

NOVEMBER 1988

Australia \$3.25, New Zealand \$4.40 (inc. GST), Malaysia \$6.10
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£1.40

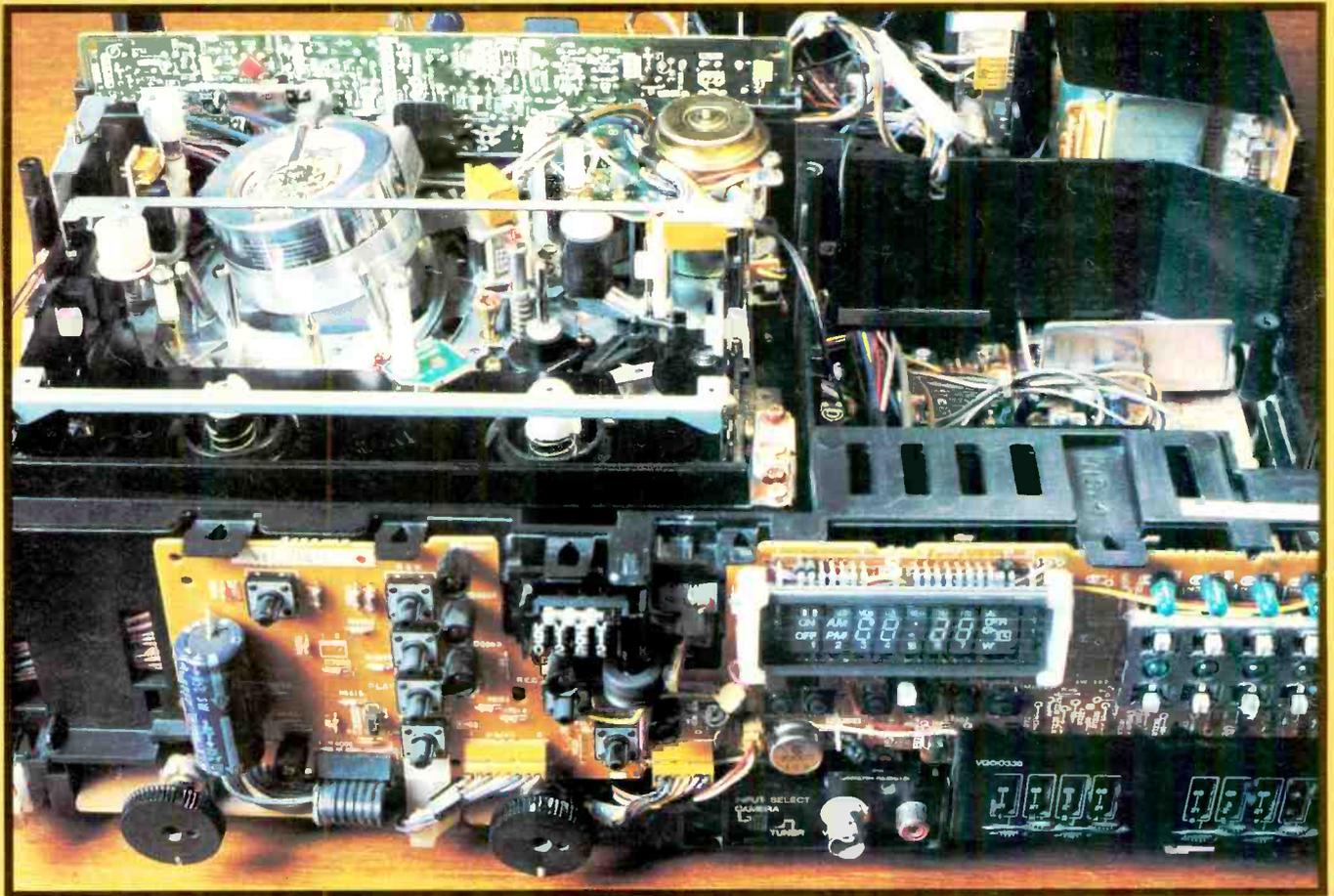
GG 35748
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E12 \$3.25

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Extra this month

HRS Video Head Chart

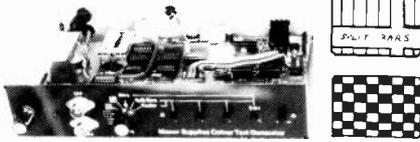


**Servicing the Panasonic NV333/366
Liquid Crystal Displays for TV
Servo Fault Finding • DX-TV
Blanking Pulse Generator Circuit
How to Run Your Vintage TVs
VCR Clinic • TV Fault Finding**

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR
FOR DOMESTIC TV & VCR.

TEST
DEMONSTRATIONS
AT 172
WEST END LANE



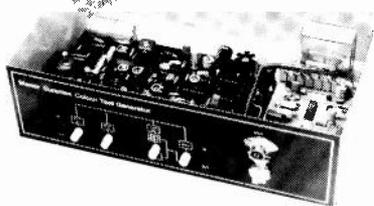
- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with 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.
- ★ Backup service available.

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 **£25.00**, Philips KT3, K30 **£20.00**, p.p. **£2.30**

PHILIPS GH PRESTEL, TELETEXT UNIT includes Mullard VM6230, Teletext Decoder, 6330 plus, plus Line Coupler and Interface **£30.00**, p.p. **£2.80**

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF
TECHNICAL EXPERTS

LOP.Ts, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

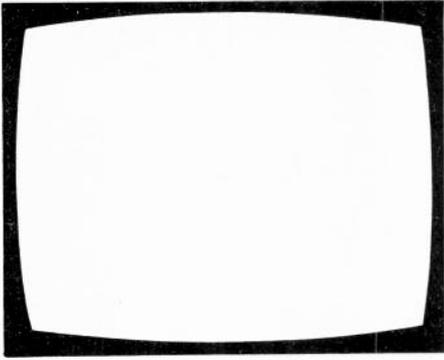
PHILIPS KT3, K30 PANELS, tested, exchange, sound power, frame, RGB **£7.50** each. Decoder (Non-text) **£10.00** p.p. **£1.50**.
THORN TX9 PANELS Complete & tested **£28.00** Exchange. (Shop only).
THORN 8000 TO 8500 Panels tested exchange. Power **£7.80**. 8800, 9800 power **£8.80** p.p. **£1.50**. Frame **£10.00** p.p. **£2.30**.
THORN TX9, TX10 Facia Control Panel Incl Infra Red Remote Receiver **£8.50** p.p. **£2.00**.
BUSH T2022 Touch Tune Facia Unit **£7.50** p.p. **£2.00**.
THORN 8800, 9800 Touch Tune Facia Unit **£3.50** p.p. **£1.50**.
PHILIPS G11 PANELS (tested).
Frame, IF, decoder **£12.50** each p.p. **£2.00**. Scan **£20.00** p.p. **£2.80**.
PHILIPS G11 PANELS ex rental (untested).
Scan Frame, Decoder **£5.00** p.p. **£2.00**.
PHILIPS G11 IF PANEL (New) Less Tuner **£2.50** p.p. **£1.30**
PHILIPS HANDSETS (New Replacements) p.p. **£1.50**.
G11 Ultrasonic Nontext **£19.50**, Infra red Text **£19.50**. Others available.
KT3 Non text (RC4001) **£22.50**, KT3, K30 etc. Text **£22.50**.
PHILIPS HANDSETS Ex rental, text. Untested. KT Text/Video Type. **£3.50** p.p. **£1.00**.
PHILIPS COLOUR MANUALS p.p. **80p**.
G11, K30, K35, 2A **£3.50**, KT3 **£4.50**, CTX-E, CTX-S, CFI **£1.50** each.
THORN REMOTE CONTROL HANDSETS
TX9, TX10 Infra red (Non-Text) **£18.00**; TX9, TX10 Infra red Teletext **£19.50**, p.p. **£1.20**. Large selection others available: Sony, Grundig, etc.
TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. **50p**.
TX Remote panel 1564 (incl. SAA5012) **£5.00** p.p. **£1.80**.
THORN TX9, TX10 Saw Filter IF Panel. **£5.00** p.p. **80p**.
TX9, TX10 Remote & tuning control panel (1515) **£7.50** p.p. **£1.80**.
PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. **£1.00**.
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CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync, and UHF Modulator, Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£13.50** p.p. **80p**. (Alum. Case **£2.90** p.p. **£1.40**.) ADDITIONAL GREY SCALE Kit **£2.90** p.p. **45p**.
UHF SIGNAL STRENGTH METER KIT **£22.00** Alum. Case **£2.90**. De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. **£2.30**.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator - can be adapted for latest CRTs **£29.50** p.p. **£2.80**.
GEC 20AX Line Time Base **£18.00** p.p. **£2.00**.
ITT CVC30 SERIES, Convergence & Purity Panels. **£2.50** p.p. **£1.50**.
ITT CVC30 SERIES PANELS SURPLUS (untested) **£2.50** each, CMP31, CMP31, CMA30, CM532, p.p. **80p**; CMD33, p.p. **£1.80**.
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THORN TX9 Panels salvaged ex factory for spares incl. Electrolytic & Mains Transformers. **£8.50** p.p. **£3.00**.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. **£1.80**.
THORN 9000 SERIES IF/Decoder **£10.00** p.p. **£2.30**.
THORN 9000 IF/Decoder Panels Salvaged. For spares **£2.50** p.p. **£1.80**.
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PHILIPS G8/G9 IF/Decoder Panels for small spares incl ICs **£2.50** p.p. **£1.60**.
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THORN TX9 **£12.50** ITT CVC25, CVC30 series **£8.80**
THORN TX10 **£16.50** ITT CVC45 **£9.80**
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PYE 691-7 chassis type only **£5.00**
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TELEVISION

November
1988

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QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. Correspondents should enclose a stamped addressed envelope. Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

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Solder Sucker Antistat std.....	5.40
Solder Sucker Antistat jge.....	6.20
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Vero Board.....	Lg. 2.59
Double Sided Adhesive Tape.....	5.75
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14SWG 100 Amp.....	1.00
17SWG 60 Amp.....	1.00
19SWG 45 Amp.....	1.00
20SWG.....	1.00
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PCF806.....	1.12
PCF807.....	1.12
PCF808.....	1.12
PCF809.....	1.12
PCF810.....	1.12
PCF811.....	1.12
PCF812.....	1.12
PCF813.....	1.12
PCF814.....	1.12
PCF815.....	1.12
PCF816.....	1.12
PCF817.....	1.12
PCF818.....	1.12
PCF819.....	1.12
PCF820.....	1.12
PCF821.....	1.12
PCF822.....	1.12
PCF823.....	1.12
PCF824.....	1.12
PCF825.....	1.12
PCF826.....	1.12
PCF827.....	1.12
PCF828.....	1.12
PCF829.....	1.12
PCF830.....	1.12
PCF831.....	1.12
PCF832.....	1.12
PCF833.....	1.12
PCF834.....	1.12
PCF835.....	1.12
PCF836.....	1.12
PCF837.....	1.12
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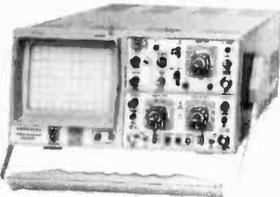
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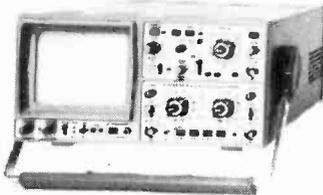
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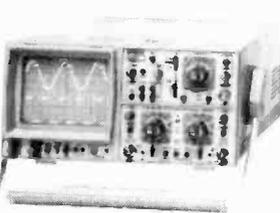
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- Delay Line
- Time Base 1.25s/cm - 10ns/cm
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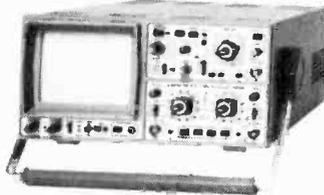
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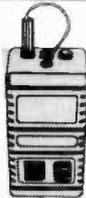
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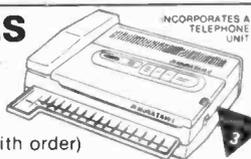
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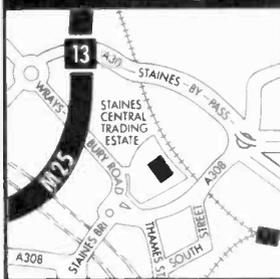
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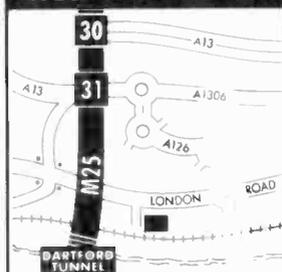
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		LA1230	2.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		LA1365	2.45	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		LA4440	2.75	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		LA4445	2.45	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		LA4450	2.45	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		LA4461	2.45	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
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		LA7801	2.90	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		MC13002	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		MC14497P	4.50	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA11250	3.85	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA11251	4.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13027	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13028	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13029	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13030	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13031	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13032	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13033	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13034	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13035	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13036	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13037	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13038	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13039	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13040	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13041	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13042	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13043	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13044	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13045	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13046	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13047	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13048	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13049	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13050	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13051	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13052	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13053	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
		SA13054	3.95	STR454	5.35	TD42582	1.95	BC360	35	TIP12H	7.75			STR454	5.35	TD42582	1.95	TIP12H	7.75	TIP12H	7.75		
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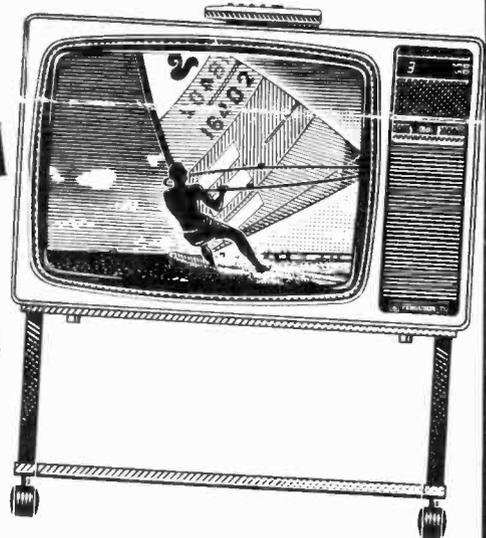
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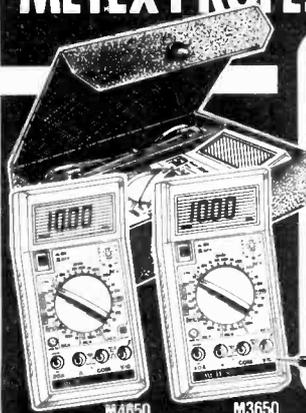


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3 1/2 floppy Disk Drive, made by the Chicon Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm, other features are high precision head positioning - single push loading and eject - direct drive brushless motor - Shugart compatible interface - standard connections - interchangeable with most other 3 1/2 and 5 1/4 drives. Brand new with copy of makers manual. Offered this month at \pounds 28.50 post and VAT included.

CASE - adaptable for 3" or 3 1/2" FDD, has room for power supply components price only \pounds 4 includes circuit of PSU. Our Ref 4P7.

POWER SUPPLY FOR FDD - 5V and 12V voltage regulated outputs, complete kit of parts will fit into case 4P7 with case \pounds 11. Our ref. 11P2.

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24/306W. Which tube is implos on and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16v dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only \pounds 16 plus \pounds 5 post.

CASE FOR 9" MONITOR

We have arranged with a metal worker to make cases for the 9" Monitor. Delivery promised for the end of May and the price \pounds 12 plus \pounds 2 post. The case will be made from coated sheet steel, overall size approx 10in \times 10in \times 7in high which will give ample space for the Power Supply and external controls if you fit them.

FLIP-OVER DIGITAL CLOCK - Quite an eyecatcher, this is mains operated. The figures flip-over per minute and per hour and give a rather than usual visual display. Supplied complete with front and perspex panels to glue together to make its case. \pounds 2.00 each. Our ref 2P205.

3" FDD HITACHI 3055XA

This has standard Shugart connections and will work with most computers but is particularly suitable for Amstrads, in fact it was recommended in a recent "Computing with Amstrad" Price \pounds 30 + \pounds 3 post.

TORRIDIAL MAINS TRANSFORMER with twin outputs. 6.3v 2amps and 12v 1amp, so ideal for FDD power supply. Price \pounds 5.00. Our reference 5P122.

DOUBLE MICRO CASSETTE DECK made by the Japanese ABS Company. This takes two micro cassettes and is complete with motors, solenoids to select the deck to use and record and playback heads. Price \pounds 10.00. Our reference 10P49.

THIS MONTH'S SNIP

LASER TUBE. Made by Philips Electrical. New and unused. This is helium-neon and has a typical power rating of 1.6mW. It emits random polarised light and is completely safe provided you do not look directly into the beam when eye damage could result. Do not use in the presence of children unless a diverging lens is fitted. DON'T MISS THIS SPECIAL BARGAIN! Price \pounds 29.95 plus \pounds 3.00 insured delivery.

LASER POWER SUPPLY UNIT for the Philips tube gives 8 KV striking and 1-25 KV at 5mA running. Complete kit with case \pounds 13 or made up working \pounds 18 + \pounds 2 post unless ordered with tube.

QUICK FIX MAINS CONNECTOR - A must for your workshop. Saves putting on plugs as you just push the wires under the spring clips. Automatically off when lid is up. Price \pounds 7.50. Our reference 7P5/1.

BT HANDSET with curly lead terminating at BT plug. Colour cream. Price \pounds 5.00. Our reference 5P123.

STEREO SPEAKERS - Each 10watts 8ohm and twin speakers mounted in Walnut-finish cabinets, size 16in high \times 10in wide \times 6in deep. Front is black Dacron and the finish is very pleasing. Price \pounds 7.00 per pair. Extra postage and packing \pounds 3.00. Our reference 7P6.

DO YOU WANT TO MEASURE AC AMPS? - We have found a few more of the 50Hz 0-40amp AC 2 1/2in diameter panel meters, made for RAF equipment these are very reliable and robust. Price \pounds 5.00 each. Our reference 5P105.

GPO TEST METER 12/C1

2000 opv. 19 AC/DC ranges, including all the usual ones and a very useful low ohms range, also shunt provision for reading up to 10a. DC. It is in a real leather carrying case and comes complete with leads, prods and croc clips. Price \pounds 7 Ref. 7P5.

8" GREEN SCREEN MONITOR

Complete and in a case with optional tilt stand for improved viewing angle. A very compact unit measuring only 10 1/2" \times 10 1/2" \times 7 1/2" high operates from a 15V DC supply - composite input so ideal for use with Electron or similar computers. Used, but we test before despatch and guarantee 6 months. Price \pounds 17.50 - Our Ref: 17P1 - please add \pounds 3 post.

CAMERA TUBE - Mullard PLUMBICON ref XQ1020G. Believed unused. Few only at \pounds 6 each.

UNUSUAL MAINS MOTOR - Quite small, measures only 2in \times 2in \times 1in approx, but is surprisingly powerful. It revs at 3,000rpm and is reversible. It has good length 1/2in diameter spindle. Price \pounds 1.80. Order ref BD640.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ET1 and similar circuits. Will refresh your home, office, shop, workshop etc. Makes you feel better and work harder - a complete mains operated kit, case included \pounds 11.50 + \pounds 3 P&P.

J & N BULL ELECTRICAL

Dept. T.V., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT.

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under \pounds 20 add \pounds 1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Brighton (0273) 734648 or 203500.

BARGAINS STILL AVAILABLE

RE-CHARGEABLE NICADS 'D' SIZE these are tagged for easy joining together but bags can easily be removed, virtually unused, tested and gnded. \pounds 2.00 each ref 2P141, 6 for \pounds 10 ref 10P47.

BRIGHT LIGHT SWITCH will control mains circuits up to 10 amps, gets its switch pulses from car headlights, bright daylight, etc, so it does not use batteries and its sensor is completely isolated from the mains, with full instruction supplied. Price \pounds 10 ref 10P46.

POWERFUL 12V MOTOR was intended for Sinclair Electric Car, rating approx. 1 1/2 HP. Price \pounds 15 plus \pounds 2 post.

3 INCH FDD Hitachi ref. HFD 2055XA. Ideal replacement or second drive in most computers, especially Amstrad 6128, etc. Price \pounds 30 plus \pounds 3 post

SOLAR POWERED NI-CAD CHARGER 4 Ni-CAD batteries AA (HP7) charged in eight hours or two in only 4 hours. It is complete, boxed ready to use unit. Price \pounds 6. Our ref. 6P3.

50v 20A TRANSFORMER 'C' Core construction so quite easy to adapt for other outputs - tapped mains input, only \pounds 25, but very heavy so please add \pounds 5. if not collecting, order Ref. 25P4.

FREE POWER! Can be yours if you use our solar cells—sturdily made modules with new system bubble magnifiers to concentrate the light and so eliminate the need for actual sunshine—they work just as well in bright light. Voltage input is .45—you join in series to get desired voltage—and in parallel for more amps. Module A gives 100mA, Price \pounds 1.00. Order ref. BD631. Module C gives 400mA, Price \pounds 2.00. Order ref. 2P199. Module D gives 700mA, Price \pounds 3.00. Order ref. 3P42.

SWITCH AC LOADS WITH YOUR COMPUTER This is easy and reliable if you use our solid state relay. This has no moving parts, has high input resistance and acts as a noise barrier and provides 4KW isolation between logic terminals. The turn-on voltage is not critical, anything between 3 and 30V, internal resistance is about 1K ohm, AC loads up to 10A can be switched. Price is \pounds 2 each. Ref. 2P183.

METAL PROJECT BOX Ideal size for battery charger, power supply etc; sprayed grey, size 8" \times 4 1/4" \times 4" high, ends are lowered for ventilation other sides are flat and undrilled order Ref. 2P191 price \pounds 2.

BIG SMOOTHING CAPACITOR. Sprague powertely 39,000uF at 50V. \pounds 3. Our Ref. 3P41.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core size 7/0.2mm. Ideal for long telephone runs or similar applications even at mains voltage. 20 metres \pounds 2. Our ref. 2P196 or 100 metres coil \pounds 8. Order ref. 8P19.

TWIN GANG TUNING CAPACITOR. Each section is .0005uF with trimmers and good length 1/4in spindle. Old but unused and in very good condition. \pounds 1 each. Our ref. BD650.

13A PLUGS. Good British make complete with fuse, parcel of 5 for \pounds 2. Order ref. 2P186.

13A ADAPTERS - Takes 2 13A plugs, packet of 3 for \pounds 2. order Ref. 2P187.

20v - 0 - 20v - Mains transformers 2 1/2 amp (100 watt) loading, tapped primary. 200-245 upright mountings 14" order Ref. 4P24.

BENCH ISOLATION TRANSFORMERS 500 watt - 230v in and out with plenty ofappings to give exact volts. \pounds 12. + \pounds 3.

BURGLAR ALARM BELL - 6" gong - OK to fix outside in the rain and shelter - mains operation. \pounds 8. Ref. 8P2.

24 HOUR TIME SWITCH - 16A changingover. up to 6 on/offts per day. Nicely cased. Intended for wall mounting. Price \pounds 8. Ref. 8P6.

CAPACITOR BARGAIN - axial ended - 4700uF @ 25v Jap made. Normally 50p each, but you will get 4 for \pounds 1. Ref. 613.

PIEZO ELECTRIC FAN an unusual fan, more like the one used by Madame Butterfly, than the conventional type, it does not rotate. The air movements is caused by two vibrating arms. It is American made, mains operated, very economical and causes no interference. So it is ideal for computer and instrument cooling. Price is only \pounds 1 each. Ref. BD605.

SPRING LOADED TEST PRODS - heavy duty, made by the famous Bulgin company. Very good quality. Price four for \pounds 1. Ref. BD597.

CURLY LEAD - four core, standard replacement for telephone handset, extends to nearly two metres Price \pounds 1 each. Ref. BD599.

TELEPHONE BELLS - these will work off our standard mains through a transformer, but to sound exactly like a telephone, they then must be led with 25Hz 50v. So with these bells we give a circuit for a suitable power supply. Price 2 bells for \pounds 1. Ref. BD600.

ASTEC PSU. Mains operated switch mode so very compact (6 1/2" \times 4" \times 2" approx.). Outputs: +5 Volts 3.5 amp. +12 Volts 1.5 amp. -5 Volt 1.5 amp. Brand new. Normal price \pounds 30+. Our price only \pounds 10. Ref. 10P34.

APPLIANCE THERMOSTATS - spindle adjust type suitable for convector heaters or similar. Price 2 for \pounds 1. Ref. BD582

3 CORE FLEX BARGAIN No.1 - Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for \pounds 2. Order Ref. 2P189.

3 CORE FLEX BARGAIN No.2 - Core size 1.25mm so suitable for long extension leads carrying up to 13 amps - or short leads up to 25A. 10m for \pounds 2. order Ref. 2P190.

CASE WITH 13A PRONGS - to go into 13A socket, nice size and suitable for plenty of projects such as car battery trickle charger, speed controller, time switch, night light, noise suppressor, dimmers etc Price - 2 for \pounds 1 Ref. BD565.

ALPHA-NUMERIC KEYBOARD - this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is a QWERTY array and on the right is a 15 key number pad, board size is approx. 13" \times 4" - brand new but offered at only a fraction of its cost namely \pounds 3, plus \pounds 1 post. Ref. 3P27.

TELEPHONE EXTENSIONS - it is now legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable, 100m coil \pounds 8.50. Extension BT sockets \pounds 2.95. Packet of 50 plastic headed staples \pounds 2. Dual adaptor for taking two appliances from one socket \pounds 3.95. Leads with BT plug for changing old phones 3 for \pounds 2.

WIRE BARGAIN - 500 metres 0.7mm solid copper tinned and p.v.c. covered. Only \pounds 3 - \pounds 1 post. Ref. 3P31 - that's well under 1p per metre, and this wire is ideal for push on connections.

INTERRUPTED BEAM KIT - this kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components - relay photo transistor, resistors and caps etc. Circuit diagram but no case. Price \pounds 2. Ref. 2P15.

3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT - with 1 amp DC output. Intended for use on the bench for experimenters, students, inventors, service engineers, etc This is probably the most important piece of equipment you can own. (After a multi range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection, which operates at 1.1 amp approximately. Other features are very low ripple output, a typical ripple is 3mV pk-pk, 1mV rms. Mounted in a metal fronted plastic case, this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is \pounds 15. Ref. 15P7.

TRANSMITTER SURVEILLANCE (BUG) - tiny, easily hidden, but which will enable conversation to be picked up with FM radio. Can be housed in a matchbox. All electronic parts and circuit. Price \pounds 2. Ref. 2P52.



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

NOVEMBER SPECIAL OFFER "CLOSED-CIRCUIT" TELEVISION SYSTEM

Comprising: 1 x CAMERA 1 x MONITOR 1 x CAMERA BRACKET

Illustrations not to scale. For guidance only - actual items supplied may vary from those illustrated.

ONLY £130 NORMALLY £150

FM TRANSMITTER

Very High Quality "MINI-BUG" - Ideal for Baby Alarm etc!!

A very good range is obtainable - we have obtained over 12 miles, but it does depend on conditions. Simply remove cover - insert battery - and you're ready to go.

