

NOVEMBER 1987

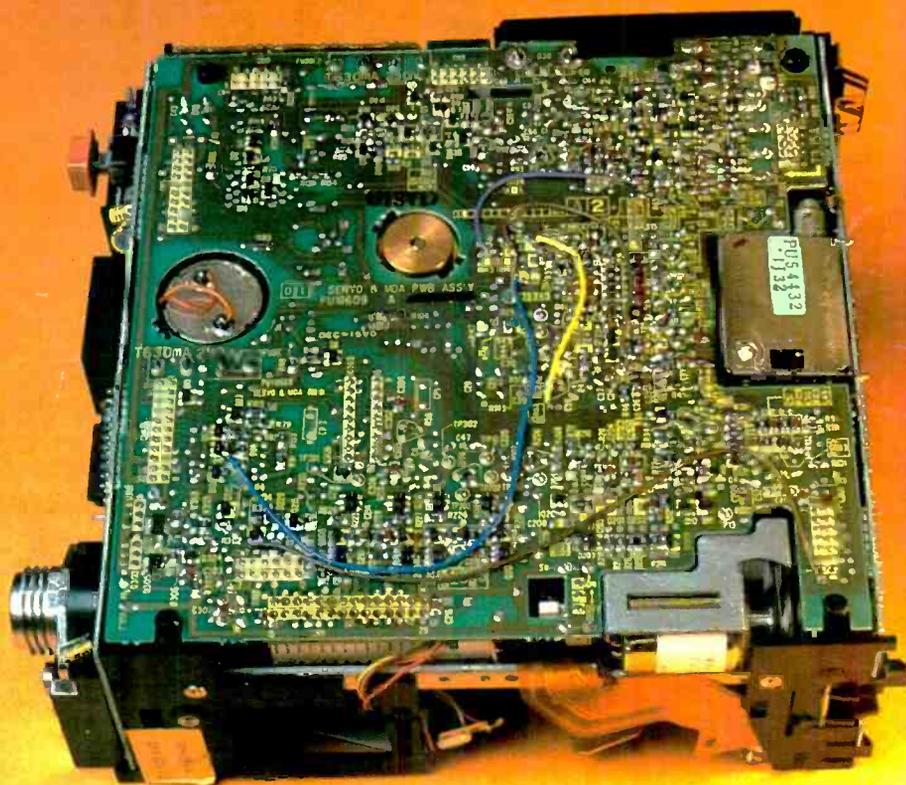
Australia \$2.20, New Zealand \$2.95 (inc. GST), Malaysia \$5.95

£1.30

# TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

*Free Assembly Tweezers*



**Guide to Servo System Operation  
Transport for Field Servicing  
Fuse Types and Ratings • DX-TV  
An Alternative Rebroadcast System  
VCR Clinic • TV Fault Finding**

# MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR  
FOR DOMESTIC TV & VCR.

TEST  
DEMONSTRATIONS  
AT 172  
WEST END LANE



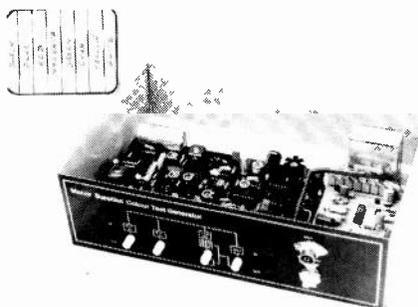
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

Price of Kit **£70.00**  
Case (10"×6"×2¼") app. **£8.60**  
Optional Sound Module (6MHz or 5.5MHz) **£3.90**  
Built & Tested in Case including Sound Module **£108.00**

SPECIAL TEST  
REPORT  
'TELEVISION'  
DEC. 1982

Post/Packing £2.80  
Add VAT 15% TO ALL PRICES

## PAL COLOUR BAR GENERATOR (Mk4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s on colour bar P.C.B.

PRICE OF MK 4 COLOUR BAR GENERATOR KIT  
£30.00. CASE £8.60. BATT HOLDERS £4.20. MAINS  
SUPPLY KIT £4.20 (Combined P&P £2.80).

MK 4 (BATTERY) BUILT & TESTED £58.00 + £2.80 P & P.  
MK 4 (MAINS) BUILT & TESTED £68.00 + £2.80 P & P.  
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.  
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD  
VAT  
15%

TELETEXT DECODER PANELS (TESTED)  
Mullard VM6101 £30.00, Philips KT3, K30 £30.00, Texas XM11  
(TIFAX) £28.00 p.p. £1.80

THORN TX9 MK2/3, TX10, teletext  
Mullard Decoder panel + Interface £35.00 p.p. £1.80  
THORN TX10, PHILIPS G11 PRESTEL, TELETEXT  
Mullard Units VM 6230, 6330 plus Line Coupler & Interface £38.00  
p.p. £2.50

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BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF  
TECHNICAL EXPERTS

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Frame, IF, decoder £12.50 each p.p. £2.00. Scan £20.00 p.p. £2.80  
PHILIPS G11 PANELS ex rental (untested).  
Scan £10.00, Frame, Decoder £5.00 p.p. £2.00.  
SPECIAL OFFER Mullard/Philips quality UHF modulator (audio & video  
input) ex new equipment £5.00 p.p. £1.00.  
PHILIPS G11 6 position touch tune channel selector units £16.00 p.p. £1.80  
(can replace earlier mechanical selector unit).  
PHILIPS HANDSETS (New Replacements) p.p. £1.50.  
G11 Ultrasonic Nontext £22.50, Infra red Text £22.50, Others available.  
KT3 Non text (RC 4001) £21.50, KT3, K30 etc. Text £25.00.  
PHILIPS HANDSETS Ex rental, text, Untested, KT Text/Video Type, £3.50  
p.p. £1.00.  
COLOUR MANUALS p.p. 50p.  
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THORN REMOTE CONTROL HANDSETS  
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TX9/TX10 Teletext interface panel (1524) £5.00 p.p. 80p.  
THORN TX9, TX10 Saw Filter IF Panel, £5.00 p.p. 80p.  
TX9, TX10 Remote & tuning control panel (1515) £10.50 p.p. £1.80.  
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CMP31, CMA30, CM532, p.p. 80p; CMD33, p.p. £1.80.  
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6-3V CRT Boost Transformers for Colour & Mono £5.90 p.p. £1.40.  
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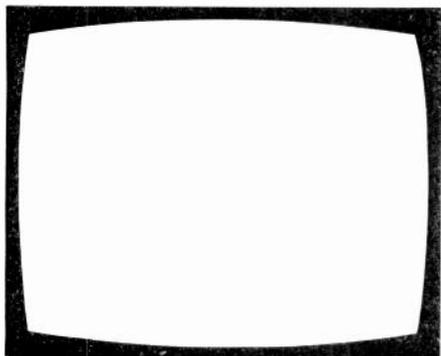
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## MANOR SUPPLIES

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# TELEVISION

November  
1987

Vol. 38, No. 1  
Issue 445

On sale October 21st

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## QUERIES

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. Correspondents should enclose a stamped addressed envelope. Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

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UPC554	2.63		
UPC566H	2.95		
UPC575C2	3.40		
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UPC587C2	2.34		
UPC1025H	2.95		
UPC1026H	1.24		
UPC1028H	2.52		
UPC1032H	94		
UPC1042C	1.56		
UPC1156H	4.26		
UPC1158H	3.50		
UPC1163H	2.48		

UPC167C2	2.70	SEMICONDUCTORS	
UPC168C	3.20	AC107	35
UPC176C	2.53	AC126	34
UPC177H	3.15	AC127	39
UPC178C	4.21	AC128	34
UPC180C	1.84	AC128K	40
UPC181H	1.62	AC141	62
UPC182H	2.95	AC141K	39
UPC183H	2.48	AC176	35
UPC185H	3.66	AC176K	35
UPC186H	1.60	AC186	41
UPC188H	4.99	AC187	38
UPC190G	1.20	AC187K	46
UPC198C	4.00	AC188	35
UPC1200V	1.18	AD143=OC28	82
UPC1211V	2.70	AD145	85
UPC1212V	1.36	AD161	54
UPC1215V	1.64	AD162	54
UPC1216V	1.20	AD162 MP	1.15
UPC1217G	2.24	AF106	49
UPC1218H	1.80	AF114	89
UPC1223C	2.20	AF121	75
UPC1225H	2.00	AF124	48
UPC1226C	1.50	AF125	53
UPC1227V	1.20	AF126	53
UPC1230H	4.39	AF127	53
UPC1238	2.50	AF139	63
UPC1245V	1.35	AF178	1.54
UPC1277	4.81	AF239	60
UPC1350C	4.15	AF239	1.56
UPC1353C	4.76	AF272	4.90
UPC1365C	6.38	AF292	3.01
UPC1366C	2.08	AU110	3.01
UPC1367	2.00	BC107	2.00
UPC1358H	1.88	BC108	20
UPC1360C	2.20	BC109	20
UPC1363C	2.16	BC114	12
UPC1368H2	2.15	BC115	17
UPC1370C2	2.58	BC116A	35
UPC1382C	1.08	BC117	30
UPC1384	3.78	BC118	24
UPC1394C	3.07	BC119	36
UPC1447H	58	BC139	32
UPC41C	2.80	BC140	32
UPC577H	2.46	BC141	30
UPC585C	1.28	BC142	30
UPD1567C2	20.76	BC143	31
UPD553C164	20.76	BC147	13
UPD7519G	17.13	BC148	12
UPD7538C020	11.06	BC149	13
UPD546C107	22.28	BC157	16
UPD547C049	11.18	BC158=BC558	16
U05G	1.27	BC159	15
V11N	1.27	BC160	52
10E2	43	BC161	32
10VT05	8.74	BC162	32
		BC170B	15
		BC171	15
		BC172	15
		BC173	16
		BC174	10
		BC177	27
		BC178	26
		BC182L	15
		BC183L	15
		BC184L	15
		BC186	35
		BC187	25
		BC204	10
		BC208	13
		BC209	10
		BC212	15
		BC212L	15
		BC213	15
		BC214	15
		BC237	14
		BC238	14
		BC251A	18
		BC252	12
		BC261	33
		BC262	30
		BC300	50
		BC301	51
		BC303	33
		BC307	20
		BC308	25
		BC323	99
		BC327	22
		BC328	18
		BC337	21
		BC338	18
		BC461	42
		BC527	35
		BC547	13
		BC548	13
		BCX32 = BC637	39
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O. Dia	I. Dia	Width	
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SONY 24.2	18	5.1	50p
HITACHI 31.8	25	4.9	50p
PANASONIC 37	27	3.9	52p
AKAI 26	20	3.9	50p
JVC 39.3	32.8	3.9	56p
JVC 33	23.9	4	56p
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Hitachi VT11/GEC 4100	35.62
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\* Thorn New Life heads are refurbished heads and we have types to cover most VHS types on an exchange basis

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AC128	21p	BD376	30p	BR106	33p	TP112	65p	BY102	40p	PCF812	60p	CA-3014	110p	LA-4516	260p	STK.441	740p	TDA-2010	170p	ZSC.467	30p	OCPT1	70p
AC129K	25p	BD377	30p	BR107	33p	TP113	65p	BY103	40p	PCF814	60p	CA-3015	110p	LA-4518	260p	STK.442	740p	TDA-2011	170p	ZSC.468	30p	ORP12	85p
AC141K	30p	BD378	30p	BR108	33p	TP114	65p	BY104	40p	PCF816	60p	CA-3016	110p	LA-4520	260p	STK.443	740p	TDA-2012	170p	ZSC.469	30p	ORP10	100p
AC142K	30p	BD379	30p	BR109	33p	TP115	65p	BY105	40p	PCF818	60p	CA-3017	110p	LA-4522	260p	STK.444	740p	TDA-2013	170p	ZSC.470	30p	ORP11	100p
AC153K	23p	BD380	30p	BR110	33p	TP116	65p	BY106	40p	PCF820	60p	CA-3018	110p	LA-4524	260p	STK.445	740p	TDA-2014	170p	ZSC.471	30p	ORP12	100p
AC176	22p	BD381	30p	BR111	33p	TP117	65p	BY107	40p	PCF822	60p	CA-3019	110p	LA-4526	260p	STK.446	740p	TDA-2015	170p	ZSC.472	30p	ORP13	100p
AC176K	22p	BD382	30p	BR112	33p	TP118	65p	BY108	40p	PCF824	60p	CA-3020	110p	LA-4528	260p	STK.447	740p	TDA-2016	170p	ZSC.473	30p	ORP14	100p
AC178	22p	BD383	30p	BR113	33p	TP119	65p	BY109	40p	PCF826	60p	CA-3021	110p	LA-4530	260p	STK.448	740p	TDA-2017	170p	ZSC.474	30p	ORP15	100p
AC181	21p	BD384	30p	BR114	33p	TP120	65p	BY110	40p	PCF828	60p	CA-3022	110p	LA-4532	260p	STK.449	740p	TDA-2018	170p	ZSC.475	30p	ORP16	100p
AC187K	28p	BD385	30p	BR115	33p	TP121	65p	BY111	40p	PCF830	60p	CA-3023	110p	LA-4534	260p	STK.450	740p	TDA-2019	170p	ZSC.476	30p	ORP17	100p
AC188	21p	BD386	30p	BR116	33p	TP122	65p	BY112	40p	PCF832	60p	CA-3024	110p	LA-4536	260p	STK.451	740p	TDA-2020	170p	ZSC.477	30p	ORP18	100p
AC188K	28p	BD387	30p	BR117	33p	TP123	65p	BY113	40p	PCF834	60p	CA-3025	110p	LA-4538	260p	STK.452	740p	TDA-2021	170p	ZSC.478	30p	ORP19	100p
AC189	21p	BD388	30p	BR118	33p	TP124	65p	BY114	40p	PCF836	60p	CA-3026	110p	LA-4540	260p	STK.453	740p	TDA-2022	170p	ZSC.479	30p	ORP20	100p
AC189K	28p	BD389	30p	BR119	33p	TP125	65p	BY115	40p	PCF838	60p	CA-3027	110p	LA-4542	260p	STK.454	740p	TDA-2023	170p	ZSC.480	30p	ORP21	100p
AC198	21p	BD390	30p	BR120	33p	TP126	65p	BY116	40p	PCF840	60p	CA-3028	110p	LA-4544	260p	STK.455	740p	TDA-2024	170p	ZSC.481	30p	ORP22	100p
AC198K	28p	BD391	30p	BR121	33p	TP127	65p	BY117	40p	PCF842	60p	CA-3029	110p	LA-4546	260p	STK.456	740p	TDA-2025	170p	ZSC.482	30p	ORP23	100p
AC199	21p	BD392	30p	BR122	33p	TP128	65p	BY118	40p	PCF844	60p	CA-3030	110p	LA-4548	260p	STK.457	740p	TDA-2026	170p	ZSC.483	30p	ORP24	100p
AC199K	28p	BD393	30p	BR123	33p	TP129	65p	BY119	40p	PCF846	60p	CA-3031	110p	LA-4550	260p	STK.458	740p	TDA-2027	170p	ZSC.484	30p	ORP25	100p
AC200	21p	BD394	30p	BR124	33p	TP130	65p	BY120	40p	PCF848	60p	CA-3032	110p	LA-4552	260p	STK.459	740p	TDA-2028	170p	ZSC.485	30p	ORP26	100p
AC200K	28p	BD395	30p	BR125	33p	TP131	65p	BY121	40p	PCF850	60p	CA-3033	110p	LA-4554	260p	STK.460	740p	TDA-2029	170p	ZSC.486	30p	ORP27	100p
AC201	21p	BD396	30p	BR126	33p	TP132	65p	BY122	40p	PCF852	60p	CA-3034	110p	LA-4556	260p	STK.461	740p	TDA-2030	170p	ZSC.487	30p	ORP28	100p
AC201K	28p	BD397	30p	BR127	33p	TP133	65p	BY123	40p	PCF854	60p	CA-3035	110p	LA-4558	260p	STK.462	740p	TDA-2031	170p	ZSC.488	30p	ORP29	100p
AC202	21p	BD398	30p	BR128	33p	TP134	65p	BY124	40p	PCF856	60p	CA-3036	110p	LA-4560	260p	STK.463	740p	TDA-2032	170p	ZSC.489	30p	ORP30	100p
AC202K	28p	BD399	30p	BR129	33p	TP135	65p	BY125	40p	PCF858	60p	CA-3037	110p	LA-4562	260p	STK.464	740p	TDA-2033	170p	ZSC.490	30p	ORP31	100p
AC203	21p	BD400	30p	BR130	33p	TP136	65p	BY126	40p	PCF860	60p	CA-3038	110p	LA-4564	260p	STK.465	740p	TDA-2034	170p	ZSC.491	30p	ORP32	100p
AC203K	28p	BD401	30p	BR131	33p	TP137	65p	BY127	40p	PCF862	60p	CA-3039	110p	LA-4566	260p	STK.466	740p	TDA-2035	170p	ZSC.492	30p	ORP33	100p
AC204	21p	BD402	30p	BR132	33p	TP138	65p	BY128	40p	PCF864	60p	CA-3040	110p	LA-4568	260p	STK.467	740p	TDA-2036	170p	ZSC.493	30p	ORP34	100p
AC204K	28p	BD403	30p	BR133	33p	TP139	65p	BY129	40p	PCF866	60p	CA-3041	110p	LA-4570	260p	STK.468	740p	TDA-2037	170p	ZSC.494	30p	ORP35	100p
AC205	21p	BD404	30p	BR134	33p	TP140	65p	BY130	40p	PCF868	60p	CA-3042	110p	LA-4572	260p	STK.469	740p	TDA-2038	170p	ZSC.495	30p	ORP36	100p
AC205K	28p	BD405	30p	BR135	33p	TP141	65p	BY131	40p	PCF870	60p	CA-3043	110p	LA-4574	260p	STK.470	740p	TDA-2039	170p	ZSC.496	30p	ORP37	100p
AC206	21p	BD406	30p	BR136	33p	TP142	65p	BY132	40p	PCF872	60p	CA-3044	110p	LA-4576	260p	STK.471	740p	TDA-2040	170p	ZSC.497	30p	ORP38	100p
AC206K	28p	BD407	30p	BR137	33p	TP143	65p	BY133	40p	PCF874	60p	CA-3045	110p	LA-4578	260p	STK.472	740p	TDA-2041	170p	ZSC.498	30p	ORP39	100p
AC207	21p	BD408	30p	BR138	33p	TP144	65p	BY134	40p	PCF876	60p	CA-3046	110p	LA-4580	260p	STK.473	740p	TDA-2042	170p	ZSC.499	30p	ORP40	100p
AC207K	28p	BD409	30p	BR139	33p	TP145	65p	BY135	40p	PCF878	60p	CA-3047	110p	LA-4582	260p	STK.474	740p	TDA-2043	170p	ZSC.500	30p	ORP41	100p
AC208	21p	BD410	30p	BR140	33p	TP146	65p	BY136	40p	PCF880	60p	CA-3048	110p	LA-4584	260p	STK.475	740p	TDA-2044	170p	ZSC.501	30p	ORP42	100p
AC208K	28p	BD411	30p	BR141	33p	TP147	65p	BY137	40p	PCF882	60p	CA-3049	110p	LA-4586	260p	STK.476	740p	TDA-2045	170p	ZSC.502	30p	ORP43	100p
AC209	21p	BD412	30p	BR142	33p	TP148	65p	BY138	40p	PCF884	60p	CA-3050	110p	LA-4588	260p	STK.477	740p	TDA-2046	170p	ZSC.503	30p	ORP44	100p
AC209K	28p	BD413	30p	BR143	33p	TP149	65p	BY139	40p	PCF886	60p	CA-3051	110p	LA-4590	260p	STK.478	740p	TDA-2047	170p	ZSC.504	30p	ORP45	100p
AC210	21p	BD414	30p	BR144	33p	TP150	65p	BY140	40p	PCF888	60p	CA-3052	110p	LA-4592	260p	STK.479	740p	TDA-2048	170p	ZSC.505	30p	ORP46	100p
AC210K	28p	BD415	30p	BR145	33p	TP151	65p	BY141	40p	PCF890	60p	CA-3053	110p	LA-4594	260p	STK.480	740p	TDA-2049	170p	ZSC.506	30p	ORP47	100p
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AC211K	28p	BD417	30p	BR147	33p	TP153	65p	BY143	40p	PCF894	60p	CA-3055	110p	LA-4598	260p	STK.482	740p	TDA-2051	170p	ZSC.508	30p	ORP49	100p
AC212	21p	BD418	30p	BR148	33p	TP154	65p	BY144	40p	PCF896	60p	CA-3056	110p	LA-4600	260p	STK.483	740p	TDA-2052	170p	ZSC.509	30p	ORP50	100p
AC212K	28p	BD419	30p	BR149	33p	TP155	65p	BY145	40p	PCF898	60p	CA-3057	110p	LA-4602	260p	STK.484	740p	TDA-2053	170p	ZSC.510	30p	ORP51	100p
AC213	21p	BD420	30p	BR150	33p	TP156	65p	BY146	40p	PCF900	60p	CA-3058	110p	LA-4604	260p	STK.485	740p	TDA-2054	170p	ZSC.511	30p	ORP52	100p
AC213K	28p	BD421	30p	BR151	33p	TP157	65p	BY147	40p	PCF902	60p	CA-3059	110p	LA-4606	260p	STK.486	740p	TDA-2055	170p	ZSC.512	30p	ORP53	100p
AC214	21p	BD422	30p	BR152	33p	TP158	65p	BY148	40p	PCF904	60p	CA-3060	110p	LA-4608	260p	STK.487	740p	TDA-2056	170p	ZSC.513	30p	ORP54	100p
AC214K	28p	BD423	30p	BR153	33p	TP159	65p	BY149	40p	PCF906	60p	CA-3061	110p	LA-4610	260p	STK.488	740p	TDA-2057	170p	ZSC.514	30p	ORP55	100p
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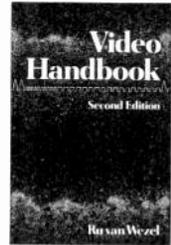
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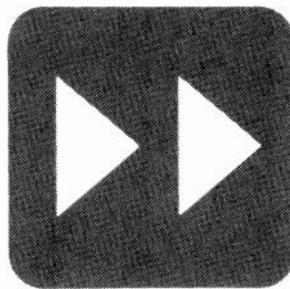
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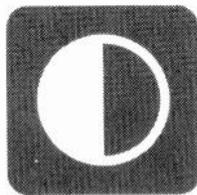
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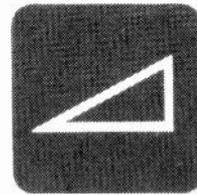
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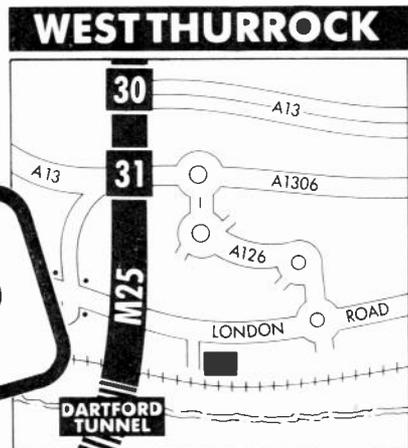
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SA11278	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807W	1.30				
SA11279	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807X	1.30				
SA11280	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807Y	1.30				
SA11281	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807Z	1.30				
SA11282	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AA	1.30				
SA11283	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AB	1.30				
SA11284	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AC	1.30				
SA11285	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AD	1.30				
SA11286	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AE	1.30				
SA11287	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AF	1.30				
SA11288	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AG	1.30				
SA11289	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AH	1.30				
SA11290	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AI	1.30				
SA11291	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AJ	1.30				
SA11292	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AK	1.30				
SA11293	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AL	1.30				
SA11294	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AM	1.30				
SA11295	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AN	1.30				
SA11296	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AO	1.30				
SA11297	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AP	1.30				
SA11298	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AQ	1.30				
SA11299	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AR	1.30				
SA11300	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AS	1.30				
SA11301	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AT	1.30				
SA11302	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AU	1.30				
SA11303	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AV	1.30				
SA11304	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AW	1.30				
SA11305	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AX	1.30				
SA11306	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AY	1.30				
SA11307	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807AZ	1.30				
SA11308	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BA	1.30				
SA11309	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BB	1.30				
SA11310	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BC	1.30				
SA11311	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BD	1.30				
SA11312	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BE	1.30				
SA11313	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BF	1.30				
SA11314	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BG	1.30				
SA11315	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BH	1.30				
SA11316	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BI	1.30				
SA11317	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BJ	1.30				
SA11318	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BK	1.30				
SA11319	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BL	1.30				
SA11320	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BM	1.30				
SA11321	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BN	1.30				
SA11322	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BO	1.30				
SA11323	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BP	1.30				
SA11324	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BQ	1.30				
SA11325	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BR	1.30				
SA11326	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BS	1.30				
SA11327	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BT	1.30				
SA11328	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BU	1.30				
SA11329	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BV	1.30				
SA11330	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BW	1.30				
SA11331	4.95	TDA1515	4.50	TDA4600/2D	3.30	BU807BX	1.30				

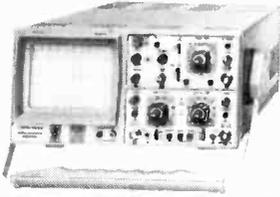
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#### HM203-6 20MHz Standard

#### FREE Securicor Delivery



- SPECIFICATION**
- Bandwidth DC-20MHz
  - Sens. Ch1, Ch2, 2mV/cm
  - Time Base 0.25s/cm - 20ns/cm
  - Trigger DC-40MHz AC, DC, HF, LF, (TV Frame)
  - Active TV Sinc. Sep.
  - Invert both channels
  - Variable hold-off 10:1
  - Calibrator
  - Plus many more features

Price £314.00 + £47.10 V.A.T.

Including two probes

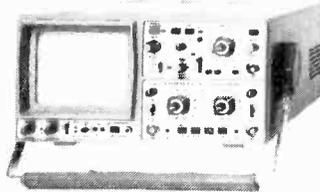
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#### HM204-2 20MHz Multi-function

**SPECIFICATION**

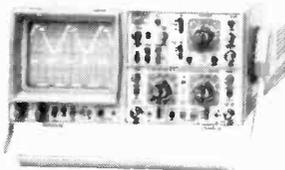
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2, 1mV/cm
- Delay Line
- Time Base 1.25s/cm - 10ns/cm
- Delayed Sweep 100ns - 0.1s
- Trigger DC-50MHz AC, DC, HF, LF, (TV Frame)
- Variable hold-off 10:1
- Overscan LED indicators
- Calibrator
- Plus many more features

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#### FREE Securicor Delivery



- SPECIFICATION**
- Digital Storage
  - Analogue Real Time (Same as 203-6)
  - Bandwidth DC-20MHz
  - Sens. Ch1, Ch2, 2mV/cm
  - Trigger DC-40MHz AC, DC, HF, LF, (TV Frame)
  - Active TV Sinc. Sep.
  - 100KHz Sample Rate
  - 2 x 1K Storage
  - Storage Range 1ms-5s/cm
  - Variable hold-off 10:1
  - Calibrator
  - Plus many more features

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Including two probes

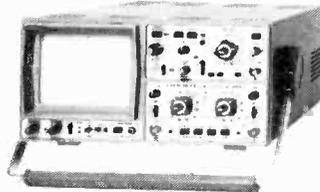
#### FREE Securicor Delivery

#### HM605 60MHz Multi-function

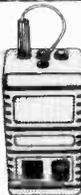
**SPECIFICATION**

- Bandwidth DC-60MHz
- Sens. Ch1, Ch2, 1mV/cm
- Delay Line
- Delayed Sweep 100ns - 0.1s
- Trigger DC-80MHz AC, DC, HF, LF, (TV Frame)
- Variable hold-off 10:1
- Switchable Calibrator
- Overscan LED indicators
- Plus many more features

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- Bandwidth 10MHz

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#### DIGITAL LCR METER

- LCD Display
- 18 Ranges
- Inductance 1µH - 2H
- Capacitance 1pf - 200µf
- Resistance 1ohm - 20Mohm
- High accuracy

Price £85.00 + £12.75 V.A.T.



#### INSULATION TESTER 500V



- Electronic battery operated
- Measuring Voltage 500V DC
- Measuring Range 0-100Mohm
- Centre scale 2Mohm

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Our top selling instrument is designed to readily test the various characteristics and rejuvenation of both colour and B/W CRT's.

- Tests for shorts and leakage between electrodes
- Tests cathode emission characteristics.
- Separately checks condition of guns
- Removal of shorts and leakage between electrodes.
- Checks heater warm-up characteristics.
- Rejuvenation of low emission cathodes with automatic timing.
- Super rejuvenation with manual control.
- Complete with tube base adaptors.
- Size H230mm W330mm D120mm.

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THE SADELTA FIELD STRENGTH METER TC-402 has been designed to measure the signal levels delivered by the antenna to a TV or FM receiver, in order to test the performance of the antenna and evaluate the best conditions during installation etc. To facilitate measurements, the tuning frequency readout is shown on a digital display.

#### FEATURES

- Covering FM and all TV bands (UHF/VHF) including CATV freq.
- Digital tuning display (3 digits) for direct frequency readout.
- Accurate 10 turn tuning potentiometer.
- Built-in loudspeaker enables monitoring of sound in AM/FM.
- Meter measurement in voltage and dB from 20µV (26dB/µV).
- Continuity tester 0-500 ohms.
- Fully portable (battery).
- Sturdy carry case.



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### SADELTA COLOUR PATTERN GENERATORS

THE SADELTA RANGE OF HAND HELD COLOUR PATTERN GENERATORS is intended for use in production, installation and service of both colour and monochrome TV sets, video and computer monitors. In order to control and adjust the various parameters eight switchable patterns are provided. The technician has ready access to Laboratory, workshop and field use as the Generator has been designed using the latest micro-technology to achieve truly pocket size instruments. Internal re-chargeable Ni-Cd's. Supplied with 9V power supply charger. Size 131mm x 81mm x 23mm.

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- Band III (5-12)
- PAL I.
- O/Put 10mV into 75ohms
- Sound output

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#### PAL VIDEO COMPOSITE GENERATOR

- PAL B, G, I.
- O/Put 1V p.p. @ 75ohms
- Audio O/Put 10mV
- Switching 12V @ 4K7ohms

Price £124.95 + £18.74 V.A.T.

#### SECAM VIDEO COMPOSITE GENERATOR

- SECAM B, G, D, K, L.
- O/Put 1V p.p. @ 75ohms
- Audio O/Put 10mV
- Switching 12V @ 4K7ohms

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- Neg. Composite
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LEADER High Voltage Metered EHT PROBE. Measures up to 40KV DC with safety. Built in meter. Accuracy ±3%

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#### DIGITAL LCR METER

- LCD Display
- 18 Ranges
- Inductance 1µH - 2H
- Capacitance 1pf - 200µf
- Resistance 1ohm - 20Mohm
- High accuracy

Price £85.00 + £12.75 V.A.T.



#### INSULATION TESTER 500V



- Electronic battery operated
- Measuring Voltage 500V DC
- Measuring Range 0-100Mohm
- Centre scale 2Mohm

Price £65.00 + £9.75 V.A.T.



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  - 5010EC | 12 range incl. CAP Hie temp etc 0.25% (R) £53.00
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  - M3650 | 130 range incl. Hie CAP freq. cont. 20A AC/DC 0.3% (R)

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- HAMEG** - all with component testers
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  - 204/2 Dual 20MHz - sweep delay £418.00
  - ★205/2 Dual 20MHz - digital store £527.00
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- HUNG CHANG** 16" FLAT screen 615 3 1/2 CRT
- ★620 Dual 20MHz - comp test £295.00
  - ★635 Dual 35MHz sweep delay £399.00
  - ★650 Dual 50MHz sweep delay £579.00
  - ★615 Dual 15MHz Batt/mains £399.00

## POCKET INSTRUMENTS

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  - 555 20Hz to 150KHz Audio Generator £47.50
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  - 5050E 41 Range FET meter 0.1uA 1000 meg etc £28.65
  - 102BZ 19 Range Meter 20K/V 10A DC Buzzer £12.61
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  - MET1000 RESOLUTION £175.00
  - MET1500 5mv min Sensitivity £199.00
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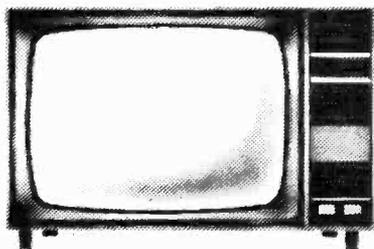
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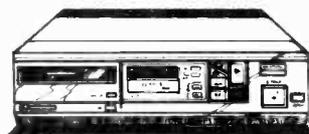
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showroom standards



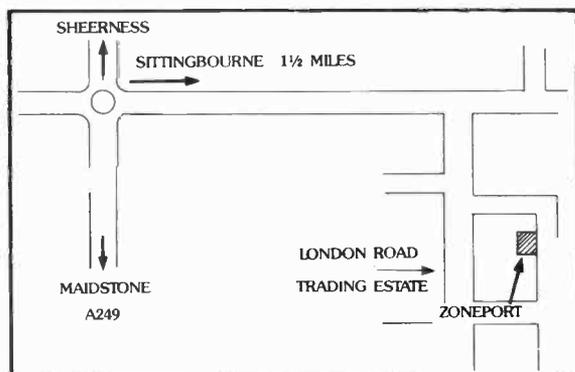
**NON-WORKING STOCK  
CHECKED  
AND COMPLETE**

CONTACT  
BRIAN MOLLETT

# COME ON DOWN THE PRICE IS RIGHT!

**UNIT N2  
London Road Trading  
Estate  
Sittingbourne, Kent.**

 **(0795) 28166**





## £1 BAKERS DOZEN PARCELS

Price per pack is £1.00.\* Order 12 you get one extra free. All the parcels listed below brand new components. Unless marked s.h.

