics added while the 1MHz signal is being deviated to 2MHz. Hence the possibly infinite number of sidebands with an f.m. system.

If we return for a moment to the mathematical way of looking at this, when values for the carrier frequency, its deviation and the modulating frequency are specified the

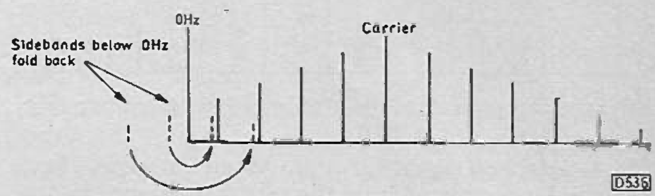

Fig. 3: A frequency-modulated carrier with sidebands that extend below 0MHz. As this is impossible, the sideband energy folds back, reappearing above 0Hz. The result is distortion of the demodulated signal.

frequency of each and every sideband can be worked out. This exercise would prove that the sidebands extend infinitely in each direction. You may wonder how the lower sidebands can extend to infinity when it's clearly impossible to have a frequency below 0Hz (d.c.): in fact however once the lower sidebands reach 0Hz they begin to 'fold back', taking up positions above 0Hz in the frequency spectrum. Fig. 3 is an attempt to illustrate this. The point is not purely theoretical: this can actually occur with f.m., and system designers have to take steps to avoid it happening.

The avoidance of lower sideband foldback is fortunately not as difficult as it might at first seem. Further analysis reveals that though the number of sidebands is potentially infinite, the energy in all but the first few sideband pairs closest to the carrier is so small that they would be almost impossible to detect, even with sensitive measuring equipment. Such equipment is not used in a radio or TV receiver or a VCR to detect the sidebands. All that's used is a simple discriminator or a pulse-counting circuit. So the problem does not arise.

To summarise the points so far: a frequency-modulated carrier is a complex signal with a theoretically infinite number of sidebands, but only a small number of the sidebands have significant strength. Thus the bandwidth is determinable. What determines the number of significant sidebands?

Sideband Power

Although f.m. didn't come into wide use for broadcasting until after World War II, much of its development took place before and during that war. Early experiments established that sideband components with a value of less than one per cent of the carrier can be ignored. The bandwidth of an f.m. signal thus came to be taken as that between the two outer sidebands with amplitudes of one per cent of the carrier.

An unmodulated carrier contains a certain amount of power. When the carrier is deviated in an f.m. system, some of this power is transferred to create the sidebands. The number of sidebands and the power in each of them depends on two things: the amount of deviation, and the frequency of the deviation. Thus the point at which the sideband power falls below one per cent of the carrier power depends on these two factors. Put simply, the bandwidth of an f.m. signal depends on the amount and frequency of its deviation.

A table known as the table of Bessel functions gives us, for any given carrier deviation and modulating frequency, the number of significant sidebands in an f.m. system.

The sidebands are separated by multiples of the modulating frequency. If, for example, a signal has ten pairs of

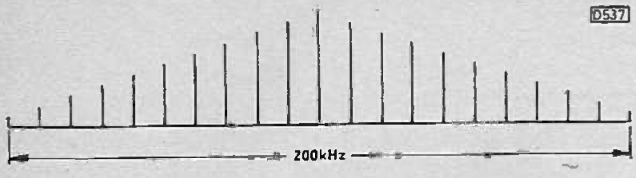

Fig. 4: Sideband signal spectrum for an f.m. signal. Each sideband is separated from the carrier frequency by the modulating signal frequency, which in this example is 10kHz. The number of significant sideband pairs can be found from the Bessel functions table.

significant sidebands (twenty sidebands in all) and the modulating frequency is 10kHz, the system bandwidth is 20 x 10kHz = 200kHz (see Fig. 4).

To use the table of Bessel functions, the ratio of the deviation to the modulating frequency has first to be calculated. This is given by the modulation index (M). The formula is:

M = carrier deviation/modulating frequency.

