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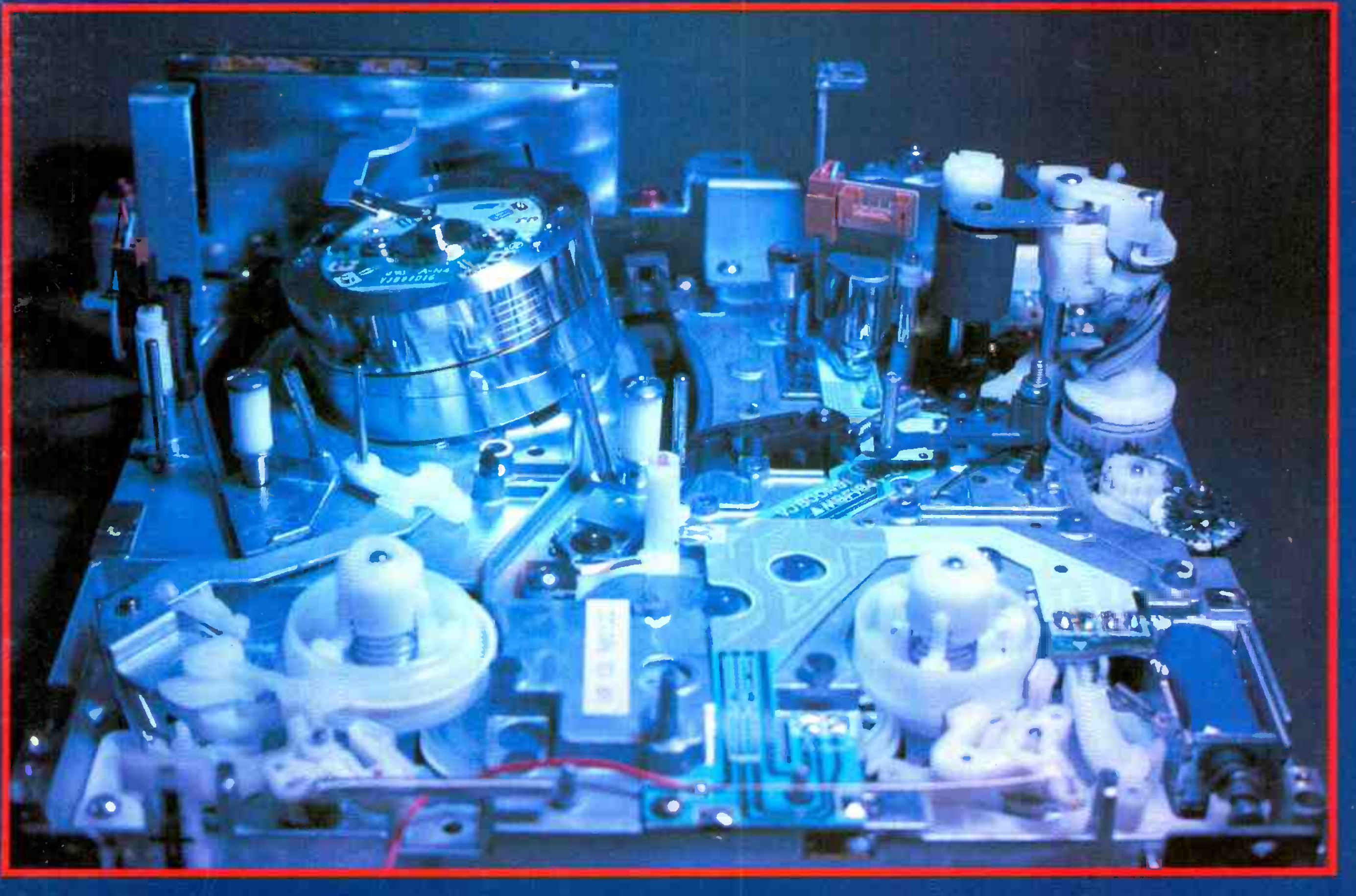

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TELEVISION

May 1991

Vol. 41, No. 7
Issue 487

On sale April 17th

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We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them.

this month

OUR NEXT ISSUE DATED JUNE WILL BE PUBLISHED ON MAY 15

AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	28p
AC141K	30p
AC142K	30p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF379	45p
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ASZ17	100p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BA526	188p
BB105B	18p
BB205B	24p
BC107	8p
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BC109C	10p
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BC118	11p
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TIS91	18p
TIS93	20p
VK1010	88p
VN.10KM	60p
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VN.88AF	115p
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ZTX108	11p
ZTX109	12p
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ZTX503	18p
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ZTX550	24p
2N.696	26p
2N.697	22p
2N.698	40p
2N.706	22p
2N.708	22p
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2N.2218A	24p
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2N 6403	160p
3N.143	65p
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Rectifier Diodes	
AA119	9p
BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
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BY206	11p
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BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX70/500	32p
BYX70/800	36p
OA47	6p
OA90	6p
OA91	8p
OA200	7p
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IN.914	2p
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IN.4006	4p
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SKE4F2/08	70p
SKE4F2/10	90p
I.C. SOCKETS	
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14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p
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400MV BYZ88 RANGE	
2V7 to 39V	6p
1.3W BZX61 RANGE	
2V7 to 39V	12p
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1.00	260p
2.00	200p
2.45670	180p
2.5	200p
3.276	115p
3.5796	95p
4.0	110p
4.194	130p
4.43	95p
4.9152	150p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
16.0	130p
18.0	130p
18.432	130p
24.0	250p
48.0	160p
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7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L08	40p
79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p
78GU1C	190p
79GU1C	215p
79HGKC	800p
VALVES	
DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
EB91	44p
EBF80	45p
EBF89	50p
ECC82	80p
ECC83	100p
ECC84	70p
ECC85	80p
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PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	62p
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PCL84	50p
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PCL86	100p
PCL805	100p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	100p
PY88	100p
PY500A	190p
L.E.D.'S	
LED 3MM RED	5p
LED 3MM YEL	10p
LED 3MM GRN	10p
LED 5MM RED	5p
LED 5MM YEL	10p
LED 5MM GRN	10p
RECTANG. L.E.D.'s	
RED	10p
GREEN	15p
YELLOW	15p
LINEAR IC'S	
AN-203	210p
AN-210	165p
AN-214Q	170p
AN-228	280p
AN-236	235p
AN-240P	150p
AN-241	135p
AN-245	290p
AN-247	230p
AN-252	150p
AN-259	250p
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AN-271	230p
AN-272	480p
AN-274	250p
AN-301	330p
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AN-304	360p
AN-305	320p
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AN-316	350p
AN-318	460p
AN-360	150p
AN-362	140p
AN-366	150p
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AN-6362	480p
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TDA-3580	500p
TDA-3590	320p
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TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	200p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	650p
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TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
UPC-20C	220p
UPC 554	130p
UPC 555	60p
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UPC 566	60p
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UPC-574	60p
UPC-575C2	90p
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UPC-1026	95p
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UPC-1470	200p
UPC-1504C	400p
UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
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ZN-428	425p
ZN-429	215p
ZN 435	340p
ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SD-868	450p
2SD-870	400p
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2SD-879	60p
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VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700 £3.20
VC387, VC481, VC483, VC486, VC496, VC581, VC582, VC583, VC585 £3.20
VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787, VC793, VCT72 £3.20

SONY
SLC5, SLC6, SLC7 £3.20
SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100 £3.20

VCR BELT KITS

AKAI
VP7100 £1.60
VS-1 £1.50
VS2EG £1.00
VS4 £1.20
VS5EG £1.00
VS9300 £1.60
VS9500 £1.55
VS9700 £1.60
VS9800 £1.55

AMSTRAD
TVR1-2-3 £2.10
VCR4600 & MKII £2.10
VCR4700 £2.10
VCR5200 £2.10
VCR7000 £0.80

FERGUSON
3292, 3V00, 3V01 £1.50
3V16, 3V22, 3V23 £0.65
3V29, 3V30 £1.20
3V31, 3V32 £0.85
3V35, 3V36 £0.80
3V38, 3V39 £0.80
3V42, 3V43 £0.65
3V44, 3V45 £0.65
3V34, 3V54, 3V55 £0.65
3V58, 3V59, 3V64, 3V65 £1.40
8950, 8951, FV10, FV11, FV12, FV13, FV14 £1.40

FISHER
VBS7000 £2.45
VBS9000 £1.20
FVHP520, FVHP530 £0.80
FVHP710, FVHP716 £1.20
FVHP722, FVHP905, FVHP906, FVHP907, FVHP910 £1.30
FVHP615, FVHP715, FVHP725, FHP830 £1.20

GEC
4005 £1.50

HITACHI
VT11, VT33 £1.00
VT5000 £1.20
VT5500 £1.30
VT8000 £0.60
VT8500 £0.60
VT9300 £0.50
VT9500 £0.50
VT9700 £0.60
VT14, VT17, VT19, VT35, VT38, VT88, VT52, VT62, VT64, VT65, VT86 £1.50

ITT
VR3605, 3905, 3935, VR3985 £1.00
VR3913, VR3914 £1.00

JVC
HR3300, HR3330 £1.50
HR3360, HR3660, HR4100 £1.80
HR7200 £0.70
HR7600 £0.80
HR7610 £0.95
HR7650 £0.75
HR7655 £0.90
HR7700 £0.77
HRD110, HRD111, HRD120, HRD225, HRD250, HRD455, HRD565, HRD566, HRD725, HRD755 £1.00
HRD170, HRD180, HRD230, HRD370, HRD430, HRD530 £1.30

MITSUBISHI
HS200 £2.00

NATIONAL
NV300 £1.60
NV333 £1.35
NV777 £1.00
NV2000 £1.50
NV3000 £1.60
NV7000 £0.95
NV7200 £0.90

NATIONAL
NV8600 £1.60
NV7500, NV7800 £1.10
NV340, NV366 £1.40
NV600, NV788 £1.20
NV230, 250, 280, 370, NV380, 430, 450, 460, NV465, 600, 630, 730, NV810, 830, 850, 870, NV890 £1.35

PHILIPS
VR6460 £1.70

SANYO
VTC500 £0.75
VTC5300 £1.00
VTC5500 £0.95
VTC9300 £2.20
VTC1100, 1300, 1500 £1.00

SHARP
VC381, VC383, VC386 £1.25
VC6300 £1.50
VC7300, 7700, 7500 £1.50
VC8300 £1.50
VC8381, VC9100 £1.25
VC9300, VC9500 £1.35

SONY
SL-C5, SL-C6 £1.40
SL-C7 £1.40
SL-C9 £1.65
SL8000, SL8080 £2.00

TOSHIBA
V55, V57 £0.85
V5250, V5280 £2.30
V5480 £2.10
V5475 £1.60
V7540 £1.60
V8600 £1.50
V9600 £0.85

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STK 5333	750p	STR 4142	650p
STK 5335	500p	STR 4512	500p
STK 5337	850p	STR 5214	650p
STK 5338	500p	STR 5314	650p
STK 5339	700p	STR 20005	550p
STK 5461	850p	STR 20013	550p
STK 5462	550p	STR 30110	330p
STK 5466	850p	STR 30112	330p
STK 5467	500p	STR 30118	330p
STK 5478	650p	STR 30120	330p
STK 5479	400p	STR 30125	550p
STK 5725	600p	STR 30134	330p
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IDLERS & PULLEYS REPLACEMENTS

		Reference	
AMSTRAD			
VCR7000		150280	£1.50
AKAI			
VS1-2, VS4-5, VS15	FF-REW IDLER	M1327773	£4.50
VS1-2, VS4-5, VS15	T-UP IDLER	BV327815	£6.00
V9700	IDLER	BV321979	£6.00
VS125, 126, 155, VS165, 240, 244, VS245, 247, 248, VS250, 512, 515, 516	IDLER ASSY	MZ366960J2	£11.00
FERGUSON			
3V16-22	T-UP IDLER	PU47752	£4.50
3V16-22	T-UP IDLER	PU49280	£6.30
3V23, 3V29-30, 3V31-32, 3V35	REEL IDLER	PU48967	£3.00
3V23	ROLLER ASSY	PU49042A	£4.00
3V29-30, 3V31-32, 3V35-36, 3V38-39, 3V49	T-UP IDLER	51402	£1.45
3V29-30,3V31-32	T-UP CLUTCH	PU51380	£2.60
3V35-36, 3V38-39, 3V49	REEL IDLER	PU55374	£2.85
3V35-36, 3V38-39, 3V49	T-UP CLUTCH	PU55373	£2.25
3V58-59, 3V64-65, FV10-11, FV12-13, FV14	IDLER ARM	PU58645	£2.50
3V42	CLUTCH ASSY	PU55822	£13.50
3V44	CLUTCH ASSY	PU57658	£11.50
3V42, 43, 48, 53, 56	T-UP CLUTCH	PU56043-1-4	£2.80
3V42, 43, 48, 53, 56	SUPPORT CLUTCH	PU56044-1-5	£2.80
FISHER			
FVHP520, FVHP530	FF-REW PULLEY	HI638531	£1.00
FVHP615	COMP. IDLER ASSY	FI1430420400300	£3.30
FVHP615	GEAR IDLER ASSY	FI1430490400900	£5.50
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FVHP975, 990, 999, FVHP5000, 5100	IDLER	FI1430420400700	£5.20
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	FF-REW IDLER	6886971	£1.50
	PLAY IDLER	V-6861482	£3.20
VT11-33, VT63-64, VT14, 17, 19, 38, 57, VT86, 88	CLUTCH ASSY	6879515	£7.50
VT120-220	CLUTCH ASSY	6886824	£7.50
VT8000-8300, VT8500-8700	FF-REW IDLER	6413663	£2.80
VT8000-8300, VT8500-8700	PLAY IDLER	6414221	£3.60
VT8000-8300 VT8500-8700	FF-REW PULLEY	6383531	£0.80
VT9300-9500	FF-REW IDLER	8681471	£3.30
VT9300-9500	PLAY IDLER	6861482	£3.20
VT9300-9500	IDLER	681505	£3.00
	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	£1.50
HINARI			
VXL3, VXL20	REEL IDLER	40000009	£1.50
ITT			
VR3905, VR3906	T-UP IDLER	PU51402	£1.45
VR3906	REEL IDLER	PU55374	£2.85
VR3913, VR3943	REEL IDLER	PU48967	£3.00
JVC			
	IDLER ASSY	PU47752	£4.50
	T-UP IDLER	PU51402A	£1.45
	T-UP CLUTCH	PU55373	£2.25
	ILDER ARM	PU55374-3-8	£2.85
	FF IDLER	PU45896C	£2.10
HR330, 3660, 4100	T-UP IDLER SML	PU49280	£6.00
HR7200, HR7600, HR7650, HR7655	T-UP CLUTCH	PU53462A	£3.00
HR7200, HR7600 HR7650, HR7655	REEL IDLER	PU48967	£3.00
HR7700	ROLLER ASSY	PU49042A	£4.00
HR7700, HR3300, 3660, 4100, HR7200, 7600, 7650	T-UP IDLER LRG	PU47752	£4.50
HR7655, HRD110, HRD120-121, HRD225	T-UP IDLER	PU51402A	£1.45
JVC			
HRD110, HRD120-121, HRD225	T-UP CLUTCH	PU55373	£2.25
HRD110, HRD120-121, HRD225	IDLER ARM	PU55374-3-8	£2.85
MATSUI			
VX730, 735, 750, 755, VX810, 820, 880, 990	CLUTCH	850A00005	£6.50

IDLERS & PULLEYS REPLACEMENTS — Cont.

		Reference	
MITSUBISHI			
HS306, 307, 318, 319, HS410, 710	GEAR ASSY	522P00201	£6.25
NATIONAL			
NV322, NV600, NV688, NV777, NV788	IDLER UNIT	VXP0463	£3.00
NV333	IDLER ARM	VXL0997	£3.60
NV333, NV366	IDLER UNIT	VXP0401	£0.75
NV333, NV366	PLAY IDLER	VXP0433	£3.00
NV333, NV3000	ACTION GEAR	VDG0016	£0.60
NV333, NV7800, NV333, 2000, 3000	INTERMEDIATE GEAR	VXG0017	£0.65
NV333	CAM GEAR	VXG0158	£1.00
NV366	IDLER ARM	VXL0997	£3.60
NV370, NV430, NV730, NV830, NV850, NV870, NVG7, NVG10, NVG12, BVG18	IDLER ARM	VXP0521	£1.70
NV370, NV430, NV470, NV730, NV830, NV850	CAM GEAR	VDG0200	£1.20
NV730	IDLER UNIT	VXP0581	£2.50
NV2000, NV3000	IDLER UNIT	VXP0331	£1.20
NV2000, NV3000	IDLER UNIT	VXP0329	£1.20
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV2000, NV3000	ACTION GEAR	VDG0016	£0.60
NV7000, 7200, 7800	IDLER UNIT	VXP0344	£1.00
NV7000, 7200, 7800	CLUTCH	VXP0343	£5.50
NV8400, NV8600,	IDLER UNIT	VXP0245	£1.20
NV8600, NV8610, NV8670	PLAY IDLER	VXP0243	£1.20
NV8620	CLUTCH	VXP0343	£5.50
NV600	IDLER	VXP0488	£3.50
NVG21-25, NVG40-45	PULLEY UNIT	VXP0767	£5.80
ORION			
VH200-201, VH555-700, VH844-900, VH1000-1500, VH1800,	IDLER	850A200004	£3.50
VP200, VH530, VH535-630, VH635-640, VH893-1440, VH2500-2600, VH2700-4010, VH5010	IDLER	850A200005	£6.50
PHILIPS			
DV464, VR6462, VR6463, VR6660, VR6860	IDLER	52220334	£2.50
VR6460, VR6520, 6920	IDLER ARM	40340162	£1.70
DB532, VR6542, VR6843	REEL IDLER		£7.50
SANYO			
VHR110, VHR1300, VHR1500	IDLER	1430662T14730	£5.00
VTC5000, VTC5150	FF-REW IDLER	1430741T20001	£3.00
VTC9100, VTC9300	IDLER	1430551T01400	£1.20
VTC9300	FF ROLLER ASSY	1430547T00200	£2.20
VTCM10-20	REEL DRIVE PULLEY	1430662T10350	£5.00
VHR2100, VHR2300	IDLER	6130374899	£5.00
VTC5000, VTC5150	PULLEY	143-0-662T-01201	£5.20
VTCM10	PULLEY	143-0-662T-10350	£5.50
SHARP			
	IDLER	NIDL0005GEZZ	£1.50
	IDLER	NIDL0006GEZZ	£1.50
VC651, VC681, VC685	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC7300, VC7700	PLAY IDLER KIT	NPLYV0041 + NDA1V1007	£5.00
VC381, VC383, VC386, VC8381, VC9100, VC9300, VC9500, VC9700	IDLER	NIDL0005GEZZ	£1.50
VC300, VC387, VC481, VC482, VC483, VC496, VC571, VC585	IDLER	NIDL0006GEZZ	£1.50
VC780-781, VC785-787, VC793-VCT72	REEL IDLER	NPLTV0111GEZZ	£7.00
SAISHO			
VR1100, VR1200, VR1200HQ, VR1600, VR2500, VR3300, VR3500, VR3600	CLUTCH	850A20000	£6.50
SAMSUNG			
VT510-511, VT520-610, VT611-616, VT620-621-626	IDLER WHEEL	65224704220	£1.50
VT510-511, VT520-610, VT611-616, VT620,621, 626	IDLER COMPLETE	69000250330	£4.50
SONY			
C6	IDLER KIT ASSY	A 6706391	£3.50
C7	IDLER ASSY	X 36533100	£3.80
SL-C5, SL-C7	REW PULLEY	A-6706-348-B	£4.00
SL-C6	REW PULLEY	A-6706-391-A-B	£3.00

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PU 55371V, 3V35, 3V36, 3V38, 3V39, 8943, 8944, HRD110, HRD120, HRD121, HH0225	CAPSTAN MOTOR	£19.50
PU 46414, 8904, 8922, HR3300, HR3320, HR3330, HR3360, HR3600, HR3660	DRUM MOTOR	£19.50
PU 51381V, 3V39, 3V30, 8930, HR7200, HR7300	REEL MOTOR	£26.50
PU 58635V, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430	CAPSTAN MOTOR	£29.00
MITSUBISHI		
288P02801, HS300, 301, 302, 310	MOTOR REEL SPOOLING	£33.50
288P02806, HS303, 304, 320, 330, 700	MOTOR REEL SPOOLING	£31.50
288P03401, HS303, 700	MOTOR REEL TAKE-UP GEN	£21.00
NATIONAL		
MYN 135V5L, NV332, NV333, NV340, NV366	REEL MOTOR	£13.50
VEM0212, NV730/NV770	MOTOR REEL GEN	£30.00
SANYO		
4-529V-10800 (RM11), VTC5000, VTC5150	REEL MOTOR	£6.30
SHARP		
RMOTV 1008GEZZ, VC200, VC381, VC384, VC385, VC386, VC483, VC3300, VC8381, VC9100, VC9300, VC9500, VC9700	REEL MOTOR	£13.50
RMOTV 1007GEZZ, VC387, VC483, VC486, VC585	REEL MOTOR	£16.50
RMOTV 1010GEZZ, VC300, VC402, VC471, VC477, VC481, VC482, VC488, VC496, VC500, VC571, VC581, VC582, VC583, VC584, VC5F3, VC8481, VC8581	REEL MOTOR	£16.00
SONY		
BHF 1100D, SLC7	CAPSTAN MOTOR	£25.00

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FERGUSON & JVC	
3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, HRD110, HRD120, HRD121, HRD225	£24.00
3V42, 3V43, 3V44, 3V45, 8945, 8947, HRD140, HRD141, HRD150, HRD455, HRD725	£24.00
8948, 8950, FV10B, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD230, HRD430, HRD530	£24.00
3V58, 3V59, 3V64, 3V65, FV11R, HRD170, HRD180, HRD370	£24.00

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1-439-286-21	KV-2215UB, 2217UB, 2215EI, 2215FE, 2212EX, 2215ET	£30.50
1-439-289-21	KV-2705F, 2705FE, 2705UB, 2705E, 2706UB, 2720EC	£40.00
1-439-303-00	KV-2064EC, 20PS1, 2082ME7, 2056EC, 2060SA, KV-2062E(ESP)	£22.75
1-439-311-00	KV-1440AEC, 1440AS MK2, CPS-14CD3, CPV-14CD2, KTX-1350NF, KTX-1430UB	£22.00
1-439-332-21	KV-2756, 2730EC, 2730FE, 2764EC, 2752UB, 2752F	£30.00
1-439-333-00	KV-1882EC, 1882UB, 1882F, 1882CH, 1882AEB, 1882AM, KV-1882ME3, 1882HK, 1882AS, 16TR1, 882EC(PS), 1770R	£21.50
1-439-363-21	KV-19HT1A, 19FX1M1, 18G2, 1602M7, 1602GE, ADM-16B, KV-2092UB, 2096UB	£22.00

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RBM T20/22A	7.35
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LA4461	2.45
LA7800	2.95
LA7801	2.95
M293B1	7.95
MC13002	4.95
MC14497P	4.50
SAA1250	4.95
SAA1251	4.95
SAA1293	6.95
SAA5000A	3.95
SAA5010	4.95
SAA5012	4.95
SL1430	1.95
SL1431	1.95
SL1432	1.75
STK5332	6.95
STK5333	12.50
STK5421	4.95
STK5481	8.95
STK5482	8.95
STK7308	7.95
STK7348	7.95
STR441	6.75
STR4090	8.95
STR4211	4.50
STR40090	7.95
STR5412	4.95
STR50103A	6.50
STR55041	6.95
STR58041	6.95
STR6020 (KIT)	5.75
TA7193P	4.50
TA7205AP	1.40
TA7227P	2.95
TBA120U	1.00
TBA820M	1.25
TBA950/2X	2.25
TDA440	2.95
TDA1035T	2.40
TDA1037	2.50
TDA1044	2.95
TDA1170S	1.80
TDA1180P	2.65
TDA1506	4.35
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50
TDA1670A	4.20

TYPE	PRICE (£)
TDA1770A	3.70
TDA1908A	1.95
TDA2003	1.50
TDA2004	2.50
TDA2005	2.50
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2530	5.95
TDA2532	2.95
TDA2540	1.95
TDA2541	2.95
TDA2560	1.95
TDA2576A	3.25
TDA2577	3.75
TDA2577A	3.95
TDA2578A	2.95
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TDA2581	2.95
TDA2582	2.50
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TDA2594	2.95
TDA2595	4.95
TDA2600	6.35
TDA2611A	1.50
TDA2653A	3.95
TDA3190	1.95
TDA3330	3.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3562A (TFK)	6.75
TDA3565	4.95
TDA3571 B/Q	7.75
TDA3576	7.50
TDA3651	2.75
TDA3651A	4.95
TDA3652	9.95
TDA3653	3.95
TDA3653A	4.75
TDA3654A	3.95
TDA4500	3.95
TDA4501H	6.50
TDA4503	4.50
TDA4505	5.75
TDA4600/2	2.85
TDA4600/2D	3.30
TDA4601	3.50
TDA8180 (Genuine)	7.50
TDA9503	2.95
TEA1014	3.95
TEA2018A	2.75
UPC1365C	3.95
UPC1378H	3.70
UPC1394C	2.95
UPC1420CA	8.50

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Decca 100	8.95
Ferguson 1790/1	17.95
Ferguson TX90 (14")	19.75
Ferguson TX90 (20")	21.50
Ferguson TX100 90D	19.95
Ferguson TX100 110D	19.95
Ferguson TX100 100D FST	27.50
Fidelity ZX2000 14"/20" (Inc. Mod)	12.50
Fidelity ZX3000 14"/20"	11.50
Hinari CT4/5	19.95
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Philips KT3	14.95
Philips K30	22.95
Philips K40	23.75
Philips 2A	23.50
Sharp C1410	23.95

ON/OFF SWITCHES

TX9/10 Standard	1.00
TX9/10 Remote	1.75
TX90/100 Standard	1.50
TX90/100 Remote	1.75
Fidelity AVS	1.50
Fidelity CTV140	1.50
Fidelity CTV14R	2.95
Fidelity CTV14S	2.95
Grundig CUC731	3.50
Philips G11	1.35
Philips G11 Remote	1.75
Philips KT3 Standard	1.75
Philips CTX Remote	1.75
RBM T20A Vol. 3K3	3.95
Sony KV1612 Genuine	3.95
Sony KV2022 Genuine	3.95
Sony Universal	3.75
Tatung 140 Standard	1.50
Tatung 160 Remote	1.75
Thorn Universal	1.00

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Ferguson T789	12.50
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Ferguson TX9/10 Text	12.95
Ferguson TX Stereo Text	12.95
Ferguson TX90 Basic	14.95
Ferguson TX100 Text	14.95
Ferguson TX100 Stereo	14.95
Ferguson 3V23	14.95
Ferguson 3V31	14.95
Ferguson 3V35	14.95
Ferguson 3V43	16.95
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Fidelity Text	17.95
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Panasonic TNQ2607	22.95
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Tatung RC40/43/45	15.95
Tatung RC42	14.95
Tatung RC60	15.95
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TYPE	PRICE
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BC327	10
BC337	10
BC547/8	10
BC557/8	10
BC639	20
BC640	20
BD238	40
BD677	65
BF337	30
BF422	35
BF423	35
BF458	35
BF460	95
BF757	70
BF871	95
BR103	75
BT151/800	1.35
BU126	1.50
BU208A	1.45
BU208D	1.95
BU426A	1.35
BU500	1.95
BU508A	1.50
BU508AF	1.95
BU508D	1.95
BU508DF	2.35
BU508V	2.50
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BU807	1.30
BU826A	2.50
BU907	2.95
BU908	1.95
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BUT12A	2.95
BUT56A	2.95
BUX84	80
R4050	2.95
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T9054V	3.50
T9064V	1.95
TIP29E (TD168V)	75
TIP41C	45
TIP42C	45
TIP112H (TD167V)	75
TIPL791A	1.95
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15/85R	2.95
2SC1942	2.95
2SC3156	3.50
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2SD1453	2.95
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7812	50

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Amstrad 4500	19.95
Amstrad 4600	19.50
Amstrad 6000	28.50
Amstrad 7000	21.95
Amstrad 9000	19.95
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Ferguson 3V44/55	22.95
Ferguson 3V43	39.95
Ferguson 3V59	37.50
Ferguson 3V64/65	29.95
Ferguson FV11/12	29.95
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Hitachi VT17/19E	39.95
Hitachi VT63E	29.95
Hitachi VT120	37.50
Hitachi VT130	32.95
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Mitsubishi 303	29.95
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Panasonic NV333	11.50
Panasonic NV366	27.50
Panasonic NV370	15.00
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Panasonic NV788	44.95
Panasonic NV2000	11.50
Panasonic NV7000	11.50
Panasonic NVG7/9	22.75
Panasonic NVG10	27.50
Panasonic NVG18	44.95
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Sharp 581/681	19.95
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Sony C9	32.95
Toshiba V73/83B	23.95
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Focus Unit TX10	8.50
Push Button TX9	16.95
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3V00/16/22

Belt Kit	2.50
Pinch Roller	3.95
Take-Up Clutch (Small)	5.95
Take-Up Clutch (Large)	5.95
Video Head	11.50

3V29/30

Belt Kit	1.80
Capstan Motor	33.50
Pinch Roller	3.95
Pilot Lamp	80
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Tension Band	1.95
Video Head	11.50

3V35/39

Belt Kit	1.95
Capstan Motor	22.95
Cassette Housing	25.95
Mains Transformer	21.95
Pinch Roller	3.95
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Tension Band	1.95
Video Head	11.50

3V44/45

Belt Kit	1.95
Cassette Housing	25.95
Pinch Roller	3.95
Take-Up Clutch	2.95
Video Head	22.95

3V64/65

Cassette Housing	29.95
Clutch Assembly	11.95
Pinch Roller	3.95
Reel Idler	1.95
Video Head	29.95

HITACHI SPARES

HM6232	5.95
HM6251	5.50

VIDEO SPARES

VT8000

Belt Kit	1.95
FF/Rew Idler	2.65
FF/Rew Pulley	85
Pinch Roller	3.95
Play Idler	4.50
Video Head	19.95

VT9300/9500

Belt Kit	1.95
Capstan Motor	31.95
FF/Rew Idler	1.95
FF/Rew Pulley	85
Pinch Roller	3.95
Play Idler	3.95
Video Head	19.95

VT11/VT33/63E

Belt Kit	1.95
Capstan Motor (VT11)	28.95
Capstan Motor (VT33)	29.95
Capstan Motor (VT63)	27.50
Clutch Assy (VT11/33)	7.95
FF/Rew Idler	2.50
Pinch Roller	3.95
Video Head (VT11/33)	19.95

PANASONIC VIDEO SPARES

NV230

Belt Kit	1.95
Complete Maintenance Kit (Genuine)	12.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	1.95
Video Head	27.50

NV333/366

Belt Kit	1.95
Complete Maintenance Kit (Genuine)	13.75
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reed Idler (Genuine)	1.25
Reel Motor (Genuine)	17.95
Tension Band	1.95
Video Head (NV333)	11.50
Video Head (NV366)	27.50

NV370

Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	1.95
Video Head	15.00

NV730

Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Tension Band	1.95
Video Head	27.50

NV777

Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Tension Band	1.95
Video Head	27.50

NV2000/2010

Complete Maintenance Kit (Genuine)	21.50
Belt Kit	1.95
Pinch Roller	3.95
Play Idler (Genuine)	1.25
Reel Idler (Genuine)	1.25
Video Head	11.50

NV7000/7200

Complete Maintenance Kit (Genuine)	17.50
Belt Kit	1.95
Pinch Roller	3.95
Play Clutch (Genuine)	4.95
Reel Idler (Genuine)	1.25
Video Head	11.50

NVG7/9/10/12

Complete Maintenance Kit (Genuine)	12.95
Video Head (NVG7/9)	22.75
Video Head (NVG10/12)	27.50

PHILIPS VIDEO SPARES

VR6460/6520

Belt Kit	1.95
Loading Motor	9.95
Pinch Roller	3.95
Reel Idler	2.95
Tension Band	1.95
Video Head	15.00

VR6462/6560

Belt Kit	1.95
Cassette Housing	17.50
Pinch Roller	4.50
Reel Idler	3.95
Reel Motor	39.50
Tension Band	1.95
Video Head	42.95

VR6467

Belt Kit	2.45
Cassette Housing	19.95
Pinch Roller Assy	17.50
Reel Idler Assy	11.95
Remote Control	22.95
Video Head	37.50

VR6760

Belt Kit	1.95
Clutch Assembly	7.95
Pinch Roller Assy	17.50
Remote Control	19.95
Video Head	49.95

SANYO/FISHER VIDEO SPARES

VTC5000

Belt Kit	1.00
Reel Idler (Genuine)	5.70
Reel Motor (Genuine)	7.95

FVH-P615

Belt Kit	1.95
Clutch Assembly	5.95
Pinch Roller	4.50
Reel Idler	5.95
Video Head	19.95

FVH-P905

Belt Kit	1.95
Reel Idler	5.95
Clutch Assembly	5.95

SERVICE MANUALS GENUINE

Ferguson TX85	9.95
Ferguson TX90	14.95
Ferguson TX100	18.95
Fidelity AVS1600	5.95
Fidelity AVS2000	5.95
Fidelity CTV14R	5.95
Fidelity CTV20T	5.95
Philips CTX-E	3.50
Philips CTX-S	3.50
Philips KT4/40	9.95
Philips 2A	6.95

VIDEO

Ferguson 3V54/55	11.95
Ferguson 3V64/65	11.95
Ferguson FV11	9.95
Ferguson FV12	9.95
Ferguson FV14	9.95
Philips VR6467	7.95
Philips VR6542	9.95
Philips VR6560	7.95
Philips VR6760	9.95

SHARP SPARES

VC9300/381

Belt Kit	2.45
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	16.95

VC481

Belt Kit	2.50
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	17.95

SONY SPARES

C5/6/7

Pinch Roller	3.95
Rewind Kit C5/7	4.95
Rewind Kit C6	3.95
Video Head	18.50

VIDEO LAMPS

Ferguson 3V23	80
Ferguson 3V29	80
Panasonic NV2000	70
Sharp 9300	1.95
Universal	50

★ ★ SPECIALS ★ ★

Alba Back Up Capacitor 1F 5V5	2.50
Alba 4000 FF/Rew Pulley	1.75
Amstrad Modification Creasing Kit	6.95
Ferguson 3V44/45 Upper & Lower Drum	17.95
Ferguson FV11 Power Supply	10.00
Philips Back Up Battery (Small) 1V2	3.95
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ELC1043/05	10.95
U321	9.95
U341	7.95
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Akai VS1/5	1.95
Amstrad 4500	1.95
Amstrad 4600	1.95
Hitachi VT120/130	1.95
Mitsubishi HS302	2.50
Sharp 7300	2.50
Sharp 8300	2.50
Sony C5/7	2.50
Sony C6	1.95

ORDERING

Please add £1.00 for p/p U.K. Add 17.5% VAT to this total. Service Manuals £1.25 p/p each. Export Orders p/p charged at cost Delivery by return on stock items. Minimum Order £5.00

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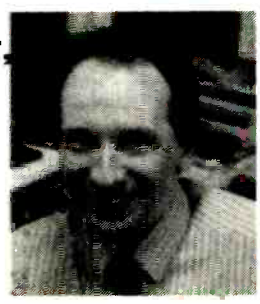
Phone Mike Curtis
0602-870789



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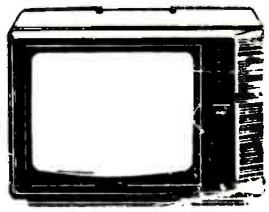

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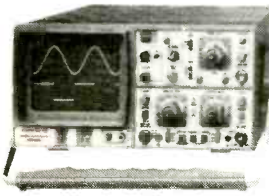
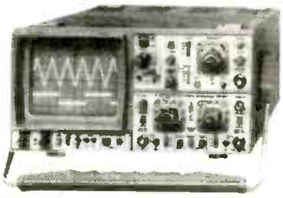


SPECIFICATION
* 2 Channels
* Bandwidth: DC - 20MHz
* Sens: Ch.!, Ch.2, 1mV/cm
* Timebase: 0.1s - 20ns/cm
* Triggering: DC - 40MHz
* Active TV - Sync - Separator
* Variable hold-off
* Trigger LED indicator
* Calibrator: 1KHz Square wave
* Component tester
* Plus many features

