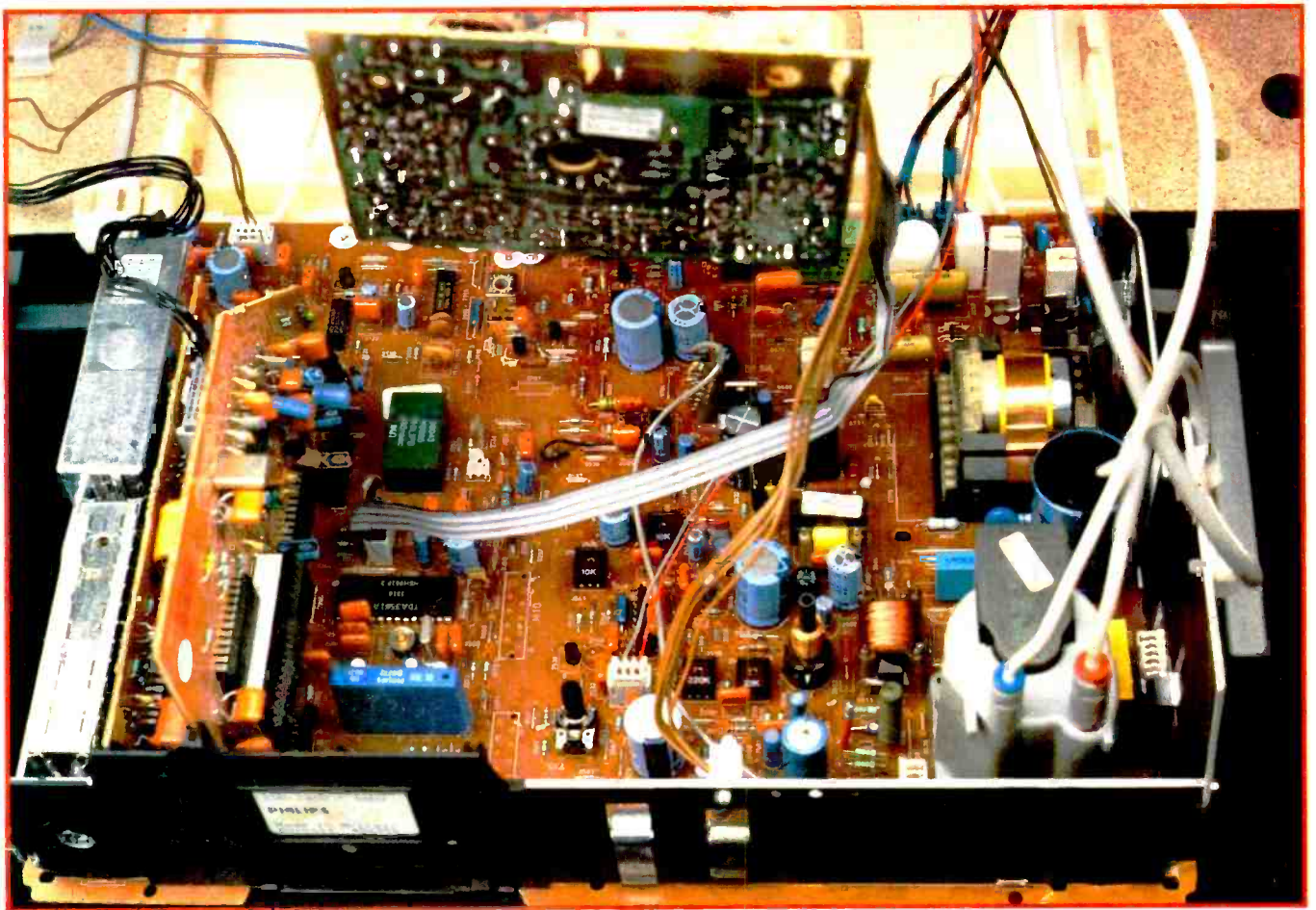


JUNE 1987

Australia \$2.20, New Zealand \$2.95 (inc. GST), Malaysia \$5.95 **£1.30**

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

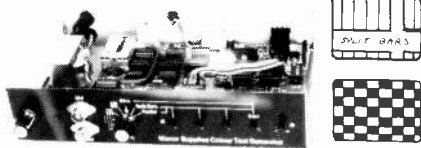


Recent Philips TV Chassis
Build this 25kV EHT Probe
Low-voltage DC Operation
The Video 8 ATF System
Vintage TV • VCR Clinic
TV Fault Finding • DX-TV

MANOR SUPPLIES

MKV PAL COLOUR
TEST GENERATOR FOR TV & VCR.

TEST
DEMONSTRATIONS
AT 172
WEST END LANE



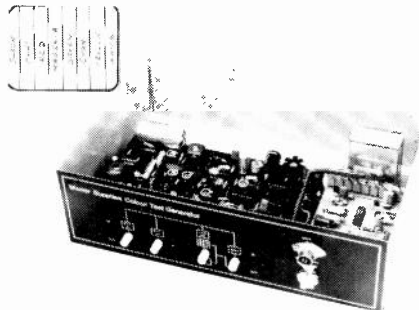
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ 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 XMII
(TIFAX) **£28.00** (untested £5.00) 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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LOPTS, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

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PHILIPS G11 6 position touch tune channel selector units **£16.00** p.p. £1.80
(can replace earlier mechanical selector unit).

PHILIPS G11 PANELS (tested).

Power, Frame, IF, decoder **£18.00** each p.p. £2.00. Scan **£28.00** p.p. £2.80.

PHILIPS G11 PANELS ex rental (untested).

Scanner **£10.00**, Frame, Decoder **£5.00** p.p. £2.00.

PHILIPS G11 Ultrasonic Non Text Replacement Handset. New. **£22.50**
p.p. £1.50 (other types available).

PHILIPS HANDSETS Ex rental. Teletext. Untested. KT3, K30, CTX, KT4,
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COLOUR MANUALS p.p. 50p.

PHILIPS G11 **£3.50**, KT3 **£3.50**, CTX-E **£1.50**, CTX-S **£1.50**.

THORN REMOTE CONTROL HANDSETS

TX9 ULTRASONIC (3-button) **£15.00**; TX9, TX10 Infra red (type 725)

£18.00; TX9, TX10 Infra red Teletext **£20.00**, p.p. £1.20.

TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. 50p.

TX9/TX10 Teletext interface panel (1524) **£5.00** p.p. 80p.

THORN TX9 Ultrasonic Remote/Control Receiver panels. **£8.50** p.p. £1.50.

TX9, TX10 Facia, control panel incl. infra-red remote receiver **£8.50** p.p. £1.80.

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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UHF Modulator, Battery Operated, also gives Peak White & Black

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£1.40.) ADDITIONAL GREY SCALE Kit **£2.90** p.p. 45p.

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Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. £2.30.

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Case, Panel Meter Indicator - can be adapted for latest CRTs **£29.50**

p.p. £2.80.

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GEC 2110 PANELS Sound **£2.50** (tested) p.p. 80p.

GEC 20AX Line Time Base **£18.00** p.p. £2.00.

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p.p. £1.50.

ITT CVC30 SERIES PANELS SURPLUS (untested) **£5.00** each. CMP31,

CMF31, CMA30, CM532, p.p. 80p; CMD33, p.p. £1.80.

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THORN TX9 Panels salvaged ex factory for spares incl. Electrolytic &

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THORN 9000 IF/Decoder Panels Salvaged. For spares **£2.50** p.p. £1.80.

PHILIPS G8/G9 IF/Decoder Panels for small spares incl ICS **£2.50** p.p. £1.60.

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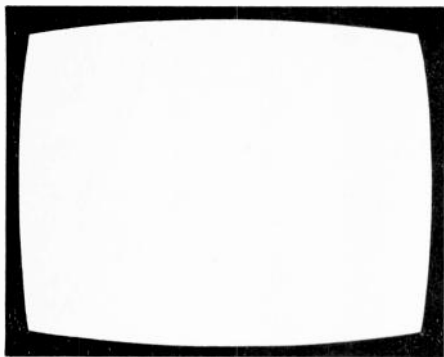
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TELEVISION

June
1987

Vol. 37, No. 8
Issue 440

On sale May 20th

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BACK NUMBERS

Some back issues published during the last six months are available from the Editorial Office at £1.40 inclusive of postage and packing. Address as above.

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").

this month

- 525 Leader**
- 526 TV Fault Finding**
Servicing hints and fault reports from Mick Dutton, Philip Blundell, Eng. Tech., Richard Roscoe, D. Parsons, Roger Burchett, Michael Dranfield and Philip H. Ireland.
- 528 A Guide to Coarse Servicing** *Chas E. Miller*
It was inevitable that Ike Hodge would get involved with satellite TV sooner or later. How the master went about it.
- 531 Teletopics**
News, comment and developments.
- 532 Recent Philips CTV Chassis** *Harold Peters*
The evolution of Philips CTV chassis from the KT3/K30 series to the most recent CP90, taking in the KT4/K40, CTX, CF1, 2A and 2B. With servicing hints and a description of the operation of Philips' self-oscillating switch-mode power supply (SOPS).
- 538 25kV EHT Probe** *Andrew J. Heron*
With care and due attention to safety factors an e.h.t. probe/meter can be built for a modest outlay.
- 539 Long-distance Television** *Roger Bunney*
Reports on DX conditions and reception and news from abroad. Thoughts on low-profile aerial systems for use where problems arise over planning permission.
- 542 VCR Clinic**
Fault reports from Alfred Damp, Eugene Trundle, Philip Blundell, Eng. Tech., Philip H. Ireland and Steve Leatherbarrow.
- 543 Next Month in Television**
- 544 Mr. Doublecheck and Mrs. Tart** *Les Lawry-Johns*
Unusual customers with unusual requests.
- 545 Cable and Satellite 87** *Harold Peters*
The satellite TV equipment on show at this recent exhibition.
- 546 Servicing Mechanical VCRs, Part 4** *Mike Phelan*
The load-1/start/stop system used in early JVC machines, with a fault chart.
- 550 Low-voltage DC Operation** *J. LeJeune*
Dealing with the sorts of problems that arise when TV/video equipment is operated from 12/24V supplies.
- 552 The 8mm Video System, Part 3** *Eugene Trundle*
This time an account of the automatic track following system used with Video-8 machines. The techniques employed in camcorder and deck models differ somewhat - both are described.
- 556 Letters**
- 559 Service Bureau**
- 560 Test Case 294**

OUR NEXT ISSUE DATED JULY WILL
BE PUBLISHED ON JUNE 17

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OSB263 G11 Non Text US	19.50
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691, 17181 G11 31 Burton US	27.00
218, 20578 KT3 K30 K35 KT4 KT40 (Non Text or Text)	25.00

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FD09200 15500 13.81
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C6 22.62
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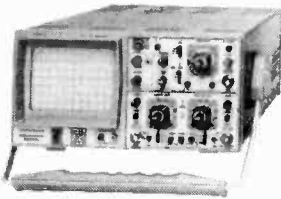
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 - Sens. Ch1, Ch2. 2mV/cm
 - Time Base 0.2s/cm - 20ns/cm
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 - Variable hold-off 10:1
 - Calibrator
 - Plus many more features

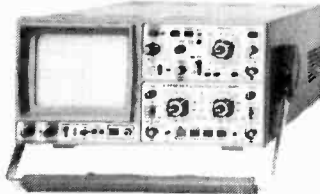
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Including two probes

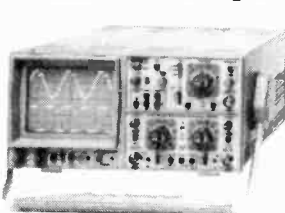
FREE Securicor Delivery **HM204-2 20MHz Multi-function**

- 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

Price £418.00 + £62.70 V.A.T.



HM205 20MHz Digital Storage **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

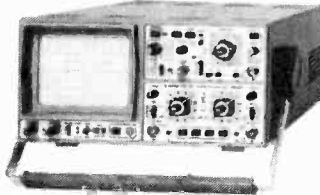
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FREE Securicor Delivery **HM605 60MHz Multi-function**

- 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
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- Only 2 1/4" thick
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- Bandwidth 10MHz

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Probe £7.50 + £1.30 V.A.T.
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DIGITAL LCR METER

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

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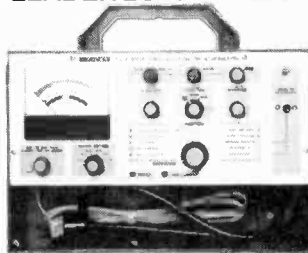
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- Measuring Range 0-100Mohm
- Centre scale 2Mohm

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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.
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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.

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- Accurate 10 turn tuning potentiometer.
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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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- Sound output

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- O/Put 1V p.p. @ 75ohms
- Audio O/Put 10mV
- Switching 12V @ 4K7ohms

Price £124.95 + £18.74 V.A.T.

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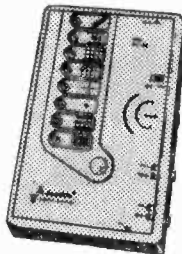
- SECAM B.G.D.K.L.
- O/Put 1V p.p. @ 75ohms
- Audio O/Put 10mV
- Switching 12V @ 4K7ohms

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R.G.B. PATTERN GENERATOR

- O/Put sigs. Pos RGB
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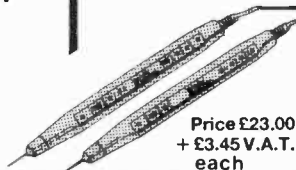
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LEADER High Voltage Metered **EHT PROBE**. Measures up to 40KV DC with safety. Built in meter. Accuracy ±3%

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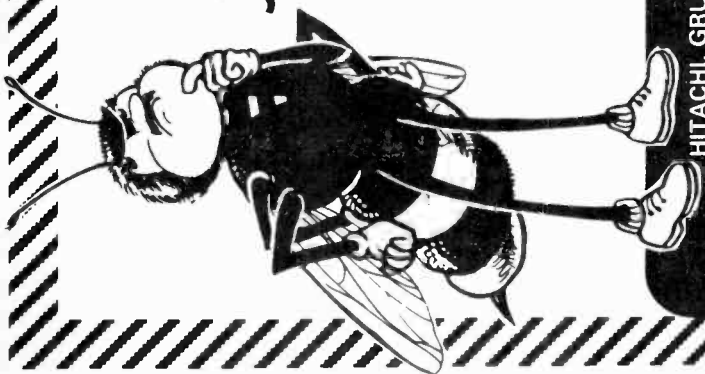
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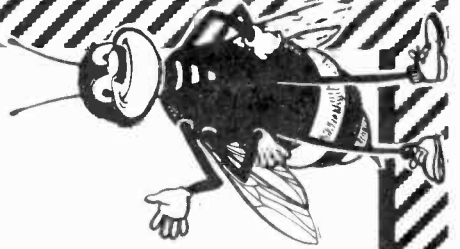
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AN7168	2.95	TA7204P	1.90
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HA1392	2.95	TBA120U	0.95
HA1397	3.95	TBA520	1.00
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LA1230	2.95	TBA560	1.45
LA1365	2.45	TBA720A	2.95
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LA4445	2.45	TBA810S	1.25
LA4460	2.45	TBA820	1.10
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SA1251	4.95	TBA1440G	2.95
SA3027	3.95	TBA2800	2.50
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SAF1039P	2.75	TDA480	2.95
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SAS570S	2.45	TDA1037	1.95
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SL471DP	2.95	TDA1190Z	2.85
SL480	2.85	TDA1470	3.25
SL490	2.50	TDA1506	4.35
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STK2129	8.50	TDA1950A	3.95
STK433	5.95	TDA2002	1.50
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TDA2523	2.80	BC147	10
TDA2525	3.20	BC148	10
TDA2530	2.00	BC327	11
TDA2532	2.10	BC328	12
TDA2540	1.95	BC337	11
TDA2541	2.70	BC338	12
TDA2545	3.55	BC548	12
TDA2546	4.95	BC547	10
TDA2560	2.40	BC557	10
TDA2571A	4.95	BC558	10
TDA2576A	3.30	BC637	30
TDA2577	3.50	BC638	25
TDA2578A	2.95	BC639	25
TDA2581	2.00	BC640	30
TDA2582	1.95	BD124M	60
TDA2581	2.30	BD131	33
TDA2593	2.30	BD132	33
TDA2594	2.95	BD160	50
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TDA2653A	3.55	BD222	50
TDA2655A	5.95	BD225	50
TDA3190	3.95	BD237	40
TDA3540	3.70	BD238	40
TDA3541	3.70	BD438	70
TDA3560	4.95	BD439	70
TDA3561A	4.95	BD677	65
TDA3562A	6.50	BD701	95
TDA3650A	4.75	BD707	95
TDA3651	2.70	BF337	28
TDA3651AQ	3.80	BF338	30
TDA3652	3.35	BF458	35
TDA4500	3.95	BF757	70
TDA4600/2	2.85	BF758	70
TDA4600/2D	3.30	BF871	80
TDA4610	3.50	BF960	1.25
TDA5700	3.95	BR103	75
TDA8170	3.55	BR303	1.95
TDA8180	4.50	BT116	1.30
TDA8190	2.80	BU126	1.50
TDA8190A	2.95	BU205	1.40
TDA8190B	2.95	BU206A	1.45
TDA8190C	2.95	BU208A	1.45
TDA8190D	2.95	BU208/02	1.95
TDA8190E	2.95	BU2080	1.00
TDA8190F	2.95	BU326A	1.45
TDA8190G	2.95	BU426A	1.60
TDA8190H	2.95	BU500	1.95
TDA8190I	2.95	BU506A	1.75
TDA8190J	2.95	BU508D	1.95
TDA8190K	2.95	BU526	2.20
TDA8190L	2.95	BU807	1.30
TDA8190M	2.95	BUW81A	3.50

TYPE	PRICE (£)	TYPE	PRICE (£)
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R2008B	70	BC147	10
R2540	2.35	BC148	10
TIP31C	45	BC327	11
TIP32C	45	BC328	12
TIP33	45	BC337	11
TIP41C	90	BC338	12
TIP42C	45	BC548	12
15/80H	2.45	BC547	10
15/85R	2.45	BC557	10
2S/B618	2.20	BC558	10
2SC867A	3.20	BC637	30
2SC1034	2.40	BC638	25
2SC1114	5.95	BC639	25
2SC1124	1.00	BC640	30
2SC1413A	3.95	BD124M	60
2SC1942	2.90	BD131	33
2SC3156	2.50	BD132	33
2SD588	2.20	BD160	50
2SD725	7.95	BD201	80
2SD870	6.50	BD203	90
2SD880	1.25	BD222	50
2SD1398	2.35	BD225	50

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DECCA 100	7.35	BY164	45
DECCA 120/130	6.95	BY179	65
ITT CVC20/30	6.95	BY223	1.25
ITT CVC45	7.30	BY227M	20
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PHILIPS KT3	7.95	BY299/800	25
RBM T20/T22A	7.35	BYX10	30
THORN 8500/8800	7.20	BYX55/600	20
THORN 9000	8.00	SKESF3/10	1.45
UNIVERSAL	5.95	1N4001-7	0.75

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PHILIPS G11(470/250)	2.20	U321	8.75
RBM T20A(220/400)	2.90	U322	8.80
THDRN 9000(400/400)	2.90	U323	16.95

TYPE	PRICE (£)	TYPE	PRICE (£)
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HM6251	4.70	NV2000 Idler	1.30
HM9032	5.70	NV3000 Idler	1.25
STR441	5.50	NV7000 Idler	1.20
STR451	5.50	NV370 Idler	4.75
STR454	5.50	NV2000 Load. Gear	1.60
STR6020 (Kit)	6.35	NV333 Pinch Roller	4.95
ET548 Tuner	14.95	NV7000 Pinch Roller	4.95
ET556A Tuner	9.95		

TYPE	PRICE (£)	TYPE	PRICE (£)
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Limiting Assy	3.15	Motor (BHF1100D)	39.95
Motor (BHF1100D)	39.95	Pinch Roller	1.30
Pinch Roller	1.30	Rewind Kit	5.25
Rewind Kit	5.25	Service Manual C5	9.40
Service Manual C5	9.40	Service Manual C7	9.40
Service Manual C7	9.40	Video Head	45.00

TYPE	PRICE (£)	TYPE	PRICE (£)
Hitachi 9300	95	3V00/16/22	
National NV2000	1.00	Capstan Motor	49.95
Sharp 8300	1.00	Drum Motor	43.95
Sharp 9300	2.65	F/F Idler	1.60
Thorn (Plug)	95	Pinch Roller	7.20
Universal	50	Take-up Idler (LG)	7.50
		Take-up Idler (SM)	5.80
		Video Head (3HSS)	32.95

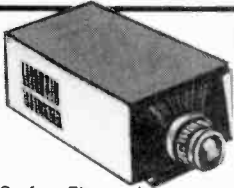
TYPE	PRICE (£)	TYPE	PRICE (£)
5000/5300	1.00	3V29/30	
Capstan Motor	32.95	Capstan Motor	38.60
Gear Idler	6.95	Loading Motor	8.95
Load Roller	1.95	Pinch Roller	6.95
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Reel Pulley	6.95	Take-up Idler	1.40

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2114 (200ns)	1.35	Handset Repair Kits	
4116-2	1.00	Buttons & Foils	
4164	1.35	Text/Non Text	
4532/2	2.50	£5.95	
4532/4	2.50		
741S 157	2.50		
ZTX 213	20		
ZTX 313	20		
ZTX 551	55		
ZTX 650	30		

AA117	9p	BD370	30p	BR100	14p	TIP54	140p	3N.128	55p	PCF200	135p	BA-6135	250p	LA-4505	280p	STK-435	510p	TDA-2004	170p	ZSC-461	30p	TIC44	22p
AA119	9p	BD371	30p	BR101	43p	TIP105	65p	3N.143	65p	PCF801	110p	BA-6208	250p	LA-4507	380p	STK-436	490p	TDA-2005	170p	ZSC-462	60p	TIC45	27p
AA120	9p	BD372	30p	BR102	43p	TIP106	65p			PCF802	110p	BA-6304	250p	LA-4510	180p	STK-437	490p	TDA-2006	170p	ZSC-463	30p	OFTO	
AA121	9p	BD373	30p	BR103	43p	TIP107	65p			PCF803	110p	BA-6400	250p	LA-4512	220p	STK-438	550p	TDA-2007	170p	ZSC-464	30p	ELECTRONICS	
AA122	9p	BD374	30p	BR104	43p	TIP108	65p			PCF804	110p	BA-6500	250p	LA-4515	220p	STK-439	550p	TDA-2008	170p	ZSC-465	30p	2N 5777	40p
AA123	9p	BD375	30p	BR105	43p	TIP109	65p			PCF805	110p	BA-6600	250p	LA-4518	220p	STK-440	550p	TDA-2009	170p	ZSC-466	30p	OC71	100p
AA124	9p	BD376	30p	BR106	43p	TIP110	65p			PCF806	110p	BA-6700	250p	LA-4520	220p	STK-441	550p	TDA-2010	170p	ZSC-467	30p	ORP60	100p
AA125	9p	BD377	30p	BR107	43p	TIP111	65p			PCF807	110p	BA-6800	250p	LA-4522	220p	STK-442	550p	TDA-2011	170p	ZSC-468	30p	ORP61	100p
AA126	9p	BD378	30p	BR108	43p	TIP112	65p			PCF808	110p	BA-6900	250p	LA-4525	220p	STK-443	550p	TDA-2012	170p	ZSC-469	30p	ORP62	100p
AA127	9p	BD379	30p	BR109	43p	TIP113	65p			PCF809	110p	BA-7000	250p	LA-4528	220p	STK-444	550p	TDA-2013	170p	ZSC-470	30p	ORP63	100p
AA128	9p	BD380	30p	BR110	43p	TIP114	65p			PCF810	110p	BA-7100	250p	LA-4530	220p	STK-445	550p	TDA-2014	170p	ZSC-471	30p	ORP64	100p
AA129	9p	BD381	30p	BR111	43p	TIP115	65p			PCF811	110p	BA-7200	250p	LA-4532	220p	STK-446	550p	TDA-2015	170p	ZSC-472	30p	ORP65	100p
AA130	9p	BD382	30p	BR112	43p	TIP116	65p			PCF812	110p	BA-7300	250p	LA-4535	220p	STK-447	550p	TDA-2016	170p	ZSC-473	30p	ORP66	100p
AA131	9p	BD383	30p	BR113	43p	TIP117	65p			PCF813	110p	BA-7400	250p	LA-4538	220p	STK-448	550p	TDA-2017	170p	ZSC-474	30p	ORP67	100p
AA132	9p	BD384	30p	BR114	43p	TIP118	65p			PCF814	110p	BA-7500	250p	LA-4540	220p	STK-449	550p	TDA-2018	170p	ZSC-475	30p	ORP68	100p
AA133	9p	BD385	30p	BR115	43p	TIP119	65p			PCF815	110p	BA-7600	250p	LA-4542	220p	STK-450	550p	TDA-2019	170p	ZSC-476	30p	ORP69	100p
AA134	9p	BD386	30p	BR116	43p	TIP120	65p			PCF816	110p	BA-7700	250p	LA-4545	220p	STK-451	550p	TDA-2020	170p	ZSC-477	30p	ORP70	100p
AA135	9p	BD387	30p	BR117	43p	TIP121	65p			PCF817	110p	BA-7800	250p	LA-4548	220p	STK-452	550p	TDA-2021	170p	ZSC-478	30p	ORP71	100p
AA136	9p	BD388	30p	BR118	43p	TIP122	65p			PCF818	110p	BA-7900	250p	LA-4550	220p	STK-453	550p	TDA-2022	170p	ZSC-479	30p	ORP72	100p
AA137	9p	BD389	30p	BR119	43p	TIP123	65p			PCF819	110p	BA-8000	250p	LA-4552	220p	STK-454	550p	TDA-2023	170p	ZSC-480	30p	ORP73	100p
AA138	9p	BD390	30p	BR120	43p	TIP124	65p			PCF820	110p	BA-8100	250p	LA-4555	220p	STK-455	550p	TDA-2024	170p	ZSC-481	30p	ORP74	100p
AA139	9p	BD391	30p	BR121	43p	TIP125	65p			PCF821	110p	BA-8200	250p	LA-4558	220p	STK-456	550p	TDA-2025	170p	ZSC-482	30p	ORP75	100p
AA140	9p	BD392	30p	BR122	43p	TIP126	65p			PCF822	110p	BA-8300	250p	LA-4560	220p	STK-457	550p	TDA-2026	170p	ZSC-483	30p	ORP76	100p
AA141	9p	BD393	30p	BR123	43p	TIP127	65p			PCF823	110p	BA-8400	250p	LA-4562	220p	STK-458	550p	TDA-2027	170p	ZSC-484	30p	ORP77	100p
AA142	9p	BD394	30p	BR124	43p	TIP128	65p			PCF824	110p	BA-8500	250p	LA-4565	220p	STK-459	550p	TDA-2028	170p	ZSC-485	30p	ORP78	100p
AA143	9p	BD395	30p	BR125	43p	TIP129	65p			PCF825	110p	BA-8600	250p	LA-4568	220p	STK-460	550p	TDA-2029	170p	ZSC-486	30p	ORP79	100p
AA144	9p	BD396	30p	BR126	43p	TIP130	65p			PCF826	110p	BA-8700	250p	LA-4570	220p	STK-461	550p	TDA-2030	170p	ZSC-487	30p	ORP80	100p
AA145	9p	BD397	30p	BR127	43p	TIP131	65p			PCF827	110p	BA-8800	250p	LA-4572	220p	STK-462	550p	TDA-2031	170p	ZSC-488	30p	ORP81	100p
AA146	9p	BD398	30p	BR128	43p	TIP132	65p			PCF828	110p	BA-8900	250p	LA-4575	220p	STK-463	550p	TDA-2032	170p	ZSC-489	30p	ORP82	100p
AA147	9p	BD399	30p	BR129	43p	TIP133	65p			PCF829	110p	BA-9000	250p	LA-4578	220p	STK-464	550p	TDA-2033	170p	ZSC-490	30p	ORP83	100p
AA148	9p	BD400	30p	BR130	43p	TIP134	65p			PCF830	110p	BA-9100	250p	LA-4580	220p	STK-465	550p	TDA-2034	170p	ZSC-491	30p	ORP84	100p
AA149	9p	BD401	30p	BR131	43p	TIP135	65p			PCF831	110p	BA-9200	250p	LA-4582	220p	STK-466	550p	TDA-2035	170p	ZSC-492	30p	ORP85	100p
AA150	9p	BD402	30p	BR132	43p	TIP136	65p			PCF832	110p	BA-9300	250p	LA-4585	220p	STK-467	550p	TDA-2036	170p	ZSC-493	30p	ORP86	100p
AA151	9p	BD403	30p	BR133	43p	TIP137	65p			PCF833	110p	BA-9400	250p	LA-4588	220p	STK-468	550p	TDA-2037	170p	ZSC-494	30p	ORP87	100p
AA152	9p	BD404	30p	BR134	43p	TIP138	65p			PCF834	110p	BA-9500	250p	LA-4590	220p	STK-469	550p	TDA-2038	170p	ZSC-495	30p	ORP88	100p
AA153	9p	BD405	30p	BR135	43p	TIP139	65p			PCF835	110p	BA-9600	250p	LA-4592	220p	STK-470	550p	TDA-2039	170p	ZSC-496	30p	ORP89	100p
AA154	9p	BD406	30p	BR136	43p	TIP140	65p			PCF836	110p	BA-9700	250p	LA-4595	220p	STK-471	550p	TDA-2040	170p	ZSC-497	30p	ORP90	100p
AA155	9p	BD407	30p	BR137	43p	TIP141	65p			PCF837	110p	BA-9800	250p	LA-4598	220p	STK-472	550p	TDA-2041	170p	ZSC-498	30p	ORP91	100p
AA156	9p	BD408	30p	BR138	43p	TIP142	65p			PCF838	110p	BA-9900	250p	LA-4600	220p	STK-473	550p	TDA-2042	170p	ZSC-499	30p	ORP92	100p
AA157	9p	BD409	30p	BR139	43p	TIP143	65p			PCF839	110p	BA-10000	250p	LA-4602	220p	STK-474	550p	TDA-2043	170p	ZSC-500	30p	ORP93	100p
AA158	9p	BD410	30p	BR140	43p	TIP144	65p			PCF840	110p	BA-10100	250p	LA-4605	220p	STK-475	550p	TDA-2044	170p	ZSC-501	30p	ORP94	100p
AA159	9p	BD411	30p	BR141	43p	TIP145	65p			PCF841	110p	BA-10200	250p	LA-4608	220p	STK-476	550p	TDA-2045	170p	ZSC-502	30p	ORP95	100p
AA160	9p	BD412	30p	BR142	43p	TIP146	65p			PCF842	110p	BA-10300	250p	LA-4610	220p	STK-477	550p	TDA-2046	170p	ZSC-503	30p	ORP96	100p
AA161	9p	BD413	30p	BR143	43p	TIP147	65p			PCF843	110p	BA-10400	250p	LA-4612	220p	STK-478	550p	TDA-2047	170p	ZSC-504	30p	ORP97	100p
AA162	9p	BD414	30p	BR144	43p	TIP148	65p			PCF844	110p	BA-10500	250p	LA-4615	220p	STK-479	550p	TDA-2048	170p	ZSC-505	30p	ORP98	100p
AA163	9p	BD415	30p	BR145	43p	TIP149	65p			PCF845	110p	BA-10600	250p	LA-4618	220p	STK-480	550p	TDA-2049	170p	ZSC-506	30p	ORP99	100p
AA164	9p	BD416	30p	BR146	43p	TIP150	65p			PCF846	110p	BA-10700	250p	LA-4620	220p	STK-481	550p	TDA-2050	170p	ZSC-507	30p	ORP100	100p

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WHAT THE PAPERS SAY ...