For example, with v.h.f. radio transmissions in the UK the maximum deviation is ±75kHz and the maximum modulating frequency 15kHz. Thus the modulation index is 75/15kHz = 5. Reference to the table of Bessel functions shows that with a modulation index of five there are sixteen significant sideband pairs. As the sidebands are separated by 15kHz, the bandwidth is 15kHz x 16 = 240kHz.

Further consideration of the f.m. technique reveals that the higher the modulation index, the better the signal-to-noise ratio. To explain this in simple terms, when the modulation index is increased more power is moved from the carrier to the sidebands, which are what we recover at the demodulator. A purist would say that to achieve a good signal-to-noise ratio the modulation index should be at least ten. This would result in a bandwidth far in excess of 240kHz however. It was therefore necessary to arrive at a compromise between spectrum space allocation and signal-to-noise ratio. You now know why v.h.f. radio is prone to a degree of h.f. hiss.

To summarise again, an f.m. signal consists of a carrier and a number of sideband pairs which are separated from the carrier by a frequency that's the same as the frequency of the modulating signal. The number of significant pairs is determined by the modulation index, which is a function of carrier deviation and modulating frequency. The higher the modulation index, the better the signal-to-noise ratio but the wider the bandwidth.

VCR FM Principles

The carrier frequency used by an f.m. system should ideally be at least ten times higher than the maximum modulating frequency. Thus with a TV luminance bandwidth of 0-5·5MHz, the ideal carrier frequency would be around 55MHz. This is impossible with today's magnetic recording technology.

The video tapes available when the VHS and Betamax systems were being developed in the late Seventies were unable to retain frequencies much higher than 6MHz – the magnetic coating was such that higher frequencies became self-demagnetised soon after being recorded. Because of this, the f.m. carrier frequency had to be kept quite low if space was to be available for carrier deviation and the recording of upper sidebands.

A low carrier frequency leaves little space for the lower sidebands however. This introduces the possibility of 'negative frequency' sidebands folding back into the required frequency spectrum. The way to avoid this is to greatly reduce the number of significant sidebands, i.e. use a low modulation index.

If frequency modulation with an audio signal is compared to that with a luminance signal however a major difference becomes apparent. Because an audio signal is by nature a.c., the carrier is deviated above and below its nominal frequency to represent the two halves of the audio waveform. A luminance signal on the other hand is unidirectional, sitting on a d.c. level. Thus when it's used to frequency modulate a carrier the deviation is in only one direction. This factor can be exploited to reduce the modulation index.

Further reduction can be achieved only by restricting both the permitted deviation and the luminance signal bandwidth. Taking all these factors into consideration, the developers of the VHS system settled on an f.m. carrier frequency of 3·8MHz, a maximum deviation of 1MHz and a luminance signal bandwidth of 2·8MHz (generally taken as 3MHz). The result is a modulation index of 1/3MHz = 0·3.

Reference to the table of Bessel functions tells us that with a modulation index of around 0·3 there will be just one pair of significant sidebands. Taking the VHS figures

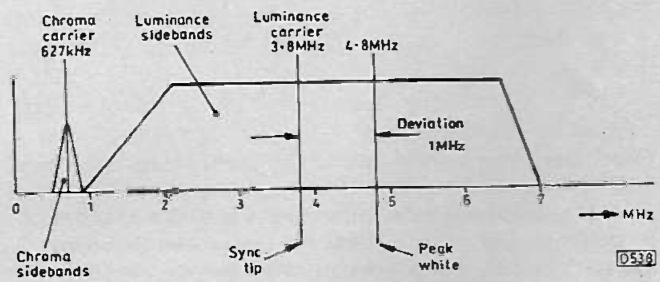

Fig. 5: Standard VHS signal frequency spectrum. The upper cut-off frequency is shown as 7MHz. This may vary slightly, depending on the width of the video head gap in the particular VCR model.

just quoted, the lower sideband will be at 3·8 – 2·8MHz = 1MHz and the upper sideband at 3·8 + 2·8MHz = 6·6MHz. Fig. 5 shows the standard VHS signal spectrum.