Price £338.00 + £50.70 V.A.T. FREE Specialist Carrier Delivery

HM604 60MHz UNIVERSAL

SPECIFICATIONS
* 2 Channels
* Bandwidth: DC - 60 MHz
* Sens: Ch.1, Ch.2, 1mV/cm
* Timebase : 2.5s - 5ns/cm
* Triggering: DC - 80MHz
* Active TV - Sync - Separator
* After delay trigger
* Sweep delay
* Delay line
* Trigger LED indicator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Component tester



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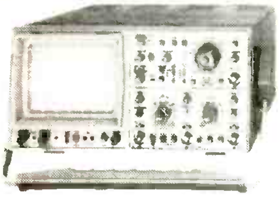

SPECIFICATION
* 3 Channels
* Bandwidth: DC - 100MHz
* Sens: Ch.1, Ch.2, Ch.3, 1mV/cm
* Timebase A: 2.5s - 5ns/cm
* Timebase B: 0.2s - 5ns/cm
* Triggering DC - 130MHz
* After delay trigger
* Delay line
* Trigger LED indicator
* Overscan LED indicator
* Active TV - Sync - Separator
* Calibrator: 1KHz & 1MHz Sq. Wave

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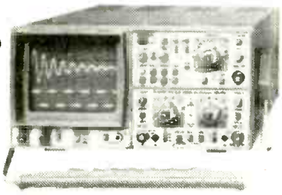
SPECIFICATION
* Digital Storage
* Analogue real time (Same as 203-7)
* Bandwidth: DC - 20MHz
* Sens: Ch.1, Ch.2, 1mV/cm
* Timebase Digital: 5s-1μs/cm
* Triggering DC - 40MHz
* Active TV - Sync - Sampling
* Max sampling rate: 2 x 20MHz
* Memory: 2 x 2048 x 8 Bit
* Dot joiner
* Printer/plotter output



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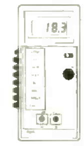

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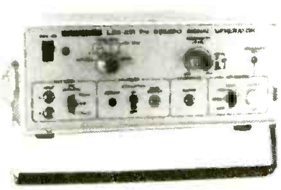

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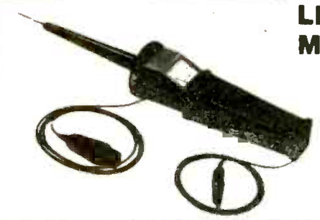

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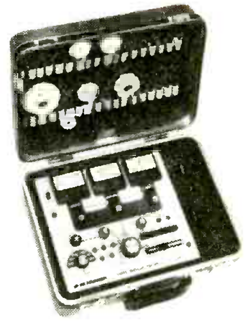

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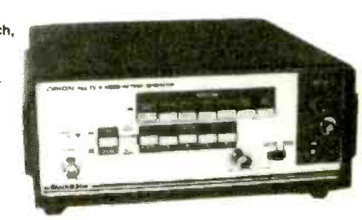

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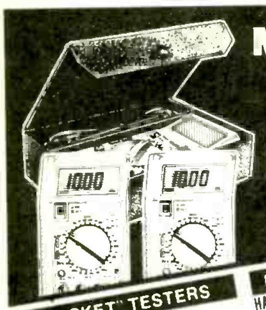

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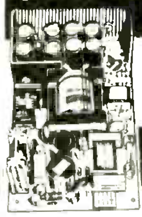

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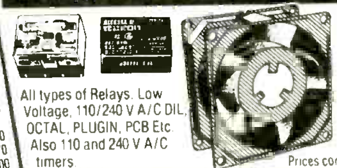

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LA4445	260p	TA7222	120p
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TA7271	275p
TA7272	260p
TA7273	350p
TA7274	260p
TA7279	400p
TA7280	330p
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TA7282	260p
TA7299	400p
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TBA800	40p
TBA820M	50p
TBA950	120p
TDA1515	250p
TDA1670	300p
TDA1908A	100p
TDA2003	100p
TDA2005	130p
TDA2575	200p
TDA2577	250p
TDA2581	200p
TDA2593	150p
TDA2653A	350p
TDA3560	320p
TDA3561	300p
TDA3562	260p
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2SA-473	35p	2SA-726	25p	2SB-548	40p	2SC-1345	30p	2SC-2238	60p	2SD-523	150p				
2SA-489	55p	2SA-733	20p	2SB-554	170p	2SC-1359	20p	2SC-2240	25p	2SD-525	70p				
2SA-490	40p	2SA-748	90p	2SB-557	150p	2SC-1368	40p	2SC-2274	30p	2SD-526	70p				
2SA-495	25p	2SA-765	300p	2SB-558	150p	2SC-1382	40p	2SC-2275	50p	2SD-560	50p				
2SA-496	40p	2SA-769	130p	2SB-560	35p	2SC-1383	35p	2SC-2278	75p	2SD-570	40p				
2SA-564	15p	2SA-771	130p	2SB-561	20p	2SC-1384	35p	2SC-2320	25p	2SD-571	30p				
2SA-608	15p	2SA-777	50p	2SB-562	35p	2SC-1393	30p	2SC-2335	120p	2SD-592	20p				
2SA-628	70p	2SA-794	60p	2SB-564	70p	2SC-1398	70p	2SC-2371	45p	2SD-600	80p				
2SA-672	30p	2SA-798	55p	2SB-566	110p	2SC-1399	60p	2SC-2427	80p	2SD-612	40p				
2SA-673	20p	2SA-817	25p	2SB-568	40p	2SC 1403	250p	2SC-2440	70p	2SD-613	70p				
2SA-677	60p	2SA-841	40p	2SB-595	80p	2SC-1413A	240p	2SC-2458	30p	2SD 621L	450p				
2SA-683	25p	2SA-844	15p	2SB-596	75p	2SC-1417	20p	2SC-2482	40p	2SD-636	25p				
2SA-684	40p	2SA-861	50p	2SB-618	325p	2SC-1445	250p	2SC-2500	30p	2SD-637	20p				
2SA-697	45p	2SA-872	20p	2SB-631	40p	2SC-1446	60p	2SC-2501	85p	2SD-639	25p				
2SA-715	35p	2SA-893	15p	2SB-632	40p	2SC-1447	75p	2SC-2502	90p	2SD 641	310p				
2SA-720	20p	2SA-896	35p	2SB-633	50p	2SC-1454	320p	2SC-2537	450p	2SD-666	25p				
2SA-722	40p	2SA-899	60p	2SB-641	20p	2SC-1473	30p	2SC-2546	20p	2SD-667	25p				
		2SA-900	35p	2SB-643	20p	2SC-1474	45p	2SC 2550	70p	2SD 669	40p				
		2SA-905	20p	2SB-644	15p	2SC-1475	45p	2SC-2555	150p	2SD-687	60p				
		2SA-915	30p	2SB-647	30p	2SC-1507	50p	2SC-2564	230p	2SD-716	120p				
		2SA-916	30p	2SB-648	55p	2SC-1509	45p	2SC-2565	260p	2SD-718	130p				
		2SA-917	35p	2SB-649	40p	2SC-1514	40p	2SC-2570	50p	2SD-721	150p				
		2SA-921	10p	2SB-673	80p	2SC-1520	85p	2SC-2575	25p	2SD-725	350p				
		2SA-940	50p	2SB-681	250p	2SC-1550	60p	2SC-2577	125p	2SD-745	250p				
		2SA-950	25p	2SB-686	120p	2SC-1567	60p	2SC-2579	130p	2SD-748	150p				
		2SA-958	70p	2SB-688	130p	2SC-1568	60p	2SC-2580	175p	2SD-761	50p				
		2SA-962	60p	2SB-695	325p	2SC-1573	40p	2SC-2581	200p	2SD-773	30p				
		2SA-964	65p	2SB-705	200p	2SC-1577	800p	2SC-2582	40p	2SD-781	30p				
		2SA-965	25p	2SB-716	30p	2SC-1584	600p	2SC-2603	20p	2SD-788	30p				
		2SA-966	25p	2SB-717	70p	2SC-1627	30p	2SC-2611	40p	2SD-789	25p				
		2SA-968	70p	2SB-718	70p	2SC-1667	150p	2SC-2631	40p	2SD-792	340p				
		2SA-970	15p	2SB-738	25p	2SC-1669	85p	2SC-2634	40p	2SD-794	60p				
		2SA-984	30p	2SB-744	25p	2SC-1670	85p	2SC-2660	85p	2SD-822	400p				
		2SA-985	65p	2SB-755	310p	2SC-1675	20p	2SC-2688	50p	2SD-836	85p				
		2SA-992	30p	2SB-757	350p	2SC-1677	80p	2SC-2753	50p	2SD-837	80p				
		2SA-999	20p	2SB-764	25p	2SC-1708	20p	2SC-2781	50p	2SD-838K	475p				
		2SA-1015	20p	2SB-772	45p	2SC-1722	60p	2SC-2785	50p	2SD-845	250p				
		2SA-1016	20p	2SB-792	45p	2SC-1756	40p	2SC-2791	325p	2SD-850	260p				
		2SA-1020	30p	2SB-793	35p	2SC-1758	30p	2SC-2792	275p	2SD-859	100p				
		2SA-1048	20p	2SB-817	200p	2SC-1760	85p	2SC-2944	175p	2SD-863	70p				
		2SA-1060	90p	2SB-837	60p	2SC-1775	20p	2SC-3078	40p	2SD-869	320p				
		2SA-1062	125p	2SB-856	60p	2SC-1815	15p	2SC-3156	325p	2SD-870	320p				
		2SA-1094	190p	2SB-857	60p	2SC-1819	50p	2SC-3179	200p	2SD-871	320p				
		2SA-1095	275p	2SB-861	60p	2SC-1845	20p	2SC-3182	250p	2SD-880	40p				
		2SA-1102	180p	2SB-886	65p	2SC-1846	45p	2SC-3284	175p	2SD-882	70p				
		2SA-1104	200p	2SC-789	50p	2SC-1848	45p	2SC-3298	120p	2SD-898B	260p				
		2SA-1106	200p	2SC-790	80p	2SC-1875	260p	2SC-3506	250p	2SD-917	180p				
		2SA-1110	60p	2SC-815	15p	2SC-1890	20p	2SC-3519	150p	2SD-951	175p				
		2SA-1123	40p	2SC-828	25p	2SC-1906	30p	2SD-198	180p	2SD-982	80p				
		2SA-1141	200p	2SC-829	20p	2SC-1909	250p	2SD-200	210p	2SD-985	80p				
		2SA-1142	65p	2SC-839	25p	2SC-1913	100p	2SD-234	40p	2SD-1128	80p				
		2SA-1145	60p	2SC-929	20p	2SC-1914	30p	2SD-235	40p	2SD-1134	80p				
		2SA-1146	190p	2SC-941	25p	2SC-1922	275p	2SD-288	80p	2SD-1135	90p				
		2SA-1147	190p	2SC-945	20p	2SC-1923	20p	2SD-299	160p	2SD-1138	60p				
		2SA-1156	60p	2SC-959	65p	2SC-1941	40p	2SD-313	40p	2SD-1153	50p				
		2SA-1180	200p	2SC-984	40p	2SC-1942	190p	2SD-315	75p	2SD-1207	50p				
		2SA-1220	50p	2SC-998	300p	2SC 1945	250p	2SD-325	45p	2SD-1265	100p				
		2SA-1232	175p	2SC-1162	35p	2SC-1969	160p	2SD-331	80p	2SD-1267	140p				
		2SA-1262	65p	2SC-1172	150p	2SC-1980	25p	2SD-400	20p	2SD-1273	100p				
		2SA-1265	150p	2SC-1173	45p	2SC-1986	60p	2SD-401	50p	2SD-1275	125p				
		2SA-1282	35p	2SC-1195	200p	2SC-2003	25p	2SD-414	40p	2SD-1276	125p				
		2SA-1386	275p	2SC-1212	60p	2SC-2009	60p	2SD-421	60p	2SD-1397	200p				
		2SB-507	100p	2SC-1213	60p	2SC-2022	60p	2SD-424	250p	2SD-1398	170p				
		2SB-509	100p	2SC-1214	40p	2SC-2026	45p	2SD-426	150p	2SD-1426	275p				
		2SB-511	100p	2SC-1222	20p	2SC-2057	25p	2SD-427	150p	2SD 1427	275p				
		2SB-511	100p	2SC-1226	75p	2SC-2068	50p	2SD-428	150p	2SD-1432	400p				
		2SB-512	100p	2SC-1306	75p	2SC-2073	50p	2SD-438	45p	2SD-1439	200p				
		2SB-514	100p	2SC-1317	25p	2SC-2120	15p	2SD-461	100p	2SD-1441	200p				
		2SB-527	40p	2SC-1318	25p	2SC-2153	40p	2SD-468	25p	2SD-1453	170p				
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		2SB-531	200p	2SC 1328	25p	2SC-2230	30p	2SD-476	60p	2SD-1497-06	520p				
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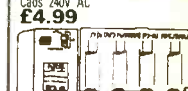

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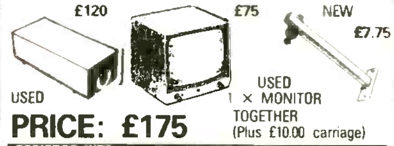

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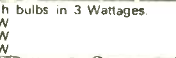

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COVER PHOTO

This month's cover photograph shows the Panasonic G deck. See article on pages 492-6.

CORRECTION

An error occurred in the Camcorder Notebook feature last month. See note on page 507.

Mixed Fortunes

First the good news. CTV receiver manufacture in and exports from the UK have been running at record levels recently. One knows why of course. Because of the success of foreign-owned firms in using the UK as a European manufacturing base. We can't complain about this. Foreign investment in the UK is wholly welcome when it brings jobs and economic well-being and strengthens the country's manufacturing sector. Little snippets keep coming out to suggest that Japanese manufacturers are well satisfied with the progress of their UK subsidiaries, for instance the news that Toshiba has added TV tuner manufacture to the activities at its Plymouth factory, creating thirty new jobs with more to come. It's clear that the Japanese firms active in TV/video manufacture in the UK have succeeded where the indigenous firms failed – in being able to take a long-term view, riding out downturns in the UK market and steadily building up production of sets that can be sold wherever market opportunities arise.

The bad news comes with the announcement that Thomson Consumer Electronics is to close its research and development laboratory at Enfield. Finance of course plays a part in this. TCE's losses increased considerably during the last financial year, and savings have to be made somewhere. But the Enfield laboratory was the flagship of research and development in the consumer electronics field in the UK. Its loss is a grievous blow to the tradition of TV development in this country. It seems that the closure of the Enfield laboratory was to some extent a consequence of the BSB debacle, another sorry event. The theme of TCE's international R and D activities, as outlined in an article in our July 1990 issue, is that laboratories in different countries specialise to some extent, contributing particular expertise to the overall programme. Naturally MAC technology was a major part of Enfield's know-how. With BSkyB abandoning MAC the system's future has been placed in considerable doubt. Other countries are obviously reluctant to commit themselves to MAC when they find that up- and down-linking PAL is quite satisfactory. This is tragic because MAC represented a way forward for TV technology, by using time-compression to separate the chrominance and luminance signals and avoid all the compromises that had to be made with the original compatible colour TV systems. MAC would have been an unthinkably complex approach to the provision of a domestic service only a few years ago. It represents an outstanding example of the way in which technological advance, in terms of the cost of processing signals, can make what was previously unthinkable a practical proposition.

Ferguson has apparently been badly affected by the poor satellite TV market in the UK at present. It was hoped that the merger of Sky and BSB would lead to an upsurge in satellite TV installations. So far this hasn't happened, either because the public is strapped for cash or maybe because the demand for satellite TV has been largely satisfied for the time being. BSkyB is to press ahead with an extensive promotional campaign. But here again there are money problems. Despite the merger, satellite TV broadcasting in the UK represents a cash drain and the prospect of profitability seems continually to slip over the horizon. We don't expect BSkyB to collapse as BSB did, but there is nevertheless a question mark over its viability. Failure of satellite TV sales to take off has badly affected Ferguson's financial planning: the problem was compounded by Ferguson's considerable involvement in BSB's technology.

All this leaves the UK with very little involvement in the future of TV, apart from assembling sets and making and watching programmes. One can't help but wonder whether the decision to remove the engineering side from the IBA's successor, the ITC, and privatise it in the form of National Transcommunications Ltd. (NTL), combined with the financial pressure placed on the BBC, has been wise. From an early stage the BBC provided a public broadcasting service in the fullest sense. Not only programmes but transmission facilities and research. When the IBA (ITA originally) was formed it adopted a similar approach. One result has been the BBC's and IBA's tradition of technological innovation, which has brought great benefit to UK viewers and industry alike. There are plenty of examples: standards converters leading to digital TV throughout the TV chain, satellite TV systems, teletext, sound-in-syncs and Nicam to mention only a few. These major developments sprang from the integrated broadcasting operations in the UK. Would they have been conceived, developed and brought into practice without the broadcasters having their own R and D facilities and programmes? It seems doubtful. The idea of setting up NTL is to maximise the use of its expertise by entering new fields. But the broadcasters have represented committed clients with a two-way approach: broadcasting needs could be dealt with in-house, while ideas from the technical side could be assessed, tested and brought into operation. It seemed to work rather well. Now all this is being axed in the interests of the present predominant liberal economic theory. Maybe NTL will do very well as an independent operation. We certainly wish it well. But, with the close connection with a broadcasting operation severed, will it be willing and able to carry out a continuous programme of R and D work on radio and TV transmission and reception? Again, it's questionable. The financial pressures put on the BBC seem likewise intended to ensure that as many of its needs as possible, including technical ones, will be provided by outside concerns. The R and D activities traditionally carried out by the BBC and the IBA have given the UK an international lead in many aspects of radio and TV. It's difficult to see how this can continue under the new regime. What it all means is less development in the UK, affecting industry as well as broadcasting.

The Development of Compact Camcorders

George Cole

Thanks to developments in head, tape and chip technology today's camcorders are remarkably small. The bulky tubes used in earlier models have been superseded by smaller and lighter CCD image sensors while sophisticated l.s.i. chips with high-density component mounting have enabled the circuitry to be squeezed into ever smaller spaces.

Fig.1 shows the trend in camcorder weight for Sony models from the early Eighties to 1990. The SL-F1 and HVC-F1 were portable Betamax VCR/camera combinations that weighed over 7kg (all weights quoted are without battery and cassette). The first domestic camcorder, the BMC100 Betamovie, weighed around 2·5kg. Sony's latest model, the CCD-TR45, weighs just 690g – for comparison my 35mm SLR camera weighs 665g without battery and film.

A wide range of full-function camcorders all weighing less than 1kg is now available. In this article we'll take a look at the techniques used by various companies to produce these lightweight models. But first a brief recap on the two mini-camcorder formats, VHS-C and Video 8.

Camcorder Formats

VHS-C was originally designed by JVC for use in portable VCR/camera combinations. It uses a cassette that's a third of the standard VHS size. Compatibility with standard VHS is maintained by slotting the VHS-C cassette into a full-sized VHS adaptor that allows it to be played by any standard VHS deck.

It seems that JVC didn't initially plan to introduce VHS-C camcorders. This conclusion appears to be confirmed by the fact that it was one of the five companies – the others being Sony, Matsushita, Hitachi and Philips – that proposed an 8mm video format for portable video. But in 1983 JVC brought out the GR-C1, the first VHS-C camcorder.

VHS-C recordings have standard VHS track dimensions to maintain compatibility. This was made possible by several technical adjustments. First the drum size was reduced from the standard 62mm diameter to 41·3mm (see Fig. 2), the tape wrap being increased from 180° to 270° to maintain the standard track length. The drum has four heads instead of two and the drum speed, with PAL machines, was increased from 1,500 to 2,250 r.p.m. (i.e. from 25Hz to 37·5Hz).

Video 8 was designed to take advantage of the technological advances that had occurred since the launch of VHS. It uses newly developed heads and high-density metal tape. The 40mm diameter drum makes the camcorders very compact. Since the initial models a miniature version of Video 8 has been developed however. It uses the same size-reduction techniques as VHS-C. First, see Fig. 3, the drum diameter was reduced to 26·7mm with, in PAL machines, the drum speed increased to 2,250 r.p.m. The tape wrap was increased from 221° to 292°. The first mini Video 8 model was Sony's CCD-V88, launched in 1988.

The Sony CCD-TR55

Sony's CCD-TR55 introduced in 1989 was a palm-sized camcorder (see accompanying photograph) weighing just 790g yet offering various functions including a selection of fast shutter speeds, digital superimposition and edit facilities. Its 0·5in. CCD image sensor has 320,000 pixels. During the design stage Sony looked at four ways of reducing the size of a Video 8 camcorder: (1) by using a mini head drum; (2) by filling any available space; (3) by using smaller and lighter materials; and (4) by developing a smaller Video 8 cassette. Sony decided to rely on the first three methods and discard the fourth as it could cause marketing problems. There are suggestions however that a mini-8 cassette has been developed for future personal applications.

The CCD-TR55's compactness was largely due to the use of a drive mechanism called FL (which apparently

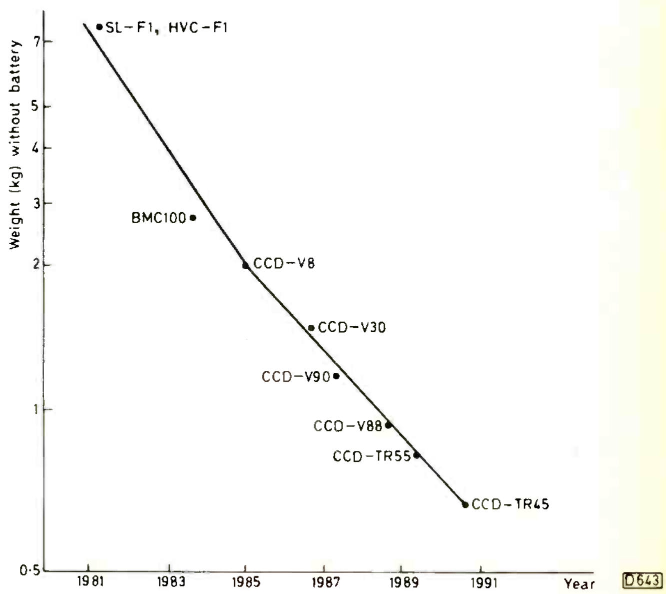

Fig. 1: Reduction in the weight of Sony portable video equipment/camcorders over the decade 1981-91.

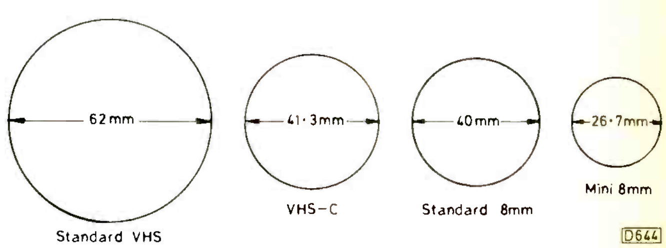

Fig. 2: Camcorder drum sizes.

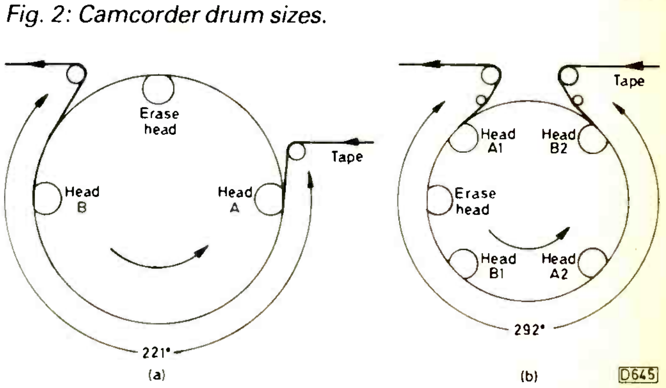

Fig. 3: Standard 8mm (a) and mini 8mm (b) head arrangements.

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The Sony CCD-TR55 Handycam.

stands for flat and light). Fig. 4 compares it with a conventional Video 8 mechanism. While the latter has dimensions of 120×100×56mm and weighs 402g the FL is 82×105×29mm and weighs 185g. Size reduction was helped by placing the motor inside the drum rather than beneath it. The flat omega-loading system has the tape guides at approximately the same height as the cassette.

The CCD-TR55 also made use of some of the dead space inside a Video 8 cassette: a linear skating (LS) mechanism slides the drum into the top section of the cassette. Other size reduction methods included a four-layer PCB which contains the camera, VCR, power and earth circuitry, with a component density of ten per square centimetre of board. Multiple-layer PCBs have long been used in the computer industry but Sony claim that the CCD-TR55 was the first domestic camcorder to use the technique.

A variety of smaller and lighter items were introduced with the CCD-TR55. Samurium-cobalt base plastic magnets replaced heavier ferrite-based plastic magnets, 0·4mm wide polyurethane belts were used instead of 1mm wide rubber belts and the diameter of the capstan motor was reduced from 37mm to 25mm.

The CCD-TR45 introduced last November brought the weight down further, to just 690g. Weight reduction with this model was achieved by using a 1/3in. CCD image sensor with 320,000 pixels mounted directly on the camera block, thus removing the need for mounting and coupling materials.

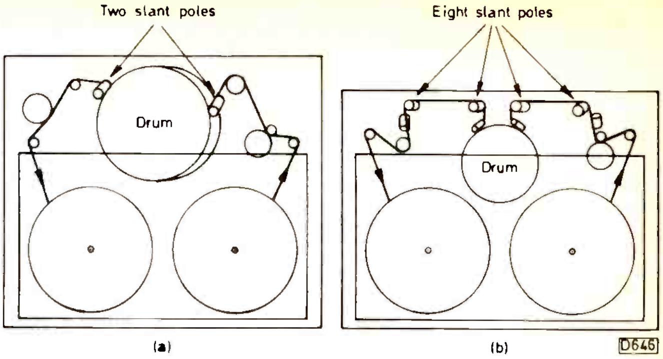


Fig. 4: Basic layout of a standard Sony 8mm deck (a) and the Sony FL deck (b).

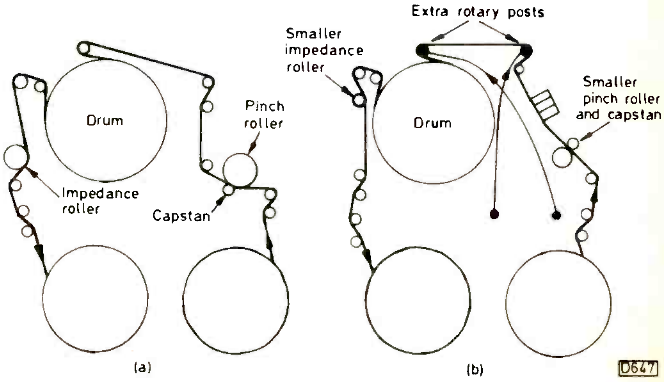


Fig. 5: Standard VHS-C tape loading (a), tandem loading arrangement used with the Panasonic C1 deck (b).

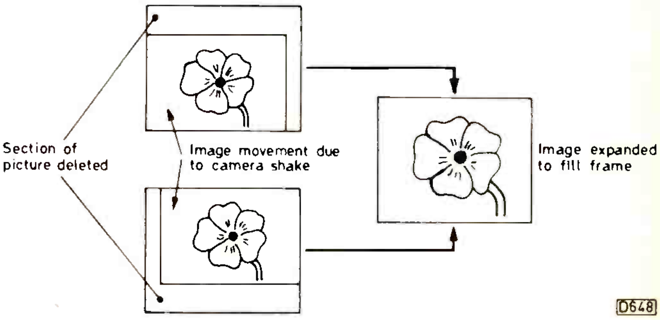


Fig. 6: The Panasonic electronic image stabiliser (EIS) system: how compensation for camera shake is provided by deleting part of the outside of the picture and expanding the remaining section.

Panasonic NV-S1

Panasonic's NV-S1 VHS-C camcorder is designed to be held vertically in one hand (see photograph) and weighs 750g. It has a 1/3in. CCD image sensor with 270,000 pixels and like the CCD-TR55 uses a four-layer PCB (with a component density of 11 per square centimetre) and a smaller, lighter drive mechanism, the C1. This measures 103×115×39·4mm and weighs 275g, compared with a conventional VHS-C mechanism measuring 105×120×48mm with a weight of 386g.

The C1 deck uses a new tape loading arrangement with two rotary posts (see Fig. 5) to reduce tape tension. In addition to improving the tape transport characteristics the posts enable the NV-S1 to use smaller pinch and impedance rollers and a lighter capstan motor that weighs 33·1g compared to the 59·5g of a capstan motor of

Panasonic's NV-S1 camcorder, designed to be hand-held.

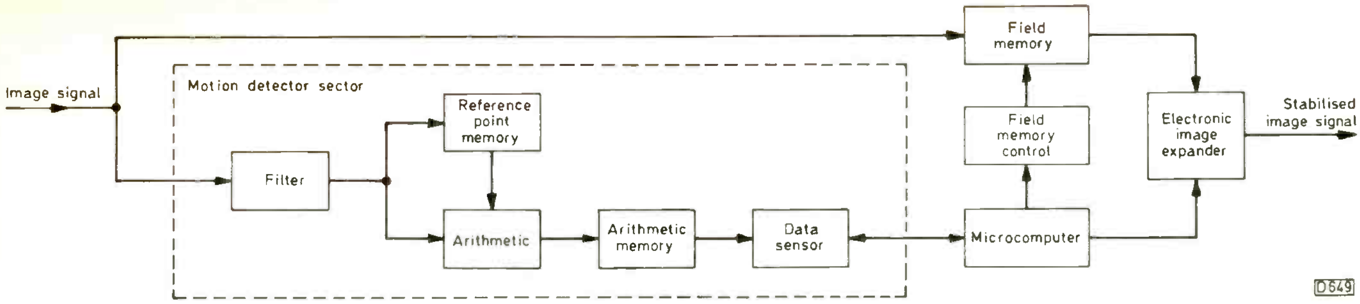


Fig. 7: Block diagram of the EIS electronics.

conventional design.

Use of a cylindrical three-layer rotary transformer and a new motor enable the drum height to be reduced from 45·2mm to 29·6mm with the weight reduced from 119·1g to 79g. Another weight saving feature is the 1/3in. aspheric lens system which has just seven lens elements and weighs 60g. Conventional 0·5in. spherical lens systems have thirteen elements and weigh 170g. Aspheric lens technology is over fifteen years old but used to be very expensive because each lens had to be ground. Today's aspheric lenses are moulded.

One of the problems with small, light camcorders is that they tend to be unstable, so that shots suffer from camera shake. To reduce jitter Panasonic developed its electronic image stabiliser (EIS) system. Figs. 6 and 7 show how this works. Each image is held in a field store and is analysed at thirty reference points. These points are compared with software stored in the motion detector: the software is designed to distinguish between camera shake, smooth panning and movement of the subject while the camcorder remains still. If camera motion is detected a border consisting of fifteen per cent of the total image is removed, the remaining 85 per cent of the picture being enlarged electronically to compensate. The process results in some picture deterioration, but Panasonic feel that the results are acceptable for most purposes.

JVC GR-AX7

The GR-AX7, launched in Japan as the GR-LT5, is JVC's contribution to camcorder miniaturisation. It measures 106×116×162mm and weighs 750g. The LT (light and thin) deck is 37 per cent smaller than a conventional mechanism, the weight reduction being 22 per cent. To reduce the camcorder's thickness the drum is positioned horizontally. Incorporating the motor in the drum and mounting the transformer close to the drum shaft has reduced the drum size by 33 per cent. The size of the motor has been reduced through the use of rare earth magnets. The GR-AX7 has a four-layer PCB with high-density component mounting.

Canon E6

Canon's E6 Video 8 camcorder uses a mini head drum and a newly-developed internal-focus lens system to reduce its weight to 900g. The new lens system has twelve elements arranged in ten groups. This compares with fourteen lenses in twelve groups in other Canon camcorders.

In most lens systems a large front lens moves to bring the image into focus. With the internal-focus lens however focusing is achieved by moving a small group of lenses behind the front lens. As a result the focus motor can be made smaller and lighter. The internal-focus lens system is 71mm long, weighs 110g and has a volume of 98cc. This compares with 105mm, 160g and 233cc for Canon's normal lens systems.

Sanyo and Hitachi Models

The Sanyo VM-ES88 and Hitachi VM-C1E combine light weight with unusual designs.

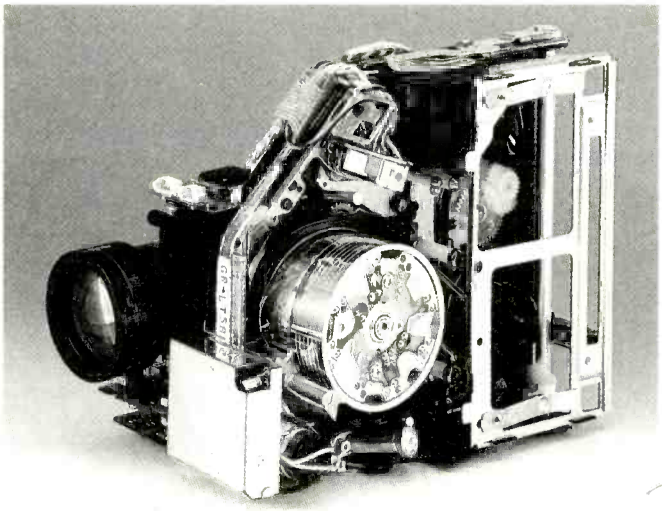
The VM-ES88 is a horizontal design intended to be held with both hands. It uses a mini 8mm drum and weighs 790g. The horizontal position of the drive mechanism improves stability, especially if the camcorder is knocked.

Hitachi's VM-C1E weighs 980g. It's width is reduced to 69mm by means of a folding camera system. When the camcorder is being carried about the camera head is folded through 90° so that it lies in a vertical position. To shoot, the user simply twists the front of the camcorder through 90°.

The Future

Camcorder size is now being affected by practical and ergonomic factors. By incorporating all the digital processing in a single chip and using smaller and lighter batteries it will be possible to produce a camcorder that weighs less than 500g. But do users really want micro-sized camcorders? Humans like objects that fit comfortably in the hand and aren't too keen on tiny buttons and switches. Another difficulty with lightweight camcorders is the previously mentioned tendency for camera shake to occur.

Another problem is that design compromises are having to be made. For example Canon's E6 cannot offer manual focusing because its lightweight lens system precludes this. Similarly Sony's CCD-TR45 is too small to be able to offer manual focusing.



Internal view of the JVC GR-AX7, from the deck side.

Long-distance Television

Roger Bunney

February was a wonderful month for long-distance TV reception. There was a little Sporadic E propagation and a small tropospheric opening but the main feature was really intense F2 layer signal reflection during much of the month, with many reports of Australian, Gulf and Thai TV reception and other exotic signals.

There was a short-lived but intense tropospheric opening on the 19th, with Band III and u.h.f. reception from Sweden, Norway, Denmark, Germany (ARD, NDR1/3, WDR, ZDF and West-3 transmitters) and the Benelux countries in eastern, central and NW areas of the UK.

Considering the time of year SpE was fairly active. The collated log is as follows:

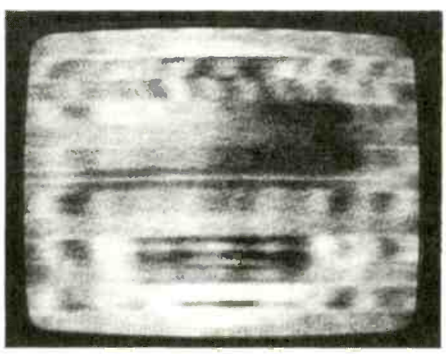
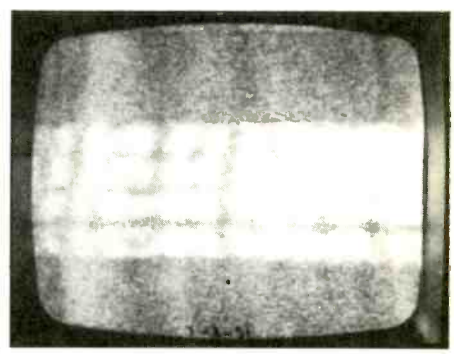
5/2/91 TVE (Spain) Chs. E2, 3; RAI (Italy) ch. IA.
7/2/91 CST (Czechoslovakia) R2; TSS (USSR) R2; DR (Denmark) E3; RUV (Iceland) E4; YLE (Finland) E4; NRK (Norway) E3; SVT (Sweden) E3.
13/2/91 TVE E2, 3.
14/2/91 +PTT (Switzerland) E3; ARD (Germany) E3.
16/2/91 TVE E3; TVP (Poland) R1.
17/2/91 CST R1; HTV (Yugoslavia) E3.
24/2/91 TVE E2, 3.
26/2/91 TVE E2, 3.
27/2/91 +PTT E2, 3; TVE E2.