NOVEMBER 1986

TELEVISION

We had the use of a Telelift for several weeks, during which it had spells with field engineers and delivery men. It was deliberately given a rough time so that any weaknesses would show up - none did.

I can highly recommend the Telelift to everyone involved in field servicing and the collection/delivery of TV sets. It's

Eugene Trundle, TELEVISION Magazine, November 1986

ERT

ELECTRICAL+RADIO TRADING

With Telelift able to cope with stairs and curbs, and pick sets up and put them down anywhere between ground level and about 3ft high, the engineer no longer needs to hump sets around. As a result, most injuries - and much damage to sets and customers' homes - are now preventable at very little cost.

Bob Crabtree, ERT Magazine, 13 November 1986

RETRA DEALER

It has been specially designed to enable one person to handle a heavy and bulky receiver with ease whether it be climbing stairs or lifting on to a work bench.

To date Telelift has moved in excess of half-a-million TV sets without one injury.

Combining lightweight construction with strength, reliability and hi-tech good looks, this trolley will give years of trouble-free service, and users find that it usually pays for itself within weeks.

RETRA Dealer, June 1986

ACE INTERNATIONAL

It can rotate bulky console sets to allow passage through narrow doorways, lift TV sets in and out of doorways and facilitate the fixing and removal of all types of TV stands. It reduces the effort required to take appliances

ACE INTERNATIONAL Vol. 10 No. 8. 1986

ELECTRICAL RETAILING

The trolley can rotate bulky console sets to allow passage through narrow doorways, lift TVs in and out of vehicles, facilitate the fixing and removal of stands, reduce the effort required in stair climbing, and protect delicate mechanisms by virtue of its suspension system.

ELECTRICAL AND ELECTRONIC TRADER

The Telelift has reportedly been saving backs last two years.

Telelift points out that one well-known rental company attributes as much as 70% of lost hours to back trouble connected to lifting and carrying TVs unaided.

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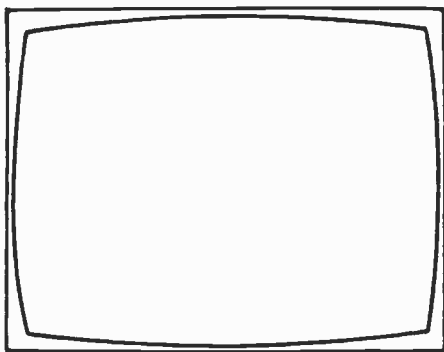
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TELEVISION

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John A. Reddihough

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HELD OVER

Due to pressure on space in this issue the vintage TV article we had planned to include has had to be held over until next month.

CORRECTION

In our test report on the Thurlby R/S PL series bench power supply last month we inadvertently specified the output impedance as 5M Ω instead of 5m Ω . Our apologies to all concerned.

COVER PHOTO

This month's cover photograph shows the Philips 2A chassis. See article on page 532.

Competing for Viewers

European TV broadcasting has long been a rather cosy business. The BBC might have had its difficulties from time to time in getting an adequate licence fee increase, but by and large funds have been something that the broadcasters have not had to worry about unduly. Could the situation be about to change?

It's rather extraordinary that in the UK the BBC and the ITV companies have traditionally split the TV audience approximately 50:50. Cable has had little effect on this duopoly so far since only a small minority of households are linked to cable services. The effect of all those VCRs on viewing habits is harder to assess. It would seem however that the VCR tends to provide extra or time-shifted viewing rather than impinging on established viewing habits. Now, getting ever nearer, we have the prospect of competition from satellite broadcasting. This could perhaps have a more significant effect on UK TV audience figures – if it doesn't, those (British Satellite Broadcasting) running the DBS franchise are going to have something of a problem on their hands. The main difficulty of course will be that of persuading people to buy dishes and extra receiving equipment. Once that hurdle has been surmounted there will be the problem of maintaining a competitive service. But whatever success BSB achieves will be at the expense of the existing services, since there's hardly likely to be a large, unsatisfied TV audience out there waiting for something more to their liking to be served up.

In short, BSB is taking a gamble. It's surprising how many organisations are at present prepared to make a similar gamble in entering the field of TV broadcasting. Leaving aside satellite TV, there seems to be no shortage worldwide of those anxious to enter the business. It would appear that every self-respecting publishing organisation of any size feels that TV broadcasting should form part of its activities. The Murdochs and Maxwells have been making considerable efforts to find ways into the international TV scene – and the emphasis is increasingly on international operations rather than the traditional national share-out of TV audiences.

Robert Maxwell's activities in recent months highlight the way in which things have been going. His group is a member of the consortium that made the successful bid for control of France's leading TV network, TF-1. Mr. Maxwell has also held discussions with the Spanish prime minister with a view to participating in a consortium that would have an interest in Spanish TV following the proposed privatisation of the services there. In addition Robert Maxwell's group has just set up a joint venture with the American company MTV to establish a continuous satellite/cable TV pop music channel, called MTV Europe, which is due to start operations later this summer. It seems that the Maxwell organisation is gradually building up quite a significant TV presence, something that's bound to significantly increase competition in the TV broadcasting field.

Is any of this cause for alarm? To established broadcasters, maybe. It's interesting to see what's been going on in the USA, the traditional home of commercial TV. Congress has recently been holding hearings into the state of US network television. Larry Tisch, who was recently appointed chief executive of the prestige network CBS, charged with reviving CBS's fading fortunes – CBS has reported a network loss in two consecutive quarters for the first time in its history – made some particularly interesting comments. According to Mr. Tisch, "the traditional television marketplace has not just changed, it has virtually disappeared and a far more complex and uncertain economic environment has taken its place". For 35 years there was uninterrupted growth in US network TV: over the last few years this growth has been thrown into reverse. Since 1970, some fifty basic cable TV programming services have come into being while the number of independent TV stations has risen from 129 to 317. Rupert Murdoch's new Fox TV network already reaches over 80 per cent of US homes. The net result of all this burgeoning activity is that the established US TV networks – CBS, ABC and NBC – have seen their share of the prime-time TV market fall from 90 per cent in 1980 to 73 per cent in 1986. The problem for the US networks is that advertising revenue now has to be shared amongst a growing number of TV outlets. During the 70s network advertising soared, with advertisers' demand for TV time insatiable; subsequently, as Mr. Tisch put it, "everything changed". Rather wistfully he added that "while we can today look back knowingly at these changes, they were not readily apparent just a few years ago".

The moral of all this seems to be that one must be prepared for upheavals in the TV broadcasting field. It could well be an uncomfortable place in the 90s. Large investments are being made by the newcomers, who will expect to see their efforts prosper. Some – perhaps quite a few – fingers are likely to get burnt. A whiff of this is already apparent in the UK. As a result of the new viewing alternatives previously mentioned there's been a decline in ITV audience figures. At a recent conference, Television '87, held in Copenhagen advertisers and agencies strongly complained about being asked to pay more for less – during the last two years the cost of TV advertising has increased by 25-30 per cent annually. In the next few years the established broadcasters face growing competition and falling revenues. Newcomers will have to survive by getting going on a low-cost base. Intriguing times lie ahead: we shall be watching them uneasily.

TV Fault Finding

Reports from Mick Dutton, Richard Roscoe, Philip Blundell, Eng. Tech., D. Parsons, Michael Dranfield, Philip H. Ireland and Roger Burchett

Philips G11 Chassis

We had a case recently of intermittent failure of the TDA2600 field timebase chip. We replaced the i.c. holder and swapped the panel over to a known good set. After a few hours the chip again failed. We then found that C2099, C2100 (both 1,000 μ F) and C2097 (680 μ F) were all leaky – C2099 was particularly bad. The chip didn't fail once we'd replaced these electrolytics.

Another capacitor that's worth checking when servicing these sets is the 37V supply reservoir capacitor C3144 (220 μ F). It's on the line output panel and also has a tendency to leak.

As soon as we'd sorted out the TDA2600 problem another unusual fault came our way. When switched on the set would run up for a few seconds then shut down. We discovered that the cause of the fault was on the power supply panel – by swapping it over with one from another set. Finding the component responsible for the fault took rather longer. The 7.5V zener diode D4001 turned out to be leaky. This was causing the inhibit monostable to operate and shut down the power supply. **M.Du.**

Triumph 8211

The customer complained that the picture on this little portable had gone very dark. The cause was simply no first anode voltage at the tube base. Tracing the source back to the main panel we found that the print land where the relevant rectifier's cathode is soldered is very close to the earth line. The panel had tracked over and it was necessary to cut away the board and replace the safety resistor to restore a good picture. **M.Du.**

Philips K40 Chassis with Teletext

This new set gave a beautiful picture when we delivered it to the customer's house. Until we'd nearly finished our cup of tea that is. There was then a crack and the picture went very dull. The tube had flashed over and now the contrast control didn't work. We were a long way from base so we decided to try following the wiring back from the contrast control to see whether anything obvious could be found. Our luck was in when we discovered that Tr7116 (BC558B) on the teletext interface panel was short-circuit base-to-emitter. **M.Du.**

Mitsubishi CP142

This set suffered from field jitter and intermittent field roll as it warmed up, but no amount of heat or freezer would induce the fault. Replacing the field oscillator transistors Q431 and Q432 (type 2SC711A) provided a cure. **M.Du.**

Luxor B2 Chassis

This set had suffered during a severe lightning storm. The chopper transistor TN03 was short-circuit all round, also the line output transistor TH02, while resistor RE05 in the electronic trip circuit was burnt. We replaced all these items and the chopper transistor's control thyristor TN02 (BRY55) for good measure. When we switched on the fuse blew instantly and we were left with another short-

circuit chopper transistor. To cut a long story short, a phone call to Luxor produced the information that TN02 has to be a BRY55L, not just a BRY55. Fitting the correct device cured the problem. **M.Du.**

Thorn 9000 Chassis

This set had teletext lines showing over the top three inches of the picture. An easy one this – C410 (100 μ F) which smooths the field timebase d.c. feedback was open-circuit. **M.Du.**

Finlux 1000 Series

Line output transformer failure isn't a common occurrence with these sets but if you do encounter one the effect is rather baffling. When the set is switched on it works for a split second then goes off, the channel display showing gibberish. This could set you looking around the microcomputer chip Ict2, but if you scope its supply pin 40 you will see it dip momentarily as the power supply shuts down due to the overload. If fitting a dummy load instead of the line output transistor gets the display working correctly it's a fair bet that the transformer is dud.

If the set switches itself intermittently to standby – or even no picture, just a plain white raster – replace diode Dal (1N4007) on the vision i.f. board. It's in the 12V supply. **P.B.**

Degaussing Thermistors

Whatever the make of set, if the mains fuse has blown and you can't find any short-circuits in the power supply suspect the degaussing thermistor. This applies to the Mullard and Siemens types, especially if the set is of recent manufacture. **P.B.**

Hitachi CNP192

This set suffered from intermittent loss of colour – it would sometimes run for hours without the fault putting in an appearance. The colour eventually went off altogether and we were able to make some tests. The culprit turned out to be the a.c.c. amplifier transistor TR25 (2SA673) on the signals panel. An AF124 transistor proved to be a suitable replacement. **M.D.**

GEC C2110 Series

Here's a handy tip when dealing with one of these sets with the no colour symptom. Look just above the aerial socket, on the luminance/chroma panel, to see whether the slider has fallen off the set burst symmetry control P203. **M.D.**

GEC 20AX/PIL Chassis Mk. II

We've had lots of these sets in, all with the same fault. The symptom is a blank white raster with flyback lines. In all cases the fault lay in the bias network for the complementary-symmetry RGB output stages: the 3.3V zener diode D212 was leaky and its associated 82k Ω resistor

R281 was open-circuit. Another of these sets had no blue due to the blue cut-off potentiometer P209 having a faulty track. **M.D.**

Teletext Faults

After three years without any teletext faults we've had a large number of problems in a variety of sets during the past few months. Although the symptoms have varied, the cause of the fault has in every case except one been the SAA5030 video input processor chip. Basic symptoms have been as follows: good text but no picture sync; text number "100" displayed with or without sync; text errors – may be intermittent or confined to the weakest channels; failure to switch to text. The odd man out was garbled characters due to a duff SAA5040B text acquisition chip. **P.H.I.**

Ferguson TX90 Chassis

We had an interesting fault on one of these sets recently – loss of field sync and no sound. A voltage check at pin 5 of IC102 (TDA4500) produced a reading of 0.5V instead of 1.4V. The amplitude of the waveform at this pin was also low. It turned out that one of the parallel resistors in series with this pin, R241 (33k Ω), had gone open-circuit. A new resistor restored normal operation. **D.P.**

Philips E2 Chassis

This was a case of a most unusual symptom caused by a very common fault. A Pye monochrome set, Model T182, fitted with the Philips E2 chassis came in with the following incredible complaint. Sometimes the sound would become distorted, but if you turned down the brightness control (yes!) the distortion would disappear. I switched on and confirmed that this was indeed the case, but I also noticed that the width was slightly down and that there was a marked hum ripple moving up the picture. The customer hadn't mentioned these points, but it did mean that the cause of all the problems lay in the power supply. Sure enough the regulated 217V output was well down, and as the brightness control was moved up and down the h.t. voltage followed it. I didn't confirm this with the meter, but presumably the line output stage derived 30V line that powers the sound output chip was also affected. This would account for the peculiar symptoms.

The series regulator circuit used in these sets is shown in Fig. 1. It's unusual in that the regulator transistor TS310 is in series on the negative instead of the positive side of the supply. The operation is otherwise quite straightforward.

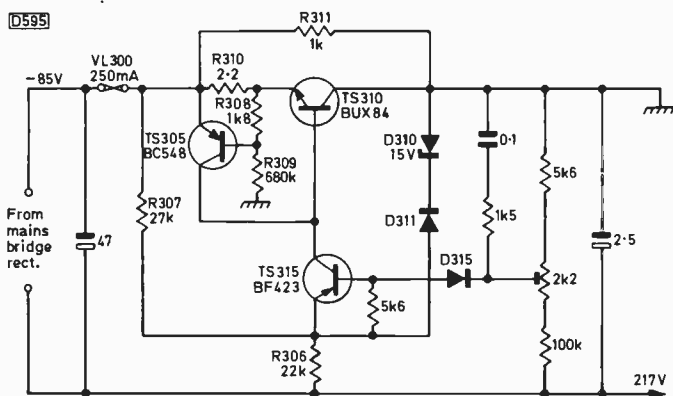


Fig. 1: Series regulator circuit used in the Philips E2 monochrome TV chassis.

TS305 and the associated components act as an excess current trip, shutting the regulator down in the event of excess current flowing via R310. The reference voltage at the emitter of the error detector transistor TS315 is provided by zener diode D310, which is biased by R307/R306.

The normal cause of low h.t. output is R306 going high in value. Since it and R307 are directly across 300V they do work pretty hard. In this particular set R306 was found to have risen in value to about 45k Ω when checked out of circuit. It's also worth checking the value of R307. When this resistor goes high in value the regulation isn't affected but D310 and D311 carry a higher current than they should and may well fail as a result. **R.R.**

Panasonic TC2205 (U2 Chassis)

The problem with this set was that the sound level was affected by operation of the contrast control! The higher the setting the more the sound level would fluctuate. Only with a dim picture would the sound stay steady. I also noticed that there was some line tearing at high contrast settings. The power supply was the first suspect. It's a chopper circuit and although the output voltage was correct the 160V line had a high ripple content. The smoothing capacitor C857 (47 μ F) had a badly corroded pin which had parted company with the interior. **R.R.**

Decca 30 Series Chassis

A fault I've not seen mentioned before, though it has become a stock one on these older sets, is the tendency for R430 (39k Ω) to go gradually high in value. This resistor is the integrator in the feedback network between the line output transformer and the flywheel line sync discriminator circuit. The symptom is that after setting the line speed and removing the short (TP400 to TP401) the line timebase either takes a long time to lock after changing channels or it doesn't lock at all. The moral would seem to be to change R430 on sight in cases of poor line lock. **R.B.**

Teleton CPL142

Poor field sync, lockable if the picture was overscanned, was traced to diode X302 (1S2473) being leaky. This allowed the line pulses to reach the field predriver transistor TR302. Fault-finding was made difficult by the poor quality circuit diagram: perhaps this is why the well-known multiple that sold it couldn't be bothered to cure the fault – they turned up the height and returned the set to the customer. **R.B.**

Rank T20/T22/T26 Chassis

For a long time the only things these sets have needed is replacement of the 1 Ω resistor 5R8 in the line output transistor's base circuit and the dreaded 910 Ω resistor 4R16 in the 12V regulator circuit – plus the occasional tripler replacement and routine inspection of the plugs and sockets. Age tells on us all however and those in my patch are beginning to deviate from the norm.

The first line driver transistor failure (open-circuit base-to-emitter) was quickly followed by the first defective tuning voltage regulator. The latter was actually in a T26 which had the tuning flap held on by blue tack (to operate the a.f.c.) and was used with a Toshiba VCR. The a.f.c. systems in the two pieces of equipment tended to pull

against each other and the owner couldn't tune the VCR satisfactorily. I must admit that it was a sensitive pair to set up, even after the faulty stabiliser had been replaced. **R.B.**

Thorn 9800 Chassis

Another first for us – one of these sets required a new line output transformer, entirely due to nicotine. The fault was reported as a “faulty on/off switch”. In fact the set would start, the e.h.t. would build up, crackovers would occur at

the e.h.t. connector and from the body of the line output transformer where the lead pushes into the socket, then the set would trip. Copious applications of methylated spirits to the line output panel and a new transformer and e.h.t. lead restored the set to health. I also washed the back in soapy water and cleaned the rest of the set inside and out as well as possible. The customer's reaction to the invoice? “Steep isn't it?” Note that there was no damage to any of the semiconductor devices. Remember the slogan “Fine sets these Fergusons”? But that was before my time! **R.B.**

A Guide to Coarse Servicing

Chas E. Miller

Ike Hodge eyed me carefully. “Your trouble,” he said, “is that you live in the past. I bet you still use a quill pen to write those so-called articles of yours. Which reminds me, I must remember to see my solicitor about suing you for libel some time. Now me, well I'm progressive. Always on the ball when something new that'll bring in extra business comes along.”

“Such as stocking up on those new, high-gain Band I aerials in 1984?” I asked gently.

“That was what you call a long-term investment. Band I might come back. And anyway they were dead cheap, and you daren't miss a bargain. But what I'm talking about now is satellite TV. That's the coming thing.”

“So I'm told. What are you thinking of doing about it?”

“Thinking! I've already done it! I'm the local agent for Dreadco Electronics. Now how about that?”

“Well I never. How did a big organisation like Dreadco get involved with a schlemiel like you?”

“They know how to pick a winner, that's how. They were seeking someone who could be looked upon for an utter commitment to sell their receiving systems – with honesty, integrity and enterprise.”

“So how come they chose you, the original guy who thought ethics was a county to the north of London?”

“I'm sure you've used that gag before” frowned Ike.

“Yeah, but the old ones are always the best. Now tell the truth about how you got that agency.”

“Same as usual, with a little bit of make-believe. Nothing serious of course. Just said I had the know-how and capital resources needed to set up the operation. I bunged old Sid Ball the car hire merchant a couple of quid to park his roller outside the shop for an hour whilst the Dreadco representative was talking to me, so he'd think it was mine.”

“Who'd be fooled into thinking that the owner of a dump like this would have a Rolls-Royce?”

“Oh, I didn't meet him here. For another couple of quid Bernie Rogers, the local manager of Anonymous Rentals, let me use his office. Quite impressive it is too.”

“That's one of the most deceitful moves I've heard of! What happens when Dreadco get wise?”

“It'll be too late,” Ike said complacently. “The agreement is signed by the big boss Sir Jasper Pennyfeather. They can't cancel it without paying me compensation. Now who's daft?”

I ignored that last bit. “Do you mean to tell me you actually intend to sell satellite TV receiving systems?” I demanded.

“Intend? I'm already selling them. Making a bomb!”

“Leave off. How many people around here have got

that kind of money to spend?”

“What kind of money? What you're overlooking is the Ike Hodge enterprise. Thanks to my ingenuity and technical expertise I can cut the price of a dish aerial down to twenty quid.”

“I know I'll be sorry I asked this, but how have you managed such a saving?”

“Easy. The aerials are normally supplied by the SkyGroper Corporation, a Dreadco subsidiary. Now I had a good look at the first one that came in and decided I could make something just as good. How's your rubbish collected?” he asked, with a puzzling switch of topics.

“In plastic bags of course, what's that got to do with it?”

“As is everyone else's around here, which means that the old metal type have become redundant. So I bunged the yard-man down at the Council 20p a go to let me scavenge all the old dustbin lids off the tip. Got 73 the first day.”

“And you're selling those as satellite dishes at twenty quid a time?”

“That's where the expertise comes in. They require treatment. I give 'em a coat of paint first.”

“I bet you even nicked the paint!”

“No way!” said Ike with dignity. “That's not business. I bunged the driver from the local paint merchant a couple of quid to drop me off a load of old stock. You have to speculate to accumulate.”

“Strikes me what you're accumulating is a load of old junk. What's going to happen when the dustbin lids fail to work?”

“I shall take them back in part exchange for an improved type – the proper aerial – giving a generous allowance. Well, about a fiver a time.”

“Ike, that's immoral. You can't do it!”

“No it's not. It's business. I know what immorality is, and it's a lot more enjoyable than scavenging the local refuse tip for dustbin lids.”

“Wish I knew what's gotten into you. What happened to the old, lovable Ike?”

“He disappeared when he got his latest Income Tax demand, that's what. I have to increase my turnover to satisfy those rapacious bar-tenders.”

“No good will come of this Ike. Providence will catch up with you sooner or later. You'll see.”

Ike laughed dismissively. “Save that sort of thing for those novels you keep trying to write. From now on I've got to look after number one. Now if you'll excuse me, I've got some painting to do.”

Will Ike be saved from himself and regain his character and self-respect? Watch this space . . .

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Teletopics

BUSINESS SCENE

For most consumer electronics products 1986 was a record year. According to the British Radio and Electronic Equipment Manufacturers' Association (BREMA) deliveries of colour sets to the trade increased by eleven per cent over 1985, reaching a record 3.9 million. Of these, sets fitted with FS tubes totalled 743,000. Deliveries of teletext equipped sets increased by eight per cent over the year. At the present time (1987 first quarter) deliveries of small-screen sets have almost reached the level of large-screen sets. Deliveries of monochrome portables fell by nine per cent in 1986. VCR deliveries increased by 30 per cent in comparison with 1985 and there were record exports of UK produced CTV sets and VCRs. There was a big increase in the number of CD players delivered, at 639,000 units. Home computer deliveries on the other hand decreased by 49 per cent.

Northern electrical retailer Wigfalls has purchased from the Electronic Rentals Group fifteen Connect shops. ERG will continue to run the Connect shops elsewhere. Wigfalls has sold its rental interests to Granada.

Fidelity claims to be the largest UK supplier of 14in. CTV sets in the UK at present, with over twelve per cent of the market. Last year Fidelity turned in a loss for its parent company Caparo Industries, which is in talks with a major foreign TV manufacturer to hive off Fidelity as a joint-venture. Recent 14in. sets introduced by Fidelity include the CTV1405 and CTV1405R.

Salora-Luxor claims to have become the fourth largest TV manufacturer in Europe and to be the market leader in Scandinavia, where it has nearly a third of the market. Production is currently running at over 700,000 sets a year.

VIDEO SCENE

HQ (high quality performance) VHS machines have been around for some months now. What contributes to the improved performance in different machines varies however. The changes in comparison with the basic VHS specification are: (1) record white clip level increased by twenty per cent; (2) improved resolution; (3) luminance noise reduction; (4) chroma noise reduction. To qualify as an HQ machine item (1) and at least one of the other items must be implemented.

Fuji Photo Film (UK) Ltd. is developing a range of video cassettes for the new S-VHS system. A new magnetic particle formulation called Beridox-SHR has been developed, with ultra fine particles. The magnetic layer also uses a newly developed binder with improved dispersion characteristics, resulting in a "super high density" magnetic layer. The net result is substantially increased h.f. output. Signal-to-noise ratio has also been improved. Mass production of the tape is due to begin shortly so that it will be available in quantity when S-VHS hardware is introduced.

The latest VCR from Panasonic, Model NVG21B, features digitally-scanned bar code programming. Special programming sheets are supplied with the recorder: these have tables of codes representing all likely programming options such as channel, date, start/stop times etc. The user employs a scanning pen/transmitter to scan the appropriate bar codes – the pen has a power-save system

that switches it off if no instructions have been received for twenty seconds. Panasonic consider that users will find the system much easier than conventional VCR programming and hope that eventually, as in Japan, programme listings in the *TV Times* etc. will be accompanied by bar codes.

Philips have developed a couple of chips which provide a decoder for the video programming system in use by some Continental broadcasting authorities – the transmissions incorporate signals to tell a programmed VCR when the various programmes start. The SAA5253 is a data line slicer and the SAF1134P (or SAF1135P) a data line decoder. Together the two chips decode the VPS signals and control the VCR via a simple two-wire inter-chip bus.

Philips is to set up a joint-venture VCR plant in Czechoslovakia. The joint company will be 70 per cent owned by the Czechoslovakian manufacturing concern Testa, 20 per cent owned by Philips and 10 per cent owned by a Czechoslovakian commercial/distribution body. The plant at Bratislava will eventually export to the West in addition to supplying the East bloc countries. Production should start next year at a rate of 100,000 machines annually, rising to 500,000 machines a year by 1993.

Amstrad and Funai Electric have set up a joint-venture company to manufacture VCRs in the UK, at Amstrad's Shoeburyness plant. Initial production will be at the rate of 5,000 machines a month, rising to 10,000 a month.

FRENCH TV

The consortium lead by construction group Bouygues was the successful bidder for control of the leading French national TV network TF-1. Bouygues and its partners, who include UK newspaper publisher Robert Maxwell, will pay over £300 million for a fifty per cent interest in the previously government controlled network. Of the remaining interest, 40 per cent will be sold to the public and ten per cent to the network's employees.

SONY WATCHCAM CCTV SYSTEM

Warsaw (Security) Ltd. of Dorma Trading Park, Staffa Road, London E10 4QX has introduced in the UK the Sony low-cost Watchcam CCTV system. Watchcam is a development of Sony's pocket TV technology, offering TV monitoring for areas where it would previously have been too intrusive or expensive. The mains-powered system comprises a small (8 × 4¼ × 1½in.) TV monitor linked to a miniature (3¾ × 2 × 1¼in.) camera. The camera can be fixed flat against the inside of the entrance door to look at right-angles through a peep-hole lens: the monitor has a flat, 4in. screen. Watchcam can perform a variety of monitoring tasks in addition to its door viewing role and is supplied with accessories to enable the camera to be placed anywhere in the home or office. A microphone in the camera, linked to a speaker in the monitor, enable users to listen in as well as viewing the scene. The system costs £585 plus VAT.