1. 5-13 amp ring main junction boxes
2. 5-13 amp ring main spur boxes
3. 3-flush electrical switches
4. 4-in flex line switches with neons
5. 2-80 watt brass cased elements
6. 2-mains transformers with 6V 1A secondaries
7. 2-mains transformers with 12V 1/2A secondaries
8. 1-extension speaker cabinet for 6 1/2" speaker
9. 5-ocul bases for relays or valves
10. 12-glass reed switches
11. 4-DCP 70 photo transistors
12. 4-tape heads, 2 record, 2 erase
13. 1-ultrasonic transmitter and 1 receiver with circuit
14. 2-15000 mfd computer grade electrolytics
15. 2-light dependent resistors
16. 5-different micro switches
17. 2-mains interference suppressors
18. 2-25 watt crossover units 2 way
19. 1-40 watt 3 way crossover unit
20. 1-6 digit counter mains voltage
21. 2-Nicad battery chargers
22. 1-key switch with key
23. 2-humidity switches
24. 2-aerosol cans of ICI Ory Lubricant
25. 48-2 metre lengths colour-coded connecting wire
26. 2-air spaced 2 gang tuning condensers
27. 2-solid dielectric 2 gang tuning condensers
28. 10-compression trimmers
29. 8-rocker switch 10 amp mains SPST
30. 5-Rocker Switches 10 amp SPDT Centre Off
31. 4-Rocker Switches 10 amp DPDT
32. 1-24 hour time switch mains operated (sh)
33. 1-6 hour clock timeswitch
34. 2-6v operated reed switch relays
35. 10-neon valves - make good night lights
36. 2-12V DC or 24V AC, 3 CO relays
37. 1-12V 2 CO miniature relay very sensitive
38. 1-12V 4 CO miniature relay
39. 2-mains operated relays 3 x 8 amp changeovers
40. 1-locking mechanism with 2 keys
41. 1-Minature Uniselector with circuit for electric jigsaw puzzle
42. 5-Dolls House switches
43. 5-ferrite rods 4" x 5/16" diameter aeriels
44. 1-4 ferrite slab aeriels with L&M wave coils
45. 4-200 ohm earpiece
46. 1-Mullard Thyristor trigger module
47. 10-assorted knobs 1/4 spindles
48. 5-different thermostats, mainly bi-metal
49. 1-Magnetic brake - stops rotation instantly
50. 1-low pressure 3 level switch can be mouth operated
51. 2-25 watt pots 8 ohm
52. 2-25 watt pots 1000 ohm
53. 4-wire wound pots - 18, 33, 50 and 100 ohm your choice
54. 4-3 watt wire wound pots 50 ohm
55. 1-time reminder adjustable 1-60 mins clockwork
56. 5-5 amp stud rectifiers 400v
57. 1-mains shaped pole motor 3/4" stack - 1/4 shaft
58. 2-5" ali fan blades fit 1/4" shaft
59. 2-3" plastic fan blades fit 1/4" shaft
60. 1-mains motor with gear box 1 rev per 24 hours
61. 1-mains motor with gear box 1 rev per 24 hours
62. 1-mains motor with gear box 16 rpm
63. 4-11 pin moulded bases for relays
64. 5-B7G valve bases
65. 4-skirted B9A valve bases
66. 1-thermostat for fridge
67. 1-motorised stud switch (s.h.)
68. 1-2 1/2 hours delay switch
69. 1-6v mains power supply unit
70. 1-4 1/2 mains power supply unit
71. 1-5 pin flex plug and panel socket
72. 1-5" speaker size radio cabinet with handle
73. 10-1/4" spindle type volume controls
74. 10-slender type volume controls
75. 1-heating pad 200 watts mains
76. 1-1W amplifier Mullard 1172
77. 1-wall mounting thermostat 24V
78. 1-teak effect extension 5" speaker cabinet
79. 2-p.c. boards with 2 amp full wave and 17 other recs
80. 12-mtr twin screened flex white p.v.c. outer
81. 2-plastic boxes with windows, ideal for interrupted beam switch
82. 1-plastic box sloping metal front, 16 x 95mm average depth 45mm
83. 1-car door speaker (very flat) 6 1/2" 15 ohm made for Radiomobile
84. 2-speakers 6" x 4" 16 ohm 5 watt made for Radiomobile
85. 2-mains transformers 9V 1/2A secondary split primary so ok also for 115V
86. 1-mains transformers 15V 1A secondary p.c.b. mounting
87. 2-6v 0.6v mains transformer 3A p.c.b. mounting
88. 40-double pole leaf switches
89. 1-7uf 660v 50hz metal cased condenser
90. 2-2 1/4in. 60ohm loudspeakers
91. 2-2 1/4in. 8ohm loudspeakers
92. 1-mains operated relay with 2 sets c/o contacts
93. 2-packets resin filler/sealer with cures
94. 3-5A round 3 pin plugs will fit item 193
95. 4-7 segment i.e.d. displays
96. 4-pc boards for stripping, lots of valuable parts
97. 1-5" 4ohm speaker with built in tweeter Radio mobil
98. 1-3A double pole magnetic tip, saves repairing fuses
99. 4-1000uf 25V axial electrolytic capacitors

## TELEPHONE BITS

- Master socket (has surge arrester - ringing condenser etc) and takes B.T. plug.....£3.95  
 Extension socket.....£2.95  
 Dual adapters (2 from one socket).....£3.95  
 Cord terminating with B.T. plug 3 metres £1  
 Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets £11.50  
 100 mtrs 4 core telephone cable £8.50

## COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 5" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 5 1/4" disc. We supply the Operators Manual and other information showing how to use this with popular computers: BBC, Spectrum, Amstrad etc. All a a special snip price of £27.50 including post and VAT. Data available separately £2, refundable if you purchase the drive

## TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw, 2kw, 2.5kw and 3kw. Prices are £5 each for the first 3, and £6.95 for the 3k. Add post £1 50 per heater if not collecting. CONTROL SWITCH enabling full heat, half heat or cold blow, with connection diagram, 50p for 2kw, 75p for 3kw.

## AXIAL FANS

mains operated, famous West German PAPST company, all metal construction for reliability even running hot. Size approx 4 1/2 x 4 1/2 x 1 1/2 especially recommended for sun beds, but they are quiet running so suitable for office, kitchen, bathroom etc. Brand new offered at about half proper price namely £3. Our ref 8P6. Good stocks, discount for quantities over 12.

## SPEAKER EXTENSION CABLE

Twin .7mm conductors so you can have long runs with min sound loss and for telephone extensions or burglar alarms, bells, intercoms etc. etc. 250m coil only £3 + £1 post. Ref 3P28.



## VENNER TIME SWITCH

Mains operated with 20 amp switch. One on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95 without case, metal case - £2.95. adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/off per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30.

Ex-Electricity Board. Guaranteed 12 months.

## 12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3 1/2" long by 3" dia. They have a good length of 1/4" spindle - 1/10 hp £3.45 1.8 hp £5.75. 1.6 hp £7.50



## SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by 1/4" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form.

## THIS MONTHS SNIP

9" VDU OR MONITOR ideal to work with computer or video camera uses Philips black and white tube ref M24/306w. VDU is brand new and has a time bases and EHT circuitry. Requires only a 16v dc supply to set it going. Its made up in a laguered metal frame work but has open sides so should be easid. The VDU comes complete with circuit diagram and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only £16 plus £5 post.

LOW VOLTAGE RELAY OMRON 3.5v coil, plug in di sockets. 5a c/o contacts. Brand new offered at a silly price 2 for £1 ref 8D548

POLARISED RELAY depending upon its direction dc current as low 4 ma makes this open circuit, so it could be used to protect delicate instruments or as an earth leakage, or reverse voltage Inp etc 2 for £1 ref 8D549

24Hr TIME SWITCH. Beautifully made with West German precision. Just under 4" square with 15 amp c/o contacts can be set anywhere around 24 hr dial to the nearest 15 mins also with an override switch. Ref 8P6 but hurry we have only 300

## COMPUTERS

The Acorn "Electron" is used in many schools for games and serious jobs. Works into colour or Black and White TV. Proper price is £199, our price, tested and working £45 + £3 post, tested but slightly faulty £36 + £3 post and lastly tested but not working £20 + £3 post. Full range of Software also in stock at very low prices.

## POCKET MULTITESTER

4K ohms per volt - 11 ranges AC/DC Volts to 1000 - DC current and ohms - nicely packaged - offered 33 1/3 discount only £7. Our ref 7P2

## TELEPHONE LEAD

3 mtrs long terminating one end with new BT. flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref 8D552 or 3 for £2 ref 2P164

## POWERFUL IONISER KIT

Generates approx. 10 times more IONS than the ET1 and similar circuits. Will refresh your home, office, shop, work room, etc. Makes you feel better and work harder - a complete mains operated kit, case included. £11.50 + £2.00 P&P.

## J & N BULL ELECTRICAL

DEPT. TV., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT  
 MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders (min £20) accepted from schools and public companies. Access & Bcard orders accepted. Brighton 0273 734648. Bulk orders: write for quote.

## NEW ITEMS

Some of the many described in our current list which you will receive with your parcel.

## £2 POUNDERS

- 2P120 - 1 combined clockwork switch and thermostat for boiler control
- 2P122 - 1 30a relay switch, surface mounting with pointer knob.
- 2P123 - 1 25a relay switch, surface mounting, cover engraved, high, rsmidrum, low and off
- 2P124 - 1 28kv .001mfd black condenser.
- 2P127 - 1 30a bridge rectifier assembly on heat sinks
- 2P129 - 1 10rpm motor 115v so supplied with adaptor for 230v.
- 2P131 - 1 Crozet motor 230v fits the Crozet gearbox
- 2P132 - 1 cooling heat-sink for fire warning or protection.
- 2P133 - 1 Circuit breaker 20a, Crabtree ref C50
- 2P134 - 1 9v 500mA psu, plugs into 13a socket
- 2P135 - 10m 10 conductor intercom cable.
- 2P136 - 1 2 1/2kw element made for tangential blowers.
- 2P137 - 1 Thermo couple, stainless steel tipped for measuring internal heat.
- 2P138 - 1 Mains transformer 20v-0-20v 1A upright mounting.
- 2P141 - 1 rechargeable battery D size (4 AH) solder lag ended.
- 2P142 - 1 3m 4 par intercom cable white PVC outer.
- 2P144 - 1 mains operated relay with 4 x 8a c/o contacts.
- 2P145 - 1 10,000 of 70v dc smoothing capacitor.
- 2P146 - 1 7,800 of 150v dc smoothing capacitor.
- 2P147 - 1 10w 100 ohm line matching transformer.
- 2P148 - 1 Technical information on 3" FDD refundable if you buy Idd
- 2P149 - 5 off battery operated model motors.
- 2P150 - 1 PSU chassis with all components for 24v 2A dc unwired.
- 2P151 - 1 Metal box 14 1/2 x 14 x 4 with lid add £2.00 post.
- 2P152 - 1 Motor start capacitor 80uf 250v
- 2P153 - 1 Two station intercom unused but line reject.
- 2P154a - 1 Nicad charger - plug into 13a socket 5.2v .7UA output
- 2P154b - 1 Nicad charger - plug into 13a socket 6v 9VA output
- 2P155 - 1 Mains transformer giving 16, 17, 18 & 20v 60w
- 2P158 - 1 Oven thermostat with temp. calibrated knob.
- 2P159 - 1 9v 500ma caps with mains lead and output lead
- 2P160 - 1 13a plug adaptor fused takes 3 x 13a plugs.
- 2P161 - 6" diagonal slide cutters.
- 2P162 - 1 Gersmo Matrix PCB mounting de-emphasis K35
- 2P163 - 1 AC Working capacitor 12uf 660v AC or 1500v dc.
- 2P163a - 1 AC Working capacitor 14uf 350v AC or 800v dc.
- 2P164 - 3 Phone leads 3 mtrs long takes one end BT plug other end.

## £3 POUNDERS

- 3P7 - 1 DC voltage, doubler or halver for 12v to 24v. 12 to 6v. 24 to 12v.
- 3P8 - 1 24hr time switch Sangamo, new condition, guaranteed 1 year
- 3P9 - 1 12v 500mA psu plugs in 13a socket
- 3P10 - 1 Mains transformer 50v 2A with 6.3 pilot light winding, upright mounting, fully shrouded.
- 3P13 - 1 Nose filler to fit in mains lead of appliance up to 25a
- 3P15 - 1 waterproof case will take 200 watt transformer
- 3P16 - 1 signal box, 3 lamps on face plate of metal box size 5 1/2 x 3 1/2
- 3P17 - 1 choke and starter to work 8" fluorescent tube at 125w.
- 3P18 - 1 22v 3a mains transformer with bridge rect fitted on top panel.
- 3P20 - 1 0-5a ammeter 3/2" a/c/dc ex equipment
- 3P21 - 1 power factor correction condenser 35uf 350vac
- 3P22 - 1 2200va - auto transformer 230 to 115v loroidal encapsulated £1.50 post.
- 3P23 - 1 36v-0-36v lapped 20v-0-20v 100va
- 3P24 - 1 3" floppy disc for Amstrad etc.
- 3P25 - 1 7" Electronics pliers

## £4 POUNDERS

- 4P11 - 1 Car Radio aerial.
- 4P12 - 50m low loss co-ax 75 ohm + £1 post.
- 4P13 - 3 Hertsman time and set switches 15 amp.
- 4P14 - 1 150w mains transformer "C" core 43v 3.5A secondary.
- 4P15 - 1 powerful motor 2" stack fitted with gearbox final speed 60 rpm, mains operated, could operate door opener etc
- 4P17 - 1 Uniselector 3 pole 25w, 50v coil standard size.
- 4P18 - 1 Volt meter with digital display (DIGIVISOR).
- 4P19 - 1 12v dc motor will fit to gearbox 4P20.
- 4P20 - 1 Gear train giving speed reduction.

## £5 POUNDERS

- 5P86 - 1 Transformer upright mounting 230/240v primary 2 x 100 1A secondary.
- 5P88 - 1 transformer in waterproof metal box 24v 5a add £2 post.
- 5P89 - 1 4 bank heating element each 2kw ideal convector heater
- 5P90 - 1 18" long tangential blower with motor at one end.
- 5P91 - 1 14" blower, motor in middle.
- 5P92 - 10m Audio co-ax double screened 75ohm super low loss for TV.
- 5P93 - 1 6" alarm bell 24v dc or ac
- 5P94 - 1 Current transformer 14v out with 1a dc input.
- 5P95 - 1 Vintage photo cell.
- 5P97 - 1 Impedance matching transformer 0-4-8-160 ohm 100 add £1.50 post.
- 5P98a - 1 0-30a ammeter for mounting outside control panel
- 5P98b - 1 0-180a ammeter for mounting outside control panel
- 5P99 - 1 Mains operated blower centralrugal output size app 5" x 1 1/2".
- 5P100 - 1 Mains splitter 45a switch 3 x 15a fused circuits
- 5P101 - 1 Model motor 1 rpm from 6v reversible

## £7 POUNDERS

- 7P1 - 1 Instant heat solder gun - mains with renewable tip and job light.

## £8 POUNDERS

- 8P1 - 1 Charger transformer 10a upright mounting 230/240 primary 16v 10a secondary.
- 8P2 - 1 6" underdome alarmbell suitable for a fire alarm or burglar alarm mains operated.
- 8P3 - 1 heat sink big powerful so ideal for power transmitter
- 8P5 - 1 1/3 hp motor 900 rpm capacitor run
- 8P6 - 1 24hr time switch - 2 on offs 16a c/o contacts 3" x 3" x 1 1/2".
- 8P7 - 1 Silent sentinel invisible ray kit.
- 8P8 - 1 Papst fan 3/2" x 3/2" x 1 1/2" 230v metal bodied.

## £10 POUNDERS

- 10P13 - 1 reversible motor with gearbox 104rpm Parvalux
- 10P14 - 1 100a time switch 1 on/off per 24hr extra triggers £1 pair.
- 10P15 - 1 Max demand meter 230 AC mains.
- 10P16 - 1 powerful air mover 2 small type blowers with motor in middle.
- 10P18 - 1 mains operated klaxon.
- 10P19 - 1 12v alarm bell really loud, mains operated, in iron case + £5 post.
- 10P22 - 1 sensitive volt meter relay.
- 10P23 - 1 fruit machine heart 3 fruit wheels each stopper motor operated.
- 10P24 - 1 big panel meter face size 4 3/4 x 2 1/2 200ua movement scaled 1-10.
- 10P26 - 1 1" square photo auto-dialler complete untested sold as such.
- 10P29 - 1 12v engine cooling fan.
- 10P30 - 1 instrument psu on pcb has 4 outputs .12v/ .5v 6v 12v .5v 5v .5a
- 10P31 - 1 7 day time switch 16a c/o contacts set switches for each day.
- 10P32 - 1 68 rpm 1/8th hp motor reversible

## £15 POUNDERS

- 15P1 - 1 kit for 115v hi 5 amp.
- 15P2 - 1 kit for psu to supply one or two 15P1 amps.
- 15P3 - 1 time switch battery or mains operated - 16a c/o contacts.7 day programmable has 36hr reserve.

LIGHT CHASER KIT Motor driven switch bank with connection diagram, used in conjunction with 4 sets of X-mas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

1987 CATALOGUE available - range of components greatly increased - over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Credit Tickets (3), Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now.

## NOVEMBER SPECIAL

FREE STANDING OR HANGING 15L OF CABLE TERMINATING IN CIGAR LIGHTER PLUG. IDEAL FOR CAR, BOAT, CARAVAN, VAN ETC.

POWER: 12V DC. DIMENSIONS: 430x300mm



ONLY £4.99

### 12 VOLT RECHARGEABLE UNIT

10 x D Size Ni-Cads (4 Ah) encapsulated in a black plastic case. Fuse holder. Gives 12 volt output when charged. Ex-equipment fully recharged dimensions: 245 x 75 x 75mm

£6.99 P&P £1.85 + VAT  
£5.25 each for 10



### CHARGING UNIT FOR THE ABOVE 12V UNIT

Manufactured by SAIT, these chargers are suitable for the above battery packs (as advertised in the May issue of 'WHAT VIDEO' - Page 6). The chargers are stated as we have modified them to a standard charger. Full charge of the packs is obtained after 10-12 hours (overnight) charging. Supplied complete with main lead and charging lead fitted with a 4 pin plug (6 pin plug version available upon request). For easy viewing, the charger has an expansion pack, these chargers are fully tested and guaranteed. Dimensions 335 x 260 x 150 mm



4-PIN £16 + £1.85 P&P + 15% VAT

### BATTERY CHARGER (Universal Nickel Cadmium)

An attractive nickel cadmium battery charger ideal for charging the rechargeable batteries detailed below. The charger will charge all the sizes listed AAA, AA, C, D and PP3 and up to four AA, AA, C and D types and one PP3 can be charged at the same time. The charger has a hinged plastic dust cover for easy viewing. The battery positions have L.E.D. charge indicators. The unit also has a switch allowing batteries to be charged for current state of charge

Power: 240V AC  
Dimensions: 210 x 100 x 50 mm

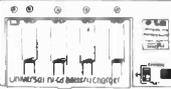
ORDER CODE

BAT CHARGE

1+ £4.50

10+ £4.25

100+ £3.75



### NI-CAD BATTERIES

AAA	£1.25	£1.20 ea/10
AA	£2.00	£1.85 ea/10
C	2.10	1.90 ea/10
D	2.50	2.20 ea/10
PP3	4.10	3.90 ea/10

### SOLDERING: 60% TIN 40% ALLOY

22g Non-corrosive Multi-core  
Solder 500g Reel £100/10  
Full range FUSE HOLDERS.

### SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (Islaite which)	10.90
Supra Freeze-It	7.50
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20
CS17 Iron Kit	1.10
C15 Iron Kit	8.30
XS25 W Iron kit/complete with steel & plug attached	11.00
CS 18W as above	5.40
Antex 18W iron	7.50
Antex 25W iron	8.20
Antex elements	3.20
Antex bits	1.15
Antex stands	2.20
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

### SERVICE AIDS

Goldtone Degreasing Solvent	1.75
Switch Cleaner	1.15
Supra Freeze-It	1.38
Foam Cleanser	1.18
Video/Tape Head Cleaner 1.0	1.25
Plastic Seal	1.35
Aero Klene	1.10
Anti-Static Spray elist	1.20
Excel Polish	1.19
Aero Duster	1.49
Super Fire	1.88
Rapid Fx Extinguisher	3.30
Silicone Grease Tube	1.80
Silicone Grease Spray	1.38
Lead Sink Compound	1.18
Solder Mop	0.78
Light gauge 0.08mm	0.78
Standatd gauge/1.2mm	0.76
Industrial reel 1.2mm	2.96

### TEST PRODS (FUDED)

Man. by Bulgin. High strength plastic inc. 1A 1 1/4" fuse. Length of prods - red & black - 144mm.  
£1.50 per pair + VAT & p&p  
RYX PORTASOL I&P  
Powered by lighter fuel  
£14.50



### SPARE TIPS

1.0mm/2.4mm/3.2mm/4.8mm £4.00

### RESISTORS - CARBON FILM 5%

1/4W 10R to 10M (E12 Range)	2p each. 15p/10. 75p/100
1/2W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	5p each. 40p/10. 3.00/100
2W 10R to 2M2 (E12 Range)	8p each. 60p/10. 5.00/100

### RESISTOR KITS - each value individually packed

1/4W pack 10 each value E12 - 10R to 1M 610 pieces	4.50
1/4W pack 5 each value E12 - 10R to 1M 305 pieces	2.95
1/4W pack Popular - 10R to 10M 1000 pieces	6.50
1/2W pack 10 each value E12 - 2R2 to 2M2 720 pieces	7.75
1/2W pack 5 each value E12 - 2R2 to 2M2 365 pieces	4.70
1/2W pack Popular - 2R2 to 10M 1000 pieces	9.50
1W pack 5 each value E12 - 2R2 to 1M 353 pieces	13.75
2W pack 5 each value E6 - 10R to 2M2 317 pieces	21.75

### ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.50
ZENER DIODES 5ea	56 pieces	£3.50
ELECTROLYTICS R	100 pieces	£7.25
FUSES 0/BLW 20mm	80 pieces	£3.75
FUSES 10K/LAY 20mm	80 pieces	£7.50
PRE-SET POTS-H	120 pieces	£6.75
PRE-SET POTS-V	120 pieces	£6.74
NUT & BOLT	800 pieces	£3.00

### EXTENSION MULTI SOCKETS

ALL 13A. FUSED WITH NEON INDICATOR	
2-WAY	£2.75 each £2.50ea/5
3-WAY	£3.90 each £3.50ea/5
4-WAY	£5.99 each £3.75ea/5
FUSES 13A. 3 pin fused, white	£0.46 each £0.42ea/10

### FUSES 20mm

QUICK BLOW - 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 8	90p/10
TIME DELAY - 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10	90p/10

### 1 DOMESTIC MAINS FUSES 1 1/4 QUICK BLOW

ALL 13A. FUSED WITH NEON INDICATOR	
1A, 1.25A, 1.5A, 1.6A, 2A, 2.5A, 3.15A, 4A, 5A, 6.3A	£1.00/10
2A, 3A, 5A, 13A	50p/10

### MULTISECTION ELECTROLYTICS

THORN 1500	100 x 300 + 100 + 16300V	5.50
1500	150 x 150 + 100/300V	2.40
3000	100/630V	0.90
3500	175/400V + 100 + 100/350V	3.00
8000	400/350V	2.65
8000/6500	250 + 250/63V	2.05
8000	700/250V	2.50
100070V		0.90
9000	400/400V	3.50
GEC 47022V		1.75
DECCA 10/30	400 + 400/350V	3.75
1700	200 + 200 + 400/350V	4.90
GEC 2047	2048 2083 2084 2104	2.90
	200 + 200 + 150 + 50/300V	2.90
	600/250V	2.40
ITT&B	200 + 200 + 75 + 25/350V	3.00
	220/400V 3 tag	2.10
PHILIPS G8	600/300V 2 tag	2.50
G8 G9	600/250V	2.40
G11	470/250V	3.10
G9	220/63V	1.35
EKCO 891	200 + 300/250V	4.50
Series	600/300V	3.50
RANK	300 + 300/300V	3.75
AB23	2500 + 2500/30V	1.65
	600/300V	2.20
	600/300V	3.10

### REPLACEMENT TV MAINS DROPPERS

Decca 5R+167+100+90+2K5	1.75
ECG 2018 1R+18R+14R+14R+14R+18R	1.15
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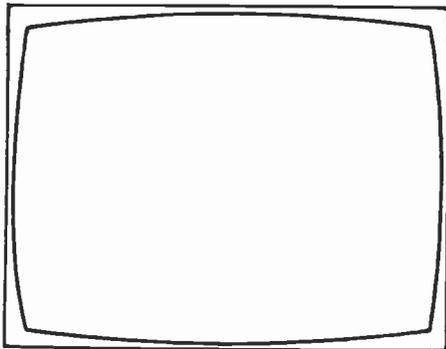
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# TELEVISION

## A Time of Change

The government has declared its intention to increase competition in the provision of TV and communications services, and developments in the technologies involved are continually increasing the scope for this. Increased "competition, variety and innovation" was indeed a commitment made in the Conservative Party's manifesto at the last general election, and the government seems to be keen to get on with it. On September 21st a seminar, at which presentations on various aspects of broadcasting policy were made, was held at 10 Downing Street. A White Paper on the future of TV broadcasting is due in the New Year - Mrs. Thatcher herself chairs the Cabinet subcommittee working on the White Paper. And a full-scale Broadcasting Bill is promised for next autumn. In a sense the programme is being forced by events, in particular the increasing availability of satellite TV transmissions. While the current low-power satellite TV services, intended primarily as cable network links, have met with little public interest, the coming of Astra next year could prove to be another matter altogether. Astra is a medium-power satellite with a 16-channel capability. Its transmissions should be receivable by the general public using fairly simple equipment - a 60cm dish etc. The footprint will cover a large area of W. Europe. How successful it will be will depend to some extent on marketing. In this connection Dixons' recent announcement that it expects to sell some half a million receiving installations at around £300 a time during Astra's first year in operation is significant. If the Dixons and Currys high street outlets are blazing the message to the public, the public will certainly take notice. At £300 a time the cost will be readily affordable - the public has proved time and again that it has this sort of money to spend on consumer electronic products. What we don't yet know is what channels will be carried and who will provide them.

The dilemma for the government is that while it has expressed its keenness for deregulation and the increased availability of competing services it is at the same time concerned about what appears on the nation's TV screens. There is of course little that the government could do about material that originates from outside the UK, though it may hope to be able to exercise some control over those who provide the programmes and backing. What seems to be of more immediate government interest however is policy on the current and forthcoming UK based services. It's understood that the Broadcasting Bill will deal with increased competition in the provision of ITV services, a change in the status of Channel 4, funding for the BBC, increased use of independent programme makers, and the framework for regulating the expanding TV services.

The government does not seem to be too happy with the established TV broadcasting arrangements in the UK, despite the fact that they have served the public well. Mrs. Thatcher is on record as holding the view that television is "the last bastion of restrictive trade practices". So the aim will be to stir things up. One obvious course would be to make Channel 4 an independent company selling its own advertising space in competition with the ITV companies. This is something about which the latter are very concerned. An alternative would be the introduction of a Channel 5 service. This has been proposed by several organisations. The ITV companies seem to be happier with this idea, presumably because they would expect to be involved. The IBA and the ITV companies have set up a working party to consider the prospects for Channel 5. IBA engineers are understood to believe that there are sufficient spare frequencies in Bands IV/V to enable a fifth channel service covering 60-70 per cent of the population to be slotted in. This is a bit surprising when one considers the care that went into the original planning and engineering of the u.h.f. services, but technical progress continues apace.

While the prospects for Ch. 5 don't look too hot, there is plenty of other competition in the offing. The BSB's DBS service, with three/four channels, is just two years away now and will be facing competition from Astra as well as the existing terrestrial networks and cable services.

The cable operators have come up with a new proposal to help get their services going. It has the approval of the Cable Authority which has decided to approach the government. The idea would be to use microwave transmissions to provide an initial service while a cable network is being laid. The technique, known as MMDS, is described in an article on page 44. A cable network takes several years to install, at considerable cost - the current figure being quoted is £30m on average to reach 100,000 households. During the installation period the cable operator has maximum costs and minimum income. Providing his service via a microwave transmitter would change that. It's an interesting prospect from both the technical and policy points of view - would the "cable" companies continue to bother with laying cable if they could provide their services via microwave transmissions instead?

The next few years will bring considerable change. It will be interesting to see whether all these different approaches to providing TV services will prove to be viable and able to coexist. For us on the technical side it will bring new and interesting equipment and installation problems.

## DISTRIBUTION DIFFICULTIES

Our apologies to readers who had difficulty in obtaining their copy of *Television* last month. The distribution arrangements for the magazine have been altered and this caused problems. We hope they will have been resolved by the time the present issue is distributed. There were also problems with the despatch of subscription copies last month, this time due to a temporary change in the despatch arrangements.

### EDITOR

John A. Reddihough

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### COVER PHOTO

Our cover photograph this month shows the servo/motor drive amplifier panel used in the JVC HRC3 VHS-C video recorder unit. An article on servo systems appears on page 30.

### CORRECTION

Our apologies for quoting the wrong part number for the Sony Audio Fault-Finding Guide in the review published in our September issue. The correct part number is S-79600001 (not S-76900001). Note that the price quoted was the trade price. Readers buying copies through a dealer/distributor may find that a handling charge is added.

# Fuses and Protective Devices

Eugene Trundle

The humble fuse has been part of the electrical and electronic scene from the beginning. When I started in the TV trade a fuse meant a 1½in. glass type with a pretty colour code. The advent of electronic trip circuits has driven the fuse from many of the places it once occupied, but a "blown fuse" is still a very common symptom today. Nowadays the 1¼ × ¼in. type is virtually obsolete. It has been replaced by the ubiquitous 20 × 5mm and various smaller types, all to be described below. A working knowledge of fuse types and characteristics is useful when servicing equipment and when building protection into home-brewed gear, whether it operates with batteries or from the mains supply.

Conventional fuses are available with current ratings of 32mA upwards and come in many different forms. In this article we'll concentrate on those relevant to consumer TV and video equipment, and also look at the "fusible" protection devices employed.

## Fuse Characteristics

The ideal fuse would withstand its rated current forever, regardless of environmental conditions, then blow instantaneously when its specified fusing current was reached. This cannot be achieved in practice! Practical fuses have well-defined characteristics, but before describing them we must define some of the terms used. The main ones are as follows.

**Rated current:** This is the one printed on the fuse. It can be carried continuously without degradation. To blow the fuse a much higher current must be passed for a period depending on the "time" rating of the fuse. This **minimum fusing current** is typically fifty to a hundred per cent more than the rated current.

**Rated voltage:** This is relevant only when the fuse blows and the available voltage is present across the severed link. It defines the highest safe voltage in the circuit of which the fuse forms a part.

**Breaking capacity:** This is the highest (short-circuit) current the fuse can safely interrupt. Glass fuses generally have a 35-50A capability (LBC type) while HBC/HRC types, which have a sand-filled ceramic body, can break a current of 1,500A or more. The effect produced by excessive breaking current is cracking or explosion of the body of the fuse. This is often seen with a mains fuse inside a TV set when a current well in excess of 50A has flown momentarily as a result of a shorted mains filter capacitor or rectifier. All delay (T) fuses are LBC types.

**Fusing current:** The lowest sustained current that will blow the fuse. When the fuse element melts, the current is maintained through an arc between the severed ends. The nature and duration of this arc depend on the construction of the fuse and the applied voltage and current. The current ceases only when the arc is extinguished. Control of this arc is an important factor in fuse operation: some types of fuse are sand filled to constrict and quickly extinguish the arc. In general, a fuse works better with

a.c. than with d.c. The r.m.s. current is the governing one in a.c. and pulse circuits.

## Fast Fuses

There are two types of quick-rated fuses, very fast (FF) and fast (F). These are the only types that have any chance of protecting semiconductor devices. FF types are designed to blow on relatively small overloads: F types have greater tolerance in this respect. In both cases the element is made of a pure drawn metal, typically silver, giving quick reaction to both sustained overloads and short-duration surges. A fast fuse can blow within 80msec at 300 per cent of the rated current and within 10msec on a ten times overload. The reaction times of fast fuses are shown at the bottom in Fig. 1.

Fast fuses have the highest resistance of all types and hence the greatest voltage drop in operation. HBC types rated at 500mA will drop as much as 1V at the rated current, and around 9V in the 50mA size. A fast LBC glass fuse rated at (and passing) 32mA will also develop around 9V. Since the fusing current is in both cases typically twice the rated current the implication is that no less than 18V must be applied to the fuse to blow it reliably! Though these are extreme examples, they do show that thought is required when dealing with fuses in low-voltage, low-current equipment.

Delay fuses of all types have a lower resistance and thus develop smaller voltage drops.

## Delay Fuses

Delay (anti-surge) fuses are used where inrush or transient current demands are expected to exceed the normal steady-state current significantly. There are three general categories of slow-acting fuses, the M, T and TT types. M (semi-delay) fuses blow fairly rapidly with a moderate overload but can tolerate limited transient current surges. T fuses are the most common anti-surge ones encountered in consumer equipment: they can withstand considerable short-duration current overloads yet blow rapidly when there's a sustained excess current. TT (long-lag) fuses have greater thermal capacity and will carry high transient overloads. Their long "sampling time" is indicated by a characteristic 4sec delay at 300 per cent of the rated current. The delay characteristics of these types of fuses are shown in the upper part of Fig. 1.

The original form of anti-surge fuse construction, which is still widely used, employs a helical spring element that's held in tension by a low melting point (i.e. tin) anchor – see Fig. 2. Only on a sustained overload does the anchor melt, releasing the spring. Under short-circuit conditions the anchor wire ruptures like a conventional fuse. This "dual-element" type of fuse is resistant to the metal fatigue effect that can affect other types of fuses during transients. It's used in both T and TT type fuses, being the slowest acting.