The F2 log resembles that of a good SpE month:

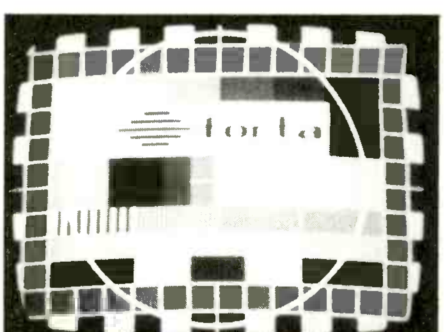
5/2/91 Unidentified R1/E2 signals.
6/2/91 Australia ch. 0 DDQ-0; Dubai E2; TSS R1; unidentified R1/E2 signals. A 525-line signal was received on ch. R1 at 0925.
7/2/91 Iran and Dubai E2; TSS R1.
8/2/91 TSS R1; Australia ch. 0.
9/2/91 Australia DDQ-0; 525-line A2 signal received at 1400; unidentified R1/E2 signals.
10/2/91 Unidentified E2 signal.
11/2/91 IRIB (Iran) E2; Dubai E2; DDQ-0; TSS R1; TSS via back-scatter at 1400; VOK (Voice of Kenya) E2 at 1413.
12/2/91 Australia ABMN-0; Dubai E2; unidentified R1/E2 signals.
15/2/91 DDQ-0; Dubai E2; TSS R1; unidentified E2 signals.
16/2/91 Thailand E2; Dubai E2; Iran E2; TSS R1; 525-line R1 signal at 0925; unidentified Australian ch. 0 signal.
17/2/91 GBC (Ghana) E2 via TE; VOK E2; China C1; TSS R1.
18/2/91 DDQ-0 and ABMN-0; NZ (New Zealand) ch. 1 logged on three offsets; TSS R1; China C1, 2; RTM (Malaysia) E2; Thailand E2; Iran E2; Dubai E2; ZTV (Zimbabwe) E2; unidentified A2 signal.
19/2/91 Very much as on the 18th!
20/2/91 Unidentified ch. R1/E2 signals.
22/2/91 Iran E2.
23/2/91 Dubai E2; Iran E2; VOK E2.
25/2/91 Dubai E2.
27/2/91 TSS R1; DDQ-0.
1/3/91 TSS R1; Dubai E2; Iran E2.

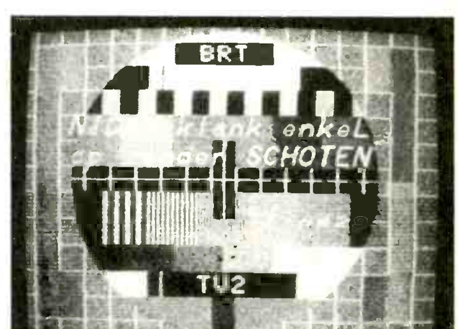
An impressive list! To aid signal identification a list of transmitters with known offsets will follow next month. Any extra information on offsets would be appreciated. Obviously a scanner is required to check channel offsets.

The 525-line R1 signal has since been received occasionally, often with a test grid. Can anyone suggest the source of this mystery signal? Garry Smith has at last identified an F2 PM5544 test pattern received back in 1989 as reception from Iraq – a logo following the start of programmes provided confirmation. Whether the transmitter still exists is not known.

Left: News at Ten from ITN received in Queensland, Australia by George Palmer via a C-band feed, using a 16ft. dish. Centre: Garry Smith, Derby, received this test pattern in October 1989 via F layer reflection. It has since been identified as Iraq ch. E2. Right: A remarkable shot of the DDQ-0 logo "WIN Queensland" received in Holland by Ryn Muntjewerff.



Left: Test pattern from Forta TV, an independent TV station in Spain, received via the Eutelsat craft at 7°E. Centre: American Forces TV (AFN-TV) Berlin test pattern, photo from Erhard Schwarz. Right: BRT (Belgium) PM5544 test pattern, with extra lettering to indicate that Nicam stereo TV sound tests are being carried out.

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Voice of Kenya ch. E2 from Kisi was a good F2 catch by Tim Anderson. VOK is on-air from 0900 GMT. Tim is currently experimenting with the production of computer-enhanced pictures using his Amiga and IBM computers: this may result in identification of some of the poorer signals received. If anyone has experience of this technique drop us a line and we'll put you in touch with Tim at St. Leonards. Tim reports that there's an E3 transmitter in Spain operating at 55·275MHz – it's been received and identified in the UK. It seems that there's a Chinese C1 transmitter operating at 48·50MHz – signals at this frequency have been heard and measured.

My thanks to Simon Hamer (Powys), Tim Anderson (St. Leonards), Garry Smith (Derby), Cyril Willis (King's Lynn), Roger Fussell (Torpoint) and Ryn Muntjewerff (Holland) for sending in reception logs.

Todd Emslie (Australia) mentions likely reception of the Norwegian Varanger transmitter on 14/2/91 at 0014-0017 and 0023-0026 GMT, the carrier being measured at 48·2496MHz, also either Steigen (NRK) or Grunten (Germany) at 48·2605MHz from 0020. Todd uses the AR3000 scanner, which has proved to be very accurate and sensitive. Another Australian report comes from Nicholas Earley in Victoria. He mentions that several stations are now transmitting UK/US news material. In Melbourne CNN is available on ch. 10 from midnight to 0630 (sometimes from 2250 depending on the last programme). The same station carries the BBC's 1800 news at 0530-0600 local time. ITN World News is available on ch. 9 from 0630 on weekdays, with many TV-AM insertions. So take care with F2 reception as BBC or ITN can be received via back-scatter in the UK, confusing the issue.

The mystery 47·645MHz "This is a test transmission from the East Tower" f.m. signal mentioned in a previous column seems to have been a test transmission from the BBC TV Centre in London. It has now ceased.

Ken Kirkley in Botswana has been experimenting with Ku band reception on his 16ft C band dish. Signals have so far eluded him but he reports that a dish installer at Harare (Zimbabwe) receives Astra transmissions with an 8m dish with very acceptable results on all channels.

News Items

Scandinavia: The Norwegian government has agreed to the formation of a second national TV network. It would be financed by advertising and would operate with a ten-year licence. MTV in Finland is now transmitting a breakfast show called 'Huomenta Suomi' at 0430-0640 GMT weekdays over the YLE-3 network. A third Danish TV network has been formed by the Lifacto group. Kanal Denmark is now in operation with almost nationwide coverage.

Italy: A new network 'TV-7' is at an advanced planning stage. It will have thirty stations in main population centres giving national coverage.

Holland: The arrangement of the Dutch network is being altered following increased competition from other services, particularly RTL-4. Channel 1 will have material from the KRO, NCRV and EO religious organisations plus additional NOS input; channel 2 will consist of AVRO, TROS and Veronica; channel 3 will have VARA, VPRO and NOS material. The new arrangement will come into operation at the beginning of October. RTL-4 now has thirty per cent of the viewing audience. Canal Plus is to provide a service in Holland and the Dutch-speaking part of Belgium.

Ireland: The Department of Communications, Radio Section, has invited applications for licences to provide TV services in the 2·5GHz band. Coverage of the country is based on "cells", 29 in all, that serve areas with a radial distance of 10-30 miles. Details can be obtained from the Department at Scotch House (Room 1·07), Dublin 2.

Austria: ORF is to use the German dual-subcarrier sound system giving mono/stereo/bilingual sound.

Chile: The second network has been taken over by a commercial organisation, Megavision. Services are available in Santiago and Valparaiso and will be extended to the rest of the country, with 21 transmitters, over the next two years. The government has given approval to the establishment of a 2·5GHz network that will provide up to 16 channels per town. Transmitter powers at up to 200W will give coverage of up to 25km.

UK: The start of the BBC's Nicam service will coincide with the start of the Autumn schedules.

In brief: The Czechoslovakian OK3 network is to be privatised . . . Relaxation of the laws relating to foreign investment in New Zealand may help TV3 survive – Nicam transmissions are being extended.

Satellite TV

The EBU is to reserve four widebeam 72MHz transponders in the new Eutelsat II series, with options on another two, all to come into operation in mid-1995. The two extra Astra 1C transponders will be higher-power ones operating outside Ku band for HD-TV options. Astra 1D will have four higher-powered transponders for possible HD-TV use.

Following German reunification full use is now being made of the DFS1 and DFS2 satellites. Consideration is being given to a DFS3 satellite with a higher transponder load.

The USSR is planning a DBS service. The Romatis system would use medium-powered transponders with up to 40 TV channels per satellite, giving 50dBW levels via four steerable aerials for pan-European coverage.

Private Satellite Network Inc. in the USA has demonstrated transmission of both analogue and digital signals over a common transponder. The tests are in readiness for a proposed Pay-TV DBS service.

The Satellite Digital Broadcasting Company in Japan is to begin digital sound broadcasting on a 24-hour basis. It's claimed that CD quality will be achieved, initially with a 32kHz sampling rate and a dynamic range of 80dB – these will be increased to 48kHz and 90dB respectively at a later date. The transmissions will be via the NHK's BS3a satellite.

Italsat at 13°E has been carrying out a series of test transmissions in the 20GHz band, also propagation tests at specific frequencies in the 30 and 40GHz bands.

French Channel J

The seventh French TV network, the children's Channel J, came into operation on March 30th. Transmissions are via satellite and the following terrestrial channels: Paris L35, Saint-Quentin L36, Lens L35, Lille L32, Amiens L55, Le Mans L51, Angers L58, Caen L63, Nantes L44, Tours L30, Orleans L33, La Rochelle L54, Bordeaux L40, Toulouse L50, Angouleme L36, Montpellier L34, Bayonne L42, Montlucon L55, Nimes L56, Clermont-Ferrand L64, Grenoble L65, Toulon L63 and Avignon L57.

Worldwide VHF Transmitter List

Gunter Lorenz has produced a thorough listing of main Band I and Band II (to 108MHz) TV transmitters throughout the world. Called *44-108MHz TV Stations Worldwide* it's a useful guide for TV-DXers. There are 40 A4 pages plus a soft cover and the listing is correct as of September 1990. Details include frequencies with offsets, transmission system, location, powers and aerial/site height where known. Details of other publications are given, including one for scanner use as applied to DX-TV use. The listing is available for DM10, a worldwide price including air mail, from Gunter Lorenz, Mittlerer Graben 35/37, 8050 Freising, Germany; also from HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR at £5·85 in the UK or £6·25 in continental Europe.

Letters

FRAUDULENT REQUESTS

I wonder whether others have noticed that the number of repairs received because of "accidental damage" has increased during the present period of financial hardship? Job cards reading along the lines of "dropped" or "pipe burst into unit" are usually followed by comments like "written estimate required" or "give insurance estimate". In most cases the circumstances are extremely suspicious and in some cases are clearly fraudulent. Is the idea to generate cash? Drop the camcorder, claim a few hundred pounds to pay the mortgage, and do without one until there's more money about?

There's an element of blatant cheek with some of these requests. Like: "Water inside unit – confirm. Customer will buy a Panasonic J30 replacement from us"! It seems that some customers expect dealers to be as crooked as themselves. For example a very modern camcorder that had allegedly been dropped was recently brought in. The customer said he wanted a new unit and would buy one from us provided the unit brought in for repair was written off. As a side issue, customers are wrong in thinking that dealers can provide a letter saying a unit is written off: the decision as to whether the unit is worth repairing is ultimately the insurance company's or the customer's if he is paying – dealers simply provide the facts.

Returning to the camcorder, the repair that was required was relatively straightforward though three hours' labour was necessary because of the amount of dismantling involved. The symptoms were not consistent with the unit having been dropped, and there were no signs of physical damage inside or out. So a written estimate for £130 was prepared. The owner insisted on being handed this in the shop and when he read it proclaimed "this is no good, I want it written off". We carried out the repair after some argument but were never thanked despite our efforts to get it done in time for "an important family event".

Another recent case of an allegedly dropped machine related to a VCR. Again there was no sign of damage. The complaint was of creasing tapes, which the machine didn't, and "could we advise on the condition of the heads etc.?" We drew up a report saying that we could find no real fault though the heads were slightly low in that while perfectly o.k. for play/record they did produce severe noise bars in review. The customer then asked for a written estimate to say that the heads had been damaged by the fall. We replied that the fault was almost certainly simply a matter of wear and that if the insurance company asked, as they usually do, they would be advised to this effect. When we enquired about the nature of the fall, since there was no physical damage, we were told that it had been dropped from the customer's lap on to a carpet! He then asked for a letter stating that the repair was to replace something else that could have been damaged by the fall, of the same cost as the heads. We politely declined.

Do customers think that dealers are stupid and/or crooked? Do they think that insurance companies pay out without question and don't contact dealers, and that an obviously deliberately damaged unit or one that's perfectly all right will be replaced/paid for by an insurance company? The answer seems to be yes.

Fraudulent insurance claims are a cost to us all, since

they affect the premiums demanded. In this respect it's worrying that insurance companies often put little effort into avoiding such claims. I suppose that in most cases it's cheaper just to pay up. But it does seem very wrong.
William T. Nawser,
Bideford, Devon.

VCR PUZZLE

I have two almost new Amstrad VCR6100s with very similar faults. One goes into standby after ejecting a cassette while the other does the same when fast forward is selected – it goes to fast forward for half a second then off (it's not a rotation sensor fault – the unit takes five seconds or so to switch off when the take-up reel is stalled). The faults are mechanical: if the decks are swapped the faults remain with the deck. All motors have been replaced, as have the mode switch PCBs and the main cams. It looks as though the loading motor is overrunning, putting the mechanism into a prohibited state for the mode selected. All that Amstrad can say is "when you've found the cause, please let us know". I haven't! Has anyone else? I'm sure I'm not the only one to have come across it.
Richard Flowerday, Harborne TV Services,
Harborne, Birmingham.

AN ECONOMY

May I suggest that if you need a service manual for the Saisho VR1200HQ, the Matsui VX820 or the Orion VSP10 you buy the one for the Hinari VXL35? It's the one that the others are photocopied from. If you need parts, get Hinari sourced ones – they are much, much cheaper. Here's an example: the limiter post assembly is Matsui part no. MA850A600039, £2·95 from CPC; it's Hinari part no. HN850A600039, 89p from the same supplier. A very common fault is that the plastic cracks and the pin drops out.
Michael Dranfield,
Buxton, Derbyshire.

USER UNFRIENDLY

I would like to join those calling for VCRs that customers can understand without a degree in computer programming and a magnifying glass, also TV sets that have sound quality approaching that of most basic sets of about five years ago, with adequately-sized, front-facing loudspeakers. A considerable amount of my time is spent teaching customers how to use their new equipment. They thoroughly appreciate this, and hopefully it will lead to recommendations. But the situation shouldn't arise. Please, could just one manufacturer take note? Here are some examples of recent calls:
(1) Called out to replace aerial. Customer has recent Philips TV set and a new Toshiba VCR. When I called up the VCR on-screen display he was amazed and had never seen this before. There was considerable beat patterning, also interference from local radar. The machine had been delivered and "set up" by the supplier.
(2) Called out to service a VCR. While there was asked to comment on a new Nicam TV set just installed by a rental company. The customer was not particularly impressed. The bass and treble were set at minimum and the set to mono! Setting up improved the performance considerably, but the set had very poor side-facing speakers.
(3) Called out to adjust a new Mitsubishi set just installed by a department store (I was recommended by a neighbour). It was a very poor reception area, but fine tuning improved matters considerably. I was asked what teletext was, so I provided a full demonstration! Also gained job of replacing a ten-element aerial and indoor amplifier, installed by a large firm some months ago, with a grid aerial correctly positioned to avoid a tree. It gave very good results.
(4) Called out to resite loft aerial outside. New Mitsubishi set. Showed customer how to set on-screen display to read out which channel had been selected. He was suitably impressed.
(5) Called out to install satellite TV system. "While you're here, can you show us how to tune our Philips video so that we can record TV programmes? We've had it for two years but have used it only for bought tapes because we couldn't work it out."
(6) Called out to reset tuning with a Grundig TV set. It had been got at by toddler and the parents couldn't fathom it out.
(7) Called out to non-working satellite TV receiver. Children had locked parental lock! Parents didn't know about it.
(8) Called out to set up digital tuning on a Japanese hi-fi "IQ puzzle" that said "hello" once I'd worked out how to switch it on!
(9) Called out to remove digital car radio from new car and replace it with one with real knobs from old car.
(10) Called out to reset "normal" settings on a stereo TV set. During test find out that hi-fi stereo VCR is connected to the TV set via only an r.f. lead.

There are many more such examples, and I'm sure that we all suffer from the same problems. I'm certain that if suitable equipment was available and customers were then helped to make a sensible choice there would be much higher customer satisfaction – and then repeat trade.
David J. Thomas,
Test Valley Television, Andover, Hants.

BEAT THIS!

I repair monitors etc. and have just received a quote of $1,924 (yes, 1,924 dollars) from Digital for a circuit diagram for a 14in. RGB monitor (Model VR241A – Hitachi chassis). I was also informed that a technical manual would be extra. Can anyone beat this?!
Dannie Bonner, Computer Centre,
University of Keele, Staffs.

COST OF REPAIRS

A customer bought a new 14in. colour set from Granada for £130. After sixteen months it went wrong and she was given a repair estimate for £103. The customer brought the set back from London, where she works, and her parents asked me to repair it. There were three faulty transistors and another one was missing. The three faulty ones had not been removed for checking. Replacing the transistors brought the set back to life. Is this some sort of record in repair costs?
A.B. Snow, Snow Electrics,
Tewkesbury, Glos.

TWO PUZZLES

A chance conversation with another TV nut revealed that when he was an apprentice in a TV repair shop in York the proprietor had told him how, during the war, he had been stationed in Dover where his job was to monitor the German TV transmissions from the Eiffel Tower. My informant was under the impression that the old chap also said he had to feed the signals to London via a coaxial line. Fascinating! I managed to get in touch with the man in question, but here the trail went cold. He suffered a stroke recently and denied all knowledge of his monitoring when I asked him about it on the phone. Mindful of his frail state I didn't press him, and my original informant doesn't wish to get involved. I'm left wondering whether his stroke affected his memory or whether he didn't want to discuss with a stranger work that was secret. It's on record that these transmissions were received by the RAF in Sussex. Could anyone confirm whether they were also picked up at Dover and relayed to London?

Here's another puzzle. A number of publications, including the 1967 *World Radio and TV Handbook*, list a UK channel 14 (405-line system). It seems clear that it was never used. Does anyone know what it was intended for? It certainly appeared on some TV tuners in the Sixties – in fact I have one. So there's a clear indication that it could have been used, though I'm pretty sure that it wasn't. Perhaps someone can clear up the mystery of channel 14? Most tuners of the period had thirteen or twelve positions. I've seen a suggestion that channel 14 was for a third network, but a definitive answer would be better.
Andrew Emmerson, 71 Falcutt Way,
Northampton NN2 8PH.

DEAD ALBA/SOLAVOX VCRs

There appears to be a great deal of confusion about how the problem with the memory back-up capacitor C821 in these machines should be handled. The correct procedure is to replace the faulty capacitor and not to carry out the suggested bodge of adding a 4·7kΩ resistor. This is the only cure. It may in addition be found that the machine won't accept tapes. This means that the syscon microcomputer chip thinks the machine already has a tape in it. The cure is as follows. Disconnect the machine from the mains supply, manually load a tape until it's fully down inside the cassette housing, reconnect the machine to the mains supply then press eject. The job is now finished, apart from the usual dry-joints on the regulator block at the rear of the machine. The reason why the faulty memory back-up capacitor results in a dead machine is simply because it's part of the power supply.
M. Barratt, Martin's TV Services,
Dewsbury, West Yorkshire.

SATELLITE TV PUZZLE

Because of poor reception with my Amstrad 100 satellite TV receiver I changed the LNB. But there were still sparklies, especially on the German channels. The cable length is 20ft. Shortening it by one metre made matters much worse, so I came to the conclusion that either standing waves were to blame or that there was a mismatch between the LNB and the cable. Increasing the cable length to 40ft cured the problem completely, with no more sparklies. Can anyone explain this odd behaviour?
R.N. Baker, 17 Chapel Lane,
Upwey, Weymouth, Dorset DT3 5NA.

HELP WANTED/FOR DISPOSAL

Can anyone supply two combi coils for the power supply section of the old but popular NordMende 14in. colour set that was sold under the Ferguson and Baird brands as Models 3787 and 8180? Also the small double PCB containing the infra-red receiver, eject button and tracking controls used in the Baird/Ferguson 8948/3V55 VCRs (Ferguson can no longer supply this part). All costs would be met in full.
D.J. Thomas, Test Valley Television,
17 Charlton Road, Andover, Hants SP10 3JH.
Telephone 0264 355 291.

Can anyone supply any of the following? (1) A service manual/instructions for a Knight KG686 r.f. generator. (2) A circuit diagram for the Telequipment D67 oscilloscope, early version. (3) A circuit diagram for the Sovereign CTV6000. Any help would be much appreciated and all expenses paid.
J. Heesom, 28 Minden Gr.,
Sneyd Green, Stoke-on-Trent ST6 1RH.
Telephone 0782 219 444.

I'm restoring a Sony CV2000 videotape recorder, their first ever. It's a high-definition 405-line model of course! I'd be pleased to hear from anyone who has sales literature, accessories and the smaller bits and pieces that go with it.
Andrew Emmerson, 71 Falcutt Way,
Northampton NN2 8PH.
Telephone 0604 844 130.

Can anyone supply a replacement transformer (T511) for the PC887-002 power supply panel in the Thorn 9500/9600 chassis? The manufacturer has discontinued this item.
T.J. Steel, Francis House, Swimbridge,
Nr. Barnstable, North Devon EX32 0QG.

Can anyone supply a copy of the circuit diagram for a NordMende TV chassis type FC1 25V? The two service sheet specialists I've tried were able to supply only unreadable photocopies.
B.C. Carter, Calle Lilas 86V, Box 54,
Urbn La Sierrezuela, Mijas Costa,
Malaga 29649, Spain.

I'm finding it impossible to obtain the line timebase thyristors, RCA types S3900SF and S3901S, used in the *Television* colour receiver project dating from 1979/80. Can anyone supply them or suggest alternatives?
L. Noble, 260 Throston Grange Lane,
Hartlepool, Cleveland TS26 0UJ.
Telephone 0429 262081 (home) or 0429 266311 Ext. 246.

I have a Grundig TK24 valve audio tape recorder that's serviceable apart from needing a new volume control. I would like to swap it for a line output transformer for the Ferguson 1690 chassis (Model 3840). A serviceable second-hand one would do. Also does anyone have a circuit diagram for a Futuristic Hips Ltd. PA amplifier Model FAL120-6? It seems that the manufacturer is out of business.
M.K. Hayter, 24A St. Albans Road,
Moseley, Birmingham B13 9AS.

We have for disposal over fifty monochrome portables. Most are faulty but a few are semi-working. We'd like them to go as one lot. We also have a very rare 26in. Thorn colour set fitted with the 4000 chassis. All items are free to a good home.
Dranfield and Harrop TV,
62 Fairfield Road, Buxton, Derbyshire.
Telephone 0298 71689.

Servicing the Panasonic G Deck

Part 1 **Nick Beer**

In the September 1988 issue I covered initial procedures for servicing the Panasonic G deck. The machines were then relatively new, though the second generation (G40/G45/D48) was just being introduced. There are now many more machines that use the mechanism and its variants and consequently a number of new mechanical faults have appeared. There are also electronic fault patterns that we can report. Many engineers have had considerable difficulty in aligning the mechanism and in fault finding. This has been recognised by Panasonic and the company's recent VCR seminars have included practical work on the G deck, a very helpful move. In this article we will provide an updated account of the mechanical situation, information on setting up, and also cover electronic faults in various Panasonic models that use the G deck. The G mechanism is also used in models in other manufacturers' ranges, for example Grundig, Philips, Pioneer, Pye and Sony.

Overview

The capstan motor drives everything except the drum. As only one belt is used a fairly complicated system with a rack and gears is required. Drive has also to be transferred from the bottom of the mechanism, where the motor drives via the belt, to the top where drive is needed for front loading of the cassette and for the mode switch and pinch roller, which descends from above and then contacts the capstan on a cam. Also driven on the top side of the mechanism are the play arm (driven by a cam on the underside of the mechanism) and the tension post P5. The design is very clever.

There are four versions of the G mechanism. After the original G came the G' which had mechanical improvements – it's used in the G40/G45 series. The G-Rev (G revised) came next, used in the L20/L25/J30/J35 series machines. Finally there's the G2, known in sales circles as the 'Turbo Intelligent' mechanism. This is used in the NV-F65, F70, F75, FS95 and FS100 top-end machines.

The first three versions are very similar, the later ones incorporating improved mechanical parts. Reliability has increased to the extent that the L and J series models come in more often because of electronic than mechanical faults – and you don't get many electronic faults.

The G2 is an enhanced design. It has an extra motor, known as the review motor, which is mounted behind the mode switch at the rear right-hand side of the mechanism. Increased capstan torque gives much faster wind times. The final difference with the G2 mechanism is a dual loading system. In common with many mechanisms the G deck has a half-lace position when a cassette is loaded: it keeps the tape in contact with the audio/control head in order to provide pulses for the real-time counter. With the G2 deck there is also a full-lace stop position (stop 2). When a cassette is inserted the unit rapidly laces fully then slackens off the tape – this operation is discussed later. The unit remains in this position for about ten minutes, after which it returns to stop 1 (half lace) if no suitable function has been selected.

Modified parts have been introduced throughout the evolution of the mechanism. Very often the modified parts fitted to later versions are supplied as replacements for earlier ones, but not always, so do check part numbers. In addition the method of fixing certain items can be different in later machines. For example in earlier versions the play arm was fixed with a circlip: in later machines such as the L20 series the arm incorporates its own plastic spring retainer.

Dismantling

The exact procedure for removing the top and bottom varies slightly depending on the model. However there are standard Phillips screws in the usual positions – as with other Panasonic models. Once you are inside, the arrangements with the various models are very similar.

In many cases the main PCB has to be moved out of the way in order to remove such things as the cassette carriage cover. As this suggests, the design of the PCB varies with different models and ranges. Follow the rule that red screws, usually four or five, retain the PCB from above (in some models such as the G21/G25 however there's a gold-coloured screw above the power supply can) and that further support comes from two or four black screws fitted across the back of the machine, around the r.f. and video sockets. With earlier models the small PCB in the rear left-hand corner will also have to be removed to allow the main PCB to move very far. Finally, you'll usually find one or two white compression clips, which need to be undone, across the front edge of the main PCB. They should always be refitted when the board is replaced, but can easily be forgotten. Locate them correctly, not only in the holes in the PCB but also in the case moulding, otherwise the PCBs or the lid will not sit correctly. After freeing it the PCB will lift up and sit on its right-hand edge. In some cases, e.g. the G40, there are also clips along this right-hand edge, holding the PCB to the plastic side frame of the cabinet.

There's no screening can over the standard G mechanism head drum. The cassette carriage is not of the type in older Panasonic machines, i.e. a substantial single unit made up from component parts. Instead it consists of two side pieces, a holder and a cage type cover across the top. To remove this cover the front of the machine will usually need to be taken off. Some of the fronts are in two pieces, upper and lower, as in the NV730 (see the November 1989 issue of *Television*) – the same removal procedures apply. Take care not to damage or lose the metal earthing strip at the inside centre of some of the top halves of the cabinet front. With the front removed, the carriage top can be taken out after undoing the two small gold screws in the centre of each side and the red and gold screws on up to three of its four corners. The rear right-hand screw often secures a black earthing lead to the main PCB, a point that should be remembered during reassembly. The cover lifts off after disconnecting the supply photosensor lead that runs across the cover from its plug on the right-hand side of the carriage.

The carrier can be removed by grabbing the centre of the holder, in the eject position, and gently moving it forwards until the rear pegs in their runners line up with the slots in the side pieces, then moving it upwards. After this the black side pieces can be removed by undoing the two red screws that hold them to the main mechanism chassis at each side. The main PCB will often have to be removed prior to this in the case of the right-hand side piece.

Mechanical Servicing

We'll consider first replacement procedures for some of the items that occasionally need to be renewed.

The pinch roller can be taken out after removing the plastic pinch cam cap then pulling it gently up and free. The cap has a modified part number, VMX1353, this being the skeleton type. The problem with the older solid type was that removing the cap with the cassette carriage fitted meant that the pinch cam shaft had to be bent. The pinch roller has been modified from the original with its brass-coloured insert to an aluminium-coloured one which is slightly longer (part no. VXL1743).

Centre Pulley Replacement

The centre pulley's 'tail' sits under the main lever, so this has to be moved out of the way during replacement. The main lever can be removed but some may prefer to take the less involved route if they aren't familiar with the positioning of the pins around the lever. Remove the slit washer on the right-hand side of the lever, taking careful note of the positions of the pins around and through the various slots in the lever, then gently lift up the lever from the right-hand end and pull it slightly towards the front of the machine. It will then sit on one of the pins. After doing this the centre pulley can be removed by taking off its slit washer and lifting it up as far as it will go then turning it about 45° anticlockwise, viewed from the front of the machine. This allows the tail to come out from under the lever. When removing the pulley take care not to lose the washer underneath it, on the shaft. It can be caught by bending the pulley's trajectory as you pull it off its shaft – the oil on the shaft will then hold the washer at the top of the shaft. When fitting the replacement pulley reverse the above procedure. Take care to get the tail into the kick gear and to get the pins in and around the main lever as before. If the mechanism is being rebuilt the main lever will of course be off and fitting a new pulley will be a minor job.

Capstan Rotor Replacement

Replacing the capstan rotor is another job that can be fiddly if you don't follow the appropriate procedure. Remove the belt, which just slips over the rotor pulley, the centre gear/pulley and the jockey pulley. The bracket that holds this pulley and the capstan brake will have to be removed. It's usually secured by one cross-headed bolt but sometimes a circlip on another shaft is also used. Access to the rotor will then be impeded by a bent bracket which is secured by one cross-headed screw at the back of the mechanism. Remove it. On later machines, the G40 for example, you will have to remove a nut on a threaded pillar in the opposite corner of the stator. To make access to the capstan easier, remove the pinch roller. Do not put the deck upside down with the pinch roller removed however: keep it on its end otherwise the pinch cam will disengage from the connection gear and the mode switch – if this is not noticed the mechanism may go out of sync, especially if the cam falls back into place in the wrong position. Now simply pull the rotor out from the bottom of the machine. Do this gently and smoothly – you will have to overcome the magnetic effect.

There are two spacers on the capstan shaft. If the rotor is removed carefully they will accommodate themselves on top of the capstan bearing on the top of the machine. You will also notice a rattle from a plate under the stator – it centres itself when the magnetic rotor is replaced, so don't be alarmed about this.

When fitting the new rotor start by inserting the very end of the capstan shaft into the bearing opening with the machine stood on its side. Place the end of your index finger on the top of the machine, holding down the top of the two spacers firmly so that when the rotor is inserted they are impaled on the capstan shaft. As the shaft appears through the top spacer let go and push the rotor in a little farther. Now insert a small screwdriver between the two spacers, forcing the second one down on to the capstan bearing while pushing the rotor in fully so that the first spacer goes to the top of the holder. Clean the capstan to remove oil and refit the pinch roller, the cap, then the hardware underneath.

Capstan Brake Arm Replacement

To replace the capstan brake arm remove the brake/pulley bracket and belt (to make it easier to refit the bracket). Then remove the split washer holding the arm and pull it and its spring off. Fit the spring to the new arm then reassemble everything.

Video Head Replacement

Replacement of the video head is largely a matter of common sense. Suffice it to say that the pins on the video head PCB should be desoldered thoroughly before the drum is removed to prevent damage to the rotary transformer. Note that the Panasonic head puller will fit all drums fitted to G mechanism machines.

Alignment on Underside

We'll deal now with alignment of the gears and other mechanism components where inaccuracies can lead to problems. A rebuild of the extent common under normal servicing conditions, i.e. where there are timing problems, is assumed. Part numbers refer to earlier models: consult the service manual for the relevant model for the correct part numbers. The following alignment instructions leave the deck in the stop mode, so the carriage should be refitted in the down position when the job is finished. Fig. 1 shows the underside of the standard G deck, Fig. 2 shows the alignment order of the parts beneath the deck and Fig.

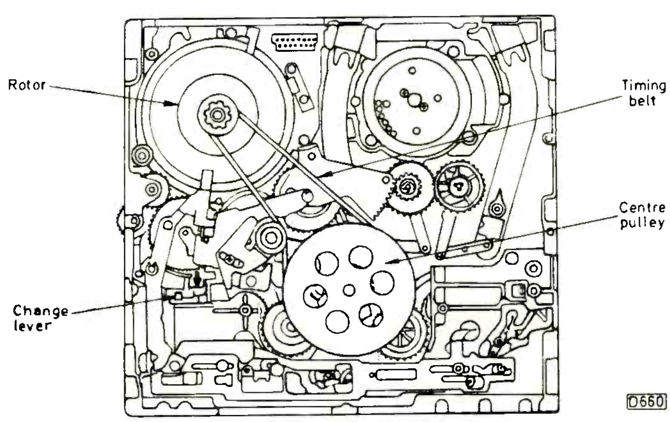

Fig. 1: View of the standard G mechanism from underneath. The arrow beside the change lever indicates the direction in which to click it during manual operation of the mechanism (see text).

3 the alignment order above the deck.

Start by inserting ring gear A, part no. VDG0342, so that its hole aligns in the hole in the mechanism beneath it. A needle or something similar is useful to maintain alignment because when further gears are inserted others can move slightly (something that must be avoided or corrected) with the result that sight of the mechanism holes is lost. Then insert sub-cam gear B, part no. VDG0343, to the left of the ring gear with its two holes in line with the one in the ring gear. At this point the indentation in the circumference of the sub-cam gear should face south, viewed from the front of the machine.

Locate detent arm C, part no. VML1861, on to its shaft and into the indentation in the sub-cam gear. You may need to jiggle the arm to clear the machine's plastic case if the mechanism hasn't been removed. The main cam gear D, part no. VDG0346, is then fitted on the same shaft on top of sub-cam gear B. The double holes in these two cam gears should coincide. Despite Fig. 2 and the manual however some main cam gears have two single holes instead of three holes, so the gear could be fitted in two ways: the correct way is with the holes at ten to and just after ten past. The right-hand hole will then align with the sub-cam gear and the left-hand hole will align with the pinch-speed down gear to be inserted later.

Insert retainer gear E, part no. VDG0344, into ring gear A. This gear has three smaller gears attached to its three arms. They don't come with the new retainer gear and have to be ordered under part no. VDG0345 – or they can be easily unclipped from the old retainer gear. When fitting the retainer gear plenty of Moriton grease should be applied to it and the inside of the ring gear. Fit it with the two holes about 170° apart at the top half, with the left-hand hole aligned with the right-hand hole in the main cam gear and the hole in the ring gear beneath it. The right-hand hole should align with the hole in loading-cam gear F, part no. VDG0347, which is fitted next. When fitting this gear ensure that the black sub-loading arm (part no. VXL1480) is moved around to the side of the audio/control head on the top of the deck, so that its spring stretches and the lug on the base of the arm engages with the indentation in the gear being fitted. Note that when the loading-cam gear, sector gear or either loading arm gear is ordered a kit of all four items (VUA4100KIT) will be supplied as they have been modified. The sector gear has been strengthened by putting a step in it: the other gears have been altered to accommodate this.