LATE NIGHT SUBSCRIPTION TV

A report by CSP International, commissioned by the Home Office following the Peacock Committee report, has concluded that it would not be feasible to finance BBC-1 and BBC-2 by subscription rather than the licence fee but that subscription could be used to finance a night-time film and entertainment service on the BBC and ITV channels, with the signals transmitted in scrambled form.

Recent Philips CTV Chassis

Harold Peters

Looking back through past issues reveals a wealth of information about the Philips G11 chassis and its reliable successor the KT3/K30 range but little about the chassis that followed them. Time then to take a brief look at the System 4, CTX, CF1, 2A and 2B chassis. We'll start by outlining the way in which these chassis evolved.

Evolution

Philips chassis both designed and manufactured in the UK have the prefix G. There was the popular G8, then the G9 110° version. These were followed by the outstanding UK swan-song, the G11, whose modular construction pleased renters and owners alike.

At the same time the continental side of Philips was designing and manufacturing its own chassis which were prefixed K (for Kleuren), namely the K9, K12, KT2 portable and the multi-standard KM2 and KM4 for France and its border countries. These sets have a two-panel chassis: the large upright panel on the left is called the small-signal panel, and the smaller one on the right the large-signal panel, large and small relating to the size of the signals rather than the panels.

To stay competitive design became centred on Eindhoven, whose first Eurochassis was the KT3/K30 series. This is of modular construction, with all the easy faults (it seemed) on the plug-in boards and the sticky ones on the mother board which, with the same Teutonic logic that transposed the large and small panels in the previous chassis, was called the monocarrier (it being a colour chassis). The modular construction enabled national variations, indicated by the suffix, to be carried out – /05 for the UK system I, /00 for the European B/G standard and so forth. What couldn't be agreed upon was a common remote control system: there was Song, Long, Long F8, Telco and RC4. Because none of these could handle teletext, and they didn't want to use the Croydon codes working so successfully with the G11 chassis, they brought forward RC5 which, in its many forms, is with us to this day.

It takes about three years from the instant when the set designer leaps out of his bath exclaiming "I've got it" till you can buy his brainchild in the shops. Thus while the KT3/K30 range was doing great business the length and breadth of Europe the boffins were well into its successor, the KT4/K40 (System 4) series chassis, which were considered to be *the* chassis for all present and future needs of all nations. The format reverted to the small- and large-signal panel arrangement, with a built-in PAL decoder on the small-signal panel. Other colour systems were catered for by means of a plug-in board that turned the other systems into quasi-PAL for processing on the mother board.

The large-signal panel had variations to cater for 90°, 110° and FS (FSQ) tubes. Teletext, now common on most European PAL systems, plugged into the SSP (small-signal panel) while stereo and hi-fi audio boards clipped around the cabinet sides. The basic sound board was confined to intercarrier sound detection and a series of switching i.c.s to route the sound as directed by the user handset command etc. The power supplies – isolated, non-isolated, etc. – were laid out on the cabinet floor.

Something as versatile as this took longer to bring into production than originally planned, especially by the time that all the pet rules and regulations of its intended markets had been taken into account. So System 4 rather missed its target. The gap was filled by an improved version of the K30, called the K35, which held pride of place for a couple of years.

During this time the rest of the television industry had moved to single-panel chassis – the Thorn TX9/10 for example. As a result when System 4 was released it was confined to upmarket sets (remotes, teletext, stereo sound etc.). Basic 22 and 26in. models continued to use the K35 chassis while smaller ones – 20in. and below – were fitted with a flat, single-panel chassis called the CTX, which we'll return to shortly.

System 4 was confined to the upmarket ranges for the whole of its comparatively short lifetime. Its cramped layout and involved service manuals didn't endear it to the trade, and once the basic 22 and 26in. models had gone directly from the K35 chassis to a new chassis, the 2A (which bore a resemblance to the CTX), and once it became possible to add remote control and teletext to these flat chassis, the only sets left using the System 4 arrangement were the Matchline modular models.

Video/audio In/out

Something else happened during the transitional period. France and Germany made it mandatory to incorporate a SCART Euroconnector, or a similar video/audio feed arrangement, and for convenience the other coun-

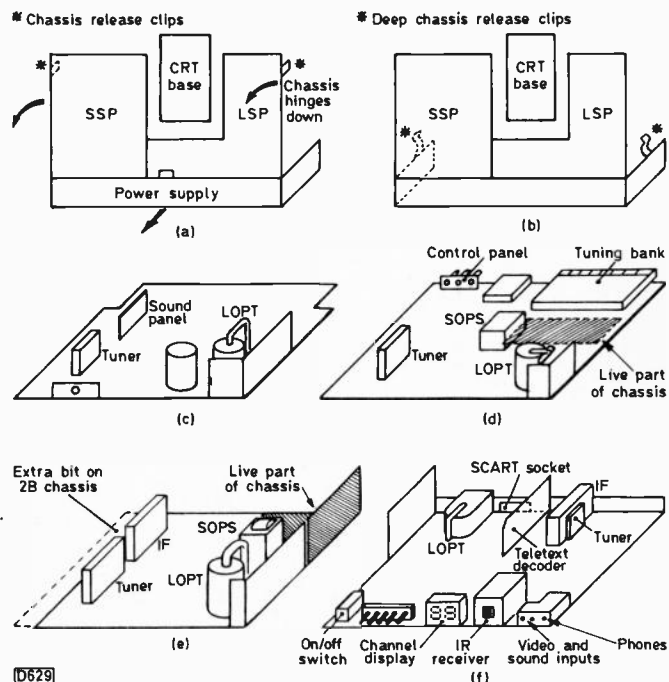


Fig. 1: Quick chassis guide. (a) System 4, K40 version. (b) System 4, KT4 version. (c) CTX chassis, E version. The S version has the larger ELC2003 tuner. (d) The CF1 chassis. (e) The 2A/2B chassis. Note the divided main heatsink: the rear section and the chassis corner alongside are live. (f) The CP90 chassis.

tries adopted the same standard. This meant that the TV set's chassis could no longer be live but had to be isolated from the mains supply. Philips solved this problem with their SOPS – a self-oscillating chopper power supply. Regulation feedback from the isolated secondary side of the circuit to the hot primary side is via an opto-isolator. SOPS was first fitted to later versions of the System 4 chassis and was then used in the flat 2A chassis – also in the CF1 chassis, an interim small-set flat chassis designed as a successor to the CTX. This multitude of chassis is a bit confusing: we'll go back to the System 4 and follow the story from there.

System 4 Chassis

When you first get it, the System 4 service manual comes as a large loose-leaf binder that looks almost empty. If you've religiously kept yours up-to-date you should have at least two of these binders bursting at the seams. The electronics part of the manual is sectionalised by dividers that bear Roman numerals (which annoy me personally), each section dealing with one aspect of the electronics. For updating there come supplements on demand, stapled to a yellow contents sheet which indicates whether you have to add or replace the sheet in question. The yellow contents sheets themselves are supposed to be filed as a check in case you missed one.

There are separate service manuals for the various models. These are no more than flimsy "contents sheets". Each contains a block diagram, showing the various electronic bricks which go to make up the set, and the plug and socket numbers of the interconnectors. Parts unique to the particular model, such as cabinet mouldings, knobs and things like headphone panels, are also detailed. But to see the set as a whole you have to piece it together mentally from the separate sections of the electronics half of the folder.

The small- and large-signal panels hinge out on a common moulding for service. On 22in. upwards K40s the clips are at the sides of the frame, near the top, with possibly a third clip between the lower edge and the top of the power supply board at the bottom of the cabinet. On 20in. and smaller KT4s the retaining clips are down at the bottom of the frame, forward of the upright chassis. Switch off before delving in this deep.

To gain access to the power supply on the floor of the set, first swing down the upright chassis section as above. Unclip the various cableform retainers, then unclip and slide the power supply backwards to the extent of its leads. You can then hinge the main frame back up while you work on the power supply.

The boards plugged into the SSP can benefit from use of the extenders you have for the KT3, but not always, due to the shortness of the cable form. Most control panels, even those along the bottom of Matchlines, come out forwards for servicing once the appropriate plastic retainers have been unclipped.

Matchline SCART Sockets

The Matchline series have a special board sporting two SCART connectors and their electronics. These double-SCART inputs are both terminated at 75Ω, but the buffer amplifiers enable the input to one to appear at the output of the other – a handy feature in the showroom, making it possible to "daisy chain" the video signal from say a satellite set without having to break into all the intermediate sets and remove the terminating resistors. Sadly you

need only a juvenile hacker to change the channel on one set in the middle for all the others down range to follow suit. If you do Saturday work in the showroom this is something you'll already have learnt to live with, but we've digressed again.

Servicing Aspects

The circuitry on the large-signal panel, the one on the right as you look in the back, closely follows that of the KT3/K30. The field timebase however consists of a TDA3650 chip and its peripheral components. Should the field scanning fail the blanking circuits will operate automatically, giving the "no picture, e.h.t. o.k." symptoms.

Another stock fault, if a chassis such as this can have such a thing, is intermittent field jump and height shrinkage due to failure of the BAX18 diode D6107 near the top of the board. Small diodes of this series abound in the System 4 chassis and appear to be only just man enough for the job in hand. Philips Service quote an improved alternative, but we use the good old BY127 and don't get any call-backs.

Another misleading fault is when the set locks up on programme 1 (usually BBC-1) with the display showing E1. Having chased red herrings all round the board we now go straight to the line output transformer and resolder all its pins. Please don't write in asking for an explanation: we found it by accident and rejoice in our good luck. Dry-joints in the line output stage can result in a dead or intermittently dead set.

KT4 90° LSPs naturally differ from the 110° panels and again from the FST (FSQ) boards, but there are even variations within these subgroups. So if you are tempted to fault find by substitution, check the boards against each other carefully. A small bit of re-engineering may be needed, though it's preferable to debug down to component level – as a rule Philips Service don't carry complete boards, though they may still have a few for the sets made in the UK.

Access to the power supply has already been described. Half way through the production run a change was made from a multivibrator driven chopper power supply to a self-oscillating chopper power supply. Should a service replacement be required you'll normally get a self-oscillating power supply with fitting instructions. Even here there are four different types of SOPS board, for 90° and 110° sets with and without teletext.

As with any switch-mode power supply, faults in this area can be sticky – with often more than one device going. Odd teletext behaviour is usually the result of an intermittent diode in the bridge rectifier circuit at the bottom left of the board. This produces a 12V supply from

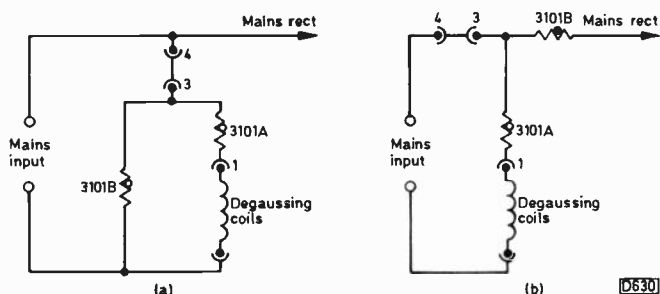


Fig. 2: Different degaussing thermistor arrangements used in System 4 chassis. (a) The KT4 arrangement, with a dual posistor. (b) Posistor/NTC thermistor arrangement used in K40s. This arrangement reduces the total current taken and acts as a surge limiter at switch on.

which the 5V teletext supply is derived. As before small diodes, this time BAX14s, are the problem. And once again BY127s do a better job. Circuit reference numbers are D6110-6113.

Beware of the degaussing arrangements. A dual-pistor is used in KT4s, as in KT3s. In K40s however this is replaced by a positive/negative thermistor arrangement (see Fig. 2) which looks the same. Various wire links are also transposed. Put the wrong item in and you'll have a big bang that will be the envy of the stock exchange.

When it comes to the small-signal panel – the one on the left when seen from the back of the set – you have again to beware of the multitude of different chassis types if you're contemplating board swapping. Unless the set has stereo or hi-fi the sound panel will resemble that in the K35, with an extra i.c. This is a switching chip to mute the sound when the set is off station, SCART is selected or tuning is taking place. So "no sound" can become a merry chase through the cableforms and manuals. The stereo/hi-fi sets have their output panels on the right-hand cabinet side: the sound module on the small-signal panel contains only the detector chip and the switching chips. As previously mentioned, the main board contains a PAL decoder and provision to add modules for other systems to convert the incoming colour to quasi-PAL for decoding on the main board.

Tuning Systems

There are two tuning systems, VST (tuning indicated by a yellow line that traverses the screen) and TRD4 (set programmed by channel numbers). Drift with VST sets when new, patterning or poor a.f.c. are usually due to the tuner itself. With the U411 tuner there are bent tinplate contacts that touch the tuner cover. If one of these is oxidised the tinplate forms a lecher bar type coupling between sections of the tuner, producing a birdie somewhere in the upper reaches of Band V. Clean and bend them, then refit. You could try leaving the tuner covers off completely.

The a.f.c. is inadequate at the top of Band V where it takes up to 3V to swing the varicap tuning through one TV channel. Early sets have a 2.2M Ω a.f.c. boost resistor (see Fig. 3) fitted in position R3106, beside the tuner on the small-signal panel (beware – there's also an R3106 on the large-signal panel). If you are in a high-channel area and continually need to retune, try fitting the 2.2M Ω resistor – then check that you've not produced lock-out on the video channel 36. If necessary try reducing the value of R3106.

The symptoms are unusual when TRD4 sets go off tune – big chunks on the picture "twitch", suggesting a field fault since this usually occurs at the bottom of the picture.

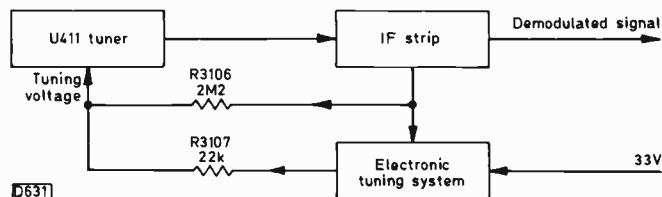


Fig. 3: System 4 a.f.c. arrangement, simplified diagram. Of the $\pm 5V$ a.f.c. swing available at the output from the a.f.c. detector, the ratio of R3106/R3107 means that only a hundredth of this is applied directly to the tuner. While this is adequate up to ch. 55, the a.f.c. action is poor from there up. Try reducing the value of R3106. A similar problem arises with the 2A/2B chassis.

The clue is that the effect is present only on some channels. What happens is this. The tuning circuit looks for an off-tune signal in eight 1MHz steps, starting at the nominal vision carrier and working upwards. If a vision carrier isn't found the circuit goes back to the nominal carrier and starts to look again. Because it never looks below the vision carrier it never finds a station that has drifted downwards but keeps twitching until reprogrammed. Simple reprogramming seldom puts this right. Normally you need to start the search action below the required channel and let the set tune upwards until locked, then restore the memory.

A range of flat, 53XX series handsets covers the series. VST sets use the RC5300 and RC5350 for simple remote control and remote plus teletext respectively. TRD4 sets, usually with stereo, use an RC5370. The Matchline series use an RC5371 which is electrically identical to the RC5370 but has the Matchline livery. Sets with a teletext paper printer need the RC5375. As a service replacement, Philips now issue a general-purpose handset, type AG RC53: this has buttons for every RC5 function in use to date – you merely ignore those not relevant to a particular set.

CTX Chassis

The CTX was the first flat, single-panel colour chassis in the Philips range. There are two basic forms, CTX-E and CTX-S, which are made in Europe and Singapore respectively. They are not interchangeable and can be identified simply by their tuners: the CTX-E has a U411 tuner while the CTX-S has the larger ELC2003. The S chassis is confined to portables, mostly basic models, while the E version is used in sets with tubes up to 20in. and some of the portables have remote control. They all have the same convergence as the KT3 – in fact the chassis is similar electrically to the KT3, but laid out on a single panel.

These sets are reasonably trouble-free: what trouble there is relates mostly to the power supply. UK versions generally incorporate a mains bridge rectifier arrangement which puts the chassis at mid-mains potential, encouraging the demise of the 4.7 Ω surge limiting resistor R3291 which is on the h.t. side of the bridge as in the KT3. Continental versions of both types have half-wave mains rectification, with the 4.7 Ω resistor fitted on the a.c. side of the rectifier where it seldom ruptures. Later CTX chassis made for UK use have this half-wave circuit, which has put the resistor problem to bed (see Fig. 4).

The S and E versions of the chassis are so different that chassis swapping isn't practical – and there are two versions of each chassis, remote control requiring an extra stage in the regulator circuit to produce the standby condition.

Before leaving this chassis, note that beam limiter circuit faults can produce the raster but no picture symptom. Check C2565 which is adjacent to the line output transformer – and if necessary the nearby R3565 which can go high in value. The same thing can happen with the KT3/K30/K35 series where the capacitor is C565.

CF1 Chassis

The requirement for an isolated chassis with audio/video input is no more important than with colour portables, especially now that they can be used as text monitors for pages of 40 characters per line. The CTX

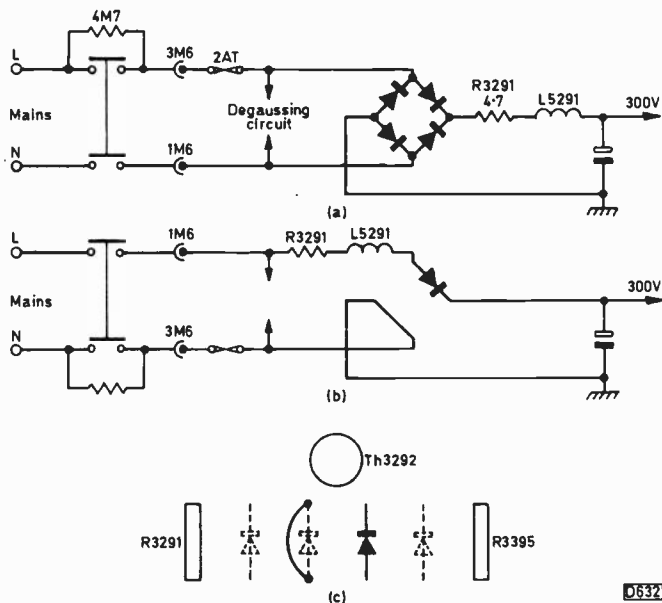


Fig. 4: CTX mains supplies. (a) Bridge rectifier circuit inherited from the KT3 chassis. (b) Later version rearranged as a half-wave rectifier. You can adopt this as shown in (c) but R3291 and L5291 will still be on the h.t. side.

chassis is unsuitable for this purpose, hence the CF1, a flat chassis that's similar to the Ferguson TX90 in that the channel selector switch and tuning resistor bank, also the user controls, are all mounted on the main board. It's slightly smaller than the CTX chassis, and though isolated the circuitry around the BUT11F chopper transistor *and its heatsink* are all at mains potential and should be treated with respect. Unlike the SOPS arrangement used with System 4 sets, on this chassis there's no plastic cage around the live part of the chassis, though a wide area of copper on the main panel is etched away to form a boundary which, for feedback purposes, is bridged by the opto-coupler. The CF1 chassis doesn't have a SCART connector: instead there are separate phono plugs for audio and video in/out and a DIN socket for any videofax type of input (RGB + sync).

The CF1's one vice for the newcomer to beware of relates to the tuning. A trimming tool is provided to tune in the channels. When you've done this the tool can be parked back in its hole in either of two ways, depending on where its flat side is. One way restores the a.f.c. after tuning, the other way doesn't. So if you suspect poor a.f.c. or tuner drift, check the position of the trimming tool first.

The CF1 is limited to use in 90° portables. The intention is to progress to new chassis known as the CP90 and CP110, which have been designed for use with FS type tubes.

CP90 Chassis

As you'd guess, the CP90 is for 90° models and the CP110 for 110° models. At the time of writing just a few details of the CP90 have become available. It's a one-panel job, similar in this respect to the CF1, carrying not only the tuner, i.f. and teletext modules but all the user controls, the remote control receiver and even the mains on-off switch. The circuitry derives in the main from the 2A chassis (see below) and the CF1, with a self-oscillating power supply that "ticks over" during standby. The tuning system is VST2 however. Remote control is assumed for use throughout the range: thus the user controls in the set itself transfer their commands to the receiver's infra-red eye via an adjacent infra-red transmitter. A fully wired

SCART connector has video and audio in/out and RGB inputs for use as a computer display. To save users having to fiddle around at the back of the set the video and audio inputs can be fed in via jack sockets on the front control panel beside the headphone socket: these inputs are in parallel with those on the SCART socket.

The field-frequency waveform for EW correction is derived from the tube's beam current instead of the field timebase (tube current is zero during the field flyback, so there's a 50Hz component). An advantage of this arrangement is that it provides width correction to compensate for heavy beam currents during bright parts of the picture.

As with the CF1, a discrete two-transistor field output stage is used, with two BD939F transistors. It looks like a class AB circuit though the operation is somewhat different – the operation of this type of circuit was described in the May 1984 issue (page 377).

These sets will be with us in the near future, and we'll be returning to them. Meanwhile, today's general-purpose chassis is the 2A.

2A Chassis

The 2A chassis is used in the majority of current Pye/Philips basic, remote control and teletext models. It's a logical progression from the CTX. Like the CF1, it has an isolated chassis, using a self-oscillating chopper power supply which, while like that in the later System 4 chassis, has the added facility of providing l.t. for the remote control receiver during standby operation. All 2As have electronic memory tuning. Basic models use a system called TUON – there are two versions, the later one being physically different from early production. This system uses an HA11484 chip for tuning and channel selection. Remote control and teletext sets employ a citac panel. This uses an MAB8441P microcomputer chip and an SAB3037 citac (computer interface for tuning and analogue control) chip. TUON closely follows the VST system, without the tuning line. Citac counts the channel numbers like TRD4. Philips also refer to citac as FST (frequency synthesised tuning), which immediately precludes use of FST to refer to the new breed of flat, square tubes – thus Philips call their FS tubes FSQ. Confused? Never mind.

The TUON panel is mounted behind the set's control panel. Although electronically similar the two versions differ in physical shape to allow for the different push-button presentations to which they are attached. The TUON memory is volatile, so the channel allocations are preserved at switch off by a 3V disc-type back-up battery. The weaknesses are carried forward from previous series, namely the tendency for pushbuttons to break off prematurely and poor a.f.c. on the higher channels. The 2.2MΩ resistor previously mentioned (System 4) is present on the board – it's R3846, and can be bypassed with another 2.2MΩ resistor to improve the a.f.c. action from ch. 55 upwards. Once again, check that this doesn't lock out VCRs on ch. 36.

The citac systems are mounted on plug-in boards alongside the tuner on the main panel, and are interesting in that an ordinary BZX79 zener diode is used to stabilise the 33V tuning line in place of the conventional ZKT33. (Newcomers who doubt whether the ZKT33 really is an i.c. should carefully break open a dud one: the "iron filing" that falls out of the gap will, if studied under a stylus microscope, reveal the etched circuits of a true i.c. The circuitry used was shown and described in the

February 1975 issue of *Television*, pages 159-160.) The writer finds that a ZKT33 is a suitable replacement.

The 2A chassis' audio is rather sharp, especially to the ear of a viewer who gets a set as a replacement for one of the older CTVs with a deeper cabinet. Sibillance can be reduced by adjusting the value of the de-emphasis capacitor C2121 (0.022 μ F) upwards. When we used to perform a similar service with KT3s we used as our yardstick the noise which accompanied the picture snow when the aerial was disconnected. You can't do this with 2As since they mute the sound when off tune. So we use a VCR run with the aerial disconnected to give us a 6MHz noise signal in the E-E mode.

2B Chassis

The 2B chassis is the stereo version of the 2A. It appears to be similar and most features are in fact identical, but it's not compatible. To identify it quickly from the rear, note that the tuner and i.f. cans are farther inboard than in the 2A chassis (that's if you failed to notice the stereo speakers . . .). At the time of writing this chassis is too new to have developed any awkward habits. It's not, as yet, fitted with a decoder capable of handling the recently approved QPSK stereo sound system.

Computer Controlled Teletext

CCT (computer controlled teletext) was first fitted to later System 4 sets and is common to all the 2As. In essence it's a development from the original teletext board fitted to KT3/K30s, and is in fact plug-compatible and interchangeable with these boards (but you need a different handset).

It has two full page memories and displays two page headers. The upper one, called the status row, shows which page is being sought by the second or background memory while you are reading the page already stored in the foreground memory. Pressing the CCT button changes the memories over. So while you are reading the page of your choice you can also be selecting and holding the one you want to read next.

The "high tech" sets in the range couple this with the old "supertext" memory, making it possible to preselect a menu of pages (on the same channel) which can be subsequently captured for reading in rapid succession. The system has two drawbacks. As stated, the pages must all be from the magazine you're watching - the thing won't change channel on its own. And the menu is lost when you switch the set off.

CCT boards produce a different typeface to previous teletext, with character rounding which on earlier sets worked only during the mixed text and picture mode. The same chip set can be used throughout Europe by rearranging links to modify the character set for any of three in-built languages.

Self-oscillating Power Supply

A self-oscillating power supply (SOPS), i.e. a self-oscillating chopper circuit, is used in the 2A, 2B, CF1 and later System 4 chassis. Since it provides mains isolation the chassis is "dead", permitting the direct connection of audio/video feeds. The circuits differ in detail from chassis to chassis but the basic principle is common to them all.

Fig. 5 shows the basic arrangement as used in the 2A chassis. The heart of the circuit is a power transistor, Tr7687, connected via transformer T5663 as a blocking

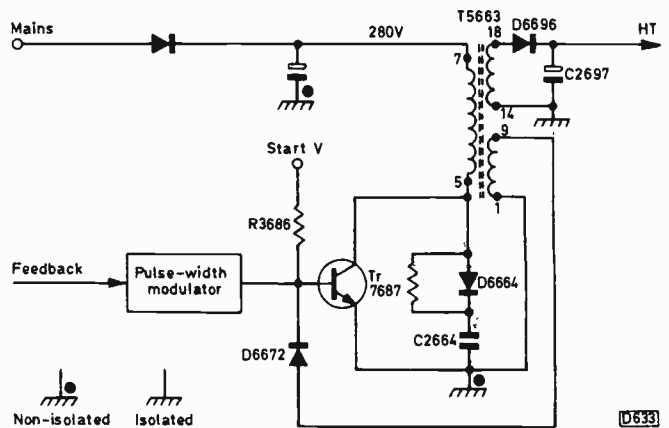


Fig. 5: Basic blocking oscillator circuit used in the self-oscillating power supply (SOPS).

oscillator. A pulse-width modulator is used to switch off the transistor at an earlier point in the cycle than the natural free-running point, thus leading to a regulated output. Let's consider the blocking-oscillator action first. At switch-on Tr7687 will begin to conduct as a result of the forward bias applied to its base via the start-up resistor R3686. As a result, a linearly increasing current will flow through primary winding 5-7 of the chopper/blocking oscillator transformer T5663. Tr7687 is held in conduction by the feedback from winding 1-9 via D6672 to its base. When the transformer saturates, the feedback winding no longer drives Tr7687 which switches off. At this point the voltage across primary winding 5-7 reverses and D6664 switches on, charging C2664. The voltage across winding 14-18 also reverses, as a result of which D6696 charges its reservoir capacitor C2697, producing the h.t. supply for the line timebase. When the currents flowing in the transformer have fallen to zero, C2664 and winding 5-7 form an oscillatory circuit and the pulse produced across winding 1-9 switches Tr7687 on again. As already noted, Tr7687 is switched off early in the cycle, the exact switch-off time being varied to ensure that D6696/C2697 (and the other rectifier circuits connected to T5663 in the full circuit) provide a regulated output. Under normal working conditions the frequency of operation is fairly high, around 40kHz, and is not locked to the line rate. Everything on the primary side of the circuit is live to mains, everything on the rectifier side is "dead" - so mind your fingers and the minus lead of the meter when servicing. There are two "chassis potentials", with a bite between them.