More recently the "solder-blob" type of T fuse has come into common use – see Fig. 3. Here a bead of solder bridges the ends of two link wires, melting when it heats sufficiently. It has a lower overload capacity than the

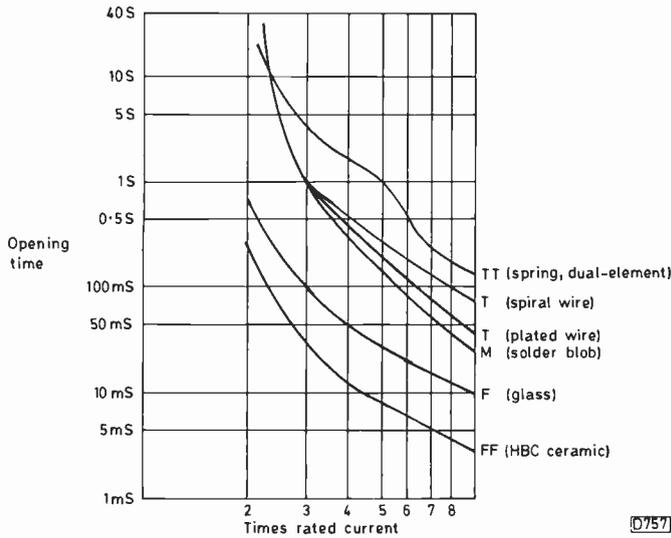


Fig. 1: Characteristic curves showing the operating times of different types of fuses. Note that there's a considerable tolerance in fuse performance.

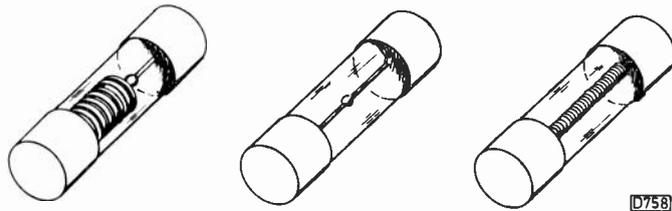


Fig. 2 (left): Dual-element delay fuse construction. Easily recognised by the helical tension spring.

Fig. 3 (centre): "Solder-blob" type delay fuse.

Fig. 4 (right): Spiral element delay fuse – the element's construction is not always as "coarse" and obvious as shown here.

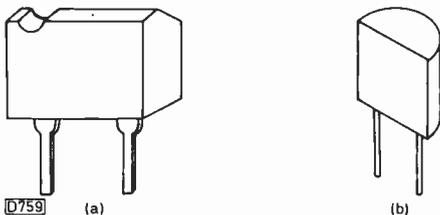


Fig. 5: ICP packages. (a) ICP-F type. (b) ICP-N type.

spring type and is used in both M and T fuses. It tends to suffer from metal fatigue when regularly subjected to heavy switch-on surges. This form of construction has a very low internal resistance, but doesn't lend itself to applications where the rated current is below about 600mA.

An alternative form of T fuse is the spiral-element type shown in Fig. 4. In this a fibreglass "rope" supports the spiral-wound element, giving increased heat generation along the length of the element. This type of fuse has a high positive temperature coefficient for self-generated heat, so spiral wound fuses rated at 1A or less are not recommended for use in circuits where the voltage is less than 5V – the fuse can absorb, without opening, all the available energy. These fuses have the widest rated current range of all anti-surge types, being available in preferred values from 32mA to 6.3A.

Falling between the spiral and blob types in the T range is the less common plated-wire fuse. The element in this type of fuse breaks on overload by a diffusion process known as M effect. Like the blob type it's available with

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only relatively high current ratings. Due to its low resistance the voltage drop is very low.

### Small Fuses

As equipment gets smaller so fuses shrink in size. The most intriguing way of putting this I came across was in some literature from a US fuse-maker who stated that its miniature types are designed for application "where real estate usage is of critical concern"! Various miniature types of fuses are available, but the ones most often encountered in video and TV equipment are the ICP (integrated circuit protector) series. The two types, ICP-F and ICP-N, shown in Fig. 5 (a) and (b) respectively, look like transistors with two legs, but in spite of their packaging and appearance they are not semiconductor devices, nor are they polarised. The figure following the type letters must be multiplied by 40 to arrive at the rated current in milliamps. Thus an ICP-N10 is a 400mA and an ICP-F25 a 1A type. F and N types with the same suffix numbers are identical electrically, differing only in their encapsulation. So if you are stocking up with these mini-fuses, bear in mind that an N type will, at a pinch, fit a board punched for an F type fuse but not vice versa.

Both the F and N types are fast acting, in keeping with their intended role of semiconductor device protection, particularly LSI chips. They blow in about 200msec at 300 per cent of the rated current. For a fast fuse the internal resistance is low – the 1A type produces a drop of only 70mV at the rated current. This means that the element is very small, hence the low rated voltage of 50V to 150V, adequate for use in low-energy semiconductor circuits. These fuses are commonly available with ratings from

250mA to 2-7A. For a fuse, they are mighty expensive!

The next stage in miniaturisation is the surface-mounted chip fuse. Those that have emerged to date have similar electrical characteristics to the ICP types.

### Temperature Fuses

The temperature fuse is less common than the current fuse. Its element is made of a low melting point metal or alloy that melts and opens the circuit when the device's temperature exceeds its rating. Although both current and temperature ratings are quoted, the current is a limiting factor beyond which the device cannot carry out its primary thermal function. These fuses don't operate on internally generated heat. They are kept in thermal contact with the device requiring protection – glued to a transistor body, suspended above a heatsink or buried in a transformer. They are commonly available in ratings from 72°C to 230°C and come in various shapes and sizes. You may encounter them in 4 × 12mm "bullet" form, encapsulated in a transparent envelope for posting in a mains transformer, or in a 5mm black plastic moulding riding piggy-back on a power transistor. These fuses are not resettable and must be replaced when they have failed.

### Fusible Resistors

The use of fusible resistors is an increasing trend in TV sets – more so than in VCRs. Most have values below 10Ω, and they sometimes perform a resistive function, i.e. as a surge limiter or load resistor, in addition to their protective role. Although they look like conventional resistors, and are colour coded in the same way, they are purpose designed and cannot safely be replaced with an ordinary resistor even when this is of the same wattage and material.

Most fusible resistors are metal-film types. The film is deposited on a ceramic rod then adjusted to the required value by means of a helical cut. The fastest-operating types have a large positive temperature coefficient, leading to a thermal avalanche effect during overload: a ½W type will open in six seconds at 2W dissipation and much faster at higher dissipation levels. Slower metal-film and slower still carbon-film fusible resistors are available. All are made in a way that prevents burning or the emission of incandescent particles when fusing.

Although the characteristics of fusible resistors are studied very closely by the setmaker at the design stage, the type used in any specific position is not quoted in detail in service manuals. For this reason it's not practical to stock a "general-purpose" range of safety resistors: they have to be ordered from the setmaker, quoting a specific part number, if the safety and reliability of the equipment is to be maintained.

### Choice of Fuse

Choosing a fuse for the mains plug of a TV set, VCR or similar piece of equipment is always a matter of compromise between safety and nuisance-blowing because of the inrush current taken by the inductive and capacitive components in the power supply at switch on. Generally a 3A type is right, though the harder to get 5A rating may be necessary with some of the older TV sets.

When fuses are specified for newly designed or constructed equipment the general rules are as follows:

(1) Choose a current rating around 125 per cent of the

circuit's full-load consumption.

(2) Use an HRC type where the prospective fault current is high, e.g. in mains or car-battery circuits.

(3) Use an FF type where the call is to protect a semiconductor device.

(4) Use the most appropriate type of delay fuse where inrush or transient current surges are expected.

### Servicing Aspects

When dealing with a blown fuse fault, beware of the voltage which may be held by reservoir and smoothing capacitors after switch off – such voltages often await you across the ends of a blown fuse!

Unexplained fuse failure is one of the most frustrating of faults. One possible cause is a faulty holder with high contact resistance. Where low-rated mains fuses are involved, problems with the mains filter capacitor or the mains supply system can be responsible – see Derek Snelling's article in the July 1985 issue, page 496. Medium-term fuse failure for no apparent reason can be caused by metal fatigue in the element – you can sometimes see the element in a TV set's mains fuse momentarily "kink" at switch on, due to expansion and contraction. Fitting a different type of delay fuse of the same rating can overcome this.

Much can be gleaned by carrying out an autopsy on a blown fuse. If the glass body is broken or cracked the fuse has probably passed more than 50A, which in a mains input context usually means that there's a short circuit mains filter capacitor or rectifier. If the glass tube is blackened and shot with metallic particles the fuse has blown violently, the current probably flowing via a surge-limiting resistor – a shorted rectifier, chopper transistor, crowbar device or whatever may have been responsible. A softly blown fuse on the other hand will have suffered from metal fatigue (replacement cures the problem) or a moderate overload. Bear in mind that ambient and self-generated heat will, in a warm or confined space, derate the fuse with the result that it blows prematurely.

Failure of a fusible resistor for legitimate reasons is usually obvious from inspection of the carcass – it will appear burnt or black pinholed. Of late we've had failure of fusible resistors for internal reasons, with either a "clean" pinhole visible or no external sign of trouble at all: in such cases replacing the resistor has permanently cured the trouble.

### Safety

The importance of fitting the correct type of fuse or fusible resistor cannot be over emphasised. Fire and shock hazards in consumer electronic equipment have been greatly reduced in recent times by good design, stringent safety regulations and the vigilance shown by the BEAB, the DTI and other inspecting bodies. All this effort is thrown away when a fuse is replaced by one of a different type or higher rating, or an ordinary resistor is fitted in place of a safety-fusible type. This may be done to save time and trouble, but the results can be horrendous, for example a house fire or electrocution of the user – for which the errant engineer or his company will be held directly responsible.

### Acknowledgements

My thanks to Beswick, Ferguson Ltd. and RS Components for the provision of information and data.

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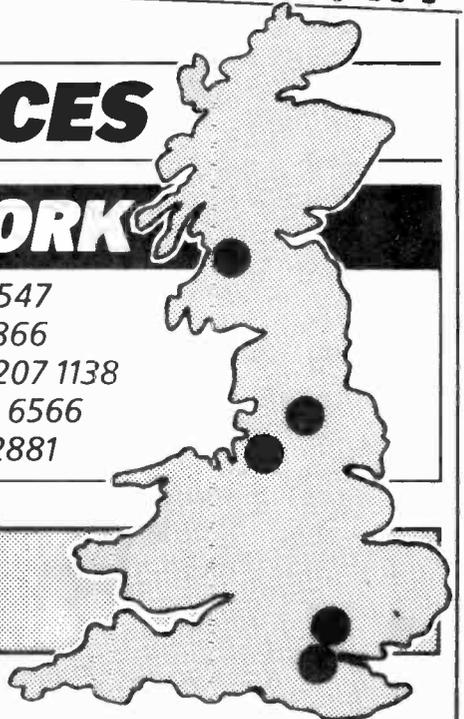
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# Transport for field servicing

**Harold B. Berkley**

Many changes have taken place in television and video servicing over the years, but we tend to cling to old habits and ideas. The pressure is now so great that we seldom have time to stop and think about our methods of working and to consider how they could best be kept in step with current requirements. One thing is certain: we must operate profitably in order to survive. A good starting point is to try to reduce overheads and avoid waste.

In this short article I'm going to consider transport for field servicing. The views expressed are based on my own personal experience. You may not agree with them, and might like to put forward other ideas. At the least I hope this article will lead you to take a cool look at your vehicle(s).

We should all be familiar with the changes that have occurred in our own field. But if you stop to think about it similar changes have taken place in the automobile industry. Yet if you look around you find that many companies are still using Escort estate cars. Now I don't dislike the Escort, but it's worth considering whether what was well suited to the purpose some years ago remains the best solution in today's fierce economic climate.

## Field servicing changes

Let's just summarise some of the main changes that have occurred in TV/video servicing. First, the improved reliability of TV sets in general means that the majority of repairs are carried out in customers' homes. Secondly there's been the move to the use of sets with smaller screen sizes – you hardly ever meet a 26in. set today and you seldom have to manhandle a massive console. Thirdly we have VCRs: an ever increasing percentage of our working day is devoted to video. This brings me to thefts from vehicles, something that's unfortunately on the increase – and VCRs are a prime target. Finally we find that we have to be able to provide service even in bad

weather conditions and where muddy farmland is involved.

## What do we need?

Taking these points into consideration, what's best suited to current needs? I would suggest the following:

- (1) A hatchback rather than an estate car.
- (2) Front wheel drive.
- (3) Four-wheel drive in rural areas.
- (4) A low sill for easy loading.
- (5) Good fuel economy.
- (6) Reliability and the concomitant low depreciation.
- (7) If possible, get a three-year warranty. Note that free servicing is sometimes available. A free courtesy car if needed is a great help.

Some of these latter points may be available from your local dealer by negotiation. Whatever special deal you obtain – *get it in writing!*

Let's consider the hatchback v. estate car question. All hatchbacks have fold-down rear seats and should be able to cope with most servicing requirements – most of the time the seats don't need to be down. One serious problem with an estate car is that it so obviously stands out as a service vehicle: your display of videos and TV sets is an invitation to the passing thief. The usual method adopted is to smash the windows and run. An unmarked hatchback with nothing of value visible is much safer.

## Recommendation

My own view is that the new type of car called a supermini is the answer to the problem. It will cope with most of our needs; is cheap to buy; the depreciation is low; fuel consumption is excellent; it's a very good town car (most of my work is in town), with convenient parking etc.; and is better from the security point of view.

In conclusion, I've deliberately not named any particular make of car. Many of the type recommended are available and new ones are appearing all the time. The main object of this exercise has been to draw attention to this aspect of servicing. Take a look at your own situation, in particular with a view to bringing down those nasty overheads.

---

## Obituary: McDonald Hobley

TV engineers who were active in the late forties and early fifties will feel an almost personal sense of loss at the recent passing of McDonald Hobley, who with his fellow announcers Mary Malcolm and Sylvia Peters was one of the most familiar of faces on television in the BBC-only days.

"Mac" Hobley, as he was generally known, was christened Denys Valentine Jack McDonald at his place of birth, the Falkland Islands, in 1917. He was educated in this country and in South America, and after leaving school started an acting career at the Theatre Royal, Brighton. Whilst appearing in rep at Bath and Cambridge he used the name Val Blanchard for a time. He joined the Royal Artillery at the start of World War Two, and was in the Far East for four years. After serving for some time under Mountbatten he became an announcer at the armed

forces radio station Radio Seac, based in Ceylon. He joined BBC television after demobilisation in 1946.

"Mac" Hobley was ideal for the kind of television (live of course) that was produced by the BBC in the pre-ITV years. In addition to his role as an announcer he was seen in a number of programmes, one of the best remembered being "Kaleidoscope". He was popular with women viewers – a contemporary cartoon depicted one of them on her knees, kissing the television screen showing his picture!

In 1956 "Mac" moved to ABC, then the London and Midlands weekends' contractor. By this time however television was becoming more aggressive and downbeat. Unfortunately his personality came to be considered out-of-date. "Mac" left ABC after three years and became a freelance on both television and radio. One of his memorable stints was as the long-suffering chairman of "Does the Team Think?", the anarchic show that had Tommy Trinder, Ted Ray and Jimmy Edwards in its cast.

"Mac" is survived by his wife Pauline. I'm sure that readers will wish to join us in sending her our sympathies.

C.E.M.

# Teletopics

## SATELLITE TV PROGRESS

The board of Eutelsat, the 26-member West European post/telecommunications (PTT) organisation that was set up to provide monopoly satellite communications services in W. Europe, has decided to agree to the SES Astra satellite TV venture on the basis that it will not have a significant adverse long-term effect on Eutelsat's operations – provided Astra sticks to the provision of TV channels. The board's decision has to be ratified by a policy-making body which will meet in mid-November. SES is a private, Luxembourg based company whose Astra satellite is due to be launched next year. The proposed agreement will remove a lot of legal uncertainty and enable SES to start negotiating with the PTTs for uplink services etc. While the present generation of Eutelsat birds operate with relatively low powers Astra is classed as a medium-power satellite – SES claims that 97 per cent of UK, German and French homes will be able to receive the Astra transmissions using 60cm dishes. Eutelsat is to launch a second generation of higher-power satellites in the early 1990s: a contract for the supply of the first one has been signed with General Dynamics Space Systems.

Dixons have announced that they expect to be able to sell receiving systems for the Astra transmissions at around £300, a considerable reduction on current TVRO equipment prices in the UK. The company envisages placing orders for half a million receivers during Astra's first year in operation.

British Satellite Broadcasting, whose three DBS channels are due to come into operation in 1989, has been filling senior positions. However SuperChannel, which is owned by several ITV companies and provides a service via the Eutelsat ECS-F1 satellite at 13°E, has had to reduce costs and has made a quarter of its staff redundant. Sky Channel, which is 85 per cent owned by Rupert Murdoch's News International and also uses ECS-F1, has made a loss of some £44m during the six years it has been providing a service. It seems that the policy of relying on advertising to generate the income for providing English-language programmes to a transnational audience via low-power satellites, with the majority of viewers taking the services via cable networks, has not been a success. SuperChannel is to introduce German- and Dutch-language programmes with English subtitles during peak evening viewing periods.

## BUSINESS CHANGES

Ferguson, now part of the Thomson group, is taking over UK distribution of NordMende consumer electronic products. Since 1985 the sole agency in the UK has been handled by Hayden Laboratories of Gerrards Cross, Bucks. During this time the brand has gained a strong foothold in the premium section of the market, with sales primarily through independent dealers.

Nokia, Finland's largest industrial group and parent company of Salora and Luxor, has bought from Electrolux the French Oceanic consumer electronic products company. The deal will make Nokia the third largest TV manufacturer in Europe after Philips and Thomson. Oceanic at present produces around 200,000 sets a year.

Thorn EMI is expanding its rental interests in Europe

and the USA. Five continental rental companies operating in Denmark, France, Spain, Italy and Switzerland have been bought from the Granada group for £64m. In the USA, Thorn EMI plans to open 170 new Rent-A-Center outlets during the coming year – the aim is to double the number of US shops to 1,000 by 1990. Branches in Canada are to be opened shortly.

## SPECIALIST VIDEO SERVICE CENTRE

Steve Beeching has opened a specialised video servicing centre that will concentrate on cameras and camcorders. A great deal of sophisticated equipment has been installed, including a vectorscope, full broadcast standard pattern generator, scopes and various items specially designed to speed fault finding and setting up. Steve's Newark Video Centre Ltd. has been appointed an Authorised Service Centre by JVC (UK) Ltd. and is fully supported by Grundig International. Enquiries from individuals or dealers should be sent to Newark Video Centre Ltd., Grove Farm, Long Lane, Barnby-in-the-Willows, Newark, Notts – telephone 063 684 327. No technical queries please – and items that have been got at will be refused!

## STEREO RETROFITTABLE SETS

ITT's latest range of TV sets has been designed so that a NICAM-728 standard stereo sound decoder can be added retrospectively by dealers. The Nicam system is to be used by the BBC and IBA when stereo sound is added to their networks.

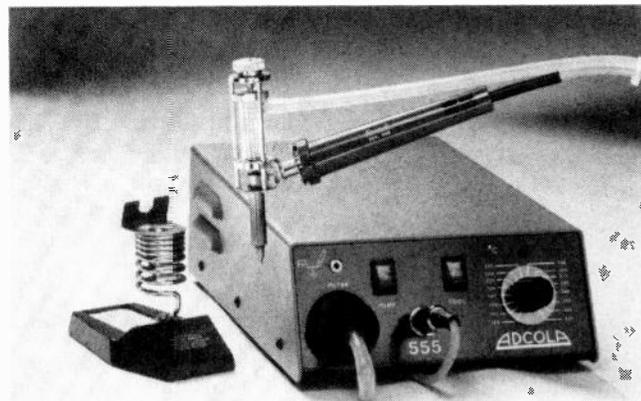
## SERVICING/SPARES

Servicing and spares enquiries on Morphy Richards and Sonatel consumer electronic products should be sent to Morphy Richards Technical Services Ltd., 99 Walton Road, Isleworth, Middx TW7 6EG, telephone 01 560 1994. The address given in our TV/VCR Spares Guide (April issue) is for Head Office.

The provision of spares/servicing and the distribution of ITT consumer electronic products in the UK is to be subcontracted out. The Head Office will remain at Basildon and will concentrate on sales and marketing. Further information on the new arrangements will be provided as soon as they have been finalised.

Note a new brand name, Proline, which is being used by Comet Radiovision Services Ltd.

The latest Wizard Distributors' catalogue of TV/video spares is available free to dealers who send a large s.a.e. The range has been increased and the layout altered to ease identification and speed delivery. Wizard Distributors' address is Empress Street Works, Empress Street,



The Adcola 555 desoldering station.

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Adcola's 555 desoldering station is claimed to give trouble-free desoldering without continual tip blockages. This has been achieved by the use of a heating element that gives the tip uniform temperature throughout its length and a diaphragm pump that operates a stored vacuum system. The 555 is portable, requiring only a 5A, 240V 50Hz supply – 110V and 220V versions are also available. Recommended selling price is around £360 per unit. For further details ask for the Adcola desoldering booklet which is available from Adcola Products Ltd., Adcola House, Gauden Road, London SW4 6LH – telephone 01 622 0291.

### TV COMPONENTS

A number of new items have been introduced by Mullard/Philips. The type 2322 662 96009 dual-PTC degaussing thermistor is encapsulated in a rectangular housing that enables the type number and production code to be clearly printed on it and eases board layout. The electrical characteristics are the same as the familiar round type and the two versions are compatible.

The type BB405 varicap diode for u.h.f. tuner use now has an improved specification to meet today's more stringent interference requirements. It's also available in two types of surface-mounted pack (types BB215 and BBY31). V.H.F. and satellite-TV tuning diodes are also included in the range.

There are new heterojunction IR emitting diodes (types CQW58A and CQW89) for use in infra-red remote control systems. The diodes have a response (50nsec) that's ten to fifteen times better than that of similar products using competing technologies, making them ideal for use with very short duration pulses, i.e. those required by fast sensors such as pin diodes and complex photo-i.c.s. The peak emissivity of the CQW89 is 830nm, making it suitable for use with popular receiving photodiodes/transistors; the 740nm peak emissivity of the CQW58A makes it suitable for use with photoreceivers. The heterojunction structure results in exceptional stability over long periods (10,000 hours continuous operation produces a degradation of only 20 per cent). Operating efficiency at low and high drive levels is improved with respect to earlier devices.

Hero Electronics Ltd. of Dunstable Street, Ampthill, Beds MK45 2JS (telephone 0525 405 015) have available at competitive prices an extensive range of optocouplers, LEDs, IR emitting diodes, laser diodes, solid-state relays etc. As an example the Sharp 6N137 at £1.01 and the Sharp PC829 at 90p can be used in positions IC1-3 and IC4 respectively in the opto-isolated RGB interfacing circuit published last March (Fig. 1, page 312).

### NEWS FROM SONY

Sony (UK) has announced that sales of digital audio tape equipment in the UK started during the course of last month. The company's first DAT product is the DTC-1000ES, a full-function player that's selling at around £1,300. Sony's Magnetic Products Division is supplying blank DAT cassettes that measure 7 × 5 × 1cm and vary in price from around £9 for a 60 minute tape to £11 for a two-hour version. The world's first portable DAT recorder is to be launched by Sony in Japan this December and will sell at some £1,100.

Sony has made an approach to CBS in the USA with a view to buying the CBS Records Division. The move would put Sony in both the hardware and software areas



Sony's UP-701 (left) and UP-811 (right) video printers.

of the record business and might allay fears of the effect of DAT recording on music copyright and the compact disc business.

A number of products have been added to Sony's range of professional video equipment. The IDX7000 monitor is of particular interest in using a new tube, called the Indextron. This presumably uses the beam-indexing principle, enabling the shadowmask and convergence arrangements to be dispensed with. The tube is said to produce an image ten times brighter than a conventional c.r.t., making the monitor particularly suited to use in brightly-lit environments. The VPH1040 projector has a 600-lumen light output which Sony claims makes it brighter than any competitive, similarly priced product on the market. It has a high resolution of 900 lines (RGB input) and can project on to screens ranging from 72 to 250in. in size. The projector can handle NTSC, PAL, SECAM and NTSC 4-43 signals. There are two new thermal video printers, the UP-701 which provides a print with 16 grey scales (similar quality to an instant photographic print) and the UP-811 which produces 32-greyscale prints. The latter has a contrast/brightness feature that eliminates trial-and-error print adjustment: when adjustments are made to the printer the same changes can be displayed on the monitor screen, enabling you to see the precise effects of your fine tuning. The EVM9010P is the first ever video presenter to use the 8mm format. It can be mains or battery operated and incorporates a built-in battery charger.

**George Cole writes:** Sony has just announced that two Extended Definition (ED) Beta VCRs are to be launched in Japan this autumn. Sony has also made a modification to the ED Beta specification. With the original specification peak white f.m. was 8.6MHz and the frequency deviation was 1.8MHz (see Fig. 1, page 827, October 1987). This has been changed to 9.3MHz and 2.5MHz respectively.

The first ED machine is the EDV-9000 "Pro" which has a double flying erase head, a new high-speed index system, and an on-line function which enables other sources to share the recorder's timer facility with the usual r.f. input. It also features a data screen function and has a built-in calendar with three week/eight event timer. The price is around £1,300. The EDV-9000 and the EDV-5000, which sells at around £800, have a new eight-bit memory function which offers a variety of digital effects including digital still/slow motion/stop motion/strobe. A high-speed digital scan system that operates at 60 times normal speed is also employed. Both recorders come equipped with wireless editor control units.

Sony is also marketing ED metal tape which features "Dignax" ultra-fine metal particles. The cost is £12 and £15 for one and two hours respectively.

No UK launch dates for ED Beta equipment have so far been announced.

# VCR Clinic

Reports from Steve Beeching, T.Eng., Alan Shaw, Joseph Cieszynski, Alfred Damp, Nick Beer and Eugene Trundle

## Panasonic NVM1/Philips VKR6800

The picture first went green, then there was no colour. Various checks were made to determine the status of the R-Y and B-Y colour difference signals. These were present as far as the input to the encoder chip IC401, though the precise levels couldn't be measured. The reproduced picture showed signs of colour suppression, but with tinges of green on the highlights. There was no chrominance output at pin 12 of IC401. Within this chip there's a regulator that should record 2.5V at pin 14. The reading here was 3V. Was this correct and the manual a wee bit wrong . . . or not? The only way to tell was to replace the chip. For once this action turned out to be the correct course. **S.B.**

## A Note on Cameras and Camcorders

Of late I've been sent a lot of cameras and camcorders for repair, from many different sources. I'd like to put the following points to all my friends who read the magazine. If a camera suddenly produces wrong colours or just green there's a reason for this, i.e. a fault - logic says that the camera hasn't just twiddled itself off adjustment. So just in case it eventually arrives at my service department, please don't try to compensate for the fault by readjustment, because it takes three-four hours to realign a camera completely, and at £25 an hour it's expensive. If you are going to send any equipment back to a manufacturer, spare a thought for the chap employed there. If you've touched any preset or changed any component, write it down and send the details with your complete fault report. The engineer will thank you for doing this and not deride you for having a try - provided you haven't twiddled everything in sight. Believe me, it does help. There's nothing worse than getting a misaligned camera or camcorder that's been worked on and then sent to the manufacturer with the single word "faulty" on the report. If it gets to me in that state the starting price is £45, minimum . . . **S.B.**

## Sanyo VTC5150

There was no playback capstan servo lock. Control track pulses were present at pin 23 of IC4001, and the reference pulses were correct at pin 27. There should have been short 4.5V pulses at pin 24 but these were absent. C4016 was disconnected in case it was leaky, then the i.c. was changed. Still no luck. After a bit more sorting around we found that R4030 (27kΩ) read about six billion ohms. **S.B.**

## Panasonic NV830

A dealer asked me to sort this one out. For some reason there was no colour after replacement of the 12V regulator Q1102. Why I do it this way I shall never know, but after proving that there was no fault in the colour circuits I discovered that the 12V rail was low. Now this isn't the rail provided by Q1102. This was at TP1002, which recorded about 10.5V. The base of Q1003 was at 4.5V instead of 5.6V while its emitter was held at a regulated 5V, so it was off. This transistor's collector is connected to 45V via 6.8kΩ and 4.7kΩ resistors, so there was no reason why the collector voltage read 11V unless Q1003 was

leaky, which it wasn't . . . In fact Q6013 on the system control panel switches the supply on and off by earthing the collector of Q1003 via D1004, which was leaky. **S.B.**

## Ferguson 3V23/JVC HR7700

The engineer who carried this machine into the workshop exclaimed "you won't believe me but I've heard it with my own ears!" There was a general muttering of "heard what?" around the workshop. "The sound is slow in the E-E mode!"

Amidst the laughter the thought occurred to me that he could just be correct. The 3V23 contains a bucket-brigade circuit in the audio channel. It's used to halve the pitch when the machine is operated in the double speed mode. The result is that the double speed sound will still be fast, but the pitch will be "normal". In fact this arrangement works remarkably well.

On putting the machine on test in the E-E mode we heard the horse racing commentator speaking in a slurred, deep voice. He wasn't speaking slowly, but the unnaturally low pitch gave this impression. The circuit is switched on by applying 12V at connector 35 on the audio panel and a d.c. voltage check at this point soon revealed that the circuit was indeed energised. The voltage comes from transistor X35 on the bottom mechacon board. D.C. and resistance checks proved that X35 was leaky.

It's worth noting that had the engineer tried the machine in the playback mode it would have been stuck at double speed as X35 also switches the capstan servo. **J.C.**

## Toshiba V71/V73

The first Toshiba VHS machines were clones of JVC models. Toshiba have since developed their own models. The first to come our way were the V71 and V73 - excellent products as you would expect from this manufacturer. So far we've had the following faults.

First, picture plays as if in search but with unmuted sound. If you press search the machine appears to go into pause. The fault can be intermittent. Remove the cabinet bottom and locate a small square switch near the capstan flywheel. Toshiba call it a mode switch. It can be cleaned but is better replaced with a modified type available from Toshiba (part no. 70197081).

No reel motor rotation due to IC603 being faulty.

A noise bar during playback due to IC601.

Playback of own recordings have a line going up the

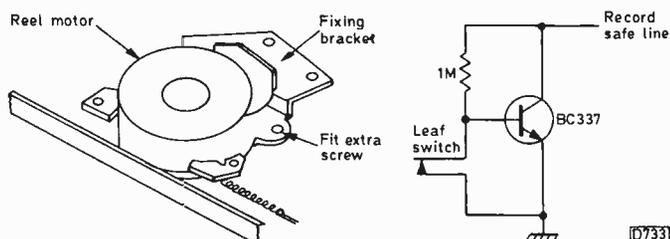


Fig. 1 (left): Modification suggested by Toshiba for Models V71 and V73.

Fig. 2 (right): Record safety switch modification for early versions of the Ferguson 3V23/JVC HR7700.

screen. Cause: IC501 faulty.

The three i.c.s mentioned above can all be damaged by a static charge on the reel motor. Toshiba recommend fitting an extra securing screw (see Fig. 1). A.S.

### **Hinari VXL-4**

We've had the following problem with these machines: the VCR works normally but won't eject the tape. The eject mechanism will work perfectly if you turn the worm drive on the loading motor – probably, that is, until the customer tries to eject his hired tape due back at the shop that evening. Replacing the motor doesn't cure the problem. Hinari now supply a loose coupling for the motor to worm drive. This seems to cure the fault. A.S.

### **Panasonic NV870**

This VCR had no tuning memory. As a secondary fault the display went dim when the machine was switched on. Our decision to trace the cause of the memory tuning fault first turned out to be a good move. We found that the  $-28\text{V}$  supply to the tuning memory chip was missing due to R7550 ( $27\Omega$ ) being open-circuit. Replacing this cured both faults as the  $-28\text{V}$  line also supplies the display driver buffer. A.D.

### **Ferguson 3V23/JVC HR7700**

As Christopher Holland mentioned in the February 1987 VCR Clinic, the owners of these machines are reluctant to part with them. This one had been repaired by us previously. We had replaced the reel motor, the audio/control head and a part of the cassette housing known as the "cassette bed". The customer had asked us for an estimate first, but had accepted this. A few months later the machine came back with the complaint that a cassette had jammed.

On removing the covers we found that the record safety switch lever, which was of the old type fixed to the cassette housing, had come out of its mounting and was jammed against the cassette. Refitting the lever provided only a temporary cure – after about five goes at inserting and ejecting a cassette the lever again came out of its mounting. When we made enquiries about a replacement shaft complete with lever we discovered that with the advent of the later mechacon board the lever had been deleted and was no longer available. In view of the previous repair another solution to the problem was called for – and I don't mean chopping out the old lever and forgetting about it.

I ordered the later type of lever, base and leaf switch. To modify the VCR, first remove the spring, item 110 in the exploded views section of the service manual, then remove the spring hook. Select several washers to fit over the large post to keep the base from fouling the mechanism – be careful not to bring the base up too high or the cassette housing will not lower correctly. When you've found the correct height of the base, secure it with a circlip on the large post. Take out the operation board and remove the record safety LED and phototransistor, and cut away the safety switch holder.

On the early mechacon board the record safe line goes low to prevent recording. On the later board it goes high, so electrical modification is also required. One side of the leaf switch has to go to chassis. It can't be taken to the supply rail because of  $10\text{k}\Omega$  pull resistors on the record safe line, so an inverter is required to match the new

switching arrangements to the old mechacon board. Use a BC337 transistor (see Fig. 2) with its collector and emitter legs in the holes left vacant by the phototransistor's collector and emitter, leaving the base leg free. Fit a  $1\text{M}\Omega$  resistor between the base and collector to provide bias and connect the leaf switch between the base and emitter. With the circuit modified in this way the record safe line falls to approximately  $2.3\text{V}$  with a protected cassette, thereby inhibiting recording. A.D.

### **Sharp VC681**

This VCR came in because of a jammed cassette. The cause was yet another misaligned mode switch. After realigning the switch we tested the machine in all modes. The sound of tape crinkling could be heard in the play mode – the tape was rubbing against the top edge of the reverse guide assembly. This guide is between the pinch roller and the cassette take-up guide. Inspection of the pinch roller revealed that it had distorted to a barrel shape. A new pinch roller cured the crinkling and hopefully prevented several tapes losing their top edges. A.D.

### **Hitachi VT120/VT220**

The problem with this new machine was no colour on record or playback. A check revealed that the chroma signal was present at the input of the HT4539B processor chip IC301, which was being correctly fed with pulses at line and half field rate. As the d.c. voltages around the chip were within tolerance we changed the i.c. module. This restored full colour. E.T.

### **JVC/Ferguson Camera Cables**

We've had increasing numbers of faulty camera-to-VCR connecting cables in our neck of the woods. It happens with several models and for some reason the core carrying the run/stop signal from the trigger is most often affected – a check on its continuity at the outset can save time and effort. The moulded-on terminations do not seem to be repairable, and the price of replacement leads is very high. Perhaps camcorders were invented to overcome this problem . . . E.T.