Centre gear G, part no. VDG0348, is next fitted over the retainer and ring gears, with the left-hand holes aligned. The right-hand hole should be at twenty past, aligned with the hole in the clutch disc that resides under the centre pulley unit (part no. VXP0917). You will usually have to rotate the clutch disc to align it prior to fitting the centre gear. Sector gear H should be positioned as shown. The main lever can now be refitted. Refit the cam follower arm into the main lever and main cam and the centre pulley unit over its shaft – if the main lever has been removed however this is best done before refitting the main lever and the belt. The main lever is simply slotted over the poles and pins that it actuates: take care to get it right.

Top Alignment

The next steps are on top of the deck. Before turning it over ensure that all circlips and slit washers have been refitted to avoid things falling off. On top the first step is to fit the pinch-speed down gear I, part no. VDG0344, with

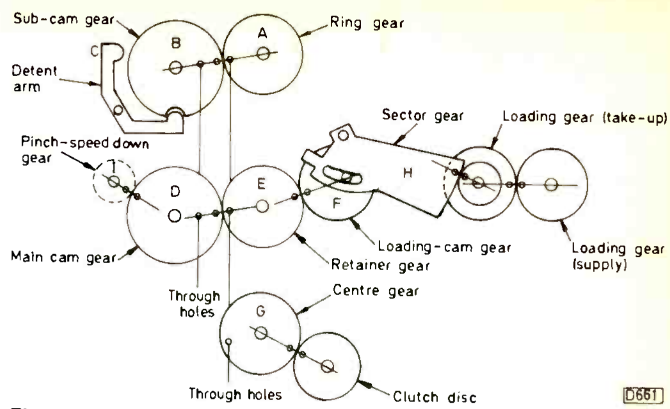

Fig. 2: Assembly/alignment order for the gears on the underside of the mechanism.

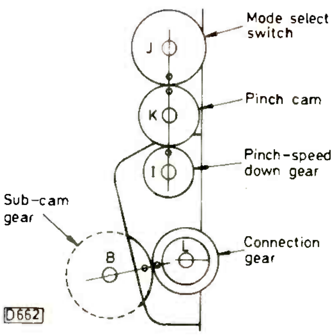

Fig 3: Assembly/alignment of the items on the top of the mechanism.

its hole aligned with the left-hand hole in the main cam gear as previously mentioned. This obviously needs to be viewed from the underside. The hole in the top gear should then face north. Mode select switch J, part no. VSS0175A, is next located so that its hole faces south. Pinch cam K, part no. VDG0356, is then inserted between them: its hole aligns with the hole in the mode switch and its arrow-head projection 180° opposite aligns with the hole in the pinch-speed down gear.

Finally on top fit connection gear L, part no. VDG0332, so that its hole is aligned with the upper hole in the edge of sub-cam gear B, seen to the left.

Take great care over all this: it's vital that alignment is single-tooth accurate if timing problems are to be avoided.

Refitting the Carriage

The mechanism is now in the stop mode (stop mode 1 with the G2 version). Thus if the carriage were fitted in the eject position the unit would go out of step. The carriage must therefore be fitted in its lowered position. This is done by mounting the two side pieces only – no carrier or lid – with the white lever on the outer side of the black, right-hand carriage side piece pushed down flat to the bottom before it's fitted. Take care not to push the lever too hard or far as it might jam. The first tooth of the rack on the right-hand side should engage with the connection gear's slot, which is marked with an adjacent indented line. You may need to jiggle the carriage side slightly to align this.

Now manually unlace and eject the mechanism – this is described below – and refit the carriage and lid.

Manual Operation

The mechanism works on a process method of mode selection: as it reaches the end of one process the solenoid has to be energised to pull a lever which then re-engages the mode-selection mechanism and the drive from the capstan motor. So if you need to move the mechanism through its modes with the machine unpowered, for example to release a damaged cassette, this can be done by turning the capstan rotor. It's much more easily done however, with the belt fitted or not, by turning the centre pulley and, at the required points (when the mechanism stops moving between modes), clicking the solenoid lever on the underside (see Fig. 1) then resuming the rotation. This is best done with a normal cassette inserted – dummy cassettes don't always agree with the front loading mechanism, but as long as they have a blinder flap they should work.

The problems occur with the action of the white jamming lever at the front right-hand side of the front loading mechanism. This mechanism has an effective jamming system to prevent cassettes of dubious construction or entry angle being loaded. It's also possible, by flicking the jamming lever at the correct point, to load the carrier with no cassette.

Though it may have sounded tedious, aligning these mechanisms isn't that bad in practice. If I've made it sound easy, maybe you've been doing it differently – give these methods a try.

Mechanical Faults List

We will conclude this instalment with a mechanical faults list. The electrical aspects of the Panasonic machines will be dealt with in Part 2 next month.

(1) Knocking noise, particularly when lacing: Noisy capstan rotor (VXP0777).

(2) Scraping noise, particularly in play: Worn capstan brake pad (VXL1500).

(3) Cassette goes in but doesn't reach the half-lace position: Check that the play arm VXL1480 is intact. It often snaps in two, particularly at the base where it enters the cam on the underside of the mechanism. This can be caused by a timing error. A sticky or open-circuit solenoid (VXA2693) is another cause.

(4) Low or muffled sound: Invariably due to a worn audio/control head. With the G21/G25 ensure that the replacement is type VBR0125. With later models the head is supplied minus its PCB, so this will have to be transferred from the old one – it involves only half a dozen or so connections and is soon done. Check the audio bias (see next month) every time you replace or adjust the head. This is very important.

(5) Won't accept a cassette/carrier askew: Return the carrier manually (see above) to the eject position, remove and replace. Check the mechanism carefully for broken pieces of plastic from the carrier – these can often fall off and impede the operation of the mechanism. Also check the alignment of the pinch cam and connection gears (see above).

(6) Tape crinkling over post P4: Check the pinch roller. If it has a gold/brass coloured insert replace it with one that has a silver/aluminium coloured insert. If it has a silver insert it could still be the cause of the fault – check it carefully for a bowed roller. Ideally the pinch roller should be checked by substitution.

If the pinch roller isn't the cause of the problem check the back-forth tilt of the audio/control head. If it's set too far one way it will still produce perfectly adequate sound (with the azimuth set to compensate) but will cause the tape to ride up or down over post P4. Readjust and lock with Unibond or Screwlock.

(7) Picture pulling at top in review, particularly at the beginning of a tape: Faulty video head. Replace and check the back tension.

(8) Picture disappears intermittently on playback – looks like intermittently clogged video heads: Cause is breaks in the leadouts or coils of the rotary transformer. If break cannot be located replace whole DD unit. In rare cases the break may be accessible and repairable, but I wouldn't recommend repair in a customer's machine.

(9) Poor still frame, noisy picture and/or poor vertical lock: Usually due to a worn or poorly aligned audio/control head if the video heads are o.k. Clean all heads and align the tape path exactly. Pay particular attention to the height and H position of the audio/control head. Regular checks should be made on the audio level and still frame performance. Check the audio bias during alignment.

(10) Cyclic clicking, ticking or rubbing noise: These symptoms suggest a noisy centre gear unit (VXP0767 G, VXP0917 G') rather than a faulty capstan rotor (VXP0777) which tends to result in a knocking noise. Note that you cannot interchange the two types of pulley without changing the belt type as the belt (VDV0169) used in the G' is thinner than the earlier G type (VDV0159). In order to rationalise spare parts stocking, Panasonic supply the later type of pulley complete with the new type of belt and new slit washers under part no. VXP0917K.

(11) Intermittent failure to accept a cassette, lace, unlace, rewind, wind fast forwards etc.: This fault usually affects rewind or eject and can be exceptionally intermittent. The cause is often a dodgy solenoid (VXA2693/3735), i.e. failure of the solenoid action to click the gears into the drive from the capstan/belt. See also (18) and (19).

(12) Cuts out in review, all other deck functions work: Mode switch set one tooth out. Turn it one tooth anticlockwise relative to the pinch cam.

(13) No take-up: This fault often occurs after replacing parts on the underside of the deck. It's due to the pin adjacent to the spike on the end of the main lever assembly. This area is at the front right-hand side with the machine upside down, viewed from the front. The pin is probably below the lever, i.e. to the front of the mechanism. It should be behind the lever. In certain circumstances this can badly damage the sector gear/guide pole gears as it prevents the back-tension arm getting out of the way of the guide pole bases during unlacing.

(14) Cassette goes in, half laces very quickly and is then ejected. Process is repeated automatically then the machine switches off: Another problem caused by mislocation of the pins in the main lever assembly. Check the pins of the left-hand side of the lever with the machine upside down and viewed from the front. For this fault the relevant pin is the one locating above the swinging arm part of the main lever.

(15) Rattling noise, particularly during lacing: Usually due to a noisy jockey pulley (VXA2674) on the belt tensioner/capstan brake bracket. To replace it undo the black screw. Fit replacement with the bracket already located over its two pips so that the black screw locates at the centre of the travel of the slot in the pulley arm.

(16) Chewing tapes/odd mechanical behaviour during half lace: This is usually due to a fractured P5 post arm unit. As a result the P5 post drops out. A replacement is easy to fit but one or two points should be mentioned. First, before removing the 5·5mm nut carefully note the height of the old unit. Install the new one at the same height then fine set it for good tape path travel, i.e. no buckling over posts P4/5 in any mode. Check the review mode especially. A jig (VFK0191) is available for use in conjunction with the height gauge VFK0190, but these are not normally required. Prior to removing the post try to establish that there is no buckling over post P4, otherwise you may be trying to set the height of post P5 to overcome a problem caused by the audio/control head being set incorrectly (see above). Secondly you will need to remove the P5 pull-out sector gear — the plastic gear that drives the post from the pinch cam. This is secured on its shaft (remove the pinch cam cap and pinch roller first to make life easier) by a sprung plastic retainer which is almost impossible to remove without being weakened or broken. It's therefore best to replace this as well. Finally ensure that the washer is refitted with the post arm.

(17) Failure to accept or reject a cassette: This is usually due to breakages on the right-hand side piece of the carriage mechanism. Prove the point by removing the carriage component parts and engaging the mechanism in the stop mode manually, then check that the timing is correct. The complete right-hand side piece is available preassembled and is often the most economical way of carrying out a repair.

(18) Odd mechanical behaviour, especially of an intermittent nature: Examples of this are tapes half lacing then immediately ejected, won't review, stops laced up whilst playing and machine then switches off, etc. The cause is the mode switch (VSS0175A). There are two designs, a black and white plastic version and a white wheel on a green/brown coloured base.

(19) Intermittent problems: Examples are refusing to accept a cassette, ejecting cassettes and loss of deck functions, particularly rewind, especially after making a fair length recording. Suspect a faulty mode switch (VSS0175A) and/or solenoid (VXA2693/3735). The mode switch is the more likely cause, especially if it's of the green/white/brown variety. You probably won't be able to experience the symptoms complained about by the customer as they can be extremely intermittent. When changing the solenoid and resoldering the flexi print take care not to get a short between the two connections: the soldering should be nice, neat and quick!

Teletopics

CHANNEL 5

The Independent Television Commission has announced that it would like the Channel 5 service to be in operation by the beginning of 1994, a year after the new ITV/Channel 3 franchises come into effect. The Channel 5 service will be available to about seventy per cent of the population, with 32 transmitters using mainly channel 35 and 37 frequencies. It's being advertised by the ITC as a national service with a ten-year franchise, though bidders will be able to apply to provide local services at some times of day – the exact structure of the service has not been decided. Setting up the network is expected to cost at least £50m. The Channel 5 operator will also have to bear the cost of retuning VCRs to new channels to avoid interference. In most cases Channel 5 viewers will require a separate aerial. Antiference is developing one specifically for Channel 5 reception: the company points out that a new design will be required in view of the relatively low transmitter powers and narrow bandwidth.

BBC ENGINEERING INFORMATION MOVES

The BBC's Engineering Information Department has moved to the new BBC Headquarters building at White City in West London. The new address is Engineering Information Department, British Broadcasting Corporation, White City, 201 Wood Lane, London W12 7TS, telephone 081 752 5040.

BSkyB BOOST

BSkyB has started a relaunch campaign for its new five-channel service. It will spend up to £30m this year on promotion. The aim is to increase the rate of dish installations, which have been running at around 40,000 a month recently. BSkyB's shareholders are providing some £200m in new equity finance after the company's bankers refused to advance further loans – BSkyB has been running at a loss of about £6m a week. In addition BSB is being sued by the various companies it commissioned to provide equipment for the ill-fated MAC services.

150-CHANNEL CABLE TV

US media and entertainment group Time Warner has announced plans to provide 150-channel cable TV services in the USA and Europe. The system would make use of the latest fibre-optic technology and be two-way interactive. The present plan is to introduce the systems in the USA within two years, at a capital cost of around £200m, and to seek local partners to launch services in other countries. A start will be made in the Queens area of New York later this year.

FERGUSON LABORATORY CLOSED

Thomson Consumer Electronics has announced that Ferguson's research and development laboratory at Enfield is to be closed, with a loss of 43 jobs. Ferguson has been suffering due to the recession and lower than expected sales of satellite TV equipment. The Enfield laboratory had been involved in particular with D-MAC technology. TCE is to confine research to its laboratories in Germany, France, the USA and Japan.

CATALOGUES

J.J. Components has just released a 56-page, A4-size 1991 trade catalogue. Additions to the range this year include cassette housings, idler tyres, idlers and clutches and video pinch rollers. Engineers will find the cross-reference guide to video heads, idlers etc. particularly useful, along with illustrations and part numbers both original and generic. Current customers will be advised by newsletter of additions to the existing ranges during the year ahead. For further details and a copy of the catalogue apply to J.J.

Components, 63 The Chase, Edgware, Middx HA8 5D – fax/telephone 081 952 4641.

Mauritron Technical Services, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY, has issued a catalogue of technical information. The company claims to be able to supply workshop manuals for "almost any type of equipment, no matter what it is or what its age". Over 100,000 makes and models are covered, from the earliest vintage valve wireless sets to the latest TV sets and VCRs. A "search and trace" service is available where MTS does not hold information required. Telephone number is 0844 51 694, fax 0844 52 554.

FERGUSON BATTERY CHANGE

To improve reliability the nickel-cadmium rechargeable battery previously used for memory back-up in the ICC5 IMC and IKC2 chassis, using CMOS chips, is being replaced by a non-rechargeable lithium battery. The two types of battery are incompatible electrically and care must be taken to fit the correct type when servicing these sets. Models affected at present are the 68M5 and 41P3. Minor circuit changes are involved in order to remove the recharge arrangement but existing sets should not be modified.

Lithium batteries can be dangerous – they can present a fire or chemical burn hazard if subjected to recharging, short-circuiting or heating above 100°C. Ferguson offers the following advice: (1) always observe the correct polarity; (2) do not dismantle; (3) do not attempt to recharge; (4) never incinerate or allow a battery to be exposed to excessive heat; (5) never handle a leaky battery with bare hands; (6) keep batteries out of the reach of children and never put one in your mouth. Lithium batteries may be subject to local bylaws. Used batteries can if necessary be returned to the Ferguson Service Division for safe disposal: any exposed electrical connections should be insulated and the batteries should be double-wrapped, sealed in plastic bags, packaged securely and labelled with the appropriate warnings.

IMPROVING VHS PICTURES

Mitsubishi and Nokia have introduced VCRs equipped with new picture enhancement circuitry. Nokia's system is called Active Sideband Optimum (ASO) and was mentioned briefly in last month's Teletopics. The advantage claimed for ASO is that it improves picture sharpness while reducing picture noise and vertical jitter. It was first demonstrated at the Berlin International Audio and Video Show in 1989 as a means of increasing the VHS playing time. VHS licence controller JVC objected to this development however because it represented a change to the basic VHS specification. ASO has since been adopted as a means of improving playback picture quality. It works by preserving the h.f. signals normally lost through demodulation, doing this by means of a filtering technique. The result is a sharpened picture with reduced edge noise. Nokia says that ASO is especially useful when viewing old or worn video tapes. The first ASO-equipped VCRs include Models VR3721, VR3731 and the Nicam-equipped VR3761. Suggested prices are £325, £350 and £500 respectively.

Mitsubishi's HS-B27 and HS-B32 VCRs feature Intelligent Picture Control (IPC), a playback system that analyses the f.m. envelope level of the off-tape signal and automatically adjusts the picture sharpness control.

An article providing more detailed information on these systems will appear in a forthcoming issue of *Television*.

Mitsubishi's current range of VCRs (HS-B12, HS-B27, HS-B32 and HS-B52, the latter an S-VHS model) feature Mitsubishi's improved "swift servo mechanism". This is an 11-bit system (previous models used 10-bits): the extra bit means that drum rotation and tape speed are checked every 0·5µsec, doubling the accuracy and reducing the picture jitter in the l.f. areas by 3-4dB. Other picture quality improvements include the use of a dynamic comb filter and colour picture improvement for S-VHS and the IPC system mentioned above. A double phase distortion improvement system helps to reduce colour fading and spillage.

VIDEO NEWS

Mitsubishi is the latest company to launch a camcorder with an interchangeable lens system. The Mitsubishi system is not compatible with the VL mount being adopted by Canon, Sony, Matsushita and Hitachi however. The HS-C35 is equipped with a standard times six zoom lens: the optional wide-angle (5·9mm to 35·4mm) and telephoto (14·2mm to 85mm) lenses cost around £70 each. Other features include hi-fi stereo sound, interval recording, an eight-colour digital superimposer and fast shutter operation. The HS-C35 has a new lightweight chassis, weighing just 1·2kg with battery. Power consumption is 7·2W at 6V. Suggested price if £1,000.

Ferguson's FV46T and FV47S (an S-VHS model) are equipped with a jog-shuttle control on the remote control handset. The idea of this is to simplify cueing and invisible editing. In addition to the variable tape speeds used for editing purposes the jog-shuttle can be used for timer programming, setting the clock and channel selection. Both models have hi-fi stereo sound and a Nicam decoder. Suggested prices are £550 and £900 respectively.

Hitachi's latest VCR, Model VTVT-M753, has a teletext facility that can be used for programming the timer, recording subtitles or recording teletext pages. Suggested price is £430.

SONY/APPLE EQUIPMENT INTERFACE

Sony's US Computer Peripheral Products Division has announced Vbox, a computer/video interface that allows Sony 8mm video equipment to be linked to Apple Macintosh and other personal computers.

CD-I NEWS

Philips, Matsushita and Sony, developers of the new compact disc interactive (CD-I) format, have reached agreement on a new standard for full-motion digital video. The three companies have also announced the formation of a CD-I consortium in Japan. It consists of over 180 companies and is designed to establish links between CD-I hardware and software companies to promote the format. Efforts are under way to form similar consortia in Europe and the USA.

DANSAI

We regret the inadvertent omission of Dansai from the Spares Guide included with last month's issue. Details are as follows: Dansai Ltd., Heming Road, Washford, Redditch, Worcs B98 0DH. Telephone 0527 510 785, fax 0527 510 636.

SONY DEVELOPS LONGER PLAYING MO SYSTEM

Sony has developed a system that increases the storage capacity of magneto-optical (MO) discs by a factor of six. The system, known as IRISTER (IRIS Thermal Eclipse Reading), enables very short wavelengths to be resolved by a conventional laser. MO discs store digital data as a series of flux reversals on a specially coated magnetic disc. A laser reads the discs, the data being detected in terms of the twist direction of the reflected beam. Other methods of increasing MO disc capacity rely on shortening the laser wavelength or enlarging the aperture of the objective lens. IRISTER however works on the principle that only the hottest part of the area irradiated by the laser is read. In the IRISTER system the discs have an upper low-coercivity readout layer and a lower high-coercivity recording layer. During playback the laser beam is focused on a small area of the readout layer. As a result the temperature rises to reach the readout temperature. The rise in temperature lowers the coercivity of the recording layer with the result that data is transferred to the readout layer: in effect, the small signals stored in the recording layer are read only in the laser's high-temperature spot.

IRISTER enables the track density to be increased by a factor of three, effectively doubling the recording density of the track width. This means that up to four gigabytes of data can be stored on a 5·25in. disc. Sony says that if blue lasers with shorter wavelengths can be developed it will be possible to increase the storage capacity by a factor of twenty. Another claim for IRISTER is that crosstalk problems during readout are largely eliminated.

The MO disc is an erasable form of CD (see December 1990 issue, page 97).

Satellite TV Aerial Systems

Part 2

Derek J. Stephenson, B.A., I.Eng.

In this instalment we'll consider aerial mounts then make a start on head units by looking at the feedhorn with its associated short length of waveguide.

The Geo-Arc

The satellites used to provide TV services are all located in a belt some 35,800km directly above the equator. A portion of this belt, known as the geo-arc, can be seen at any position, specified by latitude and longitude, on the earth's surface. The position of each satellite within this arc is specified as a particular longitude relative to the Greewich meridian (0° longitude). For example Astra 1A is quoted as being at 19.2°E.

Fig. 16 shows how the geo-arc "looks" at some arbitrary receiving site in the northern hemisphere. The higher the latitude of the receiving site, i.e. the farther north, the lower the geo-arc will appear above the horizon.

There are two common types of dish aerial mount, the az/el mount and the polar mount.

Az/El Mounts

With an az/el mount the two adjusters, for azimuth and elevation, are set to fixed positions so that the dish points at a chosen satellite in the geo-arc. Details of the angular azimuth and elevation settings are often included with manufacturers' packages. The only point to watch is that you add the relevant magnetic correction to the quoted or calculated azimuth angle. In the UK this correction varies between 4° and 10° depending on the location.

If they are not known, the elevation and azimuth angles for a particular satellite at a particular location can be calculated from the following simple equations:

$$\text{elevation} = \arctan\,[(\cos C - 0.1513)/\sin C]^\circ$$

$$\text{azimuth} = \arctan\,[(\tan(LS - LR))/\sin B]^\circ$$

where C is arc cos $[(\cos(LS - LR)) \times \cos B]^\circ$, B is the latitude at the receiving site, LS is the longitude at the receiving site and LR is the satellite's longitude.

If you should need to use the above equations, always enter longitudes west of the Greenwich meridian as negative values. A negative result for azimuth indicates that the satellite is west of south at the receiving site.

When measuring the elevation angle with an offset-focus dish it's important to subtract the offset angle, which is sometimes called the elevation reduction angle. This angle is typically within the range 22.6-26.5° and is an inherent part of the geometry of offset-focus arrangements. The precise offset angle for a particular dish will be specified in the manufacturers's literature. Sometimes the actual boom elevation angle is quoted, or the equivalent satellite elevation angle is stamped on the adjuster.

Polar Mounts

Setting up a polar mount is a bit more involved because it allows the dish to track a large portion of the geo-arc by means of one simple movement around the polar axis. For years polar mounts have been used by astronomers to track celestial bodies. Basically the polar axis angle is set for the latitude of the site, rotation around the polar axis enabling particular distant fixed objects to be tracked as the earth rotates. Due to the fact that the geo-arc is relatively close to the earth's surface however a slightly different approach is required. An angle known as the declination offset angle is introduced, so that the dish is lowered on to the satellite geo-arc. Then, as the dish is rotated around its polar axis, any fixed position within the visible geo-arc is targeted accurately. Since TV satellites are geostationary, i.e. they don't move in relation to the receiving site, the aim is to select any one of a range of static objects (the satellites) rather than to compensate for the earth's rotation.

The following terms are used in connection with polar mounts (see Fig.17). (1) Polar axis angle. This is the latitude of the receiving site in degrees. (2) Polar elevation angle. This is 90° minus the polar axis angle. (3) Apex declination angle. This is the polar axis angle plus the declination offset angle. (4) Apex elevation angle. This is 90° minus the apex declination angle.

These angles are set with the aerial mount in the "apex position", i.e. facing due south. This position corresponds with the mid-point of the aerial's travel around its polar axis: it's the highest elevation attainable with a given polar axis setting. The relationship between these angles and the aerial mount is shown, for a prime-focus dish, in Fig. 17. When measuring these angles with an offset-focus dish remember to correct for the quoted aerial offset angle or elevation reduction angle.

To set up a polar mount you need to know the receiving site latitude and the declination offset angle. The other angles can be deduced from the relationships given above. If you don't know the declination offset angle for your latitude it can be calculated as follows:

declination offset angle = arc tan [(6378 sin B)/(35803 + 6378 (1 - cos B))]° where B is the receiving site latitude.

Ku Band Polar Mounts

Use of the declination offset angle gives sufficient accuracy with C band satellites but with the Ku band, which is used almost exclusively for European TV satellites, a higher tracking accuracy is required. The basic principle used, known as the modified polar mount, is to tilt the polar axis slightly forward (increase the polar axis angle) and reduce the declination offset angle by an equal amount so that the resulting apex elevation of the aerial stays the same when it's in the apex position (pointing due south in the northern hemisphere). The overall effect of this is to improve the tracking accuracy at the extremes of the geo-arc. The following equation gives the small correction factor required for any latitude:

$$\text{Correction} = 0.66 \sin (2B)°.$$

The modified polar mount angles are found by adding this correction to the polar axis angle and subtracting it from the declination offset angle.

Actuators

Although polar mounts, particularly early low-cost versions, can be set by hand with one simple adjustment most of them use some form of remote control by motor. A linear actuator is commonly used. This is simply a motorised jack which has a sweep range of about 100° of arc, i.e. the dish can be driven to view positions between about 50° east and west of due south. The so-called "horizon-to-horizon" actuators use a geared direct-drive servo motor mounted at the rear of the dish, designed to provide the torque required to drive the dish over an increased range. Actuators are controlled by separate positioner circuitry that may be incorporated in the satellite receiver or a separate stand-alone unit.

The Head Unit

"Head unit" is a convenient name for the assembly that's mounted at the focal point of a parabolic reflector. It incorporates several different items, usually the following: (1) The feedhorn with a short length of waveguide. (2) The polariser. (3) A low-noise block (frequency downconverter).

Waveguides

We'll consider waveguides first. Transmission of a signal along a length of coaxial cable involves significant attenuation due to the following effects: (1) Dielectric losses in the material that supports the inner conductor. (2) Radiation loss because the cable acts as an aerial. (3) The inner conductor's skin resistance, which is due to its finite diameter. These losses increase with frequency, making the use of coaxial cable impractical at centimetric wavelengths. Since Ku band satellite TV signals are at frequencies around 11/12GHz coaxial cable cannot be used. Fortunately there are alternatives. The signal could be passed from the aerial to the reciver via a metal pipe:

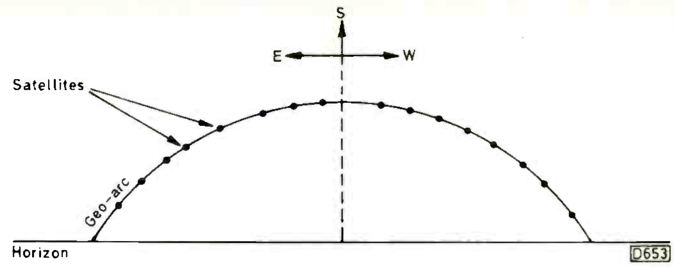

Fig. 16: A typical satellite geo-arc viewed from the northern hemisphere.

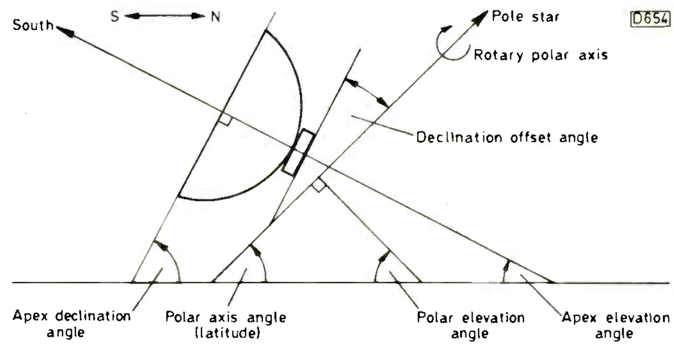

Fig. 17: Polar mount angles.

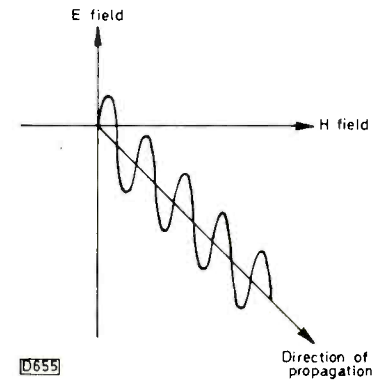

Fig. 18: Propagation of an electromagnetic wave.

this is the waveguide approach. Provided the waveguide is precision made it introduces negligible attenuation at s.h.f. (super high frequency, 3-30GHz). This would be an expensive and ugly approach to the problem however. The alternative that is universally adopted is to use a short stub of waveguide followed by frequency conversion at the head, so that the signal can be fed to the receiver via coaxial cable. Frequency conversion is performed by a unit known as an LNB (low-noise block).

Waveguide theory is notoriously complicated and specialised. So a much simplified explanation that's adequate for satellite TV purposes follows.

Rectangular Guides

Signal transmission along a coaxial cable follows conventional circuit practice and is described in terms of voltage and current. In a waveguide however the signal remains in the form of an electromagnetic wave, with an electric field E at right angles to a magnetic field H. The direction of signal propagation is at right angles to both fields, as shown in Fig. 18. There are two "boundary rules" for waves within the confining walls of a waveguide: (1) If close to a perfectly conducting surface an E field can never be parallel to it. (2) If close to a perfectly conducting surface an H field can never be at right angles to it.

Since the interior walls of a waveguide consist of almost perfect conductors it follows that the electromagnetic wave cannot be propagated straight down the metal tube but must travel along it by bouncing off the surface in a series of reflections – see Fig. 19. The bounce angle depends on the cross-sectional dimensions of the waveguide. As will become clear the wider dimension of a rectangular waveguide, the one shown in Fig. 19, is the most critical one. It should be greater than half a wavelength and less than a full wavelength. Within these limits the wider dimension B determines the reflection angle.

The wider the B dimension within the above limits the wider will the angle of signal reflection be and thus the lower the attenuation due to reflection errors. If dimension B is reduced towards the half wavelength limit the number of reflections increases dramatically: at exactly half a wavelength the signal bounces back and forth in the same place. In other words the wave will not travel along the guide and is said to be evanescent. As dimension B approaches the full wavelength limit another difficulty arises. The problem here is that so-called higher-order modes will be propagated down the waveguide. A compromise is obviously needed, and in practice dimension B is usually about three quarters of a wavelength. With satellite TV waveguides however a simple wave pattern known as the "dominant mode" is generally used. This requires the smallest possible guide-section and is thus highly selective.

The wavelength of an 11GHz signal is about 2.7cm, so a waveguide with a B dimension of around 2cm is about right. The smaller dimension A is not so critical. It's chosen to be less than dimension B so that the wave will not slip around within the guide, producing unpredictable results and polarisation errors. The rectangular waveguide used for Ku band satellite TV is known as WR75 standard.

Circular Guides

Circular waveguides are cheaper and easier to manufacture but have certain disadvantages. The main one is that it's difficult to predict the plane of the E and H fields along the path of the guide. Thus the wave might slip round as it travels along the guide, leading to polarisation errors. If the path is short however, as with the stubs used in satellite TV heads, this effect is unlikely to cause problems. There's often a transition from circular to rectangular along the waveguide path. The name given to circular waveguides for Ku band use is the C120 standard.

Impedance and VSWR

Coaxial cable has a definite characteristic impedance, and all technicians will be aware of the effect of mismatched load impedances. Not surprisingly, waveguides also have a characteristic impedance and require matched loads to function correctly. In the dominant mode described above a rectangular guide's impedance depends on the B dimension and is of the order of 600Ω. The impedance of free space is about $120\pi\Omega$, or approximately 377Ω. This is derived from the ratio of the E field to the H field, the E field equating to voltage and the H field to current.

If a waveguide is simply placed at the focal point of a parabolic dish signal power will be collected but the mismatch between the free space and waveguide impedances will result in partial reflection of the incoming signals. A factor known as the VSWR (voltage standing wave ratio) is a measure of how much signal is reflected back and lost due to impedance mismatching. The mismatch produces voltage maxima and minima at fixed points along the signal path, the ratio of maxima to minima being the VSWR. Ideally the VSWR should be 1:1, but 1.5:1 and below are acceptable in practice.

A waveguide's impedance is reduced if the B dimension is increased, so the traditional fluting to form a horn shape, as shown in Fig. 20, is one way to improve the matching to free space. Circular fluting may be used with circular waveguides, but many other methods may be used to reduce reflections – we'll come to these later. The other end of the waveguide stub is normally terminated by a projecting pin or probe that's positioned in the throat of the LNB.

Waveguide Components

Whether rectangular or circular, waveguides form the basis of tamed wave transmission at centimetric wavelengths. The usefulness of waveguides can be extended by using waveguide components that have their equivalents in conventional electrical circuit theory, for example attenuators, terminations, junctions and transforming elements.

An important principle in waveguide practice is that a wave can be carried through a change in the form of the waveguide with negligible reflections provided the change occurs gradually. This can be seen in many head units where there is a transition between a circular and a rectangular section of the guide. The transition takes place gradually over about a quarter of a wavelength.

The Orthomodal Transducer

Another commonly used waveguide component is the orthomodal transducer (OMT). This essentially connects two waveguide sections to a single common one and has many uses where two LNBs are required, for example with a SMATV (satellite master aerial TV) system for reception of Astra 1A and 1B, where one LNB is used for channels with vertical polarisation and the other, rotated through 90°, is used for the channels with vertical polarisation. Dual-band operation often involves the use of two separate LNBs. An OMT enables the signals from a single broadband feed/polariser system to be split to feed the two LNBs. Each OMT branch is formed to cater for the required frequency band. The branches can be of C120 or WR75 form or a combination of the two. Waveguide adaptors can be obtained to reduce reflections where there is a connection between a circular and a rectangular guide. When making up your own system from LNBs, feedhorns, polarisers and OMTs be careful to pay attention to the waveguide type used by each item and, where necessary, use the appropriate adaptor.

Dielectric Filling

The cross-sectional dimensions of a waveguide can be reduced, to save space or for aesthetic reasons, by filling its interior with a dielectric material. This enables the cross-section to be reduced by a factor of $1/\sqrt{k}$, where k is the filling material's dielectric constant.

Feeds

We come now to the feed, whose purpose is to collect the energy from the parabolic dish. The "illumination", or the part of the dish seen by the feed, is usually tapered in

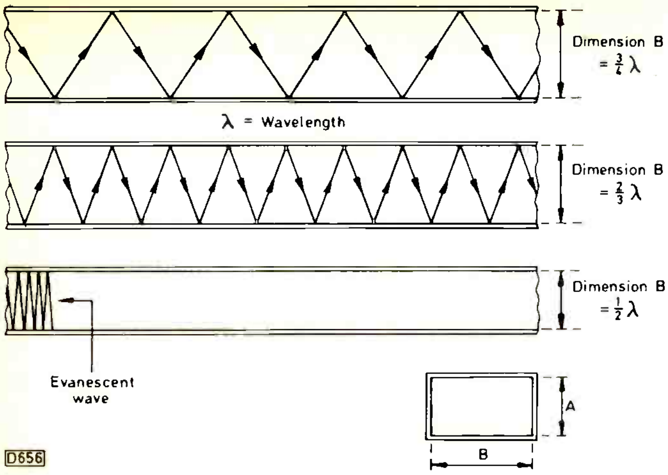

Fig. 19: Effect of dimension B on the angle of wave reflection within a guide.

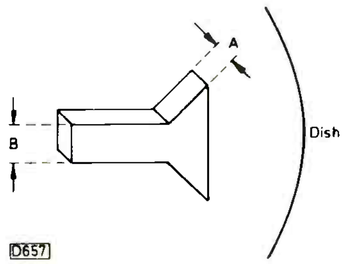

Fig. 20: Use of a horn to provide impedance matching at the focal point of a dish.

order to decrease the system's side lobe response relative to the main lobe. This can reduce the side lobes by -20dB relative to the main lobe. The feed is usually designed to provide an illumination pattern that tapers towards the outside edge of the dish relative to the centre. Thus most of the microwave energy is collected from the centre portion of the dish. A 15dB taper is typical. The use of this illumination taper reduces the likelihood of ground noise picked up by aperture diffraction effects or from beyond the edge of the dish. As mentioned last month, ground noise from the warm earth (or a wall) is the major contributor to the total system noise.