The control arrangement, in much simplified form, is shown in Fig. 6. Transistor Tr7685 acts as the pulse-width modulator. When it conducts, Tr7686 switches on, shorting out the drive to Tr7687's base via D6672. Regulation depends on the time at which Tr7685 switches on. While the chopper transistor Tr7687 is conducting, diode D6667 is on and the RC integrating network R3678/9/C2675 produces a positive-going sawtooth at Tr7685's base. Tr7685's emitter sits on a reference voltage of approximately -3.5V which is developed across C2690 by the rectifying action of D6689 and D6672. Tr7685's base is biased via R3659/R3660 and the optocoupler OC7668. Regulation works in two ways. Changes in the loading on the power supply, i.e. h.t. voltage variations, alter the bias at the base of Tr7685 and thus the point during the sawtooth at which it switches on. Comparator transistor Tr7717 senses loading variations and adjusts the bias via Tr7719 and the optocoupler OC7668. Variations in the

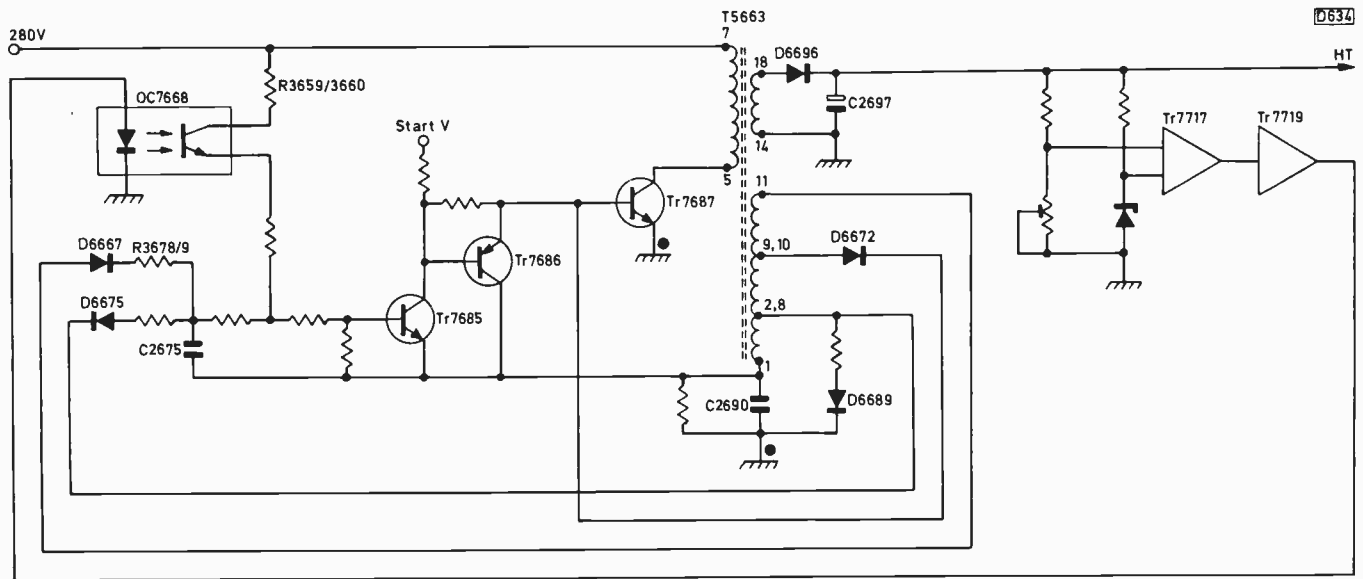


Fig. 6: Control arrangements for the self-oscillating power supply. Simplified circuit as used in the 2A chassis.

mains voltage alter the slope of the sawtooth at the base of Tr7685 and thus its conduction point. Tr7685 is switched off by applying a negative-going pulse to its base via D6675.

Servicing SOPS

The whole arrangement is to an extent self-protective against overloading. A short-circuit across the h.t. supply for example will close down the optocoupler path and thus modify the action of the pulse-width modulator. The frequency of operation falls from around 40kHz to about 1kHz, producing a harsh, audible whistle. In practice a crowbar thyristor is connected across the h.t. line. In the event of a voltage overload this thyristor conducts to give the short-circuit condition. There's a temptation when troubleshooting to disable this crowbar circuit to see what blows up. Since the answer is just about everything, the temptation should be resisted. You can tell whether the harsh whistle is due to a short-circuit or the over-voltage crowbar thyristor (Ty6698, type BT151/500R) being fired since the latter will be cold for a short and warm if it was switched on by excess voltage conditions. Incidentally, the optocoupler (type CNX62) is a small black device the size of an operational amplifier.

You can run the SOPS board (or the SOPS part of a flat chassis set) separately from the rest of the receiver by using two 60W bulbs in parallel as a dummy load across its h.t. output. By using this facility in conjunction with a separate h.t. supply (even another SOPS) you can break the feedback loops which operate the protection action in order to home in on your trouble.

On System 4 sets the SOPS is shut off during remote standby – a control circuit closes the optocoupler. A separate power supply is fitted to the board to enable the remote receiver etc. to operate during this time.

2A chassis sets are a little more advanced. The SOPS itself generates the standby l.t. Instead of closing down it changes to a lower power mode. The lower voltages thus produced are insufficient to operate the line timebase but enable the remote control receiver to work.

A few fault-finding tips. When the chopper transistor fails it usually takes with it the two control transistors, e.g. Tr7685/6 in the 2A chassis. No h.t. and a stopped chopper suggests loss of the supply from the mains rectifier or a

fault in its supply path. No h.t. and a low whistle indicate an h.t. short or a tripped crowbar – see above. No h.t. and no whistle, with the scope showing that the circuit is working at a high frequency (80kHz), suggest trouble in the SOPS itself – check for dry-joints and printed circuit cracks. H.T. plus high frequency of oscillation mean that the circuit is not loaded, i.e. the line timebase has stopped.

In Conclusion

So there we are. These are the main features of the five new chassis produced by Philips since the K30. Not a settled period, to put it mildly, and with satellite TV, stereo sound and Fastext all around the corner probably a transitory one. The proliferation of models coupled with the general improvement in reliability mean that the days when you could print a list of "stock faults" has all but gone. NTSC could now mean "never twice the same component".

The Square Portables

For the sake of completeness we should perhaps mention the little colour portables with 9in. FS tubes, Models 10CX1120 (Philips) and 25KX1201 (Pye). These use a totally different chassis which was designed and manufactured by an associate company. It's an isolated chassis fitted with a SCART connector. Isolation is provided by a Siemens type SOPS using the well-known TDA4600-2 control chip. The PAL decoder chip is a TDA3301/3303, the sync chip a TDA2592 and the field timebase chip a TDA1770. The tuning and channel memory arrangements differ from other Philips sets.

For servicing the single panel can be slid out from the rear after releasing two lugs. It can be helpful to switch the set on before withdrawing the panel. A couple of points worth noting. When the L387 5V regulator (IC661) goes short-circuit, as it sometimes does, it takes with it fuse S661 (500mAT). This is a small black device that looks like a plastic transistor – it's known as a Wickman fuse. Secondly intermittent colour tinting is a common trouble due to the 2.2kΩ background presets P3317, P3337 and P3357 on the tube base panel. We replace all three, using RS types.

25kV EHT Probe

Andrew J. Heron

This article describes the design and construction of a self-contained e.h.t. probe, i.e. the probe incorporates a moving-coil meter. The probe has been designed to measure voltages up to 25kV: the prototype has served the author reliably for over three years.

Circuit Considerations

The circuit is simple enough – the only electronic components required are resistors! It calls for careful consideration however, primarily for safety reasons.

Fig. 1 shows the circuit. The meter used in the prototype is a small (approximately 1.75in. square) panel meter with a $200\mu\text{A}$ moving-coil movement. The meter's scaling is unimportant as a suitable scale has to be fitted later. If a voltmeter is used the internal resistor must be removed.

Resistor R is the multiplier, which effectively converts the ammeter into a voltmeter. Its value can be calculated quite simply as follows:

$$R = V_{in}/I_{fsd} = 25\text{kV}/200\mu\text{A} = 125\text{M}\Omega.$$

The voltage drop across the meter can be ignored. The multiplier resistor's power dissipation is as follows:

$$P = V^2/R = 25\text{kV}^2/125\text{M}\Omega = 11\text{W}.$$

Now 25kV across a single $125\text{M}\Omega$ resistor rated at 11W is dangerous and quite impractical. The solution is to use a number of lower value resistors connected in series.

Reference to the relevant data showed that the standard metal-film resistors used in the prototype have a maximum working voltage of 250V. If we decide on a

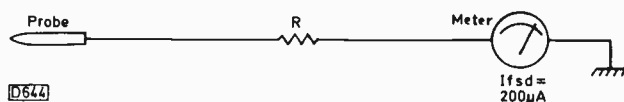


Fig. 1: Circuit diagram.

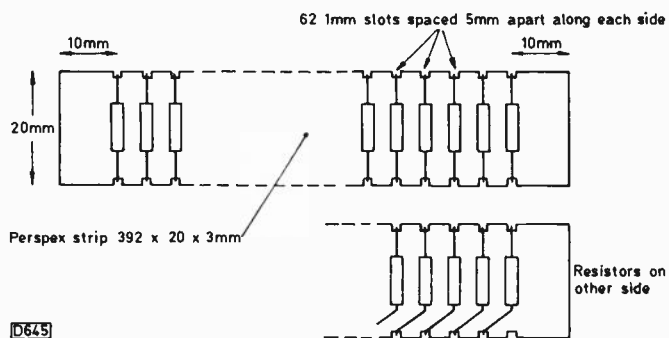


Fig. 2: Mounting the resistors. Suitable resistors are available from Maplin (metal film, 0.6W)- order number A1M (pack of ten).

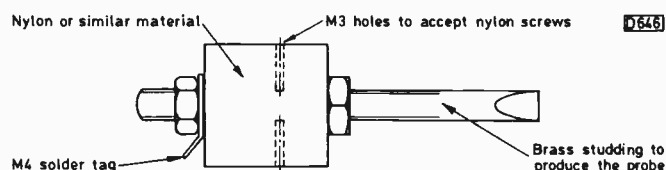


Fig. 3: Details of the probe tip.

maximum of 200V across each resistor this will be well within the working limits of these components. The number of resistors required (n) is:

$$n = 25\text{kV}/200\text{V} = 125.$$

Given that a series resistance of $125\text{M}\Omega$ is required, the value of each resistor will be:

$$R = 125\text{M}\Omega/125 = 1\text{M}\Omega.$$

The total chain of resistors will be capable of dissipating in excess of 70W, which is well in excess of the required 11W.

Construction

The resistors are connected in series around a strip of 3mm Perspex as shown in Fig. 2. Alternatively paxolin could be used – this may be easier to work with. To maintain the resistors in position, sixty one slots with a depth of approximately 1mm were cut along the two sides of the Perspex strip. The slots have a 5mm spacing and can be quite easily cut using a hacksaw. Form the leads of the resistors to engage in these slots, thus preventing them from sliding along the strip.

The simplest housing for the assembly is a length of PVC tubing into which the strip can be slid. The internal diameter of the tube should be about 25mm – the assembly should not be allowed too much movement within the tube.

Insert at one end of the tube a piece of nylon or similar insulating material of 15mm length and of diameter equal to the tube's internal diameter – see Fig. 3. Drill two holes in the tube and the plug to accept two M3 nylon screws. Drill a 4mm hole through the centre of the plug, then bolt a short length of brass studding through the plug: file one end to produce a flat blade which serves as the probe.

Trim the other end of the tube to allow the meter to sit on its surface – glue the meter in position using a suitable adhesive. This method of mounting the meter is extremely effective when the meter's physical size makes it possible.

Drill a single 4mm hole in a convenient position at the meter end of the tube to enable the earthing lead to be passed into the tube. Connect this lead to the meter's negative terminal: terminate the other end with an insulated crocodile clip. Connect the probe to the far end of the resistor chain by means of an M4 solder tag. The other end of the chain is connected to the meter's positive terminal.

Scaling

Cover the existing meter scale with a self-adhesive paper label. With the probe assembled, attach the cro-

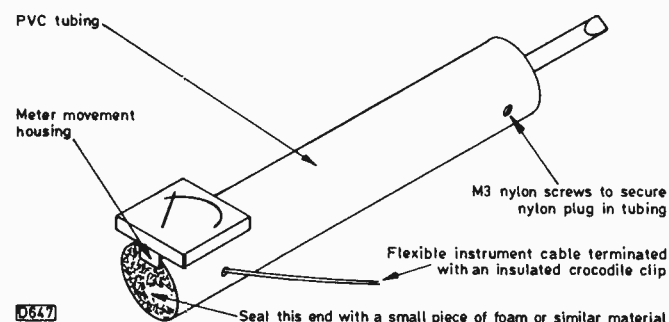


Fig. 4: General assembly.

dile clip (earth lead) to a suitable earthing point and place the probe under the final anode cap of a c.r.t. operated at 25kV. If the receiver is functioning correctly it will be safe to assume that its e.h.t. is satisfactory. Switch the receiver on and mark the 25kV point on the new scale. The 0V point can be marked when the probe has been removed. Divide the scale and mark at either 1kV intervals or significant points, e.g. 12kV, 18kV, 20kV etc. – a linear meter must be used if it's to be scaled in this manner.

Safety Factors

Most readers should be aware of the need to exercise caution when dealing with e.h.t. circuits. The following points are worth mentioning however.

- (1) Ensure that all soldered joints are smooth, i.e. avoid solder spikes.
 - (2) Trim the leads close to the joint.
 - (3) Ensure that the resistors are mounted so that they remain close to the strip on which they are assembled.
 - (4) Clean off any solder splashes.
- The above points become increasingly important towards the probe, or e.h.t., end of the chain. The following points are general tips.
- (5) Always place the probe under the c.r.t.'s final anode cap before switching the receiver on.
 - (6) Always hold the probe at the meter end, well away from the "live" end.
 - (7) Remember the golden rule: always keep one hand in your pocket.

Long-distance Television

Roger Bunney

Apart from a slight increase in Sporadic E activity, March was a disappointing month: there was no auroral or tropospheric reception, just the SpE lift and daily, random MS (meteor scatter) signals.

Very strong winds covered the UK and the Benelux countries towards the end of march (26/27th). In Holland, winds approaching force 11 overturned Ryn Muntjewerff's lattice mast. It was discovered that a bog-like region some 20cm deep, between the bottom of the concrete block foundation and the top of the frozen ground beneath, had been created by heavy rain that had been unable to drain away. When the strong wind struck the side of the mast it swivelled and toppled over. Since it fell against and was supported by a nearby barn the mast and aerials survived. We hope Ryn manages to restore his aerial system soon.

With one exception the following log covers short/medium distance SpE reception during the period:

- 7/3/87 SR (Sweden) ch. E2.
- 8/3/87 TVE (Spain) E2; RAI (Italy) IA; TSS (USSR) R1; ARD (W. Germany) E3.
- 9/3/87 TSS R1; YLE (Finland) E3.
- 11/3/87 CST (Czechoslovakia) R1; DR (Denmark) E3; RAI IA; RTE (Eire) Gort ch. B.
- 19/3/87 TSS R2.
- 21/3/87 Unidentified ballet at 2230 BST on ch. E3.
- 24/3/87 RAI IA.
- 25/3/87 +PTT (Switzerland) E2; YLE E3; TVP (Poland) R2.
- 26/3/87 TSS R2; NRK (Norway) E4.
- 28/3/87 TSS R1.

The signal from Gort, Western Ireland on the 11th was an interesting one. Simon Hamer noted the relatively strong signal at his New Radnor (N. Wales) home during a period when tropospheric propagation was absent. Thoughts are that the propagation mode could be either a form of E layer back scatter or aircraft scatter. Did anyone else notice back scatter on the 11th, with signals at higher frequencies than is normal with SpE?

Another cloud on the horizon is the suggestion that the

Copenhagen ch. E4 transmitter may close down when a new TV tower for TV2 is completed in 1988.

News Items

UK: In the March issue we mentioned a BBC-TV communications system operating at about 181.5MHz in Band III. Since then, wideband f.m. has been measured at 181.5125MHz, the transmissions carrying rehearsals, interviews etc. for the BBC's south east news programme, together with news bulletins for the 1550 and 2130 transmissions, in parallel with the BBC-1 or BBC-2 transmissions. The signals have horizontal polarisation and their direction suggests origination from Elstree. Just below Band II there's a base OB frequency at 87.825MHz from Alexandra Palace, duplexing with 77.82MHz.

Denmark: A new private TV station at Esbjerg Alt in West Denmark transmits on ch. E53. The new TV2 network will have sixteen main transmitters and 60 relay stations, all operating at u.h.f. The main transmitters will run at 100-800kW e.r.p. TV2 is to start transmissions next year, providing a form of regional TV. The first transmitter will be Copenhagen ch. E53 (with horizontal polarisation).

Sweden: The Finnish YLE-TV programme is being transmitted by three stations in the Stockholm area, a main 1,000kW outlet using ch. E39 and two relays (500W on ch. E47, 100W on ch. E49).

France: The US CBS News programme Good Evening is now being transmitted by Canal Plus at 0600-0630 GMT each weekday without scrambling. The scrambling system used by Canal Plus has been modified to give greater security. Filler signals are inserted at the start/end of certain delayed lines, preventing the use of the blanking/video transition to control descrambling. In addition the starting point in the pseudo-random sequence is varied, with approximately one second intervals between two of the eight possible values represented by the condition of three consecutive transmissions of line 622 (black or white) following white on line 309. Detailed information on the scrambling system is given in the January 1987 issue of the French magazine *Science et Vie*. If you're sufficiently versed in the arts you can apparently work out your own decoder design from this information (but please don't write to me for a circuit diagram!).

In brief: The US Information Agency is establishing new satellite receiving systems in South Asia, the Far East and Africa to provide video feeds for the Worldnet global TV programme (mainly news, sports and the US view of things). The USIA has recently installed a satellite receiving system to monitor the TSS-1 (USSR) output from the

Molniya series of communications satellites . . . Sony have introduced a new series of low-noise field-effect transistors for microwave use – they are referred to as HEMT devices. The 2SK676-1 and 2SK677-1 are available in ceramic or chip packs and have a maximum noise figure of 1dB at 12GHz, with a gain of over 10dB. They use gallium arsenide technology with MOCVD (metal organic chemical vapour deposition) fabrication.

UHF Notch Filter

A new Triax u.h.f. notch filter is now available in the UK – the u.h.f. notch filters previously on sale in the domestic market have been from Polytron, with Band IV and Band V versions giving a rejection notch of typically 22-24dB. The new filter covers chs. 21-68 with a screw adjustment at one end.

It's an in-line unit measuring two inches tip-to-tip on the signal connection axis $\times 1\frac{3}{8}$ in. high $\times \frac{5}{8}$ in. deep, the housing being apparently of bright mild steel. Since there's a d.c. short between the inner conductor and the screen/case the filter cannot be used in applications where a head amplifier is powered via the coaxial downlead: it should be fitted before the head amplifier (with suitable protection) or after the power supply (assuming use of an amplifier). The Polytron filters don't have this limitation.

Measurements were made on chs. 31 and 66. On ch. 31 the notch depth was found to be 27dB, with an insertion loss of 8dB \pm two channels, 1dB \pm four channels. On ch.66 the notch depth was 19dB, with an insertion loss of 8dB \pm two channels, 1.5dB over six channels down and 1dB over ten channels down.

It will be noted that the notch is both sharper and deeper at lower frequencies, the characteristic being less defined as the frequency increases. As a general purpose notch filter covering the entire u.h.f. band it's extremely useful and simple to adjust – though the setting is more critical at the higher frequencies.

Fitted after a power supply it's efficient at removing an unwanted local strong transmission when attempting to receive a more distant fringe signal some channels away. The problem of interference from airport radar equipment working on/about ch. 36 (particularly troublesome with VCR outputs in some areas) can be easily eradicated. It sells for rather less than comparable single notch filters.

Band I Interference

A strong carrier has been noticed at 49MHz. It's generally present in the evenings and its persistence merited investigation. It was certainly not caused by an illegal cordless phone or a child's walkie-talkie. During a local street walkabout I found that the source was about half a mile from my home. At the source the signal seemed to carry vague domestic noises, suggesting an open microphone – maybe a baby alarm – but causing interference at half a mile?! The measured frequency was 49.830MHz, which is within the December 1987 onwards allocation of 49.82-49.98MHz for "general-purpose low-level devices not exceeding 10mW output".

Friendly contact was established with the user, who confirmed that he had a baby alarm – a "plastic box" that plugs into the mains upstairs (the transmitter) and a battery-powered receiver that can be clipped to the parent's belt etc. The absence of an aerial suggests that the mains wiring is used for transmission. A label on the back stated that it conformed to an unknown FCC (US) standard and provided the information that it's a crystal controlled 49.830MHz narrow-band f.m. microphone

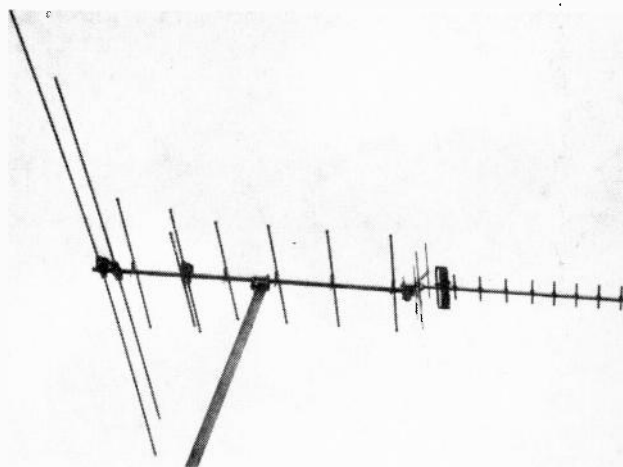
transmitter. It's identified as Model GEE420, manufactured by the Golden Eagle Electronics Manufactory Ltd. of Hong Kong!

These alarms have been distributed in large numbers by Innovations Ltd., a mail-order marketing firm whose catalogue accompanies Access card statements. The firm is based at Gelderd Road, Leeds. I've been unable to obtain from the company any information on transmitter power or whether the equipment is DTI approved. The noise-free carrier received at such a distance suggests a high output! The DTI has been advised and an investigation is being carried out. If any TV-DXing monitor suddenly experiences constant carrier problems at 49MHz, persisting over several hours, it may be due to either a cordless phone left "off the hook" or a Golden Eagle baby alarm.

Thoughts on DX Aerials

A TV-DXing system is of course only as good as the aerial that feeds it. In Band I, a two- or three-element wideband Yagi array will give excellent results when used with a rotating system/rotor. Similarly in Band III a ten-element Yagi array will, during appropriate tropospheric conditions and depending on your geographical location, provide many European signals. Both however are relatively large arrays, and with the end of the 405-line v.h.f. services a DXing aerial will tend to stand out rather amongst the usual domestic u.h.f. aerials. Large u.h.f. arrays don't stand out so much.

There's a growing tendency for local planning authorities to pay attention to "unusual" aerial systems, and in view of their relative size DX v.h.f. arrays are increasingly coming in for criticism. I've received several enquiries, from readers/DXers over the past year about planning problems, and during the week that I write this one



Above: Wideband Band I/III u.h.f. aerial array made up for use during a holiday at Ventnor. It gave impressive results and could be the answer where a low-profile array is required.



Left: 49MHz base station aerial produced by Les Wallen Manufacturing Ltd. for use with the new paging services. Another possible solution where a compact aerial is required.

Havant Dxr was told to remove all his TV aerials, including the domestic ones, when his application for permission for continued use of the aerials came up. Temporary permission had been given to him but application has to be made every three years and is subject to complaints etc. A local councillor described the aerials as "hideous" (I quote from a press cutting) and the outcome was that the applicant's housing committee gave him fourteen days to remove the structure. We are now acting on his behalf to see whether a basic low-profile wideband aerial mounted just above the roof line could be used to make continued DXing possible.

The average new house, certainly in the south, comes with a minute garden area, and with up to sixteen housing units per acre any large aerials tend to dominate the scene. I've therefore been giving the problem of aerials a great deal of thought, particularly to see whether compact systems can offer an alternative to the usual arrays.

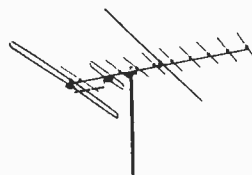
In the July 1986 column I described a fairly compact wideband Band I/III Yagi aerial mounted on a common boom, to which an Antiference TC10/W ten-element wideband u.h.f. array could be added. One of the accompanying photos shows a system I made for use while on holiday at Ventnor, Isle of Wight. The results obtained with this were impressive. To minimise the cabling, the Band I/III outputs were diplexed into a common v.h.f. downlead which was followed with a BFY90 wideband preamplifier. An indoor BFR91 preamplifier was used for the u.h.f. signals. Where local planning problems are encountered either of these two systems might provide an acceptable compromise while retaining reasonable efficiency if used with an aerial rotor. Note that the TC10/W is available for about £8 from Tandy stores.

Another alternative is the active aerial. Datong for example produce a wideband active dipole that covers s.w. and low v.h.f. into Band I. I've tried the active encapsulated "caravan" type aerials but found the results, particularly in Band I, disappointing. Omni-directional active aerials intended for marine use are also available, but these tend to be expensive. Triax recently introduced a lower priced active disc aerial covering 40-860MHz (amplifier coverage), called the UFO! The diameter of this white plastic unit is approximately 14in. It's claimed to be omni-directional with an amplifier gain from 16dB in Band I to 22dB at u.h.f. The noise figure is under 2dB and the signal handling capability is good at 104dB μ V. Triax have kindly provided a UFO for evaluation during the coming SpE season, and I'll be reporting on this in due course. My feeling is that for optimum results you really need full-size elements, but if your back is to the wall this aerial might offer a lower efficiency solution.

I also hope to report on the use of vertically polarised aerials for Band I reception during SpE openings. Last year I found that a vertical Tandy scanner monitoring aerial (marketed as the Telescan!) gave good reception of short- and medium-distance SpE signals - the signal level obtained was often higher than that from a horizontally-mounted four-element Yagi array. More distant signals tended to retain their original polarisation however. The performance of the Telescan fell off considerably below ch. E3, so I've been looking for an alternative.

Use of a CB base aerial looked like a possible solution, since the harmonic relationship of 27MHz \times 2 gives 54MHz, i.e. the middle of Band I. The inevitable mismatch could be swamped by using a wideband Band I head amplifier at the CB aerial's output. Les Wallen

FERNSEH-ANTENNA Combined Band 1/3 Aerial for TV-DXing



The 1987 Sporadic-E season should now be with us! Time to take advantage of a special offer from **Aerial Techniques** to re-equip your system. The Fernseh-Antenna DR1712 is an efficient low cost Wideband VHF aerial covering both Bands 1 & 3, it has a gain of 3.5dB in Band 1 and 9.5dB in Band 3. Folded dipoles for peak efficiency are used in both Band 1 & 3 sections. Front to back ratio is 11dB - Band 1; 25dB - Band 3. The aerial has been gold lacquered for high resistance against weather corrosion. This array has close spaced elements, making it a very compact length of 72", ideal for the enthusiast with restricted space, or those unable to erect separate aerials. This aerial only requires a single coaxial downlead.

In certain areas the use of a wideband VHF amplifier can be advantageous, the Antiference UP1300 fits the bill. This preamplifier covers 40-230MHz (Bands 1 to 3) with a gain of 19dB and a low noise figure of 2.5dB. The amplifiers matching power supply unit provides 12v DC via the coaxial downlead.

FERNSEH-ANTENNA Combined Band 1/3 Aerial - Special offer - carriage free! **£43.75**
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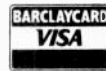
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(Ramsgate) supply a base-mounting 27MHz aerial called the Saturn (there's a certain outer space feel to these commercial names!). When I contacted Les Wallen I found that there's a 49MHz version of the Saturn, intended for base station paging use. This is 19in. long (see photograph) and I will be testing it alongside the UFO during the coming season. Incidentally, "base-mounting" means an aerial intended for use at home. The 49MHz aerial is very well made. Its bandwidth is claimed to be 49MHz \pm 5MHz with a VSWR of 1:1.5. Both the UFO and the 49MHz Saturn are for use with PL259 termination plugs (as used with v.h.f. amateur equipment/CB rigs).

I hope that by the end of the season it will be possible to recommend a compromise that may offer a solution to readers with local planning/environmental problems. Certainly the last two aerials are small and could be lifted to a considerable height, perhaps for temporary periods. The Les Wallen aerial is available from CB stores (stress the 49MHz type for paging) or advertisers in *Citizens Band* magazine. Both the UFO and the Les Wallen aerial can be obtained from Aerial Techniques.

Meanwhile, if any readers have had success with the use of compromise aerial systems I'd like to hear from them. Also from anyone who wishes to write in about planning problems and any solutions.

Help wanted/For Disposal

J.B. Colbourne of 43 Westfield Road, Stoutown, Bilston, West Midlands is seeking a complete, undamaged plastic case for a Plustron Model TVR5D. E. Goody of 20 Kent View, Aveley, South Ockendon, Essex RM15 4JP has over 100 "large" and 300 "small" radio and TV valves to give to anyone wanting them.

VCR Clinic

Panasonic NV366

This machine suffered from an intermittently noisy picture. The playback picture was very good at the start: going to search or still also produced clean pictures, but on returning to playback the picture would be noisy and the tracking control had no effect. This is a four-head machine (two for standard play and two for the search and still modes), the switching between heads being carried out by means of relays. Replacing these cured the fault.

A.D.

Grundig VS220

The playback picture had three white lines across it. One was central and the other two were in the bottom half of the picture. Advice was sought from Grundig who suggested removing the bottom of the drum motor and cleaning the brushes. When this was done and the machine was reassembled it worked perfectly.

A.D.

JVC Camera with Olympus VCR

The VCR turned out to be a Panasonic NV100 and the complaint was no recording. We found that with the camera connected to the VCR it couldn't be released from the pause mode by means of the camera's trigger. A check on the pause line input from the camera revealed a short-circuit to chassis. This cleared when the camera was unplugged. At the time this seemed strange, because it should have prevented the VCR going into the pause mode. No short-circuit could be found in the camera, but a short-circuit was present when the two units were connected. On trying another camera we found that the VCR was o.k. So the fault was in the camera or its lead. What our customer had neglected to tell us was that the lead had been repaired recently by "the man round the corner who knows about kettles". The connections to the plug at the camera end of the lead had been reversed laterally. Hence all the confusion.

A.D.