Reception can be obtained on any F.M. Radio Frequency. 105-109 MHz F.M.

Power: PP3 9V Battery (not included). Dimensions: 4.25" x 2.25" x 0.75". Order Code - 50/304

Price: £8.50

12V Twin Fluorescent Lamp

12" Double Tubes

Attractive white fitting, ribbed perspex diffuser. On/off switch. 3ft cable. Transistorised circuitry. Keyhole fitting. 12V D.C. 8W Tubes. Dimensions: 368 x 67 x 43 mm. Ideal for Caravans, Boats, Vans etc.

PRICE £5.99 £4.99 £4.50

12 VOLT RECHARGEABLE UNIT

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

£6.99 P&P £1.85 + VAT
£6.25 each for 10+

SAFE/LOC

FOR QUICKLY AND SAFELY TESTING EQUIPMENT ON MAINS VOLTAGE. SIMPLY CONNECT WIRE TO CLIPS AND CLOSE LID. £6.75

HELPING HANDS WITH MAGNIFIER £3.99

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Enquiries are welcomed for any other valve not listed here.	E241	2.85	
	E281	0.85	
	GY501	1.40	
	GZ37	1.25	
	KT68(G.E.C.)	18.00	
Type	Price (£)		
DAF96	1.05	KT77	11.50
DF96	0.80	KT88(G.E.C.)	19.00
DK96	2.70	PC82	1.45
DM71	3.00	PC92	3.05
DY86/87	0.65	PC900	1.45
DY802	0.95	PC88	0.85
CV950	2.85	PC89	0.80
CV4015	2.85	PCC189	0.90
E180F	6.55	PCF80	0.95
EABC80	0.85	PCF82	1.00
EAE42	1.55	PCF84	0.80
EB91	1.35	PCF86	1.30
EBC41	3.50	PCF87	0.60
EBF90	0.80	PCF200	2.00
EC31	1.05	PCF201	0.80
ECC82	0.95	PCF800	1.25
ECC83	1.20	PCF801	1.10
ECC84	0.78	PCF802	1.10
ECC85	0.95	PCF805	1.15
ECC88	1.25	PCF806	1.25
ECC189	0.90	PCF808	1.60
ECCF80	0.85	PCL82	1.05
ECCF81	0.85	PCL84	1.05
ECCF83	1.95	PCL84	1.05
ECCF85	3.80	PCL86	0.90
ECH81	1.45	PCL88	2.55
ECH82	1.55	PCL805	1.05
ECL85	0.80	PD500	2.70
ECL86	1.80	PFL200	1.80
EF80	0.80	PL33	1.55
EF86	1.65	PL36	1.80
EF91	1.05	PL39	0.80
EF95	1.70	PL95	2.05
EF183	0.90	PL504	1.55
EF184	1.05	PL508	2.70
EH90	1.00	PL519/509	5.20
EL34	3.45	PL802	5.55
EL36	2.30	PV81800	1.15
EL37	7.00	PV82	1.80
EL64	0.60	PV82	0.80
EL85	5.00	PV500A	2.25
EL86	6.95	PV801	0.69
EL809	7.90	UABC80	0.85
EL519	0.85	UCB1	1.25
EM90	0.90	UCB41	4.35
EM84	1.80	UCB81	1.75
EM87	3.90	UCB85	0.80
EY81	0.80	UCB90	1.25
EY86/87	0.80	UCH42	5.65
EY88	0.80	UCH81	2.05
EY500A	2.20	UCL82	1.85

OLDER 60% TIN 40% ALLOY

22g Non-corrosive "Mull-core" Solder. 500gm Reel £4.99 each. 10 Reels £3.75 each

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	7.50	Antex 15W iron	5.80
Antex 15W iron	5.80	Antex 25W iron	5.80
Antex 25W iron	5.80	Antex elements	3.20
Antex bits	1.15	Antex bits	1.15
Antex stands	2.20	Antex sucker	2.95
Spare nozzles for Solder sucker	0.80		

ORVX PORTASOL GAS SOLDERING IRON
PRICE £16.00 each SPARE TIPS - 1, 2, 3, 4, 2.4, 4.8mm £6.00 each

SERVICE AIDS

Goldlene Degreasing Solvent	1.78	Aero Duster	1.55
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Supa Freeze-it	1.46	Rapid Fire Extinguisher	3.45
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Video/Tape Head Cleaner	1.14	Silicone Compound Spray	1.48
Plastic-Sue	1.40	Heat Sink Compound	1.20
Aero-Klene	1.16	Light gauge 0.08mm	0.80
Anti-Static Spray elist	1.28	Standard gauge 1.2mm	0.78
Excel Pot - 1/2"	1.24	Industrial reel 1.2mm	2.95

RESISTORS - CARBON FILM 5%
1/4W 10R to 10M (E12 Range) 2p each 15p/10. 75p/100
1/2W 2R2 to 10M (E24 Range) 2p each 15p/10. 75p/100
1W 10R to 2M2 (E12 Range) 5p each 40p/10. 3.00/100
2W 10R to 2M2 (E6 Range) 8p each 60p/10. 5.00/100

RESISTOR KITS - each value individually packed
1/4W pack 10 each value E12 - 10R to 1M 610 pieces 4.50
1/2W pack 5 each value E12 - 10R to 1M 305 pieces 2.95
1/4W pack Popular - 10R to 10M 1000 pieces 6.50
1/2W pack 10 each value E12 - 2R2 to 2M2 730 pieces 7.75
1/2W pack 5 each value E12 - 2R2 to 2M2 365 pieces 4.25
1/2W pack Popular - 2R2 to 10M 1000 pieces 9.50
1W pack 5 each value E12 - 2R2 to 1M 353 pieces 13.75
2W pack 5 each value E6 - 10R to 2M2 317 pieces 21.75

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QUICK BLOW - 50mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3, 3.15, 4, 5, 6, 8, 10
TIME DELAY - 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3, 3.15, 4, 5, 6, 8, 10 90p/10

1 DOMESTIC MAINS FUSES
2A, 3A, 5A, 13A £1.00/10
1 1/4 QUICK FUSES
500mA, 1A 125A, 2A, 10A 50p/10

BT APPROVED EQUIPMENT
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B.T. Cable (per metre) 15p Viscomat Phone £26.00
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END NIPPERS - Economy
Yellow insul. handles. Length 4 1/2".
Order Code SO24 Price £1.00 Per 10; 90p each

TEST PRODS FUSED
Manufactured by Bulglin.
High strength plastic ins. 1A 11/4" fuse. Length of prods - red & black - 144mm.
90p per 10

T.V. AERIAL ACCESSORIES
Co-Ax Cable 75 Ohm 100 Metre Reel £11.00
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Improves signal 3 times
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Improves signal to 2 sets 50%
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Minimises CB interference on TV
TV/FM Diplexer 9006
Separates UHF TV signals from FM radio signals £6.95

TERMINAL BOX
Terminal Junction Box for powering D.C. accessories. Gives three pairs of pillar screw terminals colour coded red and black. 30cm lead from cigar lighter plug. Current: 3A max. Dimensions: 84 x 55 x 32mm.
Order Code: SO/158.
1+ £1.50
10+ £1.25

RAINBOW RIBBON CABLE
14-way for use with I.D.C. connectors. Consists of parallel stranded braided copper wire for conductors laminated between layers of P.V.C. film to form a flat ribbon cable. This cable may be split in any number of 1A.
Conductor rating: 300V D.C. 1A.
Conductor spacing: 0.8".
Each Conductor contains 7 strands of 28 AWG wire.
Capacitance: 12.9pF/ft.
Temperature range: -20°C to +80°C.
UL style: 276.
Manufacturer: T & B/ANSLEY.
Number of cores: 14.
ORDER CODE - SO/079 PRICE - £7.50 PER 100FT. REEL

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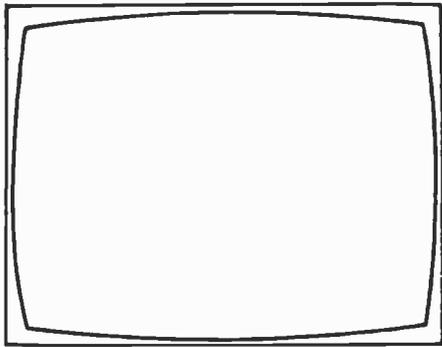
AKAI	HR-D110E	18.00
	HR-D120E	18.00
	HR-D120EG	18.00
	HR-D120EG	18.00
	HR-D125E	18.00
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	N-830EG	18.00
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	N-832	18.00
	N-833EG	18.00
	N-833EG	18.00
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FERGUSON PANASONIC

3V00	18.00	NV2000	18.00
3V01	18.00	NV2000	18.00
3V12	18.00	NV330	18.00
3V13	18.00	NV330	18.00
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3V15	18.00	NV330	18.00
3V16	18.00	NV330	18.00
3V17	18.00	NV330	18.00
3V18	18.00	NV330	18.00
3V19	18.00	NV330	18.00
3V20	18.00	NV330	18.00
3V21	18.00	NV330	18.00
3V22	18.00	NV330	18.00
3V23	18.00	NV330	18.00
3V24	18.00	NV330	18.00
3V25	18.00	NV330	18.00
3V26	18.00	NV330	18.00
3V27	18.00	NV330	18.00
3V28	18.00	NV330	18.00
3V29	18.00	NV330	18.00
3V30	18.00	NV330	18.00
3V31	18.00	NV330	18.00
3V32	18.00	NV330	18.00
3V33	18.00	NV330	18.00
3V34	18.00	NV330	18.00
3V35	18.00	NV330	18.00
3V36	18.00	NV330	18.00
3V37	18.00	NV330	18.00
3V38	18.00	NV330	18.00
3V39	18.00	NV330	18.00
3V40	18.00	NV330	18.00
3V41	18.00	NV330	18.00
3V42	18.00	NV330	18.00
3V43	18.00	NV330	18.00
3V44	18.00	NV330	18.00
3V45	18.00	NV330	18.00
3V46	18.00	NV330	18.00
3V47	18.00	NV330	18.00
3V48	18.00	NV330	18.00
3V49	18.00	NV330	18.00
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VT11EG	26.75	VC200	26.95
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VT26	26.75	VC1300	26.95
VT27	26.75	VC1400	26.95
VT28	26.75	VC1500	26.95
VT29	26.75	VC1600	26.95
VT30	26.75	VC1700	26.95
VT31	26.75	VC1800	26.95
VT32	26.75	VC1900	26.95
VT33	26.75	VC2000	26.95
VT34	26.75	VC2100	26.95
VT35	26.75	VC2200	26.95
VT36	26.75	VC2300	26.95
VT37	26.75	VC2400	26.95
VT38	26.75	VC2500	26.95
VT39	26.75	VC2600	26.95
VT40	26.75	VC2700	26.95
VT41	26.75	VC2800	26.95
VT42	26.75	VC2900	26.95
VT43	26.75	VC3000	26.95
VT44	26.75	VC3100	26.95
VT45	26.75	VC3200	26.95
VT46	26.75	VC3300	26.95
VT47	26.75	VC3400	26.95
VT48	26.75	VC3500	26.95
VT49	26.75	VC3600	26.95
VT50	26.75	VC3700	26.95
VT51	26.75	VC3800	26.95
VT52	26.75	VC3900	26.95
VT53	26.75	VC4000	26.95
VT54	26.75	VC4100	26.95
VT55	26.75	VC4200	26.95
VT56	26.75	VC4300	26.95
VT57	26.75	VC4400	26.95
VT58	26.75	VC4500	26.95
VT59	26.75	VC4600	26.95
VT60	26.75	VC4700	26.95
VT61	26.75	VC4800	26.95
VT62	26.75	VC4900	26.95
VT63	26.75	VC5000	26.95
VT64	26.75	VC5100	26.95
VT65	26.75	VC5200	26.95
VT66	26.75	VC5300	26.95
VT67	26.75	VC5400	26.95
VT68	26.75	VC5500	26.95
VT69	26.75	VC5600	26.95
VT70	26.75	VC5700	26.95
VT71	26.75	VC5800	26.95
VT72	26.75	VC5900	26.95
VT73	26.75	VC6000	26.95
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TELEVISION

Golden opportunities – but when?

Business in the TV industry has always followed a cyclic pattern, with booms interspersed by quiet periods. Right now we are going through a relatively quiet period. The VCR and second set booms have probably blown themselves out, though demand is still lively. The market is what's known as a mature one, waiting for the next major development. It won't have long to wait. If all goes well, within a few weeks Astra will be beaming Sky Television down to us and by the end of next year we'll have BSB's channels as well.

Will this mean a great bonanza for the High Street retailer? There are certainly many expressions of optimism in the trade. Micro-X Ltd. is talking in terms of sales of 300,000 dishes next year and BSB expects 400,000 installations for its channels during its first year of operation. This is a lot of business, but whether it will be profitable is another matter. Already firms are announcing prices that undercut one another – before sales have even begun. And then there's the question as to whether the public will take the bait. So far the signs are not exactly reassuring. The number of receivers that have been installed for the present low-power satellite TV transmissions is extremely modest. Though exact figures are not available, the number of installations is believed to be only a few thousand, mainly in more remote areas where normal TV reception is poor. The programmes do not amount to a full service as planned by Sky Television and BSB of course, while the sales promotion for these latter services has hardly begun. A major advertising campaign could make all the difference. Recent research suggests that viewers are not at present too enthusiastic about the extra services they are to be offered. This seems to correspond with the poor reception that's been given to the new cable services. It also reflects the fact that the public expects to get its television on the cheap. A great deal also depends on public satisfaction with the present terrestrial services. Though the public moans about these, by and large there's a reasonably high degree of satisfaction. The public is going to have to be persuaded that the new services will represent a real widening of choice before it puts its hands in its pockets and goes out to buy those dishes. It can probably be done, but the signs are that initial take-up will be slow. The public will be in a wait and see mood.

The problems that the French are having with their TDF-1 satellite cast something of a shadow over the prospects. Not so much technical problems, though there have been some of those, as of getting broadcasters to lease the transponders. Of its five channels, only one has so far been booked – despite the fact that the launch is due on October 27th. Prime minister Michel Rocard has threatened to delay the launch unless the authorities can guarantee that a reasonable level of services will be provided to make the satellite economically viable. It's all rather dispiriting: the project, which was started about ten years ago, has already cost something in the region of £190m – of public funds. You might think that with all the clamour to get aboard Astra, TDF-1 would have no problems in this respect. But then Astra does have something of a low-cost option about it. If the public did fail to respond, broadcasters could probably pull out at no great cost. The French satellite TV authorities have been asking rather a lot in terms of channel rental and have set conditions of a political nature.

All this is not to suggest that the day of the dish will not come, just that it may come rather slowly at first. Later we have the prospect of high-definition TV, which could again mean a great deal of new business. At present this is being held up by that old problem controversy over standards. Europe wants to adopt an evolutionary approach based on exploiting the full potential of the MAC satellite TV transmission standard. The Japanese have long sought to have their 1,125-line system adopted as a worldwide standard. The US authorities, while originally supporting the Japanese, have now laid down new conditions which would necessitate a different approach. The CCIR is due to make a decision on HDTV in 1990: it's a pretty safe bet that whatever the CCIR decides Europe, the USA and Japan will go their own ways. This shouldn't really matter all that much in these days of sophisticated digital standards conversion, but the broadcasters seem to feel that life would be a lot easier with internationally compatible signals.

However this particular problem is resolved, HDTV does hold out vast prospects for the industry – which is precisely why there is so much dispute about standards and so much political lobbying. Clearly if the 1,125-line HDTV standard was accepted internationally the Japanese would quickly wipe up the complete market. Industry in Europe and the USA is set to avoid this. It has good technical grounds to back its case.

While the public may not easily be persuaded of the benefits of more of the same via extra satellite channels, it could respond more quickly to the offer of a much better picture. If the advent of HDTV coincides with a period when large numbers of sets are due for replacement, the business prospects are vast. That's something to rub your hands about, some time in the late nineties.

Next question: will these sets have flat screen or c.r.t. displays? At present the tube undoubtedly has the edge. Tubes that give HDTV performance have long been available. It's hard to see those small-screen LCD panels evolving to full screen size and giving anything like the same picture quality. Nevertheless a great deal of investment is going into the development of large LC displays. Bearing in mind that the whole basis of TV is deception of the eye, LCD technology could well take over at some time in the future. Which could all add up to a lot more business. The trade, in short, has a lot going for it in the medium to long term.

EDITOR

John A. Reddihough

Please note that the telephone numbers below are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 1.

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COVER PHOTO

This month's cover photograph shows an interior view of the Panasonic NVC333 VCR – see article starting on page 22.

CORRECTION

The chassis symbol in the chopper circuit on page 905 last month (Decca/Tatung 120/130 chassis) was unfortunately omitted. The junction of F802/R810 is connected to chassis (the emitter of Q801 being at -315V with respect to chassis).

Long-distance Television

Roger Bunney

August was a surprisingly active month for long-distance TV reception, with appreciable tropospheric and Sporadic E propagation over much of the period. There was also the bonus of the Perseids meteor shower on August 11th – this was described in the press as a “shooting star spectacle”! The collated SpE log is as follows:

- 4/8/88 YLE (Finland) chs. E3, 4; TSS (USSR) R1, 2; NRK (Norway) E2, 3, 4; CST (Czechoslovakia) R1, 2; RUV (Iceland) E4; +PTT (Switzerland) E2; RAI (Italy) IA; TVE (Spain) E2, 3, 4.
- 5/8/88 TVE E2, 3, 4; TVE-2 E2; RAI IA; RTP (Portugal) E2, 3; CST R2; NRK E2, 3, 4; RUV E4; DR (Denmark) E3.
- 6/8/88 TVE E2, 3, 4; TVE-2 E2; RTP E2; RAI IA; +PTT E2; NRK E2, 3; TSS R1.
- 7/8/88 ARD (West Germany) E2; ORF (Austria) E2a; JRT (Yugoslavia) E3; RAI IA; TSS R1, 2; RUV E3, 4.
- 8/8/88 +PTT E2, 3; RAI IA; TVE E2, 3; TVP (Poland) R2; CST R2; YLE E3, 4; CST R2; NRK E2, 3, 4; SVT (Sweden) E2, 3; RUV E4.
- 9/8/88 NRK E2, 3; YLE E3; SVT E2, 3; TSS R1, 2; TVP R2; TVE E2, 3, 4; RTP E3.
- 10/8/88 TVE E2, 3, 4; RAI IA, B; YLE E3, 4; NRK E2, 3, 4; CST R1.
- 11/8/88 ARD E2, 4; +PTT E2; CST R1, 2; TVP R2; TVE E2, 3, 4; TVE-2 E2; SVT E2, 3, 4; NRK E2, 3, 4; TSS R1.
- 12/8/88 TSS R1; TVP R2; SVT E3, 4; NRK E2, 3, 4; YLE E3; TVE E2, 3, 4.
- 13/8/88 +PTT E2, 3, 4; ARD E4; TVP R2; TSS R1; RAI IA, B; NRK E3, 4; TVE E2, 3, 4.
- 14/8/88 +PTT E2, 3; RAI IA, B; C+ (Canal Plus – France) L2, 3; TVE E2, 3, 4; JRT E3; ARD E2, 4; CST R1, 2; TVP R1; ORF E2a, 4; MTV (Hungary) R1; TSS R1; SVT E4; NRK E2; RUV E4; Videolina IA – Italian free station.
- 15/8/88 TVE E2, 3, 4; NRK E3, 4; SVT E3, 4; CST R2; TVP R2; YLE E4.
- 16/8/88 TVE E2, 3; RAI IA.
- 17/8/88 RTP E3; TVE E2, 3; ORF E4; Tele Uno IA – Italian free station; TSS R2.
- 18/8/88 TVE E2, 3; RTP E3.
- 19/8/88 TVP R1, 2; TSS R1, 2; CST R1; SVT E3, 4; ARD E4; TVE E2, 3; TVE-2 E2.
- 20/8/88 NRK E3; +PTT E3.
- 21/8/88 TVE E3; +PTT E3, 4.
- 22/8/88 RAI IA, B; CST R1, 2; TVP R2.
- 23/8/88 YLE E3, 4; SVT E2, 3; NRK E3; TSS R1, 2; RAI IA; TVE E3; TVE-2 E2; ORF E2a, E4.
- 24/8/88 TSS R1, 2; TVE E2, 3; MTV R1; CST R1.
- 25/8/88 TVE E3.
- 26/8/88 TVE E3; YLE E3; DR E3; NRK E2, 3, 4.
- 28/8/88 TVE E2, 3; RAI IA; C+ L3; JRT E4.
- 29/9/88 TVE E2, 3, 4; RAI IA; RTP E2, 3; C+ L2; ARD E4; CST R1; NRK E2, 3.
- 30/8/88 RAI IA, B; CST R2.

- 31/8/88 TSS R2; NRK E2, 3.
- 4/9/88 RAI IA; JRT E3, 4.

The perseids meteor shower on August 11/12th provided a lift in the general MS conditions, giving signal pings of reasonable length in Band I. So far there have been no reports of Band III pings.

There were two spells of enhanced tropospheric reception, from the 5th to the 8th and from the 14th to the 18th. The first spell produced the usual Band III/u.h.f. signals from the nearer W. German, Dutch, Belgian and French stations throughout most of the central/south/east of the UK, extending as far as the Scottish east coast, while Band III/u.h.f. TVE signals were present in the west country – Roger Fussell received several Spanish stations including EBT ch. E35 and TV Degalicia ch. E42.

During the second spell W. Germany was again prevalent in the south/east with TVE in the west. All six French TV services were well received as far as the west Midlands. Similar conditions continued through to the 17th, which was perhaps the best day with signals from as far as E. Germany (ch. E12). On the next day Spanish signals were still present in Cornwall.

This enhanced tropospheric reception has brought several reports of a change in the NOS (Holland) test signal transmissions: prior to 0900 the FUBK pattern has been replaced by colour bars plus a black horizontal bar and the lettering “PTT-NL-AVVC”. BRT (Belgium) has been experimenting in recent times with modified FUBK patterns – without identification, with no circle and on one day with a hole in the middle!

Ryn Muntjewerff in Holland reports that during the tropospheric opening on August 6-8th he received “splendid signals” from CST, TVP and DFF in all bands. Low-power “exotics” received by him included several Danish TV2 relays, RTL and SAT-1, many GDR Band III/u.h.f. outlets and the Swedish ch. E23 SVT-2 transmitter at Nassjo. Hig log is dramatic and detailed – perhaps the most interesting signals were Berlin SAT-1 ch. E25 and Berlin AFN ch. E29.

My thanks to the following for their reception reports and comments this month: Iain Menzies (Aberdeen), David Oliver (Birmingham), Roger Fussell (Torpoint), Peter Schubert (Rainham), Tim Anderson (St. Leonards), Bill Cotterill (Tipton) and Ryn Muntjewerff (Beemster, Holland).

During mid-August I was on holiday at Ventnor, Isle of Wight, and used a Triax UFO and a Les Wallen vertical 55MHz helical aerial. Remarkable results were obtained – see comments later.

Does anyone have pin connection details for the 240-039-ET001 1E tuner which is being sold by Sendz – they don’t themselves have this information? The request for this information comes from Bill Cotterill who comments that the Sendz 46-904 and 47-920 tuners are excellent for DXing – they have similar performance and pin connections to the famed ET021 tuner. A further request for help: Tim Anderson has sent the accompanying photograph of unidentified Arabic reception – can anyone identify the source?

I intend to review the HS publications D100 de-luxe DX-TV converter shortly. A sample unit has been received and initial tests show that it works well.

In a recent talk at the Hastings Amateur Radio Club Pat Gowan suggested that the next peak in F2 propagation, corresponding to the peak of the current sunspot cycle, could be a record and could occur as early as late 1989/early 1990. He suggested that during the coming winter TV-

DXers should keep a close look out for enhanced F2 propagation during daytime hours. Look to the east from around 0815 GMT, to the south at midday and to the west from 1500. Bear in mind that F2 openings can produce high m.u.f.s, with African signals on a north/south path from around 1700 GMT.

The BBC has published a leaflet entitled "Make an F.M. Radio Aerial". It describes a four-element, carefully matched wideband aerial covering 88-108MHz with a minimum gain of 4.7dBd and a minimum front/back ratio of 13dB at the -3dB points of the $\pm 36^\circ$ beamwidth. It's highly recommended and is available from BBC Engineering Information, Broadcasting House, London W1A 1AA - send a large stamped s.a.e. and ask for Information Sheet 1104(5)8803.

TV-DX Clubs

I often receive queries as to whether there are any TV-DX clubs. There are none in the true sense in the UK, but two publications cover the subject informally, promoting social contact between members whilst publishing news and views. For details of *Screen Europe* write to Dave Shirley, 93 Alfred Road, Hastings, East Sussex TN35 5HZ. For details of *TeleRadio News* write to HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR. When writing to either for subscription details and a sample bulletin, be sure to include two first class postage stamps.

News Round-up

Sixty amateur radio transmitting licences for operation in the 50-50.5MHz band have been allocated in Finland. Only non-mobile operation is allowed, with powers of 200W p.e.p. for s.s.b. and 50W for c.w. Operation is not allowed in western Finland during TV hours - Swedish TV on ch. E2 is received there. The Belgian authorities have indicated that 50MHz operation will not be allowed during the life of the ch. E2 Antwerp transmitter - it's expected to last for at least seven years.

Eutelsat has been shifting its satellites around. The recently launched I-F5 satellite was to have taken over I-F1's services at 13°E. Due to problems the plan was revised. Instead I-F4 has taken over from I-F1. This involved moving I-F5 to 10°E where it took over from I-F4, then moving I-F4 to 13°E to take over from I-F1 which is to be moved to 16°E. The way in which these moves were arranged ensured continuity of services. So the final positions will be I-F5 at 10°E, I-F4 at 13°E and I-F1 at 16°E. I-F1 will be able to operate up to ten transponders at its



Mystery ch. E4 Arabic signal received by Tim Anderson (St. Leonards, East Sussex) on June 19th at 1850-1930 BST. Can anyone identify the source?

AERIAL TECHNIQUES

FERNSEH-ANTENNA

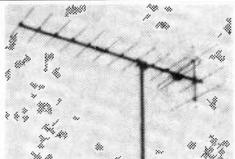
High Gain Wideband VHF

Band 3 Aerial for

TV-DXing

The Autumn Tropospheric period should now have arrived. Aerial Techniques are again offering this superb High Gain Wideband VHF Band 3 Antenna at a very special price to all enthusiasts. The Fernseh-Antenna model S1814 is a 14 element array covering all VHF channels in Band 3, it has a peak forward gain of 11.5dB and a high front to back ratio of 25dB. For high resistance against extremes of weather, the aerial is gold lacquered for complete protection from corrosion, it also comes complete with a plated mast clamp which has a 2" maximum grasp capability. The array is light and weighs under 2kg, frequency coverage is a complete 175-230MHz, a folded dipole is employed for peak efficiency.