Feed design to adjust the illumination pattern can take a variety of forms depending on the f/D ratio of the dish. It's important to remember this when assembling a system using components from various manufacturers. Feedhorn manufacturers state the f/D ratio range over which a feed is designed to operate. Typically, prime-focus feeds are designed for use with f/D ratios of 0.35 to 0.5 and offset-focus feeds with f/D ratios between 0.6 and 0.7.

The design of a feed for a satellite TV system is a very complicated business. Much experimental work or the use of powerful computers is needed to adjust the amplitude and phase distributions at the feed and the dish. To maximise the gain a uniform phase distribution across the dish's aperture is required, but reduction of the amplitude of the side lobes relative to the main lobe calls for the use of an illumination taper. In general, the rules are as follows: (1) A uniform amplitude distribution gives maximum gain. (2) An amplitude distribution tapering from maximum at the centre of the dish towards the edge reduces the side lobes at the expense of gain. (3) An amplitude distribution tapering from maximum at the edge towards the centre gives a sharper main lobe but increases the amplitude of the side lobes and reduces the gain – this is known as the inverse-taper distribution.

If an open-ended waveguide is positioned at the focal point of a dish its beamwidth, which is an inverse function of aperture diameter, will be very wide. The result will be considerable over-illumination of the dish. The feed's aperture can be increased by flaring out the waveguide into a fluted horn shape. This reduces the feed's beamwidth and thus illuminates the dish more efficiently. Flaring an open-ended waveguide to at least one wavelength will normally illuminate the dish adequately. Wide, fluted feedhorns minimise the side lobes, but a compromise width is often adopted. Very narrow feedhorns may include dielectric lenses for phase correction. With prime-focus aerials, flanges or scalar rings are commonly used to adjust the illumination pattern.

Traditionally, s.h.f. aerials used a rectangular horn at the focal point of a prime-focus dish followed by a length of waveguide. The use of block down-converters was not practical in the early days of flying hats and goggles. A more efficient method of reducing E/H field imbalances and improving the VSWR figure over a wide range of dish f/D ratios is the use of a scalar feedhorn. This is essentially a waveguide pipe surrounded at the input end with a series of quarter wavelength deep rings. The number of rings can vary, between three and five being common. The rings can sometimes be slided along the pipe in order to peak the feed for use with a range of dish f/D ratios. The shallower the dish the nearer the rings should be to the mouth of the waveguide pipe.

The dimensions of the flared feedhorns used with offset-focus dishes are carefully set to ensure that the E and H fields are detected with equal amplitude. Because only a portion of the parabola is used, the design of this type of feedhorn is considerably more involved than that of a prime-focus feedhorn. The f/D dish range that can be used with an offset-focus feedhorn is more restricted than with prime-focus arrangements.

Some feedhorn designs adjust the illumination by progressively stepping up the feedhorn diameter rather than using a gradual flute. Dielectric feeds can be used instead of a conventional feedhorn: we'll round off the present instalment in the series by taking a look at this type of feed.

Dielectric Feeds

Dielectric feeds have become increasingly popular recently, providing an efficient wideband alternative to the conventional feedhorn. The new Marconi range of feeds consist of a dielectric (polyrod) lens fitted at the mouth of the waveguide section. Certain advantages are claimed for this type of feed compared with a conventional feedhorn: (1) More even dish illumination and thus higher gain. The E and H plane polar illumination is similar, ensuring maximum aerial efficiency with any polarisation. (2) The beam shape is more rectangular than with conventional feedhorns or scalar rings. This ensures a more efficient illumination of the dish and produces a sharper cut-off at the edge, thus reducing side lobe amplitude. (3) The aerial's gain/bandwidth product is more independent of frequency.

This Marconi range of polyrod feeds can be integrated with simple V/H switched polarisers for use with single or cluster satellite packages or integrated with electromagnetic or ferrite polarisers. These high-specification versions are available for use with prime-focus dishes (f/D 0.35-0.5) and offset-focus dishes (f/D 0.6-.07) and have a wide frequency range (10.95-12.75GHz). The nominal beamwidths of the feeds at −10dB are 122° and 66° respectively.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Ed Rowland, Nick Beer, Steve Cannon, Stephen Leatherbarrow, J.S. Ruwala and Mick Dutton

Philips G90AE Chassis

The fault symptom with this set was no colour. When the colour-killer was overridden by connecting a 470Ω resistor between pins 1 and 6 of the decoder chip we were able to see that the reference oscillator was running through but couldn't be locked by adjusting C2352. The a.p.c. loop components are connected to pins 23 and 24 of the chip. Resistance checks here revealed that C2359 was leaky. **P.B.**

Philips CP90 Chassis

This set was dead with the over-voltage protection circuit operating. When we used a variac to reduce the mains input voltage we discovered that the 95V line was uncontrolled. The optocoupler was o.k. and transistor 7637 was conducting hard as it should have been to turn on transistor 7653. But this latter transistor didn't conduct because chip resistor 3668 (15Ω) was open-circuit. **P.B.**

Decca/Tatung 161 Chassis

This set appeared to be tripping – the power supply was making a ticking noise. When the supply to the line output stage was disconnected and a dummy load was substituted the power supply worked all right. The fault wasn't tripping however: the power supply was in fact unloaded as the line oscillator wasn't working. There was no supply to the TDA4503 chip because R508 (12kΩ) was open-circuit – it's in the base supply to the regulator transistor Q501. **P.B.**

Philips GR1-AX Chassis

Green screen was the complaint with this set – sometimes a green raster with flyback lines was all that appeared when it was switched on. At other times there was no tuning and the channel wouldn't change. Yes, it was the tuning microcontroller chip, type TMP47C434-3559. Current replacements come with a metal shield to screen it and the RAM – this has to be connected to chassis. **P.B.**

Bush BC6004

The h.t. voltage in this 14in. colour portable had increased from 122V to 127V, the result being that it tripped intermittently. Adjustment of the set-h.t. control P943 wouldn't reduce the voltage below 125V. When a visual check was made on the components on the sync/regulator module we noticed that R943 (330kΩ) was badly discoloured. An out-of-circuit check showed that its value had risen to over 500kΩ. Fitting a replacement restored normal operation. **E.R.**

Network NWC1410R

This set would occasionally drift off tune. We found that there was a dry-joint on the tuner's a.f.c. pin. **E.R.**

Fidelity AVS1600 (ZX3000 Chassis)

This set came in with a short-circuit line output transistor (Tr5, BU508A). A replacement was fitted and the set was switched on. There was a loud crack accompanied by a blue flash from the c.r.t.'s final anode and the new transistor went the way of its predecessor.

We then did what we should have done in the first place – check the h.t. voltage. The BU508A was removed and in its place a 100W bulb was connected between the collector feed and chassis. As we suspected, the h.t. was high. In fact it was 163V instead of 112V and turning the set-h.t. control to minimum reduced it to only 140V. The cause of the trouble was eventually traced to C91 (1μF, 63V) and once this had been replaced normal power supply operation was restored. Sadly however when a new line output transistor was fitted we were confronted with a thin white line across the screen. The field output chip IC6 (TDA2270 in this particular version) had failed. **E.R.**

Ferguson SRV1/Pace SR9000 IRD

This was one of the few genuine faults we've had with these receivers. The customer complained that there was smoke then nothing the day after installation. We found that there was no picture or sound though the test signal was available. The reason for this was absence of the 9V supply at pin 2 of the tuner. This supply is derived from the 12V line by Q2, whose feed resistor R323 had gone open-circuit and caused the smoke. Q2 was not short-circuit: its legs had not been trimmed during manufacture and were very close to the all-metal case. In addition all three legs were dry-jointed because the device's body had been bent over after soldering. When all this had been put right the unit survived a long soak test. **N.B.**

Toshiba C2220B1

This set suffered from severe field distortion when switched on cold: the height was severely reduced, there were cramping and foldover and the sync was corrupted. After about ten minutes the set worked all right apart from cramping at the centre of the screen. Replacing the field output transistors cured this problem but not the former ones. Use of freezer soon led us to the suspected faulty electrolytic – C317 (2·2μF, 50V). **N.B.**

Ferguson SRV1/Pace SR9000 IRD

We find that the usual fault with this integrated satellite TV receiver/decoder is that it won't descramble Sky Movies. Apart from one occasion when there was a fault on the Videocrypt board the cause has always been insufficient signal because, in one case, the tuning had been fiddled or more often because the i.f. offset has been incorrectly aligned. Anyone unaware of this trait could well start an unnecessary hunt for a supposed nasty fault. These units seem to be much more sensitive to a noisy signal than the separate decoders we've come across. **N.B.**

Fidelity CTV14 Mk 2 (ZX3000 Chassis)

The outputs from the power supply fell slowly until the point was reached where field cramp became apparent because of the reduced 25V supply. The power supply is of the standard TDA4600 variety, and we've found that the 1μF electrolytic C91 often gives trouble. On this occasion however the value of the h.t. preset varied with temperature. After replacing it the h.t. could be set up as per the manual instead of being left at the maximum setting as a previous engineer had done. **S.L.**

Fidelity F14

This set was dead with d.c. to the chopper but no output. The h.t. rectifier D21 was short-circuit. We used a BY299 as a replacement. This brought the set back to life but on scene changes, or when the brightness or contrast control was adjusted, the verticals became corrugated. The cause was D21's reservoir capacitor C87 (100μF, 250V). **S.L.**

Philips K40 Teletext

A common problem with these sets is a dead power supply accompanied by squealing. The panel is mounted beneath the c.r.t. neck, at the bottom of the cabinet. On a number of occasions we've found that the cause has been R3192 (680Ω, 1W). **S.L.**

Sony KVDX271TU

The problem with this set was striations, but not striations in the normal sense. To most engineers striations mean that there's an open-circuit damping resistor across the line linearity coil, causing lines that run down the left-hand side of the screen. Well these striations ran across the top of the screen! In other words they were field striations. We were fairly sure that we had a field output stage fault and eventually, after thinking about all those line linearity faults, the damping resistor R5025 (680Ω) across the field scan coils was checked. Fitting a replacement put matters right. I have to admit that a number of other components were either checked or replaced before I got round to thinking about damping. **S.C.**

Panasonic U4W Chassis

We've had many of these sets in with low h.t. and squealing from the power supply. In the majority of cases replacement of C854 (100μF, 250V) or, more recently, D557 (BY299) in the EW diode modulator circuit provides a cure. We've also found that failure of the line output transformer can cause the same symptoms. **S.C.**

Nikkai Baby 10

We've had a few of these little sets in for repair, generally for straightforward faults. This one took us a little longer to pin down. At switch-on the picture was perfect, but after the set had been on for a while the screen gradually became darker until there was no picture. Out came the freezer, and the area of the fault was traced to Q303, the picture mute transistor. Fitting a replacement, 2SC1815 or BC184, cured the fault. **S.C.**

Hitachi CPT2178

The customer complained that this set had poor colour but when it came into the workshop we were undecided as to whether there was a fault or not. The colour did look a little pale, but we weren't convinced that there was a definite fault. This was until we connected the pattern generator: on the colour-bar setting the yellow bar was virtually white and the overall colour just didn't look right. The grey scale was perfect, so we concluded that there must be a colour-difference fault. Now the colour-difference mixing is done on the tube base PCB in these sets. The three colour-difference signals emerge from pins 1, 2 and 3 of the colour decoder chip IC501. Scope checks showed that they were perfect, as was the luminance output from pin 4. Our next step was to disconnect the drives to the tube base panel. What happened next was that the screen lit up bright blue, indicating most probably that the B−Y colour-difference mixing transistor Q856 was faulty. Out it came and sure enough there was a leak from collector to emitter. A new 2SC2271 put matters right. **S.C.**

Ferguson ICC5 Chassis

The trouble with this set was field collapse – there was a single straight line about two inches from the top of the screen. We decided to check the components connected to pin 5 of the TEA2029C timebase generator chip as these are associated with the field oscillator. RF01 (3MΩ) had gone open-circuit. **J.S.R.**

Alba CTV741

The customer complained of start-up difficulty with this set – he had to play with the switch several times and claimed that it was faulty . . . On test we found that there was voltage at the collector of the BU508A chopper transistor but no drive at its base. Further checks showed that the start-up voltage at pin 9 of the TDA4601D chopper control chip IC800 was only 6V, not enough to get it going. The posistor R802 was faulty. **J.S.R.**

Grundig CUC2401 Chassis

This set had perfect picture and sound but would sometimes start tripping when switched on. No dry-joints or obviously faulty components could be seen in the power supply. I finally found the cause of the problem accidentally when attempting to reduce the h.t. setting. The 1kΩ potentiometer R637 was faulty. **J.S.R.**

ITT CP3106 (Pico S Chassis)

This colour portable came in with the complaint of lack of height when warm. On test we found that this was so: there was also increased line noise in the fault condition. A check on the supply to the field output chip IC401 (pin 9) showed that it was low at only 19V. Checks in the line output stage then showed that all the other secondary voltages were low. We suspected the line output transformer and when a replacement was fitted everything returned to normal. **M.D.**

Philips 2A Chassis

The customer complained of cracking noises from the set when it was first switched on from cold. This caused loss of memory settings for the brightness etc. The set was now dead and we were expecting a battle with the power supply. There was a.c. from the switch, but no 300V across the main reservoir capacitor C2659. In fact the a.c. supply wasn't reaching the bridge rectifier. This foiled us for a while until we realised that one half of the degaussing thermistor is in series with the bridge rectifier. It had cracked after arcing for some time. Hence the intermittent memory loss. **M.D.**

Fifty Years in Radio and TV

Part 5: The Dual-standard Era

Harold Peters

A poor thing but our own was how William Rushton described the new-born BBC-2, which started to broadcast in 1964. As a bait to get viewers to watch the 625-line transmissions it certainly got off to a poor start, though for no fault of its own. A major fire in the ducting beneath the Thames, linking Battersea power station to the national grid, cut off the power to most of West London on what should have been the opening night. Those of you who have followed the fortunes of broadcasting as recounted so far in this series will not have been in the least surprised about this!

Starting a day late, BBC-2 followed the old Chinese proverb "he who rises late trots all day" – several months passed before the new service established itself as a worthwhile alternative to the other two. For the trade, trying to familiarise itself not only with dual-standard sets but also with u.h.f. reception, this was a blessing in disguise. It wasn't just the difference between the two line speeds, 10,125Hz and 15,625Hz, although that was bad enough, causing problems with width, linearity and line output stage harmonic tuning. There were in addition the new field sync pulse train, with equalising pulses at either side, and the different modulation polarity – negative going for white with the 625-line system. The vision bandwidth increased from 3·5MHz to 5·5MHz, and with the new system the transmitted sound carrier turned up on the other side of the vision carrier. There was also the change from a.m. to f.m. sound.

As a result of all this the receiver's system switch had to change over quite a lot of functions simultaneously. It usually ran the whole width of the set and was mechanically linked to the v.h.f. tuner, operating when the latter was brought round to the spot marked U. This put quite a strain on the plastic knob as well as the user's wrist – in fact many elderly viewers never made it.

Aerial riggers had a busy time. You couldn't get away with using the existing v.h.f. array. Once again we were told that reception would be strictly line-of-sight. This time the pundits were right. In some locations you could draw a chalk line across the road to mark where the signal ended. The first u.h.f. tuners used valves, had no a.f.c. and drifted badly. Gain was low and were it not for the use of intercarrier sound in the i.f. strip we would have been up all night tuning in.

Hybrid Receivers

It wasn't long before hybrid receivers put in an appearance, with transistors in the receiver sections and valves in the output stages and timebases. The use of transistors brought with it the need for stabilised power supplies. By the time that the dual-standard phase came to an end most of the bugs had been ironed out. I say most because there was an integrated tuner that shot buttons all over the user's lounge and could possibly have been a contributory factor when Pye found itself in financial difficulties in early 1966.

Programmes

Things were getting better on the programme side. David Attenborough had taken charge, and Peter Cook and Dudley Moore gave us Not only but Also, a unique comedy series. From the archives came the mammoth series on The Great War. The black-and-white era went out like a lion with The Forsyte Saga, which caused more than one vicar to move the time of Evensong. To round off the day we had Late Night Line-up, the forerunner of today's chat shows, in which Joan Bakewell and Dennis Toughy talked to people in the news.

Technical Changes

Unlike the previous decade, during which the technology had remained fairly stable, the shape of things to come was being moulded as we worked our way through this phase of TV. On the broadcasting side the first major change was to come with stereo radio. Colour TV came soon afterwards.

Stereo radio started in August 1966, from Wrotham in Kent. It spread to the Midlands and Northern England in the following year. The BBC nearly backed the wrong horse again, having done its preliminary work on the EMI Percival system. In the event the US pilot-tone system was adopted. Today we take it for granted.

Colour Systems

Shortly afterwards the Television Advisory Committee gave its verdict on the colour system to be used. A meeting of European government ministers and their advisers had previously failed to decide on a common system for Europe. France and Russia decided to adopt the French SECAM system. Most of the other Western European countries chose the West German PAL system. Some continued to argue over the matter for several years. Belgium got stuck with both. The US NTSC system was hardly considered, having been superseded by the other two.

With the NTSC and PAL systems the two transmitted colour-difference signals modulate the phase and amplitude of the colour subcarrier. The problem with the NTSC system is that spurious phase shifts alter the colour. PAL overcomes this problem by inverting the polarity of one of the colour-difference signals on alternate lines, restoring the polarity at the receiver: processing with a delay line to store the signal from the previous line and adder and subtractor networks results in effective cancellation of any phase shifts – in practice they are converted to barely noticeable amplitude changes. With SECAM, which was the first system to be devised as an alternative to NTSC, the two colour-difference signals are transmitted on alternate lines and frequency modulate the colour subcarrier. Again a delay line is required, this time to make both colour-difference signals available on each line. Subjectively there is little to choose between the quality of the pictures produced by the PAL and SECAM systems. Various advantages were claimed in connection with such factors as tape use and transmission problems in difficult terrain.

Despite the fact that the BBC had done most of its preliminary work with the NTSC system it rapidly geared up for PAL transmission and very soon test card F with the girl and her doll took the place of test card E. Trade test transmissions alternated between the test card, colour bars and colour demonstration films.

Explaining Colour

By this time I was contributing to a trade magazine *(Radio and Electrical Retailing* – remember it?) as well as to this one, mainly because an editor had defected and persuaded me to write for him in his new capacity as well as for *Television.* So, under the name Field Engineer, I undertook the daunting task of trying to explain colour TV in simple terms to RER's trade readers. The series ran for a whole year and would have become a book had not the editor moved again. It was however used as the basis for some tests, and on one occasion while being interviewed for a job I found myself being asked questions from the instalment I'd just written!

It wasn't easy to explain things like colour-difference signals. You can't get hold of a difference easily! Luckily stereo radio came to my aid. The idea of left and right sounds being turned into sum and difference signals for compatibility reasons had by then become familiar and was straightforward. Thus when it came to colour we already had a difference signal to use as an example. Stereo radio also provided an analogy for the subcarrier – in radio terms the pilot – and synchronous demodulators. So it gave us as nice a lead-in to colour as you could wish. Thorn helped us all with two engineer-friendly steps. First it decided on all solid-state colour receivers from the word go – the famed 2000 chassis was the world's first all solid-state (except for the tube of course) large-screen production chassis. Secondly engineers were taken to Edmonton for two-day familiarisation courses.

Nowadays the need to purify, converge and set up the grey-scale of a receiver on installation is a thing of the distant past. Matters were quite different when colour began. All the c.r.t.s were of the delta-gun type, and the circuitry was nowhere near as stable as it is today. Worst of all the first sets had to be capable of dual-standard operation, and spent most of their time displaying the BBC-1 and ITV 405-line monochrome transmissions. This provided a severe test of installers' ability to converge the sets. We managed however and the results we achieved were so good that on occasion an owner would ask for a bit of corner fringing just to prove to the neighbours that it was a colour set!

A Time of Change

Many familiar brand names ceased to be used during the dual-standard era as rationalisation of the trade set in. One in particular was about to affect me, when there was a financial crisis at Pye in early 1966. Philips, Thorn and GEC all expressed an interest in taking the company over. In the event Philips succeeded, after building up a 60 per cent shareholding, but the government of the day imposed certain conditions. As a result, Pye carried on in its own inimitable way for another decade.

Shortly after this the BBC announced that it would commence live colour transmissions in June 1967, in order to be able to cover the Wimbledon Lawn Tennis Championships. My mind was on other things however. Family changes, a health problem and the desire to escape the wrath of dual-standard viewers led to my moving from retail servicing in west Norfolk into the Production Engineering Department at Pye's Lowestoft factory. It was there that a friend took me aside to explain the takeover business just mentioned, by which time I'd moved in.

next month in

TELEVISION

● VIEWDATA INSTALLATIONS AND TERMINALS
Viewdata/Prestel is now well-established for business use and many manufacturers' service departments and parts suppliers are using it to enable repairers to gain quick access to parts lists, prices and stock availability and to place orders. Next month Roy Baines describes the basic viewdata technology and the equipment required and then provides a survey of the various servicing databases available to users.

● INTERMITTENT FAULT DETECTOR
How do you go about tracing the cause of a fault that's seldom there? As many as a third of the faults in modern sets are intermittent, some showing up only once or twice a day or even less than that. Monitoring key voltages is the solution, but equipment can't always be spared for connection to faulty sets for long periods. Steve Cannon's simple fault detector provides a LED or an audible indication when the state of a line being monitored changes. A selector caters for widely different voltage levels. It's a great help when tackling intermittent faults.

● COMB FILTER OPERATION
The frequency response of a delay line plus add and subtract networks is comb-like, hence the term comb filter. The technique has long been used in colour sets to separate the two transmitted colour-difference signals and has more recently been adopted for dropout compensation and noise cancelling in VCRs. J. LeJeune describes the filtering action.

● SATELLITE TV TECHNIQUES
The next instalment in Derek Stephenson's series deals with the different polarisation techniques in use and the methods of handling them at the head, then looks at low-noise down-converter techniques. Also notes on some common head unit faults.

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This time I'm returning to the theme of faults that boggle the mind!

Panasonic NV-MC10

The first sorry tale relates to a Panasonic NV-MC10 with no auto-focus. With previous under-guarantee repairs Panasonic has borne the brunt of the cost: when we've found which PCB is responsible we fit a replacement and align it. This is quicker than fault-finding to component level, particularly if the fault is an obscure one. Panasonic forks out for a new PCB in order to reduce the labour charge, which is at a fixed rate.

In this particular case the video signal went into an analogue processing chip, IC602, at pin 34 but didn't come back out at pin 40. Maybe the chip was faulty. Before replacing it however I decided to check the pulse inputs, particularly at pin 32 where video signal clamping pulses should be present. Absence of these clamp pulses could account for the missing video. As there were no pulses at this point attention was turned to IC601, the control processor chip. The missing pulses come from pins 45 and 46. There were no pulses at either pin though pin 44 and others were active. It was reasonable to assume that IC601 was faulty, but a replacement did no good at all. So I followed the fault-finding procedure laid down in a training manual. This led me to the conclusion that the first chip, IC602, was at fault. But replacement was again fruitless.

Time was clocking up so I fitted a new auto-focus PCB. Guess what? Still no auto-focus! Obviously the cause of the problem, whatever it was, was not on the auto-focus PCB. This was strange as the control processor chip was well and running though it was not producing CP1, WNID and HN/W (whatever they are!) pulses. Logically if the cause of a fault is not on a particular PCB there must be an incorrect input. Sure enough the WHD pulses at pin 2 of B602 were at only 2V peak-to-peak. I felt that they should be at about 5V peak-to-peak, the amplitude of the VD pulses at pin 3 of B601.

The WHD pulses come from pin 18 of IC307, the main pulse generator chip on the video processing board. All right, fine, but where is it? Under the screening can which is beneath the encoder pack that straddles the whole assembly. Full auto-focus operation was restored when IC307 had been replaced, with some difficulty I might add – leaving me with a spare PCB for next time.

With camcorders it's often useful to have a test-jig chassis as an aid to more rapid fault assessment. If I'd had an NV-MC10 chassis in which to check the auto-focus PCB a considerable amount of time would have been saved. But purchase of a camcorder to serve as a test jig can be justified only where the service department deals with a particular model in large numbers.

No Camera Power

Another service centre asked me to help out with a camcorder that wouldn't power its camera section either in the record or the monitor modes. A d.c.-d.c. converter in the camera head is enabled when the camera control processor chip turns it on. This signal was missing.

Three signal lines connect the camera control processor chip and the syscon control processor chip on the main deck. The syscon CPU chip sends data and clock signals to the camera CPU chip and receives back a ready signal. On test I found that the syscon CPU chip was producing data but no clock signals. The ready-signal path was also inactive.

It would be reasonable to conclude that the syscon CPU chip was faulty. But it ran the machine in play, so maybe not. A cross-check with a known good syscon PCB eliminated the syscon CPU chip as neither PCB produced clock pulses when monitor was selected, though data pulses were present. Matters were no better when a substitute camera head was fitted, thus eliminating the camera CPU chip and its ready signal from the field of suspects. But what else was there? The syscon PCB and the deck control were fully operational, proved by substitution. There remained only the signal paths between the syscon and camera CPU chips.

In this particular camcorder the path is from the syscon PCB to the Y/C PCB, which is mounted over it, then from the Y/C PCB to the camera operation panel with which the deck and Y/C assembly mate when assembled. A large ribbon cable connects the camera control PCB to the camera head. In all quite a long path, with five connectors.

The cause of the fault was an open-circuit in the clock line between two connectors in this path, on the Y/C panel. It remains a mystery, to me anyway, why the syscon CPU chip didn't produce clock pulses when its clock line to the camera CPU chip was open-circuit. If it had continued to produce pulses, signal checks would have revealed the source of the fault quickly. Possibly the camera CPU's input ports provide pull-up bias for open-collector outputs from the syscon CPU.

Ferguson FC08

I'm not too happy about repairing Ferguson camcorders, as the technical information and supply of spares is less than adequate. The problem this time was with an FC08, the fault report saying that the picture twitches. A known good test tape (thank heaven for MTV!) wouldn't play back as the drum servo was running too fast – and appeared to be happily locked at the wrong speed. The digital servo is within a single chip, so I decided to replace it to get the drum servo FG loop running at the correct speed. This is where we fell at the first hurdle. The chip is listed as type BU3778S, but when I came to fit one I found that it had a BU3779S instead.

In the meantime it seemed to be a good idea to obtain two spare ribbon cables, the long ones that run from the rear of the cabinet to the front, as they would make it easier to work on the chassis when out of the case. Ordering Ferguson parts is difficult for me: I had to photocopy an exploded diagram, mark the two cables then fax it to Ferguson. Several days later a letter arrived stating that the cables were out of stock and no longer available. Brilliant! So much for the guarantee to hold spares for five years. A further protestation fax was sent, to higher authorities. Subsequently two cables turned up, for the FC28 as requested. However the one I wanted to use, being for the FC28, reversed the connections. So I resorted to using JVC ribbon cable extentions.

Eventually the servo chip came and was fitted. There was no real effect, just a minor improvement. We now had a basic but soft lock, with hunting. This indicated that the gain was either too low or too high. C126, a non-polarised

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electrolytic, was the first suspect but proved to be innocent.

Normality returned when C122 ($0{\cdot}22\mu F$), another non-polarised electrolytic, was replaced. I wasn't particularly happy with the servo lock-up time from loading a tape, but at least the servo did lock and remained stable.

Sharp VC-C650

A dealer sent me two Sharp VC-C650s for repair recently. The first one had a straightforward fault: the deck threaded three-quarters of the way then gave up because the drum didn't rotate. This was due to failure of the d.c.-d.c. converter power pack.

There were two faults with the second camcorder. The first was intermittent camera operation and LCD display. This was due to a particularly poorly dressed ribbon cable that had suffered damage in assembly. The second fault was more obscure. This machine also threaded only three-quarters of the way, after which it unthreaded and stopped, but this time the drum was rotating. Obviously the syscon chip thought that the drum wasn't rotating.

There were no r.f. switching pulses from the servo chip, though some very small pulses were being produced by the drum. At this time I'd no extention cables, so I ordered these plus a servo chip (IC702) since it seemed to be a likely suspect. When the new chip came I was surprised to find that the fault was still present after fitting it. But I now had the extention cable: this enabled me to check around the chip.

There were plenty of PG pulses at pin 9, but no head switching pulses at pins 10, 11, 12, 13, 14 and 15. Then I spotted the playback head switching delay monostable time-constant components R710 and C710, connected to pin 33. There was a nice, square switching waveform at this pin, with a good straight edge. But hang on, pin 33 is connected to chassis via C710 ($0{\cdot}047\mu F$). The problem was being caused by a dry-jointed chassis connection here. As it's in the centre of a large PCB earthing land area I suspect that, depending on the temperature of the flow-solder wave during manufacture, there are probably other defective joints in this area in these machines. So watch out for this.

CORRECTION

A multiple error occurred in the section on Sony CCD-V90s in last month's Camcorder Notebook. The weak picture fault with the second machine mentioned was mixed up with auto focus failure on another machine. The cause of the weak picture fault was no data on the bus that controls the high-speed shutter control circuit. As a result the camera was stuck in the very high-speed shutter mode, making the picture very dark. Waving a torch in front of the lens provided the crucial clue. This showed the judder effect experienced when the high-speed shutter is working. The cause of the fault was a break in the data track in the FPC between the CCD drive PCB and the process control PCB.

The auto-focus fault should have read failure of the white balance, in that it was stuck on auto, which worked, but couldn't be shifted to indoor or outdoor. On pressing the selector button the EVF display changed but the camera head stayed in the auto mode. This was again a flexi connector fault (FP71), as reported – the connector between the recorder and camera sections. N.B.

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	3.72
15/85R	3.72
17052	4.50
17053	5.61
17074	9.30
17089	3.45
17127	2.50
17376	1.58
1N4001	0.04
1N4002	0.04
1N4003	0.06
1N4004	0.05
1N4005	0.05
1N4006	0.08
1N4007	0.06
1N4148	0.03
1N4448	0.05
1N5401	0.11
1N5402	0.13
1N5403	0.18
1N5404	0.10
1N5408	0.16
1N914	0.04
1S555	0.18
1S44	0.10
1S921	0.10
2N2219A	0.29
2N3053	0.35
2N3054	0.99
2N3055	0.66
2N3442	1.16
2N3702	0.10
2N3703	0.18
2N3705	0.15
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	1.55
2N3772	1.55
2N3773	1.61
2N3819	0.40
2N3823	1.17
2N3904	0.50
2N4101	1.33
2N4240	2.68
2N4444	1.66
2N4905	9.99
2N5293	0.50
2N5294	0.50
2N5296	0.55
2N5297	0.60
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6292	0.60
2SA202A	0.65
2SA1208	0.26
2SA769	0.99
2SA771	0.75
2SA968	2.44
2SA1006	1.50
2SA1011	0.99
2SA1015	0.20
2SA1020Y	0.36
2SA1027R	0.45
2SA473	0.54
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.45
2SA1103	5.74
2SA329	0.40
2SA489	1.17
2SA490	1.32
2SA493	2.25
2SA562	0.57
2SA564	0.97
2SA614	4.88
2SA628	0.37
2SA639S	1.75
2SA659	0.49
2SA673	0.28
2SA684	0.97
2SA697	0.80
2SA699	1.25
2SA748	1.95
2SA835	2.50
2SA836	0.49
2SA844	0.65
2SA872	0.99
2SA884	2.15
2SA937R	0.97
2SA940	2.23
2SA950	0.50
2SA951	1.75
2SA966-Y	0.85
2SA999	0.75
2SB186	0.40
2SB688	2.10
2SB774	0.44
2SC185	1.13
2SB400	0.40
2SB405	1.03
2SB511	0.99
2SB54	1.39
2SB546	0.74
2SB56	2.80
2SB618A	5.82
2SB631	2.00
2SB643	5.68
2SB681	3.96
2SB695	3.43
2SB774	0.65
2SB819	0.60
2SC1089	1.45
2SC1101	3.22
2SC1128	6.56
2SC1307	5.06
2SC1449	0.50
2SC1941	0.56
2SC558	3.69
2SC1096	0.47
2SC1114	3.25
2SC1116	4.95
2SC1129	1.65
2SC1131	0.72
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	6.09
2SC1213	0.30
2SC1226	1.46
2SC1306	1.98
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.41
2SC1413A	2.27
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.76
2SC1573Q	1.10

2SC1583	0.34
2SC1617	3.89
2SC1678	1.98
2SC1741	0.21
2SC1810	1.75
2SC1815	0.20
2SC1826	0.69
2SC1829	3.35
2SC1875	4.50
2SC1893	3.85
2SC1921	1.37
2SC1923	0.30
2SC1929	2.35
2SC1942	2.59
2SC1959	0.20
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.79
2SC1983	1.32
2SC1985	0.60
2SC2009	0.34
2SC2029	1.95
2SC2028	2.11
2SC2063	0.99
2SC2078	1.10
2SC2073	2.73
2SC2085	1.65
2SC2091	1.30
2SC2141	1.30
2SC2166	0.87
2SC2216	0.69
2SC2233	1.20
2SC2236	1.69
2SC2278	1.14
2SC2314	0.87
2SC2335+Kit	7.00
2SC2551	0.35
2SC2565	4.65
2SC2570	0.46
2SC2577	1.34
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	3.20
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.29
2SC394V	0.81
2SC403C	0.60
2SC458	0.19
2SC495	0.92
2SC515A	1.85
2SC536	0.13
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	1.15
2SC711A	0.25
2SC717	1.28
2SC734	0.20
2SC783	3.98
2SC790Y	3.65
2SC828	0.28
2SC867A	4.54
2SC876	0.96
2SC930	0.54
2SC935	1.15
2SC940	4.68
2SD299	9.47
2SD355	0.64
2SD467	0.55
2SD869	3.75
2SD1128	0.94
2SD1138	0.62
2SD1273	1.48
2SD1453	1.50
2SD152K	2.64
2SD198	3.87
2SD234	0.47
2SD235	0.88
2SD24	2.29
2SD257	1.98
2SD313	0.55
2SD325D	2.26
2SD350	2.35
2SD401	1.40
2SD414	1.98
2SD471	0.35
2SD560	1.50
2SD600	2.98
2SD601R	0.65
2SD613	0.74
2SD636	0.20
2SD639-R	0.52
2SD655	0.98
2SD657	2.80
2SD661A	0.80
2SD731	1.95
2SD773	0.60
2SD811	6.84
2SD837	0.90
2SD841	1.37
2SD856	0.69
2SD857Q	1.84
2SD882	0.35
2SD894	1.75
2SD898	2.37
2SK105H	2.15
7805-T022	0.53
7808	0.45
7812-T022	0.35
7815	0.64
7905	0.80
AD140	1.00
AD143	1.93
AD145	1.50
AD161	0.84
AD162	0.84
AF114	2.47
AF115	0.90
AF118	1.20
AF127	0.57
AF139	0.40
AF178	1.45
AF179	0.36
AF180	0.55
AF181	0.53
AF186	1.32
AF239	0.53
AF279	0.88
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	1.56
AN211	3.25

AN214Q	2.40
AN235	4.65
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	5.48
AN253	1.80
AN260	3.85
AN272	7.92
AN295	7.63
AN301	2.45
AN302	3.99
AN305	8.88
AN315	2.46
AN316	4.95
AN318	7.16
AN320	5.47
AN321	2.25
AN322	7.62
AN337	5.37
AN340P	1.53
AN355	1.65
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	5.04
AN5256	4.40
AN5612	2.20
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	1.75
AN6300	4.40
AN6310	4.54
AN6340	5.62
AN6341	2.22
AN6363	16.00
AN6531	1.95
AN6551	0.69
AN6552	0.68
AN6610	1.78
AN7111	1.14
AN7115	2.52
AN7145	2.17
AN7146	9.90
AN7151	2.37
AN7156	3.87
AN7158	2.67
AN7218	0.80
AN7223	4.99
AU107	7.72
AU110	5.69
AU113	14.63
AY106	2.80
BA524	8.94
BA310	0.14
BA1310	1.50
BA1320	1.30
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.11
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA222	1.15
BA302	1.24
BA311	0.65
BA312	1.45
BA313	0.76
BA317	0.40
BA318	0.09
BA328	2.22
BA333	1.37
BA335	6.27
BA5102A	2.19
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.20
BA536	0.99
BA6209	1.27
BA656	1.51
BA7100	11.35
BA841A	9.27
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.24
BAV20	0.36
BAV21	0.10
BAW62	0.11
BAX12	0.49
BAX13	0.11
BAX18	0.94
BC107B	0.11
BC108B	0.15
BC109B	0.14
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.33
BC140	0.30
BC141	0.31
BC142	0.26
BC147	0.14
BC148B	0.13
BC148C	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.16
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.07
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.27
BC182	0.07
BC182LB	0.14
BC183LB	0.09
BC184	0.09
BC184LB	0.13
BC186	0.25
BC187	0.28
BC204	0.35