### **JVC GRC2**

The camcorders we get in for repair all seem to be wanted for a wedding next Saturday. This was one such: it arrived at Friday lunch time with the complaint that the viewfinder record indicator had failed . . . Normally a little dash in the top right of the viewfinder screen changes to the caption "REC" when the record-pause trigger is released. Although the record indication was being given by the flashing REC LED on the side control panel the viewfinder indication remained as a dash.

We found that the viewfinder caption generator chip IC5 on board 23 was capable of putting REC into the viewfinder if pin 25 was interfered with. The fault was due to C11 ( $1\mu\text{F}$ ,  $16\text{V}$  tantalum bead) at pin 7 of the logic array chip IC4 being open-circuit. E.T.

### **Sharp VC2300**

There were three faults on this machine. A new reel idler cured the rewind problems while a new loading belt cured a tendency not to lace up. Wavering on sound was caused by a faulty capstan motor – and a pretty expensive one at that! N.B.

# Long-distance Television

**Roger Bunney**

Reception via all long-distance propagation modes occurred during August – Sporadic E, auroral, tropospheric and meteor scatter. As the peak of the season passed there was reduced SpE activity. This is normal for August, but even so Syria was received on the 16th. The SpE log is as follows:

- 5/8/87 TVE (Spain) chs. E2, 3, 4; RTP (Portugal) ch. E2, 3; RAI (Italy) chs. 1A, B; DFF (East Germany) E4; TVP (Poland) R2; NRK (Norway) E2, 3, 4; RUV (Iceland) E2, 3, 4.
- 6/8/87 RAI 1A; CST (Czechoslovakia) R2.
- 7/8/87 RTP E2, 3; TVE E2; RAI 1A, B; NRK E2, 3, 4; TSS (USSR) R1, 2, 3; TVP R1, 2; CST R1, 2; ORF (Austria) E2a; RUV E2, 3, 4.
- 8/8/87 JRT (Yugoslavia) E3; MTV (Hungary) R1; RAI 1A, B; NRK E3, 4; SR (Sweden) E2; TVE E2, 3, 4; RAI 1A, B.
- 9/8/87 NRK E2; TVE E2, 3, 4; RTP E3.
- 10/8/87 SR E3; NRK E2, 3, 4; TVP R2; TVE E2, 3, 4.
- 11/8/87 CST R2; RTE (Eire) ch. B; +PTT (Switzerland) E2; NOS (Holland) E4; DR (Denmark) E3; C+ (Canal Plus, France) L3; RAI 1A, B; TVE E2, 3, 4; RTP E3; RUV E3; EPT (Greece) E3.
- 12/8/87 TVE E2; DR E3; SR E2, 3, 4; NRK E3.
- 13/8/87 TVE E2, 4; SR E2, 3, 4; NRK E2, 3, 4; ARD (West Germany) E2; DR E3; RAI 1A, B; SR E2, 3, 4; JRT E3.
- 14/8/87 TVE E3, 4.
- 15/8/87 TVE E2; RAI 1A, B; C+ L3; JRT E4; ORF E2a; +PTT E2; TVP R1; TSS R1, 2.
- 16/8/87 RAI 1A; TVE E2, 3, 4; RTP E3; ORF E2a; ARD E2; CST R1; TSS R1, 2; NRK E3; SR E2, 3; Syria ch. E3 at 1155 BST, Rugby.
- 17/8/87 ARD E4; EPT E3; JRT E3, 4; RAI 1A, B; MTV (Hungary) R1; TVP R1, 2; +PTT E2; ORF E2a; TVE-2 E2; CST R1, 2; TSS R1.
- 20/8/87 RTP E3.
- 21/8/87 TVE E3.
- 22/8/87 TVE E2, 3, 4; RAI 1A; RTP E2, 3.
- 23/8/87 TVE E2, 3; RTP E3; RAI 1A.
- 24/8/87 JRT E3, 4; RAI 1A; TVP R2; CST R2.
- 25/8/87 TSS R1, 2; TVP R2; CST R2; RAI 1A, B; TVE E3, 4.

- 26/8/87 TVE E2; C+ L3; TSS R1, 2.
- 28/8/87 TVE E2, 3, 4; ORF E2a, E4.
- 29/8/87 TVE E3; YLE (Finland) E4.
- 30/8/87 TVE E3.
- 31/8/87 RAI 1A; TVE E2, 3.

Meteor scatter conditions were good during the Perseids shower over the period August 10-14th. Iain Menzies received his first picture reception in Band III (ch. E5/R6) on the 11th. Earlier, on the 6th, Mark Baldwin received CST ch. R6 at good strength.

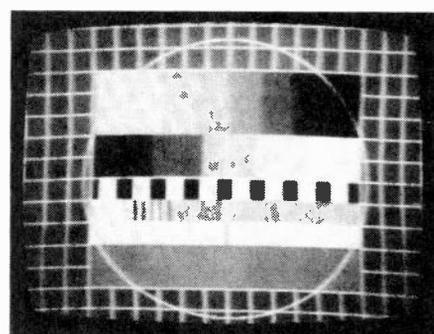
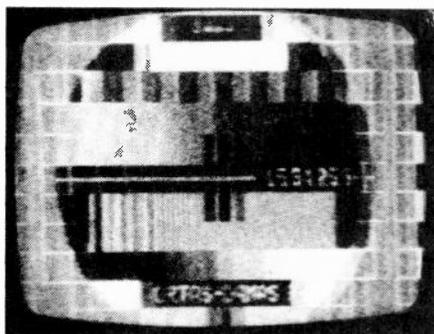
Auroral activity was present on the 3rd, 14th, 25th, 26th and 27th. NRK signals were received on all these days, and on the 27th SR was received as well. All in Band I of course.

There was tropospheric propagation on the 13-15th and 17-18th, with reception of TVE in Band III and at u.h.f. in the west country and reception from the Benelux countries, France and West/East Germany (the latter in Band III only) in the south east, east and midlands. The major tropospheric opening occurred during August 28th-September 1st however. Signals, particularly those from West Germany at u.h.f., were more intense, peaking over the 30th/31st. They were received over much of central/eastern England. Signals were also received from RTE and RTL. Cyril Willis did well on the 31st, with NRK Band III, West Germany ch. E3, GDR Band III and u.h.f. and, the best catch, Czechoslovakia ch. R10 (Plzen, 100kW, with the EZO "RS-KH" pattern). By September 1st the signals were fast fading, with only the more common West German and Benelux u.h.f. signals present.

Garry Smith (Teleradio News, Derby) reports receiving unidentified (thought to be Canadian) system M signals on July 21st. They were picked up at 2340-0010, on chs. A2 and 3. On August 1st he received an unidentified Arabic film on ch. E4 at 1404 BST.

Cyril Willis received double-hop ch. E3 SpE signals from Africa on August 4th at 1646 BST, and again on the 5th at 1715, this time with a definite NTA (Nigerian Television Authority) identification. The signal was most likely to have come from the Sokoto/Jaradi transmitter and included a music/discussion programme. There were no vision insertion test signals. Colour bars/grey scale were seen over the signal, thought to be from GBC (Ghana) Jamasi. Similar signals returned at 1758.

One of the accompanying photographs shows Arabic ch. E6 SpE reception by Mark Baldwin on August 6th, at 1735-1752. Mark had tuned to Band III to view French (Lille) TV and had come across negative-going syncs. Thinking these were from Smilde (NOS, Holland) Mark



Left: Syrian ch. E3 test pattern received by Mark Baldwin (Rugby) via SpE at 1330 BST on August 1st. The identification is ORTAS-DAMAS. Centre: Arabic ch. E6 programme received by Mark Baldwin via SpE from 1735 BST on August 5th, thought to be from either Algeria or Tunisia. Mark was using an 11-element Band III array. Right: The new Austrian test pattern, received by Garry Smith (Derby) on ch. E2a.

turned the aerial more to the south. The signal then lifted to show a Star Trek cartoon with dubbed Arabic sound, going on to captions at 1745 with a female announcer, then finally singing. Though Mark recorded the signal no identification was seen. He thinks origination was from either Algeria or Tunisia where there are at least three transmitters with powers in excess of 100kW, for example Kasserine, Tunisia with 340kW e.r.p.

The RSGB reports that there was SpE amateur radio communication in the 144MHz band on July 21st, August the 2nd and 15th. Communication with the USA occurred in the 50MHz band on July 21st and 23rd. 144MHz tropospheric propagation was noted on July 26th, between the UK and the Canary Is, and on August 12th with signals from southern France/Italy.

I took a holiday in Guernsey, Channel Is, during August. The closeness to France during the late August tropospheric openings resulted in severe loss of local signals from the group C/D Les Touillets relay transmitter. Interesting to see the large numbers of discone wideband monitoring aerials in use in Guernsey.

Thanks to the following for logs and reception reports: Peter Schubert (Rainham), David Oliver (Birmingham), Bill Cotterill (Tipton), Simon Hamer (Powys), Roger Fusell (Torpoint), Iain Menzies (Aberdeen), Mark Baldwin (Rugby) and Cyril Willis (Norfolk).

### News in Brief

Lopik 3 (NOS-3, Holland) ch. E30 has been running on test since early August, at 1,000kW e.r.p. NOS has also been noted with separate radio network programming on two carriers at plus 5.5 and 5.742MHz relative to the vision carrier for crosstalk tests . . . RTL (Luxembourg) is now known as TVi . . . A north France transmitter carrying the PTT-Telecom-1 test card on ch. E53 outside M6 network hours is thought to be Lille Lambersart . . . A local Oslo TV service is in operation on ch. E46, at 1.25kW . . . TVP (Poland) has been seen using the Hungarian originated HT test pattern . . . The Swiss/TSI test patterns have been seen with wording across the bottom indicating "the news, now, on teletext with a decoder" . . . The main USSR service TSS-1 is being transmitted from the GDR ch. E2 Nohra transmitter. TSS-1 started breakfast TV in mid-July, from around 0300-0400 GMT, in the Moscow area . . . The first Australian community TV station was on air from 9-12th August, operated by students from the Royal Melbourne Institute of Technology. The callsign "RMI-TV 39" (i.e. ch. E39) was used. Programmes ran from 1200-1730 daily.

### Compact FM TV Transmitter

Amcomm of London W3 is selling a compact, high-quality f.m. TV transmitter intended for security/surveillance applications. Different models provide synthesized tuning in the ranges 300-500MHz, 500-950MHz and 950-1,700MHz, with output powers of up to 80mW. The transmissions are demodulated to System B/G standard, with intercarrier sound. There seems to be potential for interference within the broadcast bands, and for TV pirates!

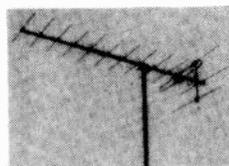
### Interference in Band III

Increased interference from various PMR/communications services is being experienced in Band III. Garry Smith reports loss of ch. E9 in the Derby area and problems with ch. E11. Information recently came to hand on the equipment installed at a rural PMR Band III

## FERNSEH-ANTENNA

### High Gain Wideband VHF

### Band 3 Aerial for TV-DXing



The Autumn Tropospheric period should now have arrived. Aerial Techniques are offering this superb High Gain Wideband VHF Band 3 Antenna at a very special price to all enthusiasts. The Fernseh-Antenna model S1814 is a 14 element array covering all VHF channels in Band 3, it has a peak forward gain of 11.5dB and a high front to back ratio of 26dB. For high resistance against extremes of weather, the aerial is gold lacquered for complete protection from corrosion, it also comes complete with a plated mast clamp which has a 2" maximum grasp capability. The array is light and weighs under 2kg, frequency coverage is a complete 175-230MHz, a folded dipole is employed for peak efficiency.

We are also offering the very popular Antiference UP1300 amplifier at a special price. If purchased with the above Band 3 aerial, the price is only £14.95. This amplifier covers 40-230MHz, which means it covers all Band 3 frequencies, the gain is 19dB, with a low noise figure of 2.5dB. This unit requires 12v DC @ 6mA from its power supply via the coaxial downlead.

FERNSEH-ANTENNA S1814 High Gain 14 element Wideband 3 Aerial . . . £29.50  
(Carriage & Insurance on aerial £4.95)  
ANTIFERENCE UP1300 amplifier, coverage 40-230MHz . . . £14.95  
(price applies if purchased with aerial - normal price £17.30)  
ANTIFERENCE Matching 12v DC Power Supply (mains operated) . . . £14.25  
KINGROTOR Automatic 'offset' Antenna Rotator & Control Console . . . £38.95  
SUPPORT BEARING for heavier rotor load applications . . . £17.00  
NEW! Band 1 Notch Filter type TDFN-1 (tuneable), peak notch depth 45dB, insertion loss less than 1dB, coax plug and socket connections . . . £10.90

Aerial Techniques is the company that knows the TV-DXing hobby. We carry a large and comprehensive range of aerial equipment for every type of installation, together with a vast range of filters, amplifiers, cables, rotators, masts and supporting hardware. Send today for a copy of our glossy covered illustrated Catalogue at 75p, in the unlikely event that it doesn't list what you want, we can obtain it quickly.

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site. Three Storno base units provide an output of 25W which is fed to vertical dipoles. The frequencies used are in the 205-206MHz range, with f.m. at 2.5kHz deviation. Some PMR companies seem to think that Band III is empty of TV in the UK and adjacent areas of Europe!

A recent press release from the DTI indicates that consideration is being given to a third cellular operator in Band I/III to start within two years, also that the five regional and five London-based PMR networks will start to operate in Band III within the next twelve months, providing access to the switched UK telephone system without the cellular complication.

### Low-power Devices

Of some importance to TV-DXers is the band set aside by the DTI for use within the UK of "general-purpose, low-level devices not exceeding 10mW output". Provided the equipment is of a type approved by the DTI no licence is required to use it. Problems have already been experienced with baby alarms sold via mail order companies - one type is advertised in the latest Mothercare catalogue.

Many of the devices being used originate from the Far East and are generally made for the US market to standards laid down by the FCC. The 49MHz band has been used for children's "junk" walkie-talkies. More recently, adult communications systems have been introduced, ranging from simple headset types to five-channel, hand-held units. FCC regulations require that the power output should be no more than 100mW into an aerial of no longer than one metre mounted on the transmitting unit. Current units give a range of about one mile, unmodified.

The five channels used by units originally intended for

the USA are 49.83MHz, 49.845MHz, 49.86MHz, 49.875MHz and 48.89MHz. It's interesting that certain of the 49MHz walkie-talkie channels are within the US cordless phone allocation for the later generation of 46/49MHz units. These channels are as follows: 1 49.67MHz, 2 49.845MHz, 3 49.86MHz, 4 49.77MHz, 5 49.875MHz, 6 49.83MHz, 7 49.89MHz, 8 49.93MHz, 9 49.99MHz and 10 49.97MHz. The band set aside for UK low-power devices at 10mW maximum output is 49.82-49.98MHz.

The details above will give TV-DXers an idea of the problems they might experience in the months ahead. If the equipment is type approved there is little one can do about the interference it might cause on TV channels such

as R1 (vision carrier 49.75MHz). Unfortunately many of these imported units are intended for mobile use, and when used in this way the transmission polarisation will be random. In addition, if previous experience is any guide many imported units will not be type approved. Interference caused by such units can be referred to the DTI with a view to stopping their sale. In the June column I reported on trouble experienced with a baby alarm that produced radiation at 49.83MHz. The DTI investigated and discovered that the unit produced spurious radiation outside the prescribed band. I understand that the system has now been withdrawn from sale. It's important to draw the attention of the DTI to any equipment that's not type approved.

## RECEIVER REVIEW: YOKO MODEL F6

Several small-screen monochrome portables suitable for DX-TV reception, with v.h.f./u.h.f. coverage and often System B/G capability, have been on sale in the UK in recent years. Most are unfortunately no longer available, though they appear from time to time in the second-hand market. Models from Plustron, Vega, Waltham, National Panasonic and Tandy all worked well. Of these the only non-Oriental set was the Vega one, which was built to withstand battlefield conditions – in a steel case and with a heavy, rear power supply. Many of these particular sets eventually failed to give v.h.f. reception due to a faulty local oscillator transistor in the tuner: once the device was replaced with a suitable Western transistor normal reception was restored.

Aerial Techniques of Poole currently have available a 5in. monochrome receiver of Korean origin, the Yoko Model F6. One was offered for review, off the pile, and this proved an interesting experience.

The receiver has an attractive black plastic case measuring about 5<sup>5</sup>/<sub>16</sub>in. high, 5<sup>1</sup>/<sub>2</sub>in. wide and 8<sup>5</sup>/<sub>16</sub>in. deep. It stands 6in. above the supporting surface at the front, being slightly tilted upwards by non-adjustable feet, and weighs around 2lb. 14oz. without internal batteries. The carrying handle recessed into the cabinet top lifts up: it may be well suited to small Korean hands but is a tight squeeze for larger European ones! Front controls from left to right are power on/off pushbutton, horizontal slide controls for band selection (Band I/III/u.h.f.), and volume. Next to the volume control there's a 1<sup>1</sup>/<sub>2</sub> × 1in. window with a tuning calibration drum behind. This is clearly (and accurately) marked with all the v.h.f. channels and every tenth channel from 21 through to 69. The tuning control itself is an almost flush, low-profile black 1<sup>1</sup>/<sub>2</sub>in. diameter knob on the right-hand side. It's convenient and easy to use, with no backlash or resistance. Adjacent to this is the speaker grill, and nearby there's a 3.5mm earphone/extension speaker jack. Brightness, contrast and field hold controls are provided at the rear of the set (line hold is preset internally). The 12V input jack and systems change switch are also at the back. The latter gives either system B/G/I or System L.

The aerial jack is a 3.5mm type. An adaptor that comes with the set converts this to the more familiar Belling Lee type socket. I've seen the 3.5mm aerial access on other sets and feel that it's inefficient, lossy and cheap. With the adaptor fitted the brightness control can't be adjusted and the telescopic whip, which extends to 35in. in seven sections, can't be retained in its moulded clip. A sliding panel on the left-hand side gives access to the internal

battery option. As with many of today's sets there's no visible fuseholder: I use a 1A fuse in the mains plug when operating from the mains supply.

The tuner provides generous coverage – Band I 44-66.5MHz, Band III 155-231MHz and u.h.f. 442-872MHz. Thus it will work on Morocco ch. M4, and should the ATS-6 satellite ever return at 860MHz it will be ideal for that as well! These figures relate to the vision carrier and encompass the associated sound signal.

In the System B/G/I position adequate sound quality is available with both sound/vision spacings (the carton mentions just systems B/G/L, but System I is included). The System L sound is similarly of reasonable quality given the limitations of a 2<sup>1</sup>/<sub>4</sub>in. diameter speaker. The sound circuit incorporates a mute/squelch facility. When tuning between stations the usual speaker shash cuts out, normal sound returning when TV sync pulses are received. Once a signal is tuned in there's about a half second delay before the sound comes on – with very weak signals the sound remains muted. I found this feature distracting at first, but having tuned around for a period I felt that the lack of shash reduces fatigue. Because of the conventional i.f. bandwidth marginal signals suffer from visual noise on the picture. Vision selectivity is about average: a weak ch. 23 London signal here at Romsey suffers slight adjacent channel interference from Rowridge ch. 24. Similarly the local ch. 21 spreads up to ch. 23, so reception of ch. 22 would be marginal, particularly with a weak signal. This is normal with a conventional receiver. The sensitivity is good, and there's a virtual absence of spurious responses over the v.h.f./u.h.f. coverage.

Two minor points. First the mains power supply runs warm. I'm told that this is normal. The power supply has about 18in. of three-core mains lead with some 5in. of twin d.c. feeder terminating in a standard jack. Secondly Aerial Techniques tell us that they can override the sound mute facility or make it switchable if asked at the time of purchase. A full manual is provided with the F6.

In conclusion I found this an easy receiver to use within the specified bands. The displayed picture is good and it's nice to be able to receive 5.5/6MHz sound without any need for switching. Reception on the French System L is excellent. My main criticism relates to the delicate 3.5mm aerial connection at the rear: I'd recommend use of a short adaptor lead from the supplied coaxial socket to a second one to avoid mechanical stress on the 3.5mm socket within the set. My thanks to Aerial Techniques for providing a sample set.

# *Servicing Notes on Pye/Philips Sets*

**Gordon Haigh**

In the April TV Fault Finding column Hugh MacMullen mentioned a silly on the Philips G8 chassis – mains fuse blowing as a result of the heater transformer having been put in the wrong way round. I've also come across some time consuming faults in these sets recently. The following notes may be of help to others who deal with them.

## **The Philips G8 Chassis**

One set had some makings of a picture but this was lost in a bright red raster. Some time was spent tracing the cause of the "fault". There was a plug and socket mix up on the c.r.t. base panel, i.e. the "blue lateral" and "set up" plugs were on the wrong pins. On a similar theme, green faces can be the result of a hastily fitted board, i.e. the wrong colour drives on the wrong pins – I know because I've had it! I also recall a case of incorrect colours where replacement of the decoder panel made no improvement. The cause turned out to be the line output transformer, a green one: I'm not sure whether it was made wrongly or someone had wired it up incorrectly, but reversal of the pulse feed cured the problem.

Another set, with the combined signal/decoder panel, had no field sync. The combined panel was connected electrically but the board was not correctly engaged at the back, resting on the chassis. This almost certainly killed the TBA550 chip – its direct field sync output print run had probably touched the chassis. A new TBA550 and correct board fitting restored field sync but there was still a natural fault present, poor field blanking. The cause was C4515 (10 $\mu$ F) on the timebase panel. It registered a low kick on the meter and was leaky.

The combined signal/decoder panel produced a real headache recently. The symptoms were as follows. Whenever the brightness or contrast control was advanced or the picture contained a lot of white the display became unstable, the picture jittering and pulsing while the power supply made noises in sympathy. The culprit turned out to be the gating pulse feed diode D3211. The OA202 fitted in this position measured o.k.: a couple of glass-banded types from scrap panels, tried in turn and soldered directly to the print side, cured the fault but put a white mist down one side. A BA145 or BA148 worked perfectly however.

On some versions of the deflection/convergence assembly the static convergence controls can develop a split in the part that turns the magnet. Adjustment then becomes a difficult task, requiring two hands – not a good idea when the guard is missing from the focus control on the c.r.t. base panel.

Here's one to note if the G8 is an older version. The symptoms are picture o.k. from a cold switch on followed by gradual loss of picture with increased brightness and flyback lines. In early versions of the power supply there's a 100 $\Omega$  resistor (R1389) in the h.t. feed to the RGB output transistors. It can change value as it warms up.

If difficulty with setting up the line hold control is experienced the 12V (D2166 on separate i.f. panel) and 18V (D4531 on the timebase panel) zener diodes should be checked. The original glass types have a tendency to drift upwards in value. Occasionally they go open-circuit. Electrolytics C4518 (50 $\mu$ F) and C4520 (16 $\mu$ F) are also

worth checking, and maybe the 10 $\mu$ F electrolytic connected to pin 1 of the TBA550 chip. The latter is C2170 on the separate i.f. panel and C3171 on the combined signals panel.

## **Pushbutton Problems**

The square station pushbuttons often let these sets down, with one or more failing due to the contacts "wilting" and dropping off. I converted one set for a hard-up owner by making a plastic plate and mounting on this a four-way rotary switch (no video). A small slide switch for a.f.c. completed the modification which, on a recent call to a minor fault, I noticed is still going strong.

The sloping pushbuttons used on some versions, also on the Philips 320 and 570 chassis, are not without troubles. For example the spring on the back mounting plate can snap off or the rivet can become detached. Failure to tune, i.e. the preset sliders not moving with the tuning wheels, can be caused by the plastic geared end caps of the presets developing a slight split – the ends then lose their grip on the screw thread. Careful heating of the split with a soldering iron sometimes helps. An a.f.c. difficulty, say when the button unit is in the sprung-back housed position and the station detunes, may have been dealt with by cropping or removing the white a.f.c. button. A stray earth braid in one box, probably helped by the fact that the box is a hinged unit that moves, was suspected of burning up a tuning voltage resistor on a 570 chassis.

I was rather puzzled by a Pye (tricky fitting vertical panel 725 series chassis) that wouldn't tune with its drawer unit. It transpired that a couple of the top selector buttons had failed and the clever repairer had inverted the symmetrical switchbank to get four good top selectors.

## **Pye 713 Series Chassis**

A few points on the Philips 570/Pye 713 series chassis are worth noting. Normal sound with traces of picture visible in a white raster can be caused by a defective TBA560C chip. When monitoring the supply lines to check for correct voltages it's not too difficult to have a meter probe accident at the clutch of fuses on the main panel. A slip here resulted in a blown l.t. fuse, a blown BD131 12V regulator transistor and a damaged TBA560C. A picture that's marred by horizontal shadows in the form of bands across the screen, depending on picture content, can be caused by slight misadjustment of the small set burst gating preset RV325 under the chroma delay line. Also check the decoupling electrolytic C353 (220 $\mu$ F, 16V – other values were fitted in production). If F691 (500mA) in the feed to the line output stage blows quickly after switching on and there's no trace of a short the line output transformer may need to be replaced. If so the transformer was probably helped on its way by a high h.t. fault.

## **Philips G11 Chassis**

Sendz Components do a six-way electrotouch station selector unit with red lights for the G11 chassis at £12 plus

VAT and postage. I mention this because it's worth considering when you have a troublesome six-button light-action mechanical bank (ever had one apart?). The replacement is a standard fitting on some models – there are no fitting problems, the only thing to get right being the connectors in the correct places. The orange connector goes to the i.f. unit. The three-pin connector with red/green tracer and brown wire goes to the power panel. The other three-pin connector (orange and green wire) fits second up on the i.f. panel, next to the loudspeaker connection. For a basic, non-remote control model the five-pin connector is left floating.

A flaw that's beginning to show up with these sets is fatigue and breakage of the black PCB retainers. The plastic seems to become brittle with age.

A G11/teletext set had intermittent field collapse. This time it wasn't the field timebase chip but a dry connector

joint on the line scan panel, i.e. to the 37V supply on the left of the panel, print side. The restored picture looked decidedly "tubby" and it was difficult to set up any sort of grey scale. The combined first anode control/gun switch assembly was playing up. If you take it apart you'll find that it's on the flimsy side. The three potentiometers are deposited on a circuit board. In my opinion the older, robust individual 2M $\Omega$  potentiometers were a much better idea.

### How Many Selectors?

Finally, are sets with up to say 30 station selectors popular? Yes said one customer. He said he could tune in his home stations then tune in at all the sites when he went caravanning, leaving them set and never having to fiddle with the thing again.

## Letters

### SERVICING CHARGES AND SPARE PARTS

As radio and TV, video and hi-fi repairers who have traded for some twenty five years now we would wholeheartedly agree with M.D. Maurice's comments (Letters, October) on the subject of cowboys and servicing charges. There's a point we would like to add. If your customers think that £20 for repairing a TV set is expensive, it's worth pointing out to them that TV sets have not gone up in price for twenty years. When colour TV came on to the market in 1966 a set cost £250-£300, but wages were much lower than today. In the intervening years only electronic brown goods have remained fairly stable in price – due to foreign competition. If the price of TV sets had increased alongside that of cars, furniture, clothes and so on a colour set would today have a price tag of about £1,000 on it. I wonder whether customers would moan and grumble about a mere £20 under those circumstances? I don't think so. The basic problem is that new sets are so cheap in this country – compare prices with those on the Continent. My advice is to confront customers with this fact. We do, and find that it works wonders.

Another problem is the supply of spare parts. Suppliers don't recognise a head bill, saying that anyone can get one and charge for goods at retail prices with no warranties. The only way to get trade prices is to open an account with the supplier, who will then recognise a head bill. This is ridiculous. We deal with every set that's been made and would have to have more accounts than the National Westminster Bank. Spares suppliers have a lot to answer for with respect to servicing charges since they inflate prices at will to suit themselves.

*D.W. Chadwick, Director.*

*Dennis's Radio and TV Services, Worksop, Notts.*

### GETTING RID OF THE COWBOYS

I read with interest M.D. Maurice's letter in which he commented on unqualified and unskilled engineers creaming off the servicing of TV sets and VCRs. The practice is just as rife in this area, as no doubt it is in many other parts of the country.

I feel that the only way in which those of us who are qualified could root out the cowboys would be for us to become part of a professional body – in the way that

doctors are members of the BMA etc. Such a body already exists, though few in the trade seem to be aware of the fact.

The body in question is the Incorporated Practitioners in Radio and Electronics, which is a branch of The Society of Radio and Electronic Technicians. It was formed to enable those of us who have taken the City and Guilds mechanics courses 222-4 to be affiliated with this latter body. It's not difficult to become a member if you have the required qualifications. These are passes in City and Guilds 222-4 parts 1 and 2 (including practical). Members can write MIPRE after their names, giving customers a means of instantly recognising their qualifications.

If enough engineers did this and included the letters in their advertisements it would hopefully not be long before "Joe Public" demanded qualified servicing. We could perhaps then watch the cowboys ride off into the sunset!

There are many other benefits in belonging to the society, but by far the most important is to know that your abilities are acknowledged. I hope that all those who are qualified will take my advice and join the society – the address is IPRE, 57-61 Newington Causeway, London SE1 6BL. Let's get our professional act together and demand the recognition we deserve.

*Keith Lane, MIPRE,*

*Southsea, Hants.*

### THAT AERIAL SOCKET

With reference to the letter from Mr. W.H. Clarke of CSC Electrix Ltd., Belfast, in your October issue, I must point out that the aerial socket and lead mentioned are available at a trade price of £7.48 – the part number is QK0947.

I have requested our Northern Ireland distributor to advise Mr. Clarke accordingly.

*C. Ferrier, Divisional Manager, Technical Services,*

*Hitachi Sales (U.K.) Ltd.,*

*Hayes, Middx UB3 4DR.*

**Editorial note:** We are pleased to publish this correction. CSC Electrix Ltd. had ordered the part through a wholesaler, not from Hitachi – a copy of the invoice was sent to us to confirm the original charge made.

### SERVICING HINTS

I'd like to pass on a couple of tips to those starting their career in servicing. Even many of the experienced en-

gineers I've talked to overlook them.

First, get yourself a clip board and write down whatever component you are testing, e.g. R181 82kΩ o.k. yes/no – cross out the yes/no after making the check, and tick it. If the fault is an obscure one this can save you a lot of time – no one's memory is infallible, and you can then always check back later on what you've done. This is particularly helpful if you have to put the piece of equipment aside for any length of time.

Secondly, get acquainted with transistor parameters. It's surprising how many up and coming TV engineers I've spoken to say they don't bother with parameters and equivalents. Time and again I've found that this has saved me time and money. Most good catalogues that list transistors include parameters. My advice is to read this information. You'll find it most helpful, maybe not at first but certainly later on.

*M.K. Hayter,  
Moseley, Birmingham.*

### INTERFERENCE FROM BRITISH TELECOM

The subject of interference experienced with VCR use appears to be inexhaustible. Radio stations seem to be at the root of most interference problems, but this was not the case with my Sony C5. The trouble started when I moved into a new house. I fitted an excellent aerial on the roof with a splitter box to run two sets. The picture was fine on all stations apart from slight low gain on ITV – this was due to the fact that I'm in a fringe area and is nothing to do with aerial alignment. To combat this I used to watch ITV amplified via my VCR. Great picture!

But blissful viewing wasn't to last. British Telecom came. Wires were being strewn all over the place next door. When I asked what was going on I was told that a frequency changer was being installed so that the line could be shared. Since this unit was installed next door I've had a buzzing noise on all channels, but only when watching programmes amplified by the VCR. When I picked up the phone and listened to the dialling tone I noticed that the buzz on TV sound matched exactly in frequency. Reverting to direct reception via the aerial clears the fault.

*S.P. Law,  
Norton Lindsey, Warwick.*

### VINTAGE MAINS DANGER

Chas E. Miller's article on vintage mains supplies, some months back, brought to mind the following incident in the days of d.c. mains supplies here. A retired gentleman complained of receiving shocks when he placed his hands in the bathroom washbasin each morning prior to splashing water over his face. He reported the matter to the local electricity authority which, after carrying out an investigation, couldn't offer a solution.

The gentleman concerned wasn't satisfied and I was asked to carry out checks. Thinking about the situation, I wondered whether the water in the washbasin was for some obscure reason live, with the result that he was getting an earth return via the wet floor. When I took up a floor board I found a slip-conduit, which was properly earthed, running across the joists. The lead outlet pipe from the basin went through the brickwork and was joined into the downpipe from the guttering. Looking along this I noticed a wire hanging over it: This turned out to be the next door radio aerial which had come adrift.

Knowing the lady next door I explained the problem and she was happy for me to continue my investigation.

I found that she had an H.M.V. d.c. radiogram whose aerial socket was at 230V positive due to a leaky isolation capacitor. It was of the paper type, which had a tendency to do this. So the electrical leak was running along the guttering, down the fall pipe, thence via the lead outlet pipe to the ring in the bottom of the basin. Thus the water was live, and the user had an earth via his feet, the wet floor and the earthed conduit! He was happy to find that he was right after all and I would say he should have been glad his house was on the old d.c. system and had yet to be converted to a.c., otherwise he might not have survived!

*R.A. Coates,  
Whitby, N. Yorks.*

### RESISTOR TROUBLES

We've had a number of unusual faults recently due to resistor troubles. Others could maybe benefit from our experiences.

First was a Toshiba 14in. colour portable, Model 141E3B (140 chassis). The set was dead. Nothing obvious like a blown fuse, switch, etc. After checking a few resistors the STR5314 (STR 5214 equivalent) power regulator seemed the only item that could be responsible. As this device is expensive we carried out a second check through the circuit. This led us to R811 (220kΩ) which was open-circuit.

A Pye set fitted with the CTX-E chassis was also dead. In this case R3222 and R3585 were both open-circuit, though they looked innocent.

The third item was a Panasonic NV370 VCR that switched itself off after five seconds. This time R1101 was open-circuit – it's on the right side power panel, next to the 2SD1275 12V regulator.

Finally, can anyone help with a programme channel selector unit for the Philips G11 chassis? They seem to be hard to obtain.