Sharp VC9300

This machine came in with the complaint "stops after a few seconds". When we opened it up we found that it had received unprofessional attention. The mains fuse had been replaced with several strands of 5A fuse wire and the counter belt from the take-up reel to the take-up sensor pulley was missing. As a result, the VCR went to stop after playing for a few seconds. The take-up and supply reels were well worn, as was the reel idler. In addition to all this the cassette motor continued to run when the housing was fully lowered. This was due to a deliberate solder blob. When this was removed the cassette housing stopped half way: the eject finish switch on the cassette housing was open-circuit.

A.D.

Hitachi VT8500

The remote control wouldn't provide channel change – the other functions worked correctly (note that channel change won't work without a cassette in the VCR). The pulses from the remote control receiver board go to the servo board and then pass to the timer board. After

Reports from Alfred Damp, Eugene Trundle, Steve Leatherbarrow, Philip H. Ireland and Philip Blundell, Eng. Tech.

processing they go to the channel selector board. C112 on the timer board was open-circuit.

A.D.

Hitachi VT130

This VCR's voltage-synthesis tuning would scan the band correctly but failed to lock on to any transmission. The most obvious cause of the fault, failure of the sync pulses to reach the tuning system, proved not to be the case. A scope comparison with another machine showed that the a.f.c. input to the panel didn't vary during the tuning search. Replacing the combined tuner/i.f. module cleared the fault.

P.H.I.

Pye 65VR20/Philips VR6520

This machine would occasionally return to stop from fast forward or rewind, especially when warm. It was noticed that the tape counter would slow down erratically without a corresponding reduction of the tape speed. The reel sensor opto-detector IC1501 proved to have reduced sensitivity when warm.

Another of these machines had no capstan rotation. The reason was loss of the unregulated 12V supply to the capstan control chip IC2004 due to fusible resistor R2096 (0.68Ω) being high in value. This device is not shown in my service manual.

P.H.I.

Sony SLC6 Mk. II

Low sound on ITV only was the unlikely complaint with this machine. It turned out to be true, along with a low-brightness button three neon. A look at the circuit showed that the neon is used to bias the mute drive transistor Q010. Replacing the neon cured both faults.

P.H.I.

Grundig 2 × 4

There was a plopping noise on the sound and a disturbance on the screen. The cause of the fault was soon found when the head screening cover was removed – the red DTF wires had been trapped under it and were shorting to chassis.

P.B.

Sharp VC9300

For low reel torque in all modes check for dry-joints on Q8001. This transistor is mounted at the rear of the chassis, by the head drum.

P.B.

Mitsubishi HS304

Stops playing after ten minutes was the complaint with this machine. The capstan was stopping as after this period of time had elapsed the capstan drive chip was hot enough to fry eggs on! The capstan motor was faulty.

P.B.

JVC HRD725/Ferguson 3V43

Intermittent failure to play can be due to resistance in the loading mechanism. Inspect the grease on the loading mechanism and gears as this can get hard.

If every segment of the display is on switch off immedi-

ately! Q2 in the power supply is probably short-circuit, causing the switched 12V supply to rise to 23V. Replace Q1, Q2 and D2 on the power supply panel and Q3, D13, D17, D18, D19, D20, C13, C14, L1 and IC1 on the tuner/timer board. P.B.

JVC HRD140/150/250

There's been a change to the intermittent bias oscillator start-up modification for these machines. Add an 0-0082 μ F Mylar capacitor (previously 0-0056 μ F was suggested) across C23. P.B.

Amstrad VCR9000

For no front loading motor rotation try giving the motor a half turn and then having another go. The motors often develop a dead spot – replacements are available for CPC. If this doesn't do the trick, try cleaning the cassette in and lift position detect switches. P.B.

Philips VR6462/Tatung 8490

This machine refused to rewind when a cassette was present. With no cassette inserted however it happily included rewind in its repertoire of tricks! The culprit was betrayed by a potential of 4-5V at connector 4DP2. This came from the "tape begin" photodiode on the right-hand side of the deck (board P672). The diode was leaky. E.T.

Panasonic NV370/830/850

There was severe horizontal twitching and pulling on playback – the corrugation of the verticals was even worse with self-recorded material. The fault was somewhat intermittent.

The cause of the problem was "sticking" of the impedance roller up-stream of the full erase head. For a complete and permanent cure both the white roller and its insert should be replaced. This applies to Models NV370, NV830 and NV850. In the case of the latter two models, which have hi-fi sound, correct alignment of this roller is crucial to correct tracking of the hi-fi signals and hence the quality of the audio output. E.T.

Sharp VC7700

This machine caused some amusement in the workshop whilst it was on test: the machine would intermittently eject a tape. Pulses going astray? Take-up reel stopping? Neither of these problems were found when the top of the machine was removed. The 555 timer chips on the mechacon board were the cause of the fault. These undeniably useful i.c.s have caused all manner of problems in all manner of equipment in the past. Oh yes, and the eject flap also opened without provocation even without a tape being in. S.L.

Sharp VC383

Playback of a prerecorded tape was fine but there was a problem when a recording was made and played back: a band a few lines deep was present, with the odd kink in it, across the screen about a third of the way down. The record switching monostable was found to be at fault. Changing the cross-coupler C714 cured the problem and all that remained was to change the reel motor and idler. S.L.

next month in

TELEVISION

● SUPER VHS

The standard VHS and Beta specifications are inevitably something of a compromise, dependent on the technology that was available at the time they were adopted. As the technology advances, so improved performance can be provided. From the VHS camp, JVC recently announced Super VHS (S-VHS). Steve Bæching reports on the new specification and the picture quality achieved.

● SERIES OR SHUNT

Back to basics with Stan Amos who describes some of the subtler aspects of series and shunt component networks. It's sometimes an advantage to replace series components with the equivalent shunt-connected arrangement.

● SERVICING THE TX9

Well the earlier version anyway. Gordon Haigh on the problem of fuse blowing with the thyristor-type power supply and one or two other faults you may experience.

● THE GLUE GUN

Harold Berkley describes a recent addition to his tool kit, the glue gun. This has proved to be invaluable, extending the range of repairs that can be carried out and often avoiding the need for a return visit.

● A VINTAGE RESTORATION

Steve Rowley has successfully restored an Ekco TA201, the 7in. TV adaptor that was on sale almost fifty years ago. As he points out, there's a great difference between normal servicing and vintage restoration.

● VIDEO-8 AUDIO

Eugene Trundle on the techniques used to handle the audio signal in the Video-8 equipment.

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Mr Doublecheck and Mrs Tart

Les Lawry-Johns

We've had some odd ones in here recently, and they're getting odder. Take Mr. Doublecheck for example. He's from some east European country and his use of the English language is on the quaint side to say the least. He carried in an old Ferguson record player with a BSR deck.

"It doesn't speak properly."

"Right oh! sir, we'll make it speak properly. Call for it tomorrow."

"No, I'll call for it on Wednesday" – which was tomorrow.

So we got down to it. The stylus had no tips and on auto it didn't land in the right place. This was seen to and the next item was that the turntable made a grinding noise. So we oiled the centre spindle then saw to a couple of other points. It now played La Boheme beautifully in rich Italian. Jim Reeves sung in rich English.

He came back the next day and asked to hear it working. So I plugged it in and put on La Boheme.

"It still doesn't speak properly."

I snatched off the record. Jim Reeves now sang in English.

"Ah, now it speaks properly – but what's that noise?"

I listened very carefully and turned the sound down. Yes, I could just hear a faint thump I'd not noticed before. I took off the turntable and inspected the rubber drive wheel. This had a slight dent where it had been in contact with the spindle and left there motionless for some time. I selected a new one from the shelf. It now played without the slight thump. Jim Reeves sang again and Mr. Doublecheck nodded cautiously. He produced a length of lead from his pocket, and a 13A plug.

"Put this on for me. My landlord doesn't like me doing these things."

I sighed and fitted the plug.

"How do I run my light and record player from this?"

"You put a socket on the end of the lead and fit a two-way adaptor."

"You do this for me. I don't mind waiting."

So I fitted a socket and supplied an adaptor.

"Thank you. I'll bring the money in tomorrow."

Mrs Tart

Some time later a tall, fashionably dressed lady came in carrying a 12in. monochrome portable. She spoke in a very la-di-da manner, obviously not her usual voice. I wondered what she had to hide.

"I've been given this TV set for my son to use in his room. The picture's very dark. Can you do something about it?"

I said I'd do my best and that she could probably have it later that day. Left alone I tried the set and found that the whites were silvery, suggesting that the tube was low or underrun. I checked the heater supply and found it to be 12V near enough. All the other tube base voltages seemed to be right except for the first anode voltage which was under 200V. The manual didn't specify what it should be so I checked the resistors and capacitors in the circuit and found them to be within specification. I reactivated the tube and was rewarded with a nice clear picture.

When Mrs. Tart returned I showed her the picture.

"Oh yes. That's a little better – but not as good as that one there."

She pointed to the TX9 14in. colour portable which had a needle-sharp picture and was for sale.

"That's a beauty" I said proudly.

"Is it for sale?"

"Yes indeed. It's eighty pounds."

"Will you take weekly payments? Say 50p a week?"

"No madam, I'm afraid I can't."

"Well, how much is my little portable?"

"Five pounds, madam."

"That much? I can't afford that much."

"Well take it away and don't come back any more."

"I don't mind giving you a pound."

"Just take it and go, please."

So she went, in her fashionable clothes and her put-on talk. I must be barmy.

The CVC30

Next came an ITT colour set with a 26in. tube – CVC30 chassis. For some peculiar reason I didn't tackle it the way I usually do. I checked the h.t. voltage and found none. Next I checked the chopper transistor which was in order. It had –320V at its emitter and base, so it wasn't being turned on. The driver transistor had no voltage at its collector. I put a short across its base and emitter and h.t. appeared at its collector. As a quick check I fitted another CMP30 switch-mode power supply control panel. Still no joy. So I dug out the circuit and studied it. I moved and the edge of the manual touched the upper right EW modulator drive panel. The whole thing then came on and a nice picture appeared. I tapped here and there, hoping to find a dry-joint. I just couldn't make it go off, so I proceeded to deal with the other complaint, intermittent height.

This was an easy one, the fault being on the correction board over the scan coils. There was a nice dry-joint here which I corrected with a short length of wire. The height was now steady and I returned to investigate the mystery shut-down. I couldn't make it repeat its original performance no matter how many times I switched off and on again. The customer returned and I related the sad tale. He expressed satisfaction with the set and carted it off. Next day he phoned to say that it was dead again and he'd be bringing it in.

This time I tackled it the usual way. I tapped the line output transistor and the set came on immediately. The usual dry-joint on the collector tag. I could have kicked myself but got Honey Bunch to do it instead. Not that hard you cruel bitch . . .

The customer carried his set off again and we haven't seen him since.

How Not to Repair Sets

When Beardy and Non-beardy carried an old Thorn 3500 in I cleared my throat ready to tell them to . . . off.

"We will pay you well to repair this TV for us."

"And guarantee it for ever no doubt."

"No, no. That was just a misunderstanding. You mis-

understood us you see.”

“Oh, all right. Leave it here and pick it up later today.”

“We’ll call for it on Friday morning.” Good Friday. Another holiday lost.

When they’d gone I started on the most horrific job I’ve mucked up for a long time. I think I did everything wrong.

I noted that the red button had tripped, so I checked for shorts and found one straight away. A BU208 had been fitted in place of the R2010 chopper transistor. After a struggle I removed it and checked it with a meter. In the set it had recorded a dead short: now it was clear of shorts. I checked the set again. No shorts. I fitted a new R2010 and switched on. There was a click and some smoke. The R2010 was dead short. I removed it and it was still short-circuit. I called the set some nasty names, removed the power supply panel and fitted a spare. As there were no shorts I switched the set on. It coughed and the 2.5A h.t. fuse failed. I again checked for shorts and found none. What I should have done was to disconnect the tripler, but I didn’t, being the fool that I am.

I decided to change the timebase panel. When I switched on the new fuse failed (not blew). Now I

disconnected the tripler, and now the fuse held. I kicked myself (softly, not like H.B. does). I tried again after fitting a new tripler. This time the picture came on but was far too bright: with the aerial out the raster was over bright.

The first anodes were at 800V, but with the controls turned down the raster was still too bright even with the brightness control at minimum. Like a fool I checked the beam limiter panel carefully and found nothing amiss. A check on the grids revealed that they were at the same voltage as the cathodes, well over 100V. A check at the tube bias preset R450 showed that there was no negative voltage here. The feed resistor was all right but there was no negative supply at connector 18/1. It then dawned on me. I’d fitted the new tripler plug without seeing it properly. On inspection only this end was contacting, the far end wasn’t even in. I called myself every rotten name I could think of, like the chief P.O. had called me when I swiped his head with my rifle in 1942. Now the picture was good and the controls had to be turned up to their previous settings. I didn’t have the nerve to fit the original panels. I just wrapped it up and waited for Beardy and Non-beardy to collect it. They still haven’t.

Cable and Satellite 87

Harold Peters

The Cable and Satellite 87 exhibition was held at the Wembley Exhibition Centre on March 26-29th. It was organised by Montbuild Ltd. in association with 21st Century Publishing Ltd., publishers of *Satellite TV Europe*, the space watchers’ *Radio Times*. There were over 60 stands in the Centre, the attendant dish farm being outside in the car park.

Although there have been no new satellite launches recently there were nevertheless several items to attract the enthusiast, especially out in the dish farm. Dishes now come in all shapes and sizes, though the 1.5m offset-fed type is almost standard for inclusion with the average TVRO package. A huge 5m dish was receiving C-band pictures from the USA. At the other end of the scale Matsushita was showing a range of light, wafer thin flat-plate aerials with the capability of lateral stacking to increase the gain.

The flat-plate aerial could well be the shape of things to come. It was jointly developed by the COMSAT Corporation in conjunction with Matsushita Electric Works. COMSAT’s contribution was the development of what is referred to as a “multilayer planar array structure” that provides high efficiencies (60-70 per cent) over a wide bandwidth – comparable to that of a conventional parabolic aerial. MEW will be manufacturing the aerials and have contributed printed circuit technology and low-cost manufacturing capability. It seems that inside the flat panel there’s a phased microstrip array. This technology calls for quite elaborate design work to get optimum characteristics. Matsushita will be marketing a range with dimensions of typically 354 × 20mm and 720 × 20mm. The aerials are expected to be available later this year at prices some 30 per cent higher than conventional parabolic aerials. Large-scale production should see lower prices.

Receivers now come with built-in aerial control. Skyscan offer two handsets with theirs, a simple one for the user and an “all-dancing, all-singing” one for the

person who has to do the programming. Drake dispense with the spaghetti bunch of wires: their control unit can be housed in the garage, with only a single coaxial connection to the receiver(s) in the house.

The broadcasters took a lot of floorspace, each trying to attract a wider audience. The Luxembourg Astra stand attracted most attention, to the chagrin of the MAC-D2 DBS protagonists.

There was some simple test gear too. Handics’ precision inclinometer uses a diffraction grating to give an accuracy of 0.2 per cent. From the Cotswolds, Satellite Systems offer the “Squawker” signal strength meter and also a portable site survey viewfinder.

Even with all this gear around we noticed, as we left, a dish being lined up in the old-fashioned way – by watching the output on a portable TV set!



The Matsushita flat-plate satellite TV aerial.

Servicing Mechanical VCRs

Part 4

Mike Phelan

This month we'll start to examine the loading mechanism – it's probably the most complicated and trouble-prone part of the machine. In fairness to the manufacturer, many of the troubles stem from previous unsuccessful attempts to repair the mechanism, though wear and tear are now taking their toll as these machines are getting old. A good understanding of the principles of operation can go a long way to easing the task of curing some of the more obscure faults in this part of the machine.

When the machine is put into the play, record or audio dub mode the tape has to be extracted from the cassette and wrapped around the video head drum. This operation is followed by several others: the impedance rollers and erase head are brought into position, the pinch roller is carried towards the capstan, the back tension arm is released, and finally the guide rollers are rigidly locked. All this is done using power supplied by the capstan motor, the drive being taken from a pinion incorporated in the capstan flywheel. The drive is taken through two intermediate gears to a large gear that controls all the operations, in much the same way that an autochanger works. The process has to be performed in reverse order when stop is selected. Loading and unloading each occupy half a revolution of the large gear.

One of the intermediate gears is mounted on a rocking arm that's coaxial with the gear (see Fig. 1) to allow the drive to be engaged and disengaged.

The Play and Stop Processes

The loading-1 and play mechanisms are shown in Figs. 2 and 3, viewed from below.

The large gear is called the timing gear – we'll keep to the manufacturer's terms to avoid confusion. This gear has two almost diametrically opposite notches in its periphery. The timing arm roller rests in one of these notches when the gear is stationary.

When the play key is depressed, either on its own or in conjunction with the record or audio dub key, the projec-

tion on the play key moves the linked play levers 1, 2 and 3. The latter has an L-shaped notch in it, in which the stud on the change lever rests. Play lever 3 is lightly spring-loaded so that the stud is in the short arm of the L. Consequently the change lever is moved, the stud at its other end allowing the gear arm to turn and engage the drive.

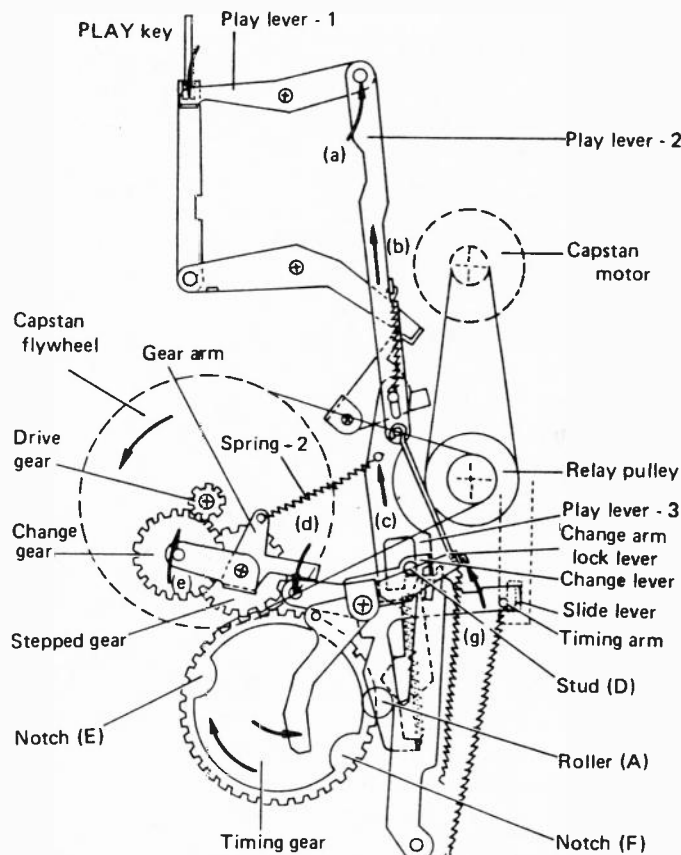
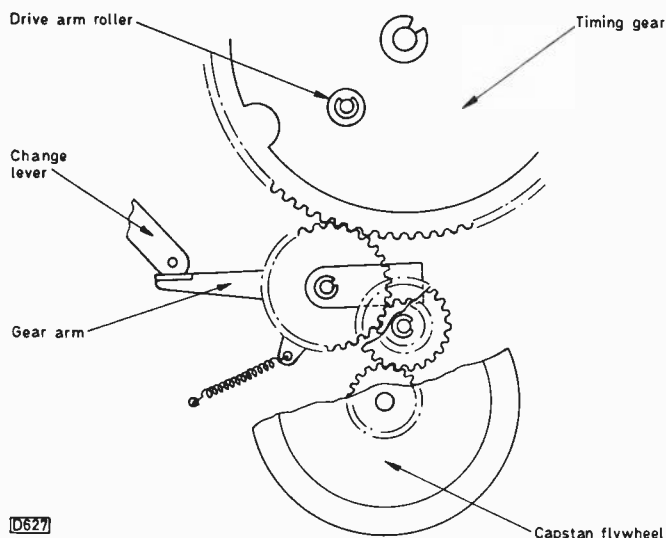


Fig. 2: The loading-1 mechanism, viewed from beneath.



D527

Fig. 1: The gear train between the capstan flywheel and the timing gear.

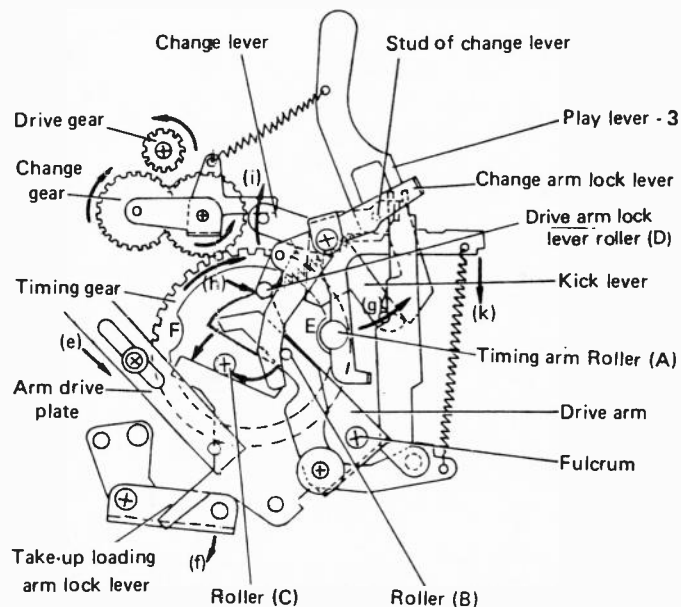


Fig. 3: The play mode mechanism, viewed from beneath.

Table 1: Common loading mechanism faults.

Symptom	Cause	Remedy
Loading mechanism doesn't engage at all. Change lever moves.	Gear arm seized on post due to lack of lubricant or flaking of plating.	Remove capstan and gear arm, clean bores of gears with cloth, clean post, grease and reassemble.
Similar but change lever doesn't move. Machine may work when stood on end for examination.	End play lever 3 bent where the kick lever engages. This fouls the underside of the timing gear and prevents the L notch moving the drive arm.	Straighten lever as necessary. Later machines have a large nylon washer over the L notch. It can become gunged up with sticky grease. Check this.
Loud clunk from mechanism at completion of loading. Machine then unloads.	Drive arm lock roller fails to engage with notch on drive arm, so latter springs back and unlocks the change arms, initiating the unloading cycle.	Either the timing post is loose or out of vertical. Some people find a temporary cure by leaving the cover plate off the timing gear, but this is not to be recommended (see below). The correct cure is to straighten the post and re-rivet if necessary. This can be accomplished by using a staking tool and punch (see Fig. 4).
Mechanism stalls part way through the unloading cycle. Capstan belt may come off.	Someone has left the cover plate off the timing gear and the small pivoted lever on drive arm has become wedged in chassis opening.	Replace plate. Turn mechanism manually in reverse to release.

At the same time the capstan motor is energised and the timing gear rotates clockwise, viewed from below. Play lever 2 also has a wire link to the change arm lock lever. As a result the latter rotates, allowing the drive arm lock lever roller to rest on the periphery of the drive arm. As the timing gear starts to rotate, the timing arm roller is lifted out of its notch and the large roller on the timing gear moves the drive arm until the drive arm lock lever roller engages the notch in the drive arm.

Beneath the timing gear there's a pin that collides with the kick lever just before completion of loading. This pushes play lever 3 so that the change lever stud is in the long arm of the L notch. The main reason for this is so that the change lever is free to move and disengage the drive gears. This happens when the timing arm roller drops into the notch in the timing gear, allowing the change lever to return to its resting position. By this time the loading arms etc. are in position for tape transport.

The reverse takes place to go to the stop position, the timing gear completing its rotation. This action is initiated by the play key being released either by operation of the stop key or by energising the stop solenoid. Play levers 1, 2 and 3 move towards the rear, the link on play lever 2 pushing the change arm lock lever back, lifting the locking

roller from the drive arm. Movement of the change arm lock lever also moves change arms 1 and 2 which push the change lever away from the gear arm, allowing the drive to start. The timing gear rotates, moving the drive arm back to the rest position. The loading arms return, and finally the timing arm roller enters its notch, pushing the change lever and releasing the drive.

The operation of the loading arms, pinch roller engagement, etc. and the faults that occur in this area will be covered next month. Meanwhile we'll look at some of the problems likely to be encountered with the mechanism under discussion.

Servicing Aspects

Many of the faults here result from the extreme spring pressures involved, particularly the springs on the drive arm and change arm lock lever. There's great strain on the posts that act as fulcrums for the various parts: they eventually become loose in the deck and need re-riveting. Fault diagnosis is made easier if the mechanism is turned slowly by hand while observing its operation. This is easier if the plate on the timing gear is first removed. Probably the best way of describing fault conditions is to list some of the more common symptoms with their causes and the appropriate remedies (see Table 1). Faults affecting the parts not yet described will be dealt with later.

Some of the heavily stressed components will benefit from a small amount of moly- or copper-based grease. Only a little though – it makes a horrific mess in quantity.

You'll find that various screws in the mechanism are locked with cellulose paint. The heads sometimes get chewed up on removal. It's not a bad idea to replace all damaged screws and relock the heads of those that were originally locked. A small car touch-up pack is ideal – whatever colour you want!

Next month we'll discuss the rest of the loading mechanism – it's rather simpler than the arrangement described above, which must be one of the most complex pieces of mechanism in any domestic VCR.

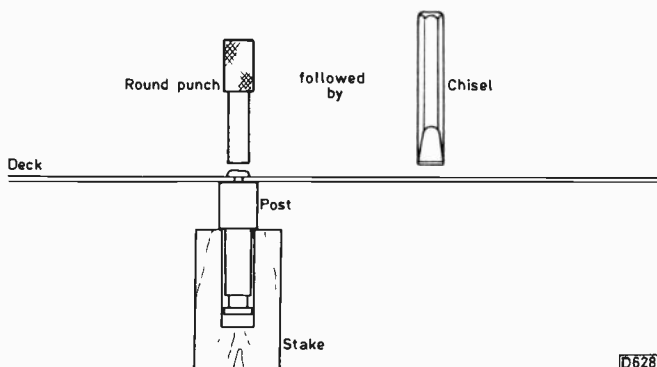


Fig. 4: Use of a stake, punch and chisel for re-riveting. Four stake sizes cover all posts in the machine.

Low-voltage DC Operation

J. LeJeune

In my day-to-day experience the arrival of the holiday season is heralded by a crop of complaints about unsatisfactory operation of domestic radio, television and video equipment intended for use on low-voltage d.c. supplies.

The operation of electronic equipment of any type with a supply shared by other electrical equipment places rather special demands on the installation. The electronic equipment may and probably will be sensitive to any disturbances present on the d.c. supply. Earth loops provide a second source of trouble when interconnected units are used. The source of the trouble may be perfectly evident, but the means of correcting it may not.

Radio equipment is normally not too difficult. Car radio receivers can be readily adapted for many forms of mobile operation, the only factor requiring attention being the operating voltage. Fortunately negative earthing is nowadays universal – and is assumed throughout this article. Where you have a 12V unit and a 24V supply some means of altering the supply voltage is required. This is most easily done by using a static regulator of sufficient current-carrying capacity. A suitable circuit is shown in Fig. 1. Advantage is taken of the regulator's ripple-rejection features to remove electrical noise from the input to the receiver. The regulator uses a chip which incorporates an operational amplifier, providing a very "quiet" output.

12V Operation

With a straight 12V supply the situation is, unhappily, not so simple. Advantage cannot be taken of an electronic regulation system since the voltage drop that this introduces cannot be tolerated. Furthermore, other electrical equipment operated from the same supply is likely to have a heavy current consumption, and quite possibly the manufacturers of such equipment will have made no attempts to reduce the interference produced by any motors or inverters in the equipment.

The first requirement of any low-voltage installation is that the wiring between the battery and the equipment consists of a heavy-gauge conductor. Wiring connection blocks and plug-and-socket connections should be substantial to ensure that they introduce a very low resistance in the circuit and thus a very low voltage drop under load. This is vital with a 12V supply, as the current demand of 12V apparatus will inevitably be higher than that of 24V equipment, assuming similar wattage. One cannot stress this point too much – it's the most common cause of unsatisfactory operation of electronic entertainment equipment on low-voltage supplies. Caravan and boat owners are alike notorious for thinking that low voltage requires only flimsy wiring! Portable TV sets give rise to the highest number of complaints.

The most common complaint with TV sets is that of the running time per battery charge. This is often the result of poor wiring. Consider a fully charged 38Ah battery with a terminal voltage of 13.6V. A colour portable with a 4A drain will operate from this battery until the voltage falls to 10.5V, a period of just over nine hours. If the wiring

introduces a loss of 1V however the viewing time per battery charge will fall to around five and a half hours. This is shorter than you might expect, but remember that the receiver's inverter power unit will try to keep the receiver's input power constant and as the input voltage falls the receiver's current demand will rise accordingly. Any resistance between the battery terminals and the receiver will make matters worse.

Operators of caravan sites and boat hire yards often try to get service engineers to adjust the low voltage cutout limit to allow a longer running time. This is not recommended, mainly because below this limit most receivers will be seriously under-run and lasting damage to the tube's emission will occur. Certainly the manufacturer's warranty will be invalidated.