These parameters result in an f.m. system with barely sufficient bandwidth to recover the information but an octave range that can be recorded on magnetic tape. Note also that the reduced luminance signal bandwidth results in considerable loss of horizontal resolution and sharp-edge definition.

Chrominance Recording

We'll conclude this instalment with a brief look at the chroma recording process used in VHS and other non-broadcast quality systems.

The term 'colour under' is used to describe the fact that with a VCR the chroma signal carrier frequency is lower than the luminance signal frequency spectrum. In the PAL system the chroma signal modulates a 4·43MHz subcarrier. This is done to keep it out of the way of the majority of the luminance sideband frequencies and thus reduce luminance-chrominance patterning. With a VCR the f.m. luminance signal bandwidth is above the chrominance signal (see Fig. 5), whose frequency must therefore be shifted.

This is done by using a heterodyne technique very much like that employed in superhet radio receivers. The chroma subscarrier frequency chosen for the VHS system is 627kHz, which places it neatly in the 0-1MHz space below the lowest luminance f.m. sidebands. However the 2·2MHz bandwidth of a PAL colour signal has to be reduced to just 1MHz. The result is a chroma signal at 627kHz ± 500kHz – see Fig. 5.

Next Month

We've made an ambitious start by looking at magnetic recording principles and f.m. theory in one go. Each of these subjects is quite complex. If more in-depth coverage is required, there are several textbooks that can be consulted. Our aim has been to provide enough information on the basic principles to enable the problems involved in recording and playing back colour TV signals to be understood.

Next month we'll start on f.m. luminance signal processing.

Help Wanted

The Help Wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement about this feature.

Wanted: Can anyone help with a source of supply for a peculiar chip in a computer monitor, Model 7133D, made in Malaysia? The number on the chip is WT8043 N204 446. It works as a field oscillator and may have other functions. The only indication of the monitor make is on the box it came in, as follows: EPA Energy Star Pollution Preventer. K. Hodgett, Cooper TV, 86 Windle Street, St. Helens, Merseyside WA10 2BL. 01744 29 622.
Wanted: Miniature c.r.t. type DH391. Tony Arnold, Courthouse Facilities, 27-29 Salisbury Street, Cranborne, Dorset. 01725 517 359.
Wanted: Remote control/information on a de Graaf VCR WHS GP1 (Philips chassis?). It's stuck in the child-lock mode. Does anyone know how to open the RC-V11A remote control unit for the Akai Model VS-F15EK?! T.M. Summerwill, 62 Clivedale Road, Woodley, Reading, Berks RG5 3RD.
Wanted: LOPT for the 20in., 90° Hinari CD/TV2. Ian Purves, Tellyman, 9 Overbrook, Hythe, Southampton SO4 5BE. 01703 845 476.
For disposal: 29 years' issues of *Television*, from 1966-1995, plus a few issues of *Practical Television* from 1963-1966. They are available for a nominal sum plus carriage. L. Burge, 40 Arch Road, Wyken, Coventry CV2 5AB. 01203 613 783.
Wanted: Circuit diagram for the Luxton Hi-Fi/TV combination or the type number of the audio chip. P. Wilkie, Castle Television, 16-18 Lady Lawson Street, Edinburgh. 0131 229 7706.
Wanted: LOPT for the NEC Model FS1502 or CT1416. Part no. is 47105230. D. Grant, The Hollies, Pandy, Abergavenny, Gwent NP7 8ED. 01873 890 291.
Wanted: Circuit diagram for the Toshiba Model C2290-B1. J.M. Thomas, 19 Cwmgelli Close, Treboth, Swansea SA5 9BY.
Wanted: Help with repairing a Russian-made oscilloscope, Model C1-5Y, and any general advice about repairing valve equipment. Laurence Steingold, 12 Chartham House, Weston Street, Bermondsey, London SE1 4DX. 0589 975 661 (mobile).
Wanted: Service data for the Triumph CTV8000 and the Saisho VR3600 VCR. Will stat and return if required. K. Smith, 43 Lourdes Avenue, Preston, Lancs PR5 5TB. 01772 321 709.
Wanted: Circuit diagram/construction details for the Intracept Electronics N7118 PAL colour bar generator – it's about 10-15 years old. Nicholas P.B. Arnold, 19 Bond Street, Bournville, Birmingham B30 2LB. 0121 458 1187.
Wanted: Teletext panel with fitting instructions for the Sony Model KV2052UB. Also a circuit diagram (photocopy will do) for the Sakura SR800ER. J. McLeod, 41 Washington Road, Haywards Heath, West Sussex RH16 3HL.