*Mike Austin, Austin Electronics,  
5 Park Lane, Bere Alston, Devon PL20 7DH.*

### VINTAGE TV

In reply to Peter Nutkin (Letters, September), no I'd not forgotten the vibrator power pack in the Ekco TMB272, the UK's first portable TV set. In fact I'd written an article on the set some years ago. I've forgotten nothing about that set, including the first time I used mine with a car battery. It was on a visit to Drayton Manor Park, in 1964. Whilst the children enjoyed themselves on the amusements I watched the film "Angels One-five", starring Jack Hawkins, John Gregson, Michael Denison and Dulcie Grey. It ran for approximately an hour and a half, and even in that short time the set's 7A drain affected the battery enough to make me glad I was parked on a slope for a rolling start! Good film though – remember Gregson's nick-name, "Septic"?

As regards the Murphy sets with the focus controlled by the current passed by the sound output valve, this too I've covered in a vintage TV article (August 1985). This type of control was not unique to the Welwyn firm by the way. Philips used it in their 385U, 485U, 492U and 683U series.  
*Chas E. Miller,  
Woodseaves, Staffs.*

# Servo System Operation

J. LeJeune

The purpose of a servo system is to maintain a constant rotational speed and/or positional relationship between a driven system and a reference source. Such systems abound in mechanical reproducers of recorded vision and sound signals. They come in many varieties and degrees of complexity.

Basically, a servo system looks at a sample signal produced by the movement of the driven object and compares this sample with a reference signal from a stable source, e.g. a crystal or the 50Hz mains supply. The result of the comparison is either zero (no error) or an error signal which is used to adjust the drive in such a way that the error is reduced to zero. Fig. 1 shows two basic examples (a) with a magnet and pickup device attached to a motor flywheel to provide the sample signal and (b) with a tacho-generator to do the same thing. Applications of such systems in domestic electronic equipment are obvious, for example to control the speed and phasing of the helical scanning of the video heads in a VCR, to maintain a constant linear velocity with compact disc turntable motors, to maintain the correct tape speed in video and audio recorders and so on. Servo systems are not difficult to understand, but seem to strike fear in the hearts of many accomplished TV service engineers.

## Phase Control

Phase control by servo action in a VCR is basically similar to the flywheel line sync system used in all TV sets. Indeed the waveforms have marked similarities – see Fig. 2 – but instead of a voltage controlled oscillator responding to an error signal the servo in a VCR controls a motor drive amplifier. The TV set's line hold control is replaced by a mysterious control marked sample position – Fig. 3 compares the two systems in block diagram form.

Early VCRs use phase control only of the heads. A pair of magnets attached to the drum motor flywheel delivers a sample signal through the action of a pickup head mounted close to the path of the rotating magnets. These sample pulses should coincide with each head's arrival at the start of its track across the tape. The reference signal source varies: in the record mode it's obtained by divide-by-two countdown of the incoming field sync pulses; in the playback mode it consists of pulses that are recorded on the tape, using the same 25Hz field reference signal. The 25Hz reference squarewave signal is converted into a trapezoidal waveform with sloping sides that have accurate timing and rise and fall rates. When the servo is locked, i.e. there is no error, the sample pulse occurs at the mid-point of either the falling or rising slope of the trapezoidal reference waveform, depending on system design. The sampling pulse operates a sample-and-hold circuit that stores in a capacitor the ramp voltage present at the instant of sampling. The stored voltage leaks away slowly between the sampling periods, generally through the use of a source-follower f.e.t. stage as shown in Fig. 3.

To obtain fast settling of the system, the drum's free-running speed is set to be very close to the normal locked speed. This results in a settling time of up to eight seconds, mainly due to the inertia of the flywheel.

This single-loop servo system is very effective as long as

the normal wear and tear on the motor and belts is within narrow limits. As the belts begin to slip, so the settling time lengthens. As the motor deteriorates, the setting of the sample position control will creep more and more towards one end of its range of travel. Short-term speed constancy depends on the mechanical flywheel, which has considerable mass and in consequence slows down the servo system's response time. It also adds to the weight of the machine!

## Twin-loop Servos

The advent of portable VCRs, then smaller, slimmer and lighter "table models", made it necessary to use low-mass mechanisms. The old, heavy flywheel was reduced in size and the loss of physical mass was replaced by electronic techniques. Thus the twin-loop servo came into use, with motors employing tacho feedback to provide speed control – see Fig. 4.

The phase control loop in a twin-loop system remains substantially the same as before, but its error signal output

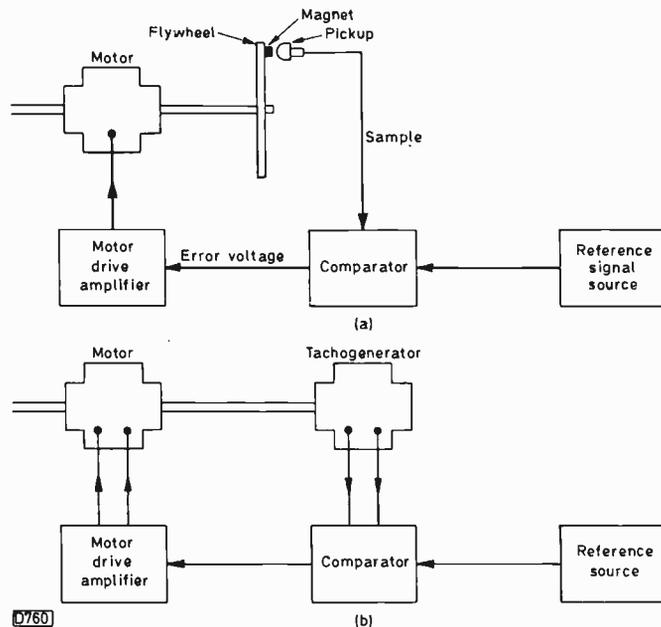


Fig. 1: Basic servo arrangements, (a) with sample signal taken from a flywheel and (b) with the sample signal provided by a tacho-generator.

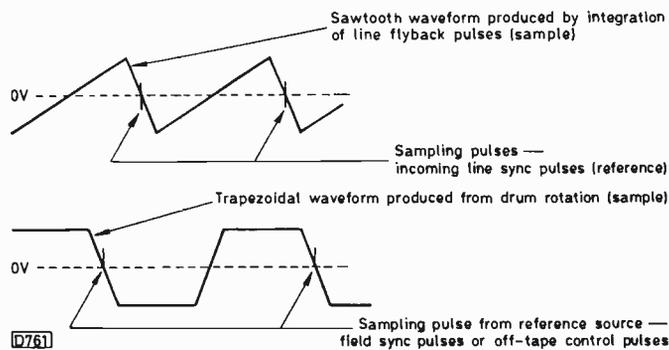


Fig. 2: A comparison of flywheel line sync and VCR servo waveforms.



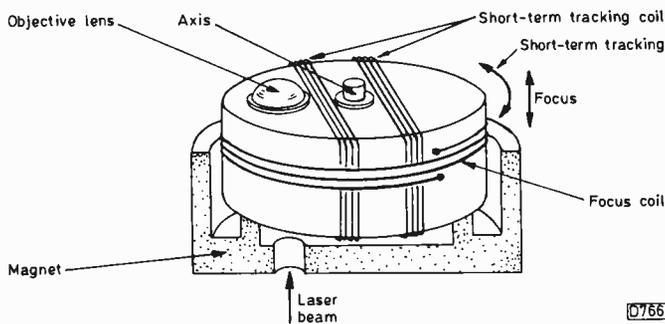


Fig. 7: Two-axis device used to provide optical unit tracking and focusing with laser-scanned disc players.

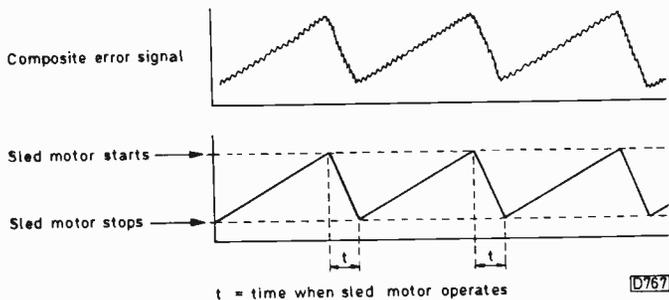


Fig. 8: Disc tracking.

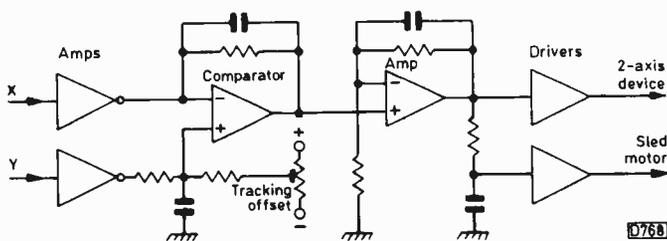


Fig. 9: CD player tracking servo system.

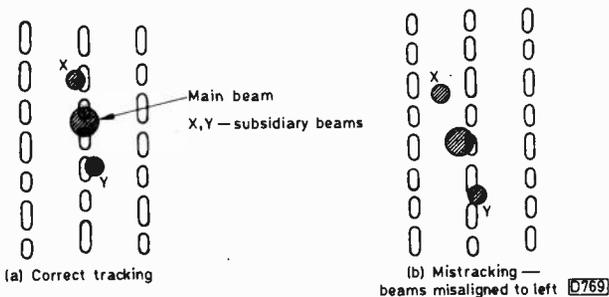


Fig. 10: The main scanning beam is accompanied by two tracking beams: (a) shows correct tracking, (b) mistracking.

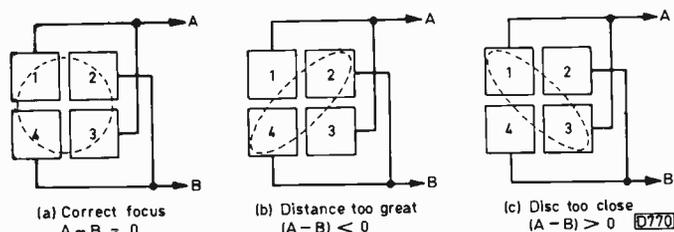


Fig. 11: Focus error detection system.

line of a colour TV transmission.

If the disc is rotating too slowly the time between the sync pulses will be too long and the peak ramp voltage produced by the RC circuit will be high, i.e. there will be a high amplitude sawtooth voltage. This is peak rectified, the diode's reservoir capacitor being provided with a leak resistor so that the circuit can follow variations in the

sawtooth peak-to-peak waveform amplitude - the CR combination has a suitable time-constant for this.

The output from the rectifier is buffered and then applied to an operational amplifier which acts as a comparator. The comparator's output is added to the output from a phase-locked loop speed governor system. The ramp generator/peak rectifier system is included primarily to provide the initial run-up to starting speed. Once the correct running speed has been obtained the PLL servo, which is almost completely contained within a single i.c., takes over. The motor run-up servo is not sufficiently stable on its own for CD control but is a good example of a single-loop servo providing speed control. The PLL chip compares the r.f. signal from the optical unit's photodetector diodes with the output of a clock oscillator which is also used to time the digital processing sections of the player.

### CD Player Servo Complement

A compact disc player contains four servo control systems. In addition to the disc motor system just described, two provide long- and short-term tracking while the other one keeps the focusing of the laser beam at optimum.

These servos operate on the same basic principle to maintain the correct physical position by means of electronic control: an opto-sensing system provides feedback information to enable the zero condition in the comparator circuit to be obtained.

### Tracking

Compact disc tracking is a complex problem since two variable components have to be taken into account, first a short-term error and secondly a long-term error related to the movement of the optical unit across the radius of the disc, from the inner to the outer edge.

A fine ( $1.6\mu\text{m}$ ) laser beam has to follow the spiral track on the surface of the disc. Because of duplication tolerances the disc may be slightly eccentric - up to  $50\mu\text{m}$  is allowed. This is taken care of by slight movement of the objective lens, enabling it to follow the recorded track as it "wobbles" from side to side. The response time of the servo used for this purpose is short.

The objective lens assembly is mounted in what is called a "two-axis device", see Fig. 7. It resembles an inverted cup mounted in a strong transverse magnetic field. Two sets of coils move the assembly up and down on the axis for focusing purposes and rotate it slightly about the axis for short-term tracking purposes. The arrangement can be imagined as a large meter movement with the addition of a coil wound at right angles to the usual moving coil, somewhat in the manner of a loudspeaker voice coil and with a similar action.

The complete optical unit is mounted on slide bars along which it moves to scan the disc's recorded surface. Correction here is applied by the "sled" motor, which is under the control of the long-term tracking servo. Movement of the sled motor occurs when the objective lens reaches its travel limit: the sled motor then turns until the opposite limit of the objective lens' travel is reached, whereupon it stops - see Fig. 8.

Separation of the fast and slow tracking components is done by a simple electrical filter: the slow component is selected by a long time-constant RC network. Fig. 9 shows the basic arrangement. Correct tracking relies on two

small beams (X and Y, Fig. 10) which are split from the main beam. Under correct tracking conditions these subsidiary beams fall mostly on the "land" area between successive sections of the spiral recorded track. Should the main beam wander off the track, say to the left as shown in Fig. 10(b), tracking beam X will fall wholly on land area while beam Y will fall mainly on the track. As the land area is highly reflective, beam X will be totally reflected on to its sensing diode whereas beam Y will suffer attenuation as a result of the presence of the track pits. This difference in the illumination levels picked up by the tracking sensors is used to correct the position of the objective lens. This is termed servo action even though the travel of the lens unit from side to side is never more than 100 $\mu$ m.

### Focusing

Main beam focusing is achieved by a cunning optical system. The control system used here is extremely simple and deserves to be called a servo since it's a closed loop. The main, reading beam reflected back into the optical assembly from the surface of the disc passes through a cylindrical lens on its way to the photodetector diodes. There are four diodes in this assembly, arranged in a square, with diagonally opposite diodes connected as shown in Fig. 11. When the focusing is incorrect the cylindrical lens distorts the circular main beam to form an ellipse whose plane depends on whether the beam is over- or under-focused. When the beam is correctly focused there's no beam distortion and all four photodiodes are illuminated to the same extent. In this condition, shown in Fig. 11(a), the difference signal obtained is zero. With too great a distance between the disc and the optical unit the distorted elliptical beam will illuminate diodes 2 and 4 much more than diodes 1 and 3 – see Fig. 11(b). As a result the focus servo comparator will produce an output of appropriate polarity to obtain the required corrective action, restoring the beam to its normal circular shape.

### LaserVision Disc Player

Note that the LaserVision disc player uses the same basic focus and tracking servo arrangements. It's motor servo uses the line sync pulses as the sample signal. See *Television* June 1982.

### Critical Damping

So much for some simple examples of the use of servo systems in modern domestic electronic equipment. The response time and gain of a control loop are critical. High gain means tight control, but gives little leeway for phase errors which will produce instability in the system, and for incorrect response times which give rise to hunting – the control system tries to catch the correct operating point but overshoots, tries again and again overshoots and so on. The frequency or period of such an oscillation depends on the mass and stiffness of the moving system. The time-constants in the feedback system are chosen to achieve "critical damping" of the whole system, so that the oscillation dies out in one half cycle.

Servo system design is a specialised branch of electronics. At one time it was beyond the brief of the service engineer handling domestic equipment to concern himself with the subject. Time marches on however, and today's specialist subjects are tomorrow's repair problems!

# next month in

# TELEVISION

## FREE CATALOGUE

The HRS Commodore Computer spares catalogue comes free with the November issue of *Television* – HRS Ltd. is the authorised Commodore spares supplier.

### ● SERVICING THE SONY SLC6

The SLC6 dates from the early 80s. It's a front-loading Betamax machine that sold in large numbers. Solidly built, it's still capable of giving good service and if properly maintained will provide an excellent picture. David Botto on servicing and fault-finding.

### ● COMPUTER PROGRAMMING FOR THE SERVICE ENGINEER

Start of a new series by Mike Phelan. What computers can do and the sorts of problems they can solve – also when they are not suitable – are initial considerations. The aim is to enable the service engineer to understand and make the most of this aid to his activities.

### ● DUAL-COMPONENT NETWORKS

Stan Amos on the uses and characteristics of dual passive-component networks in electronic circuits. Covering resistive and reactive networks.

### ● GUIDE TO SECOND-HAND VCRs

Derek Snelling reviews the strengths and weaknesses of some of the older VCRs that are readily available on the second-hand market and gives guidance on what to expect of them.

### ● VINTAGE TV

Chas E. Miller looks at one of the more straightforward designs from the early days of post-war TV – the Ferguson 842T and 843T.

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# Using a VCR for Sound Recording

Peter Marlow, B.Sc. (Hons.), C.Eng.

Whilst setting up my VCR one evening to record a TV programme it struck me that the machine would be more useful if it could record radio programmes as well. After all the VCR has an accurate timer and a three-hour tape length. It's also able to turn on and off several times over the course of two weeks. The best features on radio are often broadcast during the day when it's difficult to listen. Also the Open University and Schools' Broadcasts tend to be on at unsociable times. So these programmes are usually missed unless one has an audio cassette player and a timer hooked to the radio. Even then, audio tape cassettes last for only about 60 minutes. The timers available tend to be mechanical and are not very accurate. So using a video recorder for the purpose would seem to be ideal. In many homes the VCR spends most of its time doing nothing; another use for it, to justify the capital outlay, would be welcome.

Sony and National Panasonic have developed digital sound recording interfaces, with built in radio tuners, for use with VCRs. They use the entire width of the tape and produce excellent results, but the price is £200 plus. In addition some hi-fi VCRs, e.g. in the 8mm range, already have the sound record feature built in. But the majority of VCRs don't provide for sound recording by itself. So I thought I would have a go at designing a cheap and cheerful interface unit which would just do the basics, using the VCR's sound recording track. Wasteful of tape space maybe, but the design would be low cost and easy to build.

## Basic Considerations

There are two basic problems in providing a sound recording interface. First, how can we get the VCR to record sound alone – a video signal is required to synchronise the tape mechanism. The answer is to supply it with a complete TV signal. The video portion consists of a "black" monochrome (i.e. no colour burst) picture supplied by a sync pulse generator chip, with the sound part consisting of the material to be recorded. The VCR records this signal in the normal way. During playback the TV set provides the sound accompanied by a black raster.

There are several good chips which can be used as sync pulse generators. I put it this way because some chips that are not designed as stand-alone sync pulse generators can be used. The first item I looked at was the Ferranti ZNA134E, which is a custom CCIR/EIA sync pulse generator (a bipolar gate array). But at a price of around £22 for one off it seemed rather expensive and, with its camera drive outputs, something of an overkill solution. Two low-cost devices are available however. First there's the Thomson-CSF VDU chip type SFF96364, which has been renamed the EF9364. It requires only a 1.008MHz crystal to produce a mixed sync signal, and costs £8.00. Secondly the Mullard SAA5020 teletext timing chip produces a mixed sync signal, complete with equalising pulses, in conjunction with a 6MHz crystal oscillator. This turns out to be the best bet: it's available for £3.50.

The second problem is how to get the signal into the VCR. Two approaches are possible. One is to modulate the sound and vision on to a spare u.h.f. channel. The

second is to use the VCR's auxiliary or camera input. This approach is simpler but means that the VCR can record audio only in any session, not a combination of radio and TV programmes. The solution I decided to adopt was to design a unit that plugs into the auxiliary inputs, with an optional modulator to fit on the front end for u.h.f. connection.

## Design Approach

A few enquiries revealed that all VCRs have auxiliary video and sound inputs. On a standard UK model the video input is the usual 1V peak-to-peak into 75Ω, through a phono or BNC connector. On older models u.h.f. sockets are used for the input, while the latest types

## Components list

### Resistors:

R1 270Ω  
R2 1k  
R3 1k  
R4 120Ω  
R5 120Ω  
R6 270Ω  
R7 75Ω  
R8 120Ω  
R9 10k  
R10 1k  
R11 10k  
R12 120Ω  
All ¼W CFR type.

### Capacitors:

C1 0.47, 100V film  
C2 0.22, 100V film  
C3 1n plate crimped  
C4 10n plate crimped  
C5 1n plate crimped  
C6 10, 50V min. radial electrolytic  
C7 10n plate crimped  
C8 100, 6.3V min. radial electrolytic  
C9 1000, 10V radial electrolytic  
C10 0.1, 63V polyester  
TC1 10-65p trimmer

### Semiconductor devices:

D1 1N4001  
D2 2.7V e.g. BZY88C2V7 LED  
IC1 7404  
IC2 SAA5020  
IC3 7407  
IC4 7805  
Tr1 2N2222A

### Miscellaneous electrical:

L1 10μH miniature choke. Toko 283AS-100  
3mm red, e.g. CQY85  
T1 Eagle LT700 (Electrovalue)  
X1 6MHz crystal. HC18U case

### Sundries:

PCB VIP001-D  
Case 120 × 65 × 40mm Verobox. Electrovalue or Verospeed 65-2518H  
PL1 2.5mm jack socket, e.g. RS 478-526  
PL2 3.5mm jack socket, e.g. RS 478-497  
PL3 240° 5-way panel mounting DIN socket, e.g. RS 473-284  
9V mains power unit, e.g. Electrovalue 88 – Lux Altai  
6BA nut, bolt and washer for 7805  
Silicone rubber RTV162  
Araldite to secure LED  
Wire to connect jack sockets etc.  
Plugs for connection to the VCR.

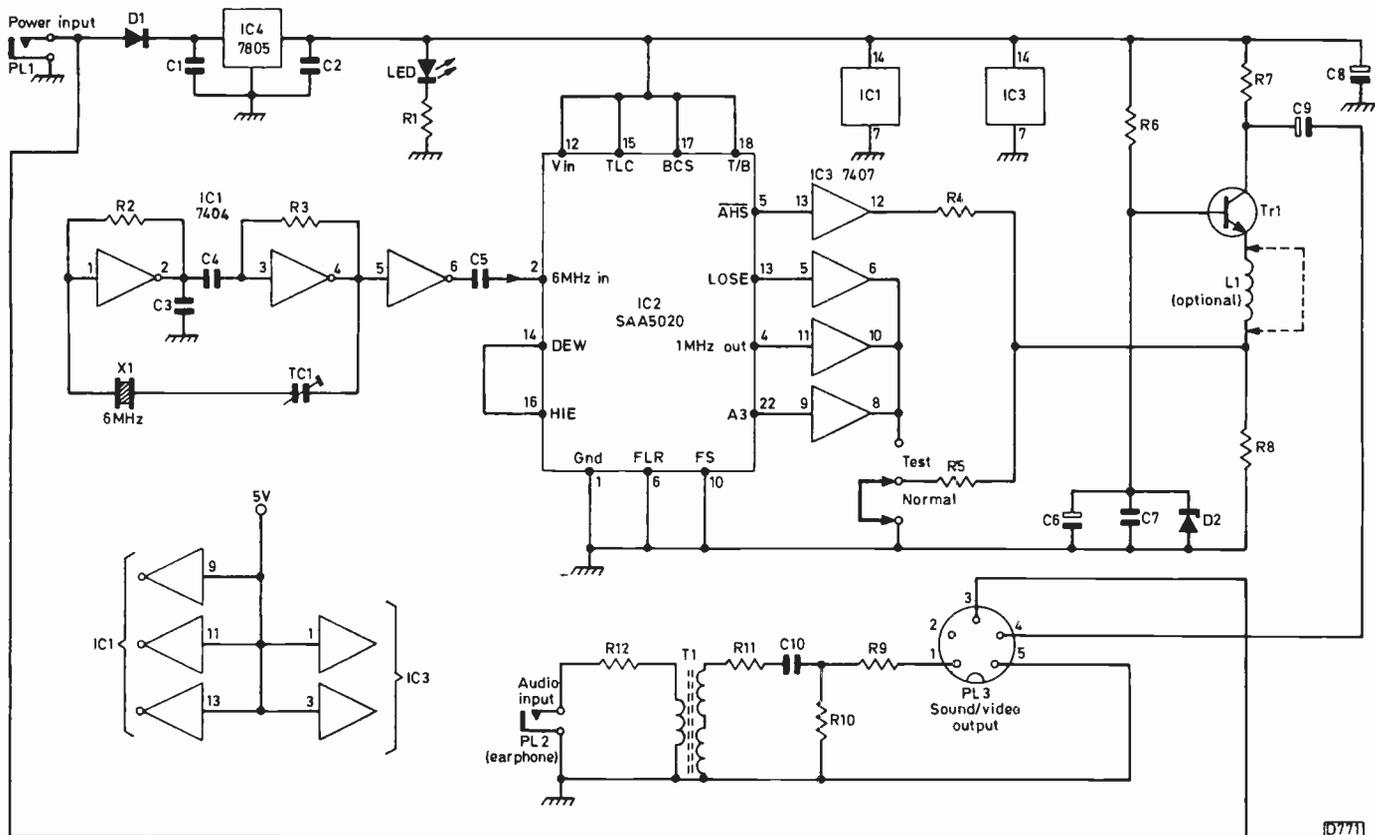


Fig. 1: Circuit diagram of the VCR sound interface unit.

have scart connectors. With Philips V2000 machines an AV adaptor is required to get the signals in. The standard audio input is 250mV peak-to-peak into 1kΩ through a phono or five-way, 180° DIN connector.

The auxiliary input is switchable manually, usually by means of a front panel switch under a cover. Hitachi VCRs change to auxiliary as soon as a phono connector is inserted. On all the machines tried the auxiliary input could be used in the timer mode. On some Sony Beta machines however the auxiliary or camera input must be selected after the timer has been turned on when you set the machine up for a timed recording.

Camera sockets are available on some VCRs, allowing the same auxiliary inputs to enter via the camera connector and also providing the luxury of a built-in 12V power supply. It's possible to use Betamax camera sockets in this way but not VHS ones (see later).

A unit was therefore designed to plug into the auxiliary inputs, using an external power supply. Facilities were also provided to enable it to be connected to a Betamax machine's camera socket, utilizing the VCR's own power. The advantage of this latter arrangement is that the device does not have to be left switched on – it's turned on and off by the VCR's timer. The circuit board has been laid out to allow for as many options as possible.

### Circuit Description

The full circuit of the VCR sound recording interface is shown in Fig. 1. A standard crystal oscillator circuit using two 7404 gates produces a 6MHz clock signal for the SAA5020 sync pulse generator chip. For cheapness I wanted to use a ceramic resonator instead of a crystal, but I found that it was neither accurate enough nor very stable with temperature: VCRs require very precise timing at their inputs.

The SAA5020 is connected to supply a composite sync output from pin 5 (/AHS). A test signal consisting of vertical bars is generated by adding the chip's F1 (1MHz clock), A3 (row address line) and LOSE outputs – the latter provides video blanking. This signal is used only to check for correct operation. It could be left on all the time but I've found that it's better without it. The 7407 provides signal buffering and its open-collector outputs allow for or-tying – this works as an and gate for inverted signals.

The transistor output stage is a current amplifier which has been borrowed from the pattern generator design featured in the January 1985 issue. R6 and zener diode D2 provide 2.7V to bias the base of Tr1. This holds the voltage across R8 at a fairly constant 2V. The junction of Tr1 and R8 is used as a summing point for the sync and video test signals. By virtue of the transistor's gain a composite signal of about 2V peak-to-peak is developed across R7. The output is delivered into 75Ω at 1V peak-to-peak through C9. The value of this capacitor is shown as 1,000μF, but values down to 100μF will work as the VCR fixes the black level. An optional small choke (L1) in series with Tr1's emitter, and the decoupling capacitor C8, cut down any stray 6MHz output from the unit – this would otherwise interfere with the 6MHz sound feed from the VCR's modulator. If the effect is not noticeable on your VCR L1 can be linked out.

Power is supplied from an integral plug mains supply or from the camera socket (see later). Diode D1 is placed in the input feed to ensure correct supply polarity – some mains units make it possible to choose different polarities at their output jack plugs. A 7805 regulator fixes the 5V supply (however did we manage without them?). No heatsink is required. The LED, driven via R1, is fixed on the front panel.

The audio signal could be delivered to the VCR direct,

but I found it useful to use a small battery portable radio which has only an earpiece socket for its output (8Ω). I've therefore included an earphone interface on the PCB, in the form of a small audio transformer (T1). R12 limits the input current – and prevents any damage should the mains unit be plugged into the wrong socket. R11 and C10 act as a simple bass boost tone control, with R10 and R9 adjusting the overall gain. Provision has been made on the PCB for a second transformer to provide a stereo option (see later).

Signals are delivered to the VCR through a five-way, 240° DIN socket (PL3). This gives ground, power (in or out), video out (1V p-p into 75Ω), audio out and a spare pin that can be used for the extra audio channel or pause control signal if a camera socket is being used (see later). The socket also allows for add-on modules such as the modulator already mentioned or a small f.m. tuner unit.

## Construction

The case selected for the unit is a 120 × 65 × 40mm plastic Verobox. The PCB, coded VIP001-D, or a complete kit is available from VIP Ltd., 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX (telephone 0242 581 383). The PCB costs £4.50 and the complete kit (excluding mains adaptor and video leads) £30. The unit built and tested, with mains adaptor and universal video connector, is available at £46. These prices include VAT and postage. Access cards are welcome.

Figs. 2 and 3 show the PCB print pattern and drilling details. Some extra options are included on the PCB – for a Beta camera socket connection and stereo input. Fig. 4 shows the component layout.

Commence construction on the PCB, with all the wire links, diodes and resistors apart from R1 and R5. Note that R3 should be fitted slightly rightwards to avoid trimmer TC1. The integrated circuits and regulator should be added next, the latter fastened with a nut and bolt – no heatsink is required. Solder in the capacitors: note that holes have been provided to allow for different sizes of C1 and C2. C9 is placed on the PCB horizontally and can be secured with silicone rubber (RTV162). R1 can now be connected to the board vertically. Add the rest of the components except R5. The crystal is mounted vertically and can be secured with silicone rubber if desired. Connect short lengths of wire (about 4in.) for the power, LED and earphone inputs, as shown: the power lines should be soldered beneath the board.

Drilling details for the case are shown in Fig. 5. The box is in two parts which are held together with four screws. I had the benefit of a 16.5mm punch for PL3's hole but a smaller drill, a rounded file and some patience should enable the hole to be made accurately. PL1's hole (4mm) should be slightly countersunk inside the case to allow the socket thread to come out far enough for the nut. The small plastic lugs in the middle inside the lower section of the case should be broken off with a pair of pliers. Drill the box lid and secure the LED with Araldite – the glue can be made to flow evenly around the back of the LED by brief application of a heat gun, if available. Wait for the glue to cure before putting the case together.

## Connecting Up

It's essential to make the connections to the plugs before testing the unit. Wire a five-way, 240° DIN plug for sound and vision as shown – ordinary twin screened cable

will do as the run should be short. Terminate the sound lead with a five-way, 180° DIN plug or phono plug depending on the VCR. Terminate the video lead with a BNC or phono plug as required. The audio feed is provided by a length of miniature screened cable terminated at both ends with 3.5mm jack plugs. The mains power unit is fitted with a multipurpose connector: it's best to remove this and attach a 2.5mm jack plug.

## Testing

Testing is done in steps, initially with the board out of the case.

- (1) Fit R5 temporarily as shown in Fig. 4 (link for test).
- (2) Temporarily tack on the power connector PL1. Check that the mains power unit is set to produce 9V. Plug it into PL1. Check that the power consumption is about 110mA and that the 7805 regulator is producing 5V (measure the voltage between pins 7 and 14 of IC3). Turn off.
- (3) Connect the unit to the VCR via PL3. Switch the VCR and the TV set on – switch to auxiliary input. Power the unit. This should result in a display of short, vertical bars on the TV screen – adjust TC1 as necessary. Turn the unit off.

Now put the PCB into its case, secure with the screws provided and wire up PL1 and PL2 as shown in Fig. 4. Fit R5 permanently on the board.

Any radio set with an earphone socket can be used as an audio source, receiving v.h.f./f.m. transmissions – unfortunately TV radiations can be picked up on the long and medium wavebands if the radio is placed close to the set. Turn the radio on with the volume at a reasonable level. Connect it to the sound recording interface unit. Power the unit and sound should come from the TV set's speaker, the screen displaying a black raster. Adjust the radio set's volume to the same level you'd use when watching a TV programme. Now press the VCR's record button. Leave it for a few minutes then rewind and play.

A recording of the radio programme should be heard through the TV loudspeaker. The TV screen will still be dark though there may be the odd drop out due to tape quality – if you find this annoying, turn the brightness down when replaying radio programmes.

Now try using the timer. Set up the clock as usual, switch on the timer and wait. With Betamax VCRs it's necessary to set up the timer on a normal TV channel, switch the timer on, *then* switch to auxiliary input. Replay in the usual manner to get back the radio programme through the TV set, with a blank screen.

Switch back to "tuner" input to record TV programmes. It's advisable to disconnect the mains power when the unit is not in use.

## Options

The sound source can of course be the home hi-fi system, in which case it could be connected direct to the VCR's audio in/out socket. Sound could be replayed through the hi-fi.

The interface PCB has room for an additional audio channel to allow the stereo input from the hi-fi unit's headphone socket to be used. 3.5mm stereo sockets can be bought for this purpose. The audio signals can be kept separate or mixed – by connecting pins 1 and 2 of PL3 together – before entering the VCR. Components are fitted as shown in Fig. 7, though C9 has to be stood up.

The unit can be powered from a Beta VCR's camera socket by adding four extra components and a wire link

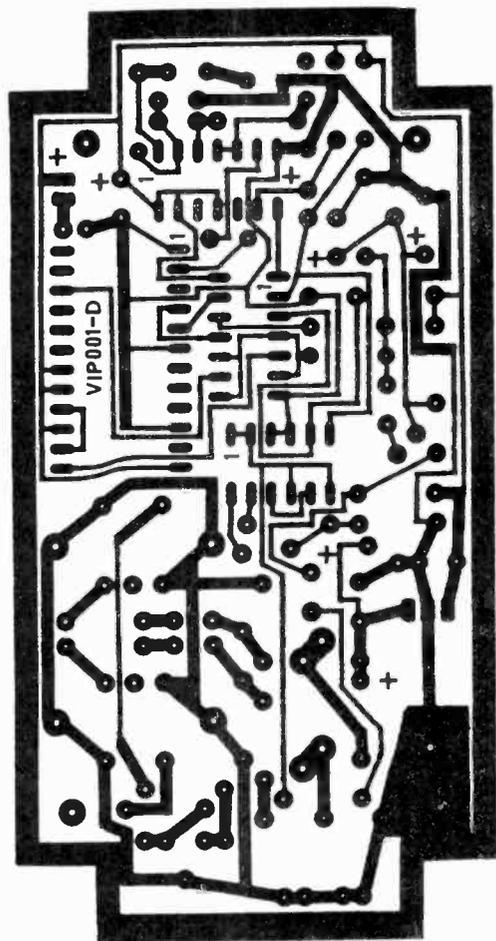


Fig. 2: PCB print layout. Standard, single-sided 1/16in. fibreglass is suitable. To complete, cut along inside the black border line.