BC207	0.19
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.38
BC301	0.34
BC302	0.53
BC303	0.48
BC307A	0.13
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.09
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.19
BC440	0.69
BC441	0.39
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.08
BC547	0.10
BC548	0.28
BC549	0.10
BC550	0.19
BC556	0.13
BC557	0.08
BC558	0.10
BC559	0.10
BC560C	0.20
BC635	0.22
BC637	0.24
BC638	0.20
BC639	0.20
BC640	0.24
BCX34	0.55
BD115	0.36
BD116	0.70
BD124	1.31
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.41
BD138	0.28
BD139	0.24
BD140	0.35
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.69
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.80
BD189	0.65
BD190	0.55
BD201	0.41
BD202	0.60
BD203	0.46
BD204	0.45
BD207	1.73
BD222	0.52
BD225	0.46
BD228	0.63
BD229	0.80
BD231	0.50
BD232	0.49
BD234	0.39
BD237	0.36
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.37
BD243A	0.62
BD243C	0.50
BD244	0.42
BD244C	0.58
BD245	0.83
BD246	0.95
BD253	1.05
BD278A	0.70
BD317	1.40
BD318	2.72
BD375	0.42
BD380	0.66
BD410	0.33
BD433	0.39
BD434	0.37
BD435	0.49
BD436	1.14
BD437	0.45
BD438	0.52
BD441	0.62
BD442	0.50
BD509	1.64
BD510	1.08
BD519	0.78
BD529	0.80
BD530	0.73
BD533	0.67
BD534	0.52
BD535	0.38
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.75
BD677	0.33
BD679	0.43
BD680	0.49
BD681	1.48
BD696	2.47
BD699	0.80
BD700	3.70
BD707	0.60
BD709	0.80
BD710	0.80
BD809	0.45
BD810	0.74
BD879	2.18
BD895	0.55
BD901	0.56
BD902	1.20
BDW83C	0.99
BDW84C	1.65
BDX32	0.45
BDX53A	3.35
BDX538	

BDX54B	0.33
BDX63A	2.09
BDX63A	1.96
BDY20	1.98
BDY81	1.18
BF115	0.29
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.24
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.67
BF255	0.20
BF256	0.15
BF257	0.34
BF258	0.33
BF259	0.30
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.34
BF324	0.32
BF336	0.33
BF337	0.31
BF338	0.34
BF355	0.45
BF362	0.99
BF363	0.50
BF371	0.50
BF391	0.25
BF419	0.65
BF422	0.15
BF423	0.33
BF435	2.61
BF450	0.35
BF451	0.11
BF457	0.41
BF458	0.49
BF459	1.27
BF460	1.63
BF469	0.33
BF470	0.26
BF471	0.25
BF472	0.33
BF479	0.61
BF480	0.89
BF491	0.50
BF506	0.43
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.34
BF759	0.28
BF761	0.43
BF762	0.34
BF869	0.49
BF870	0.30
BF960	0.47
BF966	0.51
BF970	0.39
BFR39	0.63
BFR61	0.92
BFR62	0.50
BFR81	0.29
BFR89	0.29
BFR90A	1.63
BFX29	0.63
BFX84	0.34
BFX85	0.37
BFX86	0.31
BFX87	0.36
BFX88	0.55
BFY50	0.34
BFY51	0.30
BFY90	0.33
BLY49	1.16
BR100	2.20
BR101	0.23
BR103	0.78
BR303	0.79
BRC84	1.20
BRX44	2.08
BRX45	0.60
BRX46	0.81
BRY39	0.30
BRY44	0.56
BSS38	0.85
BSTB0140G	0.34
BSTC0246	1.18
BSTC0233	4.93
BSTC1233	6.99
BSTD1043	6.12
BSV57B	4.34
BSW68	2.85
BSX19	3.69
BSX20	0.60
BSY52	0.34
BT106	1.12
BT108	0.50
BT109	1.18
BT119	1.45
BT120	1.76
BT121	2.17
BT151-800R	2.48
BT8018	1.98
BU106	0.95
BU110	1.36
BU111Y	2.48
BU124	1.35
BU125	4.16
	1.48
	2.48

BU126	1.10
BU204	1.58
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.12
BU208	2.35
BU208A	1.12
BU208D	1.43
BU209	1.75
BU226	2.55
BU326A	0.99
BU406	1.24
BU406D	1.24
BU407	0.54
BU412	5.29
BU426A	1.67
BU500	1.53
BU508A	1.50
BU536	1.53
BU608	2.17
BU705	2.67
BU806	0.98
BU807	1.40
BU826A	1.95
BUW84	0.66
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.09
BY133	0.15
BY164	0.64
BY176	0.93
BY179	0.85
BY182	1.05
BY187	0.79
BY189	1.76
BY198	1.62
BY207	0.17
BY208	1.86
BY210-400	0.18
BY210-600	0.31
BY210-800	0.19
BY223	1.45
BY224-600	4.95
BY226	0.15
BY227	0.20
BY228	0.60
BY229-600	1.28
BY229-800	0.90
BY255	0.13
BY295-600	1.23
BY298	0.20
BY299	0.20
BY407	0.90
BY409	1.49
BY448	1.40
BY713	1.12
BYW56	0.29
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.88
BYY56	1.48
BZY93C30	1.65
C20	1.95
C106M	0.76
CA3046	1.55
CA3089	3.29
CA3090AQ	3.25
CA3094	1.72
CA3131EM	3.12
CD4001	0.24
CD4002	0.27
CD4008	1.35
CD4011	0.20
CD4012	0.24
CD4013	0.33
CD4016	0.25
CD4017	0.30
CD4020	0.75
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.45
CD4047	1.06
CD4049	0.24
CD4052	0.35
CD4066	0.29
CD4069	0.29
CD4070	0.24
CD4081	0.14
CD4093	0.40
CD4511	0.44
CD4528	0.52
CD4556	1.47
CR02AM-8	1.70
CV12E	4.19
CX095D	3.14
CX104	8.77
CX108	5.52
CX109	7.20
CX130	8.76
CX135	7.50
CX136	11.49
CX139	11.83
CX157	5.52
CX158	10.45
CX177	8.80
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	1.95
GF758	1.07
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	2.15
HA11235	1.95
HA11244	2.95
HA1125	4.29
HA1137W	1.38
HA1138	3.75
HA11414	2.25
HA1156	1.16
HA1166X	5.77
HA11167	6.73
HA11706	6.60
HA11705	3.61
HA11703	8.00
HA11701	3.45
HA11710	3.37
HA11713	3.45
HA11711	2.90
HA11715	9.40
HA11714	10.19
HA11716	7.76
HA11725MP	13.10
HA11756	18.26
HA11781	16.00
HA1180	13.50
	21.15
	5.15

HA1196	7.43
HA13001	1.63
HA1306	2.26
HA13402	7.06
HA13403	11.86
HA1342A	6.08
HA1364	12.25
HA1366WR	2.88
HA1367	2.75
HA1368R	2.45
HA1368	1.95
HA1374	2.88
HA1377	1.59
HA1388	1.87
HA1389R	2.05
HA1389	2.39
HA1392	2.22
HA1394	3.19
HA1397	2.75
HA1398	2.55
HA1406	2.07
HA1452	0.85
HA1457W	2.23
HD38702-A2	2.99
HD38750A53	5.77
HD38750A-7	8.53
HD38800A50	14.12
HD44801A05	14.07
HISH1010	14.60
HISH1002	9.50
HM6211	14.55
HM6231	12.24
HM6232	7.20
HM6251	5.69
HM7103	2.97
HM9032	4.00
HM9012	3.22
HT4207	11.99
HT4208	2.75
ICH28I	1.20
KA2101	1.00
KC581C	7.75
KC582C	4.85
L200CV	1.27
LA1201	0.75
LA1210	1.56
LA1230	1.18
LA1231	3.04
LA1357N	3.06
LA1363	1.05
LA1364	3.02
LA1365J	1.45
LA1385	1.53
LA1387	3.18
LA3350	1.43
LA3361	1.00
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	1.35
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.23
LA4220	1.25
LA4420	1.72
LA4422	1.28
LA4430	1.47
LA4440	1.99
LA4445	1.52
LA4460	1.50
LA4461	1.60
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LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	4.05
LA7800	1.36
LA7801	3.21
LA7820	2.95
LB1274	1.90
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM383	1.10
LM1017N	1.81
LM1877	1.88
LM2808	5.94
LM2877	7.45
LM324N	0.59
LM339N	0.43
LM340K	11.85
LM348N	2.15
LM380N	1.50
LM6402A093	10.15
LM6416	11.08
LM748	1.82
LM8360	3.87
LM8361	2.95
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	20.62
LU52011	14.95
LU03112	12.37
M21C	1.32
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M192B1	2.32
M293	7.09
M51102L	1.75
M5115P	5.24
M51203L	3.15
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M51301P	4.53
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M51393AP	4.50
M51394P	14.50
M5142P	6.85
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M51515BL	2.75
M51516L	1.95
M51521L	1.50
M5192	3.13
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M5231L	1.58
M53274P	1.33
M54532P	1.45
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M58478P	6.75
M58485P	14.43
MA8001	0.82
MAA4004	11.46
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.31
MB3731	11.50
MC13002	2.99
MC1310P	1.95
MC1327P	1.33

MC1330P	1.98
MC1350P	1.56
MC1351P	1.25
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	3.75
MC14497	7.10
MC14511BCP	1.10
MC1458P	2.91
MC154288CP	2.15
MC1712	3.88
MC3340	1.40
MC5192	19.50
MC7724CP	3.49
MCR106-5/6	1.56
MCR220/7	1.25
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME9002	0.45
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MEM4956	2.50
MJ2501	3.30
MJ3000	2.37
MJE2955	1.03
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MJE520	0.49
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ML926	3.45
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MM5316N	3.50
MM5318N	3.11
MM5369N	2.01
MM5387AA N	1.20
MM5841N	6.93
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MN1435VX	13.20
MN1455	14.04
MP1192	5.07
MP2794	4.00
MPC13355C	1.98
MPF256C	0.60
MPS6570	0.48
MPSA42	0.22
MPSA55	0.15
MPSA56	0.11
MPSA92	0.15
MPSU05	0.86
MPSU10	2.84
MPSU56	0.65
MPSU60	2.21
MR818	0.33
MR854	0.46
MR914	0.80
MRF477	24.77
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MVS460-02	0.61
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NE555	0.35
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NE565N	1.18
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OA47	0.16
OA91	0.14
OA95	0.16
OC28	9.07
OC35	1.06
OC36	7.53
OC44	1.95
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.65
OT121	1.45
PT6042	3.25
PT8504	5.65
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R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.38
R2265	1.49
R2306	1.36
R2322	0.67
R2323	0.76
R2354A	0.60
R2354B	2.01
R2441	1.36
R2461	0.95
R2540	1.65
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.23
RGP30M	0.36
RM11C	0.85
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S2055AF	3.75
S2800D	1.50
S2802	2.90
S2818	4.05
S3702S	5.21
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SA8063	15.55
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SAA1024	2.50
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SAA1351	8.11
SAA3027P	2.71
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SAA5010	3.54
SAA5012	5.50
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SAA5030	6.33
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SAB3021	3.95
SAB3024	6.36
SAB3209	5.82
SAB3210	3.21
SAF1032P	5.13
SAF1039	1.95
SAS5010	8.39
SAS560S	1.91

SAS560T	5.42
SAS570T	5.42
SAS570S	1.95
SAS580	2.85
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SDA2006	17.10
SDA2010	20.50
SDA21122	11.77
SG264A	9.25
SG613	12.37
SG629	8.27
SG6533	9.00
SI1125H	7.50
SI163HD	27.87
SKE2F1 04	1.25
SKE2G3 04	0.73
SKE4F1 06	0.30
SKE4F2 08	1.07
SKE4F2 06	0.85
SKE4F2/10	1.36
SKE5F3 10	1.36
SKE4G104	0.54
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	4.45
SL480	7.24
SL490	2.37
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SL918A	9.07
SN16861ANO	0.82
SN16966N	10.25
SN29715N	6.04
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SN74141N	2.65
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SN7472	1.54
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SN74LS26N	1.45
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SP5422	1.83
STA401	2.75
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STK0029	5.70
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STK0050	11.96
STK011	5.08
STK014	12.25
STK031	12.95
STK040	13.34
STK054	9.35
STK058	27.50
STK077	9.28
STK1039	5.75
STK2110	11.95
STK2145	13.77
STK2240	16.65
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STK3042	6.08
STK3044	5.75
STK4019	13.87
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STK4332	5.37
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STK460	9.85
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STK502	7.25
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TA7323P	3.15
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TA7607AP	1.95
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TDA9513	3.15
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TEA1014	3.00
TEA1020SP	4.93
TEA2018A	2.16
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TIC47	0.77
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TIP32A	0.35
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TIP47	0.65
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TMS1024NLL	6.50
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TMS3720ANS	4.95
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TUA2000	8.98
TV106	1.76
TY6010B	2.97
ULN2204	8.50
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UPC30C	2.51
UPC324C	4.70
UPC32C	4.94
UPC339C	2.95
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UPC474	5.11
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UPC575C2	1.55
UPC580C	2.73
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	4.76
UPD2819C	4.98
UPD553-164	14.07
UPD8049C-1	11.50
XO022CE	5.75
XO029CE	7.09
XO031CE	6.38
XO035TA	6.60
XO040TA	4.50
XO042CE	3.19
XO043CE	2.75
XO055GE	5.02
XO057GE	6.00
XO065CE	5.95
XO074GE	17.14
XO077GE	14.60
XO079CE	4.95
XO092CE	10.31
XO096CE	6.20
XO109CE	13.61
XO113CE	10.31
XO195CE	9.60
XO204CE	8.74
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FERGUSON/JVC
Machine Nos.: 3292 8903 3V00 3V01 3V06 3V16 3V22 3V23 3V24 3V29 3V30 3V31 3V35 3V36 3V38 3V39 3V49 — **VHS A**

FISHER
Machine Nos.: FVH — D520 D530 D620 D720 P420 P510 P520 P530 P615 P620 P622 P710 P720 P721 P722 — **VHS U**

GEC
Head Part Nos.: 5458161 5458165
Machine Nos.: 4000H 4001H 4002H — **VHS I**
Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: 4001H 4004H — **VHS K**

HITACHI
Machine Nos.: VT3000 — **VHS A**
Head Part Nos.: 5458104
Machine Nos.: VT4000 VT4200 VT5000 VT5500 — **VHS H**
Head Part Nos.: 5458161 5458165
Machine Nos.: VT6500 VT7000 VT8000 VT8040 VT8100 VT8500 VT8700 VT9000 VT9300 VT9500 VT9700 VT9900 — **VHS I**

Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: VT11 V14 VT33 VT34 VT330 VT340 VT5030 VTP10 VTP30 — **VHS K**

ITT
Machine Nos.: VR3605 VR3033 VR3905 VR3913 VR3914 VR3935 VR3943 VR3963 VR3993 VR3975 VR3985 VR3986 VR3833 — **VHS A**

JVC (see also Ferguson)
Machine Nos.: HP4000 HR3300 HR3320 HR3330 HR3350 HR3360 HR3750 HR3860 HR4100 HR7200 HR7600 — **VHS A**

MITSUBISHI
Machine No.: HS200 — **VHS A**
HS700 HS303 HS304 — **VH700**

NATIONAL PANASONIC
Head Part Nos.: VEH0099 0103 0115 0121 0131
Machine Nos.: NV300 NV322 NV332 NV333 NV340 NV390 NV2000 NV3000 NV7000 NV7200 NV7500 NV7800 NV7850 NV8170 NV8200 NV8400 NV8600 NV8610 NV8620 — **VHS B**

Head Part Nos.: VEH0171 VEH0218
Machine No.: NV370 NV3708 — **VHS M**
Head Part Nos.: VEH0171
Machine No.: NV330 NV777 — **VHS N**
Head Part Nos.: VEH0286
Machine No.: NV430 — **VHS W**
Head Part Nos.: VEH0174
Machine No.: NV366 — **VHS X**

SHARP
Head Part Nos.: DDRMU 0002 HE17/21/27
Machine No.: VC581/2/3 651 681/2/3/5 659 699 — **VHS S**
Head Part Nos.: DDRMU 0001 HE00 0002 HE02 04 05 06
Machine No.: 2C9 VC110 VC200 VC220 VC300 VC381 VC384 VC386 VC387 VC388 VC477 VC481 VC482 VC930 VC970 VC3300 VC9100 VC9300 VC9400 VC9500 VC9600 VC9700 — **VHS C**
Head Part Nos.: DDRMU 0001 HE09
Machine No.: VC7300 VC7700 VC7750 — **VHS D**
Head Part Nos.: DDRMU 0001 HE10
Machine No.: VC6300 — **VHS E**
Head Part Nos.: DDRMU 0001 HE12
Machine No.: VC8300 — **VHS L**
Head Part Nos.: DDRMU 0001 HE14
Machine No.: VC2300 — **VHS F**

SANYO
Head Part Nos.: 1430242 T01700 1430242 T22300
Machine No.: VTC5000 VTC5150 VTC5300 VTC5400 — **BETA D**
Head Part Nos.: 1430242 T02200
Machine No.: VTC5350 VTC5500 — **BETA D**
Head Part Nos.: 1430762 T02000
Machine No.: VTC9300 VTC9455 VTC9500 — **BETA X**
Head Part Nos.: 143072 T02100
Machine No.: VTC9300PS VTC9350 — **BETA X**

SONY
Head Part Nos.: A6762 044A, 044B, 054A, 147A
Machine No.: SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME — **BETA A**
Head Part Nos.: A6762 012A, 038A, 055A, 129A
Machine No.: SL5W, 5000 5100 SLC5, C6, C7 — **BETA B**
Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A
Machine No.: SLC20, C30, C33, C40, C44
SLF1, F30, HF72, T20, T30 — **BETA W**

Please see next col. for prices.

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BETA W	£19.95
BETA X	£31.92
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VHS B	£11.95
VHS C	£18.75
VHS D	£81.76
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VHS M	£14.75
VHS N	£26.95
VHS R	£21.00
VHS S	£19.81
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VHS U	£21.95
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VHS X	£35.00
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01X0 033 825	£47.05
01X0 040 002	£48.32
01X0 056 013	£61.55
01X0 057 002	£31.36
01X0 082 001	£46.02
01X0 083 063	£66.03
PHILIPS	
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691 200 54	£49.68
691 200 98	£62.02
691 201 12	£61.66
691 201 66	£61.93
691 201 78	£49.96
691 202 87	£55.37

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VID2	01X0-018-024	Take up idler T3292/PU47752	6.73
VID3	01X0-018-025	Rewind idler assembly T3V16/PU49282	6.20
VID4	01X0-018-729	Take up idler T3V00/PU49280	7.96
VID5	01X0-040-006	Loading belt T3V29/30/PU48941-2	0.26
VID6	01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042	4.50
VID7	01X0-040-007	Take up idler 3V29/30/PU48967B	2.45
VID8	01X0-040-017	Reel motor assembly 3V29/30/PU51381V	27.95
VID9	01X0-065-009	Capston motor 3V35/36/38/39/PU55371V	20.92
VID10	01X0-065-016	Cass. housing Assy. 3V35/36/38/39/PU29825	22.55
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VID11	V5577355	GEC 4100/Hitachi VT11E capston motor	26.78
VID12	V6413663	GEC 4000/Hitachi VT33 f/f rewind arm	2.10
VID13	V6861471	GEC 4001/2/Hitachi 93/9500 f/f rewind arm	2.07
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VID33	NIDL0004	Idler wheel VC2300	3.50
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VID35	LA9210S	Universal lamp with socket 310mm	0.50
VID36	NAT/PAN.	P.C. MTG. leadless lamp	0.20
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VS 2 EG	DBK101	£1.50	HR 3600	DBK107	£5.25
VS 3	DBK134	£1.76	HR 3660	DBK103	£1.42
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VS 10	DBK136	£0.68	HR 7200	DBK139	£1.22
VS 9300	DBK103	£1.42	HR 7600	DBK138	£0.86
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VS 9700	DBK102	£1.96	HR 7700	DBK108	£0.85
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			SLT 7 ME	DBK100	£1.95
SANYO			SLT 7 MER	DBK100	£1.95
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VTC 5400	DBK105	£1.15	V 7540	DBK123	£1.79
VTC 5500	DBK106	£1.95	V 8600	DBK124	£1.24
VTC 6500	VID7533	£1.00	V 9600	VID7810	£1.95
VTC 9300	DBK104	£3.12	V 5250	DBK148	£2.66
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VCR Clinic

Reports from Philip Blundell, AMIEIE, Alfred Damp, Jeff Herbert, Mick Dutton, Stephen Leatherbarrow, Richard Flowerday, Ian Bowden and Ed Rowland

Philips DMP3-0 Deck

This machine recorded colour all right but there was no playback colour. When we scoped the input to the modulator we could see that alternate fields of bursts and chroma were missing. A chroma panel swap proved that the fault wasn't there. It wasn't on any of the other likely panels either. But when the deck was changed the colour returned. A scope check on the off-tape f.m. signal showed that the output from one head was low, but new heads didn't restore the playback colour. Use of a signal generator then showed that the picture was being made up from the signals from one video head and one hi-fi audio head. The f.m. from VK2 was missing at pin 3 of the LA7018 chip as transistor 7004 was switched on in the play mode – it should conduct only in still frame and record. Transistor 7014 was also switched on as there was a crack in the print to the stop motion line (pin 1 of plug L6). This particular machine was fitted with the P404 head amplifier.

P.B.

Philips VR6460

Playback was o.k. but there was a very poor picture in the E-E mode. There was no sync and the picture was pulling and shaking. C22 (1μF) on the i.f. panel was open-circuit.

P.B.

Philips VR6467

A noise bar ran through the picture every ten seconds or so. Scope checks showed that the amplitude of the control track pulse at pin 13 of 7551 was low at 2V instead of 5V. This chip (8051) was defective, with an internal pull-up open-circuit.

P.B.

Philips DMP3-0 Deck/VR6561

When play was selected the take-up spool didn't rotate – in fact if a dummy cassette was tried it was the supply spool that was being driven! Normally in play the rack pushes lever 237 which reverses the rotation of the coupling and changes the gearing. This wasn't happening as the leaf spring on lever 237 had come off. The VCR was a VR6561.

P.B.

GEC V4005

Intermittent failure to play was the problem with this machine. When it was tried first thing in the morning it laced up but line slip showed that the drum speed was incorrect. Then, after a few seconds, it would go to stop. Selecting play-pause had no effect. Probing around in the power supply would instigate the fault and voltage checks then showed that the 12V/16V supply was disappearing. The cause of the trouble was a dry-joint at pin 6 of the STK5451 chip.

P.B.

Ferguson 3V54

The job card said "dead" but the supply lines were o.k. The actual symptoms were no timer display and no operation, with a cassette still in the machine. Checks showed that the display grid drive was correct but there was no segment drive. We then found that the microcontroller chip was not receiving the a.c. clock reference pulse though it was arriving at the timer board. C214 was found to be faulty with a resistance of 330Ω.

A.D.

Hitachi VT220

Poor colour was the report. In fact on playback the chroma produced a diamond pattern. A scope check at pin 16 of IC301 (playback main converter output) showed that the signal was virtually the same as that at pin 8 (4·43MHz chroma input). Replacing the bandpass filter CP302 seemed to be the logical thing to do but the fault remained. After pursuing several other red herrings we cured the fault by changing the chip.

A.D.

Hitachi VT17

There was very bad interference on playback, with two thick bands of noise that moved up or down the picture. A scope check on the playback f.m. signal showed that there was an h.f. signal superimposed on it. The h.f. signal wasn't locked to either the f.m. signal or the drum FF pulses. A scope check was then made on the 9V PB line. This showed that an 0·5V peak-to-peak ripple at approximately 2·7MHz was present. It cleared when C1159 on the servo/reg board was replaced. A meter check showed that this electrolytic charged correctly. It also produced the correct display with the component tester built into our Hameg scope. Unfortunately these testers work at 50Hz and don't show up h.f. faults.

A.D.

JVC HRS5000

The problem was overloaded video and crushed sync in the E-E mode. Its cause was traced to C14 on the signal processing panel being short-circuit. As a result the relevant pin of IC1 was at 5V instead of 1·4V, upsetting the clamp detector stage.

J.H.

JVC HRS5000

The E-E signals were normal but on playback there was sound only, the monitor displaying a blank raster. Scope checks in the playback signal path showed that composite playback video was present at pin 15 of IC3 but was missing at pin 16. This was due to about 3V at pin 13, bringing on the muting within the chip. Open-circuiting pin 13 restored the playback video and left 3V on the print. The source of this voltage was traced to leakage in C121 (10μF, 16V), replacement providing a cure.

J.H.

Toshiba V66

This JVC clone came in with complaints about poor tracking and poor quality recording. This was not surprising as there was no back tension – the adjustment screw had been set up to give no tension.

M.D.

ITT VR3916

There was an audio fault with this machine: the customer said that he couldn't record the sound. When we opened it up we found that the audio stages had been got at. If a hand was placed near the machine there was a lot of hum pick up in record. We repaired the print and replaced the AN3991K amplifier chip IC1 and the TA7361AP switching chip IC2 but the problem persisted. The only thing left seemed to be the head. When a replacement was fitted the problem had been cured but we couldn't find anything wrong with the old one. **M.D.**

Ferguson 3V48/JVC HRD565

This machine nearly drove us to desperation and certainly had us all questioning its parentage. On the fourth visit to the workshop the fault showed up as no take-up: the capstan motor would stop after an indeterminate time. The merest suggestion of heat or cold on IC202 (M50742-614SP) had the desired effect so we replaced it. But the fault was still present. A scope was connected to pins 8 and 7 to monitor the capstan drive while a meter was connected to the unswitched 5V supply at pin 9. We waited, and waited! Eventually the fault showed up as a distortion, reduction and final disappearance of the capstan drive. IC403 (BU2710) proved to be faulty, again in a thermal manner.

S.L.

Fisher FVH-P615

There was a no record fault with this machine. The switching signal at pin 16 of the LM6416E-239 chip IC503 goes low in the record mode, turning on the REC 9V switching transistor Q513. The REC 9V line was low because Q513 was faulty. A BC640 gave good results. **S.L.**

Samsung VI8220

Bias oscillator problems with earlier Samsung VCRs are common. The oscillator circuit in this later model was redesigned and taken out of its can. It still fails, though for different reasons. The sequence of events is usually as follows. Service call one, no fault found. Call two, dry-joints found and resoldered, usually on the oscillator transistor Q501. Call three, hole in the PCB where Q501 used to live. What happens is that you get shorted turns in the REC 9V smoothing choke L0503. As a result there's enough ripple on the rail eventually to upset the oscillator coil and the transistor. The answer is to order and replace all three items at the same time, i.e. L0503, L0504 and Q501. The parts are inexpensive and Samsung is courteous and efficient. This looks like the fault reported by Ed Rowland in the January 1991 VCR Clinic. **S.L.**

Panasonic NV-F65

This machine failed when it was being installed. It would go completely dead, with no display etc. When it was powered in the workshop it ran all right for many hours before it failed. Failure eventually occurred during play: the tape remained laced up and it was just as if the mains plug had been pulled out. If the mains supply was disconnected then quickly reconnected a short buzzing noise was heard from the power supply. If the mains supply was disconnected for a couple of minutes before reconnection however the power supply would start up and the machine would work without any problems for perhaps an hour or two before it stopped again.

Because of the disorderly shut down a power supply problem seemed likely. A careful examination of the PCB revealed no suspect joints or breaks, but there was an interesting pointer. If the mains supply was connected to the power unit with no connection made to the rest of the machine the power supply wouldn't run: it just buzzed for a couple of seconds (unlike the G21 etc. which will work in this condition). As a check we fitted the power supply from another new machine and connected it up. The machine faulted again after several hours, so the fault wasn't in the power supply itself. We then found that the fault could be brought on by flexing the main PCB. Careful pressure in different parts revealed a sensitive point, down the left edge near the mechanism. As the fault occurred when the board was pressed down a break on the underside print was suspected. Ohmmeter checks on the print then revealed the cause of the trouble: a break in the print that connects R6036 to the base of the motor regulator transistor Q6004 near the front of the machine. To put matters right we connected a link across the faulty section of print. Presumably the loss of loading on the one power supply output caused the complete shut down. **I.B.**

Logik VR950

The poor, low-contrast pictures produced by this machine led us to suspect that the playback luminance amplifier Q0310 was faulty. We've had this transistor fail on other occasions. This time however the culprit was its collector resistor R0364 (3·3kΩ) which had gone high in value.

E.R.

A Fairy Tale

How about this one for a bodge? The owner of a Sharp VC381H brought it to us saying that a friend of his had looked at it but had failed to repair it, and would we like to try? After removing the top cover we connected the mains supply and pressed the operate button. To our amazement the interior of the machine was bathed in a warm, pink glow. Raising the top PCB revealed the source of this wondrous phenomenon. There, nestling among the components on the bottom panel, was of all things a Christmas-tree fairy light. There was no sign of the original cassette lamp or its holder, so new ones were fitted and the makeshift lamp was consigned to the bin. After doing this all that was required was a new idler and a general clean up. Whatever next? **E.R.**

Ferguson 3V45/JVC HRD150

Although this machine would accept a cassette and the fast-forward and rewind modes were o.k. there was no drum rotation and the function LED wouldn't come on. The cause of the problem was an open-circuit fusible link, B3, which is located in the power supply. **E.R.**

NEC 9077

We had had to clean the heads on this new machine several times, which seemed odd. So we brought it in for a check over. The customer's tapes were new and of good quality, and apparently he never used hired or rented ones. After several days' testing the fault showed up. Fast forward and rewind became very slow, and in the playback and record modes the machine shut down because the take-up reel had stopped, the tape being laced tight enough across the upper drum eventually to stall it. Attention was turned to the reel braking mechanism where the cause of the problem was found to be an intermittent brake solenoid. It energises to take off the reel brakes and occasionally didn't do so. Fitting a replacement put matters right. **R.F.**

Receiving Extra TV Channels

Tim Anderson

Winter can be a bleak time for TV-DXing, with very few exotic signals to log. During December there was only a little SpE around, tropospheric propagation was in very short supply and the amazing F2 signals of the past two winters seemed to have almost disappeard now that the peak of the present sun-spot cycle has past. I was sitting in front of my DX receivers, wishing the next three or four months would flash by, when I decided on one more scan through the bands before giving up. I found only one signal in Band I – the Dutch first channel from Lopik. Band III produced only the usual Canal Plus and two pictures from Belgium. So with nothing better to do I decided to give up and see what was on TF1, A2 or FR3 from Boulogne. This made me realise just how many signals are receivable here at St. Leonards, East Sussex, even on a "flat" day. These signals are in fact present every day and, like most things that are always around, we tend to take them for granted.

I decided to make a complete census of these signals, noting the distance of the transmitters and the average quality of the received pictures. The results are collated here for two reasons. First to show other DXers what can be achieved by way of over the horizon reception using average equipment, and secondly to give anyone looking for an extra TV service at or near entertainment quality a general idea over what distances they can expect to have success.

Location

My location at St. Leonards is approximately 200ft above sea level. The land rises to around 500ft at a distance of three miles to the east. From the hill to the east a long ridge runs away to the north west, the nearest part being only a mile to the north of me. Its height never drops below 300ft and much of it is above 400ft. To the west the land is only 50ft higher than my house, but as the distance is some 100yds this forms the worst screen for my aerials. All this is reflected in the map (see Fig. 1): my best "local" reception is from the east through to the south. Crystal Palace and Sudbury are received through one of the small dips in the ridge to the north.

Equipment

I used my DX-TV aerials for this survey. For u.h.f. two Triax BB grids are stacked side-by-side, linked by a Labgear wideband combining unit. The Band III aerial is a 14-element wideband type, while the Band I aerial is a home-built three-element wideband type. These aerials are all mounted horizontally on a rotatable mast, the u.h.f. grids at 40ft, the Band III array at 38ft and the Band I aerial at 34ft. CT100 low-loss coaxial feeder is used for all the aerials and the preamplifiers are all mounted beside the sets.

The local 1kW u.h.f. station is only a quarter of a mile away, so break through can be a problem. By keeping the preamplifiers in the shack I can easily disconnect them or add filters to control any problems. The sets used include standard three-band monochrome portables, a large-screen multistandard Loewe set, and a custom made set-up with an external tuner and external i.f. stages with variable i.f. bandwidth feeding an old monochrome set via an up-converter. So much for the equipment. What can be seen on a daily basis is summarised in Table 1.

Results

I've included in the table all the signals that are received on a daily or near daily basis. Some are well below entertainment quality of course, but group or single-channel stacked aerials and group preamplifiers could be used to bring a station particularly wanted up to or near to entertainment quality.

Effect of Local Terrain

Local terrain obviously has a lot to do with the possibility of this sort of reception. The high land to the north and north west explains why I receive very few over the horizon signals other than Heathfield from that direction, except during a tropospheric lift. A local DXer a mile to the east of me has a totally unobscured view of the sea to the south and is far enough from the Hastings relay to be able to use mast-head preamplifiers. His "local" reception is virtually the same as mine but all French signals are about 1-2 P points up on mine while his Dutch reception is nil. Viewers just over one and half miles to the east, on the other side of the hill, can watch several Dutch channels every day. Some of them would be reasonable here but the best, NOS-1 from Goes, is co-channel with TF1 Boulogne while NOS-2 is on the same channel as the local Ch. 4 (however there are many days when I can hear the Dutch ch. 32 sound if I switch to 5.5MHz while watching Ch.4!).

In Conclusion

I'm sure that similar distant extra channel reception is possible in many other parts of the country. When I lived in Stroud, Gloucestershire almost daily reception of RTE-1 was possible in Band III, and I know of several people in East Anglia who watch Dutch TV on a daily basis.

Finally, to all those TV-DXers who want to live on the south coast for better DXing I have to say that it's not all it's cracked up to be. From Roger Bunney's reports of tropospheric reception I've noticed that DXers in the Midlands and even North Wales seem to do much better

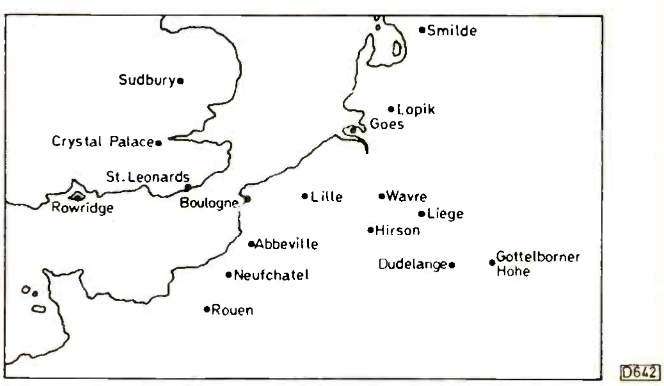

Fig. 1: Transmitters that are receivable on a daily basis at St. Leonards, East Sussex.

Table 1: Signals received daily at St. Leonards.