We are also offering the very popular Antiference UP 1300 amplifier at a special price. If purchased with the above Band 3 aerial, the price is only £16.30. This amplifier covers 40-230MHz, which means it covers all Band 3 frequencies, the gain is 19dB with a low noise figure of 2.5dB. This unit requires 12v DC @ 6mA from its power supply via the coaxial downlead.



FERNSEH-ANTENNA S1814 High Gain 14 element Wideband 3 Aerial	£29.50
(Carriage & Insurance on aerial £5.50)	
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AR300XL Automatic 'offset' Antenna Rotator & Control Console	£39.95
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new position - these have already been booked by UK, French and Spanish users.

As mentioned in Teletopics last month Intelsat VA F11 at 27.5°W (or 332.5°E as British Telecom International prefer to call it!) has now been correctly aligned. Signal levels have increased quite dramatically, though our Spanish contacts report a corresponding drop in signal quality there. The Intelsat bird at 21.5°W is now downlinking material for four Italian cable TV operators at various times of the day.

The Triax UFO Active Aerial

A report on this aerial appeared in the July column (page 656). During August I tried it out while on holiday in the south of the Isle of Wight - an ideal site at some 150ft a.s.l.

IRISH T.V. DEALERS

VIDEOS UHF-VHF Ferguson, Sharp, ITT, Panasonic, Nord, etc fully serviced. Top Loaders, from £150 each. Front Loaders from £175 each.

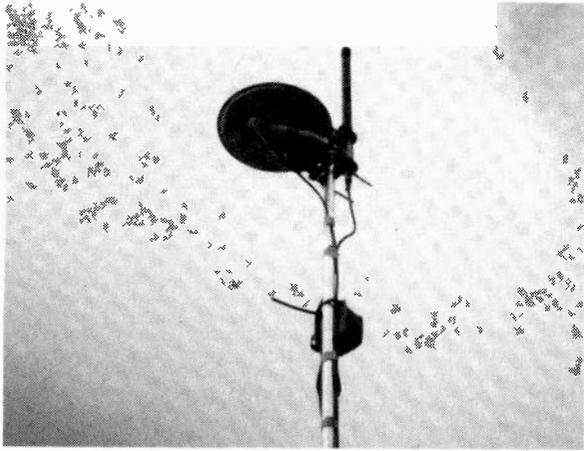
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The Triax UFO and Les Wallen 55MHz helical aerials on test at Ventnor, with a Fringe Electronics v.h.f. amplifier.

with a sea path from east through to west! The upstairs flat we rented had a balcony, and with a couple of 6ft aerial masts the UFO and also the 55MHz Les Wallen helical aerial were soon installed. The latter had a masthead amplifier covering 40-230MHz with a gain of 20dB. Both aerials were supplied from an indoor PSU via a two-way aerial switch. The holiday coincided with a period of tropospheric enhancement followed by a typical UK summer period of gales and rain. This enabled a true evaluation to be made.

U.H.F. reception with the UFO aerial was efficient. During the enhanced tropospheric spell most of the u.h.f. channels were full of French signals, including the fifth and sixth networks. High cliffs to the north of the site effectively blocked all UK signals other than those from the Ventnor relay. This is a low-power station with group B outputs – the aerial in use for reception was an XG21, which indicates the signal strength! With the return of the English summer – gales and rain – many of the French signals disappeared, but even with heavy rain and force eight winds Caen (group A) and Cherbourg (group CD) continued to provide reception, the Cherbourg signals being somewhat stronger. The poor weather and relatively long cross-Channel path speak well of the UFO's u.h.f. performance.

During the good tropospheric period French Band III L channels provided signals and a bonus was West Germany ch. E7! When the weather deteriorated, so did the signals, leaving just weak signals from Lille ch. L5 and very fluttery signals from Caen ch. L9. Since the aerial is physically much smaller than the signal frequency this was to be expected. It was interesting to switch to the helical aerial during this period and find that the signals from these two transmitters were much the same.

French signals also predominated in Band II (f.m. radio): The UFO aerial provided acceptable reception with these relatively narrow-band signals, in conjunction with a portable radio with an external aerial socket.

In Band I the UFO aerial was ineffective except with very strong SpE signals. During the enhanced tropospheric spell the helical aerial produced, quite remarkably, TVE (Spain) ch. E3 and ARD (West Germany) ch. E4 with, on one specific morning, sustained, non-fading signals at good levels. The helical aerial is vertically mounted and both these transmitters use horizontal polarisation. The UFO aerial failed to resolve these two signals. Later in the week a small SpE opening gave SVT (Sweden) ch. E4: the helical aerial resolved this signal strongly, while it was "visible" with the UFO.

To summarise, good conditions for carrying out practical tests on these two aerials. The UFO works well at u.h.f., gives acceptable Band II/III reception, but in Band I resolves only strong signals. Being omnidirectional, the UFO responds equally well to co-channel signals: for example, the ch. E21 A2-network signals from Lille and Brest were both solid and locked – with line displacement on the screen. For anyone who wishes to experiment with DX-TV reception but cannot erect a large aerial system the combination of the UFO plus a Les Wallen 55MHz helical aerial for Band I represents a good compromise, giving all-band reception.

The wideband amplifier used with the Les Wallen aerial was fitted within fifteen inches of the aerial's output socket. RS silicone grease was used on both aerial terminations (SO329/PL259s) to ensure freedom from corrosion – during the short period that the aerials were in use at the location wind-born salt air produced white discolouration of previously shiny parts!

From our Correspondents . . .

While on holiday in Sweden recently Mark Baldwin saw many of the transmitters that can be received in the UK when SpE conditions are appropriate. He comments that TV1 and TV2 programme transmissions often don't start before 1900 locally. The PM5534 is the local test pattern but is often not transmitted until after 1800 – so viewers with teletext sets have a rather meagre service in some areas. Mark feels that the programme standards are poor – on one day he noted a Yugoslavian made programme about the Welsh language, with Swedish subtitles!

George North has taken up residence in Brussels and has sent details, via Gareth Foster, of the TV services available there. His local cable system offers seventeen channels as follows: NOS-1 (Dutch) E2; A2 (French) E3; RTL-TV1 (Luxembourg) E4; NOS-2 M3; FR2 (French) M5; RAI-1 (Italy) M10; BRT-TV1 (Belgium) E5; TF1 (French) E6; RTBF-1 (Belgium) E7; ARD (West Germany) E9; BRT-TV2 E11; RTBF-TELE 21 (Belgium) E12; ZDF (W. German) U2; BBC-1 U3; WDR (W. German) U4; BBC-2 U6; TV5 (French satellite service) U7. In addition, the "matrix channel" has the screen subdivided into 16 sections each displaying one of the above programmes to aid selection.

405 Corner

M. Duffy of 7 Cranbourne Drive, Chorley, Lancs PR6 0LJ (072 25 73081) has for disposal free of charge a very early Ferranti Model 14T5. This 12in. 405-line set is complete but very dusty and comes with a few dozen old TV valves. It must be collected – phone or write (with s.a.e.) first.

Receiver Conversions

A new service is being offered by Aerial Techniques. If you are going overseas or returning to the UK with a foreign standard set the firm can carry out realignment to suit the system required, i.e. B/G, D or I. Since the prices of receivers in many overseas countries are much higher than here, it may well be worth having your set realigned and taking it with you – with an upconverter if you plan to go to an area where v.h.f. transmission is used. Sets can also be modified for dual-sound reception, adding a special panel. This gives B/G/I, B/G/D or I/D operation, which is useful for DXing.

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Teletopics

HDTV MOVES

A complete, operational high-definition television (HDTV) chain, developed under the European EU-REKA EU95 programme, was publicly demonstrated for the first time at the Brighton 1988 International Broadcasting Convention, on September 23rd. Participants in the programme include Bosch, Philips, Thomson and major broadcasting organisations. The aim of the EU95 project has been to develop a high-definition, wide-picture TV system that's compatible with existing receivers and equipment, unlike the Japanese-developed system that would require all new equipment.

The EU95 standard is compatible with 625-line, 50Hz transmissions but gives 1,250 lines after decoding. For transmission, the MAC European satellite TV system is used. This still leaves the problem of how to get the extra information into the available channel bandwidth. In the EU95 system this is done by analysing the picture to look for stationary and moving parts of the scene. These are then sent at different rates. The algorithm for signal compression was developed over a year ago. Since then the hardware required has been under development. During this time a new algorithm that gives a further improvement has been developed; according to Rodney Young of Thorn EMI this "will be very close to the final system". It's claimed that the EU95 system as demonstrated already gives a twenty per cent better resolution than the Japanese system.

The Japanese HDTV system, which has 1,125 lines and a field rate of 60Hz, was officially announced in 1986. It uses the MUSE (multiple subnyquist sample encoding) system for bandwidth compression. Live satellite transmissions using the system were provided for the first time by the Japanese broadcasting organisation NHK at the Seoul Olympic Games. There has been a long campaign to get the NHK-sponsored system, which took twenty years to develop, accepted as a World standard. In the latest move the Japanese have offered to make the technology available at cost to any company worldwide wishing to make receivers.

The Federal Communications Commission (FCC) recently laid down the requirements for an HDTV system for use in the USA. It would have to be compatible with existing standards and channels, must be suitable for cable or broadcast transmission, and must provide picture quality comparable with other HDTV standards. The first requirement would rule out the Japanese system. The US electronics industry is endeavouring to use the introduction of HDTV as an opportunity to re-enter the domestic TV market which, as in the UK, is dominated by foreign owned companies. To this end an Advanced TV task force has been set up by the American Electronics Association (AEA), which has proposed the formation of a government/industry research and development consortium to tackle the problem. The idea has been presented by the industry in testimony to the US Congress. In addition the AEA has called for a study by the National Research Council to investigate the current state of the US consumer electronics industry. At stake is a vast market for chips as well as studio, transmitting and receiving equipment. It has been suggested that by the mid-1990s the market for next-generation TV equipment

could be \$20 billion in the USA and \$40 billion worldwide. HDTV receivers require considerable memory and processing capability.

All this activity is taking place in the lead-up to the next plenary session of the International Radio Consultative Committee in 1990, when a decision on a recommended worldwide HDTV standard is due.

Back at Brighton, the IBA gave a demonstration to show the quality of wide-screen pictures that can be achieved using existing 625-line equipment modified to give wider pictures and then processing these to obtain an extended definition TV (ETV) display that makes fuller use of the potential of the 625-line system. ETV is seen as a logical development, compatible with the D-MAC system, leading towards HDTV.

FLAT-SCREEN TV

The Japanese Ministry of International Trade and Industry is to set up a joint venture with twelve Japanese firms to develop large colour LCD screens for TV use. The aim is to put into trial production a "wall TV set" with a 40in. diagonal screen only 10cm thick by the spring of 1995. MITI plans to invest over £30 million in the venture, with a further contribution of £15 million coming from the firms involved.

At the 1988 meeting of the British Association for the Advancement of Science Dr John White, head of optical devices at the Thorn EMI research laboratories, described the joint work being done by several companies, in conjunction with Hull University (where the early work on liquid crystals was done), on the development of ferroelectric LCDs. Such devices do not require continuous power, would be ten times cheaper to make than active-matrix displays and could be built in very large sizes. According to Dr White the new system could be a practical reality within a decade, opening up opportunities for a wide range of new devices which it is hoped will be developed by British industry.

Panasonic has just introduced in the UK an LCD CTV with a 3in. active-matrix screen and multi-standard operation (systems B/G/I). Model TCL3G has up/down tuning buttons – the tuner seeks the strongest signals available, a cursor showing the channel number – and a suggested retail price of £330. Power is from six HP7 cells, from the mains via an adaptor which is provided, or from an optional NiCad pack. An AV lead so that the set can be used as a monitor with a camera or camcorder is a further optional extra.

EXTRA BBC TELETEXT LINES

The BBC has recently been carrying out engineering trials using ten and eleven lines for teletext services (Ceefax and the Datacast service provided by BBC Enterprises). At present the services use seven lines per field. The aim is to be able to broadcast teletext pages at a faster rate.

SATELLITE TV

Announcements of satellite TV receiving equipment are beginning to come through thick and fast. As briefly mentioned in Long-distance Television last month, Micro-X Ltd (16 Beresford Avenue, Wembley, Middx HAQ 1QR) is to introduce a basic model for Astra reception at a retail price of £190. There will also be a tracking model for reception from the medium- and high-power satellites (including Astra, BSB and the Eutelsat II series) at £280

plus an expected £100 for a decoder for the BSB subscription channels. These systems will be based on existing electronics and a new 65cm dish produced by a sister company in the Parkfield Group, Polarcold of Congleton, Cheshire. The single-satellite dish is due to be on sale by the end of the year while the polar-mount version for multi-satellite reception is due out early next year. The company expects to produce around 300,000 dishes during 1989.

Alba has announced its intention to launch TV sets with built-in satellite receiver circuitry for under £700 by the middle of next year. Announcements of receiving equipment for Astra etc. have also been made by Ferguson and Grundig.

Problems with the French TDF-1 satellite seem to be affecting the launch of the Astra satellite. There is at present some uncertainty about the exact date but the launch should take place in late November/early December. The French have signed up operators for only one of TDF-1's five channels and are hoping that one or two channels will be taken up by the W. German broadcasting authorities.

The satellite broadcasters are going to have their work cut out to interest the UK public if a poll carried out by MORI for the *Reader's Digest* is anything to go by. It found that seven out of ten people would not be prepared to pay anything extra to receive the new satellite channels and that those who were prepared to pay considered, on average, that a fee of about £17 a year would be acceptable.

Sky Television has chosen the Centaurs Business Park at Osterley in West London as the location for its new TV centre. The three and a half acre site with three buildings covering 77,500 sq. ft. has been leased from Eagle Star Properties and London and Metropolitan plc. The finished centre, with four studios and transmission suites, will represent an investment of over £15 million and will be ready for use next February.

SERT/IEEIE MERGER TALKS

The Joint Amalgamation Committee of the Society of Electronic and Radio Technicians (SERT) and the Institution of Electrical and Electronics Incorporated Engineers (IEEIE) has produced a report which will now be put to members. The proposal is to form a new, non-chartered Institution which, with some 27,000 members, would be in a better position to cater for the needs of the combined memberships and the industries they serve. The new organisation would have the title the Institution of Electronics and Electrical Incorporated Engineers.

CABLE TV

The Cable Authority has advertised a further six franchises covering almost 750,000 homes. According to the Authority a quarter of the country is now either franchised or in the process of doing this. Only some 265,000 homes are at present linked to cable services however, and of these only 48,000 are connected to the ten modern broadband services now in operation.

Videotron, Canada's second largest cable operator, has taken a 45 per cent interest in Southampton Cable. In addition to around forty channels a range of two-way services are proposed. Videotron's computerised technology would enable viewers to choose which camera to view through with locally generated programmes. Other services would include estate agency, video games, classified

advertising, home security, etc.

Cabletime, the UK manufacturer of switched-star systems for cable TV networks, has introduced an option allowing u.h.f. broadband delivery of signals. Channels could thus be provided without the need for extra equipment in the home, reducing the cost per subscriber for basic services.

INDUSTRIAL NEWS

Philips has announced the closure of its TV assembly plant at Croydon. The plant has a production capacity of around 500,000 sets a year but the output has been only some 350,000 sets a year recently. About 500 jobs will be lost at the plant, which has been in operation for 32 years. Over £9 million has been invested in the plant during the past five years.

The management of Sony (UK) is proposing to head office in Japan a further extension to its Bridgend, South Wales TV tube and receiver manufacturing operations – just a month after completion of a £30 million expansion plan. One aim would be increased production of 14in. colour receivers.

Aiwa has moved its UK operations to Unit 5, Heathrow Summit Centre, Skyport Drive, West Drayton, Middx (01-897 7000) where sales, administration, spares and service will all be under one roof.

Sets sold by SL Consumer Electronics (UK) will in future be marketed under the brand name ITT Nokia. The aim is to establish the parent company's name in the market and keep the well-known ITT name going.

Cathay Electronics has acquired from J.J. Silber, a subsidiary of Great Universal Stores, the right to use the Murphy brand name. A range of colour TV receivers and VCRs will be launched at the March trade shows. The Murphy name had previously been licenced to Fidelity, and will continue to be used by J.J. Silber for audio and telecom products sold through GUS home-shopping catalogues.

VIDEO NEWS

The European Commission has imposed duties on imports of cheap VCRs from the three Korean manufacturers Samsung, GoldStar and Daewoo, and the two Japanese manufacturers Orion and Funai which mainly supply own-branded machines. It's not certain exactly when the duties will have an effect on shop prices since large stocks have been delivered in anticipation of the move while both Samsung and Orion have assembly plants in the UK and GoldStar has a factory in West Germany. In addition Amstrad, which used to buy from Funai, now has a UK assembly plant. The duties are nonetheless steep, varying from 18 per cent for the Japanese manufacturers to 29.2 per cent in the case of Daewoo.

The authorities in four Chinese cities are negotiating with overseas VCR manufacturers with a view to setting up production lines in China. Hitachi has already completed technology transfer agreements with two cities while Matsushita and Philips are conducting negotiations with two other cities.

NEC has introduced in the UK a VCR with picture-in-picture capability at only £380. Model PX1200K omits some possible features such as strobe, digital noise reduction, long-play operation and automatic programme access but is nevertheless keenly priced for the package on offer.

Lamba Electronics (Albion Road, St. Albans AL1

5EB) has introduced in the UK the Videonics DirectED video editor and effects generator. This interesting processor operates via remote control, enabling the viewer to carry out editing from the armchair, and has a suggested price of £499. It can be used with VHS, Beta, 8mm and 3/4in. equipment.

The Tamron CX7 Movie 8 camcorder is being imported by Johnsons of Hendon Ltd. (Hempstalls Lane, Newcastle, Staffs ST5 0SW). It can be converted to record-only operation by removing the playback unit, thus reducing the weight. The suggested price is £999. Tamron is a major manufacturer of video camera lenses.

Servicing the Amstrad CTV2200/CTV2210

Dave Mackrill

I read with interest recent comments in *Television* on these sets. They first started to appear in my workshop a couple of years ago, when the local shops that originally sold them some two years before no longer wanted to know about them. Since then most of the faulty ones in this area seem to end up here. We've handled quite a lot of them, sometimes two or three a week. They do present problems: to provide lasting repairs, time and patience are required. If you are lucky the set won't have been got at by the customer or his neighbour who understands TVs because he works for the GPO, is in the RAF or is a radio amateur . . .

Before you even remove the back the first essential is to warn the customer, who has probably said "it's only a fuse", that the repair will be expensive. I usually quote a price that's on the high side. When this is accepted, as it usually is since the customer has tried everywhere else, work can begin.

Dealing with a Dead Set

Place the set on its side, protecting the cabinet by putting a couple of sheets of newspaper beneath it. Remove two of the screws that hold the chassis. Then, carefully supporting the chassis, loosen the other two screws, slide the chassis back and re-fix it. Any carelessness here could result in a broken c.r.t. neck. Remove the 2SC3156 chopper transistor Q501, the 2SD1398 line output transistor Q802 complete with its heatsink, the 100 μ F h.t. smoothing capacitor C520, C316 (22 μ F) which smooths the supply to the audio output stage and C853 (1 μ F) which decouples the supply to the line driver transistor - C853 is hidden under the feed resistor R813. Replace the chopper transistor: we use a BU500D, which is readily available from Sendz. When doing this fit a new mica washer with heatsink compound. Test the line output transistor Q802 - don't forget that there's a parallel diode, and a resistor across the emitter-base junction, within the encapsulation. If in doubt, compare readings with a new one - available from CPC. If it's no good, replace it - check its mica washer carefully, and remove the burr from its heatsink with a drill bit. Don't forget to apply heatsink compound. Replace the three electrolytics with ones rated at 250V minimum - 100 μ F, 250V electrolytics are available from SEME.

Now turn the set over on its top, protecting the cabinet with more newspaper. Using a small iron and 22 gauge solder, carry out blanket resoldering of every component in the power supply (prefix 5), also the line output and driver transformers and all the other transformers and chokes, the power transistors, large diodes (including all those fed from the line output transformer), connector and plug pins including the scan connector P9, plus any other large or power-consuming items, earthing points, wirewound resistors, the tuner, delay lines and anything else that takes your fancy. Pay particular attention to

components in the line scan current path. It may pay to remove and clean up R862 before resoldering as it's always dry-jointed. Any other visibly fatigued connections should be attended to.

It's a good idea to clean the c.r.t. cavity, e.h.t. cap and lead with methylated spirit and to squirt all preset potentiometers with some Philips contact cleaner - we find that this is the only one that works and keeps on working.

Having turned the set the right way up we usually power it via a variac while monitoring the h.t. rail with a digital meter. A convenient point to do this is at the nearest end of R813, using the tuner as the earth connection. Set the h.t. to 153V with VR501, with the volume at minimum and the brightness and contrast at maximum.

Other Problems

If you have field collapse, check the service switch SW801 first - customers waggle it around to try to repair their sets. Then check the voltages at pins 6 and 9 of the TDA3652 field output chip IC801. The 7.5V supply at pin 9 is provided by D805/C842, with the diode fed via R818 from a winding on the line output transformer. If necessary replace the TDA3652 chip. I wouldn't advise adjustment of any of the field circuit controls unless absolutely necessary.

If you have low, distorted sound check R313 (100 Ω , 0.5W). This resistor is in series with the audio output transistors and tends to go open-circuit - but this doesn't result in silence as you would expect.

I've been told that other electrolytics associated with the line output transformer derived supplies, e.g. C845 (4.7 μ F, 250V) which is the reservoir capacitor for the h.t. supply to the RGB output transistors, can give trouble but we've had no problems with any of them to date.

You should by now have a reliable, working TV set. With their 30AX tubes these sets can give good picture quality, subject to correct grey-scale, focus and first anode adjustment. We turn the brightness and contrast down and adjust the first anode (G2) control for a just visible picture with flyback lines, then back it off to either lose the lines or blank the screen. Take the "alignment instructions" given in the manual with a pinch of salt - especially those relating to grey-scale adjustment.

We've had only one of these sets bounce back on us. After close examination, called for because of the component density, we found that there was liquid spillage between the chopper transistor Q501 and the h.t. smoothing capacitor C520. The excess current protection transistor Q503 had arced across to the tuner and blown in half and the associated resistors R526/7 had gone open-circuit. Q501, IC501, R814 and C845 also had to be replaced.

My mate Steve called around the other day and said "Cor that's a big reel of solder (3 kilos), why do you need that much?" Then, after a moment's thought, he added "I suppose it's all those Amstrads you keep mending!"

Servicing the Panasonic NV333 and NV366

Part 1

Nick Beer

These machines were sold in massive numbers during the years 1982-3. The NV333 is the basic and thus cheaper machine. It has a single-event, 14-day timer, wired remote control and a conventional two-head video deck with correspondingly non-perfect still frame. Both machines are top loaders and were sold in a silver/grey cabinet. The NV366 has an expanded four-event timer and perfect still frame, achieved through the use of four heads. Along with the super still it was given a still advance function, via on-board as well as remote control.

As always with Panasonic VCRs the sound and vision are very good. They continue to give excellent results and sterling service in their thousands, not least as rental machines. The two models are virtually identical in appearance, though when you know them you can tell them apart instantly by the deck control buttons – on the NV333 they are the same colour as the surrounding cabinet whereas on the NV366 they are bright silver. The mechanisms differ only in the video head drum and flywheel used. The electronics are along the same lines, and are layered out in much the same way in both machines.

Access

To gain access to the innards you remove the two screws that hold the lid on the cassette carrier, then the three screws at the back, holding on the top. This will give access to the upper half. The screening can (two screws) will have to be removed to clean the heads etc. To replace the reel idler the cassette carrier has to be removed. This is done by undoing the four red screws – do not undo the two gold screws between them.

For most service work however the bottom has to be removed. This is done by taking out the six gold screws and releasing the metal sheet. Next unclip the front, from below, to expose the front panel. This has to be unclipped to allow the bottom PCB to be unhinged. To do this, unclip the four locking tabs across the top of the board then gently hinge the board forwards. It should be lifted up slightly to clear the tracking knob. Next remove the six screws (red) from the bottom board and undo the four locking tabs, two on the left-hand side, one on the right and one beside the tracking control. The whole board can now be hinged, with the front panel attached backwards. You now have access to the bottom of the mechanism.

Mechanical Operation

The following brief outline of the mechanical operation should give you enough information to be able to service these machines effectively.

In true Panasonic tradition, there are plenty of rubber bits! These can all cause faults. Replace the lot at the least sign of wear.

The head drum is a direct-drive unit. Model NV333's two-head drum is type VEH0103 while the four-head drum used in the NV366 is type VEH0174. The capstan motor (MAX13V9LP) drives the capstan via flat belt VDV0131 – the capstan bearing is bolted to the aluminium chassis. The loading motor (VEM0135) is mounted next to the capstan

motor, the drive being transferred to an intermediate pulley by the small loading belt VDV0122, from where it's used to drive the loading gears to provide lacing and main cam drive. This drive is provided by the large loading belt VDV0135. From the large loading pulley the kick belt VDV0138 provides drive for the kick pulley.

Reel drive is from the reel motor (MYN13V5L) via the idler arm unit (VXL0997) and the reel idler (VXP0401) to the two reel turntables. Note that the part number for the reel idler in the service manual is incorrect on the photograph but correct in the parts list.

The state of the mechanism is detected by the mode switch (VSS0060) which is controlled by the main cam via the main lever. This switch is of similar pattern to that used in the earlier NV7000 series machines and is mounted on the underside of the mechanism.

Up on top again, the take-up reel is driven by the knurled base of the capstan/flywheel via the take-up idler (VXP0433). This part can be replaced with or without the arm. A wheel of similar diameter to the reel idler is introduced between the take-up reel and this knurled capstan base during playback and record. The pinch roller is of the conventional centre-pivot design (part no. VXP0432). It's of smaller diameter than the earlier types. When you order, Panasonic supply the arm as well as the roller. The only belts on the top side of the mechanism are used to drive the counter from the take-up reel. The counter has a Hall-effect rotation sensor on it: the syscon will stop the machine should this rotation sensor fail to provide pulses. The part numbers for the belts are VDV0139 and VDV0137.

The back tension should be between 25-30g.

The rewind speed is approximately one and a half minutes per hour of tape. The take-up torque should be between 130-180g-cm while the rewind and fast forward torque should measure at least 400g-cm.

Each head in the NV333 has a gap of 70 μ . The NV366's left and right heads have the same gap while the image heads have a 49 μ gap.

Mechanical Servicing

The mechanism, especially the belts, idlers, heads, etc., should be checked whenever one of these machines comes in for attention. This should be standard practice for reputable engineers. If you don't observe it, you'll come unstuck one day. Say for example that you repair a capstan fault for £50 but don't check the deck in the review mode. Next week the customer could come back with a couple of tapes that have been chewed in review and claim a free-of-charge recall. The fault will be either the direct-drive unit or at very least the heads! A difficult situation.

If the fault reported is due to a worn belt or idler it's a fair bet that the rest of the rubber bits need changing as well. With this in mind Panasonic have produced a 1,000 hour service kit for these models and a number of others. A note on these kits appeared last month (page 918).