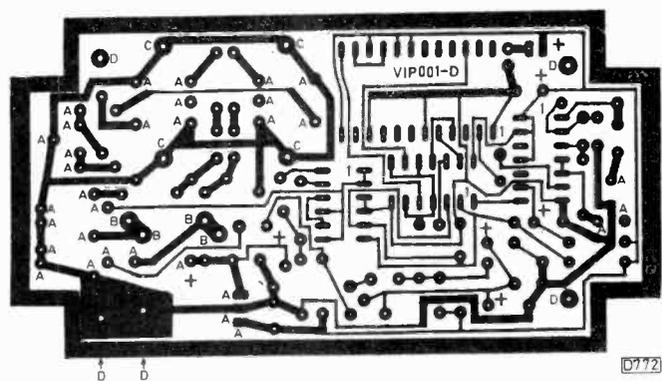


Fig. 3: PCB drilling details. All holes 0.8mm except A = 1.2mm (32), B = 1.5mm (4), C = 1.8mm (4), D = 3mm (5).

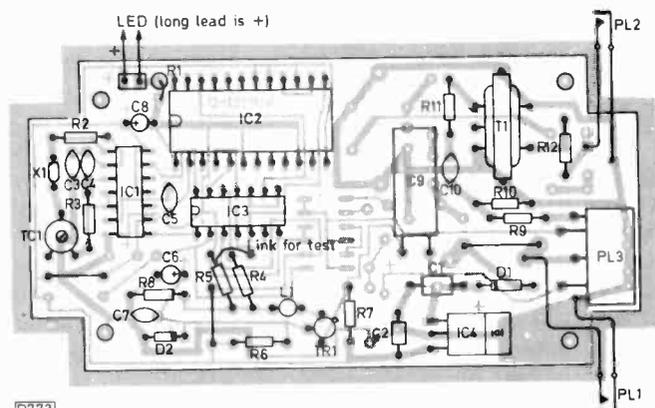


Fig. 4: Component layout. Fit R3 to clear TC1.

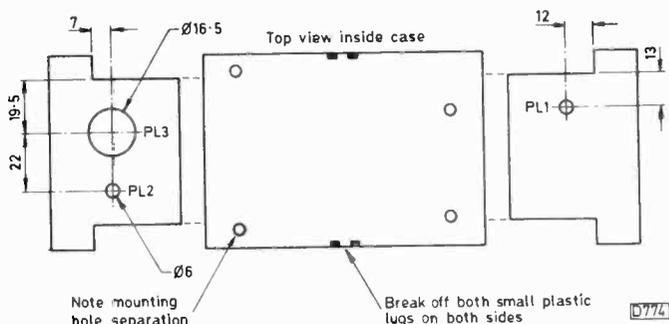


Fig. 5: Case drilling details (not to scale). All dimensions in mm. The lid requires a 3.1mm diameter hole for the LED.

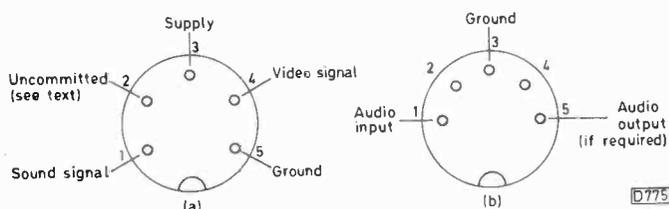


Fig. 6: Connections to the VCR. (a) PL3, looking in. (b) VCR DIN audio socket, looking in.

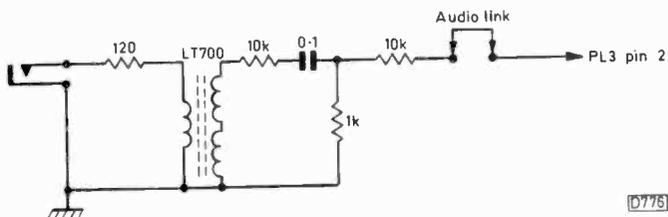


Fig. 7: Fitting an extra audio channel.

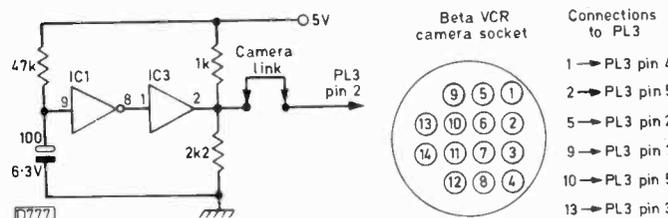


Fig. 8: Modifications for use with a Beta VCR camera socket.

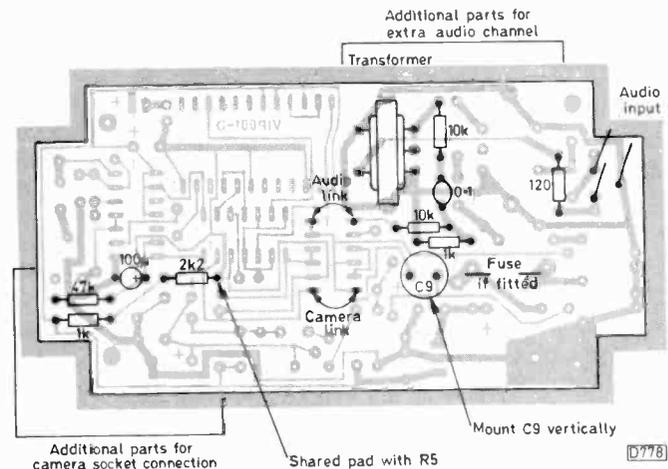


Fig. 9: Component layout details for the extra options.

(see Fig. 8). External power must not be applied to the unit when it's being used in this way. When the unit is attached to the VCR it will power up from cold in "pause" but works perfectly when on the timer. Sony Beta camera

plugs are available from standard suppliers – they use crimp type pins. Unfortunately the VHS camera socket is not usable with the unit as 5V is superimposed on the video signal during record, making some sort of relay switching system necessary to avoid reverse biasing C9.

Space is provided on the PCB to mount a fuse to protect the power supply.

Out of interest, I've successfully used the unit to make audio only recordings on a BVU50 portable Umatic recorder without a camera. It also enabled a tape to be

“formatted” before use. The BVG100 timecode generator locked up to it without any problems. The unit was powered by a feed from the Umatic's battery. It should be possible to record on both audio tracks of other Umatic machines without the need for a camera or other video source.

The design of a small v.h.f./f.m. tuner using the TDA7000 chip and fitted in the same type of box as the interface unit will be the subject of a future article, as will an add-on modulator.

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## Video Topics

A disc that could be erased and recorded as well as being played back would make discs as versatile as tape. Research on the development of such discs has been mentioned in the magazine before. One possibility is to use an amorphous crystal layer whose state can be changed by laser action. In one state the surface is reflective and in the other it's non-reflective. Information can thus be put on the disc and read. Use of different laser temperatures gives read/erase/record. Philips and Matsushita have both carried out research on this technique. An alternative approach is to use a disc with a magnetic alloy layer whose polarity can be changed. Apparently Sony are close to announcing a disc of this type, though it's cost means that it would be used for computer storage applications – the recording density is much greater than with a floppy disc.

At the recent Berlin Consumer Electronics Fair Grundig showed a VCR that incorporated a teletext decoder. In addition to giving teletext displays on the TV set's screen the teletext programme list page can be used to set the VCR's timer. You call up the page with programme times, using the remote control handset, then call up a spot of light which appears on the screen and can be moved about. This spot is moved to a time when a programme is to be recorded and a further control is then operated to set the timer – both to start and stop recording. So all is done in a user-friendly way via the remote control unit.

Toshiba has developed a portable video camera that can be used to make 3D recordings. It's expected to go on sale in Japan early next year at around £1,300.

Ampex will be highlighting the technical features and advantages of its composite digital recording format at SMPTE '87. One key advantage of the format is the fact that it can be integrated cost effectively with existing facilities. The system has been developed by Ampex with support from Sony and is to be submitted to the SMPTE for acceptance as a recording standard. It will be the basis of a family of composite digital VTRs for broadcast and other applications. A 19mm cassette with metal particle tape is used.

New collections of initials continually appear in the field of electronics. Here are a couple more. VISS stands for VHS Index Search System, which is a standard that has been accepted by the VHS VCR manufacturers and is already being used in some of the latest machines. The technique records pulses on the control track to give fast location of the start of recordings. SQ video uses S-VHS tape along with circuitry that provides an improvement on the basic S-VHS specification – without loss of compatibility.

Now for some hardware. Sanyo has introduced, at a suggested retail price of £1,100, an 8mm camcorder with

advanced features. The VM-D1 has a super-fast electronic shutter with a speed of 1/1,500th of a second, making it the world's fastest PAL format camcorder. A unique double-azimuth three-head system gives noiseless, blur-free stills and slow playback of fast-moving subjects, e.g. a cricket ball bowled at over 70 m.p.h. The digital autofocus system provides high precision focusing with an accuracy that's claimed to far surpass conventional infra-red systems.

Ferguson's new top-of-the-range VCR, Model FV14T, incorporates a NICAM-728 decoder to give the user access to broadcast stereo sound as soon as this is added to the UK networks – probably some time next year, though experimental transmissions are likely to be available in some areas in the meantime.

The Ferguson FC05 VHS-C record/playback camcorder replaces the VC03. It offers many features including 400-line picture resolution, a long-play facility, two-speed times six electronic zoom magnification, auto focus, variable shutter speed to enable moving objects to be recorded clearly, HQ picture enhancement, an indoor light switch to adjust for use with fluorescent lighting, automatic fader control, backlight control and a date and time insertion facility.

### Video Processor

The Sansui VX99 video processor provides a wide range of video effects and editing facilities, and has built-in facilities for further expansion. Variable colours, tints and a wide range of wipes, with a hard or soft edge, are amongst the features provided, all for £410. With genlocking or a timebase corrector the VX99 can be used to combine separate pictures in a variety of ways. For further details contact Sansui Electronics UK Ltd., Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middx UB6 0AA (telephone 01 575 1133).

### Business News

Orion is to double VCR production at its Kenfig Hill, S. Wales plant, to 70,000 machines a month – 70 per cent will be exported. In the UK, Orion machines are mostly sold with own-name branding, e.g. through Dixons. Further expansion is planned.

The European Commission has launched an anti-dumping inquiry into VCRs exported from South Korea and by two Japanese companies, Funai and Orion. The inquiry has been initiated by the European Association of Consumer Electronics Manufacturers which claims that European manufacturers are being unfairly undercut by some 20 per cent. Imports of VCRs from South Korea quadrupled between 1985 and 1986 and have since climbed further. In 1986 South Korean manufacturers had six per cent of the market while the two Japanese firms complained about had 9.5 per cent of the market.

# Ike's Come-uppance

Chas E. Miller

You'll recall that Ike Hodge had incurred my disapproval for selling painted dustbin lids as satellite dishes, and that I'd prophesied he would get his come-uppance. I'm never one to say "I told you so", but . . .

I'd not seen Ike to speak to since learning of his latest money-making wheeze, but I'd espied him from time to time dashing around town in his pick-up truck, its back laden with brightly-painted lids. Each time he studiously avoided my gaze, though he must have seen me. Then one afternoon, when I was engrossed in my work, I was startled by a thunderous knocking at the front door. Squeezing past Our Glad, my faithful amanuensis\*, something that's not easy in the small space but is indisputably interesting, I had a quick look through the window in case a creditor had called and was taken aback to see Ike on the step, huddled against the door.

"Lemme in" he said as I opened the door. "Quick, they're after me!"

I grasped the situation at once. Ike had clearly been found out in some misdeed and the victims were now in hot pursuit, bent on summary vengeance. In a case like this there's only one course of action open to a gentleman.

"Get out!" I said loudly. "I've never seen you before in my life!"

"Don't muck about" complained Ike. "You don't want to see me lynched, do you?"

"Only if they're giving complimentary tickets."

"How can you make jokes when your best mate is about to be torn limb from limb?"

"It's a knack. Either you've got it or you haven't."

He clutched my wrist. "Listen, I can hear 'em! Now will you let me in?"

Sure enough the sound of angry voices and heavy footsteps could be heard in the distance. "All right then" I said reluctantly, "though why I should do this beats me."

Relief shone from his face as he pushed past me and leaned panting against the unpaid bills cabinet. By this time Our Glad had left the office to see what was going on. Standing hands on hips she gazed in wonderment at Ike. Her feminine intuition and natural compassion were as usual in evidence.

"Who's this bum?" she asked dispassionately.

"Trouble with a capital T" I said briefly. "There's a mob outside after his blood - how can we help?"

"Lend 'em a tin-opener?" Our Glad suggested brightly.

"Does she write your scripts?" groaned Ike. "Hide me somewhere, can't you?"

"All right. Get in that cabinet with the unpaid bills. No one will look in there - I certainly don't."

He was into it like a rabbit into its burrow. Almost at once there was another knock at the door. Our Glad opened it to reveal a very large, angry gentleman carrying what looked like a horse whip.

"Have you seen an undersized, miserable, two-faced swindler?" he demanded peremptorily.

"Yes, I've been watching the party political broadcasts too" said Our Glad.

"I mean has one been here? I want to get my hands on him."

"What's he done then?" asked Our Glad curiously.

"Only twisted me and my mates out of a lot of money, that's all!"

"About how much?"

"Something like five hundred quid, that's how much!"

"I see . . . no, he's not been here, that's for sure. I did hear someone running down the road a few minutes ago though. I think he went that way."

The angry gent sped off down the road and Ike cautiously emerged from the cabinet, half suffocated.

"Bless you" he intoned. "I knew you wouldn't let me down. Though why you should help a nogoodnik like me I don't know" he added, with a rare flash of sincerity.

"I can think of many good reasons" said Our Glad. "Why don't you come into the office where we can have some tea?"

It all came out over the tea cups. "I suppose this is something to do with your so-called satellite TV dishes?" I suggested. Ike had to admit I was right.

"It was that rotten cheap paint I bought" said Ike bitterly. "It must have been a reject lot because as soon as it rained heavily it all came off and you could read what it said on the dustbin lids - 'Property of Tottingham Council Sanitary Department'. That sort of let the cat out of the bag. That bloke and his mates didn't take it in the proper spirit. Said that wanted a cash refund or blood."

"Told you it would happen" I said triumphantly. "Knew you'd come unstuck! What are you going to do now - you can't hide here forever."

"Well I can't go back home. Heard them talking about presenting me with an illuminated address."

"Why not give them their money back?"

Ike shuddered. "And break the habit of a lifetime? There's got to be something better than that!"

"What about your missus?" asked Our Glad. "You can't let her face the music on her own."

"My wife," said Ike grandly, "is in heaven."

"It's the first time I've heard Watford called that" I couldn't help but interject.

"All right then" Ike said sulkily, "so she's gone to see her mother. Said it was either separate from me or separate me from my breath."

"So you're all alone in the world" mused Our Glad.

"Apart from a howling mob of creditors" I put in, recognising the danger signs. When Our Glad gets that look in her eyes it's time to take to the hills. Ike didn't know that of course and went like a lamb to the slaughter.

"I'm afraid so" admitted Ike.

"In that case I suppose I'd better help you out. I'll sneak you out to my place in the back of my car. You can hole up there till the heat's off."

I wish Our Glad didn't watch so many old black-and-white crime films on the telly. It does tend to colour her speech. Still, her heart's in the right place. Come dusk Our Glad went out and backed her car right up to the front door so that Ike could make an unobtrusive getaway.

In the intervening hours he'd staged a remarkable recovery. He was almost back to his usual insufferably cheerful self.

"You see" he said triumphantly just before he dashed out, "you and your wittering about Providence punishing me! I've fallen on my feet again as usual!"

"If I were you" I said, "I'd opt for the mob." But he was gone. Has Ike jumped out of the frying pan into the fire? Watch this space!

\*You don't get two-dollar words like this in any old story!

# ECONOMIC DEVICES & QUICK SAVE T.V. SPARES

15/80H	3.71	2SA940	0.59	2SC535	0.79	AF180	0.55	BA656	5.46	BC560C	0.14	BDX63A	1.96	BFY52	0.27	BYX71-350	0.92
15/85R	3.30	2SA940-2	2.14	2SC536	0.33	AF181	0.53	BA7100	11.35	BC635	0.30	BDY20	1.21	BFY79	0.49	BYX94	0.16
16039	0.79	2SA950	0.72	2SC537	0.54	AF186	0.53	BA841A	28.98	BC636	0.28	BDY81	1.05	BFY90	0.61	BY956	1.86
16181	1.04	2SA951	1.75	2SC605L	1.16	AF239	0.43	BA843	3.96	BC637	0.24	BF115	0.40	BLY49	2.20	BZ93C30	1.20
16182	1.04	2SA966-Y	1.16	2SC620	0.95	AF279	0.88	BA854	5.76	BC639	0.20	BF117	0.66	BR100	0.29	BZ88 RANGE	0.10
16334	0.98	2SA989	1.36	2SC643A	1.36	AL113	1.36	BAV18	0.21	BC640	0.20	BF118	0.67	BR101	0.65	BZ61 RANGE	0.18
16335	0.94	2SB774	1.15	2SC668	0.67	AN115	3.98	BAV19	0.11	BC879	0.39	BF121	0.25	BR103	0.55	BZ79 RANGE	0.10
16446	0.98	2SB185	1.13	2SC681	4.40	AN155	1.89	BAV20	0.35	BC880	0.31	BF123	0.21	BR303	1.23	C106D	0.46
16600	1.38	2SB375	3.87	2SC682	1.88	AN206	2.58	BAV21	0.12	BCX34	0.40	BF127	0.13	BRC116	0.67	C106M	0.76
16802	1.27	2SB400	0.40	2SC684	1.65	AN208	3.55	BAW62	0.29	BCY70	0.30	BF137	0.29	BRC300	2.01	CA3046	1.55
17052	5.61	2SB405	1.03	2SC693	0.63	AN210	2.28	BAX12	0.48	BCY71	0.21	BF153	0.58	BRC5296	0.77	CA3089	1.86
17053	5.61	2SB449B	6.98	2SC710	0.69	AN211	3.25	BAX13	0.11	BCY72	0.20	BF154	0.26	BRC6109	0.83	CA3090AQ	3.25
17074	9.30	2SB511	2.26	2SC711A	0.50	AN212	1.50	BAX16	0.11	BD115	0.34	BF157	0.33	BRC82	1.08	CA3094	2.20
17089	3.45	2SB54	1.39	2SC717	1.28	AN214Q	1.50	BAX17	0.13	BD116	0.70	BF158	0.18	BRC83	2.19	CA3131EM	2.95
17127	3.51	2SB546	3.75	2SC734	1.43	AN234	5.92	BC107A	0.11	BD124	1.31	BF159	0.18	BRC84	2.08	CBF16848N-071	1.56
17376	1.58	2SB56	2.80	2SC761-Y	0.95	AN236	3.78	BC107B	0.18	BD124P+KIT	0.69	BF160	0.31	BRX44	0.60	CD4001	0.34
1N4001	0.06	2SB618A	2.22	2SC783	3.98	AN239	4.68	BC108	0.15	BD131	0.57	BF167	0.38	BRX49	0.67	CD4002	0.27
1N4002	0.06	2SB631	1.45	2SC790Y	1.85	AN240P	1.25	BC108B	0.15	BD132	0.42	BF173	0.34	BRX84	0.69	CD4008	1.35
1N4003	0.06	2SB643	0.35	2SC828	0.28	AN241	1.71	BC109	0.12	BD133	0.53	BF177	0.35	BRX89	0.69	CD4011	0.29
1N4004	0.08	2SB669	3.67	2SC867A	3.84	AN245	4.49	BC109B	0.15	BD139	0.36	BF178	0.40	BSS38	0.87	CD4012	0.33
1N4005	0.08	2SB681	3.96	2SC876	0.96	AN253	1.10	BC109C	0.12	BD136	0.26	BF179	0.36	BSTBD140G	5.25	CD4013	0.24
1N4006	0.08	2SB695	1.98	2SC930	0.54	AN260	3.85	BC113	0.14	BD137	0.36	BF180	0.36	BSTC0246	6.99	CD4016	0.46
1N4007	0.07	2SB75	1.04	2SC935	8.66	AN262	1.20	BC119	0.36	BD138	0.46	BF181	0.32	BSTC0233	7.25	CD4017	0.82
1N4148	0.03	2SB774	0.61	2SC936	8.66	AN272	8.25	BC126	0.23	BD139	0.34	BF182	0.34	BSTCC0143	3.07	CD4020	1.23
1N4148	0.07	2SB819	1.13	2SC940	4.68	AN295	5.52	BC132	0.14	BD144	0.29	BF183	0.43	BSX20	2.85	CD4021	0.39
1N4448	0.05	2SC1034	6.75	2SD1128	2.90	AN301	3.60	BC135	0.14	BD144	1.70	BF184	0.39	BSY57B	3.49	CD4023	0.28
1N5401	0.14	2SC1050	5.06	2SD1138	0.78	AN302	3.99	BC137	0.18	BD150	1.25	BF185	0.39	BSX20	0.60	CD4025	0.64
1N5402	0.15	2SC1096	1.16	2SD1273	1.56	AN303	4.39	BC138	0.34	BD157	0.67	BF194	0.14	BSY52	1.29	CD4028	0.84
1N5403	0.16	2SC1104	3.98	2SD1453	5.39	AN305	8.95	BC140	0.45	BD160	1.60	BF196	0.71	BSY79	0.51	CD4049	0.46
1N5404	0.15	2SC1106	4.54	2SD152K	2.64	AN306	2.46	BC141	0.34	BD163	0.62	BF197	0.18	BT100A	1.61	CD4052	0.75
1N5408	0.35	2SC1114	3.25	2SD198	3.87	AN315	5.53	BC142	0.23	BD166	0.42	BF198	0.73	BT108	1.45	CD4056	0.30
1N914	0.04	2SC1116	4.95	2SD234	0.49	AN316	2.46	BC143	0.19	BD168	0.73	BF199	0.20	BT119	1.76	CD4069	0.29
IR3403	5.00	2SC1124	1.28	2SD235	0.60	AN318	5.44	BC144	0.08	BD175	0.07	BF200	0.37	BT120	2.17	CD4070	0.66
IS1555	0.31	2SC1129	1.65	2SD242	2.29	AN321	2.25	BC148A	0.11	BD179	0.49	BF218	0.36	BT121	2.48	CD4081	0.35
IS44	0.10	2SC1131	0.64	2SD257	2.94	AN322	5.85	BC148B	0.13	BD181	0.99	BF224	0.17	BT123	1.98	CD4093	0.72
IS5012A	0.81	2SC1158	3.33	2SD292	2.59	AN327	4.59	BC148C	0.11	BD182	0.99	BF230	0.65	BT124	2.48	CD4095	0.30
IS921	0.10	2SC1162	0.55	2SD313	2.59	AN331	3.81	BC149	0.11	BD183	0.99	BF240	0.17	BT151-800R	0.89	CD4511	1.10
2N1303	0.38	2SC1175	5.80	2SD325D	2.26	AN337	3.81	BC149B	0.11	BD184	1.21	BF245	0.50	BT6018	2.42	CD5228	2.04
2N2219A	0.33	2SC1192	2.22	2SD348	16.13	AN340P	1.17	BC154	0.13	BD189	0.69	BF245A	0.52	BT8124	4.89	CD4556	1.47
2N2222	0.38	2SC1213	0.89	2SD350	5.20	AN355	5.98	BC159	0.36	BD190	0.69	BF245B	0.59	CR02AM-8	1.70	CD4556	1.47
2N2646	0.80	2SC1226	1.46	2SD353	8.38	AN370	3.95	BC160	0.40	BD201	0.60	BF246A	2.52	CR02AM-8	1.70	CD4556	1.47
2N2904	0.36	2SC1293	0.90	2SD389	2.41	AN5010	5.70	BC161	0.28	BD202	0.60	BF256	0.38	CV12E	4.09	CD4556	1.47
2N2905	0.43	2SC1306	1.98	2SD401	0.97	AN5111	2.92	BC162	0.28	BD202	0.60	BF256	0.38	CV12E	4.09	CD4556	1.47
2N2906	0.38	2SC1316	10.25	2SD414	1.98	AN5120N	4.05	BC168	0.36	BD203	0.50	BF256	0.38	CV12E	4.09	CD4556	1.47
2N2926	0.15	2SC1317	0.87	2SD471	2.13	AN5132	4.39	BC169C	0.16	BD204	0.61	BF256LB	0.42	CV12E	4.09	CD4556	1.47
2N3053	0.27	2SC1364	0.49	2SD560	2.95	AN5250	3.98	BC170	0.16	BD207	1.79	BF256LC	0.82	CV12E	4.09	CD4556	1.47
2N3054	0.99	2SC1383	1.20	2SD588A	2.36	AN5435	2.80	BC171	0.11	BD208	0.34	BF257	0.34	CV12E	4.09	CD4556	1.47
2N3055	0.61	2SC1391	2.45	2SD600	3.25	AN5610	7.42	BC172	0.12	BD222	0.44	BF258	0.36	CV12E	4.09	CD4556	1.47
2N3442	1.56	2SC1398	0.79	2SD601R	0.65	AN5612	4.68	BC172B	0.27	BD225	0.49	BF259	0.34	CV12E	4.09	CD4556	1.47
2N3702	0.14	2SC1413A	3.05	2SD613	1.03	AN5613	4.63	BC173	0.17	BD228	0.63	BF262	0.57	CV12E	4.09	CD4556	1.47
2N3703	0.18	2SC1446	1.25	2SD621	12.85	AN5630	3.95	BC174B	0.27	BD229	1.05	BF263	0.57	CV12E	4.09	CD4556	1.47
2N3705	0.16	2SC1447	2.07	2SD636	0.55	AN5701N	1.66	BC177	0.35	BD232	0.50	BF271	0.34	CV12E	4.09	CD4556	1.47
2N3706	0.14	2SC1475	0.60	2SD639-R	0.77	AN6250	2.95	BC178	0.26	BD234	0.42	BF273	0.20	CV12E	4.09	CD4556	1.47
2N3707	0.16	2SC1505	1.00	2SD655	0.98	AN6300	4.40	BC179	0.26	BD237	0.47	BF274	0.20	CV12E	4.09	CD4556	1.47
2N3711	0.13	2SC1514	1.69	2SD657	3.50	AN6310	8.74	BC182	0.08	BD237	0.39	BF274	0.20	CV12E	4.09	CD4556	1.47
2N3711	0.70	2SC1514	1.69	2SD661A	0.80	AN6320N	4.28	BC182L	0.10	BD239	0.45	BF336	0.33	CV12E	4.09	CD4556	1.47
2N3711	0.70	2SC1573Q	1.25	2SD731	1.05	AN6340	10.14	BC182LB	0.14	BD240	0.57	BF337	0.45	CV12E	4.09	CD4556	1.47
2N3772	1.71	2SC1578	8.74	2SD773	0.60	AN6341	2.02	BC183L	0.14	BD241	0.39	BF338	0.33	CV12E	4.09	CD4556	1.47
2N3773	1.65	2SC1583	0.50	2SD811	7.65	AN6342	2.77	BC183LB	0.26	BD242	0.39	BF355	0.31	CV12E	4.09	CD4556	1.47
2N3819	0.42	2SC1617	3.89	2SD823	1.98	AN6363	19.00	BC184	0.13	BD243A	0.33	BF362	0.62	CV12E	4.09	CD4556	1.47
2N3823	1.17	2SC675	1.41	2SD837	1.56	AN6371	5.24	BC184L	0.14	BD243C	0.29	BF363	0.60	CV12E	4.09	CD4556	1.47
2N3904	0.62	2SC1678	1.98	2SD841	2.60	AN6387	10.65	BC184LB	0.26	BD244	0.51	BF371	0.50	CV12E	4.09	CD4556	1.47
2N3908	0.62	2SC1741	1.25	2SD856	1.55	AN6531	1.95	BC186	0.27	BD244C	0.79	BF391	0.25	CV12E	4.09	CD4556	1.47
2N4101	1.73	2SC1810	1.70	2SD857Q	1.84	AN6551	1.35	BC187	0.28	BD245C	0.99	BF417	1.87	CV12E	4.09	CD4556	1.47
2N4240	3.30	2SC1815	0.45	2SD882	1.15	AN6552	0.68	BC204	0.16	BD246C	1.25	BF418	1.87	CV12E	4.09	CD4556	1.47
2N4444	0.99	2SC1826	0.67	2SD894	1.63	AN6610	2.40	BC207	0.14	BD253	1.05	BF422	0.52	CV12E	4.09	CD4556	1.47
2N5293	0.50	2SC1829	3.34	2SD898	3.45	AN6677	10.45	BC212	0.11	BD278A	0.60	BF423	0.29	CV12E	4.09	CD4556	1.47
2N5294	0.50	2SC1875	5.85	2SK105H	2.15	AN7111	8.54	BC212B	0.26	BD317	2.60	BF450	0.35	CV12E	4.09	CD4556	1.47
2N5296	0.49	2SC1881K	2.98	2SK152	2.50	AN7114E	1.25	BC213B	0.10	BD318	2.85	BF451	0.29	CV12E	4.09	CD4556	1.47
2N5297	0.50	2SC1893	3.02	2SK34	0.76	AN7115	3.38	BC213LB	0.15	BD375	0.42	BF457	0.47	CV12E	4.09	CD4556	1.47
2N5298	0.61	2SC1906	0.98	2SK41	1.07	AN7120	4.65	BC214	0.10	BD380							