Answer to Test Case 395

– see page 38 –

Tatung TV faults don't elude Television Ted for long! In retrospect, Cathode Ray's component-substitution tests in the line output stage were a waste of time. It's usually far better to try to diagnose the cause of a fault by making test readings and following a logical reasoning process rather than to keep changing components in the hope that you will hit on the right one – even though some faults and symptoms seem to defy logical analysis. It is also sometimes difficult, even when the faulty component has been located and replaced, to see why or how it caused the problem!

There are two reasons why this was to some degree true here. First, because by rights the fault should have stopped the line output stage working at all. And secondly because it's hard to understand why the symptom depended on the brightness of the picture.

When the pulses at the collectors of the line driver transistors Q401/2 were examined (waveform 410) they were seen to be of low amplitude and distorted. This led to a check on R423, in the feed to the line driver transformer's primary winding. Its value had risen from 22Ω to more than 300Ω. As a result, the driver transistors were not passing sufficient collector current. Once a new 22Ω resistor had been fitted the picture problem disappeared regardless of the brightness and contrast control settings.

Similar symptoms can occur with other makes and models when the resistor in this position fails.

Published on the third Wednesday of each month by Reed Business Publishing Ltd., Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. **Filmsetting** by Wace Publication Imaging, 2-4 Powerscroft Road, Sidcup, Kent DA14 5DT. **Printed** in England by BPCC Magazines Division, Carlisle Web Offset, Cumbria. **Distributed** by Marketforce (UK) Ltd., 247 Tottenham Court Road, London W1P 0AU (0171 261 5555). **Sole Agents** for Australia and New Zealand, Gordon and Gotch (Asia) Ltd.; South Africa, Central News Agency Ltd. ***Television*** is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

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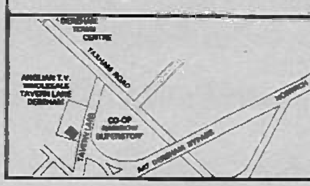

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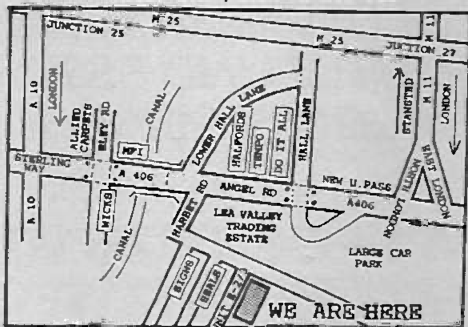

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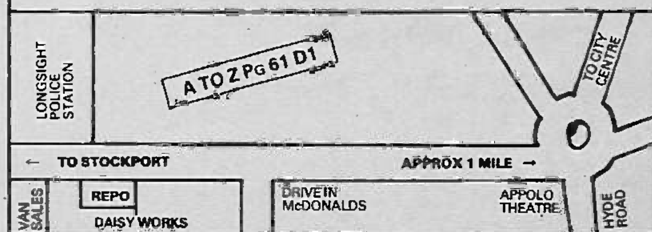