24V Operation

Coaches, heavy goods vehicles and some larger boats use a 24V supply. In keeping with fundamental rules of electric power distribution, a higher voltage poses fewer problems in respect of voltage drop because the current demand of appliances is half that of similar 12V models. This is fine as long as the TV set, radio receiver or video equipment is capable of direct operation with a 24V supply. In practice very few receivers and VCRs have this facility. Where it's available, use it – the reduced current consumption will be an advantage.

On-board entertainment is being increasingly offered on luxury coaches. Off-air TV reception is not a practical proposition: coach companies don't want to employ an operator to steer the aerial and change the tuning as the vehicle moves from the area of one transmitter to that of the next. Neither do they want passengers arguing over which channel should be tuned in. Use of a VCR is the obvious solution.

Trouble-free operation here depends on the exact arrangement of the connections between the VCR and the TV set. Patterning may occur where a TV set with a non-isolated aerial socket is used – an earth loop is formed as a result of the common negative supply connection. Similar trouble can occur with a direct composite video and a direct sound input. The easy way out is to use an isolated r.f. lead for the signal, but if direct video and sound coupling is for some reason mandatory the filter shown in Fig. 2 should be incorporated in the supply to the TV set. The filter removes the ripple imposed on the d.c. supply to the receiver by its own inverter. This ripple is present on the negative line, and is thus part of an earth loop.

Most UK and European manufactured models can be operated at 24V but oriental models are generally suitable only for operation at 12V. Should it be necessary to operate a 12V set from a 24V supply the regulator circuit previously shown (Fig. 1) can be used with success. Portable video equipment used for playing tapes usually has a car battery adaptor accessory which is o.k. for 12V, but again when the supply is at 24V the regulator circuit shown in Fig. 1 should be used. A cheaper solution to this problem would obviously be to tap the coach or lorry battery at 12V. This will work with a lorry where the TV set is used when the vehicle is stationary and the alternator is not being used to charge the battery. With a coach however the opposite situation is found – the VCR and TV combination is in use while the vehicle is moving, often at night with the lights switched on and the alternator charging the battery. Under these conditions a considerable amount of alternator ripple is present on the

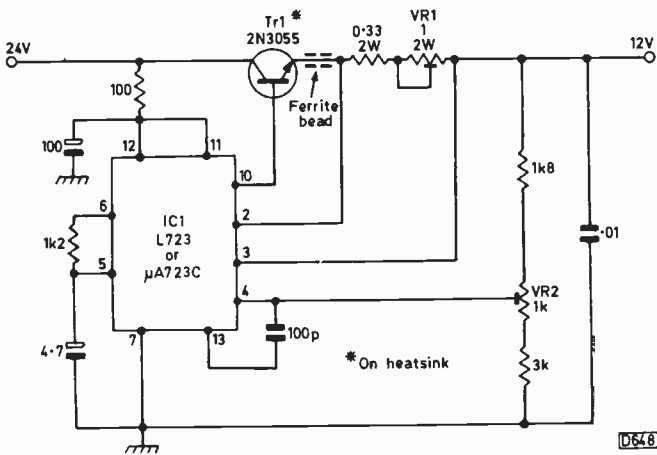


Fig. 1: Obtaining a stabilised 12V supply from a 24V source. Tr1 should be mounted on a heatsink – suitable types are the HQ70M, FL54J and FL77J from Maplin Electronics. Pins 1, 8 and 14 of IC1 have no connection and pin 9 is not used in this circuit. Set VR2 for 12V \pm 10%. Set VR1 (current limit) as follows. Rotate to minimum resistance and connect an ammeter in series with the load(s) to ascertain the peak current demand, e.g. TV at peak white and VCR in the loading/unloading mode. Switch off and disconnect load(s). Rotate VR1 to maximum resistance and connect an ammeter across the regulator's output terminals. Switch on and adjust VR1 for a reading slightly above the peak current demand. This sets the current limit to operate whenever the peak demand is exceeded.

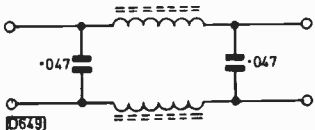


Fig. 2: Filter to remove inverter ripple. The chokes are Wilmslow Audio 8mH "standard power" inductors.

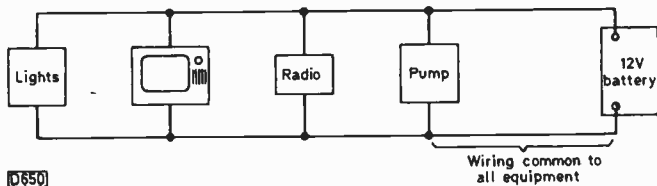


Fig. 3: Interference can occur when supply wiring is shared by several types of equipment, as here.

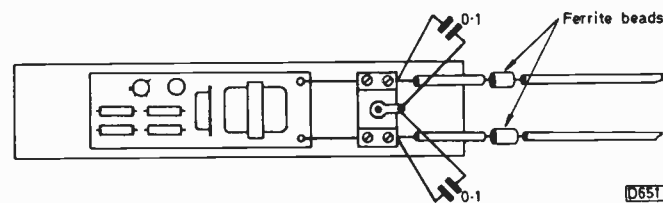


Fig. 4: Method of suppressing fluorescent light hash.



Fig. 5: "Heavy" filter using a bifilar choke (see Fig. 6).

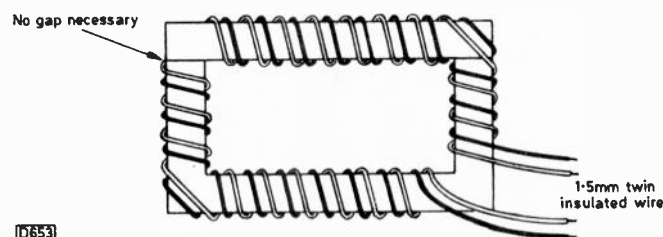


Fig. 6: Bifilar choke wound on the core of a discarded line output transformer.

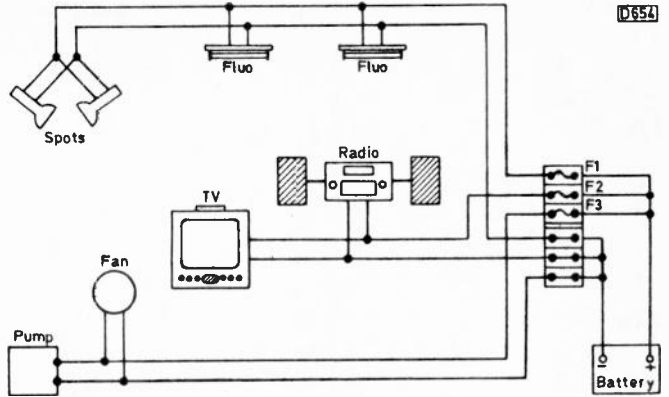


Fig. 7: Suggested wiring arrangement for a caravan. The fuses should be rated as follows: F1 and F2 15A, F3 30A.

supply. As a result the possibility of picture and sound disturbance is considerable, so the use of a regulator with a high ripple rejection factor is recommended. Make sure that units are not upset by the back-feed of h.f. from a TV set's inverter unit.

The guide-lines for coach installations should be followed with 24V marine installations. In addition, the TV set's supply should be filtered to reduce or eliminate the possibility of interference to navigational and communications equipment. The combination of high voltages and a lot of water is not always an amiable situation, so fusing of the TV receiver's supply is a wise precaution. If it doesn't drop more than a volt or so a conveniently situated circuit breaker is worth consideration.

Electrical Interference

Along with all the other problems associated with low-voltage operation there's the possibility of reception disruption due to supply disturbances caused by other equipment that shares the same circuit. Again, this can be simply the result of inadequate wiring. This sort of interference is caused by coupling via the shared wiring. Fig. 3 illustrates how the problem arises: a separate feed should be used for the TV, video or radio.

The small 12V fluorescent lamps used in caravans are a common cause of patterning. Diagonal bars and rippling bands are the most common signs that the fluorescent lamp inverter needs isolating. Some suppression of the h.f. energy fed back into the d.c. supply is advisable in the lamp fitting itself (see Fig. 4). Because of the high frequency of operation, usually around 30kHz, ceramic or low-inductance Mylar capacitors should be used.

Another source of temporary but annoying interference is the caravan water pump. A filter is the only cure. It will have to be a fairly "heavy" type – see Fig. 5. Because of the large d.c. flowing in them the stopper chokes should be of the gapped or rod type. Where space permits I use the C limbs of discarded line output transformers. These are plentiful in most workshops – look under any bench! The gauge of wire to use on them depends on the current to be carried and the voltage drop tolerable. To overcome the polarisation problem, the bifilar type can be used: the go and return currents cancel and an ungapped core can be used in a closed magnetic circuit. Again, provided there's space old line scan transformers can be used (see Fig. 6). Choke design is largely empirical: their purpose is solely to provide a high impedance to h.f. currents.

Fig. 7 shows how the wiring in a typical caravan installation should be arranged. Note the separate feed to the electronic equipment.

The 8mm Video System

Part 3

Eugene Trundle

With any helical-scan tape recording system it's necessary to record on the tape something to provide an indication of the physical position of the video tracks, so that the playback head scanning can be aligned with the tracks and maintained along the track centres. In the VHS and Beta formats the position reference signal consists of pulses which are laid down at 40msec intervals, forming a longitudinal control track at the edge of the tape. Each control pulse recorded on the tape has a fixed positional relationship to the associated video track. Thus correct tracking of the playback heads can be established and maintained as the tape passes round the head drum.

This system has served us well, but with very narrow tracks, especially those containing digital sound, a more precise tracking arrangement is required. The ideal is a system which, like the groove of a conventional gramophone record, acts as a guide for the heads as well as carrying the recorded programme material. The first example of such a system used with domestic VCR equipment was the DTF (dynamic track following) system that was adopted for the ill-fated Philips/Grundig V2000 format. The principle of the Video-8 format's ATF (automatic track following) system is very similar to DTF, though its practical implementation is different, as we shall see.

ATF Basics

The essence of the Video-8 ATF system is a recorded pilot tone which is recorded along with the picture throughout every field period. There are four pilot tone frequencies, f_1 (101.024kHz), f_2 (117.188kHz), f_3 (162.760kHz) and f_4 (146.484kHz). They are added to the luminance signal and recorded in track sequence, i.e. one tone frequency per field/head sweep as shown in Fig. 17.

Such relatively low frequencies are virtually unaffected by playback head azimuth offsets, so pilot-tone crosstalk from adjacent tracks is easily picked up by the heads during playback. The tone frequencies have been chosen

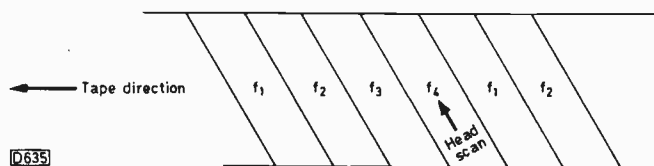


Fig. 17: The order of the ATF pilot tones during successive recorded video tracks.

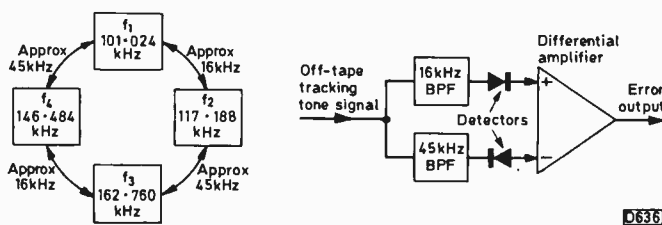


Fig. 18 (left): Frequency relationships between the ATF tracking pilot tones.

Fig. 19 (right): Simple method of deriving an error voltage from the inter-track pilot-tone beat signals.

to have specific relationships, as Fig. 18 shows. The pilot-tone beat frequencies that arise from mixing the signals from adjacent tracks are always 16kHz or 45kHz: it's these beat frequency products that are used to steer the heads – or the tape – to the optimum tracking position. Correct tracking is indicated by equal crosstalk from the adjacent tracks: the head is then dead-centred along the track it's scanning.

There are several ways in which the pilot-beat signals can be processed during playback. The simplest is the bandpass filter system, as used in some V2000 machines (see Fig. 19), which separates the 16kHz and 45kHz beat products so that they can be measured and applied to the two inputs of a differential amplifier whose output forms the error signal. This error output can be applied to piezoelectric head mounts, as in the V2000 system, or used to phase lock either the capstan or drum servo. While piezoelectric mounts can (and almost certainly will) be used in Video-8 machines to give noise-free trick playback pictures, the first generation of these machines uses phase lock of the capstan servo. Before looking into this we must see how the pilot tones are generated.

Pilot Tone Generation

The ATF frequencies are derived from a crystal oscillator that runs at 5.859375MHz, i.e. 375 times f_H – it's shown at the bottom of Fig. 21. The output from this oscillator is fed to a programmable divider which has four preset ratios, 58, 50, 36 and 40. The division ratio is selected by a pair of control lines from the system control circuit. These lines are designated SEL1 and SEL2 and Table 4 shows their effect. The syscon, working from head tach pulses, ensures that the correct sequence of pilot tones is produced, with head A (ch. 1) recording f_1 and f_3 and head B (ch. 2) f_2 and f_4 . To understand the playback tracking system it's essential to appreciate the operation of the SEL1 and SEL2 lines. The generated tones are added to the luminance f.m. signal in the record amplifier.

Unlike the V2000 system, no pilot tones are used for head positioning in the record mode. The fixed heads are precision-mounted on the drum, and in any piezoelectric head versions that may appear the heads will be held in a nominally central position in the record mode. A fifth pilot tone is specified in this format but this relates to multi-PCM audio only recordings – we'll return to this later.

ATF Playback

In Sony and Sony-derived Video-8 machines the pilot tones are also generated during playback as an essential part of the tracking-correction process. In the camcorder models the syscon, via the SEL1 and SEL2 lines, controls the generation of tones f_1 - f_4 in the reverse sequence to that during record, i.e. f_4 , f_3 , f_2 , f_1 – see Fig. 20. In this diagram the off-tape ATF signal is referred to as the REC pilot and the locally-generated sequence as the REF pilot. This diagram shows the ideal tracking conditions, where the off-tape tones switch in synchronism with the REF pilot tones. At every fourth field two f_1 tones appear

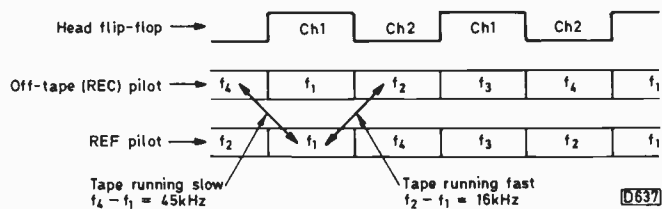


Fig. 20: Production of the beat tones in camcorder models: the off-tape pilot frequencies are compared with a locally generated tone sequence.

simultaneously at a mixer which in consequence produces a zero beat product. During the other fields the beat product is either zero (f_3 and f_3) or 29kHz (f_2 and f_4) – the latter is outside the bands of interest and is thus rejected.

Consider the situation when the tape speeds up. As will be noted from Figs. 17 and 20, the REC pilot will move to the left. As a result some REC pilot f_2 will appear during the REF pilot f_1 period, giving rise to a 16kHz beat product at the mixer output. In the same way f_3 beats with f_4 , f_4 with f_3 and f_1 with f_2 , producing a 16kHz output in each case.

When the tape slows down the REC pilot pattern moves to the right. Some REC f_4 now appears during the REF f_1 period, producing a 45kHz beat product. Likewise during the next three fields REC f_1 beats with f_4 , f_2 with f_3 and f_3 with f_2 , producing a 45kHz output in each case.

Thus a fast-running tape always results in a 16kHz output from the mixer while a slow-running tape produces a 45kHz output. It remains only to use suitably tuned bandpass filters to select these products and monitor the outputs by means of separate peak detectors. After passing through a differential amplifier (see Fig. 21) the ATF error signal is smoothed out and is passed on to be used as the capstan servo phase control voltage.

In practice the ATF sampling process is a little more elaborate than this, as Fig. 21 suggests. There are two sample/hold circuits, fed with sampling pulses TSA and TSB from the syscon. What happens is that the REF pilot tone sequence is delayed by 2.4msec as shown by line (c) in Fig. 22. The delay is generated by the syscon, which also produces the synchronous TSA (ATF error) and TSB (ATF lock) sampling pulses shown in rows (d) and (e). During its low periods TSA samples for capstan phase error. At these times the conditions shown in Fig. 20 are satisfied despite the timing offset of the REF pilot signal, so a coherent phase error voltage is produced.

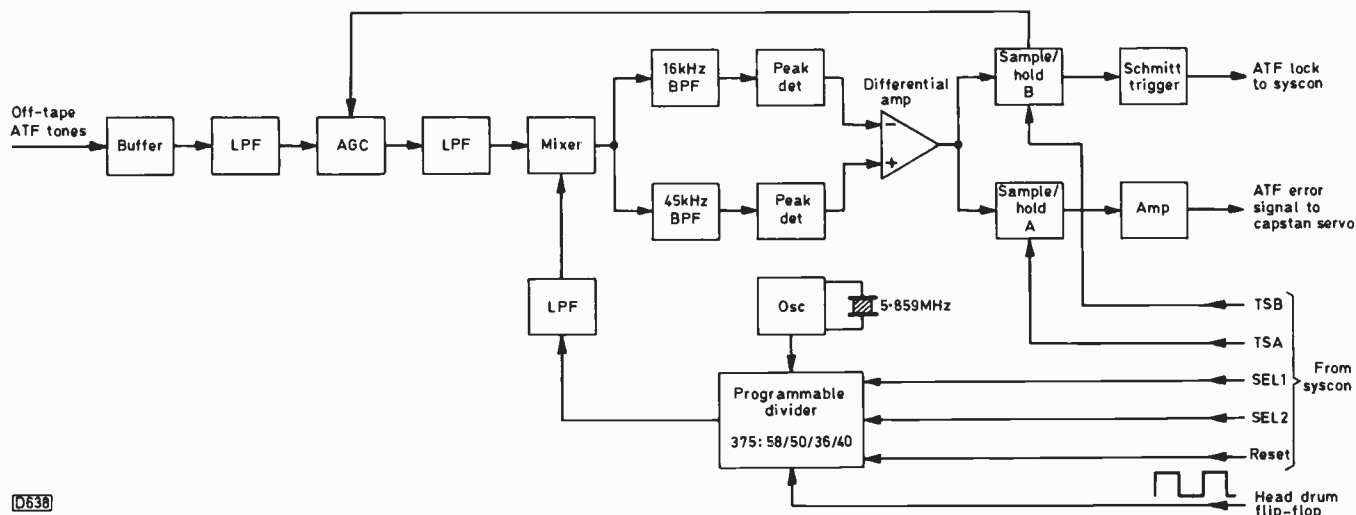


Fig. 21: Simplified block diagram of the ATF system used in camcorders.

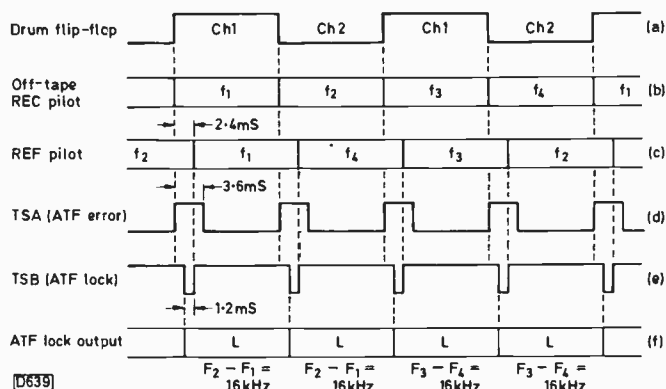


Fig. 22: Playback ATF processing pulse timing diagram for camcorders. Error sampling is carried out by the TSA pulses and servo lock confirmation by the TSB pulses.

The REF pilot signal timing offset is present so that a method of checking for “false” servo lock can be introduced. “False” locking can arise if the servo lock is so far out that head A (ch. 1) is following a ch. 1 track with the wrong tone, i.e. f_3 instead of f_1 . The capstan servo would be satisfied so long as the tracking remained spot on, with good sound and vision reproduction. But as soon as a tracking error started to occur the 16kHz and 45kHz beat frequencies would be reversed, leading to violent capstan speed instability.

To prevent this the syscon produces a second, short sampling pulse, TSB (ATF lock), whose duration is 1.2msec. It coincides with the “overlap” period between the REC pilot and REF pilot tone sequences – line (e) in Fig. 22. During its low period pulse TSB samples, in sample/hold block B (Fig. 21), the beat product between the REC and REF pilot tones. If all is well with the tracking, comparison is made in progressive fields between f_1 and f_2 (16kHz), f_2 and f_1 (16kHz) f_3 and f_4 (16kHz), f_4 and f_3 (16kHz) and so on. The result is a continuous low at the sample/hold B output (ATF lock) – see line (f) in Fig. 22. This informs the syscon that the ATF system is correctly locked.

The false lock situation is depicted in Fig. 23. Here we have a playback f_3 REC pilot during the period of an f_1 REF pilot. During the sampling periods (TSB low) the beat products will this time all be at 45kHz ($f_3 - f_2$ or $4f_1 - f_1$). The output from sample/hold block B is thus a continuous high, see line (e), indicating false lock. Since at this stage the vision and sound are both stable, and to “kick” the servo would result in temporary instability, on

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switches Q303 and Q304 are closed. When the tape is running fast the 16kHz resultant during f1 and f3 is coupled to peak detector 1 via the high resonant impedance of the 16kHz parallel LC filter A. Thus the "fast" input of the error differential amplifier is driven. During this period peak detector 2's input is grounded by the low impedance of the 45kHz filter B. During the alternate f2 and f4 field periods the 45kHz beat is applied to peak detector 1. For this purpose Q303 and Q304 are closed, the input to peak detector 2 being grounded by the low impedance (to 45kHz) of filter A. A slow-running tape's 45kHz output during the f1 and f3 periods is routed to peak detector 2 only, which also receives 16kHz during f2 and f4 as a result of the action of the switched filters. Thus all fast beat products are routed to peak detector 1 only and all slow beat products are routed to peak detector 2. The outputs from the fast and slow detectors are applied to the inverting and non-inverting inputs respectively of the differential amplifier, whose error output polarity and voltage indicate the direction and severity respectively of any tracking error.

The switching pulses (BP cont for Q301/2 and /BP cont for Q303/4) are antiphase squarewaves at a repetition rate of 40msec and are derived from the syscon.

The reasons for using this more complex playback ATF system in the "deck" machines are twofold. First, by reversing the BP cont and /BP cont signals during the review (reverse search) mode the servo will work "backwards" so that mistracking noise bars can be locked stationary on the screen. Secondly, in future multi-PCM audio configurations the potential is present for reverse-reading operation, in which continuous sound record or playback for up to eighteen hours is possible without a rewind cycle - the tape can shuttle back and forth evenly in normal speed each way.

The same REF pilot tone delay of 2-4msec is used in the switched-filter ATF system, with TSA (error) and TSB (lock) sampling pulses producing outputs for the servo and syscon respectively - as in Figs. 22 and 23.

receiving a false-lock message the syscon merely toggles the SEL2 line to reverse the REF pilot sequence. Reference to Table 4 shows that this establishes stable servo operation as depicted in Fig. 22, with no disturbance in the timing or tracking of the off-tape programme signals.

Deck Machines

The ATF playback system used in Sony "deck" machines such as the EVA300, EVS600 and EVS700 is a little different. This time the playback REC pilot tones are as before but the syscon governed REF pilot is sequenced in the same order as during record, i.e. f1, f2, f3, f4. When the tracking is correct this gives rise to the aligned tone sequences shown in Fig. 24.

If the tape speeds up, more and more f2 REC pilot will be played back during the f1 REF pilot period, producing a 16kHz beat. The same beat will be produced during the f3 REF period, as a result of the intrusion of f4 REC. During the f2 REF period the same circumstances (tape running fast) bring together f2 and f3, so the beat product is 45kHz. During f4 REF and f1 REC we'll also get 45kHz. So with a fast-running tape we'll get 16kHz for the duration of the f1 and f3 REF periods and 45kHz for the duration of the f2 and f4 REF periods. Conversely, when the tape is running slow 45kHz will appear during f1 and f3 REF and 16kHz during f2 and f4 REF. A filter-switching system is thus required to route the beat-product signal according to the track being replayed. The switch arrangement is shown in Fig. 25.

The output from the ATF tone mixer at the left passes through separate buffer amplifiers. During f1 and f3 only, switches Q301 and Q302 are closed; during f2 and f4 only,

SP/LP Switching

When a tape is presented for playback the machine has to detect whether it was recorded in the SP or LP mode and to switch the capstan speed automatically to suit. This is the second purpose of the ATF lock output previously described. Fig. 26(a) shows the situation in a V8 camcorder when an LP tape is running at the SP speed. During the TSB sampling period the REC and REF pilot beat products produce a characteristic LHLH pulse train at the ATF lock output of the ATF servo chip. This is interpreted by the syscon as a signal telling it to switch to the LP mode. The alternative situation, SP tape moving at LP speed, is shown in Fig. 26(b). This time the ATF lock pulse pattern is LHHL, on receipt of which the syscon switches to the SP mode. The process is the same in the deck machines, but the opposite sequence of REF pilot tones gives rise to different (but distinctive) pulse patterns which the syscon is programmed to recognise. In all cases the LP/SP switching is done only after sampling the tape for twelve fields.

Cue and Review

The deck machines have facilities to lock the noise bars during the search modes. For this purpose the gain of the capstan phase control loop is increased and the rate at

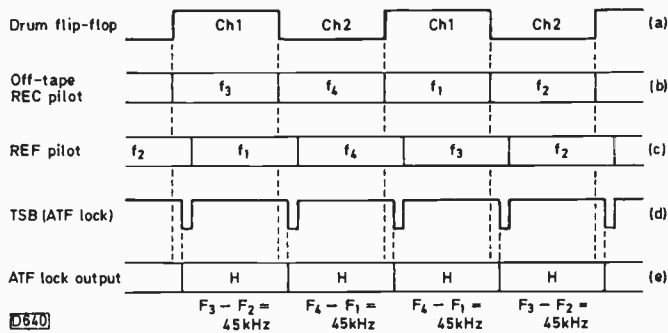


Fig. 23: A false-lock situation, where the servo is running two fields adrift. It's remedied by the ATF lock output's continuous high (bottom line).

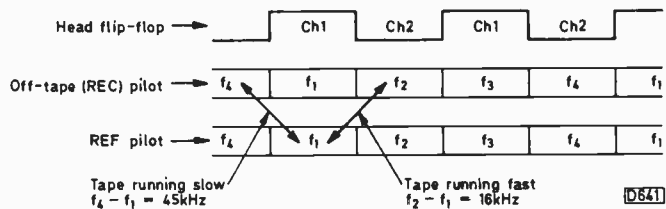


Fig. 24: Reference pilot tone sequence in deck machines: this is a more versatile arrangement than that shown in Fig. 20 but requires a more complex ATF error processing circuit.

which the REF pilot is changed increases to match the faster rate at which the off-tape REC pilot tones change. Thus for the cue mode the capstan speed is set at typically nine times normal by a programmable divider in the capstan FG path – the divider's input control data from the syscon tells it to divide by nine. Speed is established in this way: phase control is by means of the ATF system, giving three locked noise bars on the screen.

Review (minus seven times speed) is carried out in the same way, but in this case the REF pilot tone sequence must be generated backwards, i.e. f4, f3, f2, f1, to match the reversed sequence of the REC pilot tones coming off the tape. Again three solidly-locked noise bars are produced.

Freeze Frame

Good freeze-frame reproduction is available only on three-head (plus erase head) machines which have ch. 1 and ch. 1' heads. This ensures, via the ATF system, that

Table 4: Programmable divider control.

Control signals		Pilot frequency	Division ratio
SEL1	SEL2		
1	1	f1	375:58
0	1	f2	375:50
1	0	f3	375:36
0	0	f4	375:40

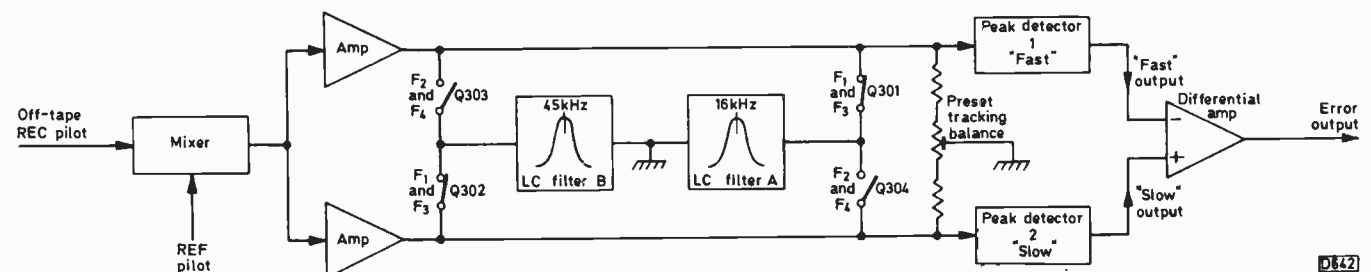


Fig. 25: Block diagram of the filter-switching arrangement used with the REF pilot tone sequence shown in Fig. 24. Switching transistors Q301-4 are driven by suitably timed pulses from the syscon.