Say then that the machine has been dismantled to give access to both sides of the mechanism. I'll describe replacement of the various mechanical parts that may need to be changed in normal servicing.

The video heads are removed by undoing the single screw that holds the discharge angle and removing it, followed by removal of the two silver screws that hold the drum itself and the lead clamp. Unsolder the four/eight leads from the drum at the head PCB and lift the head away. If the head is tight on its shaft, application of heat from a hairdryer at the shaft centre should help. The head connection lead colours are marked on the PCB, so unless you want to be doubly sure there's no need to make a list. Don't forget to check the back tension after changing the heads – you don't want to have to do it all again in twelve months' time, do you?!

Still on the top part of the deck, reel idler failure is one of the more common faults and replacement is simplicity itself. It's a lot easier if you've removed the cassette carriage, but the method remains the same. Just undo the retaining circlip – take care that it doesn't fly off never to be seen again – and the idler will lift off the intermediate gear. To replace the latter, unbolt the plastic spike (one bolt) above it and loosen the hex grub screw that holds it to the spindle of the reel motor – take care, you don't get a new grub screw! The gear can then be lifted off. One thing I've seen engineers do after replacing the gear and idler is to test the machine before complete reassembly, without refitting the plastic spike. The tape won't move of course because the spike releases the cassette's internal brakes.

The rear right-hand corner is an area where replacements are often needed. To replace the play idler you have to remove the pinch roller arm, the take-up sensor bracket and the capstan/loading motor block. An invaluable tool here is a pair of internal circlip pliers. The Panasonic pair, part no. VFK0144 (3mm), is o.k. but I prefer the RS pair. It's as well to replace the play idler and pinch roller while you are at it.

When replacing the play idler, whether a new wheel on the old arm or a complete new assembly, ensure that the pin on the bottom of the arm fits to the right of the kick lever on the underside of the deck – I do this by holding the kick lever with a screwdriver whilst inserting the idler arm. This can be done from above through the slot in the mechanism occupied by the pinch roller adjust screw.

When replacing the pinch roller I find it easiest to fit the spring to its mount then fit the arm over its pivot. It's secured by one of the internal circlips. If you are not removing anything else in this area the pinch roller can be replaced without its arm by removing the white plastic cap.

The easiest way of replacing the capstan motor is to remove the block mentioned above (three screws) then undo the three bolts that hold it to the block with the loading motor. The capstan and loading belts should be removed from their pulleys below before the motor block is lifted upwards. The capstan motor connections are shown in Fig. 1.

To replace the brake band, remove the back-tension arm (one internal circlip), disengage its spring then lift this off carefully. The single screw that holds the plastic base of the brake band can then be released, together with the circlip that holds the other end of the band to the tension arm's

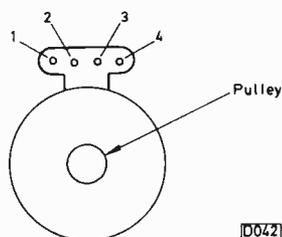


Fig. 1: Colour coding of the connections to the capstan motor. (1) Light blue. (2) Yellow. (3) Dark blue. (4) Red.

underside. When the replacement is fitted, align the back tension carefully.

Now to the underside of the mechanism, which is where the important belts reside. Remove the kick belt first, followed by the large loading belt then the small loading belt. Replace them in the reverse order. To remove the large loading belt the direct-drive unit's plug should be disconnected: the new belt should be threaded over it.

To replace the capstan belt, the flywheel bracket and the plastic belt holder have to be removed. The easiest way to go about this is to undo the single bolt that retains the holder and one end of the metal bracket, then remove the plastic holder and loosen the bolt that holds the other end of the metal bracket so that the belt can be guided up over it. Cleaning the capstan motor pulley before fitting a new belt is a sensible precaution – it tends to get very dirty, with the result that the belt sticks.

The loading motor is mounted on the same block. Replace it in the same way.

The mode switch comes mounted on its small PCB. Before replacement a note should be made of the lead connections. I've not listed these as I've seen different colours used.

Mechanical Fault Summary

We've had the following mechanical faults with these machines.

- (1) Knocking noise on fast wind – noise affected by pressure on the cassette. Lubricate the spool shafts with suitable oil (RZZOL0#56).
- (2) Squeaking capstan – put into the pause mode to confirm. This fault can be caused either by worn bearings in the capstan motor itself (MAX13V9LP), which will have to be replaced to provide a complete cure, or by a dry flywheel bearing which can usually be successfully lubricated with the previously mentioned type of oil from the top of the deck – ensure that any excess oil is thoroughly wiped up.
- (3) When review is selected the machine ejects the cassette. Suspect a faulty or misaligned mode switch.
- (4) Cassette inside machine which will not eject or carry out any deck function. Suspect the mode switch.
- (5) Tape will not unlace or will not complete lacing. Replace the large loading belt and check the others.
- (6) Tape loops into the machine in the review mode. This is caused by excessive friction at the drum. It's sometimes due to the grooves on the drum having worn, but is more commonly due to a worn lower drum. If the latter is the case treatment with Brasso is sometimes effective, but more commonly replacement is required thus writing off the machine as replacements are around £250 trade. This fault is normally experienced only with the NV333.
- (7) Tape is not reeled back into the cassette during unloading. Replace the reel idler (VXP0401) and check the state of the intermediate gear (VDG0017).
- (8) Distorted sound with corrugated verticals. Thoroughly clean the erase head – replace if necessary. Can also be caused by a worn audio/control head (VBR0050).
- (9) Excessive noise in the load and unload modes. Replace reel idler arm VXL0997.
- (10) Sluggish rewind. If the reel idler is o.k. check the supply reel – it's probably tight on its shaft (lubricate as necessary).
- (11) Won't eject and no other functions work. Check eject switch SW6501.
- (12) No functions except eject. Suspect dirty contacts on

the cassette-in switch.

(13) Squeaks when loading or unloading. Lubricate loading roller bearings.

(14) Intermittently cuts out on deck functions. The counter has a Hall-effect sensor. Any of the following can cause the complaint: the reel idler, idler arm, counter belt, a tight take-up reel, the Hall-effect device faulty or too far from the magnet, or a defective reel motor.

(15) Goes into fast forward as soon as the tray is closed. Faulty supply reel sensor.

(16) Tape snatching in the review mode. Can be caused by excessive play in the joints of the reel idler arm (VXL0997). If a replacement doesn't provide a cure, fit a washer on the joint - see also item (6).

(17) Whine or whistle from direct-drive unit. This is a fairly common complaint with most Panasonic VCRs. The

discharge angle at the top of the drum has worn. Repositioning it slightly may work but a replacement costs less than £1. Sometimes the DD motor bearings become noisy - replacement is expensive (see 6).

(18) Wavering playback sound. This is nearly always due to a worn capstan motor.

(19) Squeaking noise which stops in pause. Listen closely to the capstan motor - it very often goes noisy mechanically.

(20) Cassette carriage ascends too quickly. Teeth in damper unit worn. A replacement unit is required - part no. VDG0100.

(21) Capstan runs too fast. Faulty FG in capstan motor.

(22) No deck functions. Cassette down switch on eject latching assembly dirty or worn. Part no. VSH0013.

Next month we'll deal with the electrical side of these machines.

Practical Computer Programming

Part 9

Mike Phelan

First, an omission from last time. We had promised to show the three functions we described in pseudo-code written in real code. Here they are. The language is Clipper, which is a dBase III compiler with some additions of its own.

A few notes will not come amiss. Lines starting with an asterisk are remarks. A PARAMETERS statement means that one or more variables are passed to the function: RETURN means the value passed back to the calling program. For example, y_or_n returns TRUE or FALSE. An example of use would be:

```
IF y_or_n ('Do you wish to continue?')
  statements
  " "
  " "
END IF
```

which means that the message 'Do you wish to continue?' (y/n) is displayed in a box at row 19, column 36 and centred. The DO WHILE loop will be exited only when a Y or N in upper case or lower case is entered. The function returns the logical expression mv = 'Y', which is true if a y or a Y is entered.

These examples have been taken from a working program, and are used again and again in different systems (reusable code).

```
FUNCTION y_or_n
```

```
* -----
*           returns t or f after
*           displaying prompt box
* -----
```

```
PARAMETERS message
PRIVATE m_len,mv,l
m_len = len(message)+4
SAVE screen
SET cursor OFF
SET colour TO +gr/r
@ 18,34-m_len/2 TO 20,40+m_len/2
@ 19,35-m_len/2 SAY SPACE(m_len - 2)
mv = ' '
@ 19,36-m_len/2 SAY message - " ? (y/n)"
DO WHILE.NOT. mv $ "YN"
  i = inkey(0)
```

```
  mv = upper(chr(i))
END DO
SET colour to w+/n,gr+/gr,,,n/w
RESTORE screen
SET cursor ON
RETURN (mv = "Y")
```

```
FUNCTION wt
```

```
* -----
*           displays message & waits
*           for keypress
* -----
```

```
PARAMETERS message
PRIVATE m_len
m_len = len(message)+11
SAVE screen
SET cursor OFF
SET colour TO +gr/r
@ 18,38-m_len/2 TO 20,44+m_len/2
@ 19,39-m_len/2 SAY SPACE(m_len - 1)
mv = ' '
@ 19,40-m_len/2 SAY message + " - press a key "
i = inkey(0)
SET colour TO w+/n,gr+/gr,,,n/w
RESTORE screen
SET cursor ON
RETURN 1
```

```
FUNCTION pw
```

```
* -----
*           displays 'Please wait' +
*           message. Expects RESTORE
*           SCREEN after process
* -----
```

```
PARAMETERS message
PRIVATE m_len
m_len = len(message)+10
SAVE screen
SET cursor OFF
SET colour TO +gr/r
@ 18,38-m_len/2 TO 20,44+m_len/2
@ 19,39-m_len/2 SAY SPACE(m_len - 1)
@ 19,40-m_len/2 SAY "Please wait - " + message
SET cursor ON
RETURN 0
```

The final line is a 'void' function, i.e. it doesn't return anything.

Testing and Debugging

We will assume that by now you've written a few pages of code and are ready to test it. If everything works perfectly, read no further – you are not of this world!

Program errors fall into various groups, and appear in a different way if a compiler rather than an interpreter is used. In the latter case errors of any sort will appear when you run the program. With a compiler some errors will be shown when you compile, some when you run the program. If the errors are serious ones they will prevent compilation.

Types of Error

First, the types of error in greater depth, using a fairly standard BASIC interpreter as the context. A few notes on compiler error checking will be given later.

Typographical errors are the easiest to spot, especially when the error is simply a misspelt keyword. The program will display an error message and return to the keyboard mode. The mistake could be incorrect typing of a numeric value (letter O instead of zero or vice versa, or 8 for 0). The result of this will depend on where it occurs. The most common place is in a DATA list of numeric values to be READ. The data may be screen co-ordinates or anything, so the program may possibly fall over at a later point, when it tries to use the numeric code.

Take for example a variable called XO being initialised with a value of 24, for the screen row of a message to appear at the bottom. If we type X0=24, with zero instead of letter O, when we use XO it won't have been initialised and will assume a value of zero. So our message will appear at the top of the screen or the program will crash, depending on whether the top row of the screen is 1 or 0.

It can be seen then that the symptom may occur many program lines after the cause. Also, as a point of interest, BASIC is one of the few languages that allow you to use a variable that didn't previously exist – in other languages you must at least initialise (give a value to) or even declare (say what type the variable is) and initialise all variables, a much more rigid discipline. For example, in C:

```
int tom; /* declaration */
char dick;
float harry;
tom=42; /* initialisation */
dick='D';
harry=42.123;
```

The /*s are remarks.

Logic errors are usually the result of bad planning and design, or of insufficient testing of ideas. With a logic error the computer doesn't do what you intend it to do. As this is a rather sweeping statement, applicable to all bugs, we must narrow it down by giving an example.

Common logic errors consist of things like forgetting that the loop counter in a FOR/NEXT loop reaches a terminal value of one more than the limit.

```
FOR j=1 to 10
  statements
NEXT
REM j now has a value of 11
```

Another is to forget that a WHILE loop will not be executed if the condition is false on entry.

```
x = 10
WHILE x<10
  statements
  x = x+1
WEND
REM this will do NOTHING!
```

It's easy to confuse the operators <, >, >=, <= and <>, leading to all sorts of problems.

Design errors are the most serious ones – the program works perfectly but doesn't do what was intended. It all boils down to not defining the problem accurately in the first place, or misjudging the amount/size of data (an important step). One solution is to try to correct the program, which is sometimes possible, but often the best course is to start again from scratch. Don't be put off by this – many systems are better after a rewrite.

Compiler Errors

Most compilers classify errors as either WARNING or FATAL. The latter will prevent the compiler producing object code when it comes across a situation it cannot resolve. Most syntax errors are of this type. WARNING errors allow a compilation to continue, but the resulting program may not work. If the compiler encounters a call to a function it cannot find, a message such as 'Cannot open FRED, assumed external' may appear. What this means is that provided the linker process at the end of the compilation can find FRED somewhere in a compiled file all is well, otherwise the linker will fail – linking joins one or more .OBJ files to produce the final .EXE file.

The better compilers allow various levels of error checking, from letting almost anything through to being very restrictive but safe. With a system of any size, the first few attempts at compilation will produce screens full of error messages. Try to stop the compiler before the screen is full, and correct the errors. Often one error gives rise to many – e.g. with most compilers omission of a terminating semicolon in c early on will give an error on nearly every following line, while misdeclaration of a variable creates an error with every occurrence of the variable.

Running Test

Having got past the compiler – if one is being used – it's time for a running test, using a variety of data. The best person to carry out the test is not the programmer but someone who has never seen the software before – the former is always unconsciously prejudiced in favour of the program working.

Try to make notes of any errors, if possible correcting them in batches of five or so to speed up the process. Take heart from the fact that no program of any size is entirely error free – this is so even with expensive commercial jobs costing four or five figures!

In Conclusion

That's all for now on this subject. I hope the series has provided food for thought amongst readers, and that some useful systems will find themselves saving effort in businesses out there.

Colour TVs with LC Displays

Nick Beer

Several personal-type colour sets with liquid crystal displays (LCDs) are now on the market in the UK. Perhaps the best known are those available from Citizen, Ferguson and Panasonic. They have screen sizes of typically three inches (diagonal). In this article we'll look at the construction and operation of the display and the arrangements needed to drive it.

What is a Liquid Crystal?

First a bit about the nature of liquid crystals. For most substances the terms liquid and crystalline are contradictory, i.e. when a substance is liquid it has an irregular molecular structure with weak inter-molecular bonds whereas in the crystalline state a substance has a regular molecular structure and the inter-molecular bonds are strong. So how can we have a liquid crystal? The fact is that unlike most substances some organic compounds have an intermediate state between the transition from solid to liquid. In this state they exhibit the external properties associated with liquids while still having a crystalline molecular structure. Many thousands of types of liquid crystals have now been discovered. They can be grouped into three main categories depending on how their molecules are arranged. These are the cholesteric, nematic and smectic types, see Fig. 1. The cholesteric type has a layered arrangement, the molecular direction being different in each layer. In the nematic group the molecules are again arranged in parallel, but they are not layered. Smectic liquid crystals are arranged in parallel and are layered. The type used for liquid crystal TV is the nematic arrangement, in a modified form – twisted nematic.

How LCDs Work

A point that has to be made clear is that liquid crystal displays do not, as a c.r.t. does, convert an electrical signal into light energy. What they do is to control the transmission of light passing through the LCD. This feature is used to produce a display consisting of varying brightness levels. To control the brightness level at a particular point we have to be able to vary the crystal structure, something that can be done electrically.

For use in displays the nematic crystals are twisted through 90°. As a result the light passing through is also twisted through 90°. This is known as rotary polarisation. The twisted crystals are sandwiched between transparent electrodes that are some 10µ apart – see Fig. 2. The molecular arrangement, i.e. the degree of twist, can be altered in three ways: by applying a voltage across the crystals, by passing a current through them or by applying heat. For TV purposes the voltage method is used. This is also known as field effect control, because an electric field is established between the electrodes that sandwich the liquid crystal layer. The field established in the layer depends on the applied voltage, irrespective of polarity.

Thus varying the voltage applied to the electrodes alters the rotational polarisation of the crystal layer and in turn the polarity of the light that passes through the layer. But on its own this is not of much use to us. We want to vary the amount of light passing through, not its polarity. The

addition of polarising filters at the front and back of the layer – as shown in Fig. 2 – gives us control of the amount of light passing through the combined assembly. How this works is shown in Fig. 3. Natural light is randomly polarised. The input polariser allows through only light with 90° polarisation. If the liquid crystals are untwisted – see Fig. 2(a) – this light passes through the liquid crystal section then through the output polariser, which has the same polarity as the input one. If the liquid crystals are twisted through 90° and will thus be unable to pass through the output polariser. Adjusting the drive applied to the liquid crystals

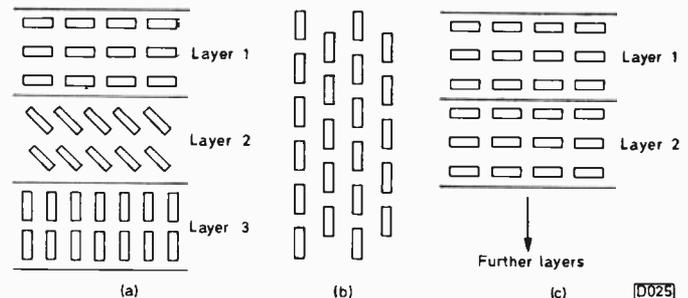


Fig. 1: The three types of liquid crystal, (a) cholesteric, (b) nematic, (c) smectic.

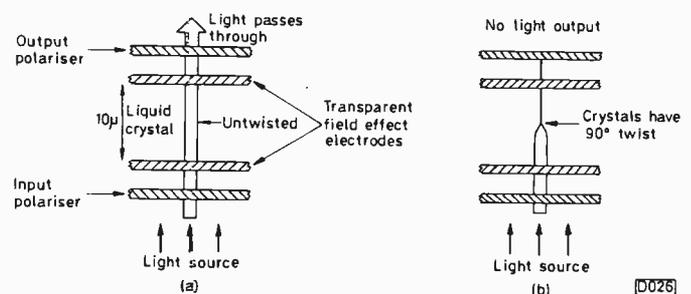


Fig. 2: Arrangement of the liquid crystal layer, drive electrodes and input/output polarisers. In (a) the crystal's rotary polarisation has been removed by applying field effect bias, so light passes through. In (b) the crystals have a 90° twist which alters the light polarisation likewise: the output polariser then blocks the light.

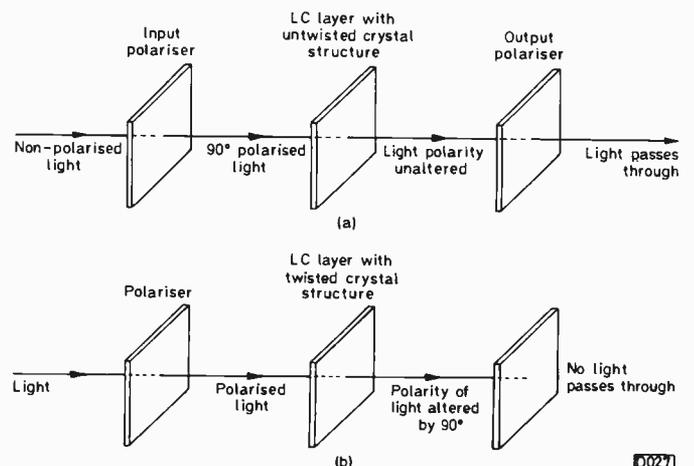


Fig. 3: Action of the polarisers and liquid crystal layer, (a) providing light transmission, (b) blocking the light.

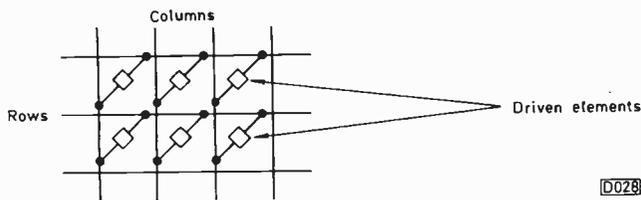


Fig. 4: Matrix drive arrangement.

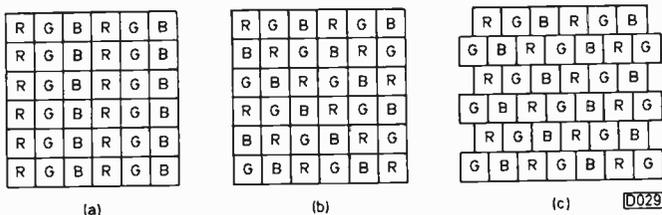


Fig. 5: Three-colour filter arrangements, (a) stripe, (b) offset, (c) triangular.

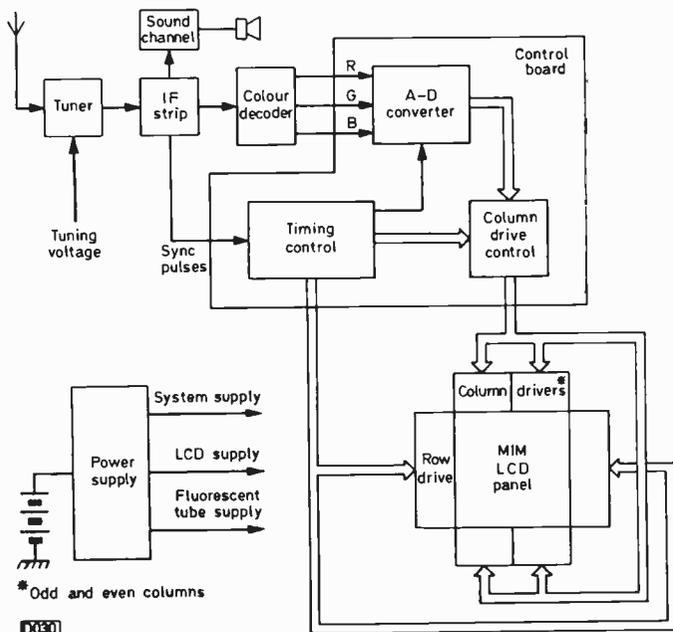


Fig. 6: Simplified block diagram of the Ferguson Model PTV01 receiver.

varies the twist and thus the amount of light that passes through the complete assembly. The polarisers are made of plastic impregnated with alcohol molecules to provide the polarising characteristic. This method of brightness control is called "blind effect" because the basic way in which the light is controlled is similar to the action of a window blind.

Driving an LCD

We can thus see how light is controlled, but for TV purposes we want to be able to build up a complete picture consisting of brightness variations. For this purpose the display is split up into picture elements (pixels) each of which can be driven separately. A matrix drive system, see Fig. 4, is used to give separate, sequential access to each pixel. Nowadays active matrix drive is used, i.e. each pixel is driven by a separate switching device which can be a thin-film field effect transistor or a MIM (metal-insulator-metal) device. Pulse-width modulation is used to vary the drive to each switching element and thus the brightness at each pixel. The switched elements act basically as driven capacitors across which a variable charge is developed. With earlier LC displays passive

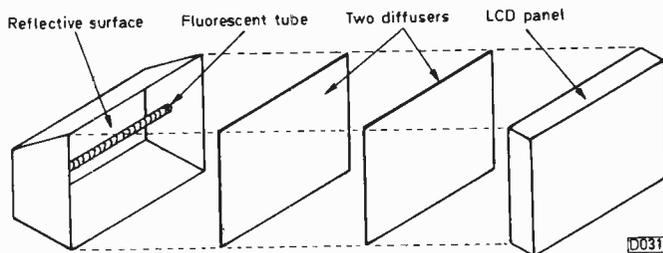


Fig. 7: The backlight system used in the Panasonic LCD receiver. The fluorescent tube generates white light, with RGB components only. A reflective surface is used for even light distribution: two diffusers then reduce the centre illumination in order to even out the illumination applied to the LCD panel.

matrix drive was used. The problem with this was a degree of crosstalk between pixels and thus an inferior contrast resolution.

Colour

Having seen how a controllable display can be produced, what about colour? This is a matter of introducing RGB filters into the display so that RGB outputs are obtained. Easy to understand but not to manufacture! As with c.r.t. shadowmasks and screen phosphors, there's more than one way in which to arrange the filters. Fig. 5 shows three possible arrangements. The disadvantage of the stripe arrangement shown at (a) is that the pattern is prominent and thus stands out. Some improvement is obtained by using the offset arrangement shown at (b). For TV purposes the best method is the triangular arrangement shown at (c) since this provides the least discernible pattern.

Practical Receiver Arrangements

The display is driven in three ways. There has to be row and column drive and in addition a backlight is required unless the LCD is being used with strong external back lighting. The row drive biases each row in turn so that the active devices in the row are responsive to the column drive signals, i.e. the video signals in PWM digital form. Note that the number of lines is not the same as with the transmitted signal – neither does the number of columns correspond with the transmitted picture's horizontal resolution. The video signal thus has to be A-D converted and then converted to a form that corresponds with the display panel's pixel arrangement. Fig. 6 shows a simplified block diagram of the Ferguson Model PTV01, whose 2.6in. display consists of 56,320 MIM-driven pixels arranged in 220 rows by 256 columns with a triangular filter arrangement.

As a further example, let's consider briefly the Panasonic LCD set whose 3in. display has 102,672 pixels arranged as 276 rows and 372 columns. The row driver gates each row in turn while the column driver samples the digital video and applies appropriate RGB signals to the thin-film transistors in the display. As is now conventional, the row and column drivers are built into the display panel. Basically the row driver consists of a series of flip-flops that act as a shift register – several chips are required. For correct operation there are timing and clock inputs. The column driver again consists of several i.c.s, in two sets, one to drive the odd columns and the other to drive the even columns.

The backlight arrangement used in the Panasonic set is

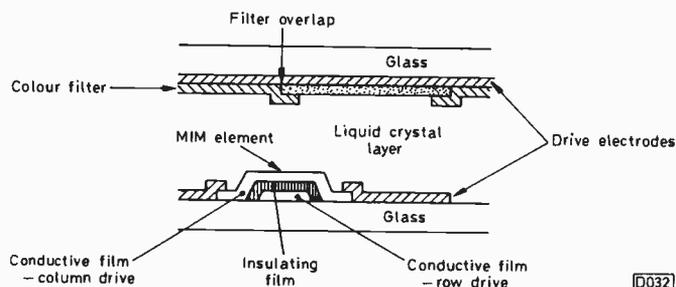


Fig. 8: Cross-sectional view of the MIM display used in the Ferguson receiver.

shown in Fig. 7. This provides the light input for the LCD and, as you'll appreciate, the light must be very evenly

distributed over the entire rear surface of the display.

Fig. 8 shows a cross-sectional view of the MIM display used in the Ferguson set. The use of MIM as opposed to thin-film transistor (TFT) switching elements is claimed to give a production cost saving of one third. The colour filter is in this case built into the liquid crystal layer, with boundary superimposition to provide shielding between primary colours instead of a metal shield. This arrangement allows more light through the LCD, improving the picture under high ambient lighting conditions.

Acknowledgement

Our thanks to Ferguson and Panasonic for providing information on their sets.