**PO BOX 15, WOLVERHAMPTON, WV2 4AZ TEL 0902 712083**

HA1374	4.80	LR3419	9.37	NE565N	1.33	SKE4F2/08	1.24	STK3042	9.95	TA7312P	2.45	TD62105F	2.50	TDA3560	5.25	TUA2000	8.98
HA1377	4.98	LR3471	9.37	NE645BN	3.35	SKE4F2/06	0.44	STK3044	5.75	TA7313AP	1.36	TD62104F	2.50	TD4357IQ	3.48	TV106	2.37
HA1389R	2.05	LU1141	7.27	NP1106	8.80	SKE4F2/10	1.24	STK4019	4.50	TA7314	5.94	TD62706F	2.50	TD4357E	3.48	TY6010B	2.97
HA1392	1.65	LU52012	5.95	DA202	0.11	SKE4G2/02	0.96	STK4030	10.55	TA7323P	3.15	TD62706F	2.50	TD43590	5.79	U05G	1.14
HA1394	3.95	LU52011	14.95	DA47	0.09	SKE5F3/10	1.60	STK433	6.25	TA7325P	1.15	TD62706F	2.50	TD43591	6.45	ULN2204	11.45
HA1397	3.76	M193	6.83	DA91	0.16	SKS1/10	2.15	STK4332	8.25	TA7339P	1.85	TD62706F	2.50	TD43650	7.95	UPA53C	4.94
HA1398	3.98	M21C	1.13	DA95	0.12	SL1310	3.14	STK435	5.94	TA7340P	5.95	TD62706F	2.50	TD43652	7.95	UPA53C	5.95
HA1406	2.47	M23C	2.83	DC28	2.95	SL1430T	2.32	STK4352	12.25	TA7340P	3.10	TD62706F	2.50	TD43652	7.95	UPA53C	5.95
HA1452	0.85	M293	6.95	DC29	2.15	SL1414	3.69	STK436	4.70	TA7609	3.91	TD62706F	2.50	TD43651AQ	2.95	UPC1009C	8.95
HBF4030AF	2.48	M51102L	4.95	DC36	1.28	SL432A	2.44	STK437	9.65	TA7611AP	3.25	TD62706F	2.50	TD43651A	1.75	UPC1025H	3.00
HD14538	2.07	M5115P	5.24	DC44	0.35	SL439	3.48	STK4372	3.85	TA7616P	5.25	TD62706F	2.50	TD43651A	1.95	UPC1026C	1.24
HD38702-A2	8.95	M51203L	3.15	DC45	0.18	SL471	4.78	STK439	7.25	TA7622AP	12.87	TD62706F	2.50	TD43651A	2.95	UPC1028H	2.00
HD38750A53	11.78	M51231P	0.95	DC75	0.44	SL480	3.98	STK441	10.25	TA7628P	5.06	TD62706F	2.50	TD44280	5.45	UPC1032H	0.62
HD38750A-7	7.25	M5134-9341	4.13	DN236	1.06	SL490	2.44	STK443	10.25	TA7629P	7.50	TD62706F	2.50	TD44400	4.27	UPC1032H	2.96
HD38800A50	14.09	M51353P	5.25	DN782	1.98	SL901B	6.95	STK447	13.45	TA7630P	1.55	TD62706F	2.50	TD44420	2.02	UPC1156H	5.84
HD44801A05	19.98	M51381P	5.09	DN821	1.45	SL918A	1.65	STK460	9.68	TA7640AP	2.29	TD62706F	2.50	TD44427S	3.00	UPC1161C	4.98
HEF4001BP	0.67	M51394P	14.05	PT6042	4.98	SN16861ANO	1.68	STK461	6.10	TA7672P	2.40	TD62706F	2.50	TD44431	9.05	UPC1182H	1.22
HIS11010	8.59	M5142P	6.85	PT8504	2.19	SN16862AN	2.98	STK463	11.85	TA7676P	2.81	TD62706F	2.50	TD44442	3.65	UPC1186H	1.05
HIS11004	6.00	M5144P	2.97	R1038	1.29	SN16966N	10.25	STK466	11.77	TA7726P	12.50	TD62706F	2.50	TD44443	4.10	UPC1186H	1.25
HIS11002	9.50	M51513L	2.06	R2008B	2.13	SN29717N	7.19	STK4833	16.95	TAA320A	1.27	TD62706F	2.50	TD44444	4.15	UPC1185H	1.60
HM6231	9.81	M51515BL	3.23	R2009	1.98	SN29716N	3.66	STK501	6.32	TAA350A	6.45	TD62706F	2.50	TD44445	4.75	UPC1188	7.40
HM6232	10.65	M51517L	2.90	R2010B	1.33	SN29715N	6.04	STK502	5.74	TAA570	1.74	TD62706F	2.50	TD44446	2.10	UPC1212C	1.72
HM6251	4.95	M5192	2.20	R2029	1.33	SN29722AN	8.77	STK5314	12.32	TAA621AX1	4.85	TD62706F	2.50	TD44447	4.08	UPC1230	1.78
HM7103	4.95	M5194AP	5.74	R2030	1.33	SN29727AN	8.77	STK5314	12.32	TAA621A12	2.14	TD62706F	2.50	TD44448	6.73	UPC1238	4.09
HM9032	9.85	M5231L	1.95	R2257	3.71	SN29764AN	0.98	STK7216	14.50	TAA661B	2.62	TD62706F	2.50	TD44449	2.25	UPC1263	4.09
HM9012	3.22	M53274P	1.33	R2265	1.49	SN29767	4.99	STK772	6.95	TAA691	8.58	TD62706F	2.50	TD44450	2.75	UPC1277H	5.85
HM9015	3.24	M54532P	1.71	R2305	1.18	SN29770BN	1.95	STR1096	5.45	TAA700	3.75	TD62706F	2.50	TD44451	3.96	UPC1278H	5.80
HT4207	17.16	M54544L	3.45	R2322	0.59	SN29772BN	2.95	STR4090	11.98	TAA930	4.87	TD62706F	2.50	TD44452	2.47	UPC1351C	1.81
HT4208	20.65	M58478P	8.77	R2323	0.76	SN29771BN	1.48	STR440	7.85	TAA970	2.83	TD62706F	2.50	TD44453	4.20	UPC1350C	1.40
INS4011	0.11	M58485P	13.65	R2354A	2.01	SN29791	2.98	STR441	3.95	TAA110	2.52	TD62706F	2.50	TD44454	5.44	UPC1353C	7.85
IR2403	4.25	MA8001	0.82	R2354B	2.01	SN29798N	5.56	STR451	5.36	TAG232-600	0.79	TD62706F	2.50	TD44455	2.68	UPC1353C	2.13
IR2C05	4.25	MA8003	1.16	R2443	0.88	SN2709	0.44	STR452	8.16	TAG626-600	1.20	TD62706F	2.50	TD44456	7.05	UPC1363	4.50
IR3P06	4.25	MB3705	1.98	R2461	1.50	SN7400N	0.34	STR453	8.06	TBA120AS	0.85	TD62706F	2.50	TD44457	1.49	UPC1362	2.98
IR3P08	2.95	MB3712	1.85	R2540	1.95	SN7401N	0.36	STR454	7.50	TBA120SB	1.05	TD62706F	2.50	TD44458	1.33	UPC1365C	6.98
IR94558	6.25	MB3713	1.69	R2540X	3.30	SN7402N	0.65	STR6020+KIT	8.31	TBA120T	0.65	TD62706F	2.50	TD44459	2.55	UPC1366	2.25
IS751	2.85	MB3730	2.94	R2615	0.67	SN7404N	0.24	TG629V	5.75	TBA120U	0.62	TD62706F	2.50	TD44460	2.90	UPC1366	4.50
ITT425	0.18	MC13002	3.69	RCA16029	2.01	SN7408N	0.27	TG635V	0.73	TBA120A	1.05	TD62706F	2.50	TD44461	8.21	UPC1378H	2.44
I20063GE	5.37	MC1310P	2.25	RCA16600	1.38	SN7410N	0.27	TG636	0.67	TBA1440	1.80	TD62706F	2.50	TD44462	2.25	UPC141C	3.75
I20020GE	5.37	MC1327P	1.33	RCA16802	1.08	SN74121	1.60	TG637	0.97	TBA1441	1.95	TD62706F	2.50	TD44463	4.80	UPC1458	8.66
K1741P	3.46	MC1330P	1.45	RCA17074	6.60	SN7413N	0.37	TG640V	2.11	TBA1441	2.80	TD62706F	2.50	TD44464	2.07	UPC151C	2.95
KA2101	2.92	MC1350P	1.61	RCA17376	1.58	SN74141N	2.65	TG645	1.45	TBA1512	2.65	TD62706F	2.50	TD44465	3.69	UPC2002	1.48
KC581C	6.32	MC1351P	3.96	RCA17523	0.83	SN74151AN	1.51	TG649	1.20	TBA1515	1.10	TD62706F	2.50	TD44466	6.98	UPC300C	2.51
KC582C	3.97	MC1352P	2.50	RCA17523	0.83	SN74154N	1.27	TG652V	0.87	TBA1559	3.15	TD62706F	2.50	TD44467	4.18	UPC324C	4.77
KC583C	1.63	MC1357P	2.15	RCA17523	2.00	SN74190	1.35	TG658	3.08	TBA1670	4.25	TD62706F	2.50	TD44468	2.90	UPC324C	5.15
L200CV	6.89	MC1358P	1.55	RG011-15	1.65	SN7420N	0.34	TG659	2.77	TBA400	2.39	TD62706F	2.50	TD44469	1.76	UPC339C	4.90
LA1201	1.02	MC14001	2.40	RGP101	0.30	SN7430	0.49	TG903V	1.25	TBA440P	1.55	TD62706F	2.50	TD44470	3.85	UPC41C	4.10
LA1210	1.56	MC14013	0.41	RGP101	0.40	SN7440N	0.27	TG905V	2.38	TBA480Q	1.30	TD62706F	2.50	TD44471	1.95	UPC4588C	2.15
LA1230	1.10	MC14493P	5.64	RT402	0.40	SN74472	1.54	TG911V	0.99	TBA510	2.11	TD62706F	2.50	TD44472	0.87	UPC474	5.11
LA1320	2.87	MC14494P	2.15	RT905A	2.38	SN7474N	0.44	TG913V	7.22	TBA520	1.84	TD62706F	2.50	TD44473	0.95	UPC554C	1.85
LA1352	1.75	MC14497	3.15	S1299	1.98	SN7490AN	0.44	TG914V	2.60	TBA520Q	1.68	TD62706F	2.50	TD44474	2.95	UPC566H	2.95
LA1357N	11.07	MC14510BAL	3.75	S175	31.48	SN74512AN	0.53	TG914V	1.92	TBA530	1.30	TD62706F	2.50	TD44475	1.55	UPC574	4.09
LA1363	1.05	MC14511BCP	1.10	S2062D	0.95	SN74515AN	1.65	TG919W	1.08	TBA530	1.30	TD62706F	2.50	TD44476	3.99	UPC574C2	2.40
LA1364	3.02	MC14528BCP	2.15	S2800D	5.54	SN76013ND	1.65	TG934V	1.45	TBA540	1.15	TD62706F	2.50	TD44477	1.75	UPC576H	2.58
LA1365J	0.95	MC1712	3.88	S2800D	3.47	SN76023N	5.15	TG935V	1.95	TBA540Q	1.15	TD62706F	2.50	TD44478	0.90	UPC577H	1.25
LA1385	1.94	MC5192	19.50	S2818	4.05	SN76023ND	3.96	TG954V	0.77	TBA560CQ	1.40	TD62706F	2.50	TD44479	1.68	UPC580C	8.70
LA1387	8.10	MC7724CP	3.49	S3702S	6.15	SN76033N	3.65	TG957V	0.70	TBA560CQ	1.60	TD62706F	2.50	TD44480	0.40	UPC580C	4.13
LA3155	1.25	MC7818C	2.18	S400V	10.50	SN76110N	0.60	TG957V	0.77	TBA570A	1.71	TD62706F	2.50	TD44481	1.99	UPC582H	1.34
LA3301	1.65	MCR1007	1.65	S6080B	8.80	SN76115AN	1.61	TG962V	1.03	TBA570A	1.71	TD62706F	2.50	TD44482	1.68	UPC595	2.95
LA3350	1.43	MCR106-5/6	0.95	SAA1006	5.17	SN76131	1.92	TG964	4.43	TBA641A12	4.13	TD62706F	2.50	TD44483	0.16	UPC596	1.95
LA3361	3.89	MCR2207	2.28	SAA1020	1.75	SN76227N	1.33	TG964	4.30	TBA641B72	3.03	TD62706F	2.50	TD44484	2.07	UPD1514C	8.95
LA3365	3.98	ME0402	0.17	SAA1024	4.76	SN76228N	1.98	TG967	4.85	TBA651	0.87	TD62706F	2.50	TD44485	3.38	UPD2819C	4.98
LA3390	5.52	ME0404/2	0.47	SAA1025	4.40	SN76228N	3.27	TG967	1.74	TBA673	2.60	TD62706F	2.50	TD44486	1.85	UPD4013B	4.00
LA4030P	3.16	ME0411	0.28	SAA11075	2.81	SN76242	8.90	TG967	1.74	TBA700	1.85	TD62706F	2.50	TD44487	0.50	UPD4066B	4.95
LA4031P	3.20	ME6002	0.26	SAA11124	6.25	SN76243	2.50	TG967	1.74	TBA720	2.65	TD62706F	2.50	TD44488	0.53	UPD4066B	4.95
LA4032P	2.35	ME1002	0.28	SAA1130	7.44	SN76396	8.90	TG967	1.74	TBA730	3.55	TD62706F	2.50	TD44489	0.69	UPD533-164	19.25
LA4100	1.25	ME8001	0.34	SAA11174	3.30	SN76533N	2.47	TG967	1.27	TBA750Q	2.90	TD62706F	2.50	TD44490	0.40	UPD8049C-1	11.50
LA41																	

# TV Fault Finding

*Reports from J.R. Armagh, Jim Rainey, Denis R. Parsons, Roger Burchett, Philip Blundell, Eng. Tech., Paul Hardy and David Minster*

## Ferguson TX100 Chassis

It was a rush day and the bench was cluttered with sets. A Ferguson 22D1 was pushed on to the bench, reported "dead". No trouble expected: these sets are normally reliable and easy to service. So I folded the circuit diagram along the line above the line output transformer and laid it on top of the cabinet. With the line output stage feed disconnected and a 60W bulb to check the chopper circuit the power supply was found to be in order. The line output transistor and the diodes fed from the line output transformer were o.k., so the transformer was replaced. Still the power supply tripped out. After mucking about a bit the whole circuit from the line driver through to the line output stage and checked. We found the BC372 driver transistor short-circuit and its feed resistor R143 open-circuit. Naturally replacing these items didn't help.

The circuit slipped off the top of the set and I saw the separate line output stage bit above the fold – the bit applicable to 110° models. There's a fat diode, D28 (BY299), in series with the h.t. feed. This turned out to be short-circuit. Replacing it brought up the h.t. and e.h.t., but there was still no raster. The three outputs from the TDA3562A colour decoder chip were very low at about 1V. Video in was o.k. and there were voltages from the controls. I tried a new i.c., but again no luck. Then I did what we all know to do on Grundigs with auto grey scale, check the first anode voltage at the c.r.t. The reading was around 200V instead of 350V, so I flicked the transformer mounted potentiometer up full. This produced a picture and flyback lines. Turning it down again flooded the raster with white, with no picture. Panic, what had I done?! The TDA3562A outputs were now at 9V. Greater panic.

I switched off and did another job. When I switched on again there was a black raster. This is where we came in! All was well when the first anode voltage was set correctly, for 350V. So the morals are (a) don't fold the circuit diagram when working, and (b) if the set has auto grey scale don't let the voltages fool you if the first anode voltage is not set correctly. Do I hear the skirl of Andy's pipes at Ferguson? . . .

J.R.A.

## Decca 100 Chassis

The bottom half of the scan was missing – it was as if one of the field output transistors wasn't working. The cause of the trouble was reverse leakage in D302 (1N4148) which is in the sync pulse feed to the field oscillator circuit. One thing I noticed about this fault was that adjusting the field hold control VR302 moved the section of scan still present up and down – the hold control had the effect of a shift control!

J.R.

## National Panasonic TC275G (PIX-M8 Chassis)

The fault with this set was reduced field scan with no video information! The 160V line was found to be low at about 95V because the reservoir capacitor C564 (10 $\mu$ F, 250V) was leaky. Replace it along with the surge limiting resistor R559 (3.3 $\Omega$ ).

For no results with a low-frequency clicking noise coming from the power supply check for dry-joints around

C553 (0.12 $\mu$ F, 1kV) and C556 (0.1 $\mu$ F, 2kV) in the thyristor line output stage. Remove them both, clean the lead-out connections and resolder. Note that these capacitors have two connections at each end instead of the normal one.

J.R.

## Ferguson TX100 Chassis

None of the channels could be tuned in, and when the set was switched on from cold the mute LED was permanently on. A known good set was used to make comparative voltage checks. This revealed that in the faulty set the voltage at pin 13 of IC2007 on panel PC1546, i.e. one of the crystal oscillator pins, was 0V instead of 0.2V. Replacing C2022 (330pF) connected to this pin cured the fault.

D.R.P.

## ITT CVC40 Chassis

The problem with this set was no results, so I started by checking for 300V at the collector of the BU326 chopper transistor. This was o.k. Whilst prodding around on the chopper control panel the set came on, so I changed the usual resistors here associated with a dead set, i.e. the two 220k $\Omega$  resistors R808 and R809, but this didn't cure the fault. The trouble was eventually traced to the 470k $\Omega$  resistor on this panel, R806.

D.M.

## Ferguson TX90 Chassis

This set had been got at before it came to me. First I had to replace the mains transformer and the line output transistor. After this everything went well for about 30 seconds, then TR107 (BD839) in the boost regulator went short-circuit and the overvoltage trip operated. TR107 was very hot. All the transistors, diodes and resistors in the regulator section were checked and found to be blameless, so TR107 was replaced and the set was powered via a variac to limit the dissipation in TR107 while further checks were made.

Scope checks revealed that the waveforms around TR107 and TR108 were horrible. The amplitudes were correct but the switching peaks were ill-defined and there appeared to be a lot of what looked like ringing between the peaks. This was why TR107 was getting so hot: it was not being turned on and off properly. The ringing led to about the only component that hadn't been changed, the series choke L120 which had shorted turns. At first glance this choke appears to be just a bit of smoothing, but it's an essential part of the regulator arrangement.

This is the first time I've had to get involved with this rather unusual regulator system, so the repair took a considerable time. One thing is certain: fault-finding would have been impossible without the use of a variac. The choke had probably failed as a result of the action of the previous repairer who had increased the ratings of the fuses connected to the mains transformer to "cure" fuse blowing. The fuse failure had been caused by shorted turns in the transformer. When an uprated fuse eventually blew as more and more turns joined the short there must have been a brief but substantial overload.

Regulation problems can also be caused by the four parallel-connected 47k $\Omega$  resistors R208, R209, R210, R221. Apparently their end caps sometimes make intermittent contact. **P.H.**

### Philips G8 Chassis

The problem with this set was no colour. It was fitted with the combined signals panel. Overriding the colour killer produced unlocked colour, but changing the TBA540 and TBA560C chips made no difference. I eventually found that there was no burst at pin 7 (burst output) of the TBA560C. The cause of the trouble was R3215 (1.8M $\Omega$ ) which was open-circuit, upsetting the bias at pin 10 (burst gate pulse input) of the TBA560C. **P.H.**

### JVC 7575GB

This set appeared to be suffering from loss of ident – the colours for the first quarter of the line scan were incorrect. Not having a circuit I resorted to the trusty can of freezer and eventually found that C324 (33 $\mu$ F, tantalum) was temperature sensitive. Fitting a replacement cured the fault. **P.H.**

### Philips G11 Chassis

The fault with this set was low width when the picture was bright. It was worse when the set was cold. A blast of freezer revealed that C3105 (0.0022 $\mu$ F) in the line driver circuit was responsible. It's part of the damping network across the driver transformer's primary winding. **P.B.**

### ITT CVC30 Chassis

For tuning drift with the CMC60 control assembly check whether R68 (2.2k $\Omega$ ) is open-circuit. **P.B.**

### Tandberg CTV3 Chassis

For a "fingerprint" type of patterning on the colour, try resoldering the earth connections to the *sound* module!! **P.B.**

### Thorn 3500 Chassis

When the set was warm the 60V h.t. supply wouldn't start, so out came the hairdryer and freezer. Freezing either VT605 or VT606 in the monostable/chopper drive circuit would get the set going, but the transistors were o.k. VT606's base bias resistor R620 (2.7k $\Omega$ ) was low in value at 1.9k $\Omega$ . **P.B.**

### ITT Digi-3 Chassis

There's a modification to prevent the set locking out the remote control signals intermittently. Connect a 10k $\Omega$  resistor between pin 6 of IC1404 and chassis – this i.c. is on the IFB286 control unit. **P.B.**

### Toshiba C2225B1/Rank T24 Chassis

Teletext interference was the problem with one of these sets – all the teletext lines were displayed, but they didn't move when the height was reduced as you would expect. I suspected a blanking fault, incorrectly, and chased around various diodes before doing what I should have done first in a set of this age, try bridging likely electrolytics. C313

(4.7 $\mu$ F) which decouples the supply to the field output stage was open-circuit. **P.B.**

### ITT 80-110° Chassis (CVC830 board)

For intermittent or no colour try replacing C721 (100 $\mu$ F) which decouples the 12V supply to the TDA9503 sync separator/line oscillator chip. If it's dried up the sandcastle pulse is affected. **P.B.**

### Decca 130 Chassis

If the black level of one colour keeps varying, check the value of R226 (red), R244 (green) or R251 (blue) – this assumes that the c.r.t. is o.k. These resistors provide feedback in the cascade RGB output stages and often go high in value (the correct value is 100k $\Omega$ ). **P.B.**

### Philips G8 Chassis

Maybe I've been lucky, but this is the first time I've had a no colour fault with one of these sets. This one had the BA00 combined signals panel. Adjusting the line discriminator balance control produced colour, but it was varying all the time. This variation could be seen on a meter as voltage variations at pin 9 (a.c.c. output) of the TBA540Q reference oscillator chip. The fact that the burst was distorted and varying led me to check the line pulse input. R212 (750k $\Omega$ ) in the pulse feed network was found to be almost open-circuit. Strange that the set seemed to be o.k. until a day or two previously, but as it has only just come into my area someone may have tweaked it up. **R.B.**

### Thorn 9906 Chassis

This was a new chassis to me but the fault seemed to be a simple one. The set would go to standby and a sharp thump on the right-hand side of the cabinet would usually start it up again. It was getting more and more temperamental however. The remote standby power panel (PC998) lives on the side of the cabinet, and the problem was that the primary winding of mains transformer T101 was going open-circuit intermittently. The panel is the very devil to remove and worse to refit, as the plastic clips that hold it are very stiff. It's easy to crack the panel when trying to refit it. **R.B.**

### Decca 30 Chassis

Very intermittent brightness variations were eventually traced to a dirty brightness preset. **R.B.**

### Thorn 9800 Chassis

One of these sets plagued me for some time. The complaint was intermittent failure to start. The owner blamed the on/off switch, so to humour him I changed it. My guess was tripping due to an accumulation of nicotine. As the set continued to give trouble I brought it into the workshop – and used the best part of a bottle of meths on it. Made me feel quite light headed! The set was then returned to its smokey lair, only to return shortly after. This time I gave it a closer inspection and discovered that C810 (4.7 $\mu$ F) in the soft-start circuit was bulging and leaking. Replacing this electrolytic seems to have cured the problem – the parallel resistor R810 (390k $\Omega$ ) was beginning to go high in value and was changed as a precaution. **R.B.**

# The MMDS Rebroadcast System

Geoff Lewis, B.A., M.Sc.

There are many areas of the UK, for example the valleys of Wales and Scotland, where it's impossible to receive television pictures or stereo radio satisfactorily. The communities in such areas are often small, making it uneconomic to provide services via the national networks. A number of ingenious receiver/retransmitter arrangements have been devised and installed in an attempt to overcome the problem. These are often privately owned and operated. In addition there are many areas in towns and cities where it's not economic, or even feasible, to bury sections of a cable distribution system. A system known variously as Multichannel Multipoint Distribution Services or Multichannel Microwave Distribution Services (MMDS) has been developed in the USA and Canada and is in use there to provide broadband services, constituting an effective solution to these problems.

## Basics

In its original form MMDS operates in the 2.5GHz band, retransmitting either national or satellite sourced TV signals. Such a service has recently been sanctioned in County Cork, Eire, to provide an extension to a twelve-channel cable network. The band 2.5-2.69GHz is allocated to troposcatter services, both fixed and mobile, in the UK - it's used in particular to provide outside broadcast links operated by the national broadcasting networks. Despite this it can be shown to be possible to operate MMD services without mutual interference.

MMDS is essentially a local, wideband rebroadcast system intended for the delivery of TV signals, including teletext, radio including stereo sound, and data over a restricted area. High-power MMDS, using transmitter output powers of 10-100W, can provide a service extending over more than 40km. Low-power MMDS (1-10W output) will provide a service for up to 10km, depending on the output power, the height of the transmitting aerial and the terrain - a line-of-sight path is essential with such a service. Fig. 1 shows the basic elements of such a system.

## Equipment

Compared with the transmission and reception of TV signals in the C and Ku bands the equipment required at 2.5GHz - low-noise blocks and aerials - represents relatively low technology. The dish reflectors used for both transmission and reception are often of around 50cm diameter or a similar rectangular area. Because of the relatively low frequencies the reflectors can be perforated to reduce the effect of wind and lightly corrugated to increase the mechanical stiffness without introducing significant surface error losses. Such small reflectors can be fabricated from stainless steel to give good resistance to corrosion, providing aerials and mountings that are more robust and less expensive than a Yagi array with similar gain. A 50cm diameter dish has a typical beamwidth of 15°, so pointing accuracy is not a problem - neither is aerial movement in the wind. For transmission purposes one or more reflector aerials can be fed in parallel to provide the coverage required.

At the transmitter the incoming signals are either up or down converted, filtered and then amplified at 2.5GHz. Early high-power MMDS transmitters used one driver and power amplifier per channel. Recent developments in gallium arsenide field effect transistors however allow low-power systems to combine channels into blocks for delivery via a single driver and power amplifier.

The provision of power supplies for rebroadcast transmitters at isolated sites has always been a problem. With low-power MMDS it should be possible to make use of the latest technology in battery operation, recharging from either a wind or a solar generator.

At the receiver the LNB down-converts the 2.5GHz signals to frequencies that allow direct input to standard receivers.

## Practical Systems

The results of high-power MMDS are well documented. Low-power MMDS trials are at present under way in Manitoba, Canada. The results of these trials and the previously mentioned development in Eire are to be reported in a proposed paper at IBC 1988.

There are many ways in which the retransmission bandwidth could be used, the simplest being block translation of the incoming channels. In some cases however this might be wasteful of spectrum space. For example in some areas of the UK the four u.h.f. TV channels are spread over 128MHz, although the spread is more often 80MHz. Retransmission of the v.h.f. f.m. spectrum would call for a further 2.2MHz, while the introduction of local radio in Band II would require a total of 14MHz to transmit the five UK channels. This still leaves spectrum space for some satellite delivered television and a possible computer service. In the interests of good spectrum management it would be an advantage to demodulate the f.m. satellite TV signals before retransmission and remodulate them using a.m., the latter being a minimal bandwidth system.

The Irish Department of Communications will license the band 2.5-2.686GHz for MMDS use, providing for 23 PAL I system channels. To minimise interference these use standard carrier frequency offsets plus vertical or horizontal polarisation. The 23 channels are utilised in

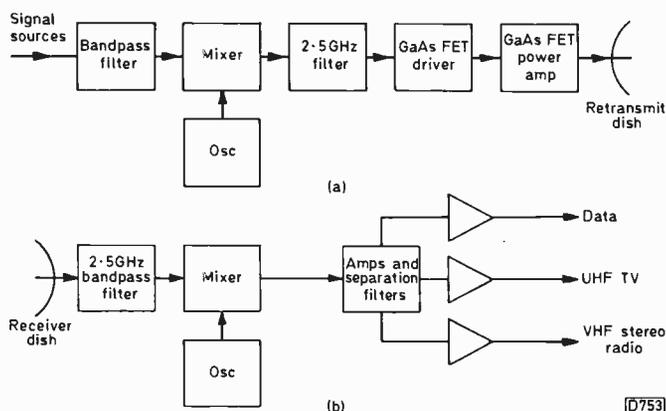


Fig. 1: Block diagram of the transmitter section of an MMD system (a) and the receiver section (b).

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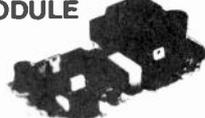
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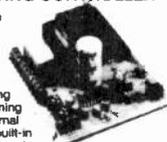
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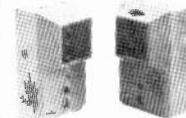
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such a way that at least eleven TV channels can be provided in any area.

Community ownership of the equipment for MMDS operation is logical. Alternatively it would be fairly simple to include scrambling for reception on a subscriber basis. A very useful security system, known as the "comband" system, has been developed in North America: two TV channels are multiplexed into a single channel bandwidth, effectively doubling the system's capacity. Since subscribers require a special demultiplexer to recover the signals the technique acts as a simple scrambling system.

Since directional aerials with a useful gain are used, and only low transmission power is needed, it would be quite easy to provide a subscriber return channel. This could be used to provide a demand link to the cable head end or for a full duplex computer data service.

There's almost complete absence of Sporadic E propagation at 2.5GHz. This, along with the use of alternate signal polarisation and lower powers, means that adjacent or co-channel interference effects are negligible.

### Feasibility

For good picture quality a colour TV receiver typically requires an input of about 1mV into 75Ω. This represents

an input signal power of 13.3nW. As this is provided by a matched aerial system the total power required is 26.6nW. The information given in Table 1 has been calculated on the basis that both the retransmit and receiving aerials have 50cm diameters and an efficiency of 55 per cent. At 2.5GHz the gain will be better than 20dBi. The calculated receiver input signal-to-noise ratio can be achieved using an LNB with a noise figure conservatively rated at 6.5dB. Even if these theoretical figures are in error by a factor of 4 or 6dB, MMDS is still shown to be a highly viable proposition.

Small communities have most to gain from MMDS. It might be difficult to ensure a line-of-sight path in some areas, but it's usually possible to tailor the aerial radiation pattern to suit.

If MMDS had to use a higher frequency band some of its cost effectiveness would almost certainly be lost. 2.5GHz LNBs are already in quantity production for use in Arabsat TVRO systems. Increased use would lead to production economies. MMD services are not competitive with either terrestrial broadcasting or cable distribution. MMDS is able to provide a useful supportive role however. It's expected that the use of MMD services in Eire will help reduce the number of unauthorised rebroadcast systems that have sprung up within the u.h.f. TV spectrum.

Table 1: Calculated MMD system performance.

Transmission path length	10km	40km
Attenuation	120.5dB	132.5dB
Transmitter power output	2.92W	47.3W
Receiver input s/n ratio	52-75dB	52-75dB

### Acknowledgements

I would like to record my grateful thanks to Bill Evans of the Manitoba Television System and Derek Henry of DGH Communication Systems Ltd., Toronto, for their help in the preparation of this article.

# Caught Again

Les Lawry-Johns

First of all I'd like to thank John Wakely of Colliers Wood for his kind letter. It's nice to know that someone has long memories of the years gone by and has benefited from time to time from my jottings. I'm sorry if I'm not as bright as I used to be, but it's over thirty years since I started to write on TV servicing. I was in my thirties then, so we haven't done too badly – with a bit of luck and some help from the little angel who sits on my shoulder.

## The ITT CVC30 Series

Now a word of warning that concerns the ITT CVC32 chassis and its relatives. They keep coming in with the BU208 line output transistor short-circuit. You fit another one and everything is lovely – for a day or perhaps a week, then the nice new BU208 bites the dust for apparently no reason. When this first happened to me I went to bed and dreamed of a Bush T20. The next morning it dawned on me. If you have this sort of thing with a T20 you don't hesitate to look at the scan coil connection plug, and you are not surprised to find the end pin burnt. You wire the lead with solder and the battle is over. With the CVC32 etc. the orange lead, second from the bottom, requires the same treatment. Cut it at the plug and solder it to the panel. The rule is to look at this plug to see if any of the pins show signs of scorch marks and check the panel above the scan coils for dry-joints. I know that the ITT experts will be laughing at this "old one". But we can't all be ITT experts, and we can all be caught at some time or another.

## Notes on GEC Sets

If we get an old GEC C2110 series receiver – this includes the later C2219H etc. – that mucks about heightwise, varying with heat etc., we tend to charge the field driver transistor TR453 with being heat sensitive. This may well be so, but often the 47 $\mu$ F field charging capacitor C457 connected to its base is leaky, upsetting the AC128, BD150 or whatever is fitted in the TR453 position.

Now to something more up to date, the C1403H etc. These little sets are fitted with the ITT CVC1100 series chassis and we get a number in with the 1A chopper power supply fuse Si651 blown. The cause is usually the 120V over-voltage protection zener diode D658 (type ZPY120) going short-circuit. These little diodes seem to have a short life expectancy. Order some now.

## Driven to Drink

A Philips monochrome portable (TX chassis) nearly drove me barmy the other day. It had a very grainy picture that wouldn't respond to anything I did. I looked at it and it sneered.

"You think I don't know you need a new tuner, don't you?"

It didn't answer so I sucked off all the solder from the tuner's legs and selected a new U321 off the shelf. I looked at its legs (I always look at legs) to ensure that it hadn't seen service previously. They were bright and clean and had not seen solder. So I fitted it and switched on,

expecting to see a nice, clear picture. It was the same as before.

I checked the first i.f. stage and the a.g.c. circuit carefully. The latter wasn't working properly. It took me quite a long time before I found a leaky diode. This was replaced and I switched on again. Exactly the same results.

I put the portable to one side and got on with more fruitful activities, to wit a Philips K30 that arced viciously all over the tube base after switching on. I stared at it and then listened carefully. A spitting noise was coming from the line output transformer. Ah, ha! I just happened to have a spare transformer which was fitted in a trice. The spitting stopped and no damage had been done to anything else. At last a success. Now back to the portable.

I checked here, there and everywhere and got nowhere. At last I gave up, removed the new tuner and refitted the old one. Just for fun I gave it one last try. Perfect! The new tuner was faulty, the old one was o.k. and the set's trouble was the a.g.c. fault. What kind of fool am I?

## The Ferguson TX9

The next set in was a Ferguson Moviestar 14in. colour portable (TX9 chassis). It was brought along on a trolley to which the set was securely strapped. We unstrapped it and put it on the bench. "I dropped it" its owner – a lady we know well – said, "and when I put it on it went pop."

I took the chassis out and examined it. There were cracks in a dozen places but the tube was all right. Its owner keeps half a dozen dogs at any one time, so I thought I'd do my best for her. I asked her to call back in a couple of days' time.

It took me a fair amount of time to join up the tracks. I then closely examined the rest of the panel and checked for shorts – there weren't any. With the set still on its side I fitted a new 1.6A mains fuse and switched on. The set started up all right. The tube's heaters glowed and e.h.t. was present. I wrongly thought that the sound was muted because no aerial was connected, but at the time I was more interested in whether the fuse would hold. It did.

I put the set upright and the fuse immediately blew. I turned the chassis up and checked very carefully. No shorts. I put the set upright and checked the h.t. line etc. Many fuses and a mains filter capacitor later I found that with the chassis on its side a track became open-circuit, removing the 24V line output transformer derived supply to the TDA1170S field timebase chip. In short, the TDA1170S was short-circuit and the supply track to it was cracked. The crack was invisible to the naked eye (mine anyway). A meter check proved the point.

A length of wire was used to bypass the faulty track and a new TDA1170S was fitted. This time the fuse held and the screen lit up too brightly, with loud sound. The controls had no effect. This was traced to an open-circuit, which couldn't be seen, on the chassis socket.

Everything was fine until the chassis was put upright. With the set upright there was no sound and no picture. Only the tube heaters glowed. This time an open-circuit track to the 12V regulator was eventually found. It was again invisible and made with the chassis on its side. After this had been attended to everything in the garden was rosy and I regained a trace of my always shaky self-confidence.

When its owner came back with her trolley I was worried in case the set would get shaken up, probably opening more cracks. I asked whether I could run her home in the car, but she declined on the grounds that she

had only a few yards to go up the road. So I laid the set on the trolley carefully, resting it on a thick pad. She had a dozen straps with clips at either end and placed these carefully round the set – without attaching any of them to the trolley! I just had to speak when she came to the last two.

“Uh, the set’s completely covered with straps, none of which is attached to the trolley. What’s to stop it falling off?”

“Oh, I’ll hold it on.”

“What are the straps for then – to keep the set together?”

“You put the last two on then.”

So the set was secured to the trolley and its owner departed, bumping the trolley off the path into the road. Oh well . . .

### The Grundig

A Grundig 2210 with the two-thyristor line output stage was given to us by its owner. He didn’t say why he was parting with it. On examination the only fault seemed to be an open-circuit surge limiter resistor (12Ω, 17W). There are two of these in series with the mains bridge

rectifier. We replaced the resistor, checked everything else and switched on. The tube had a lazy green gun but the picture was fair. I left the set on test.

The next day, a few minutes after switching on, it went bonk. This time the other surge limiter had failed. After replacing it I studied the circuit. There’s no fuse in the supply to the line output stage. I looked at the scan coil plug and decided to clip the h.t. loop and fit a 1A fuseholder. At least this would narrow down the fault possibilities. An hour later the fuse failed.

I changed both thyristors and their mica washers, fitted a new fuse and tried again. The set continued to work all day. Next day the fuse failed. This time I found a leaky diode in the beam limiter circuit, on the earthy side of the e.h.t. supply. I replaced it without much confidence. About an hour later the fuse again failed. By now I was getting fed up. I went over all the soldered joints, particularly those in the line output stage and the connections to the scan coils – remembering the IIT sets etc. All the contacts were found to be good. The set now rests, showing its magenta picture, and I’m expecting the fuse to fail at any moment. Why? Perhaps I’ll be able to tell you next month. Then again, perhaps I won’t.