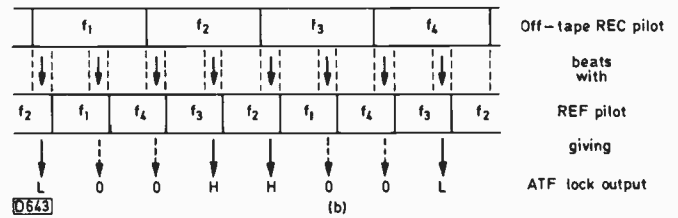
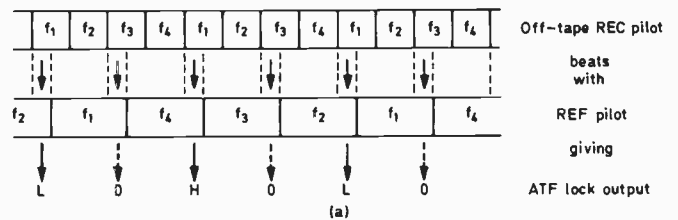


Fig. 26: Playback SP/LP mode detection. The sequence of beat frequencies sets up distinctive pulse patterns at the ATF lock output. The situation shown at (a) will switch the machine to LP operation while that shown at (b) will switch it to SP operation.

the tape stops with an f1 track being scanned. To maintain correct tracking during freeze frame the REC pilot is now continuously f1. In the step and slow modes only the ch. 1 tracks can be used by the ch. 1 and ch. 1' heads now in operation, and the SEL1 and SEL2 lines are used to generate f1 and f3 on alternate fields to maintain the ATF operation and to avoid the false lock condition.

A separate microcomputer chip (servo CPU) handles pulse generation and motor drive during the trick playback modes.

Servo Systems

With the exception of the ATF system, which merely provides a phase control voltage for the capstan servo, there's nothing unusual about the servos used in Video-8 format equipment. They follow current design practice, i.e. they are dual-loop digital servos with gain compensation, a programmable divider in the capstan FG circuit, a 4-43MHz oscillator to master the basic speed, and drum and capstan speed correction in the trick modes. In Sony machines the basic digital servo circuitry for both drum and capstan control is incorporated in a common i.c. package (type CX20035 or CX20135), with built-in D-A converters at the speed and phase outputs and with serial data input from the syscon for mode selection and control.

It's interesting that to save on battery power the camcorders use switch-mode motor-drive amplifiers whereas conventional linear motor-drive amplifiers are used in the deck machines – not only because energy is at less of a premium but because the PWM switching frequency and its harmonics could cause interference to the PCM audio circuits incorporated in some of these machines.

Letters

EVALUATING SERVICE

With reference to Mr. Roberts' letter on surveys in the April issue, while I can find no fault with the servicing procedure carried out on the 3V29 in question – in fact many of us might have missed the intermittent low-gain tuner fault – I think that the problem wouldn't have arisen if (a) the customer had been advised of the fault and cost before collection and (b) the parts were returned or offered to the customer at the time of collection. We obviously can't guard against every wally who has no experience of repair procedure, but if I take a part out the customer gets the old bit and I'm confident that if there's any dispute I can prove my point by putting it back.

I'd like however to make a further criticism of the "survey". A service engineer working for one company may leave and start to work for another without losing, or gaining, any skill. It's most unlikely however that the two firms will charge the same for his labour. Wouldn't it have been better if the trading standards officer concerned had based his report on labour costs, which must have varied? An if he had evaluation experts, shouldn't they have tested the old tuner which could have developed a dry-joint on any of its trips from one shop to the next? They might even have commended the engineer on his sharp eyesight and persistence.

Doesn't anyone else out there think that it's time for a fixed charge for labour, to cut out the "surprise, surprise" element and give the customer a fair chance? It's not impossible, because if you divide jobs into categories you can charge differently for colour and monochrome sets, VCRs, audio equipment, computers and so on. The swings and roundabouts system would make up for the difference between a fuse and a line output transformer. Parts and VAT would be extra.

*John Hopkins, The TV Workshop,
Felixstowe, Suffolk*

CORRECT PROCEDURES

Whilst I sympathise fully with Mr. Roberts I think I should put one point forward. He states that the VCR came in with a blown fuse. Examination of the fuse would have indicated whether it had gone open-circuit due to a dead short or alternatively either a slight overload or simply ageing. In Mr. Roberts' case he was quite right in checking for a slight overload since fuses very rarely blow for no reason. He should not however have replaced the tuner at the customer's expense without first informing him. This can be an awkward situation, especially when it's difficult to locate the customer. It's better to hold on to the machine rather than give the customer an expensive repair bill (how much was he charged? – say £60, assuming £40 for the tuner plus labour plus VAT?).

I must make it quite clear that this is my *only* criticism. Mr. Roberts' engineer did the right thing in investigating the cause of the blown fuse rather than "blindly" replacing it. Any service engineer of good upbringing would have done the same. I sympathise with Mr. Roberts over the deceitful way in which he was treated.

I wonder what would have happened if an estimate had been given instead of completing the job? If the consumer services department had been told that the tuner was

faulty, would they have blown their cover by saying that only a faulty fuse had been fitted? Have they the knowledge and expertise to contradict Mr. Roberts' engineer and his findings?

It doesn't say much for the consumer services department's so-called expert that he simply fitted a blown fuse. Surely that's no way to prove whatever they were trying to prove. A good service department, like Mr. Roberts', mine and many others, is always vulnerable to being criticised when we honestly and conscientiously repair items that have previously been taken to cowboys – when we give a true assessment of what's involved we get frowned on and accused of over charging etc.

Keep up the good work Mr. Roberts! You have the backing of all genuine, experienced, honest engineers.

*Eric Edwards, Proprietor,
Barry, South Glamorgan.*

SPOT CHECKS USEFUL

I don't think it was quite fair of Mr. Roberts to suggest that Birmingham consumer services department was trying to prove that all TV and video repairmen are crooks and con men. I'm sure he would acknowledge that although most repair establishments are basically honest there is always a very small minority of dishonest get-rich-quick types out to make a quick buck. It's desirable to weed these people out so that the integrity of the trade as a whole is preserved.

I've been in the servicing trade for 24 years and during that time I've come across quite a few shady practices. Although these occurrences are not everyday practices I think it's important to have body such as the Birmingham consumer services department to make spot checks here and there to ensure that the customer gets his money's worth. I accept that Mr. Roberts acted in good faith, but he made two mistakes.

First, he should have sought more information on what was wrong with the machine when it came in. Secondly, he assumed that the customer was taping off-air and not using the machine solely for viewing cassettes from the local shops, which could have been the case!

*J. McCorry,
Little Bromwich, Birmingham*

LIVING WITH CUSTOMERS

While sympathising with Colin Goodman (Letters, April) I was relieved to know that I'm not alone with this problem. It's a sad situation, that the lay person doesn't appreciate the complexities of VCRs and TV sets (but then if they did perhaps we wouldn't have a job). I've been self-employed for seven years and there have been many occasions on which I've nearly thrown in the towel. But you have to live, don't you? – and it's not easy to find another job at 45. I've now resigned myself to biting the bullet and surviving. Perhaps us poor souls could find a way of communicating with one another to laugh it off instead of suffering in lonely silence.

*B. Dean, Fenland TV Repair Services,
Wisbech, Cambs.*

TIME FOR MEMOIRS

No Colin (Letters, April), it wasn't you: you're not heading for a nervous breakdown! But it probably wasn't "the picture valve", or "the on/off switch", more likely "a wire off".

In the Black Country customers would a few years ago say "ther ay arf a lot of wirkins in them things", or "it's a piece of furniture", or "keep away from the master". Did you ever have to crouch on a slightly sloping quarry tiled floor beside a blazing fire in June with a Murphy V120C on casters, trying to centre and focus the picture with the help of one of those aluminium tools like a catapult handle? A small child is leaning over an armchair eating a banana in your ear. And when you stand up you bang your head on the bottom of the birdcage, causing much excitement and confusion, the charge for the visit being 12/6d.

In contrast, picture the hall of an ancestral home. An immaculate butler stands at the telephone. "Her Grace sends her compliments and instructs me to desire you to slip her in a picture valve on your way home."

Perhaps we should write our memoirs.

*R.S. Daynes,
Dudley, West Midlands.*

MAINS FILTERING

With reference to the article on mains filtering in the April issue, surely an audio tone superimposed on the mains supply wouldn't reduce the capacitor reactance and blow the fuse. The audio tone would have to be at mains voltage. Consider also the use of capacitors for power factor correction in industrial installations and discharge lighting.

It would not be good practice to connect the capacitor to the input side of the fuse as shown in Fig. 8. On the subject of earthing, the local electricity board should be consulted. Water boards sometimes carry out repairs with plastic/PVC type piping.

*L. Hutchinson,
London E11.*

MAINS FILTERING/EARTHING

I was most interested in J. LeJeune's article on mains filtering in the April issue. A number of points that affect the usefulness of such filters come to mind however.

First, where a residual current circuit breaker (RCCB) is in use the filters with an $0.1\mu\text{F}$ capacitor from line to earth will draw 7mA or so of unbalanced current in each capacitor. With four capacitors the RCCB will probably trip. With professional screened rooms capacitor currents of 6A are not unknown! It doesn't however need many mains filters for the unbalanced currents to add up and, along with any leakage from washing machines, immersion heaters and so on, this could lead to RCCB tripping.

Where PME (protective multiple earthing) is installed, the earth and neutral are bonded by the electricity board at or close to the electricity meter. In the event of a rupture of the neutral, the earth pin of the mains sockets and any radiators, plumbing etc. (bonded to the mains earth) may float at a potential that could be as high as 240V above ground. The provision of separate parallel earths in such cases, e.g. an external earth on a piece of equipment and the mains earth, could lead to large fault currents in the equipment's earth leads, with the danger of fire. For the same reasons metal-cased power tools should not be used outside if supplied from a PME installation. A point to note is that various aeriels could become live: I would recommend anyone working on these to ensure that they are unplugged before climbing up to them.

Rupture of the neutral is rare, and the electricity supply authorities do their best to prevent both this and the rise

above earth of the consumers' supply. Nevertheless it can happen, which is why metalwork is bonded to the earth terminal.

Finally, Mr. LeJeune's remedy for blowing 50mA fuses – moving the capacitor to the mains side of the fuse – is extremely dangerous. In the event of the capacitor failing the only protection is the (hopefully) 3A fuse in the plug. If the fuse is a 13A (or even 3A) one the energy dissipation in a failing capacitor could cause a fire. I would suggest fitting another fuse of say 150-250mA.

*Peter E. Chadwick,
Swindon, Wilts.*

TAPE CREASING

In the May VCR Clinic Philip Blundell gives advice on Sharp VCRs that crease Scotch tapes. In the cases I've come across the machines have creased all makes of tapes in the rewind search mode. The fault first shows up only with four-hour tapes, but in extreme cases it will occur with all lengths. The cause in the 30-40 cases I've come across is the poles, not the guides, and in a few cases the lower drum. Don't forget to check the back tension when these have been replaced.

In the TV Fault Finding section Roger Burchett suggests that tripler faults with the Rediffusion Mk. III chassis are rare. In my experience this is the most common problem with these sets. I too think Granada were mad to close down the Rediffusion setmaking business.

*P.M. Ward,
Margate, Kent.*

TUNED STUBS

In his letter on tuned stubs for interference reduction (February, page 262) Geoff Lewis should have written "a short-circuit half-wave or an open-circuit quarter-wave line will present a short at the unwanted frequency when connected across the aerial feeder".

While writing, a general criticism of your otherwise excellent magazine. Why the continued use of obsolete symbols in circuit diagrams? This causes comments from students who are more familiar with the BS3939 symbols. *Ron Bravery, Senior Lecturer, Radio/TV Studies, Brighton College of Technology.*

Editorial comment: Our apologies for transposing the words "open" and "short". With regard to circuit symbols, we simply feel that the traditional symbols are more to the point and less confusing than the current preferred ones. We are not alone in this! Didn't BS once insist on "sender" instead of "transmitter"? The symbols have remained with us longer, but who knows!

FIDELITY HANDSET ADVICE

A problem that sometimes occurs with Fidelity ZX3000 teletext handsets is that they begin to draw excessive current, sometimes even discharging new batteries when these have been fitted. The normal average current consumption is in the region of 45mA, but this may increase to 70mA or more under fault conditions. The quiescent current still remains at its normal 2-3 μA . The usual cause of this is that the supply decoupling capacitor C303 (100 μF) develops a rather high internal resistance. Replacing it with a good quality component will restore the current consumption to the normal 45mA.

The current consumption is still quite high in comparison with other control units that use the same SAA5000 i.c. A simple modification that will reduce the average current taken by the unit to about 25-30mA is to change the value of R310 from 47kΩ to 100Ω. When this is done the peak infra-red LED current stays about the same but the width of the base of the pulse is reduced. This consumption compares favourably with similar handsets that use the same i.c.

*M.J. Edis, G4RPT,
Broughton, Northants.*

VARYING SOUND

In the April Letters page John Howard mentioned the problem of varying sound with the Panasonic TC2205. I've found that the usual cause is either C852 or C857 in the 160V supply or C854 or C856 in the 195V supply. At least one of these capacitors will be found open-circuit. The resultant line-frequency ripple on the h.t. line is somehow interpreted by the remote control circuitry to give varying volume.

*Paul Hardy,
Reading, Berks.*

RECYCLING COMPONENTS

It beats me why Alastair Downs (Letters, May) is using a blowlamp to recycle components when he can use a 25W iron fitted with a dual in-line bit and some chip removal tweezers. I've been using these for years and have had no trouble removing chips on even the oldest boards. Both items are available from Maplin.

*S.P. Law, Midland Microelectronic Services,
Norton Lindsay, Warwick.*

COMPUTER AID TO SERVICING

I would like to add a few comments following Chas E. Miller's recent articles on using the dBase II program. Hopefully these articles will result in a few more micros appearing in service departments – apart from faulty ones!

The statement INDEX ON MODIND FOR etc. on page 402 (April issue) won't work – "syntax error" will be the result. The correct syntax for creating an index is INDEX ON <field> TO <indexfile> – in this case, INDEX ON MODEL TO MODIND. Model is the "key field", and if any changes are made to this field by EDITing the database it will be necessary to rebuild the index, either by a REINDEX command, which will recreate all the indexes for this database, or by repeating the INDEX ON etc. command.

If an index is in use, the quickest way to perform the search (page 403) is:

```
USE TVDATA INDEX TRANSIND  
FIND BU105
```

```
DISPLAY WHILE "BU105" $ TRANSIND
```

Incidentally, the difference between LIST and DISPLAY is as follows. LIST or DISPLAY ALL will list the entire database (in order of entry if not open with an index). DISPLAY ALL however will stop at every screenful. DISPLAY without any qualification will display the record currently "pointed at". If the file has just been opened, this will be the first one (not necessarily no. 1 if an index is in use). Hence the command LIST followed by DISPLAY will list the entire database and then display the last record again.

DISPLAY FOR <expression> will search the entire

database for records answering the criterion given by the expression. DISPLAY WHILE <expression> will display only a consecutive block of records answering the criterion. This, then is more use with an index.

The advantage of using FIND with an index rather than LOCATE without one is in the time taken. A FIND on an index takes typically two seconds irrespective of the database size. LOCATE on the other hand has to start at the beginning of the file and test each record until the required one is found. It's a bit like looking for Mr. Bloggs in a tower block with and without the flat number. DISPLAY FOR <expression> will also search the entire file. For example, imagine a database of 1,000 names. The command DISPLAY for NAME = "Aardvark" may find the one entry of this at record 1 but will still carry on searching until the end of the file is reached. Maybe several minutes later.

As far as I know all command lines can be in upper, lower or mixed case. If the keyword is in upper case the speed of execution is fractionally faster, as it is if the first four letters only of the command are used, e.g. LOCA for name = "Fred". This is of no advantage when using dBase II in the interactive mode, i.e. entering commands singly. dBase II has a fairly powerful programming language that can be used to automate jobs like Chas's examples.

An important point about using any software that writes data to disc: you must ensure that any files used are properly closed. Exiting dBase II with QUIT does this, as do the CLEAR and USE commands. The point is that any data added is not written on disc until either the disc buffer is full or the file is closed. If the machine is switched off or rebooted with the file open the directory is not updated and the data in the file may be lost. The clue to this is the appearance on the disc of a file with an extension of \$\$\$, e.g. NAMES.\$\$\$.

dBase II runs quite happily on the Amstrad 6128/8256/8512 and IBM PC compatibles.

*Mike Phelan,
Liversedge, West Yorkshire.*

Editorial comment: Our thanks to Ken Holding for making similar points. Ken points out that the command LIST is most effective when a printer is attached and a hard copy is required, having previously used the SET PRINT ON command.

IDENTIFICATION HELP WANTED

I have in for repair a 22in. set with remote control. It's one I've never seen before and unfortunately someone has removed the manufacturer's name. The Model number is still intact however, 7-758. Can anyone identify the manufacturer/brand?

*John J. Hamnett, 39 Artillery Court,
Wadson Road, Manchester M13 9TX.*

FOR DISPOSAL

Due to retirement I'm having to dispose of a lot of radio/TV equipment. Would any reader be interested in a 9in., single-channel HMV t.r.f. receiver approximately thirty years old? Also a prewar four-band radiogram (not working) which has all the original s.w. stations shown, e.g. W2XAD, W2XAF, etc. These items are available for collection free.

*G. Snewin, 14 Woodland Gardens,
Woodford New Road, London E17 3PS.*

Service Bureau

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PHILIPS KT3 CHASSIS WITH REMOTE CONTROL

The remote control is inoperative: figure 1 appears in the window and BBC-1 sound is heard with random lines on the screen. None of the handset controls have any effect. There are two i.c.s on the small remote control panel in the set, types SAB3013 and SAA1082P. The latter doesn't seem to be listed by any of your advertisers.

First check the supply voltage at pin 1 of the SAA1082P chip: if it's not between 11.5-12.5V and free of ripple check the 12V supply, which comes via the TMS1000 panel. If the supply voltage is o.k. the SAA1082P chip is suspect. It can be obtained from Philips Service or one of their dealers/Service Centres.

GRUNDIG 2 x 4

This machine occasionally unloads itself when put into the playback, slow-motion or fast-motion mode, the "tape" light flashing. There's no problem with the fast-forward, rewind or APF search modes. When the fault occurs the tape is not wound round the head drum. The problem is random but is extremely difficult to stop once it has happened. The tape path has been cleaned.

The problem seems to occur with the functions where the tape is laced up completely. Most likely causes, in order of probability, are: switch segments on the loading ring not making contact; a broken or damaged loading pinion or worm; a defective capstan motor or dry-joints on the motor connection panel; dry-joints on the large transistor at the front of the power supply.

DECCA 120 SERIES CHASSIS

The chopper transistor and fuse F802 fail at random after some hours' use. Changing the TDA4600 control chip has made no difference. The fault occurs while the set is in use, not at switch on.

The problem is generally solved by replacing R808, R810 and R805. To be on the safe side it's as well to change R804 and C810 in the chopper transistor's base circuit at the same time.

SPECTRA PORTABLE 3602

The fault on this set (NordMende F8 chassis) is as follows - it's getting worse. From a cold start there's good sound, correct tuning and a picture which is normal but suffers from random brightness variations that make the picture suddenly disappear. The sound continues happily. Picture geometry seems to be broadly unaffected by the fade condition, which appears visually as a rapid defocusing of the beam leading to picture disappearance. The fault clears gradually as the set warms up, correct operation being restored after about half an hour.

The fact that the focus appears to be affected when the brightness fault is present suggests that the problem is due to either the tube's heater or focus supply. Watch the heater carefully during the fault condition. If it flickers or goes out check RV01 (tube baseboard) and for dry-joints throughout the heater circuit, via pins 5 and 6 of the line output transformer. If the heater glows steadily during the fault check the focus spark gap and the associated 1M Ω resistor on the baseboard before suspecting the e.h.t. tripler and control PL06.

BUSH BC6004

If this set hasn't been used for a day or so it will go off and on intermittently. It settles down after two or three such periods and then works normally all day. After this initial period the set works correctly when switched off and on. The only intermittency is during the initial period from cold. I've replaced the chopper/line output transistor, the diode in series with it and the efficiency diode.

It's quite possible that one of the protection circuits is coming into operation. Check the adjustment of P943: set it for 120V at pin 8 of the sync/control module, using an accurate meter. If the trouble persists, check zener diode D698 in the protection circuit, diode D725 which links the two sides of the chopper/line output circuit, and the joints on the chopper transformer Tr841. If you've not already done so, check the power supply and line scan circuits thoroughly for dry-joints.

SHARP VC7300

The playback is in monochrome on a minority of prerecorded tapes. The machine records well and most tapes give good colour playback.

Although we've not encountered this specific problem on this model we have experienced failure of the HA11710 a.c.c./mixer chip I501 and would consider this to be suspect. Before replacing it however we would suggest that you check very carefully, with a good counter, the settings of R536 and C544: if you have the slightest doubt about their stability, replace the associated crystals as necessary.

RANK T22 CHASSIS

This set was bought with 4C19 in the start-up circuit faulty. After correcting this fault I find that to get colour it's necessary to adjust the tuning potentiometer to an almost out of tune position. When the potentiometer is in the middle of the tuning range the picture is in monochrome, but not noisy. When the colour control is turned to maximum the picture becomes very noisy, with horizontal bars. Colour is also sometimes lost on channel change.

Start by linking TP9 and TP10 on the decoder panel to override the colour killer. If you get a rainbow hue, adjust

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VC1 for the correct reference oscillator frequency. If this can't be obtained, try a new crystal (X1). If the subcarrier frequency is reasonably close to specification you'll need a colour-bar generator and scope to check the chroma/luminance ratio at L6. If the chroma level is low, check the settings of the a.f.c. discriminator coil L4 and the detector tank coil L3, then suspect poor i.f. response at around 35MHz.

AKAI VS5EK

When an attempt was made to record, play back, etc. this machine flashed "breakdown", with the buzzer of course. Switching off/on made no difference. The cassette lamp was found to have failed, but the manual doesn't specify the type. When the lamp for a VS8 was fitted the machine worked but tended to flash breakdown until cleared by on/off switching.

The breakdown caption normally appears only for bulb failure, faulty loading switches or lack of reel tacho pulses. First fit the correct type of bulb (part no. EL330446) then check these points. Also check the resistor in series with the bulb.

TEST CASE

294

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.

This Decca colour set was brought to the workshop by its owner who left it with us for repair, which was just as well as it turned out – it was no five-minute job, as our description will show! The chassis was the well-known 100 series and the symptoms were described to us as sound o.k. but the picture pulling sideways and rolling, with a shading effect. This just about summed up what we saw when we switched it on.

We've got into the habit of studying all the fault symptoms carefully and taking a few mandatory minutes to mull over them before we jump in with the test gear and soldering iron: this pays rich dividends and can save a lot of fruitless investigation of innocent components and stages. In this particular case the presence of the picture shading (an ill-defined horizontal dark bar across the centre of the picture) directed our thoughts away from the sync separator circuitry towards the signal-processing stages upstream. Consequently our first action was to connect an oscilloscope to display the video output from the TCA270S vision demodulator chip IC102 – at pin 9.

The waveform here, viewed at field rate, was shocking. Each field of video information was riding on a whopping great ripple waveform which took roughly the form of a positive half-sinusoid per field. The field sync pulse train

was climbing up a steep incline at the left, and the line sync pulses were so deeply buried in the fuzz that the scope wouldn't lock to them even when switched to 20 μ sec/div! We found that the effect of the fault was much reduced on a weak signal – to the point where, provided the tuning was carefully tweaked, a satisfactory though snowy picture could be obtained. Twiddling the tuner a.g.c. preset VR127 would also reduce the fault symptoms, again at the expense of a snowy picture.

As an elimination test another i.f. panel from a working set was fitted to the troubled one. The result was a good picture, so our efforts were concentrated on the circuitry centred on the i.c. chips IC101 and IC102 (MC1349 and TCA270S respectively). The a.g.c. control potential is developed at pin 5 of IC102: no excessive ripple was found here. Even so we discovered that applying a certain critical voltage (2.4V in fact) from a low-impedance and heavily decoupled external source restored a good picture. Replacing the a.g.c. smoothing capacitor C127 (220 μ F) made no difference so we moved to pin 6 of the chip, since the a.g.c. reservoir capacitor C126 (47nF) is connected to this pin. Could this capacitor be in trouble? The 200mV peak-to-peak ripple across it seemed reasonable but was similar in shape to, and synchronous with, the ripple on which the detected video signal was sitting. Replacing C126 didn't help and suspicion started to fall on IC102.

At this point a fresh idea dawned: what about the supply lines to the two chips? These are derived from the stabilising zener diodes D102 (12V) and D101 (15V or 16V). Both these devices were producing the correct voltages however. It wasn't the chip, and we were on the right track in investigating the a.g.c. line. So what was it? See next month.

ANSWER TO TEST CASE 293 — page 487 last month —

Our trainee's confidence in his mentor was shaken in last month's test case. They were investigating a venerable ITT hybrid colour receiver fitted with the CVC9 chassis, the fault being no colour – apart from that resulting from the grey-scale errors of an eleven-year old tube.

It had been established that there was drive at the base of the 7.8kHz ident generator transistor T35 but that the ident signal was not being amplified at all. The transistor and a couple of associated resistors had been changed without restoring the ident signal or the colour. The key component eventually removed by the senior technician as a test was rectifier diode D37 which produces the colour-killer bias voltage. This bias is, or should be, developed across its 4.7 μ F reservoir capacitor C218. The diode itself was in order, but C218 had developed a leak of about 4k Ω which was heavily loading the high-impedance ident tuned circuit L75/C215 – and indeed draining T35's operating voltage.

Tantalum capacitors were ever notorious in this series of chassis, and maybe eleven years is not a bad life-span. The picture on the set, now back with its grateful owner, still looks a bit tired. But at least it's now in full colour.