How to Run Your Vintage TVs

Part 1

There have been many articles in this magazine on 405-line television. Most of them have concentrated on receiver techniques and restoration, few dealing with the problems of providing 405-line pictures now that there are no suitable transmissions. Hence this article, in which I hope to cover all aspects of practical 405 apart from the receivers themselves.

Standards

It's vital that TV standards should be thoroughly understood – they are the foundation of all TV broadcasting. The 405-line standard was the first one to become established as a public service and not surprisingly became known as System A. The present UK 625-line transmissions are System I. No need to worry about the many other ones here.

There are two aspects to TV standards. The video standard lays down how the signal is generated and handled within the studio. It defines the scan rates, signal voltage levels, sync pulse parameters, in fact everything apart from the way in which the signal is modulated on to an r.f. carrier and transmitted. The r.f. standard defines the latter characteristics. For our purposes it's simplest to treat the video and r.f. standards separately. The golden rule for providing signals for your 405-line receivers is to handle everything as a studio type video signal until it has to be modulated to the final r.f. standard for application to the receiver(s). Fig. 1 shows the elements of a video system plus modulator.

Table 1 lists the video standards of Systems A and I while Fig. 2 shows the 405-line video waveform. The video is positive-going while the sync pulses are negative-going. With both 625 and 405 the video is always 1V peak-to-peak at 75Ω. The absolute d.c. level doesn't matter within reason – you can always clamp or d.c. restore the signal if necessary. These basic characteristics make connecting video equipment together very straightforward. Provided everyone plays by the rules, you never have problems with video levels and polarities regardless of the line rate.

The situation with the transmission standards – see Table 2 – is very different. With Systems A and I the vision signals have different polarities while the sound is a.m. in one case, f.m. in the other. This affects the design

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of only the modulators and receivers: the video signal is not directly affected. In fact you can concoct some wonderful hybrid standards. Try for example putting a 625-line signal into a System A modulator. The result is a perfectly respectable looking signal that doesn't work with any standard receiver. But more of this later.

Signal Quality

Many older sets need all the help they can get to give decent pictures. So make sure that your other equipment doesn't degrade the pictures unnecessarily. For good locking and freedom from line pairing the signals should be properly 2:1 interlaced, with accurate line and field sync pulses. To allow black-level clamps to do their job, the line sync pulse back porch must be present and correct.

Any reasonable modulator should not harm the signal, and there's no excuse for faults such as sync crushing. It

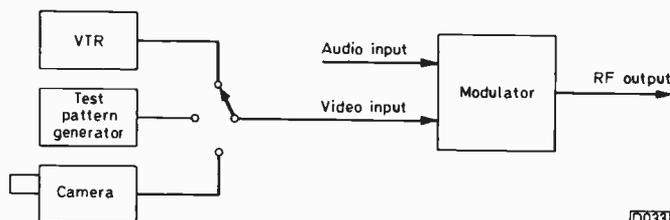


Fig. 1: A video system with modulator.

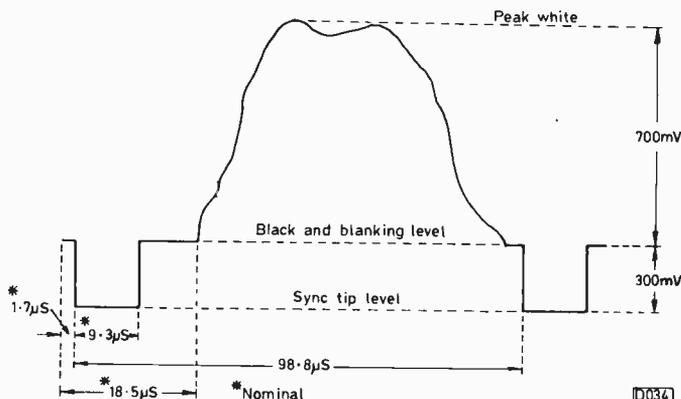


Fig. 2: The 405-line video waveform.

helps to keep the video levels reasonably accurate. Studio professionals keep the levels accurate to within one per cent, but this is not necessary for us. Try to keep the voltage levels accurate to within five per cent, then you can interconnect equipment without worry or fuss. For 75Ω terminations two per cent resistors are cheap and readily available. It costs little to keep all video leads and connectors in good order. Super grade coaxial cable is not necessary. For preference use BNC connectors throughout. To avoid soldering those wretched UHF/PL259/F and E plugs it's very easy to make your own u.h.f. to BNC adaptors: just use a large iron to solder a BNC socket to the back of a u.h.f. plug. None of this is absolutely essential, but if you insist on using crocodile clips and damp string expect them to introduce unnecessary problems – especially if you connect your gear to anyone else's.

The only test gear you need is a scope. A bandwidth of 5MHz will give you a decent view of the video signal. If you are fortunate enough to have a scope with a bandwidth of 25MHz or more a modulated channel 1 carrier will be visible (a 25MHz scope has some response at 45MHz).

405-line Signal Sources

If you can generate, beg or borrow 405-line video signals, recording them is ridiculously easy. VHS, Betamax and U-Matic machines happily accept 405-line signals at the video input and play them back via the video output. Some new machines, especially VHS ones with HQ specification, may object but the vast majority know nothing of the line count. Even 819 should work. The field rate must be 50Hz, that's all. Two hints. First, switching the machine to monochrome may improve

Table 1: Comparison of video standards.

Parameter	System A	System I
Lines per picture	405	625
Fields per second	50	50
Interlace	2:1	2:1
Line frequency	10.125kHz	15.625kHz
Line length	98.8μS	64μS
Line blanking	17.5-19μS	12μS
Front porch	1.5-2μS	1.6μS
Line sync width	8-10μS	4.7μS
Field blanking	13-15.5 lines	25 lines
Number of broad pulses	8	5
Number of equalising pulses	None	5 + 5
Broad pulse width	38-42μS	27.3μS
Black level	0V nominal	0V nominal
Sync tip below black	300mV	300mV
White above black	700mV	700mV

Table 2: Comparison of r.f. standards.

Parameter	System A	System I
Nominal channel width	5MHz	8MHz
Sound carrier frequency	-3.5MHz	+6MHz
Vision modulation polarity	Positive	Negative
Sync tip carrier	Zero	100%
Black level carrier	30%	76%
White level carrier	100%	20%
Sound modulation	AM	FM
Ratio of peak vision carrier voltage to unmodulated sound carrier	2:1	3.3:1

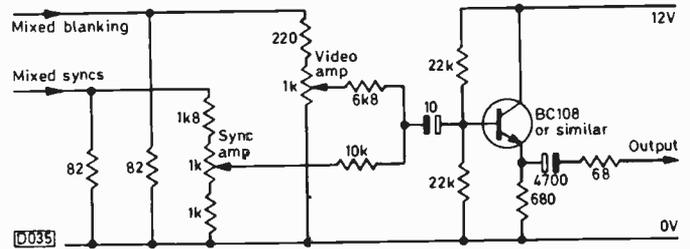


Fig. 3: Circuit to produce a variable brightness blank screen. This is not claimed to be a high-quality design – its merit is simplicity.

results since a 405-line signal might confuse the colour circuits. Secondly, use good tapes and keep them in particularly clean condition – the one part of the machine that doesn't work on 405-lines is the dropout compensator.

The quality of 405-line recordings is really excellent, better than with 625-line signals because the recorder can accommodate the full 3MHz bandwidth. But all VTRs have playback timing jitter. This won't affect sets with direct line locking, but early flywheel line sync circuits may give hooking at the top of the picture. The only cure is to modify the set concerned, though careful adjustment of the set's line hold control and, if you can manage this, the VTR's tape tension may provide an improvement. Tapes with 405-line recordings can be copied using two machines: use direct video and audio connections, since many machines seem to play up when a 405-line signal is copied at u.h.f. The timing jitter problems worsen with copying. Many 405-line sets object to multi-generation copies, usually by showing assorted poor sync systems.

Those of you with more exotic VTRs should not need my guidance on using them for 405-line recording. Hands up all those with a 2in. quadruplex machine in their lounges!

A TV camera is a very pleasant source of 405-line material and serves a dual purpose, as we shall see later. Virtually any monochrome camera will work at 405 lines. The line scan circuits are usually very simple, operating at a low power level and without the burden of having to generate the e.h.t. voltage. In some cases all that's necessary is to retune down to 405 and readjust the width. Some cameras have built-in 405-line pulse generation that ranges from rough and ready to excellent with crystal-locked 2:1 interlace. Others will need drive pulses and thus a 405-line sync pulse generator – of which more later.

Small vidicon cameras such as the Pye Lynx and the EMI 900 series are very suitable and are often available quite cheaply. A good source is the British Amateur Television Club and the advertisements in its journal *CQ-TV* (address later). Small domestic colour cameras are not really suitable. Proud owners of image orthicon cameras and other fancy hardware are probably more pressed for space than technical guidance.

Test patterns are always handy. The old Telecheck and similar generators are useful but not always very accurate. DIY test patterns will normally require a sync pulse generator to provide pulses. Crosshatch, sawtooth and grey-scale patterns are all useful and not difficult to arrange. One very simple and useful device generates a blank field that's variable from black to white. Fig. 3 shows a crude but effective circuit. If you have any of the old BBC White Front test modules, these are all 405 capable, sometimes with minor modification.

Fortunate owners of monoscopes such as the Marconi BD617 have an excellent test pattern source. A

monoscope is basically a c.r.t. whose screen is a target that selectively absorbs or reflects electrons depending on the brightness of the picture engraved on its inside surface. A thorough overhaul will be necessary – these are no longer young. Modifying a 625-line unit for 405 lines or vice versa is very easy. You occasionally find monoscopes advertised in *CQ-TV*.

Standards Conversion

Standards conversion is the bit you've all been waiting for. Unfortunately there are no easy answers. Any electronic converter, whether analogue or digital, will be a complex instrument and there are no surplus units to be had. All the ex-BBC and ITV converters that survive are in the hands of museums and leading collectors who are not going to dispose of them. Even a digital converter circuit would be of limited use – PCBs would be essential. For this sort of project plated through holes would be necessary, resulting in a very expensive unit. Most enthusiasts' test gear would not be adequate to debug a hand-wired version.

Despite all this bad news there is one practical method for the enthusiast: good old-fashioned optical conversion, a fancy title for pointing a 405-line camera at a 625-line monitor or receiver. This was the first method used to convert between 405, 525, 625 and 819 lines, in any direction, and the only method available until 1960 when the BBC developed the first all-electronic systems.

For amateur use the process is fairly simple. Obviously a good camera and monitor will give better results. The monitor must have a respectable black-level clamp or d.c. restorer. It should be underscanned so that the entire picture is visible. If off-air pictures only are wanted an ordinary monochrome receiver could be used. Disable any auto-target or auto-iris on the camera and exclude all stray light. For a permanent system a small monitor and camera could be clamped to a baseboard and a simple cover made – paint all the inside surfaces matt black.

To set up the system a test signal such as a grey scale is ideal. Adjust the monitor to obtain a normal picture – sometimes increasing the display brightness so that blacks are fairly visible gives better results. Ideally, display the 625- and 405-line waveforms together on a scope and use the camera's lift and target controls to try to make them identical. Experiment is definitely necessary for best results.

With pictures you may need to defocus the camera slightly to prevent objectionable moiré patterns – these are caused by a beat between the 625- and 405-line structures. If you can manage it, a better cure is to fill the gaps between the scan lines either by using spot wobble or a tall, astigmatic spot.

The results I've personally obtained with optical conversion have been very encouraging, but then very good cameras and monitors are used. I've also tried 405-to-625 conversion, which works better than it has any right to do.

If anyone fancies having a go at making an electronic converter, the following notes on the basic principles used in professional converters and some ideas for modern approaches may provide a starting point. A general warning however: if you are not sure how to start, don't! If you are planning a design for possible publication, despite the possible pitfalls, I might be able to assist with evaluation, tolerancing, etc. Unfortunately however I do not have the spare time to embark on a complete design myself.

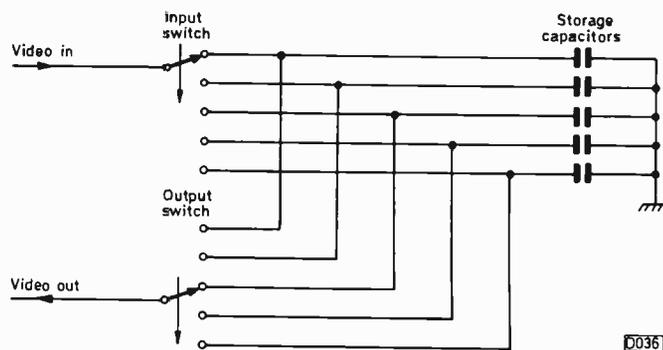


Fig. 4: Basic idea of the switched capacitor line store – only five out of 576 switch positions shown.

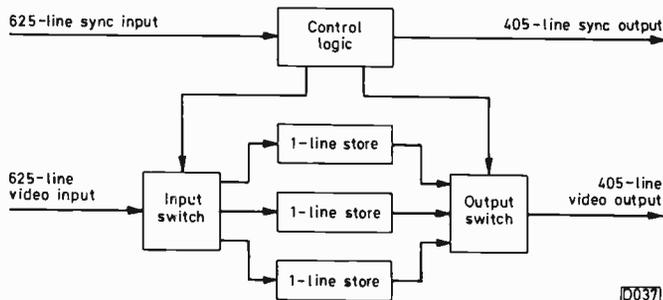


Fig. 5: Standards conversion with three line stores.

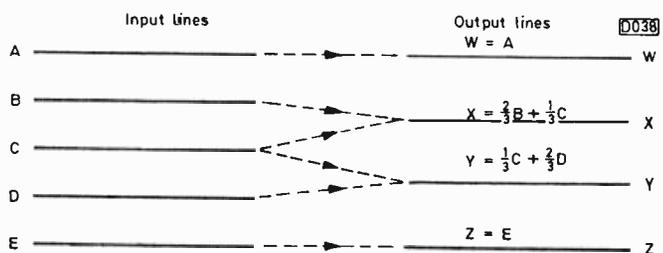


Fig. 6: Simple interpolation, from five input lines to four output lines.

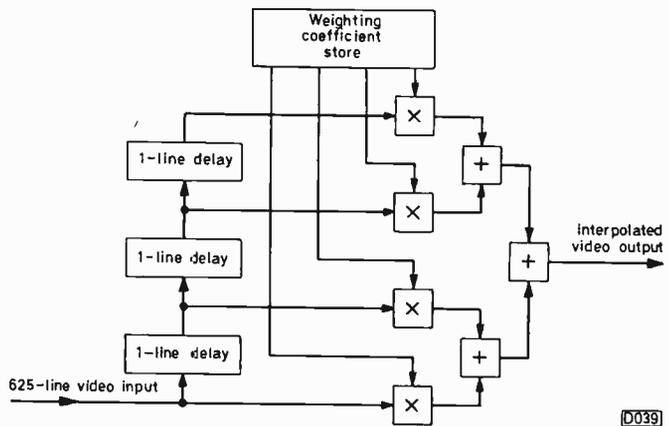


Fig. 7: Block diagram of a four-line interpolator.

Any electronic converter requires storage – enough for at least one line. The simplest approach is to discard 220 lines from a 625-line picture. This is about one in three lines, and those discarded should be evenly spaced down the picture. The remaining lines must then be stretched – this is where the storage comes in – from $64\mu\text{sec}$ to $99\mu\text{sec}$.

Early BBC analogue converters divided each line into 576 samples, or pixels. The voltage at each sample was stored in one of 576 capacitors. Fig. 4 shows the general idea, with a bank of capacitors connected to two 576-way

switches. One switch stores the samples in the capacitors over a period of $64\mu\text{sec}$, the other extracts the samples over a period of $99\mu\text{sec}$. This however is a gross simplification of what goes on in a very complex and brilliantly designed piece of equipment. When it was designed, only the earliest and crudest RTL logic was available: all the other chips that might be used today, including the operational amplifiers we take for granted, had yet to be developed.

A modern analogue converter might use CCD delay lines such as the Fairchild CCD921. Everyone has heard of CCD cameras: these CCD devices are much simpler and have been around for some years now. Each delay line can store a complete TV line simply by clocking it in. If the clock is stopped, the line will be stored intact for a limited period. It can then be clocked out at a different speed. Fig. 5 shows three delay lines which are filled and emptied in sequence. Control logic is obviously required to ensure that the 220 unwanted lines are not put into the stores.

Digital conversion can be carried out along the same lines. The BBC designed its digital standards converters in the late 1960s, when it looked as though the old analogue ones wouldn't last until the end of the 405-line service. When the BBC did this the stores used were brand new and expensive shift registers holding about one kilobits each. The ADC (analogue-to-digital converter) running at 12.65625MHz was a $17 \times 10\text{in.}$ board full of exotic bits. Single-chip ADCs are now readily available. For example

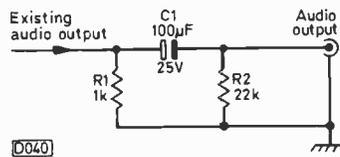


Fig. 8: Modification to improve the audio output from the Telebox.

the Mullard PNA7509, a seven-bit device, is available for under £30 at the time of writing. For DAC even the humble DAC08 at about £2 provides a reasonable solution. A modern converter using this method would employ high-speed RAM stores – $2\text{K} \times 8$ bit devices holding well over one line each are available for under £15 each. Unfortunately a fair amount of address circuitry is needed, unlike the old fashioned shift registers that didn't require any.

The latest answer is the large FIFO (first in, first out) memory with a price tag to match. The Integrated Device Technology IDT7202 for example is a $1,024 \times 9$ bit device that will operate at video speeds. Since the input and output clock rates can be completely independent, we no longer need the three-block approach shown in Fig. 5. The device can be treated as an electronic sausage machine: stuff the 625-line data in at one end and pull it out as 405 lines at the other. This sounds quite simple, but fairly complex support circuitry is required and we are still crudely dropping the unwanted lines. The result is nasty, stepped diagonals and could easily be inferior to the results obtained with a reasonable optical converter. To get over this we need to use interpolation.

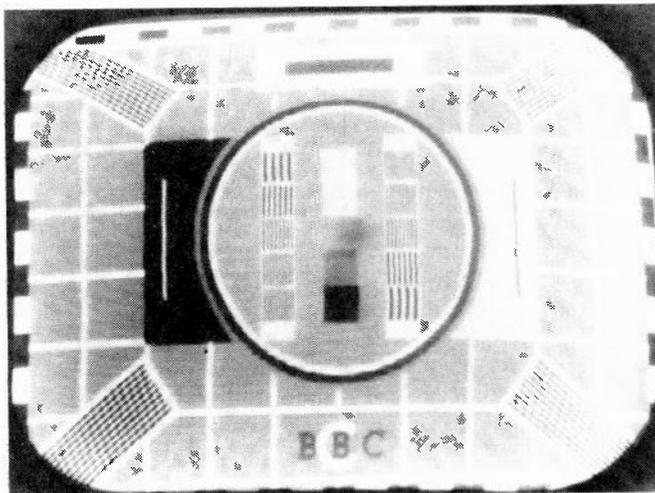
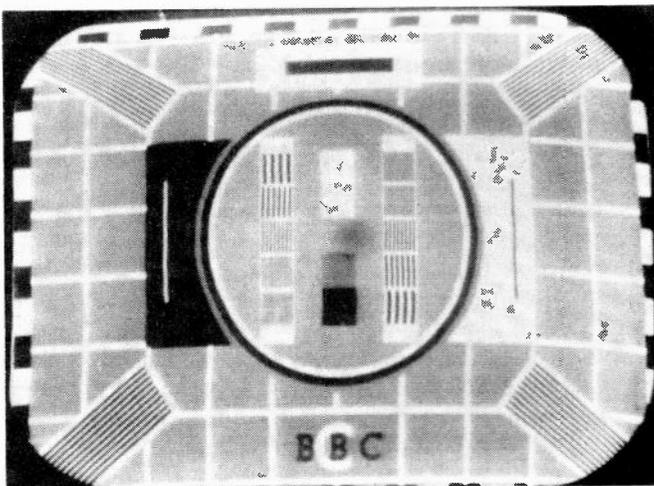
To generate a new line half way between two existing ones, a better approach is to average the two adjacent lines. This is a bit like what happens in a PAL decoder. It needs a one-line delay and is called interpolation. Fig. 6 illustrates the idea. For a new line three-quarters of the way down between two old lines we can take an average of 75 to 25 per cent.

With a little care we can work out the fractions for each of the 405 lines we intend to derive from a 625-line source. The results will be even better if we use contributions from more input lines. Fig. 7 shows in block diagram form a four-line interpolator of the type used in the BBC digital converter. The three one-line delays make four lines available at the same time. Four multipliers apply pre-calculated weighting factors which are stored in a PROM. The idea is quite simple but the multipliers are costly. In the BBC design each multiplier occupies a whole PCB. Modern technology reduces this to a single chip – at a price.

Many of the devices named in this section are expensive and are available only through specialist distributors who are often unhappy about supplying ones and twos to individual order. You've been warned! Please don't blame me if you get hold of some exotic device then can't make it work.

625-line Sources

Whether your standards converter is optical or electronic you'll need a 625-line video source. A domestic VCR will provide suitable signals. If a separate tuner is required the excellent Telebox can be used – this is available from Display Electronics, 32 Biggin Way, London SE19 3DF (01-679 4414). Note that this firm has no connection with Display Electronics of Uxbridge who rebuild c.r.t.s. This ex-Rediffusion tuner provides high-quality video and audio outputs. A simple modification to remove the d.c. on the audio output is shown in Fig. 8 – R1 is necessary to provide a d.c. return.



A 405-line picture with (above) and without (below) interpolation. Note the stepped diagonals and uneven circle without interpolation.

VCR Servo Systems

Part 2: Fault diagnosis and location

Joe Cieszynski

The TV display produced by a VCR with a servo fault provides a clue to the nature of the fault, i.e. the loop in which the fault lies. Unfortunately one cannot rely one hundred per cent on such visual clues, but they do provide a starting point for fault tracing.

Diagnosis

Drum servo faults produce horizontal picture shift, line pulling or a display that looks as though the line hold is unlocked. The reason for this is as follows. When the drum speed changes, the speed at which the video information is read from the tape alters. Thus the line sync pulse rate will be fast or slow. With a minor error the flywheel line sync circuit in the TV set will try to compensate, giving the line shift symptom – the picture pulling from side to side. As the error increases, the sync pulses will move out of the range of the flywheel line sync circuit and line lock will be lost. With drum speed (FG) errors the drum rotation will move so far off that line hold lock-out will occur. The most common cause of this condition is loss of the FG signal, as a result of which the drum will run up to full speed. This can be anything up to 5,000 r.p.m., a far cry from the correct 1,500 r.p.m. When this happens you can usually hear the drum running free quite clearly. With a phase (PG) error the result may be line pulling or unlocked line sync – the line hold will not be as far off frequency as with a speed fault. Experience gained watching a number of drum servo fault symptoms will make this distinction clearer.

Capstan servo errors usually result in horizontal noise bars that roll down the screen. If the noise bars are stationary, the chances are that the fault is a mechanical one rather than being in the servo. If the noise bars are numerous (three or more across the screen at any one time) and move, a capstan speed (FG) error is usually responsible. Capstan phase errors can produce numerous noise bars, but more often the symptom is an occasional noise bar that appears every few seconds, clearing in between to give a good picture.

This summary of symptoms is intended to serve as a guideline, indicating where initial checks should be made. There are exceptions to these general rules, but a few checks in appropriate places should soon confirm whether your suspicions are correct.

Fault Finding

Thus the first check to make will depend on the screen symptom. We'll begin this fault location section however by mentioning some basic rules.

First, it's helpful to use a scope to check whether the sample pulse is stable on the trapezoid ramp in the sample-and-hold circuit in each phase control loop. If, for example, the playback picture suggests that there is a capstan phase error, scoping the signal at the capstan phase control sample-and-hold circuit will confirm that the fault lies in the capstan and not the drum servo. If you find that the pulse is stable on the ramp, ignore the screen symptom and make a check in the drum phase control sample-and-hold circuit.

An important point to remember is that a speed control loop error will result in the pulse in the phase control sample-and-hold circuit running through the trapezoid, so a scope check in this circuit will not prove that the fault is in the phase control loop. There are ways of deciding whether there's a phase or speed error present – we'll look at them later.

A second point that should be emphasised is the importance of certain adjustments. The two most critical ones are the drum and capstan discriminator. These set up the gain in each speed control loop and misadjustment can cause many and varied faults. If you suspect that a machine has been tampered with before it came into your hands, it's well worth checking these adjustments before proceeding further. The only way to ensure that the adjustments are correct is to do them by the book. If the manual isn't available, make a visual check to see if the controls look as though they've been altered. Those familiar with a particular model will know the approximate positions of the controls in a correctly set up machine. In most VCRs the correct setting for these controls is near the centre of their travel. Putting the controls in this position will give you approximately correct settings, but it must be stressed that they are critical and that correct operation in all modes and with all tapes can be assured only when the controls have been adjusted as laid down by the manufacturer.

Generally speaking, if the pulse and trapezoid signals are present in the drum and the capstan phase control loops the fault is either in a speed control loop or there's an incorrect adjustment or an i.c. failure. If a pulse or trapezoid signal is missing, fault tracing is simply a matter of using the circuit diagram to identify the source (bearing in mind that this varies with different designs) then using the scope to follow through the appropriate signal path.

When observing a sample-and-hold waveform, remember that the pulse does not have to be at the centre of the ramp. It may be slightly off centre. The important point is that its position is stable. Another thing to remember is that in many machines a second pulse may be present. This pulse will be present somewhere other than on the ramp, and occurs because of the trailing edge of the output of one of the monostable multivibrators in the relevant timing network. This second pulse is not used by the servo. Many engineers have been caught out by this, thinking that the extra pulse is the cause of the fault, and have spent hours attempting to get rid of it! Fig. 12 illustrates these points.

In some machines the type of combined ramp/pulse waveform shown in Fig. 12 may not be available because the VCR manufacturer has not included a test point. To clarify this, consider the sample-and-hold circuit shown in Fig. 2 last month. The pulse arrives from one source and the trapezoid from another, and at no point will the two be seen together unless a double-beam oscilloscope is used, triggered by the trapezoid and with the two beams overlaid. Because of the filtering action of C1, only the resultant d.c. will be present at the collector of the transistor. Fig. 13 shows in block diagram form part of a common analogue servo chip, the HA11711, and the relevant external components. The sample-and-hold block



Fig. 12: Basic sample-and-hold circuit waveform.

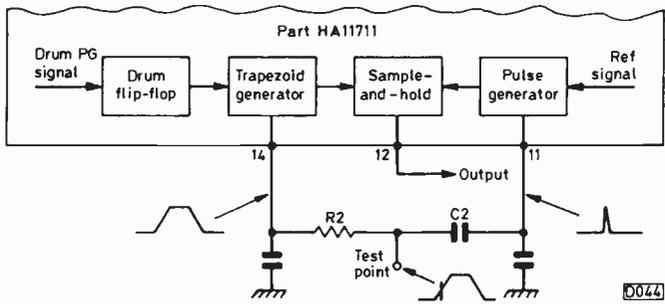


Fig. 13: Provision of a test point for the sample-and-hold circuit waveform.