## A Versatile Bench Transformer

Albert L. Hitchings

Often a particular transformer voltage is required and although you search through your Aladdin’s Cave of electrical goodies Murphy’s Law says ‘you won’t find one’. You need worry no more. All you need is an old transformer with a sound mains primary winding, or you can purchase a kit. RS Components sell suitable kits, cost depending on VA rating of course. They consist of a transformer with a primary already wound. You merely have to put on your own secondary and assemble the laminations etc. Instructions and technical information are supplied with the kit.

Let’s assume that you are going to use an old transformer however. First decide whether it will supply your power demands – it’s always a good idea to make one a little larger than your expected uses require. Check the transformer and measure some of the secondary voltages. Make a note of these, as you will be using this information to work out how many turns-per-volt will be required on the secondary you are going to wind. I suggest rewinding the secondary to provide a 40V output, obtained by connecting four separate windings in additive sequence. Make these secondary windings for 1V, 3V, 9V and 27V. This gives four windings, each one of which is three times the value of the previous one. As a result you can have any voltage you want between 1V and 40V in 1V steps.

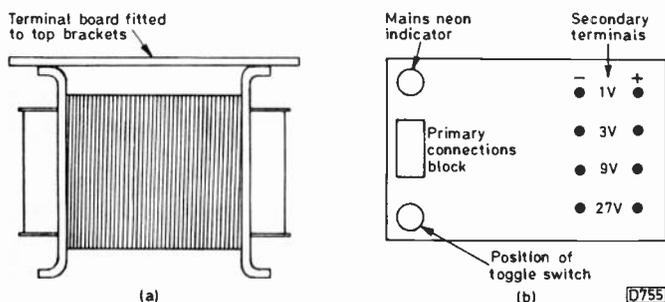


Fig. 1: Suitable transformer termination (a) and terminal/component layout (b).

Note that you should always check the transformer’s output voltage before you connect it to your circuit.

Fig. 1 shows at (a) a simple way of terminating the transformer to provide for the addition of a switch, a neon indicator light and a fuse – always a good feature in any electrical arrangement – and at (b) a suitable layout for the termination board. Fig. 2 shows at (a) the connections for two voltages available, 4V and 18V – the actual links are shown in (b). It may be thought strange to put positive and negative markings on an a.c. supply, but I find that this is a help in adding up or subtracting voltages.

Here are some more examples. 1V added to 9V gives 10V of course. 3V connected in opposition to 27V gives 24V. Should you require higher voltages, add a 3 × 27V winding, i.e. an 81V winding. You will now have available any voltage up to 121V in 1V steps.

Don’t forget to check voltages before making an external connection, and to earth the transformer, i.e. make sure that the iron laminations and frame are effectively earthed.

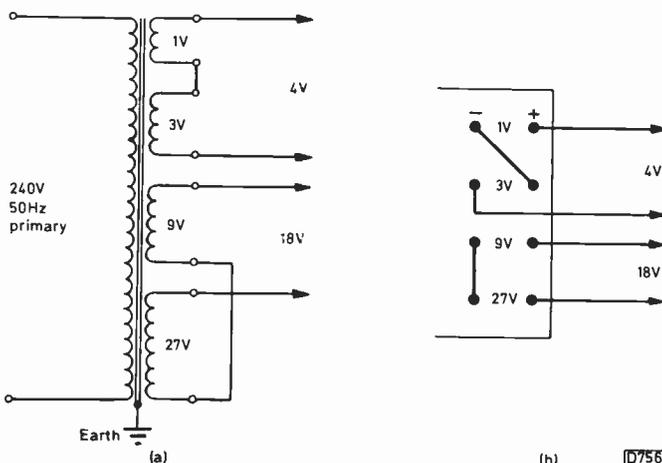


Fig. 2: Transformer windings, showing how to obtain 4V and 18V outputs (a). Links for 4V and 18V (b).

# Service Bureau

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## **FERGUSON 3V06 CAMERA**

This camera has been realigned but there's a green overcast that spoils what would otherwise be a very good picture. There don't appear to be any camera faults. Any idea how best to trim the colour to get rid of the green?

A very common cause of a green cast with a camera whose chroma circuits are working correctly is beam defocusing. Adjusting the focus control (R75) for optimum white balance should cure the problem.

## **ITT CVC25 CHASSIS**

The trouble is that the line output transistor fails the moment the set is switched on. We've fitted a new line output transformer and checked components in the line output stage but the trouble persists. Feeding the set via a 100W bulb produces e.h.t. for a short time then the switch-mode power supply shuts down.

First disconnect the h.t. smoothing choke L9 and fit a 60W light bulb across the reservoir capacitor C51. Switch on and check for the correct 160V h.t. If this is o.k. check that the resistor (R1101) in series with the base of the line output transistor is of the correct value (0.47 $\Omega$ ) and that the waveform at the collector of the line driver transistor has fast rise and fall times. If so and none of the diodes, or the tripler, fed from the line output transformer is faulty it's likely that the flyback tuning capacitor C1102 (6.2nF) is defective – perhaps open-circuit.

## **SONY SLC6 Mk. II**

The drum speed varies in both the playback and record modes. As a result the playback picture breaks up into lines. Adjusting the drum free preset RV9 clears the fault, but it returns after about a week's use. The CX186 drum servo chip has also been replaced.

We've had problems with capacitors in the drum servo in this machine. Check by substitution the small electrolytics around IC3 (C44, C54, C55 etc.). If necessary replace RV9, then R103, R106 and R110 – one has to go about it in this way because of the intermittent nature of the fault. If replacing these items doesn't cure the problem it's likely that the drum motor is in trouble, though this doesn't often happen with these machines.

## **PHILIPS CTX-E CHASSIS**

The problem is no results, with the largest spark gap on the tube base sparking and the chopper output way down at only 60V. When the c.r.t. cap is removed the sparking stops, normal sound returns and the h.t. rises to 122V. I suspect the line output transformer.

Failure of the line output transformer is the most likely

cause of the trouble, as you suspect. Eliminate the tube by retesting with the tube's base off. If the e.h.t. and h.t. stay up, suspect a soft tube rather than a dud line output transformer. Check also the soldering to the transformer's pins. They often become dry-jointed, producing all manner of misleading effects.

## **FERGUSON 3V38**

There are sporadic bursts of what looks like interference on the screen – like a line of teletext, but usually lasting for only a part or parts of a line. The "interference" can occur anywhere but is more frequently seen about two inches from the top of the screen and to a lesser extent about four inches from the bottom. It can be absent for quite a few minutes.

This sounds like dropout. You can prove the diagnosis by confirming that the effect always occurs at the same screen point in the same field of every playback. The cause is usually worn tapes, but it's worth checking that the heads are clean, also that the dropout compensator is working – to do this, temporarily remove DL101 from the circuit (the dropout incidence should then increase). With care and patience a suitable "test" dropout can be frozen, using the still frame facility.

If the lines appear rhythmically and in fixed patterns it's likely that the tape is being creased by fluff or hair on the pinch roller or capstan – close examination of the tape should reveal this.

## **TANDBERG CTV2-4**

The problem with this set is teletext lines two inches from the top of the picture, which is otherwise perfect. Are there any modifications to deal with this?

The presence of teletext lines in a set like this, for which there are no official modifications, is generally due to slow field flyback. A common cause is deterioration of the electrolytics associated with the field timebase. First check that the 24V and -24V lines are present and correct, then check C818, C814, C819, C820 etc. If these are o.k. D804 or Q806 could be leaky.

## **PYE 725 CHASSIS**

The problem is field bounce. Various things have been tried in the field timebase – the 25V supply smoothing components have also been checked. The effect can be minimised by adjusting the set-h.t. control RV917.

The most common cause of field bounce with these sets is excessive h.t. RV917 has to be set for 185V or slightly less at the junction of R972/3. If the picture is satisfactory when RV917's setting is reduced, leave it at that.

## **SONY SLF1**

The problem is with the tape transport. In the playback mode the take-up motor intermittently allows a small loop of tape to appear between it and the capstan. Rewind is the major problem however. The supply motor appears to run unevenly, causing the tape to bounce and snatch, eventually tripping the machine into the stop mode. The effect is of an intermittently sticking brake or motor commutation slightly off. All measurements around the reel motor circuit are correct. The reel motor assembly has been replaced and the brake circuit appears to operate correctly. Removing the brake assembly almost cures the trouble.

This fault is now very common with the SLF1. It's caused by a worn (shiny) upper drum assembly. This

greatly increases the tape running friction. Replacement is the only cure.

# TEST CASE

299

*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.*

Mitsubishi is not a brand we've had many dealings with, though we see enough of the products to be reasonably familiar with them and have most of the service manuals. A man arrived at the Service Department carrying a twin-speed HS307B VCR. Could we clean the heads as he was getting a snowy picture? Of course we could!

On the bench the results we got suggested everything but the heads. While playing back a good prerecorded tape there were many narrow mistracking bars across the picture. In addition the machine would spasmodically flick between the SP and LP modes, with the tape speed altering to match the indication. The sound was very woolly and would fade in and out. Time to consider these related symptoms.

Experienced technicians will have realised that the position of the tape exit guide had wandered. As a result the video heads were crossing several tracks during their sweep across the tape while the path of the tape past the audio/control track head was far astray – hence the machine's indecision about the playback mode (SP/LP switching depends on the pulses picked up by the control track head). Indeed we found that both the entry and exit guides were very loose and could be readily turned between the finger and thumb. No wonder the mistracking was so severe!

So it seemed to be a straightforward case of resetting and locking the two guides. To start with the lockscrews at the bottom of the guide stems were tightened a bit to provide some friction and reduce the "floppiness". An alignment tape was then put in the machine. Careful adjustment of each guide in turn produced an f.m. envelope with a reasonable shape on the screen of an oscilloscope connected to TP-2C on the main panel. The beginning and end of each head's envelope was full-bodied and square, though there was some amplitude flutter in the middle of each sweep and the envelopes here were somewhat "waisted". Very critical adjustment of the guides improved this to some extent. But each time the tape was unlaced to tighten the guide lockscrews fully we found, on the next playback, that the envelopes were misshapen, usually with a sag in the middle. With some difficulty a satisfactory waveform was obtained; certainly record and playback of a broadcast transmission were all right, with full, clear sound.

So the job was wrapped up and the owner collected his

machine, paying a labour charge. Next day – surprise, surprise – the customer was on the phone to us. The gist of his message was that the machine didn't work properly, that he was on his way to the workshop with it, that he wanted it fixed properly this time and that he wasn't going to pay another penny. There was more, but we wouldn't care to repeat it here . . .

Back on the bench we fed various tapes, including the alignment tape, into the machine – and had to agree that the results were erratic. Typical was a broad noise band around the centre of the picture: the f.m. playback envelope had a corresponding waist. After careful and close inspection of the machine in operation we went out back and kicked ourselves hard. Why? See next month's issue for the answer.

## ANSWER TO TEST CASE 298 – page 844 last month –

Not all VCRs use fluorescent display panels for the time, channel, counter and status indication. Early ones used LED segment indicators, while portable gear tends to use LCD displays. The JVC HR7200 (Ferguson 3V29) described last month employs a fluorescent display system that wouldn't light up, even though its supply voltages appeared to be correct and the digit and segment control strobe drive pulses were present.

Indeed there was no electrical fault once all the broken PCB tracks had been bridged. You'll recall that the machine had taken a violent trip downstairs by itself, during which its cabinet and PCBs had sustained damage. Also clobbered it seems was the display panel itself, which like all thermionic, emissive devices should contain a vacuum. Also like a valve or a picture tube the evacuated envelope is sealed at a glass pinch, which is in this case located at the back of the panel. As a result of its mishap the glass spout and its seal had broken off: thus the panel was "soft" and there was no emission and no lighting up. A peep at the rear glass wall would have revealed all, though it's easy to forget about electron beam theory when servicing VCRs . . .

Incidentally, we are encountering an increasing number of these and similar digital display panels that have worn out due to low emission or phosphor ageing – the segment illumination becomes uneven and replacement seems to be the only cure.

(Our apologies for giving the VCR model number as HR2200) last month instead of HR7200.)

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Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by The Riverside Press Ltd., Thanet Way Whitstable, Kent. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/asia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £16, overseas (surface mail) £19 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.



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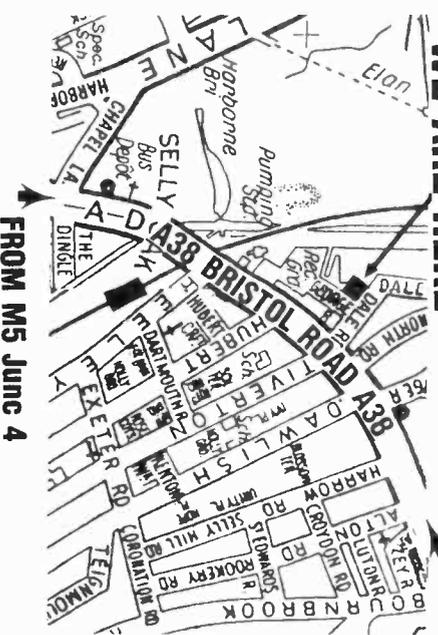
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AN2390	£4.20	AN7213	£3.20	HA1372	£3.50	LA1387	£3.60	M51517L	£2.80	STR6020	£7.20	UPC30C	£2.20	2SA768	£0.95
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AN247P	£2.50	AN7310	£1.20	HA1388	£3.50	LA3160	£1.50	M63705	£1.80	TA7054P	£2.20	UPC566H	£0.75	2SA1015	£0.20
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AN612	£1.80	BA653	£7.50	HA11701	£3.50	LA4182	£2.10	STK430	£5.50	TA7205AP	£1.00	UPC1171C	£1.50	2SC503Y	£0.70
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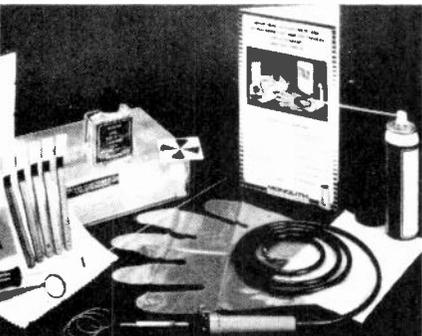
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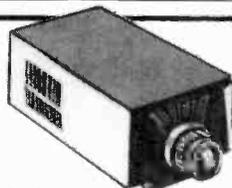
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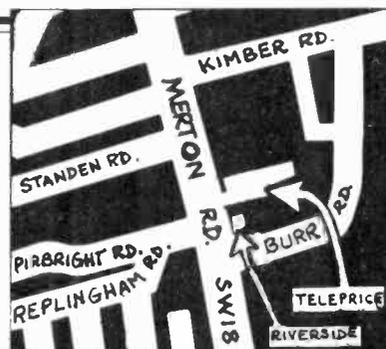
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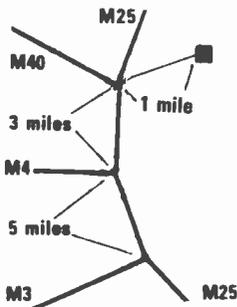
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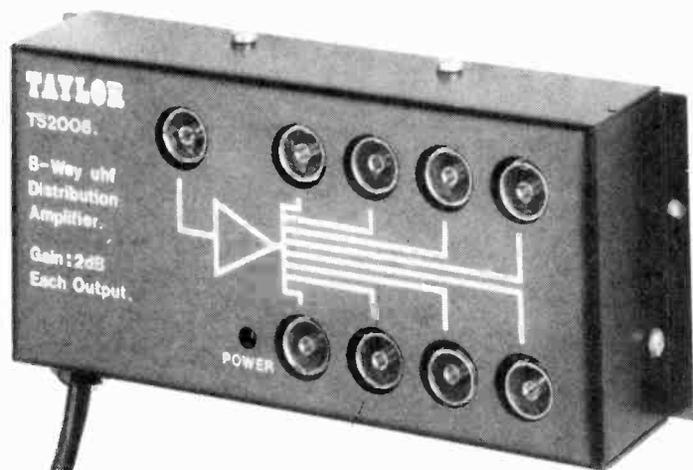
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2SA-1048	£1.10	ZSC-644	£0.25	ZSC-1675	£0.10	ZSD-386	£0.75	AN-5700	£0.60	HA-1196	£1.30	CA-3401E	£2.40	VC-7400	£2.50	VC-7400	£2.50			RW-59	£0.36
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2SA-1102	£1.00	ZSC-717	£0.25	ZSC-1775	£0.15	ZSD-401	£0.45	AN-5732	£1.25	HA-1366W	£1.75	CA-3401E	£2.40	VC-7800	£2.50	VC-7800	£2.50			RW-59	£0.36
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2SA-1106	£1.50	ZSC-738	£0.25	ZSC-1819	£0.15	ZSD-428	£1.50	AN-5900	£1.50	HA-1374	£1.99	CA-3401E	£2.40	VC-8000	£2.50	VC-8000	£2.50			RW-59	£0.36
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2SA-1142	£0.30	ZSC-783	£1.10	ZSC-1875	£0.48	ZSD-468	£0.25	AN-6249	£1.20	HA-11225	£1.70	CA-3401E	£2.40	VC-8200	£2.50	VC-8200	£2.50			RW-59	£0.36
2SA-1145	£0.20	ZSC-789	£0.35	ZSC-1890	£0.20	ZSD-476	£0.45	AN-6250	£0.40	HA-11227	£1.00	CA-3401E	£2.40	VC-8300	£2.50	VC-8300	£2.50			RW-59	£0.36
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2SA-1156	£0.60	ZSC-828	£0.15	ZSC-1913	£0.90	ZSD-525	£0.75	AN-6338	£5.00	HA-11244	£1.65	CA-3401E	£2.40	VC-8500	£2.50	VC-8500	£2.50			RW-59	£0.36
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2SA-1232	£0.80	ZSC-829	£0.15	ZSC-1941	£0.40	ZSD-612	£0.40	AN-6360	£2.80	HA-12002	£1.70	CA-3401E	£2.40	VC-8800	£2.50	VC-8800	£2.50			RW-59	£0.36
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2SA-1265	£1.30	ZSC-941	£0.25	ZSC-1986	£0.45	ZSD-669	£0.45	AN-6651	£0.45	HA-12413	£1.30	CA-3401E	£2.40	VC-9000	£2.50	VC-9000	£2.50			RW-59	£0.36
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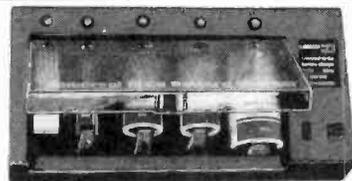
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BC109	£0.19	BR101	£0.29
BC141	£0.30	BR101	£0.40
BC142	£0.30	BR103	£0.84
BC143	£0.30	BR303	£1.40
BC147A	£0.10	BSS101	£0.08
BC147B	£0.12	BT116	£1.86
BC148	£0.14	BT151-800	£1.60
BC149	£0.12	BU126	£1.68
BC157	£0.12	BU205	£1.80
BC159	£0.12	BU208	£1.48
BC171	£0.15	BU208A	£1.40
BC172C	£0.28	BU208D	£1.90
BC177B	£0.28	BU326A	£1.80
BC182B	£0.11	BU406	£1.00
BC182L	£0.12	BU406D	£1.20
BC183	£0.10	BU407	£1.20
BC183L	£0.12	BU407D	£1.20
BC184	£0.13	BU426A	£1.54
BC184L	£0.13	BU500	£2.30
BC186	£0.34	BU508A	£2.00
BC212	£0.10	BU508D	£1.95
BC212L	£0.14	BU526A	£2.20
BC213	£0.14	BU806	£1.60
BC213L	£0.14	BU807	£1.60
BC214	£0.14	BUX84	£1.50
BC214L	£0.14	BYW56	£0.34
BC237	£0.14	BYW96	£0.80
BC238	£0.14	BY1276P	£0.18
BC239	£0.14	BY133	£0.12
BC300	£0.50	BY164	£0.56
BC303	£0.48	BY179	£0.75
BC307	£0.13	BY206	£0.16
BC308	£0.14	BY210-800	£0.32
BC305	£0.10	BY227	£1.25
BC309B	£0.12	BY228	£0.80
BC327	£0.16	BY229-800	£1.00
BC328	£0.14	BY298	£0.24
BC337	£0.16	BY299	£0.26
BC337L	£0.16	BYX10	£0.28
BC338	£0.16	BYX55-600	£0.36
BC413C	£0.15	C106D	£0.46
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BC548	£0.12	MJE340	£0.56
BC549	£0.10	SKE4F	£1.20
BC557B	£0.12	SKE5F	£1.80
BC558	£0.09	STR441	£0.05
BC639	£0.17	STR451	£0.05
BC640	£0.20	STR6020	£0.20
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BCY71	£0.29	TIP30C	£0.50
BCX30	£0.15	TIP31A	£0.54
BCX36	£0.15	TIP32A	£0.54
BD124P	£0.76	TIP32C	£0.46
BD131	£0.46	TIP33	£0.85
BD132	£0.50	TIP41A	£0.45
BD136	£0.34	TIP41C	£0.45
BD137	£0.40	TIP42A	£0.45
BD138	£0.32	TIP42C	£0.45
BD139	£0.20	TIP47	£0.82
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BD203	£0.62	TIP117	£0.72
BD222	£0.46	TIP132	£1.10
BD225	£0.47	TIP137	£1.10
BD233	£0.60	TIP2955	£0.98
BD234	£0.44	TIP3055	£0.98
BD237	£0.48	VA1104	£0.90
BD238	£0.48	VA8650	£0.56
BD239	£0.42	7805	£0.82
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BD708	£0.84	IN4148	£0.04
BD709	£0.84	IN4446	£0.04
BDX32	£1.88	IN5410	£0.13
BF180	£0.36	IN5402	£0.17
BF178	£0.10	IN5404	£0.15
BF194	£0.12	IN5406	£0.17
BF195	£0.12	IN5407	£0.18
BF196	£0.16	IN5408	£0.24
BF197	£0.22	2N3055	£0.80
BF198	£0.15	2N4444	£2.00
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HA1368R	£2.40	TA7193P	£6.95
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HA1389R	£2.54	TA7204P	£2.00
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Idler Kit SLC6	3.35	NV3370430 IDLER	VXP0433 3.06	CAPSTAN MOTOR HRD120/3V35	24.75	NV366A	V500257 11.21
SG613 (SG6533)	9.05	NV81030/5070 IDLER	VXP0521 2.56	DRUM MOTOR HR3660/3V22	24.75	NV370	BLACK OR SILVER 11.30
<b>VIDEO HEADS REPLACEMENT HEADS</b>		NV600688 IDLER	VXP0515 3.18	T/UP IDLER (LARGE) HR3660	5.50	NV730	V500357 38.50
JVC/FERGUSON ETC 3HSS-V	24.50	NV730 IDLER	VXP0581 3.18	T/UP IDLER (SMALL) HR3660	5.50	NV777	NV-A17E 38.50
TOSHIBA 9600	33.50	NV777778 IDLER	VXP0463 3.18	T/UP IDLER HR7200/3V29	1.30	NV1000	V500117B 36.87
PANASONIC NV-366 (4 HEAD)	44.50	NV2000 SERIES IDLER	VXP0329 1.24	REEL IDLER HR7200/3V29	2.20	NV7200	BLACK OR SILVER 48.96
PANASONIC NV-330/777	38.45	NV2000 (PLAY/TAKE UP)	VXP0331 1.24	REEL IDLER HRD120/3V35	2.96	<b>ALL OTHER PAN. REMOTES AVAILABLE</b>	
PANASONIC NV-333-2000/7000 ETC	26.50	NV7000 SERIES IDLER	VXP0344 1.24	T/UP CLUTCH HRD110/120/125	2.20	<b>GOODIES SELECTION</b>	
SHARP UNIVERSAL	34.10	NV7000 (PLAY/TAKE UP)	VXP0343 5.76	CASSETTE CARRIAGE 3V45	33.60	SONY BETAMAX ALIGNMENT TAPE	36.56
SONY SLC5-6 7/8000	27.80	NV7100 (PLAY/TAKE UP)	VXP0521 2.56	CASSETTE CARRIAGE 3V35HRD120	33.60	PANASONIC VHS ALIGNMENT TAPE	88.10
SONY SLC9	43.50	P ROLLER NV333-366	VXP0432 8.51	PINCH ROLLER (ALL MODELS)	3.90	SONY V.8 BATTERY PACKS NP22	84.95
SONY SLC20/30/40/F1	34.10	P ROLLER NV370	VXL1154 7.58	<b>VIDEO BELT KITS (ORIGINAL)</b>		SONY OPK2038 TEXT BOARD	65.31
FISHER FVDH-615 ETC	34.10	P ROLLER NV2000	VXP0330 10.66	<b>VIDEO BELT KITS (REPLACEMENT)</b>		OPK115 T60ARD+LEADS - KV1442	84.40
<b>PANASONIC ORIGINAL HEADS</b>		P ROLLER NV7000	VDP0759 2.56	PANASONIC NV-2000 SERIES	1.65	SONY Y.8 BATTERY PACKS NP22	84.95
NV100 2000	VEH0171 41.40	TENS BAND NV233366/777	VZ01299 2.08	PANASONIC NV-7000 SERIES	3.65	SONY OPK202A SECAM ADAPTOR	53.20
NV180	VEH0252 62.10	TENS BAND NV370/730	VZ01665 1.95	SONY SLC5-7	5.40	SONY REM. RUBBER PAD-RM632/6	5.40
NV230	VEH0296 41.40	TENS BAND NV2000/2020	VZ00076 5.92	SONY SLC6	8.26	SONY CASSETTE MOTOR DNF1001B	22.53
NV333	VEH0103 41.40	TENS BAND NV7000/7200	VZ00078 3.08	SONY SLC5	8.82	TELESCOPIC AERIAL KV1400/1612	7.86
NV366	VEH0174 62.10	REEL MOTOR NV333-366	MYN13V5L 15.83	SONY SL8000/8090		TELESCOPIC AERIAL KV1412/1430	6.53
NV600	VEH0209 62.10	<b>ORIGINAL SONY VIDEO SPARES</b>		<b>VIDEO BELT KITS (REPLACEMENT)</b>		VIDEO COPYING KIT (UNIV.)	4.25
NV688	VEH0210 62.10	FF & REW ASSY SLC20/30/40/HF100	5.40	SANYO VTC-5000	1.65	SCART KIT (UNIV.)	5.60
NV788	VEH0201 78.38	SPLIT-MOD SLF25/HF100/C20 ETC	51.10	SANYO VTC-5300	2.29	<b>STYL AVAILABLE FOR MOST MODELS</b>	
NV810	VEH0294 59.11	GUIDE PIN KIT SLF1/C9/C20/30/40	6.65	SANYO VTC-5500	1.78	<b>MANUALS (0 VAT RATED)</b>	
NV830	VEH0266 70.38	DC/CC CONVERTOR SLC9	22.53	JVC HR-3330/3360/3660/3V16/22	2.50	ALL SONY & PAN TV MANUALS	5.30
NV850	VEH0231 93.84	CARRIAGE MOD KIT SLC9	6.40	JVC HR-7650	2.10	ALL SONY & PAN VIDEO MANUALS	16.86
NV870	VEH0288 93.84	CARRIAGE COMPLETE SLC9	68.10	HITACHI VT111	1.70	<b>SONY SWITCHES</b>	
NV2000/2010	VEH0201 78.38	UPPER DRUM UNIT SLC9/SLF1	27.85	HITACHI VT3000	2.58	POWER TV REMOTE (QUOTE MODEL)	4.98
NV3000/7000/7200	VEH0131 41.40	LOADING RING ASSY SLC9/SLF1	18.85	HITACHI VT8000	1.31	POWER TV NO-REMOTE (QUOTE MODEL)	4.98
NV8600	VEH0121 41.40	CAPSTAN MOTOR SLC5/7	33.58	SHARP VTC300	2.28	TIMER SWITCH C57	21.64
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NV97	VEH0121 41.40	IDLER KIT SLC5/7	4.80	SHARP V3300	2.20	RELAY SOUND SLC5/7	4.98
NVG10	VEH0287 62.10	IDLER KIT SLC6	3.68	TOSHIBA 7540	2.58	<b>SONY SEMICONDUCTORS</b>	
<b>HITACHI/SANYO ORIGINAL HEADS</b>		FWD LIMITER ASSY SLC5/7	2.72	TOSHIBA 9600	1.60	SG613/SG6533	9.95
HITACHI VT11	27.50	PINCH ROLLER SLC5/6/7	1.90	SONY SLC5/6/7	2.73	SG264A	4.98
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SANYO VTC3000/5500	44.50	REEL MOTOR SLC6 MKII	23.78	RM604B KV1612 MKII/2204	43.76	2SC3867A	2.98
<b>SONY ORIGINAL HEADS</b>		LOADING PULLEY SLC6	1.00	RM615 KV2056/2212/16/2705 ETC	52.38	2SC1114 - 2SC1454	6.40
EVA300/EV5700 (RED)	DVR-04R 88.82	PLEASE ASK FOR ANY PARTS NOT LISTED		RM632 KV2062/66/2216/17 ETC.	37.50	2SC1316 TRS ASSY	7.85
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		SHARP REEL DR. IDLER VDC3000 ETC	2.55	RM1230 SLP30	37.50	TDI2652	4.98
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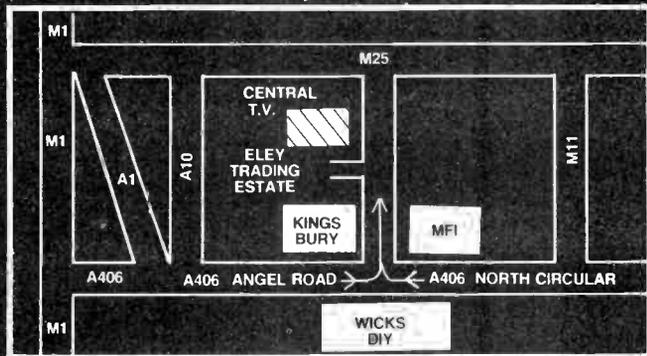
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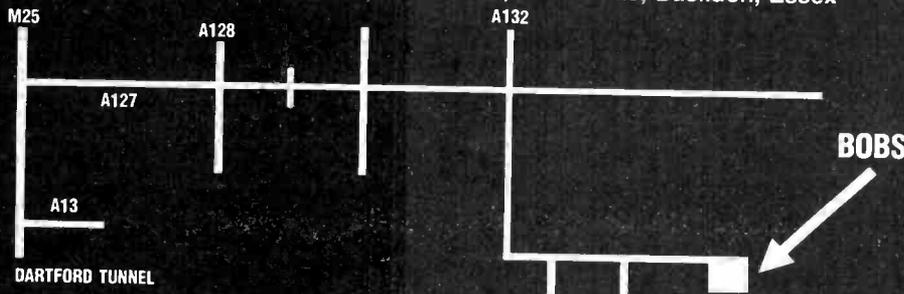
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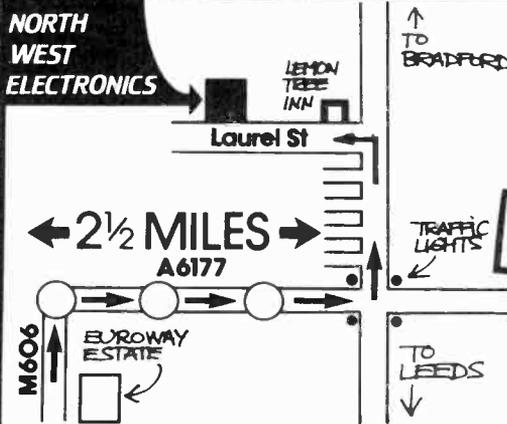
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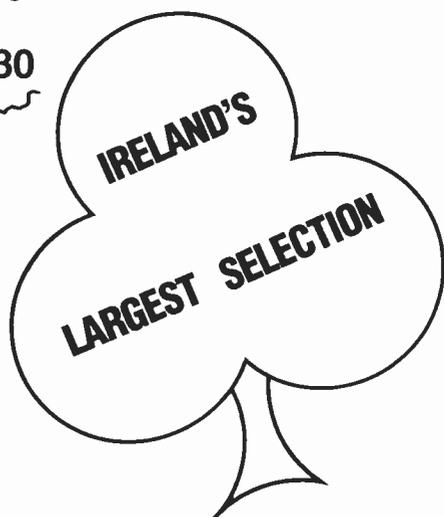
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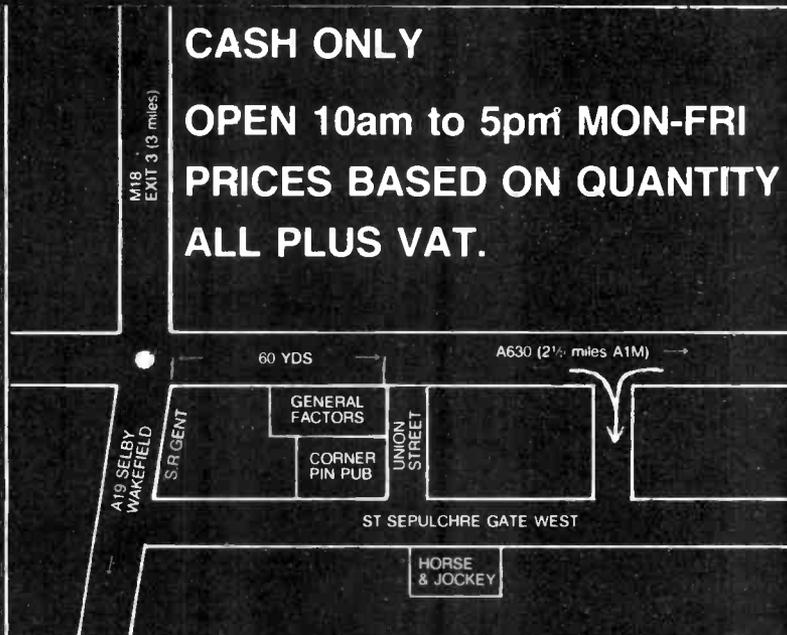
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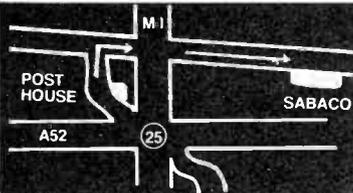
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11/87

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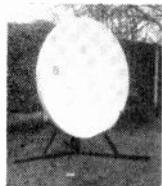
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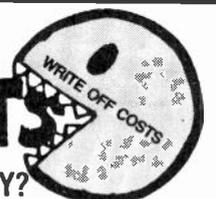
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