Transmitter	*Services*	*Band*	*Transmitter e.r.p. (kW)*	*Approximate distance (miles)*	*Quality*
Crystal Palace	Thames etc.	u.h.f.	1,000	45	P3-4. Watchable
Rowridge	TVS etc.	u.h.f.	500	80	P2-3. Often with colour
Sudbury	Anglia etc.	u.h.f.	250	85	P4. Good
Boulogne	TF1, A2, FR3	u.h.f.	100	45	Perfect every day
Abbeville	TF1, A2, FR3	u.h.f.	250	75	P4-5. Reasonable colour
Neufchatel	TF1, A2, FR3	u.h.f.	80	80	P4-5. With colour
Neufchatel	Canal Plus	u.h.f.	5	80	P1-2
Lille	TF1, A2, FR3	u.h.f.	1,000	80	P3-4. Sometimes colour
Lille	Canal Plus	III	200	110	P4-5. Watchable with a decoder
Rouen	Canal Plus	III	65	110	P3. Average
Rouen	La 5, M6	u.h.f.	10	110	P2-3. Average
Goes	NOS 1, 2, 3	u.h.f.	250	150	Would be good but swamped by local stations
Paris	Canal Plus	III	100	150	P3. Average
Hirson	TF1, A2, FR3	u.h.f.	200	180	P3. Average
Wavre	RTBF, BRT 1	III	100	175	P1-5 but always there
Liege	RTBF	I	100	215	P1-5 but always there
Lopik	NOS 1	I	100	190	P1-5 but always there
Smilde	NOS 1	III	50	300	Detectable many days
Dudelange	RTL Plus	III	100	260	Very variable. There 90 per cent of the year
Gottelborner Hohe	SWF	I	100	300	Often detectable at scanner level

with really long-haul reception from Poland, Czechoslovakia and Austria during such openings. This is possibly because there aren't hundreds of French transmitters on the doorstep, "blocking" the way. During some lifts here just about every channel can be occupied by French pictures.

Tube Lifter

Denis Mott

One of the more awkward and potentially dangerous things in television engineering is c.r.t. handling, especially with tubes that have screen sizes greater than 16in. In recent times the problem has been made worse by the use of monitor-style cabinets that make it impossible to get one's hands down the sides of the cabinet to lift the c.r.t. out – never lift a c.r.t. by its neck.

I work in a development and test laboratory where we often test several makes of c.r.t. in a particular model, so I have to change more than the average number of tubes. This has brought the problem very much home to me. Tube handling has to be carried out in complete safety while not altering the tubes' characteristics, e.g. convergence and purity.

After a bit of thought I devised the implement described in this article – see Fig. 1. A number of these have been in use for some time and have proved to be a great help. The lifter shown in Fig. 1 consists of a full length of 10 s.w.g. steel welding rod and a length of 20mm outside diameter plastic conduit or other suitable material to form a handle. Two of these devices are required, as shown in Fig. 2. The details are suitable for use with 21in. and smaller tubes. If larger tubes are to be lifted, make a second set of lifters with proportionally larger dimensions.

The rods can be bent by using a vice and a pair of heavy-duty pliers. Bend one end and side to the angles shown, slide the handle tubing on to the rod, then bend the other leg to suit. If the hooks are too small they won't seat in some lug holes: if they are too large they won't enter the holes.

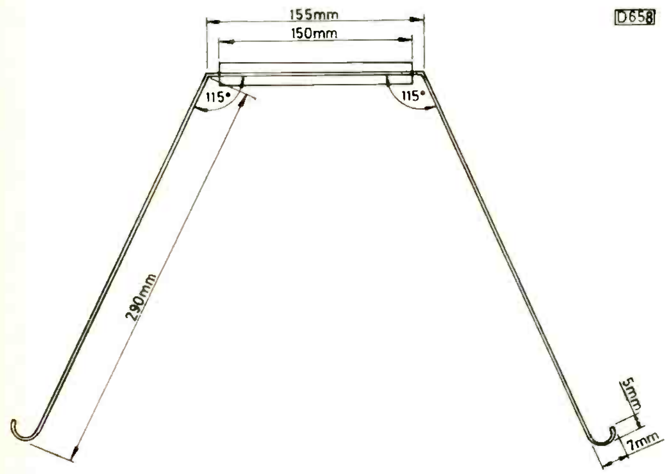

Fig. 1: Constructional details. Dimensions are a guide only. Larger tubes will require different angles.

Tube Removal

To remove a c.r.t., first lay the set face downwards, then release the c.r.t. mounting bolts. Next tilt the c.r.t. by the safest means possible and hook the tool into the lugs at one

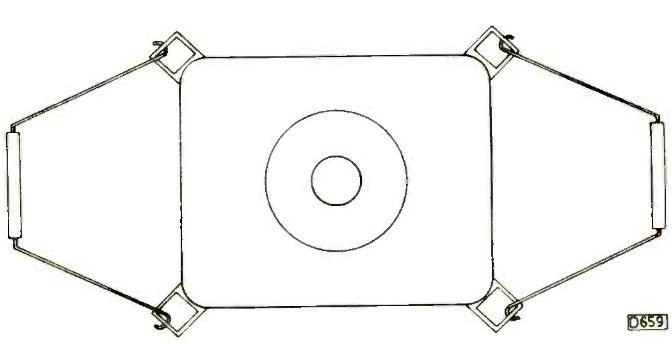

Fig. 2: Method of attaching the lifter to a c.r.t.

side. Tilt the tube the other way and attach the other lifter. It's vital, before lifting out the c.r.t., to ensure that all four hooks are fully located and are not liable to slip. Make sure that all leads are disconnected, then lift out the c.r.t. and place it on the bench next to the cabinet. It's not advisable to use the lifters to carry the tube very far. After fitting the peripheral bits, i.e. the degaussing coil and earthing braid, use the tools to lift the new c.r.t. into position.

I've used the lifting aids for well over a year without mishap or scraped knuckles. They've proved to be most useful items in our laboratory.

What a Life

Donald Bullock

One thing we're not short of around here is unusual people. Pleasant enough, most of them, though there can be awkward moments.

Mr Fussie's Fisher

"This video's never been right since you did it" said Mr. Fussie as he placed his Fisher FVHP905K on the bench. "You say you fitted a new idler thing in it six months ago, but it's still faulty. If you put a tape in and press the play button the motor thing whirrs then stops and the video switches off."

"Then why didn't you bring it back before?" I asked.

"Because it happens only occasionally. The rest of the time it's o.k."

He left it with me and I moved it to the end of the bench, where I tried it now and again whilst working on other jobs. Eventually it did as he said. So I fitted a new idler. It's the one that looks like an elliptical halo with a black wheel orbiting at one end. Then I switched on, inserted a cassette and pressed play. It failed at the first try. As the idler spring seemed to be slack I fitted another. This time the machine worked perfectly. It continued to do so on soak test over the next few days. So I pronounced it fit and in due course Mr. Fussie called for it.

"I hope it's all right now" he said as he took it away. Just then the phone rang. It was the elderly Miss Briske.

A Dead Roberts'

"Mr Bullock? My Roberts radio's gone dead dear. I've sent my father along with it. You won't get much sense out of him so you'll have to phone me about it. He looks all right but there's nothing upstairs dear."

Lumme I thought. Miss Briske must be a hundred. What must her father look like? Then he appeared. He was old all right, and stocky, but fresh-faced with sparkling eyes and a bushy white waxed moustache.

"Hello Mr. Pillock" he said, holding the radio aloft. "Won't go. Think there's anyone in there?"

"I wouldn't think so."

"Best have a look eh?" he said, pointing to the car aerial socket.

"No need for that. I hardly ever find anyone in radios like these."

"Better have a quick look through here" he insisted, holding the radio up with the aerial socket close to my eye. I decided to humour him and peered into the aerial socket carefully.

"No" I pronounced. "Nobody at all in there. Not a soul."

The old man shuffled off and I put the radio on the bench. It was an R404, dating from many years back, and was dead. The batteries were down a little but were still good enough for the set to oscillate all right. Then I remembered that the four-legged AF117 transistors had an earthed screen within them and that this would sometimes short to the base. I snipped the first i.f. amplifier transistor's earthed lead-out wire and switched on. The radio sprang to life.

Crackling Sound

The next call was from Mrs. Bustler, who lives up the street. Her TV sound was crackling. I slipped along to find her having a row with her husband, who had just returned from the local and had managed to knock her clothes-horse over, sending the freshly ironed washing all over the place.

I joined the mound of shoes amidst the miles of cable behind her Philips G11, plugged the iron in and took the back off. Sure enough the BD131 audio output transistors were footloose. I resoldered them and switched on. Up came the sound minus the crackle, and Mrs. Bustler grinned. An easy one that.

A Curious Display

A colour portable awaited me when I got back. It was an ITT set fitted with the CVC801 chassis. When I switched it on and plugged in the aerial four horiontal strips of picture, separated by blank strips, appeared on the screen, each with a conical squiggle in its centre. I looked around the line output stage for a likely looking open-circuit electrolytic, but my eye was drawn to the mains bridge rectifier's reservoir capacitor C658 (200μF, 385V). It might be causing some of the trouble at least I felt, so best to check it first. When a test capacitor was connected across it there was a perfect picture. Another easy one. But my joy soon turned to sadness as Mr. Fussie came into view with his Fisher FVHP905K.

"Worse than ever" he declared, "worse than ever."

Battle with the Fisher

He departed and I tried the machine. The take-up spool kept stopping and starting and the machine then switched off. Since the fault was now more definite I felt that the idler I'd fitted, not being a manufacturer's spare, might have been outside the tolerance limit. So I ordered some Fisher idlers and springs and put the job to one side.

When they came I fitted a new idler and a new spring. The recorder now worked all right. Feeling optimistic, I put it back on the soak test bench. A while later it started to play up again.

Operating it repeatedly with a servicing cassette inserted I noticed that when play was pressed the pinch wheel didn't always press the tape firmly against the capstan. In fact it was sometimes possible to pull the tape through by hand quite easily. I couldn't see any signs of wear then, whilst studying the mechanism, I noticed a tiny cross-headed adjusting screw near but below the pinch wheel. To adjust it I had to take out the tape deck. After doing this I found that turning the screw moved the pinch wheel towards the capstan. Progress! When I'd adjusted it the grip was firm and consistent and I reassembled the machine, with a sigh of relief.

On soak test it behaved perfectly every time for days.

But since it had given me so much stick I was wary. Sure enough it eventually failed to start when play was pressed, though the motors whirred.

I turned the machine upside down and studied the mechanics as I pressed play and stop time after time. It worked perfectly for days, then did it again. This time I thought I noticed that the loading belt slipped ever so slightly at the very end of its cycle. I wanted to be sure, so I put a white spot of typewriter correction fluid on it. This proved the point beyond doubt, a new belt curing the trouble. Why hadn't I thought of this first?

Abe's Sets

Then Abe called. He's a yokel who lives in a riverside woodman's hut together with two ageing Ferguson monochrome portables, a car battery and a screwdriver. Small and emaciated, he foresakes shaves and haircuts and looks like a hopelessy overdressed scarecrow. The idea of the two sets is that if one fails he can resort to the other one. While watching the working set he gently pulls the other one to pieces, then tries to put it back together. If this doesn't get it going he wraps it in a blanket, ties it up with binder twine and walks it the five or six miles to me. He's polite and pays his way. Perhaps that's why I play along with him and try to unravel the various faults he introduces in his sets.

This time along with the set in a blanket he had a couple of old canes, an old-fashioned seaside bucket, and a spade in a second, plastic bucket. And one of his overcoat pockets was bulging. He unpacked the set and my first surprise was to find that it wasn't one of his Fergusons. It was an old Bush BM6004 colour portable.

"Worked at first" he said, "then 'e stopped altogether an' I opened 'un up."

I put the set on the bench and unscrewed the back. Now this set has a Saba chassis, with modules galore. It was dead. I homed in on the horiontal deflection module (no. 11) and checked the supply voltage at pin 3 - this is the supply to the line driver stage. It was well down. I removed the module and checked the heavyweight diodes on it. D687, an SKE4F1/10, was short-circuit. When I replaced it the set sprang to life. But with its own aerial the picture was noisy.

"Set's working" I said to Abe, "but the picture's snowy."

"Thank 'ee sir" Abe replied, "it'll be all right with my aerial plugged in."

He went outside and filled the little buckets with soil, pushed in the canes and slung a length of ancient black-covered copper aerial wire between them on the first pair of porcelain-egg insulators I'd seen for thirty years. Then he came in and approached the set with a gnarled wander plug on the end of yards of feed-in aerial wire.

"What's all this, Abe?" I asked.

"A gentlemun gave me the set for diggin' his garden, then said I could have his old aerial if I took it down. This is how I puts it."

"Abe, that aerial wire is as old as me. It was made for early wireless sets before they ever invented television receivers. Throw it away."

But Abe had reached the set. He unplugged the loop aerial and connected his contraption. It transformed the picture to perfection.

I put the back on and reached for a pen as Abe dismantled and packed his aerial kit. Then he came back in, pulling at his overcoat to get at his jacket pockets.

"For mending your set" I said, "£15 less £5 for educational entertainment. £10 to pay."

"Thank you Mr. Bullock. See you again, you'm kind."

"Right on both points, Abe" I replied.

CD Player Casebook

Reports from Mike Leach and Nick Beer

Kenwood DP460

This machine wouldn't play. It would read the TOC on all discs but when play was selected the disc would spin and nothing else would happen. The disc appeared to rotate at a constant speed, and the r.f. waveform was stable and clean. I opened the tray and tried again, but the same symptom occurred each time.

The next step I took was to select track five to see whether the laser assembly would move to the correct section of the disc. It remained at the centre of the disc and didn't move at all. When I gave the sled motor a jolt however the laser assembly moved happily and track five was played as requested. Out came a scrap Lasertech CD100 machine which uses the same type of sled motor. When this was fitted in the Kenwood machine it worked normally again. **M.L.**

Technics SLP420

This Technics machine wouldn't play, nor would it read the TOC. On occasions the disc would spin extremely fast, but this occurred with only some discs, not all of them. We cleaned the laser lens and serviced the mechanism but the fault persisted.

A check on the r.f. waveform at test point TJ301 provided a clue as to the possible cause of the fault. The waveform could be seen to be contracting and expanding slightly at the right-side whatever disc was inserted into the machine. This indicated that the turntable speed wasn't correct, probably due to a servo fault. Further scope checks led me to the EHDGA1234 data slicer and EFM chip IC304. Replacing this cured the fault and when the machine had been set up it performed superbly. **M.L.**

Denon DCD700

The disc caught on the mechanism as the tray went in and out. This marked it. In addition the disc scraped as it span. The cause of these problems was the fact that the turntable had slipped down the spindle motor shaft. It relies on the friction of the plastic material, and as this was worn it wouldn't stay at the correct height.

New parts were ordered, including a new spindle motor as the bearings in the original one had become noisy and knocked. What we received was a modification kit containing a motor of new design and a metal turntable which has a hex-headed grub screw for fixing – a much more suitable arrangement. A circuit modification is also needed – add an $0{\cdot}1\mu F$ capacitor in series with a 22Ω resistor between pin 1 of IC201 and chassis. This is in the circuit that controls the spindle motor drive transistors. **N.B.**

Astra Update

Robin Marshall

1991 should be a good year for Astra. The initial Astra 1A satellite came into operation in 1989, with sixteen channels beamed at Europe from an orbital position at 19·2°E. On March 2nd the Astra 1B satellite was placed in orbit less than 70km from the 1A craft, adding a further sixteen channels. This satellite is forty per cent heavier than 1A and has a transmitting power of 60W per transponder instead of 45W. It will give the 1B satellite a wider coverage, thus avoiding some of the misunderstandings there have been about Astra 1A's services.

These have stemmed from the publication in various places of 60cm dish footprint maps suggesting that the service area for these small dishes is greater than it is. With both Astra 1A and 1B the transponders are grouped in four sets of four, with each set having a different transmitting mode and a slightly different footprint. It's because of this that viewers in the UK to the north and west of a line that curves from the Wash through Birmingham and Bristol down to Bournemouth can get good-quality signals from the four German services only when they have an 85cm dish. Many viewers with 60cm dishes living outside the south east, hearing about programmes like Tutti Frutti and RTL's football coverage, have tuned in and found that the picture quality with the German channels is not so hot. There has been even more confusion about signal strength and dish sizes in Eastern Europe.

Astra 1B Reception

With the 1B satellite's higher power the 60cm dish contour will extend into Scotland for all sixteen transponders. The footprints for the four different groups of four channels will be broadly similar, with the 60cm area extending into Norway, Sweden and most of Poland. They cover half of Czechoslovakia and Austria, the north of Italy and Corsica and, for the first time, the small-dish area extends into parts of Spain. Eight of the channels have a side spot that covers the Canary Islands, though for good picture quality a 1.5m dish will be required there.

There are over 1.3 million Astra dish owners in the UK. Most of them can now tune their receivers to the frequencies on which the 1B satellite's transponders will operate. The exceptions are those who have early models like the Amstrad with only sixteen-channel capability. Their choice will be to upgrade or wait to select the new channels they want on a regular basis, programming their sets accordingly. Some of the new channels may be scrambled of course, and some will probably remain unused for several months. But from now on a daily scan of the new channels is bound to bring surprises.

SES in Luxembourg has been very cagey so far about the stations that will use the 1B satellite. There will be three German channels however, ARD, Tele 5 and Premiere. ARD, the German equivalent of the BBC, already operates a subsidiary service "ARD Eins Plus" via several satellites including Kopernikus and TV Sat. BSkyB is using two Astra 1B transponders for its Sky Sports channel and The Movie Channel.

Channels and Tuning

Tables 1 and 2 list the Astra 1A and 1B channels in groups according to the transmitting mode. Don't be surprised to find that the signals in a particular group are consistently weaker since the footprints of the different groups are not quite the same. Many instruction manuals for receivers list the first i.f. rather that the downlink frequencies. These are usually the frequencies listed in Tables 1 and 2 minus 10GHz. As it is virtually impossible to manufacture an LNB whose local oscillator operates at exactly 10·00000GHz below the incoming signal, some fine tuning is necessary with all Astra channels. Failure to appreciate this point is responsible for more sparklies than any other factor. If there are sparklies on some or even all channels and they are all white or all black, not a mixture of the two, a quiet session with the instruction manual to learn about the fine tuning controls will pay dividends.

The Future

Future Astra plans include a third and fourth satellite in the same orbital position, to be launched in two-three years' time. This will increase the number of channels

Table 1: Astra 1A transponders.

Transponder	Service	Frequency (GHz)	Polarisation/ mode
1	Screensport	11·21425	H1
5	TCC, Lifestyle	11·27325	H1
9	Teleclub	11·33225	H1
13	RTL-4	11·39125	H1
3	TV3	11·24375	H2
7	TV1000	11·30275	H2
11	Filmnet	11·36175	H2
15	MTV	11·42075	H2
4	Eurosport	11·25850	V1
8	Sky One	11·31750	V1
12	Sky News	11·37650	V1
16	Sky Movies	11·43550	V1
2	RTL Plus	11·22900	V2
6	SAT-1	11·28800	V2
10	3-SAT	11·34700	V2
14	PRO-7	11·40600	V2

Table 2: Astra 1B transponders.

Transponder	Frequency (GHz)	Polarisation/ mode
17	11·46425	H1
21	11·52325	H1
25	11·58225	H1
29	11·64125	H1
19	11·49375	H2
23	11·55275	H2
27	11·61175	H2
31	11·67075	H2
20	11·50850	V1
24	11·56750	V1
28	11·62650	V1
32	11·68550	V1
18	11·47900	V2
22	11·53800	V2
26	11·59700	V2
30	11·65600	V2

available to over sixty, though some will be allocated for back-up purposes. Astra 1A has operated for over two years with no back-up should the satellite get into trouble, as some do. Apart from a minor wobble in May 1989, lasting for a few hours, the technical operation of 1A has been extremely smooth and free from hitches. This smoothness hides a massive amount of highly skilled and occasionally frenetic activity at the control centre however. As far as transmitter breakdowns are concerned Astra has been far more reliable than the UK terrestrial transmitters which went off-air several times during 1990 due to storms or even modest falls of rain or snow.

With three satellites at 19·2°E Astra will be able to fill the lower segment of Ku band, from 11-11·8GHz, with domestic TV channels. In principle this situation could be repeated every 5° around the Clarke belt, offering something like 500 channels. This would not be economically feasible of course even if there was enough programme material. But the fact that Astra's management got in first means that it will dominate the satellite TV market for at least the rest of the decade. No other single direct-to-home service will be able to offer a range of channels to compete with Astra's because most of the broadcasters who can afford to go on to satellite are already committed to this orbital position.

The BSB debacle puts a question mark beside services with a small audience and the need for more costly equipment such as D-MAC receivers or steerable dishes. The outlook for cable TV is also rather grim in the UK. Both the award of cable franchises and the start of services have been excruciatingly slow. This has allowed Astra to take a significant lead. Once viewers have installed a dish that gives them a wide choice of channels they'll be unlikely to switch to cable.

Aligning the Maplin Nicam Decoder

Keith Cummins

Since writing (April) on using the Maplin decoder panel to obtain Nicam sound I've had further thoughts on setting up the decoder.

Considering what a good product it is, Maplin's setting-up instructions are rather sparse. We are told to set RV1 and VC1 to their half-way positions then, using a trimming tool, adjust the cores of T1 and T2 until they are flush with the tops of their screening cans and finally give them two and a half turns clockwise. For more precise alignment one's advised to connect a scope to TP1 and adjust the level of the 6·552MHz signal to approximately 200mV peak-to-peak, using RV1. That's it!

As mentioned in my previous article, Maplin caution that some SAW filters may not leave enough Nicam signal to drive the decoder. In his series of articles on Nicam (September-November 1990) Eugene Trundle mentioned that a quasi-paralled i.f. system is preferred for Nicam use. The companion Maplin tuner uses this approach but most non-Nicam TV sets, including mine, don't. E.T. didn't go into detail on why the quasi-parallel system is best, but I believe the reasons are that it minimises the effects of unwanted vision carrier phase shift and maybe video harmonics, which can knock on into the Nicam carrier, making as good as possible an eye pattern more important. In other words, the quasi-paralled approach improves the ruggedness of the system.

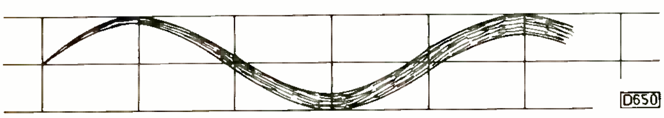

Fig. 1: The basic 6·552MHz signal at TP1.

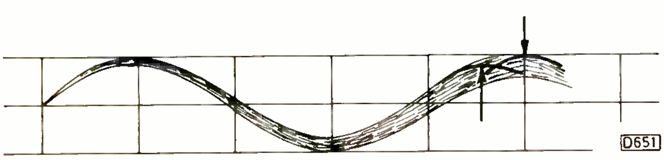

Fig. 2: Fine tuning the scope's timebase enables the signal inequalities to be observed.

Fig. 3: Tune T2 to equalise the peaks then reset RV1 to restore the signal amplitude.

Originally I set up the Maplin decoder by peaking T1 and T2. This was subsequently followed by slight stagger tuning to eliminate occasional drop-outs which produced pops and crackles. The results achieved in this way were all right for the most part but the odd crackle still occurred on captions. So I thought I'd take a more detailed look at the waveform at TP1.

The results of my investigation have been instructive. Peaking isn't the best way of setting up, neither is stagger tuning. Instead, I've devised a simple, precise method that leads to consistently good results.

When you look at the signal at TP1, with a scope internally synchronised, you'll see something like the waveform shown in Fig. 1 – depending on the timebase speed selected. Because of the DQPSK modulation the trace blurs as it moves to the right. Careful adjustment of the timebase will reveal the dominant components of the waveform, as shown in Fig.2. You'll probably be able to see the amplitude differences I've indicated. Now it's bad news if the amplitude changes: the Nicam signal is transmitted at constant amplitude and if the demodulator slicers in the decoder chip are to operate correctly the signal amplitude has to be constant and optimised (the chip has a.g.c., but its time-constant is far too long to be able to cope with these short-term amplitude changes).

So where does this amplitude modulation come from? The most likely cause is asymmetry in the SAW filter characteristics in the region of the Nicam carrier (this would probably not have been considered at the time when the filter was designed). As a result the Nicam sidebands are attenuated to a greater or lesser degree depending on their frequency. This introduces amplitude modulation.

Fortunately it's simple to fix this nasty situation once you've realised what is happening. To correct the signal an equal and opposite effect is required. This is achieved by tuning the second Nicam i.f. transformer so that the carrier is set down the appropriate flank of its resonance curve, thus providing the equalising effect required.

This may sound complicated but in practice is simple. Tune T1 in the Maplin decoder for maximum signal.

Connect the scope to TP1 and set it up as described above. Then tune T2 so that the unequal parts of the waveform shown in Fig. 2 are brought to the same height, see Fig. 3. In my case the optimum position produced an overall reduction in signal amplitude of about 4dB. RV1 can be reset to restore the amplitude. Finally VC1 is set to the centre of its correct operating range using a low-capacitance trimming tool. Tuning T2 to obtain the correct waveform is quite precise, the method described giving a very positive indication that the phase/amplitude characteristics of the system have been correctly set up. The excellent results heard bear this out.

TEST CASE

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Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

Solving equipment hook-up and interfacing problems is an increasing part of the service engineer's workload as the need for basic fault diagnosis and repair declines with the increasing reliability of consumer electronic equipment. As video and audio systems link up and more black boxes take their place in consumers' homes, so the interfacing problems become more complex. This month's puzzle is typical of field servicing in 1991.

It's been a good year for our local tree-feller Mr. Evans. The hurricane in 1987 marked a turn in his fortunes and he's been doing well ever since. In the recent past he's invested in a nice new TV set and a VCR. His latest acquisition is a Sony satellite TV receiver, and the corner of his lounge where this lot sit now has a spaghetti-like tangle of wires and cables. One of them is a scart lead that links the satellite box to the TV set.

Shortly after the Sony satellite receiver was delivered Mr. Evans came into the service department with a chain-saw in his hand. Not in order to attack the Service Manager: he wanted a spark-plug lead for it, and could we come out and check his system over? He went off with a foot of e.h.t. lead and a promise that we'd come and look at the Sony receiver.

Later that day Mrs. Evans told our man about her problems with the newfangled gear. Every time they switched on the satellite box the TV set latched on to it and produced pictures and sound from Astra. Fine when they wanted to watch Sky News or Eurosport, but sometimes they wanted to record satellite TV programmes while watching BBC or ITV. Only they couldn't get them unless they switched the Sony unit off. The VCR took its input signal from the Sony unit's u.h.f. output. Nor was this all! Since the Sony unit had been installed, reception of terrestrial broadcasts had deteriorated – despite the fact that there were very strong signals from the nearby u.h.f. transmitter. With two of the four local channels there were often floating bars and lines, and sometimes a wavy patterning effect on the picture. Somehow it seemed that the newcomer was interfering with signal reception that was perfectly all right before.

The proliferation of remote control handsets was not to Mrs. Evans' liking either. One of her large Alsatian dogs had long ago crunched up the little handset that went with the Philips TV set they had rented at the time. Now they were eyeing the three new ones hungrily. They were also eyeing our man Philbert.

Philbert is an installation man rather than a full-blown technician. Somewhat intimidated by the dogs, and baffled by the problem, he showed Mrs. Evans how to remove the scart plug from the back of the TV set. This enabled her to regain control of the set while taping an Astra broadcast. After this Philbert retreated to the safety of the workshop, where he poured out his troubles to a small technical committee consisting of Techno Crat, Workshop Sage and Service Manager. The upshot was that he was given three items, a small hand-tool, a free-of-charge component and an accessory that the Evanses would have to purchase if they wanted to keep it.

What were the basic problems, and what were the bits and pieces that Philbert took with him on his next successful visit? See next month for the answer and another teaser in our Test Case series.

ANSWER TO TEST CASE 340
– page 421 last month –

Last month's puzzle related to a Panasonic TC2205. It had Dylan exasperated while Sage tried hard to remember the solution to the problem, which he'd had on a previous occasion with a Panasonic U2 chassis. The problem was overheating and premature failure of the BU208A line output transistor, with acceptable pictures being produced right up to the moment when the transistor failed. The initial conclusion had been that there was overloading in the line output stage. After a few smaller items had been checked, a new line output transformer had been fitted. But the transistor continued to cook.

Sage took over the repair and very soon found that overloading was not the cause of the problem. Heavy loading is very often the cause of this type of fault: many things can be responsible, clues usually being provided by local overheating or picture defects. A less common cause is defective line output transistor drive. Unless the transistor's base current is switched on and off rapidly and cleanly the transistor departs from true switching operation and dissipates energy during the times that it takes to change state. Sage found that there was a good squarewave at the collector of the line driver transistor but a messy one at the base of the the line output transistor. R525 ($0{\cdot}15\Omega$), which is in series with the BU208A's base, had risen in value to the point where it restricted the flow of base current. A new resistor kept the BU208A alive and cool.

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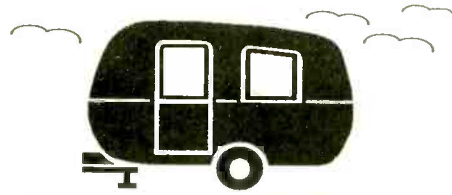

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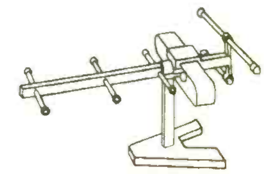

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TDA1510A	£3.20
TDA1512	£1.00
TDA1515A	£2.50
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2SC2592	£0.95
2SC2621	£1.25
2SC2631	£0.30
2SC2632	£0.30
2SC2655	£0.60
2SC2958	£2.50
2SC2979	£3.00
2SC3153	£3.40
2SC3402	£0.40
2SC3519	£4.60
2SC3678	£1.25
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2SC458	£0.20
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2SD1051	£0.85
2SD1128	£1.50
2SD1138	£0.85
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2SD138	£0.85
2SD1391	£4.20
SDC1397	£3.75
2SD1398	£2.25
2SD1426	£4.50
2SD1453	£1.60
2SD1455/2SD1730	£3.10
2SD1496	£4.00
2SD1497	£2.60
2SD1497-02	£5.95
2SD1497-06	£5.95
2SD1650	£3.50
2SD1877	£2.30
2SD639	£0.35
2SD667	£1.00
2SD725	£3.70
2SD787E	£0.30
2SD811	£2.95
2SD836	£1.10
2SD837	£0.80
2SD845	£2.70
2SD868	£3.50
2SD869	£3.00
2SD870	£3.50
2SD871	£4.50
2SD895	£2.00
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2SD898B	£2.75
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BC108	£0.10
BC108B	£0.10
BC115	£0.16
BC118	£0.12
BC147A	£0.07
BC159	£0.09
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BC172	£0.09
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A. Z. ELECTRICS

SEE ADDRESS DETAILS ON NEXT PAGE

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GOULD OS4020 Digital Storage Dual Trace 10MHZ	£450
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MARCONI TF2015 without Synchroniser TF2171	£250
MARCONI TF2016 AM/FM 10KHZ-120MHZ Sig Gen with TF2173	£350
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MARCONI TF893A AF Power Meter 20HZ-35KHZ 20mW-10W	£20
RACAL 9915 Freq Counter 10-520MHZ Crystal Oven	£150
PHILIPS PM6622 Universal Timer Counter 80MHZ 9 digit	£130
FEEDBACK SFG606 Sweep Fun Gen Sine Sq Tri 0 01HZ-1MHZ	£140
FEEDBACK FG600 Fun Gen Sine/Sq Tri 0 01HZ-100KHZ	£55
AVO VALVE TESTER CT160 Suitcase style 22 Bases (Valve Data NOT INCLUDED	£40
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HAMEG OSCILLOSCOPE Triple Trace 100MHz. Delay Timebase	£792
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All other models available
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BLACK STAR EQUIPMENT (p&p all units £5)

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JUPITOR 500 FUNCTION GENERATOR 0.1Hz-500KHz Sine/Sq In	£110
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All other Black Star Equipment available

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A.Z. ELECTRICS

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BC214A	£0.07	BD434	£0.80	BU426A	£1.00
BC214B	£0.07	BO508	£0.90	BU500	£1.00
BC214L	£0.09	BF195	£0.07	BU508A	£1.00
BC237	£0.07	BF196	£0.15	BU508AF	£1.70
BC238	£0.07	BF197	£0.15	BU5080	£1.00
BC307	£0.12	BF198	£0.07	BU806	£0.75
BC308B	£0.07	BF199	£0.14	BU807	£0.75
BC327-25	£0.07	BF244	£0.40	BUT11	£0.75
BC328-40	£0.05	BF259	£0.22	BUT11AF	£1.95
BC337	£0.07	BF422	£0.15	BUW84	£1.65
BC372	£0.95	BF458	£0.22	BUX84	£0.60
BC392	£1.50	BF459	£0.22	S012659	£0.75
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BC461	£0.25		£0.25	TIP110	£0.45
BC547	£0.07	BF471	£0.25	TIP112	£0.45
BC548	£0.07	BF472	£0.25	TIP29	£0.30
BC549	£0.07	BF870/BF472		TIP30	£0.45
BC557	£0.30		£0.25	TIP31	£0.30
BC559B	£0.07	BU108	£0.75	TIP32	£0.30
BC639	£0.18	BU126	£0.70	TIP41	£0.27
BC640	£0.30	BU208	£1.00	TIP42C	£0.40
BD131	£0.50	BU208A	£1.00	TIP47	£0.98
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BD237	£0.22	BU208T		ZTX650	£0.70
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BR100	£0.20		£0.55	OT112	£2.20
BR101	£1.40	BY210/800/BYV96		RGP15G	£0.45
BR103	£0.75		£0.55	RGP15J	£0.55
BR303	£1.50	BY227	£0.20	RGP15K	£0.35
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BT116	£2.50	BY229	£1.15	RHI	£1.30
BT128P	£4.50	BY299	£0.50	RM11C	£0.45
BT129P	£4.50	BY960	£0.30	SG264	£8.50
BT151/800R		BYV96D	£0.55	SG613	£12.00
	£1.75	BYW56	£0.50	SKB/02	£0.60
BY126	£0.20	BYW96E	£0.50	SKB/08	£1.20
BY127	£0.08	BYX10	£0.50	SKB2/02	£0.90
BY133	£0.20	BYX55/600	£0.55	SKB2/08	£1.10
BY164	£0.90	FB2506	£1.50	SKE1/02	£0.60
BY164/SKB2/02		IN4001	£0.06	SKE1M15	£0.65
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BY179	£1.10	IN4004	£0.10	SKE2G3/04	£1.30
BY179/SK2/08		IN4005	£0.10	SKE4F1/04	£0.45
	£1.10	IN4006	£0.08	SKE4F1/06	£0.45
BY184	£0.65	IN4007	£0.08	SKE5F3/10	£2.20
BY189	£2.00	IN4148	£0.10	SR2M	£0.75
BY190	£2.00	IN5408	£0.25	T9053V	£1.40
BY223	£2.00	KBL08	£1.95	T9064V	£2.28

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD

3HSSR-VCR7000 (Saisho/Orion)	£18.00
PSF1-VCR4500,5200,9000	£15.00
PSF2-VCR4600,4700	£15.00
PSF3-VCR6000	£21.50

FERGUSON

3HSSV-2 Head universal	£7.50
3HSSVA-3V42,44,45,46 etc	£20.00
3HSS4VB-3V32/HR7655	£25.00
3HSS4VC-3V48/HRD565	£26.00
3V48,58,59,65,FV10,11, 12,13,14,20,21,26 And most other Fergusons	POA

HITACHI

3HSSHA-VT8000,9000 series	£17.00
3HSSHB-VT11,33 etc	£17.00
10082-VT120,220	£29.00
10081-VT130,135	£30.50

PANASONIC

3HSSN-2 Head universal	£7.50
3HSSU1N-NV100,370,380/Philips VR6460	£11.00
3HSSU2N-NV230,470,480,G9,10, 11,15PX	£21.00
3HSSU3N-NV430,460	£16.00
3HSS3N-NV777,330	£18.50
3HSS4NB-NV730	£26.00
3HSS4NA-NV366	£24.00
NVG30,33,40,45,46,130, & most other Panasonics	POA

SANYO

3HSSSY-VHR1100,1110,1300	£20.00
3HSS3SY-VHR1500	£34.00

SHARP

3HSSSP-VC9300,9500,9700,381,481, 482,483,486 etc	£17.00
3HSSSPB-VC581,583,651,670 etc	£17.00
VC7000,8000 series (Brass)	£42.00

OTHER MAKES

Alba 4000, Goldstar 8000, Sentra 8000, Solavox 1000	£22.50
Fisher FVHP510,520,530,615,710 etc	£18.00
Fisher VBS7000,9000 etc	£25.00
Hinari VXL2,4,3,20,25	£18.00
Hinari VXL5,6,20H	£15.00
Mitsubishi HS306,710	£30.00
Orion VC150,180,VH1,2,3 etc	£18.00
Saisho VR100,605,705,805,905	£18.00
Samsung Universal 2 Head	£24.25
Toshiba V71,73,74,75,81,82,83,84,85,87	£20.00
Toshiba V93	£21.00

ASK FOR VIDEO HEADS NOT LISTED

The above heads are new and replacements.