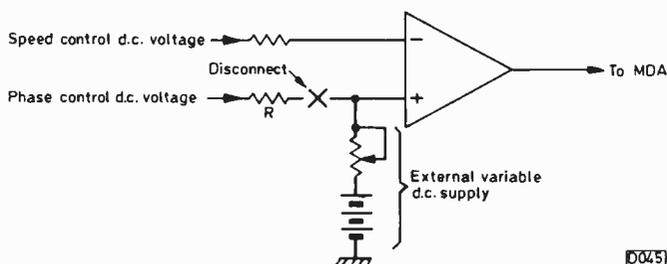


Fig. 14: Method of disconnecting the phase error control voltage when an operational amplifier is used to add the speed and phase control voltages. The simplest method of disconnection is simply to remove resistor R.

is equivalent to the circuit shown in Fig. 2. This is the point where the pulse and ramp are added and a d.c. control voltage is produced. An oscilloscope connected to pin 11 would show the pulse while connection to pin 14 would show the trapezoid. To assist with servicing, some manufacturers add the network C2/R2 for the sole purpose of enabling these waveforms to be displayed simultaneously on a scope.

The phase loop sample-and-hold check is clearly an important one, as it tells you whether both the phase and the speed control loops are locked. If the pulse is running through the ramp you can't, unfortunately, be certain whether the trouble is in the phase or the speed control loop, and in some cases it's not easy to tell from the displayed picture, or from visual checks such as strobing the drum under 50Hz lighting or observing the rotational speed of the spools. So how can you determine which loop is faulty? This can be difficult, but here are a few tests I've found helpful over the years.

Phase or Speed Fault?

The simplest approach is to work on the assumption that when the pulse and ramp are both present the bulk of the phase control loop, though unlocked, is functioning. So follow your check on the waveform at the phase control sample-and-hold circuit with some basic checks on the speed control loop. Check the motor supply voltage, scope the FG signal path and make d.c. voltage checks around the frequency-to-voltage converter. This assumption overlooks the fact that there may be a fault in the phase control sample-and-hold circuit, which will be in an i.c. So if the speed control loop checks fail to reveal anything significant, replacing the chip (if you have one

available) may well cure the fault.

With most servo faults the quick method outlined above will take you to the source of the fault and there will be nothing else to do but calculate the customer's bill. The time will come however when, having run through the quick basic routine, you find yourself chasing your tail, not knowing whether the speed control loop is causing the phase control loop to appear unlocked or the phase control loop is driving the speed loop out of control. Clearly you then have to delve more deeply.

Disconnecting the Phase Loop

The most effective way of isolating the source of the fault is to disconnect the phase control loop and leave the machine running with just speed control. This sounds simple enough, but two problems arise. First the speed control loop may require the d.c. voltage from the phase control loop's sample-and-hold circuit to attain the correct speed. Without it, the machine often runs at a much slower speed. Secondly it's not always easy to find a place where the two loops can be disconnected.

To take the second point first, bear in mind the two ways in which the output from the phase control sample-and-hold circuit can be applied to the speed control loop. The first was shown in Fig. 3, where the time-constant of a monostable multivibrator in the speed control timing network is altered. The second was shown in Fig. 11, where the speed control and phase control voltages are fed to the two inputs of an operational amplifier. Check which method is used in the machine concerned, then see if the phase loop can be disconnected. This may be difficult with the first method, but in the second it usually involves simply removing a resistor. Once the phase control loop has been isolated the problem of the speed control loop giving fast or slow operation can be overcome by connecting an external control voltage in place of the bias from the phase control loop - see Fig. 14.

A word of warning here. When connecting the external d.c. supply you may think it appropriate to set this to the voltage shown in the manual for a correctly working machine (typically 5V). The following stage is current operated however, and 5V from an external power source may provide enough current to send the speed control loop into full drive, destroying a number of expensive components in a short period of time. Begin with the output from the external power supply turned down, put the machine into the playback mode, then slowly increase the voltage. If the speed control loop is working, it should begin to respond to the external voltage at around 0.5-2V and, given time to lock up, a picture of sorts will appear. You won't obtain a perfect picture with this method because there's no phase control. Minute movements of the external power supply control will make the servo react as though you are adjusting the tracking. If, while carrying out this check, the servo totally refuses to lock it's fairly safe to assume that the speed control loop is faulty.

Pulse Generators

When a servo pulse or signal goes astray the cause is often failure of one of the generators. If for example the drum pulse generator (PG) in Fig. 8 failed the drum flip-flop would stop and there would be no trapezoidal waveform in the drum phase control loop. In this instance the machine would play for approximately six seconds then stop, because the output from the drum flip-flop is also fed to the system control microcomputer chip to tell it

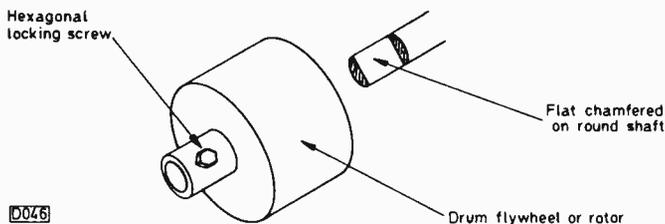


Fig. 15: Lower drum flywheel or rotor alignment: ensure that the screw locates with the flat on the shaft. Incorrect alignment will affect the phase of the output from the drum flip-flop circuit.

that the drum is rotating. Furthermore the picture would give the impression that one video head is open-circuit, because head switching would not take place and the head preamplifier would operate with one channel permanently on and the other permanently off.

Possible causes of failure of the drum PG are an open-circuit pick-up coil, the drum pulse level control being set too low or the magnet being too far away from the coil (this is not possible with some machines). Other problems I've had have been intermittent leads to the pick-up coil and one magnet broken off the lower drum assembly (caused by a clumsy engineer!). Another favourite is for an engineer to remove the lower drum flywheel assembly for some reason and fail to align it correctly when replacing it. The drum flip-flop will still operate, but not in the correct phase. This will give incorrect head switching: over part of the screen the picture will be good while over the rest of the screen there will be noise as the head is turned off either too early or too late. Alignment of the lower drum flywheel is very simple. The shaft on which the flywheel fits has a flat chamfered on one side: the flywheel is mounted so that the locking screw contacts this flat (see Fig. 15). Although this is obvious, it's surprising how many engineers get it wrong.

In some Philips machines the drum PG consists of an optocoupler mounted above the drum. A small metal spike on top of the drum breaks the light path, thus generating a pulse. I've had a number of these machines where the spike has broken off and disappeared.

The off-tape control pulses, which can be applied to either servo, are generated in the audio-control head. If the pulses are not present at the relevant sample-and-hold circuit the most likely cause is a dirty control head, which is sometimes the last thing people think of. The control head can wear, but this is not very common except in some machines where poor head design results in it being a stock fault. Another control pulse fault is when a machine plays prerecorded tapes perfectly but suffers from an obvious phase loop fault when playing its own recordings. This is because it's not recording the pulses. The fault can be caused by a dirty control head or component failure on the servo board. Finally on the subject of control pulses check that the audio/control head hasn't been misadjusted in either the height, zenith or azimuth planes. Such misadjustment can cause intermittent or total loss of the control pulses without necessarily affecting the sound to any large extent.

Note that it's not possible to scope the drum PG or playback control pulses at the pick-up coil itself. You sometimes find that the pick-up coil doesn't read open-circuit on an ohmmeter and you are then left wondering whether the fault lies in the coil or in the leads and coupling network to the first amplifier. A quick way round this is to inject a small signal into the lead

connected to the pick-up coil and use the scope to check whether this appears at various points along the signal path. A word of warning however: if the cause of the fault is an open-circuit lead or a changed value capacitor, the injected signal may be able to get through whereas the small PG/CTL signal cannot do so. Measurement of the attenuation of the injected signal may help here.

Where reference pulses are derived from a crystal oscillator and then divided down, problems frequently arise due to failure of the oscillator. In most cases the cause is a defective crystal.

FG Signals

In Part 1 we discussed methods of deriving FG signals for the speed control loops. Where brush type motors are used, the FG signal may be extracted from the ripple on the d.c. supply line caused by the commutator action. With machines that use this type of motor problems occur after a few years' use: the commutator wears and the ripple becomes too large, driving the servo into instability. An attempt to reset the discriminator may be successful at the time, but the servo will move out of adjustment within a few hours or days. The only cure here is to replace the motor.

Other brush type motors incorporate a tachogenerator inside the motor housing. Such generators are very reliable, though the motors can cause wow and flutter problems after a few years' use. In the case of the capstan motor this is clearly heard on the sound and there may be noise bars as a result of the capstan phase drifting off. When a drum motor of this type fails the picture will move from side to side as the servo hunts in an attempt to stabilise conditions. In an extreme case the line hold will lock out.

The FG devices mentioned so far are more commonly encountered in older machines. Modern VCRs employ a Hall-effect motor to drive the drum – in many machines the capstan is also driven by a Hall-effect motor. In this case the FG signal is generated either in one of the motor windings or by a tachogenerator inside the motor. Such generators are very reliable. If they do fail there is usually very little you can do to repair them, though there's nothing to lose in trying!

One other FG device that's often seen is a magnet assembly beneath the capstan flywheel, rotating over a pick-up coil. The only problems that occur here are when the coil goes open-circuit or the flywheel mounting bracket works loose and the flywheel drops down, with the result that the amplitude of the FG signal falls, possibly to zero.

In Conclusion

I could go on to mention hundreds of faults I've encountered over the years, but there would be many stock faults of which I'm not aware. The purpose of this article has not been to provide a list of stock faults but to encourage you to look at how the circuit actually works and then work out a series of logical tests that will lead you to whatever has failed.

Digital servos and associated fault-finding routines have not been covered. This is a large subject that calls for separate treatment. Perhaps time will permit me to cover it in the future. For the time being I'll just emphasise once more that when faced with a difficult servo fault don't panic: study the service data thoroughly, think logically and be patient. You'll get there eventually. Happy hunting!

TV Fault Finding

Reports from Mick Dutton, John Coombes, John C. Priest, Ian Bowden, J.K. Potts, Rana S. Narwan, Alfred Damp and Philip Blundell, Eng. Tech.

Philips CF1 Chassis

This set worked for only a few minutes from initial switch on when new. Checks around the chopper power supply didn't reveal anything obvious so we disconnected the 95V output and provided it with a dummy load bulb. A scope showed that there was an initial switch-on kick at the base of the BUT11F chopper transistor. All the semiconductor devices in the power supply were checked and found to be perfect. We disconnected pin 4 of the feedback optocoupler and still the power supply didn't run. This at any rate proved that the fault lay on the primary side of the transformer. We then started to check each component in turn and when C2317 (47nF) was bridged the power supply came to life. When it was unsoldered we found that one leg was loose in the body. A replacement put matters right.

A second of these sets failed very quickly from new. The problem was lack of line sync due to a faulty TDA2577A sync/timebase generator chip. M.D.

Mitsubishi BB1201

The sound was very poor and there was a blank white raster. All voltages throughout the i.f. and a.g.c. stages were slightly wrong, but nothing seemed to be particularly significant. We spent a lot of time on this one until we noticed that the video amplifier transistor is d.c. coupled to the video output transistor, with the a.g.c. take-off from the video amplifier. The cause of the problem was that the video output transistor Q202 was leaky, as a result of which its base voltage was slightly high. M.D.

ITT 80 Chassis

We recently had a case of no green in a set fitted with this chassis. The problem turned out to be due to the 100nF capacitor connected to pin 19 of the TDA3560 colour decoder chip. M.D.

Crackling Sound

We've recently had two cases of crackling sound caused by ceramic disc capacitors. The first set was fitted with the Rediffusion Mk 4 chassis, the culprit being 0C35 (5.6pF). The second one was a GEC 2218 where the problem was caused by C808. In both cases we had already changed the appropriate chips. This will teach us to measure voltages first! M.D.

Philips 2A Chassis

The problem with this set was intermittent failure to start. As the fault was very erratic we decided to disconnect the supply to the line output stage and provide a bulb as a dummy load. The set then started every time. When the line output stage was reconnected we were back to the intermittent tripping. This state of affairs continued for several days until we noticed a spitting noise that came from the set while it was in the corner of the workshop. Investigation showed that flashes were coming from inside C2609 (9.1nF) in the diode modulator circuit, and when it was removed we found that one leg was badly charred. Fitting a replacement cured the problem, but while we were working on the set we noticed that the components in

the 18V regulator circuit had been running very warm. We replaced these, spacing the resistors off the panel slightly. We've since had several of these sets that showed signs of overheating in the same area. M.D.

Ferguson 3787/NordMende F VI Chassis

Field collapse which may be very intermittent can be caused by cracked print or dry-joints around the bonding on the bottom half of the chassis.

For a blue tinted screen or a bright raster with flyback lines check whether DJ59 (BA179, BA173 or MR31) is leaky. J.C.

Safety Resistors

Are manufacturers cutting down on the quality of safety resistors or are the wattages too close to the operating level? I find that these components often seem to go open-circuit without any additional current being drawn. Is this just a problem here in Devon where it's warmer, or is it a general problem? J.C.

Bush BC6004/Murphy MC6124

For a bright raster with flyback lines check on the RGB panel to see whether safety resistor R568 (56Ω) is

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open-circuit. If so the associated decoupling capacitor C568 (470 μ F or 1,000 μ F) is probably short-circuit.

For tripping, first check that the h.t. is set correctly at 125V. If higher the set will trip. If there's an intermittent h.t. variation check the condition of the set h.t. control P943's track. If the h.t. can be set correctly but the control is at one end of its track, check the value of R943 (330k Ω). J.C.

Ferguson TX90 Chassis

There was no sound or picture and the line output transistor was short-circuit. When this was replaced we found that the boost line regulator transistor TR107 got extremely hot – so hot in fact that the solder was melting. The series choke L120 (5mH) had shorted turns. J.C.

Sharp C2092

For no memory operation/part tuning bar check carefully the voltage at pin 7 of I1005. It should drop to 0V when searching for a channel. If it stays high all the time check I1010 (IX0135CE) and R1072 (33k Ω) which can go high in value or open-circuit. J.C.

Sanyo CPT7118

Intermittent/random channel changing can be caused by dirty touch sensors that need cleaning. In the winter, dampness around the final anode e.h.t. connector can be responsible. Other things you might need to check are the focus control, which is part of the tripler, and the tube base – check this by replacement. J.C.

Rank Z718 Chassis

An uncommon variant of the Z718 chassis cropped up recently in the workshop. The set had a stock fault, failure to start up, so I went straight to 4R77 (910 Ω) in the 12V regulator circuit. It proved to be blameless, as also were the EW modulator diodes that provide the 30V supply from which the 12V line is derived and other common causes. Connecting a temporary start/run supply (PP9) to the junction of 4D10 and 4D11 got the set working, with the 30V rail and the 12V regulated supply at the emitter of 4VT20 normal, but when the PP9 was disconnected the set turned off.

Further investigation revealed that the 12V supply to the TBA950 sync/line generator chip 4SIC1 was not derived from the emitter of 4VT20 in the usual way, via 4R96 and 4D10. The blue wire link that normally goes from pin b adjacent to 4R96 to the anode of 4D10 went off the panel to the decoder. Instead, an additional BD150 transistor 4VT13 (see Fig. 1) is used as a separate constant-current source regulator supplying just 4SIC1. 4VT13 is fitted in the unused three holes between 4D10 and 4C18, with its collector connected to the anode of 4D10 and its emitter fed by 4R42 (200 Ω) from the 30V rail at pin 8 of 4Z2. 4R42

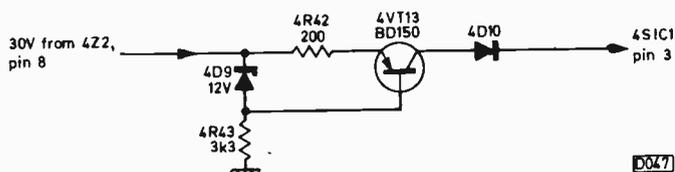


Fig. 1: Constant-current regulator circuit used to supply the TBA950 sync/line oscillator chip 4SIC1 in some versions of the Rank Z718 chassis.

occupies the space between 4D10 and 4R58. The normal position of 4R97 is occupied by the BZY88C12 zener diode 4D9, whose anode biases the base of 4VT13. A new resistor (3.3k Ω) links the base of 4VT13 to chassis and is fitted in the space between 4C18 and 4D12.

The culprit in this case turned out to be 4R42 which had gone open-circuit. This fault notwithstanding, it would seem that this modified version of the chassis is an improvement since it provides 4SIC1 with a more stable supply and relieves the load on the 12V regulator transistor 4VT20. In this case the notorious 4R77 was in perfect condition. J.C.P.

Salora 1F0

The customer complained of field roll for the first few minutes after switching on. This problem, as previously mentioned in these pages, can be caused by condensation on the main panel. The set had previously been working correctly however so we decided to take it to the workshop. Here the fault was as the customer described, and in addition the field tripped intermittently after running for several hours.

We found that when the fault occurred the field sync pulses fed to pin 1 of the plug-in field timebase panel (STW) were of reduced amplitude. In fact the interval between the pulses changed from a low d.c. level to a ramp waveform – see Fig. 2. Application of freezer to the main panel along the top of the c.r.t. cutout would also bring on the fault. The land connected via RA41 to the field timebase panel sync input runs very close to the 750V first anode supply and several other high-voltage supplies. But even after cleaning this area to remove any dirt that might be causing leakage the fault persisted. The only way to stop it was to use a wired connection in place of the land, as follows.

Pin 1 of the field timebase panel connector and RA41 (10k Ω) were removed from the main panel and the pin 1 part of the socket on the field timebase panel was removed. One end of RA41 was soldered into the hole left on the field timebase panel where the socket had been: the other end was sleeved and connected via an insulated wire which was run half way round the chassis to the lower end of

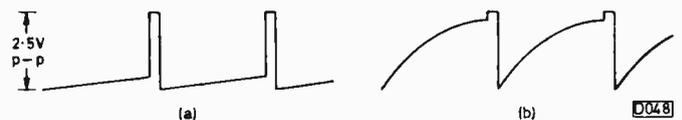


Fig. 2: Salora 1F0 field sync fault. (a) Normal sync pulses at pin 1 of the field timebase panel connector, (b) the waveform in the fault condition.

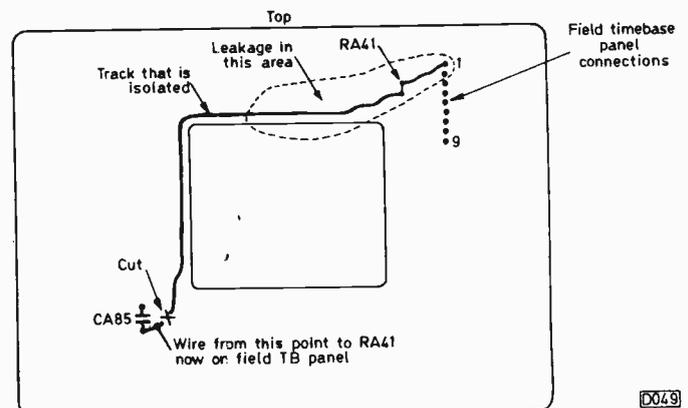


Fig. 3: The modification adopted to clear the problem.

CA85 – see Fig. 3. The print connected to this end of the capacitor was cut to isolate it from the land that was picking up the leakage. A soak test for several days proved that the fault had cleared. **I.B.**

Some Quickies

Nikkai BG001N: The trouble with this 14in. colour portable was top foldover. Electrolytic C313 was found to be open-circuit.

Cathay CTV3000: Set dead, not starting up. R504 (150k Ω) was open-circuit.

Bush T20 chassis: The power supply was pulsating because 7C7 (1.5 μ F, 63V) was open-circuit.

Sharp C2051: The complaint was of random drifting off station. Q104 (2SC458A) on the sensor panel had become temperature sensitive. **J.K.P.**

Philips CTX-S Chassis

Strange symptoms here: high brightness, off line frequency and when the set was switched off you got off-tune vision and sound momentarily. As a start we checked the brightness circuit which was found to be working correctly, then the colour decoder chip. After wasting much time we decided to scope the input to the TDA2540 i.f. chip. It seemed clear that the problem was in this area. After carrying out d.c. checks we decided to resolder the chip and the i.f. coils. This did the trick and we kept the set on soak test for a few days to be sure. **R.S.N.**

Mitsubishi CT2117

This set suffered from intermittent excess saturation. Under the fault condition the colour control voltage input to the colour decoder chip was found to be 6.5V for minimum colour instead of 3.5V. The cause of the trouble was a slither of solder between two links on the component side of the PCB – one link was part of the 12V supply, the other went to the colour decoder chip's colour control input pin. **A.D.**

Philips 2A Chassis

For a dead set or even one that's intermittently dead check C2609 (9.1nF, 1.5kV) by substitution. This component is in the EW diode modulator circuit. Note that it's not present in sets fitted with FS tubes while with conventional 90° tubes its value is 5.6nF. **P.B.**

Philips K35 Chassis

This set had a small picture with the channel display showing E1. The 140V h.t. line was low at 100V and substitution proved that the fault was in the chopper drive module U11. Zener diode D343 (BZX79/B6V8) was leaky. **P.B.**

Grundig CUC70 Chassis

If the line oscillator stops when the set is hot, check the 7.5V zener diode D352 for leakage. Failing that suspect leakage in the tripler. **P.B.**

Philips 2A Chassis

Watch out if you have to change the tube in recent Philips TV sets. The one I encountered, fitted with the 2A chassis, had fixing nuts with left-hand threads! **P.B.**

next month in

TELEVISION

FREE CATALOGUE

The HRS Commodore computer spares catalogue comes free with the December issue of *Television* – HRS Electronics Ltd. is the authorised Commodore spares supplier.

● THE MODERN TV/VCR WORKSHOP

Nowadays the workshop has to pay its way and preferably show a profit – the latter is essential of course with an independent servicing operation. The way in which the workshop is organised and equipped plays a vital role in this. It's no good wasting time searching for things or trying to carry out repairs under inconvenient conditions. The right equipment is also essential. David Botto gives practical advice on setting up and equipping a workshop for efficient, profitable operation.

● UNDERSTANDING NEGATIVE FEEDBACK

Negative feedback is a very widely used technique in electronics, yet there are many misconceptions about it. The use of negative feedback improves linearity, can adjust the frequency response, reduces distortion, sets input and output resistances and, if sufficient feedback is used, can make a circuit's parameters independent of the characteristics of the active devices used in the circuit. Stan Amos explains.

● PROBLEMS WITH LSI CHIPS

Larger and more complex i.c.s are increasingly found in domestic electronic equipment and present problems for the engineer. Nick Beer offers practical advice on how to handle them, including the latest surface-mounted types.

● MORE ON

The Panasonic NV333/NV366 VCRs – this time the electronics. And the r.f. side of providing 405-line signals for vintage equipment.

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Letters

VIABLE SERVICING

There have been many letters on the subject of service charges. I'd like to express my views and, in doing so, suggest a workable approach.

Back in the fifties and sixties the service department was usually part of a retail shop. It was recognised throughout the industry that the workshop was run at a loss. It was in fact subsidised by the sales side of the business. This is probably still the case with some dealers. The service department was there to help with the sales – it was a back-up for under guarantee sets and rentals. The reliability of TV sets was not what it is today, and because receivers were relatively expensive customers kept them going for as long as possible. So the service department was a busy part of the business, often employing a staff of five ranking in seniority from service manager to apprentice. Other domestic electronic equipment was repaired and things like kettles and irons would also receive attention. The workshop had to be well stocked – in fact it contained its own warehouse.

Compare this with today's workshop. Can you see a small, self-sufficient service department carrying stocks to that extent? Even to purchase a hundred of each 20mm fuse would cost a small fortune. Accountants now have a greater say and stocks have to be carefully controlled. Business management is considered to be the key to success and the provision of an efficient service.

Actual charges must depend on the type of service organisation. Let's look at some of the facts that determine the price the customer has to pay.

A self-employed TV/video engineer operating from home has quite different costs from those of a small company employing two or more engineers. The loner shares the cost of such things as electricity, rates, mortgage etc. between his home and business. As he's probably not VAT rated he can charge 15 per cent less to start with. He can manage by generating an income not much more than what he'd get as a working wage. A company employing say three engineers, divorced from a retail outlet, must bring in somewhere in the region of £1,000 each week. In theory the three engineers are there because three times as much work is available. So each engineer must bring in a minimum of £300 a week (VAT is calculated separately) every week of the year. On the basis of £25 per job, that's two completed chargeable jobs per day, six days a week. Don't forget the refused estimates, sets beyond economic repair and those who never call back.

Some jobs, I hear you say, bring in £40, £60 etc. But what about the £8, £12 jobs, i.e. transistor radios, cassettes – or perhaps you don't accept these! Then what about holidays – the £25 has to cover these as well. Overheads have to be met and bank charges paid. Perhaps you can't manage on £25 per repair. But the loner can! If you have to charge the customer more this will be on top of the VAT, which is not your money. But the customer still sees his bill as £28.75 from you and £25 from the chap who lives down the road.

The answer is to give the customer more for his money. Give him a better service. Say a longer guarantee – we give twelve months full guarantee with no regrets. Charge what you think is a fair price for the job, competing on service rather than cost. Advertise accordingly – the customer will pay more if he knows he's getting more.

In the fast approaching throw-away age, with discount houses offering merchandise at silly prices and with easy credit, one has to be careful not to over-price a repair job, a difficult decision at times.

So if you can't compete in cash, compete in service. Keep up the struggle chaps. It's still a good trade.

*Eric Edwards,
Barry, South Glamorgan.*

THE ENGINEERING SOLUTION

There've been a lot of interesting letters on the subject of servicing costs recently. It's healthy that this matter is being debated openly, as opposed to just lumbering more costs on to the customer without comment as is the case with many less useful professions.

As engineers, we must look to engineering solutions to the problem. The situation is similar to the transition from the pre-war servant/tradesman based economy to the present DIY based system.

The engineering solution is relatively simple. Manufacture all equipment in modular form, for "gross servicing" by the owner. For example, a TV set could be considered as three units: cabinet plus tube; power supply plus timebases; receiver section. The modules should be designed so that anyone can replace them, without faults being propagated between them. They could be sold to the public at manufacturing cost, with the old one handed in – the mark up on the original sale should cover the cost of marketing plus profit, and it would be unfair to expect the user to pay for these twice because of a breakdown. Handing in defective modules would prevent "kit building".

Such a scheme might add something to the initial cost of equipment. But, bearing in mind the fact that the cost of providing services is still rising steeply in real terms while the real cost of manufacturing brown goods is falling, the overall benefit will in the long run be to the customer. By transferring some of the burden of repair costs to the manufacturing process, which is inherently cheaper, the overall cost of ownership is reduced.

This would not be good news for the individual repair business. But it should be taken as a warning of the direction in which things must eventually go.