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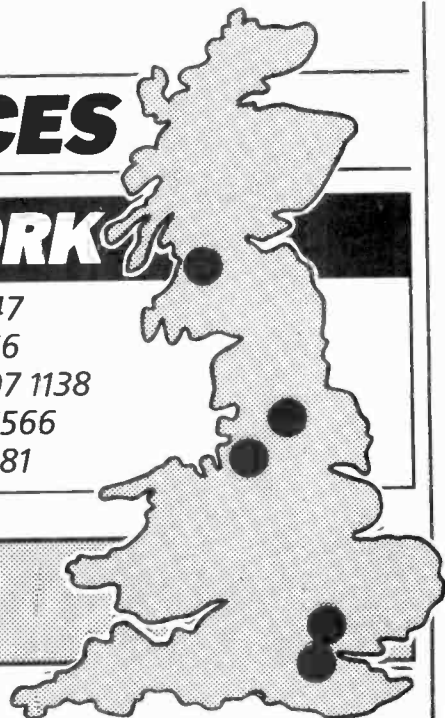
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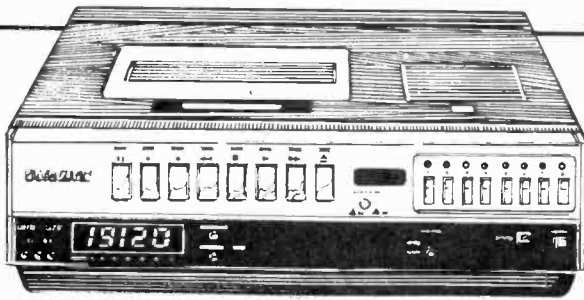
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SEMICONDUCTORS	TRANSISTORS CONTINUED	VIDEO SPARES	SWITCHES & RELAYS
DIODES	2SC 945-2SC 634 SP=2SC 1364	SLCS7	RELAY SLC7
10E2 Gen. 0.42	2SC 1034 Gen. 6.40	BOOSTER ANTENNA MODULATOR 1-463-296-00 37.50	RELAY 1-515-416-00 4.98
GH 3F KV Gen. 1.80	2SC 1061 Gen. 2.98	TAPE UP SENSOR (C7) 1-543-145-00 1.30	RELAY TC-K55 1-515-547-11 4.98
IS 1555 0.42	2SC 1124 Gen. 1.24	CONTROL KNOB (C7) 3-659-547-00 1.24	CHANNEL KV1340/1820 1-516-847-00 16.80
VIN KV 1810UB 1.24	2SC 1316 Gen. 7.85	LID TIMER (C7) 3-703-075-00 1.24	TIMER SW SLC5/7 1-552-438-00 1.80
CV 12E GEN = CSM-2A 4A 101 2.98	25C 1362-7 Gen. = 25C 634 SP-47 0.42	CAP 2 SHAFT (C7) 3-703-075-00 0.42	SLIDE SW REC SL8000 1-552-438-00 1.24
U05G KV 1810UB 1.24	25C 1413A Gen. 7.90	CAPSTAN MOTOR A-678-634-8B 42.01	SLIDE SW R/P SL8000 1-552-836-00 1.80
BR 303 KV 2704=SHOR 3042 1.80	25C 1454-6 Gen. 4.98	IDLER KIT X-365-931-00 5.40	SWITCH POWER KV GEN 1.24
THYRISTORS	25C 1475 KV 1810UB=2SA 1174 1.24	LIMITER ASSEMBLY X-365-932-40 1.24	
SG-264A KV Gen. 4.98	25C 1962 Gen. 1.80	IDLER ASSEMBLY X-365-932-82 1.80	REMOTE CONTROLS
SG-629 KV 1810UB Gen. 10.86	25C 2009 Gen. 0.42	BRAKE ASSEMBLY X-365-932-82 1.24	RM 604B KV 1612 43.76
SG-6533 KV Gen.=SG613 10.86	25C 2278 Gen. 7.90	PINCH ROLLER X-865-933-70 1.24	RM 606 KV 2704 52.38
IC's	25C 2369 SLC5/7UB Gen. 1.24	SLCS	RM 603B KV 2206 43.76
BM-342 SLC7UB 4.98	25C 2551 KV Gen. 1.24	SOLENOID 1-454-293-11 10.86	RM 609 KV 1612 (MK2) 61.51
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CX-177 6.40	25D 870 KV 2704 7.85	FORWARD ASSEMBLY A-676-007-9 4.10	RM 616 SLC6 32.38
CX-186 SLC5UB 10.86	25D 1164 SLC8UB 1.24	MOTOR FRONT LOAD A-676-113-1 8.19	RM 72 SLC6 22.53
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MS1231P SI1225 16.80	25D 1487-06 KV 2252/2752 4.98	SL-F1C9	GENERAL COMPONENTS
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STK 4026 10.86	NON-STOCK ITEMS AVAILABLE ON REQUEST.	CARRIAGE MOD KIT (C9) X-675-121-2B 10.86	ACFI CHARGER UNIT 42.01
STR 5314 0.98	VIDEO HEADS & ACE ASSY.	CASS. LOAD MECH. (C9) A-675-123-6A 70.91	CAP 33mf 160V KV 1-123-024-11 1.24
TBA 120U 4.10	SL8000/8080 DSR-43R 56.75	GUIDE PIN KIT A-675-910-7C 6.65	CAP 22mf 400V KV 1-123-032-11 1.24
TCP 4621 AF6 10.86	SLCS5/7 DSR-36R 48.60	UPPER CYLINDER A-676-013-8A 27.85	CAP 0.018mf 1.5v KV 1-129-952-11 1.80
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UPC 1394C KV 2060/62UB 10.86	SLC7 ACE 34.40	SL8000 KIT 5 PIECES 8.82	STYLUS NO 143G 1-548-114-00 11.31
UPD 546C107 SLC7UB 21.64		SLCS7 KIT 6 PIECES 8.26	R/P HEAD 181-3602D 8-828-373-40 22.53
UPD 547C049 SLC7UB 10.86		TC Gen. 3-434-110-00 1.24	MOTOR DNF-1001B 8-835-006-00 22.53
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2SA 771 TAF 5A=2SA 1206 2.98	360mA 11V Gen. 1-518-116-00 1.24	BELT CAPSTAN TC 92 3-530-447-01 1.24	STYLUS NO 150G A-458-706-2A 10.86
2SA 835 Gen. 1.80	40mA 4.5V Gen. 1-518-169-XX 1.24	CAPSTAN TC 135/136SD 3-542-458-00 1.24	PINCH ROLLER TC Gen. X-348-930-60 1.24
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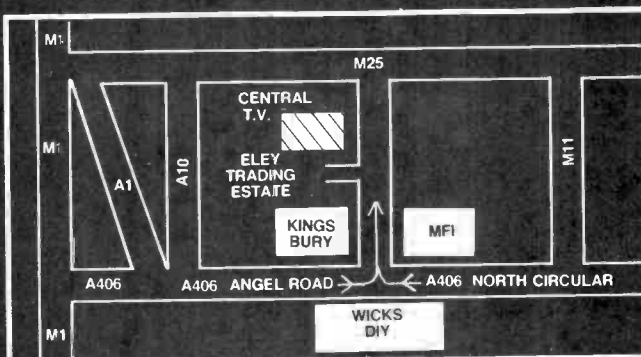
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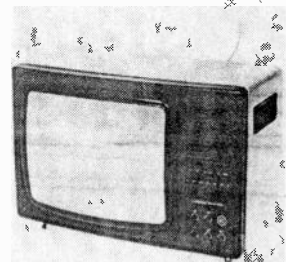
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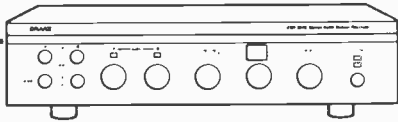
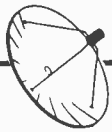
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SL917	£7.50	TDA1327	£1.60	UPC2203	£2.50
SL917	£7.50	TDA1412	£1.52	UPC2203	£2.50
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1000mfd 25v	£0.52	22mfd 63v	£0.20
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VC8300	£6.50
VC9300, 381 etc	£6.50
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VTC5000	£1.99
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VT8000, 8500	£2.90
VT9300, 9300	£3.90
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3V23	£4.50
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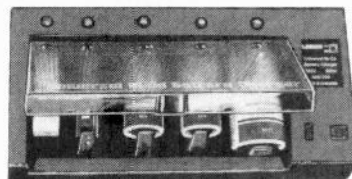
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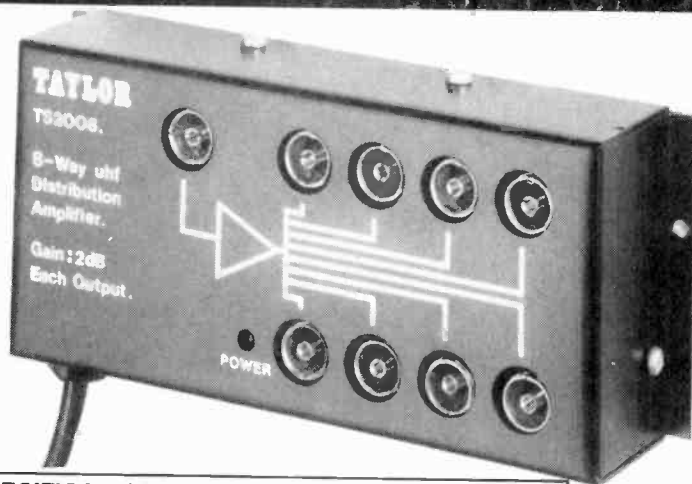
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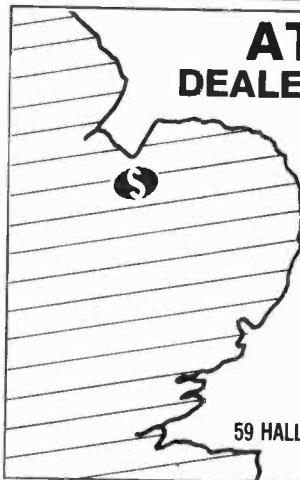


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2SA-564 £0.15	2SD-850 £2.60	HA-1151 £1.25	TA-7229 £2.50	BC-307A £9.055	BDX-538 £0.42	TD-2009 £2.20	L-165V £2.80	SANYO VTC-5500 £0.98	REPLACEMENT STYLUS WE HAVE FULL RANGE OF THE STYLUS MOSTLY JAPANESE MODELS: PLS ASK FOR FULL LIST THE UNIT PRICE: £2.60.	RW-317 £9.52
2SA-673 £0.20	2SD-869 £3.20	HA-1156 £1.30	TA-7230 £1.30	BC-307B £9.055	BDX-548 £0.42	TD-2020 £1.40	L-200CH £1.50	VTC-9300 £2.50	STYLUS (Cion) BR-1225 £0.75	
2SA-683 £0.20	2SD-880 £3.50	HA-1367 £3.60	TA-7248 £4.00	BC-308 £9.055	BF-173 £0.65	TD-2030AH £1.80	L-2605CV £1.80		BR-1616 £0.75	
2SA-684 £0.20	2SD-882 £4.50	HA-1382 £2.50	TA-7248 £4.00	BC-308A £9.055	BF-257 £0.30	TD-2030AH £2.40	MC-1458CP £0.50		BR-2016 £0.75	
2SA-748 £1.00	2SD-1135 £0.85	HA-1406 £0.75	TA-7310 £1.25	BC-308B £9.055	BF-258 £0.30	TD-2040H £1.60	MC-1489P £0.45		BR-2020 £0.75	
2SA-765 £3.00	AN-203 £1.00	HA-11227 £1.00	TA-7313 £0.80	BC-309 £9.055	BF-259 £0.30	TD-2040H £2.20	MC-1489P £0.45		BR-2320 £0.75	
2SA-769 £1.50	AN-210 £0.90	HA-11227 £1.00	TA-7314 £1.35	BC-309B £9.055	BF-2725 £0.75	TD-2040H £2.20	MC-1489P £0.45		BR-2325 £0.75	
2SA-771 £1.50	AN-214 £1.50	HA-12017 £1.30	TA-7315 £1.35	BC-327-16 £9.055	BF-457 £0.51	TD-2040H £2.20	MC-1489P £0.45		CR-1120 £0.75	
2SA-794 £0.60	AN-272U £2.90	HA-12413 £1.30	TA-7317 £1.60	BC-327-40 £9.055	BF-458 £0.54	TD-2530 £2.70	MC-1489P £0.45		CR-1220 £0.75	
2SA-798 £0.60	AN-301 £2.35	LA-12411 £1.60	TA-7323 £1.20	BC-328 £9.055	BFY-52 £0.30	TD-2822 £0.90	MC-1489P £0.45		CR-2025 £0.75	
2SA-850 £0.30	AN-302 £2.50	LA-1365 £1.20	TA-7324 £1.10	BC-337 £9.055	BFY-76 £0.37	TD-2822M £0.90	MC-1489P £0.45		CR-2032 £0.75	
2SA-893 £0.30	AN-303 £3.20	LA-3161 £1.20	TA-7325 £0.75	BC-337-16 £9.055	BFY-50 £0.40	TD-3410 £1.60	MC-1489P £0.45		CR-2420 £0.75	
2SA-958 £0.75	AN-315 £1.00	LA-3220 £1.00	TA-7326 £1.40	BC-337-25 £9.055	BFY-51 £0.41	TD-3560 £2.10	MC-1489P £0.45		CR-2430 £0.75	
2SA-985 £0.75	AN-318 £5.75	LA-3365 £1.20	TA-7328 £1.40	BC-337-40 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SA-985 £1.20	AN-360 £2.50	LA-4125 £1.90	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SA-992 £0.30	AN-5010 £1.90	LA-4125 £1.90	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SA-1060 £1.50	AN-5431 £2.20	LA-4183 £1.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SA-1106 £1.50	AN-5435 £1.80	LA-4190 £1.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SA-1141 £2.90	AN-5440 £2.15	LA-4195 £1.70	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SA-1303 £1.50	AN-5510 £2.50	LA-4422 £1.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-527 £0.60	AN-5612 £2.80	LA-4430 £1.30	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-544 £0.40	AN-5720 £1.25	LA-4440 £2.10	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-557 £2.25	AN-5722 £1.25	LA-4445 £2.20	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-562 £0.30	AN-5730 £1.35	LA-4508 £1.70	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-681 £2.50	AN-5732 £1.25	M-51512L £2.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-688 £1.25	AN-5738 £1.00	MB-3712 £1.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-718 £0.75	AN-5900 £1.90	MB-3713 £2.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SB-772 £0.50	AN-6249 £0.40	MB-3730 £2.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-497 £1.50	AN-6250 £2.00	ME-646 £2.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-681 £1.95	AN-6320 £2.00	NE-646 £2.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-710 £0.20	AN-6332 £5.00	STK-011 £5.98	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-738 £0.25	AN-6341 £2.00	STK-015 £5.25	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-741 £1.95	AN-6342 £1.50	STK-016 £5.80	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-790 £0.90	AN-6360 £2.80	STK-032 £12.45	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-828 £0.15	AN-6551 £1.80	STK-035 £0.80	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-829 £0.15	AN-6884 £0.90	STK-043 £7.56	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-945 £0.15	AN-6912 £1.25	STK-080 £6.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1018 £0.75	AN-7060 £1.25	STK-082 £18.05	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1061 £0.75	AN-7105 £1.60	STK-0029 £4.10	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1173 £0.40	AN-7110 £1.20	STK-0060 £0.70	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1383 £0.30	AN-7116 £0.90	STK-435 £4.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1384 £0.25	AN-7117 £0.90	STK-436 £5.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1413AH £3.00	AN-7120 £1.25	STK-439 £7.45	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1454 £0.50	AN-7140 £1.50	STK-441 £9.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1567 £0.50	AN-7143 £1.50	STK-457 £7.90	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1775 £0.15	AN-7145 £2.20	STK-459 £6.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1815 £0.15	AN-7146 £2.20	STK-460 £0.70	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1845 £0.15	AN-7156 £2.00	STK-1030 £4.95	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-1913 £0.90	AN-7161 £2.50	STK-2029 £7.35	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-2240 £0.15	AN-7168 £2.80	STK-2125 £7.45	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-2320 £0.15	AN-7213 £1.00	STK-2129 £0.10	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-2350 £0.75	AN-7218 £1.10	STK-2250 £11.40	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-2577 £1.25	AN-7220 £1.60	STK-4909 £0.80	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-2581 £1.50	AN-7223 £1.40	TA-7061 £1.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-3284 £1.50	AN-7224 £1.80	TA-7137 £1.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-3298 £1.50	AN-7311 £0.90	TA-7140 £1.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SC-3519 £1.50	AN-7410 £1.50	TA-7157 £1.20	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-288 £0.75	AN-7812 £1.50	TA-7204 £1.20	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-381 £0.90	BA-301 £1.00	TA-7205 £1.20	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-525 £0.75	BA-308 £1.00	TA-7207 £1.35	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-526 £0.75	BA-311 £1.00	TA-7208 £1.00	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-600K £1.50	BA-333 £1.00	TA-7214 £2.90	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-718 £1.25	HA-1124 £1.25	TA-7215 £2.20	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-837 £0.85	HA-1125 £1.25	TA-7225 £2.50	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
2SD-845 £1.75	HA-1137W £1.35	TA-7227 £2.20	TA-7328 £1.40	BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45			
BC-307A £9.055	BDX-538 £0.42	TD-2009 £2.20	L-165V £2.80	SANYO VTC-5500 £0.98	REPLACEMENT STYLUS WE HAVE FULL RANGE OF THE STYLUS MOSTLY JAPANESE MODELS: PLS ASK FOR FULL LIST THE UNIT PRICE: £2.60.	RW-317 £9.52				
BC-307B £9.055	BDX-548 £0.42	TD-2020 £1.40	L-200CH £1.50	VTC-9300 £2.50		RW-320 £0.36				
BC-308 £9.055	BF-173 £0.65	TD-2030AH £1.80	L-2605CV £1.80			RW-321 £0.52				
BC-308A £9.055	BF-257 £0.30	TD-2030AH £2.40	MC-1458CP £0.50			RW-327 £0.54				
BC-308B £9.055	BF-258 £0.30	TD-2040H £1.60	MC-1489P £0.45			RW-328 £0.81				
BC-309 £9.055	BF-259 £0.30	TD-2040H £2.20	MC-1489P £0.45			RW-329 £0.45				
BC-309B £9.055	BF-2725 £0.75	TD-2040H £2.20	MC-1489P £0.45			RW-51 £0.51				
BC-327-16 £9.055	BF-457 £0.51	TD-2040H £2.20	MC-1489P £0.45			RW-52 £0.36				
BC-327-40 £9.055	BF-458 £0.54	TD-2530 £2.70	MC-1489P £0.45			RW-54 £0.36				
BC-328 £9.055	BFY-52 £0.30	TD-2822 £0.90	MC-1489P £0.45			RW-56 £0.36				
BC-337 £9.055	BFY-76 £0.37	TD-2822M £0.90	MC-1489P £0.45			RW-57 £0.36				
BC-337-16 £9.055	BFY-50 £0.40	TD-3410 £1.60	MC-1489P £0.45			RW-58 £0.36				
BC-337-25 £9.055	BFY-51 £0.41	TD-3560 £2.10	MC-1489P £0.45							
BC-338 £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338A £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338B £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338C £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338D £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338E £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338F £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338G £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338H £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338I £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338J £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338K £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338L £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338M £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338N £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338O £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338P £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338Q £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
BC-338R £9.055	BFY-90 £1.10	TD-3560 £2.10	MC-1489P £0.45							
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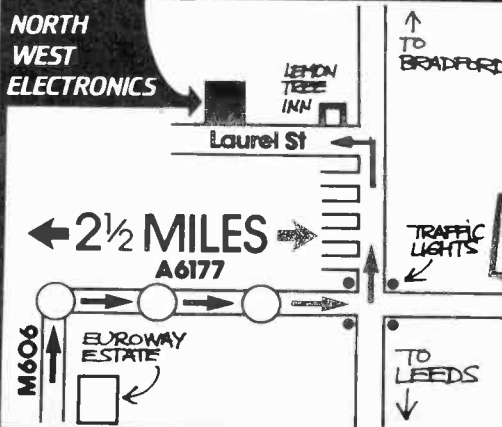
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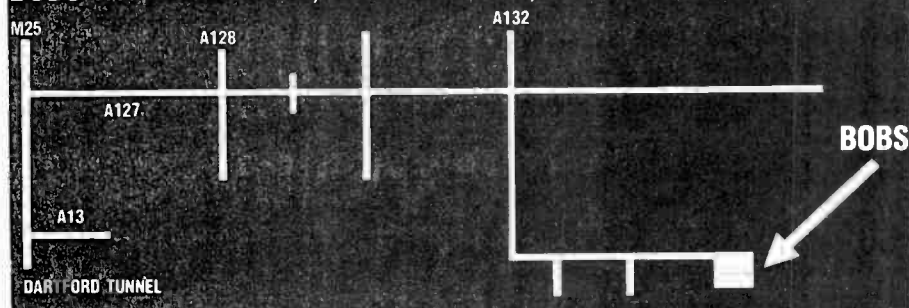
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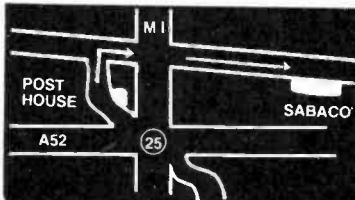
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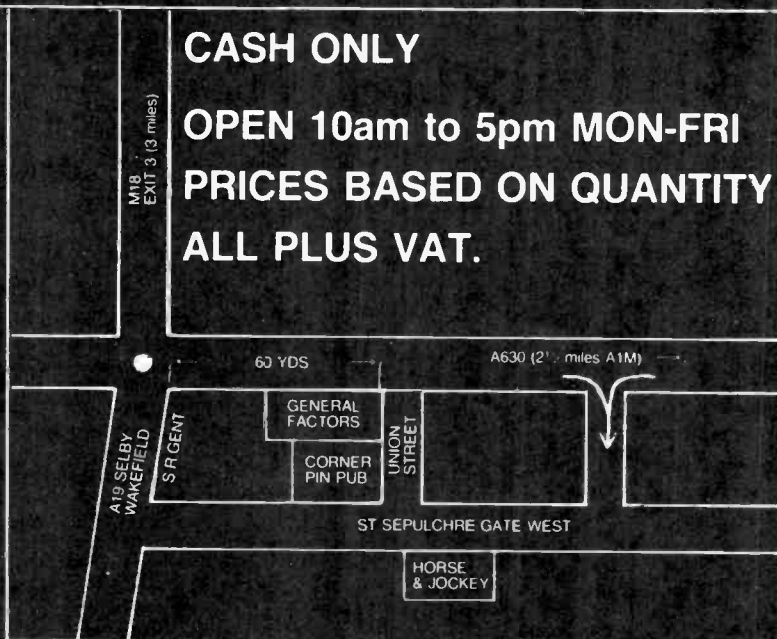
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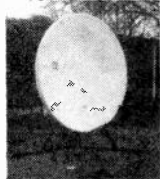
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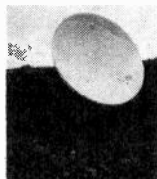
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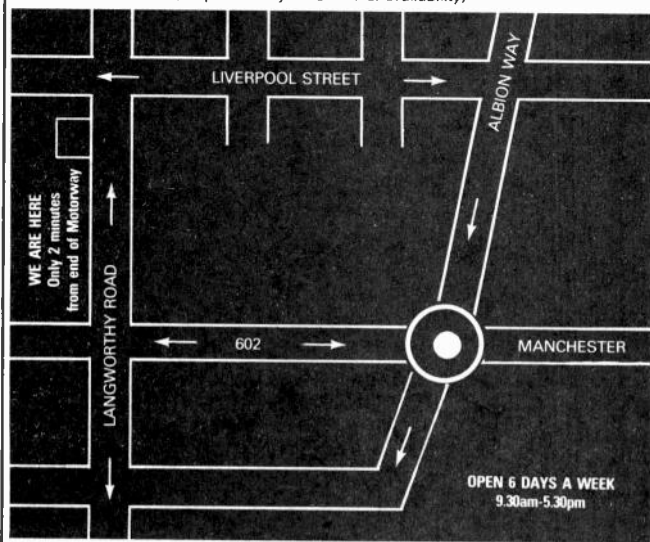
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20v/1.5A; £3 17.5A; 19.5A; 28.05A Mains ViewData 240V/240V/6V/4 amp/6v 500mA in / out ----- Mains trans 240/12v-0-12v 2 amp £3.50 Voltage Regulators +5V/UA78PO5SC 30p -5V/LM79MO5CP 25p -8V/79M08c 30p +6V/78M06c 30p +10v/78LA10 20p LM 337 30p LM 342/18 30p LM 340T 5.0 50p +12V/LM 340T12 50p +15V/78M15 15p +18V/MC78M18 20p +24V/78M24 30p MC 7724cp 40p MC 7824 40p TIS 90 10p TIS 92 20p TIS 93 20p U 19885 40p U 3832 15p U 3845 15p MR 508 10p MR 501 10p MR 502 10p BCW 71R 30p BYF 1202 10p BYF 1204 10p BYF 3126 40p BYF 3214 40p BYX 10 40p BYX 36/600 35p BYX 38/300 25p BYX49/600R 75p BYX 55/350 10p BYX 55/600 (Bead) 10p BYX 71/350 20p BYX 71/600 50p BYX 72/300 20p BYX 36/600 50p BYV 95B 10p BVY 95C 12p BYV 96D 10p BYZ 106 10p BPW 41 15p BYW 56 2A/1000v G11 8p BZU 15/24 54p BZY 93c75 50p BZV 15/18 30p BZV 15/30 30p BZW 70ctov2 10p BZX 79.3v 10p Bush thyristor RCA 76122 £1 Transformer 240v/20v-500Ma 75p Chassis type Transformer 50p 240v/12 Volts 500mA 75p CVC 20 tube base £2 Tube Base Rank & G11 £1.20 6v-9v-13v tape motor 75p Infra red led 15p LD57CA £1 AT 4041/41 transductor £1 15K-20 turn pots 20p Thorn panel 6×100 pot + changeover switch (Irish) 50p Battery converter TA 75 for colour TV, 12/24v Thorn 3787 £6 Thorn 3500 2A cut out 50p Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6 SPECIAL OFFER Decca-TTT etc. FEO4/1/250AC/4 Mains filters (grey type) × 4 50p BRIDGES KBL 005 30p KBL 02 30p KBP 04 30p W02 15p W004 15p W005 20p Thorn Chassis U916D Complete £10 Thorn TX9 Remote Panels with L.C.s £2.50 Thorn 9000 4 Slider Front Panel with Mains Switch and LRAD £4	24V 4Amp (100VA) Trans £4.00 Mains 240V (100VA) to 240V out fully shrouded £5.00 ITT CVC45 8 way resistor unit for v/cap £3 CVC40 8 button unit with mains lead & slider pots with sockets £10.00 8000/30v 50p 470/40v × 10 £1 22/100v × 10 £1 100/350v 70p 400/350v 70p .47/500v 25p 1/600v 25p .022/1kv 10p NI,CD Charger MW398 6A.A £8 NI,CD 5 Hours Battery Charger £8 Multi Core £4.50 60-40 Solder 500G 20 SWG £5.00 15 Watt Stereo Amp Sanyo Module with Data 50p 25pcs Precision Screwdriver & Tool Set £6.00 25 Watt Solder Iron £4.00 Various Tools and Accessories T/V V/Aerial 3000l or 75ml £1.50 L.C.D. clock display with alarm 75p * D/P push mains switch 20p each Mains lead & two pin socket for radio cassette 35p TV loop aerial 75p Radio Telescopic Aerial £1.00 Philips Neon Lamps for TV sets 5p Freeze Philips £1.20 Foam Cleaner Philips £1.20 Contact Cleaner Philips £1.20 Cans of Anti Static, Degrease Cleaner and Anti Corona All at £1.40 Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00 Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket £3.00 Screen locking agent, large can £1.50 Red E.H.T. 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SENDZ COMPONENTS

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Toshiba VHF/UHF LGS22F	£6	K35 Split Diode 3122-138-35930	£10.00
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New 9000 Decoder	£8.50	Line O.P. Trans Mono L.X 12"14"	
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9000 Censors panel	£1.50	4822	£10
9000/8500 timebase panel	£8	10273	£10
8800 convergence panel	£6	Thorn 1690 LOP1	£6.50
8500 convergence panel	£6	2 J/Pots 3,500 L/OI of each type	£3.00
4000 Power supply	£3	G8 Trans. Philips	£7.00
1600 Mains lead, switch		G11 Split Diode	£12.00
3500 6 push button + cable form	£1.50	CVC 820 Split Diode IT1	£10.00
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9000 Sound output panel		1600 Thorn L HLI over-wind with diode lead & anode cap	£2.50
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3500 cut out	10 for	Mullard A1 2056	£1.50
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3500 Line panel	£3	Split Diode Trans	£7.00
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3500 AI pots	50p	CVC 30 L11	£5.00
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6x4 G11	£1.00		
5 1/2x2 1/2	£1.00		
5x3	80 ohm	70p	
5x3	80 ohm	50p	
5x3	35 ohm	70p	
6x4	35 ohm	£1.30	
6x4 speaker	16 ohm		
7x3	70 ohm	£1.00	
8x5	8 ohm 15 watt	£2	
8x5	8 ohm	£1	
5x3	8 ohm	70p	
7x3	16 ohm	£1.00	
5 1/2x1	8 ohm	£1.00	
6 1/2x1	4 ohm	£1.50	
6 1/2x2	4 ohm	£1.50	
2 1/4x4	8 ohm	75p	
3x4	8 ohm	75p	
4 1/2x4	15 ohm	75p	
K13 speaker	8.30	£2	
3x4	15 ohm	£1	
1600 5x3	12 ohm	£1	
K45 Philip	15 ohm	75p	
K30 15 watt		£1	
KT3-K30			
01-425		10p	
01-550	1 W	10p	
01-513	correction	50p	
01-557		50p	
DIOIDES			
BY 126	10p		
BY 127	10p		
BY 133	10p		
BY 134	10p		
BY 164	50p		
BY 176	25p		
BY 179	40p		
BY 184	25p		
BY 187	10p		
BY 190	40p		
BY 196	30p		
BY 198	10p		
BY 204 4	8p		
BY 206	8p		
BY 208/80	8p		
BY 210/400	5p		
BY 210/800	5p		
BY 223	60p		
BY 224/600	4.5A 600k bridge	50p	
BY 226	15p		
BY 227	15p		
BY 228 1500k	20p		
Flat BY 229 black	20p		
BY 299 Red	20p		
BY 299/40p	20p		
BY 299/80p	20p		
BY 237	5p		
BY 254	30p		
BY 255	30p		
BY 268	10p		
BY 299	10p		
BY 406	8p		
BY 527	20p		
BY 407A	20p		
BY 527	20p		
BY 642	10p		
G 2 217	10p		
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GEC 2110 tuner unit + IF Panel	£12.00	220 MFH Sprague 385V	50p
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Pvc 205 T/unit	£7.00	400V 400M	60p
Pvc 305 Line on panel	£7.00	350V 400M	60p
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Pvc 713 Chroma	£10.00	175/100/100/350k	£1.00
Pvc/Chelsea 1rncbase panel with LOPT1	£5.00	K13/200/25/25/385V	£1.00
Pvc 731 Frame Panel	£5.00	200+300+75+25M 325V	£1.00
Pvc 731 Convergence Panel	£5.00	300+300+150+100+50MFD	380V
Pvc 731 Chroma	£10.00	G11 CAP 470/250	£2
Pvc 731 IF panel + tuner	£10.00	47/220/350k	60p
Pvc CDA/205 panel	£10.00	£4.00	
GEC portable chassis + LOP11 2114 New	£6.00	150/150/100/100/320k	£2.00
Thorn 1612/1713 chassis	9.75	2500/2500/63v	50p
G9 Power Panel	£5.00	150/200/200/300k	70p
Mono RANK Chassis 127A NEW	£10.00	300/100/100/16/275v	£1.50
N1-W G9 Frame Panel	£4.00	100/200/325v	£1.00
N1-W G11 IF Panel	£10.00	150/150/100/375v	£1.50
		200/200/75/25M 325V	£1
		Thorn TX9 Caps 500+500M 175V	£1.75
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		1500/2000/30k	50p
		150/150/100/320k	£2.00
		100/350+ 300/200/100/16/275v	£1.50
		25+35/380 G1EC	70p
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