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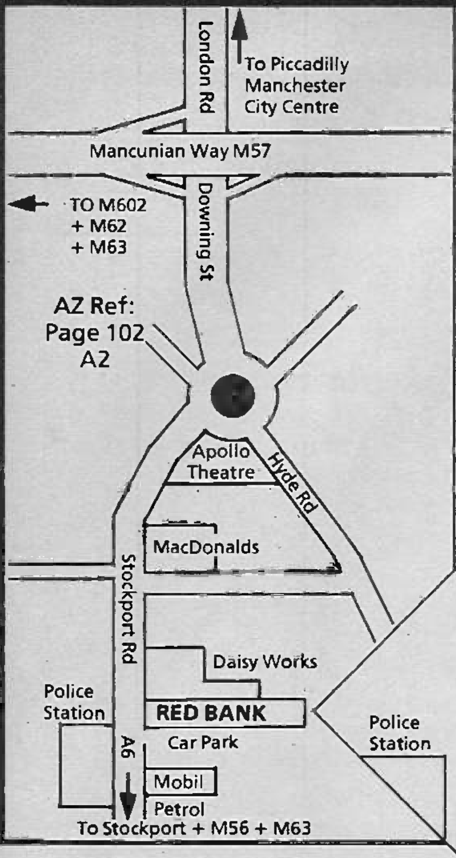

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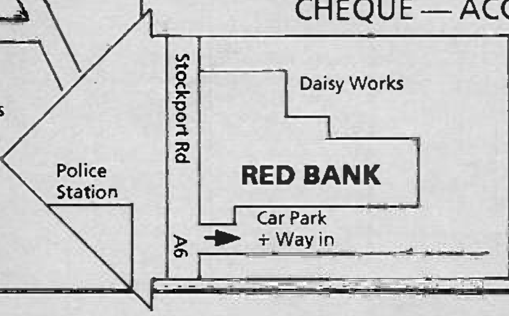

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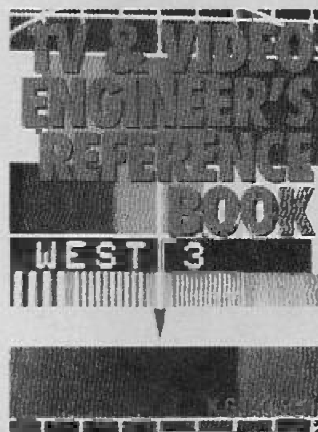

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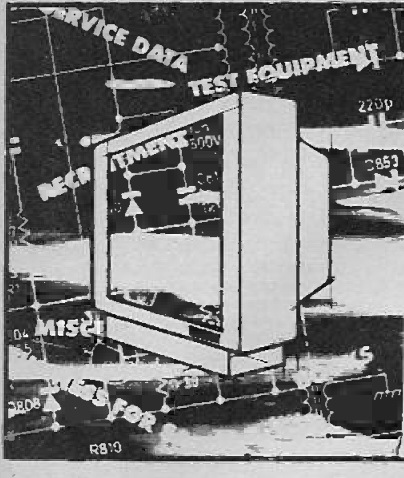

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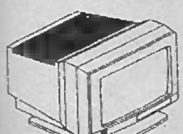

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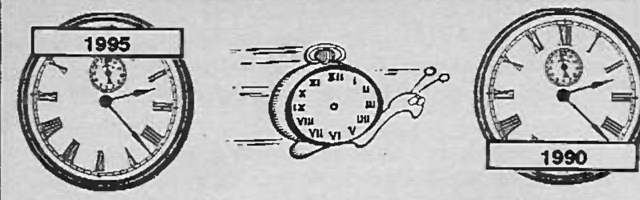

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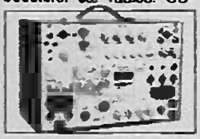

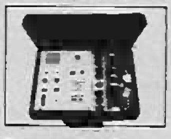

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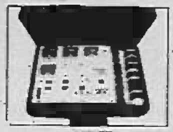