*John de Rivaz, B.Sc. (Eng.), AMIEE
Porthowan, Cornwall.*

CORRECTION AND DEALER SUPPORT

In reply to K. Booth (Letters, September) on the subject of the chopper transistor in the Decca 70/90 series chassis, there was unfortunately an editorial error in my original note (TV Fault Finding, April, page 415). The suggested replacement should have been the BU826, not BU426A as printed. The BU826 is a Decca recommended equivalent to the BUW81A, as at one time there were supply and reliability problems with the latter device. A technical note on how to fit the differently cased BU826 to the same heatsink was issued, but you don't need to be Einstein to work it out!

With regard to the problem of intermittent failure of the replacement device, there are many possible causes. The first thing to do is to ensure that the drive waveform is absolutely accurate, and that it's being measured from TP605 with respect to TP604 with the 1A fuse fitted. With intermittent failure, suspect that the drive is being lost: the most likely cause of this is Tr604 (BSR59) in the driver stage. Fit a genuine replacement, then follow the list of

items mentioned in April's TV Fault Finding note – as if you are dealing with a permanently dead set.

On a different subject, how I agree with K.J. Treeby's comments (Letters, August) on circuit diagrams and descriptions. I totally agree with him, and suspect most would, on circuit symbols. What could be more logical than a spiral for a coil or a zigzag for a resistor? The modern symbols are ridiculous: every time you follow a circuit through you have to refer to a key to establish what the thick and thin lines and boxes with dots mean. Many circuit diagrams now don't have the values or ratings beside the component. Instead there's a series of obscure shapes inside the rectangle, and again you have to refer to a key. The old system worked flawlessly and was preferred – why change?

The overall standard of service manuals seems to be declining rapidly and many are riddled with mistakes. In my opinion the worst ever are those produced by Philips. Until recently this didn't worry me, because I'd never worked for a Philips dealer. But they are now producing CD and video products for B & O. The manuals are totally illogical in layout, the symbols used and the interconnection notation. As to explaining how to remove and reassemble mechanical parts in the VHS82 manual, it may as well have remained in the language from which it was so poorly translated for all the sense it makes.

We really should have a concentrated drive not only to rid the industry of bodgers and of poor calibre equipment but to improve the standard of dealer support from manufacturers. If realistic prices were charged for new equipment the manuals could be improved and supplied free to appropriate dealers and labour reimbursement could be stepped up to a realistic level.

*Nick Beer,
Bideford, N. Devon.*

SONY FAULT

In the September Service Bureau a fault with the Sony KV2000 Mk II was mentioned – the picture starting off blank, then gradually coming on from the bottom over a period of about half an hour. I've had this fault in a number of Sony KV1820 receivers, which are similar to the KV2000, and in each case the cause was that C816 (4.7µF, 250V) had lost capacitance. This electrolytic is, as you say, in the blanking circuit. In later versions of the KV2000 Mk II the capacitor is C818.

Another similar fault occurs in the KV1820 when C827 (4.7µF, 250V), the h.t. reservoir capacitor for the RGB output stages, loses capacitance. This time however the picture loss is from side to side and the non-picture part goes white.

I must admit that these faults look very puzzling when you first come across them.

*W.G. Hall,
Stockton-on-Tees.*

ORACLE PUZZLE

With reference to Chris Plaice's "Oracle puzzle" (Letters, August), the complete answer is as follows. The quickly scrolling information seen on page 777 is a new nationwide service called Televox Link. It uses an interactive speech recognition telephone arrangement and the teletext alarm clock setting to provide information on various subjects including homes, holidays, jobs, cars, travel and quizzes. The service operates with telephone numbers 0898 444 777 and 0898 444 747, which are charged at 38p per minute

peak and 25p per minute off peak. In my view this is too expensive considering the length of time it takes to obtain information. A short demonstration of the service is available by dialling the freephone number 0800 515 333.

The front page of Televox can be viewed by selecting page 777 then setting the teletext alarm clock time to 3333. When you phone the Televox number you are asked to repeat several key words (star, next, zero, one, two and three), then you are given a new number to enter into the alarm clock. After this the menu-driven pages can be obtained by saying various combinations of key words such as "star next".

Further information can be obtained from the system operators McCallum Televox Ltd., 151 Cambridge Science Park, Milton Road, Cambridge CB4 4GG (0223 861 565).
*Andy Worrall, I.Eng., MIElecIE,
Bexleyheath, Kent.*

Editorial note: Our thanks to several other readers who wrote providing information on this subject.

LICENCE ANOMALIES

Hiding in the undergrowth of small print in the domestic TV licence is a fictitious creature that's lived there for 27 years. This is the "portable television receiving equipment powered only by its own internal batteries". It has been zealously preserved by the bright lads at the Home Office who have evidently never tried to buy such a set. Since 1961 this has been stated to be the only sort of portable TV set authorised for use away from the licensee's address. Later, by 1973, family members away as full-time students came to be mentioned, craftily reinforcing the pretence that a concession was being offered. The Licence Records Office folk act as fundamentalist believers in the inspired wording sent down to them and apply it rigidly.

An unjust licence rule is that if you "stop needing a licence" no refund of the fee is allowed unless you apply within its first 28 days. This is an unfair burden on people living alone, mainly the old or infirm, who may have to leave their homes through illness or accident. Effectively they are in a grim lottery as to the date when trouble may strike. It's not clear why the vehicle tax disc refund system cannot be applied to TV licences. Home Office reasons are unconvincing.

A curiosity is the rule that a registered blind person can deduct £1.25 from the licence fee. It must embarrass post office staff who have to explain this. Blind people used to be given free wireless licences, which once cost 25 shillings. Sheer inertia has kept it as a concession ever since, without revision.

The future broadcasting changes will require new legislation. It's a bleak prospect if our legislators cannot improve on their past performance. Our licence system will continue for some years yet. It would be a good opportunity to get these anomalies cleared up.

*L.A.C. Dopping-Hepenstal,
Hindhead, Surrey.*

HELP WANTED

Has anyone any idea where a service manual for an Akashi Model 1450 colour portable with remote control can be obtained? The set was made in Hong Kong fairly recently.
*Alan's TV and Radio,
Paiges Lane, Barnstaple, Devon EX31 1BA.
Telephone 0271 78 678.*

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

1589R	3.30	25C1826	0.67	AN206	2.58	BC207	0.14	BDX54B	2.16	BU205	1.15	HA1196	7.43	MC1351P	2.55	SAS580T	5.42	STR40	4.78	TBA90	1.87	TD4431	2.27
1589B	3.30	25C1829	2.22	AN208	2.58	BC212B	0.26	BDX62A	2.16	BU206	1.27	HA13001	1.73	MC1352P	2.59	SAS570T	5.42	STR51	5.38	TBA95	1.84	TD4440	2.26
17052	5.61	25C1875	4.50	AN210	2.28	BC213L	0.10	BDX63A	1.96	BU207	1.65	HA1306	2.85	MC1357P	2.55	SAS570S	5.42	STR45	5.11	TBA97	1.96	TD4442	4.15
17053	4.30	25C1883	3.02	AN211	2.25	BC214	0.10	BDY20	1.21	BU208	1.20	HA13402	1.76	MC1358P	1.35	SAS580	2.25	STR45A	4.95	TBA99	1.58	TD4500	4.75
17074	9.30	25C1906	0.98	AN214Q	4.20	BC225	0.40	BDY81	1.05	BU208A2	1.97	HA13342	2.65	MC14001	2.40	SAR620	1.33	STR620	5.25	TBA990L	1.86	TD4600.2	2.10
17089	3.45	25C1921	1.37	AN224	5.92	BC227	0.10	BU115	0.80	BU209A	1.12	HA13265	4.02	MC14013	0.40	SAS680	2.37	TB029V	5.75	TC270	1.98	TD4610	6.80
17127	2.50	25C1923	0.30	AN226	3.78	BC228	0.10	BU117	0.66	BU210	1.95	HA1366WR	2.51	MC14039P	1.75	SAS700	1.33	TB035V	0.73	TC2A270S	0.95	TD4620	6.80
17319	1.50	25C1949	0.80	AN227	1.80	BC229	0.10	BU118	0.67	BU211	0.80	HA1368	2.51	MC14048P	1.75	SAS710	1.33	TB037V	0.73	TC2A270S	0.95	TD4630	6.80
1N4001	0.40	25C1942	1.65	AN241	1.71	BC298B	0.25	BU121	0.25	BU212	2.45	HA1368R	4.45	MC14497	3.46	SAS8170	2.21	TB072	2.11	TC2A290	2.20	TD4507	2.75
1N4002	0.06	25C1959	0.26	AN245	4.50	BC251A	0.31	BU123	0.21	BU226	2.00	HA1368L	3.76	MC14510AB	3.75	SBA750	1.61	TB044V	0.97	TC2A210A	2.20	TD4720S	2.25
1N4003	0.06	25C1957	1.09	AN253	1.80	BC294	0.50	BU124	0.19	BU236A	2.20	HA1370	1.30	MC14518CP	1.30	SC8423S	19.35	TB045	1.20	TC440	2.25	TD4819	2.75
1N4004	0.05	25C1963	1.80	AN260	3.65	BC300	0.35	BU127	0.29	BU246	1.49	HA1374	4.80	MC14528BCP	2.15	SC924P	1.46	TB049	1.45	TC450	2.24	TD4903	3.15
1N4005	0.06	25C1962	1.93	AN272	8.25	BC301	0.45	BU153	0.50	BU246D	1.79	HA1117	1.79	HA1117	1.79	HA1117	1.79	TB052V	0.87	TC460	2.24	TD4903	1.95
1N4006	0.06	25C1969	2.94	AN285	5.82	BC302	0.53	BU154	0.67	BU247	0.67	HA1177	1.79	MC14572	1.95	SDA211/22	12.85	TB058	3.08	TC460S	2.24	TD4913	3.15
1N4007	0.07	25C1983	2.21	AN301	2.00	BC303	0.04	BU157	0.37	BU248	1.33	HA1389R	2.05	MC724CP	3.40	SG264A	6.45	TB059	2.77	TC460B	2.20	TD4933	2.88
1N4148	0.03	25C1986	1.55	AN302	1.93	BC307A	1.04	BU158	0.18	BU254A	1.13	HA1389	2.39	MC7818C	2.18	SG261	10.75	TB059V	1.25	TC470	3.81	TD4918	7.05
1N4448	0.05	25C2009	0.34	AN305	3.20	BC308A	0.11	BU159	0.15	HA1392	1.50	HA1392	1.50	MC1095.5/6	0.90	SG629	8.27	TB059V	2.38	TC470	2.95	TD4920	2.30
1N5401	0.14	25C2029	2.33	AN315	1.29	BC309	0.17	BU160	0.31	BU258A	1.25	HA1394	1.95	MC92207	2.28	SG653	11.96	TB101V	1.40	TC4800	6.25	TD4919	1.50
1N5402	0.15	25C2028	2.11	AN316	3.50	BC317A	0.13	BU167	0.30	BU256	1.65	HA1397	2.17	SG1125H	2.08	SG1125H	2.08	TB101V	1.40	TC4800S	2.24	TD4918	2.50
1N5403	0.16	25C2083	0.80	AN317	4.41	BC321	0.36	BU167	0.36	BU257	0.45	HA1398	1.90	HA1398	1.90	SG1125H	2.08	TB101V	1.40	TC4800S	2.24	TD4918	2.50
1N5404	0.15	25C2078	3.11	AN320	5.47	BC328	0.10	BU177	0.35	BU205	2.95	HA1406	1.30	ME1002	0.28	SH1630D	10.50	TB101V	1.40	TC4800	2.04	TD4920SP	0.61
1N5408	0.25	25C2073	2.25	AN321	2.25	BC337	0.09	BU178	0.40	BU206	1.79	HA1452	0.85	ME8001	0.34	SKZ2F/004	1.39	TB1019W	1.98	TC4910	2.04	TD106M	0.77
1N514	0.04	25C2086.0	1.65	AN322	5.85	BC338	0.10	BU179	0.36	BU207	0.80	HD1458	2.07	ME0411	0.75	SKZ2G/004	0.85	TB034V	1.85	TC490	2.47	TD106M	0.77
1S1555	0.50	25C2091	1.30	AN327	5.17	BC340	0.24	BU180	0.26	BU208A	1.95	HC3870.2	7.94	MCJ2601	0.36	SKZ4F/106	0.35	TB035V	1.95	TC490A	2.63	TD105	0.50
1S44	0.10	25C2141	2.44	AN340P	1.37	BC348	0.69	BU181	0.32	BU209A	1.39	HC3870.5A2	10.05	MCJ3001	1.76	SKZ4F/106	0.37	TB035V	1.95	TC490B	2.66	TD105	0.50
1N5432	0.16	25C2156	1.88	AN355	5.88	BC341	0.44	BU182	0.24	BU210	1.80	HC3870.5A1	7.25	MCJ3101	1.53	SKZ4F/106	0.44	TB034V	1.85	TC490A	2.66	TD105	0.50
2N2195A	0.33	25C2216	0.68	AN362	1.32	BC454	0.36	BU183	0.39	BU215	0.39	HC3880.5A0	14.09	MCJ802	4.90	SKZ4F/120	1.24	TB035V	1.95	TC490	2.04	TD106M	0.77
2N3053	0.35	25C2223	1.80	AN370	3.95	BC460	0.42	BU184	0.43	BU216	0.10	HD4480A06	19.09	MJ2955	1.82	SKZ4G/202	0.90	TB062V	0.49	TD1010P	2.31	TD117	0.45
2N3054	0.59	25C2236	1.65	AN5111	3.43	BC461	0.35	BU185	0.39	BU217	0.28	HSH1010	0.59	MJ2955	1.25	SKZ5F/310	1.00	TB064	1.25	TD1003A	2.25	TD117	0.50
2N3055	0.61	25C2278	1.69	AN5120N	4.50	BC462	1.15	BU194	0.14	BU213	0.12	HSH1004	0.60	MJ2940	0.45	SKS1170	2.15	TA7027	4.80	TD1005A	2.30	TD121	0.50
2N3442	1.56	25C2314	2.17	AN532	5.39	BC463	0.64	BU195	0.14	BU214	0.14	HSH1002	0.90	MJ2950	0.49	SL1310	3.14	TA7080	1.74	TD1006A	2.21	TD126	0.73
2N3702	0.14	25C2354+Kt	12.50	AN533	4.40	BC464	0.41	BU196	0.16	BU215	0.16	HSH1001	0.90	MJ2950	0.49	SL1310	3.14	TA7080	1.74	TD1006A	2.21	TD126	0.73
2N3703	0.18	25C2565	1.25	AN5610	5.50	BC479	0.41	BU197	0.18	BU216	1.08	HMS232	5.25	ML232B	3.01	SL414	6.57	TA7054	0.80	TD1011	0.95	TD137	1.50
2N3705	0.16	25C2565	3.22	AN5612	4.20	BC532	0.28	BU198	0.17	BU217	0.18	HM6251	5.25	ML237B	2.51	SL432A	3.44	TA7060AP	0.71	TD10110	1.28	TD129	0.84
2N3706	0.14	25C2570	2.08	AN5613	4.20	BC546	0.08	BU199	0.17	BU218	0.17	HM6251	5.25	ML238	5.77	SL439	2.48	TA7060AP	1.27	TD1011A	1.03	TD129	0.84
2N3707	0.16	25C2577	1.60	AN5630	3.95	BC547	0.10	BU200	0.37	BU219	0.37	HM6251	5.25	ML923	3.00	SL471	2.50	TA7069	3.13	TD1028	2.45	TD129A	0.46
2N3711	0.13	25C2678	6.75	AN5710N	1.66	BC648	0.12	BU210	0.36	BU219	1.62	HM9032	3.92	ML923	3.98	SL480	3.98	TA7079P	1.83	TD1034B	2.42	TD129B	0.63
2N3717	0.70	25C2871	1.90	AN5745	1.60	BC649	0.12	BU211	0.36	BU220	1.17	HM9032	3.92	ML923	3.98	SL480	3.98	TA7079P	1.83	TD1034B	2.42	TD129B	0.63
2N3772	1.00	25C2871	1.85	AN6300	4.40	BC650	0.10	BU227	0.46	BU220	0.46	HT2407	20.16	MMS316N	9.16	SL818A	6.57	TA7074P	1.96	TD1035I	1.80	TD129	0.75
2N3773	2.71	25C3153	6.84	AN6310	4.54	BC656	0.10	BU240	0.17	BU210-400	0.19	HT4207	17.65	MMS316N	9.16	SL918A	6.57	TA7076P	1.96	TD1037	1.95	TD1305	0.75
2N3819	0.54	25C372	1.40	AN6340	10.14	BC657	0.10	BU241	0.15	BU210-600	0.27	KA2010	2.92	MMS369N	2.01	SN16861A0	2.96	TA7089P	2.82	TD1037A	2.05	TD130A	0.40
2N3823	1.17	25C373	1.16	AN6341	1.43	BC658	0.10	BU245	0.10	BU210-800	0.30	KC581C	7.60	MC1882AAN	6.20	SN16862AAN	2.96	TA7092P	8.65	TD1044	1.95	TD130C	0.40
2N3904	0.62	25C383	1.60	AN6353	1.60	BC659	0.10	BU246	0.09	BU218	1.45	MC1582C	3.97	MMS3941N	6.64	SN16866N	3.06	TA7093P	3.99	TD1044P	1.35	TD131A	0.34
2N3906	0.62	25C388	0.60	AN6353	1.95	BC660	0.14	BU246A	0.14	BU219	1.23	MC1582V	3.97	MMS3941N	6.64	SN16866N	3.06	TA7093P	3.99	TD1044P	1.35	TD131A	0.34
2N4101	0.30	25C3951	1.81	AN6351	1.80	BC661	0.25	BU247	0.25	BU220-400	0.80	MC1582V	3.97	MMS3941N	6.64	SN16866N	3.06	TA7093P	3.99	TD1044P	1.35	TD131A	0.34
2N4140	0.30	25C403C	0.60	AN6552	0.68	BC636	0.28	BU256	0.38	BU226	0.25	LA1210	1.33	MN1435V	12.40	SN29715N	6.04	TA7109	3.71	TD1060	2.60	TD132A	0.30
2N4444	0.99	25C458	0.15	AN6610	2.60	BC637	0.24	BU257	0.24	BU227	0.20	LA1210	1.05	MP1192	5.07	SN29722	11.95	TA7122B/P	0.92	TD1082	3.25	TD132B	0.30
2N5293	0.50	25C455	0.92	AN7111	1.25	BC639	0.20	BU258	0.36	BU228	0.36	LA1210	1.05	MP1192	5.07	SN29722AAN	11.95	TA7124P	2.34	TD1151	1.22	TD132C	0.30
2N5294	0.50	25C515A	2.85	AN7115	3.38	BC640	0.24	BU259	0.34	BU229	1.00	LA1370N	2.87	MP2812	5.07	SN29724AN	11.95	TA7129P	1.50	TD1190	1.21	TD133	0.30
2N5295	0.60	25C535	0.79	AN7165	1.68	BC641	0.18	BU262	0.28	BU229-500	0.92	LA1353	1.05	MP2812	1.57	SN29724AN	11.95	TA7129P	1.50	TD1190	1.21	TD133	0.30
2N5297	0.60	25C535	0.79	AN7165	1.68	BC641	0.18	BU262	0.28	BU229-500	0.92	LA1353	1.05	MP2812	1.57	SN29724AN	11.95	TA7129P	1.50	TD1190	1.21	TD133	0.30
2N5298	0.61	25C537	0.54	AN7151	2.37	BD116	0.70	BU271	0.31	BU255-400	1.03	LA1365J	2.80	MP256C	0.80	SN29727BN	1.95	TA7137P	0.73	TD1235	3.88	TD134	

★ HIGH QUALITY VIDEO SPARES ★

(FAST EX-STOCK)

AKAI
Machine Nos.: VP77 VP88 VP1700 VP7200 VS1 VS2 VS3 VS5
VS10 VS9300 VS9500 VS9700 VS-P1 VS-P5

AMSTRAD
Machine Nos.: VCR4500 VCR5200
Machine Nos.: VCR7000
VCR4600 VCR9000

FERGUSON/JVC
Machine Nos.: 3292 8903 3V00 3V01 3V06 3V16 3V22 3V23 3V24
3V29 3V30 3V31 3V35 3V36 3V38 3V39 3V49

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

GEC
Head Part Nos.: 5458161 5458165
Machine Nos.: 4000H 4001H 4002H
Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: 4001H 4004H

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

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

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

JVC (see also Ferguson)
Machine Nos.: HP4000 HR2200 HR3300 HR3320 HR3330 HR3350
HR3360 HR3660 HR3750 HR3860 HR4100 HR7200 HR7600
HR7610 HRD110 HRD111 HRD120 HRD121 HRD140 HRD150
HRD220 HRD225

MITSUBISHI
Machine No.: HS200
HS7008

NATIONAL PANASONIC
Head Part Nos.: VEH0099 0103 0115 0121 0131
Machine Nos.: NV300 NV322 NV332 NV333 NV340 NV380 NV2000
NV3000 NV7000 NV7200 NV7500 NV7800 NV7850 NV8170
NV8200 NV8400 NV8600 NV8610 NV8620

Head Part Nos.: VEH0171 VEH0218
Machine No.: NV370 NV3708
Head Part Nos.: VEH0171
Machine No.: NV330 NV777

Head Part Nos.: VEH0286
Machine No.: NV430
Head Part Nos.: VEH0174
Machine No.: NV366

SHARP
Head Part Nos.: DDRMU 0002 HE172127
Machine No.: VC5812/3 651 681 2/3/5 659 699

Head Part Nos.: DDRMU 0001 HE00 0002 HE02 04 05 06
Machine No.: 2C9 VC110 VC200 VC220 VC300 VC381 VC384
VC386 VC387 VC388 VC477 VC481 VC482 VC930 VC970 VC3300
VC9100 VC9300 VC9400 VC9500 VC9600 VC9700

Head Part Nos.: DDRMU 0001 HE09
Machine No.: VC7300 VC7700 VC7750
Head Part Nos.: DDRMU 0001 HE10
Machine No.: VC6300

Head Part Nos.: DDRMU 0001 HE12
Machine No.: VC8300
Head Part Nos.: DDRMU 0001 HE14
Machine No.: VC2300

SANYO
Head Part Nos.: 1430242 T01700 1430242 T22300
Machine No.: VTC5000 VTC5150 VTC5300 VTC5400

Head Part Nos.: 1430242 T02200
Machine No.: VTC5350 VTC5500
Head Part Nos.: 1430762 T02000
Machine No.: VTC9300 VTC9455 VTC9500
Head Part Nos.: 143072 T02100
Machine No.: VTC9300PS VTC9350

SONY
Head Part Nos.: A6762 044A, 044B, 054A, 147A
Machine No.: SL3000, 8000, 8030, SLT 6Me, 7, 7E, 7ME
Head Part Nos.: A6762 012A, 038A, 055A, 129A
Machine No.: SLSW, 5000 5100 SLC5, C6, C7
Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A
Machine No.: SLC20, C30, C33, C40, C44
SLF1, F30, HF72, HF100, T20, T30

HEADS		Price
Head	Part No.	1 +
BETA A		£24.50
BETA B		£22.50
BETA D		£39.50
BETA E		£42.95
BETA T		£30.85
BETA W		£28.99
BETA X		£39.50

VHS VIDEO		Price
VHS A		£21.50
VHS B		£21.50
VHS C		£26.95
VHS D		£83.00
VHS E		£76.38
VHS F		£83.10
VHS H		£25.99
VHS I		£24.50
VHS K		£24.50
VHS L		£82.95
VHS M		£25.99
VHS N		£35.99
VHS P		£25.99
VHS R		£26.95
VHS S		£26.95
VHS T		£25.99
VHS U		£26.95
VHS V		£35.99
VHS W		£28.25
VHS X		£42.35

ORIGINAL FERGUSON		Price
01X0 003 222		£31.35
01X0 027 085		£46.02
01X0 033 825		£47.05
01X0 040 002		£48.32
01X0 056 013		£61.55
01X0 057 002		£31.36
01X0 082 001		£46.02
01X0 083 063		£66.03

PHILIPS		Price
310 274 44	POA	
691 200 54		£49.68
691 200 98		£62.02
691 201 12		£61.66
691 201 66		£61.93
691 201 78		£49.96
691 202 87		£55.37

FERGUSON/JVC		
VID1	01X0-003-381	Tension band T3292/PU545904A 2.55
VID2	01X0-018-024	Take up idler T3292/PU47752 5.00
VID3	01X0-018-025	Rewind idler assembly T3V16/PU49282 6.20
VID4	01X0-018-729	Take up idler T3V00/PU49280 6.95
VID5	01X0-040-006	Loading belt T3V29/30/PU48941-2 0.50
VID6	01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042 4.50
VID7	01X0-040-007	Take up idler 3V29/30/PU48967B 2.90
VID8	01X0-040-017	Reel motor assembly 3V29/30/PU51381V 27.95
VID9	01X0-065-009	Capston motor 3V35/36/38/39/PU55371V 27.00
VID10	01X0-065-016	Cass. housing Assy. 3V35/36/38/39/PU29825 27.00

GEC/HITACHI		
VID11	V577355	GEC 4100/Hitachi VT11E capston motor 21.90
VID12	V6413663	GEC 4000/Hitachi VT33 f/w rewind arm 2.10
VID13	V6861471	GEC 4001/2/Hitachi 93/9500 f/w rewind arm 1.70
VID14	V6861482	GEC 4001/2/Hitachi 93/9500 play idler Assy. 4.75
VID15	V6886971	GEC 4004/Hitachi VT33 f/w rewind arm 1.80
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VS 1	2 DBK134	HR 3360	7 DBK103
VS 2 EG	5 DBK101	HR 3600	7 DBK107
VS 3	2 DBK134	HR 3660	7 DBK103
VS 5 EG	6 DBK101	HR 4100	7 DBK127
VS 10	2 DBK136	HR 7200	3 DBK139
VS 9300	7 DBK103	HR 7600	3 DBK138
VS 9500	7 DBK103	HR 7650	3 DBK132
VS 9700	6 DBK102	HR 7700	3 DBK108
VS 9800	7 DBK103		
		NATIONAL PANASONIC	
		NV 300	5 DBK110
		NV 330	5 DBK110
		NV 777	4 DBK131
		NV 2000	5 DBK109
		NV 3000	6 DBK113
		NV 7000	5 DBK111
		NV 7200	5 DBK140
		NV 8600	7 DBK112
		SHARP	
		VC 381	4 DBK116
		VC 383	4 DBK116
		VC 385	4 DBK116
		VC 388	4 DBK116
		VC 6000	5 DBK117
		VC 6300	5 DBK117
		VC 6500	5 DBK117
		VC 7300	5 DBK117
		VC 7700	5 DBK118
		VC 7750	5 DBK118
		VC 8300	5 DBK119
		VC 9300	5 DBK120
		VC 9500	5 DBK120
		VC 9700	3 DBK121
		SONY	
		SL 8000	6 DBK115
		SL 8080	6 DBK115
		SL 8500	6 DBK115
		SL 8600	6 DBK115
		SLC 6	6 DBK100
		SLC 7	6 DBK100
		SLC 9	6 DBK130
		SLJ 7	6 DBK100
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VCR Clinic

Reports from Nick Beer, John Coombes, Eugene Trundle, Philip Blundell, Eng. Tech., Alfred Damp, Mick Dutton, B. Ross and Dave Dulson

Ferguson 3C03

This autofocus VHS-C camcorder came in with the complaint that the autofocus didn't work. It could well have been something to do with the fact that the focus ring was cross-threaded and was consequently seized solid. The fact remained however that the camera head wouldn't work at all. In the record or monitor modes there was only a blank raster, and there was no power zoom, autofocus etc.