BELT KITS

AKAI

VS1,2,5	1.20
VS4,6,9,15	1.10
VS9300,9500,9800	1.60

AMSTRAD

7000	2.00
VCR4600,5200	1.90
VCR4500,9000	2.00

FERGUSON/JVC

3V00/16/22 Mechanical Models	1.60
3V23	1.00
3V29/30	1.20
3V29/30 Loading Belt	0.35
3V31/32	1.00
3V35/36/38/39	1.10
3V42/43/44/45/48/54/55	1.00
3V58/59/64/65/8950/51/FV10/11/12/13/14	1.60

FISHER

FVHP520/530	1.70
FVHP615/710/715/716/722/725/830	1.00
FVHP905/906/907/908/910/911/915/916	1.20

HITACHI

VT11/14/17/19/33/34/35/38/39/88	1.30
VT52/61/62/63/64/65/85/86	2.10
VT100/110/111/113/115/118/120/125/130/135/145/150/175	2.50
VT8000/8500	1.70
VT9300/9500/9700	1.50

PANASONIC

NV230/250/280/370/380/430/450/460/465/485/630/810/830/850/870/890	1.90
NV300/333/340/366	1.60
NV600/777/788	1.50
NV2000/3000	1.50
NV7000/7200/7500/7800	1.40
NV8600	2.20
NV730	0.60

PHILIPS

VR6367/6467/6561/6751/6760/68SB4	2.25
VR6460/6920/6520	2.40
VR6580/6581	2.50
VR6362/6367/6470/6467	2.25
VR6542/6843	2.00

SANYO

VTC5000/6500	0.65
VTC5300/5350	1.00
VHR1100/1300/1500	1.00
VHR2300/2500/2700	2.90

SHARP

VCF3/VC402/500/571/581/582/583/584/585	1.10
VC6F3/6V3/VC600/651/681/682/683/684/685/693/700/7832.10	2.10
VC200/381/384/385/386/390/9300/9500/9700	1.95
VC300/387/388/481/483/486/488/496	1.20
VC7300/7700/7750	1.95
VC8000/8300	1.95

TOSHIBA

V8700/9600	1.05
V55/57	1.10
V66/67	2.80
V31/33	2.30
V73/81/83/85	2.30
V8600	4.10

Belt kits for Funai, GEC, Goldstar, Grundig, Hinari, ITT, Mitsubishi, NEC, Orion, Saisho, Samsung, Schneider, Sony and Tensai also available.

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Matsui/Saisho Limiter Post £1.75

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ITT CVC25/30/32	9.50
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ITT Compact 80 Series 90	19.75
ITT CVC45	18.00
ITT 1109F	14.00
ITT CVC1204	11.50
ITT CVC800/1/3	21.50
ITT CVC1100	16.50
ITT CVC1150/1175	20.00
ITT 6325	18.50
ITT 3546	18.50
ITT 1200/1	20.00

Other ITT transformers available

Fidelity all models up to 20" ZX3000	10.50
Fidelity Panel for ZX2000	1.00
Fidelity 22" ZX3000	24.50
Hinari CT4/5 & TVA1	21.00
Philips K13	12.95
Rank Bush T20A	11.50
Thorn TX100 Green Spot 110	17.25
Thorn TX90 Mains Trans	18.85
Ferguson TX90 LOPT	19.50
Ferguson 3V35/36 Mains Transformer	23.00
Ferguson 3V44/44/45 Mains Transformer	18.85
Sony – Please state model for price	
Universal Tripler	4.75
Universal Tripler with focus unit	9.50
Decca 120/130 series tripler	8.50
Thorn TX10 Focus Unit Kit	9.00

VIDEO MOTORS

REEL MOTORS

Ferguson 3V29/30	£20.00
Ferguson 3V58,59,65, FV10,11,12,13,14,20,21,22	£17.25
Ferguson FV26D	£14.50
Hitachi 8000,8300,8500	£8.50
Sanyo VTC5000,5150,5400,5300,6500	£7.50
Sharp VC9300,9500 etc. Original	£15.90
Panasonic NV333,366 Original	£13.20
All other Panasonics	POA

DRUM MOTORS

Ferguson JVC (Mechanical models)	£23.00
Sharp 7000 series Original	£24.63
All Panasonic Original	POA

CAPSTAN MOTORS

Ferguson 3V35,36 Original	£22.50
Ferguson JVC (Mechanical models)	£20.00
Hitachi VT11 Original	£30.00
Hitachi VT33 Original	£32.00
Hitachi VT64 Original	£19.75
Hitachi VT8000 series Original	£34.50
Hitachi VT9000 series Original	£34.50
Sharp VC7000 series Original	£30.50

MODE CONTROL MOTORS

Ferguson 3V42,43,44,45,48,49,52,53	£6.00
Ferguson 3V58,59,65, FV10,11,12,13,14,20,21,22,26	£4.50

IDLER ASSEMBLIES

FERGUSON

Take up Clutch (Mechanical models)	£5.00
3V29/30 Take up Idler	£2.00
3V29/30 Take up Clutch	£2.85
3V29/30 Reel Idler	£3.00
3V35 Reel Idler	£3.00
3V35,36,38,39 Take up Clutch	£2.85
3V58,59,64,65,FV10,11,12,13,14 Idler Arm	£1.80
Clutch Assembly 3V44,45,48,49,52,53,54,55	£14.00
Clutch Assembly 3V42,43	£14.00

FISHER

FVHP615,905,910, Idler Assembly Original	£5.00
FVHP615 Gear Idler Assembly	£4.35
FVHP905,910 Gear Idler Assembly	£5.00
FVHP520,530 Idler	£3.00
FVHP520,530 Pulley	£0.70

HITACHI

VT11,33 etc. Original Idler Arm	£2.50
VT11,33 etc. Idler Arm Replacement	£1.75
VT9300,9500 etc. Play Idler	£3.65
VT9300,9500 etc. F/F Idler	£2.95
VT9300,9500 etc. Idler	£2.95
VT8000,8500 etc. F/F Rew Idler	£2.95
VT8000,8500 etc. Play Idler Assembly	£3.00
VT8000,8500 etc. FF/Rew Pulley	£0.70
VT11,33 etc. Clutch Assembly	£8.00

PHILIPS

VR6460,6920 Idler Arm (original)	£3.00
DV464,6462,6463,650 etc. Idler Mod. Kit	£4.50
VR6542,6843 Reel Idler	£6.50
VR6542 Reel Drive Pulley	£7.75
VR6843 Reel Drive Pulley	£9.50

PANASONIC (All Original)

NV370 Idler Arm Unit VXP0521 Gen.	£3.00
NV8600,8610 Play Idler VXP0243	£0.95
NV332,777,788 Idler Unit VXP0463	£3.00
NV600,688 Idler VXP0515	£3.00
NV333,366 Idler Arm 2 Unit VXL0997	£10.50
NV8400,8600,8610 etc. VXP0245	£0.95
NV333,366 etc. Idler VXP0401-NV700,7200,7800 Idler VXP0344	£0.90
NV2000,3000 Play Idler VXP0331-NV2000,3000 Idler Unit VXP0329	£1.10
Back Tension Bands	From £1.50
All Panasonic Maintenance Kits	POA

QUOTE PANASONIC PART No. FOR PARTS NOT LISTED

SANYO

Idler VHR1100,1300,1500	£5.50
Idler VHR2100,2300,2500,2700	£5.50
Reel Drive Pulley Unit VTC5000,5150,6500	£5.00
Idler Roller Assembly VTC5000,5150,6500	£2.25

SHARP

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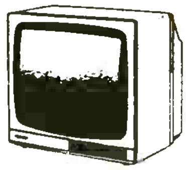
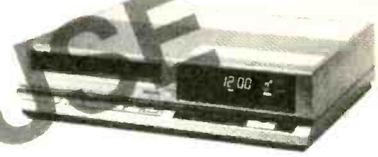
GOGGLEBOX
DISCOUNT ELECTRICAL WAREHOUSE

TEL: LEEDS 0532-310359
ASK FOR ROBERT



VISION LAND

WHOLESALERS



NEW WAREHOUSE OPEN NOW

THE WORKING SET WHOLESALER YOU CAN RELY ON

We specialize in supplying trade customers with top quality working ex-rental TVs & videos.
We offer good product, friendly service & keen prices.

TVs

Thorn 9000/9200/9600/9800/9900 from	£15
Thorn TX9/10 Basic	£30
Thorn TX9/10 Remote	£40
Thorn TX9/10 Text	£55
Thorn TX100 Text	£65
Thorn Stereo Text	£70
FST's from	£85
Philips KT3/30	£25
Philips KT3/30 Text	£50
Philips KT35/40 Text	£55
Bush T20/22/26	£15
Portable TV from	£50
Portable Text from	£70

BRAND NEW HANDSETS TV STANDS TV/VCR STANDS and Video Heads for sale

VIDEOS

Thorn 3V23	£60
Thorn 3V29/30	£55
Thorn 3V31/35	£80
Thorn 3V32 Long Play	£90
Thorn 3V43/44/48/55/59 from	£110
Hitachi 8500/9300	£55
Hitachi VT11	£60
Hitachi VT33	£70
Sharp 9300/381	£60
Amstrad 7000	£50
Pan NV333/7200	£55
Pan NV777	£70

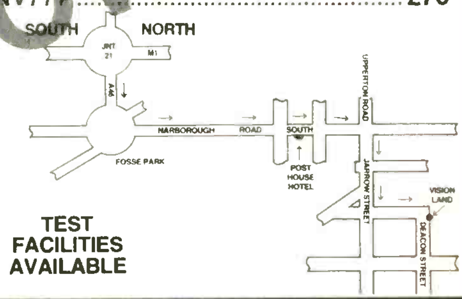
Numerous other manufacturers names stocked: Sony, Sanyo, Toshiba, Hitachi and Panasonic

NEW STOCK ARRIVING EVERY WEEK. SPECIAL DISCOUNTS & DELIVERY ON LARGE QUANTITIES

Prices: All prices subject to VAT but include handsets (where appropriate).

0533 555519

Open Mon-Sat 9 - 5



TEST FACILITIES AVAILABLE

VISION LAND 34 Deacon Street, Leicester
Approx. 5 mins from Jnct 21 M1. Opposite Polytechnic car park.

W. TREE ★ TRADE ★ WAREHOUSE

TUBE REGUNNING PLANT NOW INSTALLED

(Ex-SBW of Silsden) Qualified Operator

RE-GUNNED TUBES WITH GUARANTEES AVAILABLE NOW!

THIS MONTH'S SPECIAL OFFER

SEVERAL PARCELS of TVs, Video, Midis, Portables and Microwave ovens

All 'B' Grade
All boxed with handsets

Phone for Quotes
YOU WON'T BE DISAPPOINTED

EX-DISPLAY CAMCORDERS
(Complete AMSTRAD camcorders from only £150 working)
Non-workers from £65

B GRADE FSTs & VIDEOS (Some Nicam)
ALSO MICROWAVES
(Makes Include Samsung & Ferguson)

UNIT ONE, SUNSHINE MILLS, WORTLEY ROAD, LEEDS 12.
Telephone: 0532 638804
Fax: 0532 310275

EXPORT ENQUIRIES WELCOME ON CONTAINER LOADS OF TVs & VCRs

MAKE £££s

IDEAL RENTAL SETS Philips KT3s or Philips K30s. Working with new regunned tubes. 2 years warrantee on tube

£59 EACH
OTHER MODELS AVAILABLE

Mixed loads of TVs and VCRs by the container. Telephone NOW for details

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Wiltsgrove Ltd

TV and Video Trade Centre

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TEL: 021 772 2733 FAX: 021 766 6100

Everything under one roof in Birmingham's largest TV & Video Warehouse

EXPORT ENQUIRIES WELCOME

500 Portables to clear from £75 'B' Grade (monitor style)

EX-RENTAL TVs
Workers from £15
Text from £45

EX-RENTAL VCRs
Workers from £45
Front Loaders from £60
Long Players from £85

Ferguson 3C01 VIDEO CAMERA

- Low Light Camera
- Ex-Rental
- 3 Hour VHS Tape
- Complete-in-Case
- Batteries
- Charger
- Motorised Zoom
- Auto Focus

£400

Non-Workers: all makes from £20

TWO REGULAR STOCK DELIVERIES EVERY WEEK.

SPARES, EQUIPMENT, MANUALS, COMPONENTS, SPARES, EQUIPMENT, MANUALS, COMPONENTS, SPARES

SERVICE MANUALS

Ferg./Thorn 3V31/8941	£6.00
Ferg./Thorn 3V32/8942	£6.00
Ferg./JVC 3V43 HRD725	£4.00
Ferg./Thorn 3V35-6/8943-44	£4.00
Ferg./Thorn 3V42/8945	£6.00
Ferg./Thorn 3V48/3V65/8951	£4.00
Ferg. 3V58	£6.00
Ferg./JVC 3V04/GS1000EK	£4.00
ITT CVC25/30	£4.00
ITT Digivision Mu Hicontrol MC3896	£6.00
ITT Digivision Mu Hicontrol 3896	£6.00
Ferg. 3V43 Cir. Desc.	£3.00
Ferg. 3V48 Cir. Desc.	£3.00
Ferg. 3V53 Cir. Desc.	£3.00
Ferg. 3V59 Cir. Desc.	£3.00
Loewe P17 Cir. Diag.	£2.00
Loewe C8500 Mono Cir. Diag.	£2.00
TX10 (1550/1551 Series) Cir. Diag.	£2.00
TX100/PC1150 Cir. Diag.	£2.00
TX100 Cir. Diag.	£6.00
TX912/913 Cir. Diag.	£2.00
Thorn 8290 Cir. Diag.	£2.00
Toshiba 211T4BA Cir. Diag.	£2.00
JVC Technical Books	from £2.00

Extensive Range of Service Manuals In Stock

REMOTE CONTROL HAND UNITS

IR8331 KT/K30 Non Text	£10.00
IR8420 KT3/30 Text	(£9.00)
IR8432 Toshiba (2295/2695)	£15.50
IR8435 Philips G11 Text	£9.00
IR8443 Ferg. TX9/10/100 Text	£9.00
IR8613 Grundig Tex	£11.50
IR8649 ITT 3 & 5 (with Mute)	£11.50
IR8650 ITT CT1511 (with Fine Tune)	£11.50
IR8689 Ferg. Stereo TX9/10/100	£9.00
IR8838 Granada/Rediffusion	£11.00
IR8850 Rediffusion Mk4 Text	£10.50
IR8861 Panasonic TNQ 1633	£14.50
IR8867 Sony KV22/2	£14.50
IR8876 Fidelity CTV 14R/20R/22R	£13.50
IR8952 Ferg. T9/10/100 R/C	£10.00
IR8956 Ferg. TX10/100/2235	£11.50
IR8957 Ferg. TX100 Text	£11.50
IR8982 ITT Digivision FS9/1	£13.00

REMOTES CONT/D

IR8983 Fidelity Text 09193	£14.50
IR8991 Grundig TP600/TT	£14.58
IR9052 Decca RC40/43/45	£14.58
IR9058 Loewe Opta M124	£15.50
IR9100 Ferg. 3V35 (8944)	£10.00
IR9101 Ferg. 3V32 (8941/2)	£10.00
IR8947 Ferg. 3V43	£10.50

REPLACEMENT VIDEO HEADS

★ ★ STAR BUYS ★ ★

Panasonic NV2000/333	£7.50
Ferg. 3V29/30/31/35	£7.50

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Akai VS4	[illegible]
Amstrad 7000	£17.50
Amstrad 4600	£17.50
Amstrad 4600 MK2	£14.00
Ferg. 3V43	£36.75
Ferg. 3V32 4 heads	£27.00
Fisher FVM510-722	£14.75
Fisher FVH516/520/530/615/622/710/715/720	£16.00
Hitachi VT11/13	£15.00
Hitachi VT64/65	£19.50
Osaki/Goldstar VCR 32/GHV12321 (413-048A)	£24.50
Panasonic NV366	£24.00

MANY MORE

LOPTS

Ferguson TX100 Green Spot	£18.75
Ferguson TX90 Series	£18.75
Decca 100	£8.50
Hinari CT4-5 Lopt with PCB	£16.75
ITT CVC20	£7.50
ITT CVC1203 4515-01-61	£10.25
ITT CVC801 4515-03-01	£19.50
ITT Digivision 4515-03-19	£18.75
ITT CT3835 4515-03-24	£16.50
ITT 4515-03-22	£18.50
Hitachi CPT2176 (2434274)	£18.75
Grundig 7100 FAT3761	£12.75
Grundig 6100 FAT3759	£12.75
Fidelity 14"-20" FC-2015BE	£9.50

CAPSTAN MOTORS

Akai VS4	£15.00
Akai VS2	£15.00
Ferguson 3V35/8944/HRD120	£16.50
Ferguson 3V16/8909 (PV47987M-Z)	£15.00
Hitachi VT11/17	£26.50
Hitachi VT33	£26.75
Hitachi VT61/62	£29.50
Hitachi 5000	£15.00
Mitsubishi H5306B (288 P05401)	£16.50
Osaki/Goldstar (414-029A) VCR32 GHV12321	£19.50

DRUM MOTORS

Sharp VC3800 (Pt No RMOTP10 9GEZZ)	£16.50
Sharp VC9100 (RMO TP1010GEZZ)	£16.50

LOADING MOTORS

Sharp VC9100 (RMO TM1017GEZZ)	£12.00
Funai VCR4000 (8000-05-305)	£10.00

REEL MOTORS

Hitachi VT9300 (5577291)	£12.00
Sharp VC9100/9300	£12.50
Sharp VC481/482	£13.95

AUDIO CONTROL HEADS

Ferg. 3V23	£5.00
Ferg. 3V35	£9.50

CASSETTE HOUSINGS

Akai VS4	£10.00
Akai VS2	£12.00
Ferg. 3V35	(£19.50)
Ferg. 3V41 Camcord	£14.50
Ferg. 3V42/4	£19.50
Ferg. 3V29130 (PUS26140C)	£10.00
Mitsubishi HS304	£10.00
Siemens FM391/761	£19.50
Sharp VC9100 (CHLDX 3014GE44)	£18.50

NEW VIDEO BOARDS

Ferg. 3V29 Audio Y/C Board	£15.00
Ferg. 3V29 MDA	£10.00
Ferg. 3V23/T/T Board	£15.00
Ferg. 3V23 Mechan Board	£15.00
Ferg. 3V35 YC Board PU10701	£15.00

CABINET PARTS

Thorn 8930/40 Top Covers Brand New	£5.00
Thorn 8930/40 Front Fascia Brand New	£14.75
Baird VC121 Front Fascia Brand New	£10.00
Ferg. 3V23 Front Fascia Brand New	£15.00
Sharp VC383 Front Fascia	£12.00
Rediffusion 620 Front Fascia	£12.00

SERVICE EQUIPMENT

Servo Test point Jig PUJ43067	£19.50
Colour Bar Chart	£19.50
Strip Grey Scale	£19.50

CAMERA SPARES

Saticon Tube Ferg. 3V34 Compact Camera	£45.00
Saticon Tube Ferg. 3V41 Camcorder	£45.00

MISCELLANEOUS

Fluorescent display for Ferg./Thom 3V30/8930	£2.00
Thom 8945	£2.00

VIDEO TAPES from 95p each per box of 50

VHF-UHF TELEVERTERS (Require 15 volts supply) £12.50

TW ELECTRONICS

Main Distributor in Birmingham

COME and SAVE with DAVE . . . The main MAN in BIRMINGHAM

POSTAGE AND PACKING EXTRA. MINIMUM CHARGE £1.00 + VAT

BARCLAYCARD VISA

All prices exclude remote controls and VAT. Stock subject to availability

THE UK'S LARGEST INDEPENDENT WHOLESALERS

HUSSAIN CENTRAL TV LTD

HAVE FIVE BRANCHES NATIONWIDE

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at the best prices
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unbeatable prices

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GOODS AT THE
LOWEST PRICES
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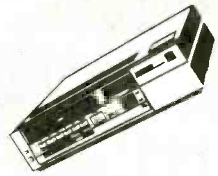
Approved Wholesalers*

DON'T DELAY – CALL YOUR LOCAL BRANCH TODAY



Working CTV's from £15
TX9/10 Text from £49
Working VCR's from £45

SPECIAL THIS MONTH 'B' GRADE PORTABLES FROM £85

Stock currently includes THORN TX Basic, TX Text, stereo Text and numerous NON THORN including PHILIPS, GRUNDIG, and TOSHIBA, THORN VCR's 3V29/30/31/32, 3V35/6, 3V43/4/5 plus SHARP, AKAI, SAMSUNG, TOSHIBA and SANYO.

West Midlands T.V. & Video Wholesale

DELIVERY SERVICE NATIONWIDE

2 mins from Junction 9 – M6. Warehouse in Passage off, Little London, Caldmore, Walsall. Tel: 0922-724542/722208.
Open: Mon.-Fri. 9am-6pm. Sat. 9am-2pm.

FAX: 0274 722229

BESCO LIMITED T/A NORTH WEST ELECTRONICS

ENTIRE RANGE OF EX-RENTAL TVs & VIDEOS

NEW STOCKS EVERY DAY, WORKING OR OFF THE PILE
makes include:- Sharp, Hitachi, Ferguson, Pye, NAT PAN, ITT etc.
Working VHS video from **£35.00.** Late models always available.

KNOCKOUT PRICES ON COLOUR TVs
FERGUSON, PYE, HITACHI, PHILIPS, BUSH, ITT, etc.
TELETEXT BARGAINS FROM **£30.00** (WORKING).
FERGUSON TX TELETEXT ONLY **£55.00.** PHILIPS/PYE TEXT ALWAYS AVAILABLE.
OVER 1000 COLOUR TV AND VIDEOS AVAILABLE.
RING OUR HOTLINE NOW FOR PRICES OR CALL IN YOU WILL BE DELIGHTED.

Working Ex-Equipment Panels

	IF	Converger	Decoder	Line scan	Power	Frame
T20//22X		5	14	18	17	14
T26 X		5	16	20	17	X
Philips G11	14.50	5	12	20	20	11.50

All prices include Postage & Packing. But + VAT
★ IF THE PANEL YOU REQUIRE IS NOT LISTED PLEASE ASK ★

BRADFORD
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MANCHESTER ROAD, BD5 7RL.
RING: TONY (0274) 308186
OPEN 6 DAYS 9am-5pm.

Prices are plus VAT & based on quantity

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CHEQUES ACCEPTED WITH BANK CARD

NEW (B) GRADED FERGUSON STOCK JUST ARRIVED

i.e. 51cm FAST TEXT WITH NICAM BOX FROM
£240.00

FERGUSON VIDEOS BOXED, i.e. FV30B FROM
£150.00
(Too many to list)

+ BRAND NEW 21 F.S.T TVs BOXED FROM
£155.00

EX-RENTAL TVs

9.0	£12
9.6	£18
TX26" Full Remote	£35
TX9 Text 20"	£50
TX10 Text 22"	£55
TX10 Text 26"	£50

WORKING STOCK
Brand New Handsets for TVs & Videos from only £7.50

NON-THORN TVs (OFF PILE) FROM
£3.00

3V29, 3V30...£55
QUANTITY...£50
8941 Remote...£75
8942 Remote L.P....£85
NON-THORN VCRs FROM £35.00

FRESH STOCK ARRIVING DAILY — RING FOR UPDATE ON STOCK

STEREO TEXT...£65.00
TX9/TX10 BASICS...£30.00

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SUPERVISION

WHY TRAVEL THE WHOLE COUNTRY?
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★ ALL PRICES ARE SUBJECT TO VAT ★
★ (OFFERS APPLY WHILE STOCKS LAST) ★

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OFF WATER LANE. NEAR HILTON HOTEL. EASY ACCESS FROM M1 & M62 (2 Mins)

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LONDON ● BIRMINGHAM ● BOLTON

EXCELLENT RANGE
OF EX-RENTAL
TVs & VCRs
THORN
&
GRANADA

NEW 'B' GRADE
Portable 51cm, 59cm, 66cm, 68cm,
FST, Nicam, Fastext
TVs – VIDEOS –
AUDIO – MICROWAVES – HIFI
Also stocks of Handsets,
Video Heads, Aerials, Set-Tops,
Selfix-R.F. Leads,
A.C. Leads

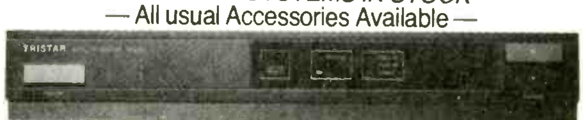
STOP PRESS
Quantity of Branded 'B' Grade Digital picture in picture VHS Videos including FV31 available this month

AGENTS
REQUIRED FOR
UK & EXPORT

EXCLUSIVE
TRISTAR SATELLITE SYSTEM DISTRIBUTOR IN BIRMINGHAM

- 100 Channels
- Stereo
- Full Remote Control
- Upgradable
- 60 cm Offset Dish
- Pre-Programmed 01-16 For Astra 1A
- 2 Year Guarantee on Receiver

COMPLETE SYSTEMS IN STOCK
— All usual Accessories Available —



UNIVERCEL

UHF/VHF
14" COLOUR TV
WITH INFRA RED
REMOTE CONTROL

£110 + VAT
(minimum quantity 10 for this month only)

Sleep Timer, 44 programme non-volatile memory. Function select. On screen display.

OTHER PRODUCTS INCLUDE:
Personal Stereo, Radio Cassettes, Midi's, Radios, Radio Alarms, Video Tapes, Batteries.

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Extn. 3001

HEAD OFFICE
CENTRAL TV WHOLESALE DISTRIBUTION LTD.
369 Stratford Road,
Sparkhill,
Birmingham B11.
Tel: 021-772 1591
Fax: 021-766 6383

CTV LONDON
Eley Estate,
Noble Road,
(Off Angel Road, A406),
Edmonton N18.
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081-884 1314

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THE NATION'S BIGGEST SUPPLIER OF THE BEST EX-RENTAL T.V.'s & VIDEO RECORDERS

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THORN EX RENTAL TV & VIDEO

From the co-ordinator of the ONLY
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NO shortages NO silly prices at:-

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ALL AT COMPETITIVE PRICES
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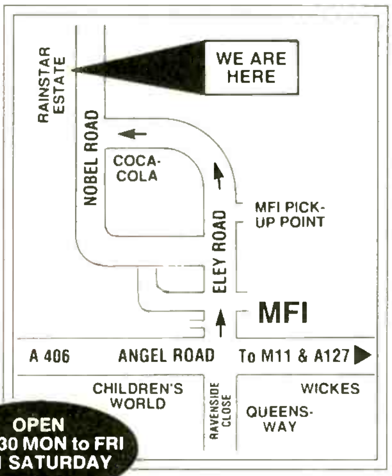
EXPORT ENQUIRIES WELCOME

VISIONS • LONDON

Suppliers of THORN ex-rental TVs and Videos Working *or* Off-the-pile

TW ELECTRONICS Main Distributor in London



OPEN
9 - 5.30 MON to FRI
9 - 1 SATURDAY

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APPROVED THORN TELEPRICE DISTRIBUTOR

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OPEN SUNDAYS BY APPOINTMENT ONLY

EXPORT ENQUIRIES: Fax 081-345 6597

PHONE FOR OUR CATALOGUE NOW!!

REMOTE CONTROL HAND UNITS

IR309	Granada Universal	£10.00
IR401	Grundig Text TP400	£11.50
IR650	Grundig Text TP630/650	£11.50
IR143	ITT Digi	£11.50
IR148	ITT Digi	£11.50
IR305	ITT/Rediffusion	£10.00
IR306	ITT	£10.00
IR135N	Philips KT3/K30 Non Text	£10.00
IR5301	Philips Text	£10.00
IR5352	Philips Text/VCR	£11.00
IR5534	Philips St Text/VCR	£11.00
IR140	Sony RM604/605/606	£12.00
IR141	Sony RM613	£12.00
IR160	Sony RM615/630 etc	£12.00
IR790	Thorn FST	£10.00
IR342	Thorn 3V35/36/42/45/48	£8.75
IR344	Thorn 3V31/32	£8.75
IR732	Thorn TX9/10 Text	£8.75
IR738	Thorn TX9/10 Stereo	£8.75

Original Panasonic Mode Switches

NV7000/7200/7800/2000/2010	VSS048	£3.30
NV230/430/810/870	VSS0110	£2.50
NV830	VSS0091	£2.39

ALL PRICES EXCLUDE VAT & P.&P.
STOCK SUBJECT TO AVAILABILITY

LOPTS	Konig Quality Transformers	
Thorn TX100	Green Spot	£18.50
Thorn TX100	Blue Spot	£18.50
Thorn TX100	Yellow Spot	£20.50
Thorn TX100	Non Spot	£21.95
Fidelity Lopt 3000	Chasis	£7.99

DESCRIPTION		PRICE
3HSSV		£6.95
3HSSN		£6.95
3HSSA	Akai 1-2-3-5-10	£16.50
3HSSR	Amstrad 7000	£16.95
3HSSU2N	VEH0287 NVG10/12	£22.00
3HSSU3N	VEH0286	£14.95
3HSS3N	VEH0177	£21.95
3HSS4NB	VEH0267	£24.95
3HSSSP	Sharp	£22.00
3HSSSPB	Sharp	£22.00
3HSSSSA	Samsung	£24.95

OVER 150 HEADS NOW IN STOCK

MISCELLANEOUS Special Offer While Stocks Last

TDA3654	£1.75
STK5481	£3.50
TX10 Focus Units	£4.50
Gas Soldering Iron	£8.50
Scart Splitter	£10.00
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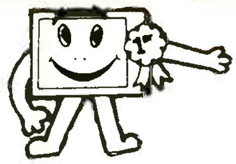

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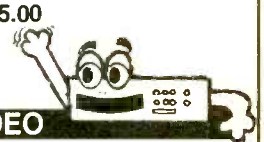

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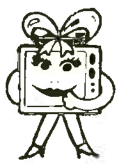

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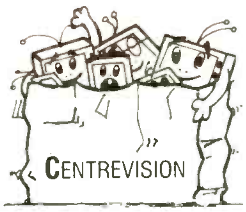

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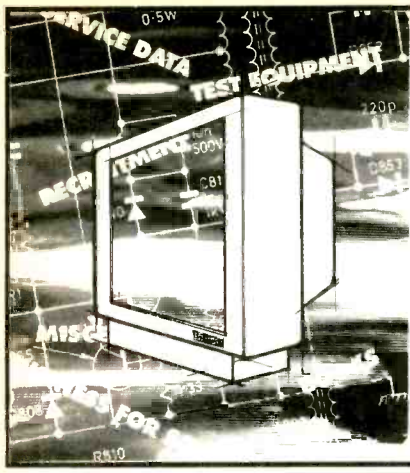

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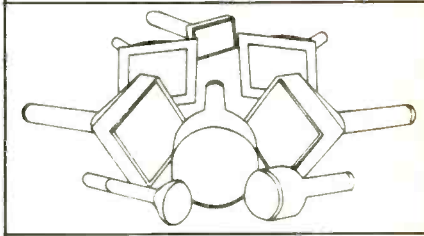

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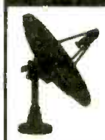

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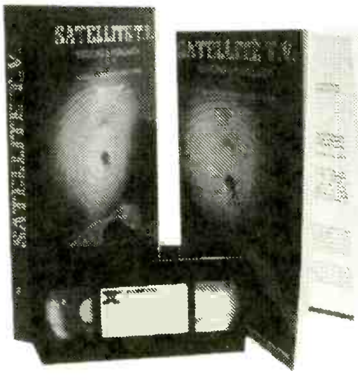

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KT3-K30

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BY 196	30p
BY 198	10p
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BY 224/600: 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
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TIC 116n/Y 1003	30p
TIC 126N	30p
TIC 225S	30p
TIC 226E	30p
TIC 226m	30p
TIC 236m	30p
TAG 226/600	30p
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(T092 case 2A/400V)	10p
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TIP 30	25p
TIP 30A	25p
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TIP 31	25p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41	15p
TIP 41B	40p
TIP 41D	70p
TIP 42	10p
TIP 42/BRC 6109	10p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 100	30p
TIP 102	30p
TIP 110	20p
TIP 115	50p
TIP 117	50p
TIP 125	35p
TIP 126	40p
TIP 127	40p
TIP 130	30p
TIP 131	6p
TIP 136	30p
TIP 140	50p
TIP 142	80p
TIP 640	50p
TIP 2955	35p
TIP L761A-1000V/4Amp	75p
T6032	30p
T6036	40p
T6040	40p
T6047	40p
T6049	40p
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MAB 8440P-D070 £3.00
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MAB 8440P-D056 £3.00
MAB 8441P-T001 £3.00
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HT300 Multimeter £7.75
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CT9383 CT9384 £4.00 each

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TOSHIBA HAND SETS
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THORN
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Decca RC 12 £14.00
G11 Infra-red full teletext £20.00
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Hitachi infra red handset £18.00
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Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T/Text £12.50
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
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GEC 8 button full remote £14.00
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TDA3560	£4.00
TDA3561A	£3.00
TDA3562A	£3.00
TDA3566	£3.50
TDA3564	£4.00
TDA3565	£3.00
TDA3571A	£2.75
TDA3581	£3.00
TDA3590	£3.00
TDA3591	£1.00
TDA3592A	£3.00
TDA3650	£7.00
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TDA3651AO	£3.50
TDA3652	£3.50
TDA3653AO	£2.00
TDA3653	£3.00
TDA3654	£2.00
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TDA3710	£3.50
TDA3800	£4.00
TDA3180	£2.00
TDA4260	50p
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TDA4505N4	£3.00
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TDA4600-2 Flat	£3.00
TDA4601	£2.00
TDA8190	£3.00
TDA9403	£1.50
TDA9503	£3.00
TDB2033	£1.00
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TD6306P	£2.00
TDA1060	£3.00
TEA1009	50p
TEA1039	£2.00
TEA1060	£2.00
TEA2017	£2.00
TEA5114	£1.00
TDA3300B	£6.00
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p
Sanikron Diode	30p

Transistors

A1222	25p	BF181	20p
A1223	25p	BF182	20p
AC106	25p	BF184	20p
AC121	25p	BF194	10p
AC124	25p	BF195	10p
AC128	25p	BF196	10p
AC137	25p	BF197	12p
AC151	25p	BF198	10p
AC131	25p	BF199	10p
AC138	25p	BF200	20p
AC152	25p	BF222	10p
AC153K	25p	BF224	15p
AC142K	25p	BF238	20p
AC169	25p	BF240	10p
AC176	25p	BF244	40p
AC178K	25p	BF245b	20p
AC179	25p	BF255	20p
AC186	25p	BF256	20p
AC188	25p	BF257	20p
ACY21	25p	BF258	25p
AD143	50p	BF262	15p
AD149	50p	BF263p	25p
AD161/162 pair	40p	BF264	15p
		BF271	10p
		BF273	10p
AF17A	25p	BF274	10p
AF139	25p	BF324	25p
AF181	£1.00	BF337	50p
AF239	25p	BF355	30p
AF367	25p	BF362	20p
AL102	£1.75	BF363	15p
AU110	£1.50	BF367	15p
BLY49	50p	BF391	15p
BF115	20p	BF394	10p
BF121	20p	BF419	30p
BF127	20p	BF422	15p
BF137	20p	BF423	15p
BF157	20p	BF448	30p
BF160	20p	BF470	30p
BF161	20p	BF471	30p
BF164	60p	BF597T	10p
BF179	30p	BF694	10p
BF180	20p		

Thorn Transformers

DT2076/78	£10.00
90D34B54003	£10.00
90D4-106-003	£1.00
90D34038-001	£5.00
OT204130	£3.00

I.C.s

MA721PC	£1.00	UPD114LC-2	£1.00
M50430-8505P	£1.00	MN1250BJC	£1.00
TD6359P	£1.00	M50441-5505P	£1.00
M58657P	£1.00	M491BB1	£2.00
PCD8572	£1.00	HA513385	£1.00
HD74HC86P	£1.00		