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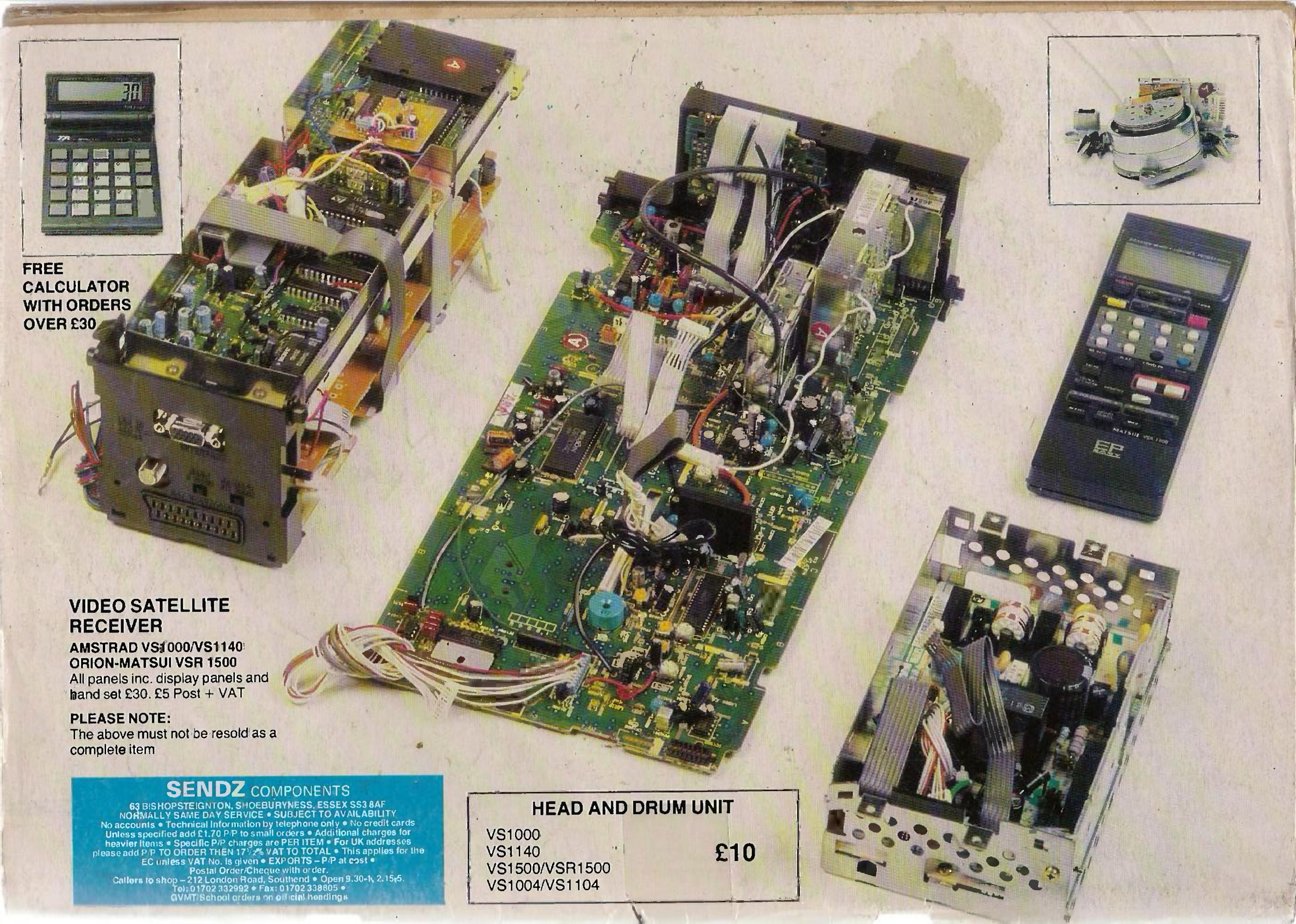
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