On investigation we found that there was no output from the camera's d.c. to d.c. converter, though the specified input was present. The outputs can be switched off of course, this being carried out by the syscon. When the unit is being used for playback for example the camera head is switched off to save power and prevent accidental damage to the pick-up tube.

The control line comes from pin 24 of the microcomputer control chip IC401. It was found to be permanently low. It should be high in the record and monitor modes and low in playback. The line follows a fairly elaborate path through various connectors, and a fair amount of time was spent checking around. Eventually we came to the conclusion that the microcomputer chip itself was faulty, and a replacement put everything right. The camera was then realigned. Considering that it was under guarantee it was quite a way out – even taking into account the new lens we had to fit. **N.B.**

Panasonic NV-M7/VW-CG1

The fault here was in the character generator/special effects unit which comes as part of the £1,300 package. Its owner of one week complained that although the titling worked the clock and calendar didn't. Dismantling was, as with this company's VCR remote control units, a matter of well timed pokes at the side of the case. With this type of click fit you rarely get away without damaging the case, and I think that at this price a better method should have been used. However, to the fault. We could see that the title/date switch is connected directly to four pins of IC1. The appropriate pin, 31, was dry. As you might expect, this chip is a surface-mounted device. **N.B.**

Ferguson 3V58

This hi-fi machine was completely dead – no clock or anything. After checking the obvious fuses I decided to check for an open-circuit primary winding on the mains transformer, having had this fault previously in one of these machines. It was intact, as were all the secondary windings. A check at the plug that connects the regulator PCB to the transformer then showed that the unregulated 45V supply was missing. The cause was neither an open-circuit safety resistor (R2) nor the rectifier diode (D4) but the reservoir capacitor C5 (4.7µF, 63V). It read about 10Ω! I've had this fault several times now. **N.B.**

Panasonic NV777

This was a very confused machine! It would accept commands with no cassette in, and only rewind actually worked. It would go into fast forward but wouldn't go far enough to drive the reel. In the play mode it would only

half lace the tape. After watching the mechanism for a few cycles I checked the alignment and timing. The main cam was miles out and when it was removed I could see why – it was stripped and lots of plastic "blips" were rolling around in the mechanism. A new cam was fitted and aligned, with the mechanism and mode switch as per the manual – don't forget that this is for the stop mode, not eject. **N.B.**

Ferguson 3V30/JVC HR7300

About two days after publication of my article on back tension (August) this machine was sent in with the suggestion that the heads had failed. Sure enough the picture was all but obliterated, but the heads weren't duff. There was inadequate back tension, in fact virtually none, the clue being provided by the spooling of the supply reel. The cause of the fault was a snapped soft brakeband. **N.B.**

Panasonic NV7200

For failure to record, check the voltage at pin 9 of the f.m. modulator IC3001. If 9V is present check Q3003. **J.C.**

Panasonic NV7200

The symptoms were no channels, no E-E signals and no capstan operation. We found that the 45V supply at pin 5 of P1003 and pin 4 of P1002 was missing. Checking back revealed that R1019 (120Ω) was open-circuit. **J.C.**

Mitsubishi HS300

"Cannot tune" said the job card. In fact the tuning line was stuck at 30V regardless of the settings of the tuning potentiometers. It's a pity that we didn't try them all, because if we'd selected spare programme button six and twiddled its preset it would have worked. The problem was due to leakage in D7A5 (1S2076A), the programme no. 6 isolation diode. We found it after a lengthy foray inside the machine. **E.T.**

Grundig VS310, VS380

Replace tape guide 149/27123-270.00 if a strip is sliced off the tape. **P.B.**

Ferguson 3V54

The fault report was no colour and sure enough a test tape played back in monochrome. Checks revealed that the playback chroma was leaving the colour module for the delay line at the correct amplitude, but was distorted when it returned. This distortion can best be described as a colour-bar waveform with two sets of bursts and chroma in the white bar, seen at the composite video output socket. As this waveform was also present at the output from the delay line the latter was replaced. This did no good and a lot of time was then spent checking the components around the delay line, all to no avail. Replacing the chroma module didn't improve matters either.

At this point I did what I should have done to start off with – I made a recording and played it back. As expected there was no colour, but the head switching point must

have been some thirty lines before the field sync. A double check with a prerecorded tape proved that the playback switching point was correct, so now we had two problems, no colour and an incorrect record head switching point.

Attention was next turned to the servo circuit, where the capstan servo was found to be unstable. When the shield over the drum assembly was removed the drum was seen to be running slightly too fast. Assuming that the machine was working correctly before the colour was lost, something was causing four symptoms: no colour, an unstable capstan (not audible though), the drum running too fast and the record head switching point incorrect. In the hope that these were all related we decided to tackle the servo fault. Now the only common factor in the drum and capstan servos is the 4.43MHz reference signal, which is derived from the chroma module. Ah! A check with a frequency counter revealed that the frequency was 4.4764MHz instead of 4.43MHz. Replacing the 4.43MHz crystal cleared all the faults.

Why was the chroma waveform coming out of the delay line so distorted, with two sets of bursts? My theory is as follows. With the drum rotating too fast the time the heads took to read the video tracks was shorter than the delay line's preset delay. Since the direct path signal was faster than the delay period, the direct and delayed signals would not overlay exactly in the adding circuit. Has anyone any other theories? On the circuit diagram the delay line is referred to as a comb filter, with no details as to what goes on inside.

A.D.

Akai VS4

There was no screen clock and the machine couldn't be tuned. The only characters displayed on the screen could best be described as a child's drawing of a house. Both faults were cured by replacement of the MB88303 character generator chip IC2.

A.D.

Hitachi VT120

This machine had no fluorescent display, though a faint glimmer could be seen if all the workshop lights were extinguished. Checks around the display driver/timer chip showed that the -30V supply was missing. This comes from the visual search board where we found an open-circuit circuit protector.

A.D.

Matsui VX820

The complaint was no operation and no clock display. We checked that all outputs from the transformer were present then followed the wiring down to the power supply chip on the main panel. There was a burn mark under transistor Q02, as if it had been overheating. It appeared to be a 12V regulator. Fitting a replacement put matters right.

M.D.

Mitsubishi HS307

There was no drum rotation. When we removed the top we found evidence of liquid spillage. This had rotted the connections to connector MA.

M.D.

Panasonic NV850

This one came from the local air base with the complaint that it was dead. The problem, which is a common one, was that C1101 (3,300 μ F, 16V) had failed. Unfortunately the power supply had received considerable attention and

when we switched on the mechanism started to oscillate in an alarming way while the clock display took thirty seconds to appear. The cause of this trouble was that a 6.2V zener diode instead of a 6.8V type had been fitted in position D1105. As a result the regulated line was slightly low and the timer and mechanism control microcomputer chips failed to initialise properly.

M.D.

Hitachi VT5000

This golden oldie had no playback chroma. We traced the chroma signal through the playback circuitry and found that there was no 5.06MHz signal at pin 16 of IC204. Further checks showed that there was no sawtooth waveform at pin 10. C275 (0.047 μ F) turned out to be leaky. It's of the shiny green type found in many mono-chrome portables.

M.D.

Panasonic NV333

The tuner didn't work because there was no 30V supply to the tuning potentiometers. The 30V stabiliser IC7001 was short-circuit.

M.D.

Grundig 2 x 4 Super

Whilst one of these machines was in the workshop we noticed that the operation of the handset was intermittent. Flexing the unit had some effect, and we envisaged dry-joints. During the fault we found that the battery voltage fell from 6V to 2V, which we assumed to be due to poor internal contact between the cells. We've since had one other case. Both these units still had the original battery fitted. Replacement batteries of different manufacture do not seem to have this problem.

B.R.

Fisher FVHP520

This machine would wind fast forward but there were no other deck functions. The cause was at first thought to be a keyboard or system control fault, but subsequent checks ruled these out. A mechanical fault seemed likely therefore. Turning the machine on its side and pressing play proved fruitful as it then worked. The cause of the trouble then became apparent: the loading belt was slipping. Fitting a replacement restored normal operation.

D.D.

Panasonic NV730

The fault report stated that the machine would work for a short while then stop. So we put it in play and soak tested it. After an hour the fault showed: the machine unthreaded and switched off. When it was tried again in play the machine threaded up then the capstan motor shaft oscillated, after which it unthreaded and switched off again. Voltage checks proved that the AN3822 capstan motor drive chip IC2004 was faulty.

D.D.

Panasonic NV370

This machine was totally dead, with no clock or channel displays and no deck functions. Voltage checks on the right side power supply confirmed that this was operating correctly. The next checks were made in the power supply section of the main panel, where we discovered that the 5V rail was missing because R1001 (0.39 Ω) was open-circuit. This resistor feeds the collector of the 5V regulator transistor.

D.D.

Hi!

Les Lawry-Johns

Greetings not only from me but also from Rick Kinslow of the Medway Towns. He wants to be remembered to all his friends who used to work so well together at Southern Rentals (Hove and Brighton) in the old days.

Problem Fidelity

I'd like to thank David Botto for his article on the Fidelity ZX3000 chassis in the September 1986 issue. As you know, I've been a bit muddled for some time now. When I was trying to fix this CTV22R with the ZX3000 chassis I couldn't concentrate properly at all – the set just kept blowing the h.t. fuse and the BU426A chopper transistor as soon as I switched it on.

I thought I'd checked just about everything – I'd changed all the obvious components. Then, in the end, I took time off to go through my back issues. At last I came to David's article, where he drew particular attention to R91 (270k Ω) which is connected to pin 4 of the TDA4600 chopper control chip. I'd run the meter over this item, but I hadn't disconnected one end. When I did I found that it was open-circuit. A new one was fitted as quick as a flash, along with a new BU508A (I'd run out of BU426As).

With a new fuse in place I switched on again, averting my eyes – the flash when the fuse had blown previously had not been very pleasant. This time there was no flash. The set started up and a nice picture appeared. Years ago I

would have remembered reading about that, but lately I've been re-reading some of my own articles and wondered just how I wrote them. I seem to have forgotten so much except what occurred forty or fifty years ago, and that's not much good to me now. At least I don't think it is.

Shortly after the above incident a Fidelity CTV14R (ZX2000 chassis) came in. It wouldn't start up. It was also in a bit of a mess, and someone had fitted a pair of resistors in series to take the place of R801 (18k Ω). This resistor, with the 12V zener diode ZD5, provides a stabilised supply for the emitter of the chopper driver transistor and the TDA2581 chopper control chip. It wasn't until I'd fitted a proper wirewound resistor in place of the two series resistors that the set started up and worked properly. This despite the fact that the "faulty" resistors seemed to measure right and ran quite warm. Oh well . . .

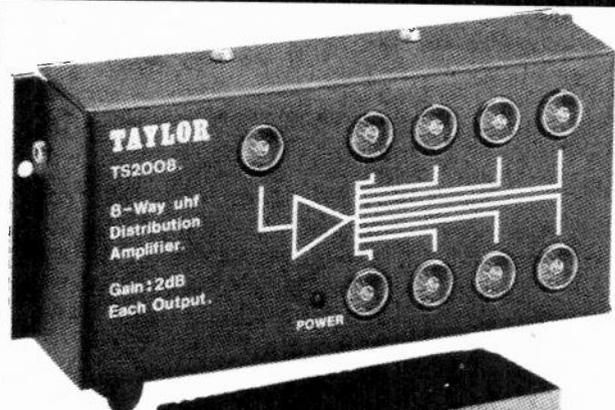
The Fry Up

Eddie Fry came in with his set. His wife is French so we call him French Fry. A bit naughty perhaps but it seemed reasonable to us (HB and me). His ITT CVC5 had been going well but had then just given up. He said the picture had come in from the sides, jumped back out again, then the set had gone off. He also said he'd be back later.

So I whipped off the rear cover and checked all the usual things – the fuse in the h.t. supply to the line output stage, the boost capacitor, etc. Then I noticed that one end of the line output valve's screen grid feed resistor R421 (2.7k Ω) was free. I soldered it up and switched on. The h.t. came up all right but there was no life from the line output stage after several minutes' warm up. A voltage check revealed that there was no voltage at the line output valve's screen grid: so the resistor I'd soldered up was open-circuit after

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all. This aroused my suspicions, and I accused the PL509 of having an internal short. The excess current passing through the resistor must have melted the solder just before the resistor itself had given up. When the resistor was removed there was a black mark on its side. A nice new 2.7kΩ resistor and a new PL509 restored normal operation and a very good picture – I never stop to marvel at the goodness of the tubes fitted in these sets, after all the years of service they've given. The 22 and 26in. tubes seem to last for ever.

Why no sound? Well, if you remember your ITT hybrids, the sound output stage is muted until the line timebase gets going.

The Thorn 8000

This one came in about an hour ago. Its owner, Mr. Cheapskate, said he was willing to pay up to a fiver on it. So I told him to take it away. He laughed and said he was only joking.

I switched it on and it tripped like mad. With the e.h.t. rectifier unit disconnected from the line output transformer

it continued to trip. I lowered the right side (looking from the rear) timebase unit and tried again. This time I saw smoke rising from the 3.3kΩ resistor in series with the rectifier that provides the supply for the c.r.t.'s first anodes. I looked at the associated 0.047μF, 1kV white capacitor (C401). This item has always given up easily. I fitted a replacement and ran the set up again. A perfect picture appeared and Mr. Cheapskate was delighted.

"There you are then" I told him. There's your £5 job. Now take it away before I look at the set properly.

Post Strike

The post strike was still on while this issue was being prepared. I wondered what the editor would do if he received nothing in the post? What he could do is to reprint some of the better of the old pieces, a request that several readers have made. I wonder how it would go down? In the end the editor's inestimable assistant Tessa took this all down over the phone. Why didn't I Fax it? Well these newfangled machines are not all that thick on the ground yet in this neck of the woods.

Blanking Pulse Generator Circuit

John de Rivaz, B.Sc. (Eng.)

Those still using sets fitted with the Rank A823 series chassis will have noticed that over the last few months white lines have appeared at the top of the screen — the effect is particularly noticeable on Channel 4. These lines are caused by additional text services introduced for closed user groups. They benefit the viewer only in as much as the charges made for the new services contribute towards the cost of the broadcasting services.

One possible way of removing these lines would be to modify the field timebase to produce a faster flyback, but this would undoubtedly put strain on components that weren't originally designed to withstand the changed conditions. An alternative approach was therefore tried.

Circuit Description

A simple two-transistor monostable multivibrator circuit that provides a positive-going pulse of sufficient duration to blank out the unwanted text signals was designed and built. The circuit is shown in Fig. 1. R1 was added to prevent instability, and the value of R2 may need to be selected to obtain a long enough output pulse. You could use an 0-20kΩ potentiometer to set this up. Reduce the value of R3 if the blanking is insufficient.

Since the two transistors operate as switches a collector load resistor for Tr1 didn't seem to be necessary. If the transistor used in this position is slightly leaky however a load resistor connected to the positive side of the supply may be required. Hopefully the value shouldn't need to be less than 100kΩ. A BC384L or similar transistor is suitable in the npn position and a BC212L or similar device can be used in the pnp position.

The circuit was powered from the A823 chassis' 18V rail, which is convenient as this is used by the field timebase. The input pulse for the circuit was tapped from the collector of the upper BD131 transistor in the field output stage (5VT11 on the A803 panel used in earlier versions of the A823 chassis, 5VT9 on the A802A panel

used in the A823A and later versions of the chassis).

R3 and the 1N4148 diode should be mounted at the input to the luminance delay line, with a wire running from them to the timebase board. The diode is reverse biased via Tr2's collector load resistor when the blanking pulse is not present. Thus when Tr2 is off the existing luminance circuitry is loaded only by the diode's capacitance, which is negligible. The new circuit can be made using a tagstrip or piece of Veroboard fitted with stiff wires to the 18V supply smoothing electrolytic (5C24 on board A803, 5C36 on board A802A).

To avoid unnecessary disturbance to the picture, the blanking pulse is wide enough to only just remove the unwanted lines. Some of the teletext lines and the pulse and bar test signal remain in their usual positions off the top of the screen. The effect of adding the pulse is to shift the video signal in a positive direction: as the circuit is d.c. coupled at this point this action is sufficient to blank the screen.

Other Sets

Other old sets that suffer from this problem could be modified in a similar way, though the circuit may have to be arranged the other way up to provide negative-going pulses if these are easier to apply to the video circuitry.

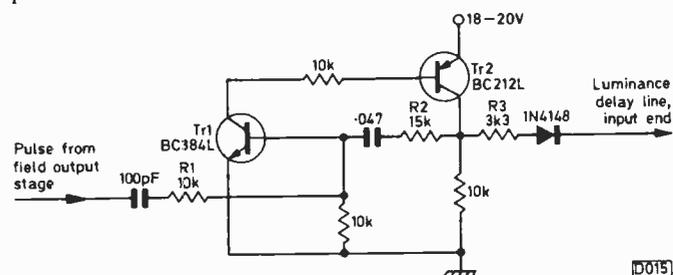


Fig. 1: Pulse generator circuit to provide field flyback blanking pulses in the Rank A823 chassis.

TV from the Astra Satellite

Roger Bunney

Sky Television broadcasting from the Astra satellite is due to start next February. Whether this aim is fulfilled depends on Astra's launch date, which has already been postponed twice. The latest announcement from its owner SES (Societe Europeene des Satellites) suggests that the launch date will be in December instead of November. An Ariane 4 launch vehicle will be used. The cause of the latest postponement is a delay in the Ariane launch programme due to problems with the French TDF-1 satellite, which is due up first.

Basic Parameters

If all goes well Astra will be placed in orbit at 19.2°E. It will have a 16-channel capacity plus six spares. The channel bandwidth is 26MHz, the 45W travelling-wave tube output amplifiers providing an e.i.r.p. of 52dBW in the primary service area. Fig. 1 shows the coverage – the e.i.r.p. falls to 44dBW at the outer contour. The signal level in the centre area should allow noise-free reception with a "basic" receiver and 0.6m dish.

SES is a private company based in Luxembourg. It's leasing the channels, which will be financed mainly by

advertising, to Sky and other broadcasters. Some channels intended for subscription viewing will have partial scrambling but most will be clear. Fig. 2 shows the channel frequencies and polarisation – horizontal or vertical. The design assumes 24-hour operation of the transponders, the total power consumption being 2.31kW. There's full eclipse protection. Output power variations due to uplink signal variations produced by rain attenuation etc. are minimised by using special limiting driver amplifiers. Up to four sound subcarriers allow for bilingual transmissions or stereo sound. The uplink band is 14.25-14.5GHz, downlink transmissions being at 11.2-11.45GHz. A three-axis type stabilisation system is used, the station-keeping accuracy being $\pm 0.05^\circ$ EW and NS. The satellite's expected lifetime is ten years.

For at least eight channels the uplinking will be from SES's control building at Betzdorf. Other uplink sites in Europe will be approved. There's already considerable competition between manufacturers who have announced receiving equipment at under £200, but existing TVRO equipment will also be suitable. F.M. video modulation will of course be used, with transmissions generally to the 625-line system B/G/1 standards with PAL colour.

The satellite itself, type 4000, has been made by RCA Astro-Electronics. It has an orbital weight mass of 1,045kgs.

Performance

To achieve specific standards with a domestic installation, certain parameters have been laid down by SES. With an 0.85m dish and an LNB with a noise figure of 2dB, a picture quality of four on the CCIR five-grade scale should be available for 99.5 per cent of the time in central Europe, allowing for the worst possible weather. Grade 4 is "good", representing a signal/noise figure of 43.4dB (carrier/noise ratio 12.6dB).

Installation

Installation costs of around £40 have been suggested in the press, though at least one major satellite house has suggested that a figure of £70, inclusive of VAT, would be more realistic. Basic models will be intended for single-satellite reception, where greater care and precision are necessary to obtain optimal alignment with the orbital slot. So even an experienced installer isn't likely to be able to complete more than three-four jobs a day, not allowing for travel to distant sites. Polar mount dishes are likely to be available at extra cost, enabling a simple drive system to be fitted to give access to other satellites.

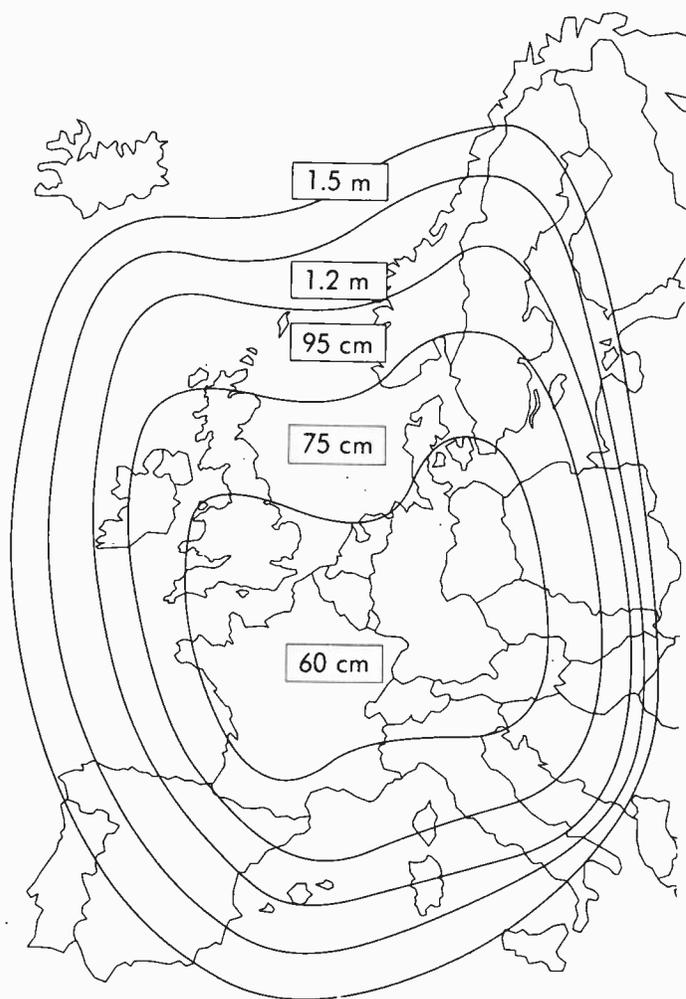
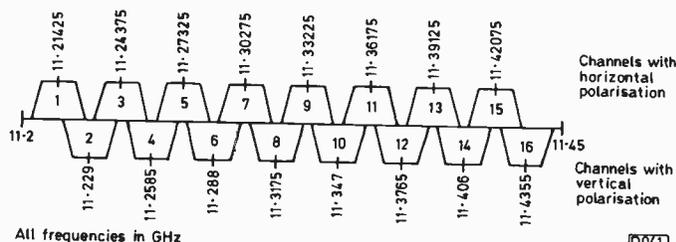


Fig. 1: Typical dish size guide for individual home reception of channels 3, 7, 11 and 15. The contours vary somewhat for the four groups of four channels.



All frequencies in GHz

Fig. 2: Channel frequencies and polarisation.

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GRUNDIG VS310

There's an annoying sound problem with this machine: when it switches into the record mode a "pop" is recorded on the audio track. I've tried increasing the value of C1346 to slow down the bias/erase oscillator turn on, but this has had no effect. In fact the disturbance is just as noticeable when the oscillator is disabled. I assume that the cause is connected with switching of the supply rails to the TDA5651 chip IC1320 on the sound board.

The sound channel should be muted at record start by the action of C1373 (1 μ F, 150V). Check this capacitor, its connections and that the +F supply is reaching its positive terminal. You may find that an improvement is obtained by starting from record-pause rather than stop. If this gives too long a gap in the sound track the official recommendation is to reduce the value of C1373 to 0.47 μ F.

FERGUSON TX10 CHASSIS

This set keeps tripping. At switch on sound and vision appear for about ten seconds, then the set starts to trip off and on, with the sound and vision coming up each time. The disconnections suggested in the manual have been tried without success so there doesn't seem to be any overloading. A check on the h.t. reveals that this rises above the correct 150V each time – to around 170V. The set h.t. control has no effect.

In view of the high h.t. and the fact that sound and vision appear on each pump cycle there's no doubt that the over-voltage trip is operating. We strongly suspect that the h.t. sampling/feedback resistor R813 is open-circuit.

SHARP VC7300

This machine won't rewind three-hour tapes completely. It rewinds normally until fairly close to the end of the tape, then suddenly slows right down and cuts out. The rewind belt can be seen to be slipping when the machine is viewed from the under side, with the panels in the service position. Replacing the belts, rewind gear and reel disc has failed to solve the problem. It seems that the brake is being applied too soon. Just occasionally the machine will rewind one of these tape completely. I'm told that the trouble has been present from new.

It's unlikely that the syscon is permitting the reel brake to come on while rewind is in progress. Ensure that both turntables spin freely and that the friction from the "soft" brakes is not excessive. Use an empty cassette shell to get the machine in rewind, with no tape reels present, then feel the torque on the left-hand one and the friction on the right-hand one. If the rewind torque is insufficient, check the friction on the rewind belt pulleys.

GRUNDIG 8635

Close inspection shows that when the set is switched on the picture has a faint, narrow vertical red line about four inches from the left-hand edge of the screen with, one inch to the right of this, a very faint vertical striation. After about fifteen-thirty minutes a dark patch appears in the same left-hand position, extending about three inches from the top of the screen. This increases until it covers an area about half an inch by five-six inches. The patch varies with beam current. I've made extensive checks in the line output stage and changed the tripler but not the line output transformer. Lead dressings have been checked and altered to no avail.

Ensure that the ferrite frames of the commutating and line output transformers are not broken or damaged. Other than this it's very unlikely that the output transformer is responsible. Closely examine the set while it's operating in total darkness for signs of discharge or corona. If these checks show nothing, try the effect of adding ferrite beads on the anode leads of the line output thyristors and the cathode leads of the associated diodes (if fitted – the diodes are encapsulated with some of the thyristor types used).

SHARP VC9300

This machine suffers from intermittent loss of colour about two hours into one of its own recordings. I've checked the crystals in the colour circuitry by substitution and also for tuner drift.

Use a baseband input (from a bar generator etc.) to check that the problem is not due to tuning drift. If the baseband recording is o.k., make sure that R908 is 2.7k Ω – if not, fit this item. If the symptom is unchanged when a baseband input is used, change C543 to part no. RC-QZA102TAYJ or VCQCSH1HM102J and C539 to part no. VCCUPA1HJ181J, then reset the crystal oscillators.

PHILIPS G11 CHASSIS

The picture is distorted by sideways picture slip, as though it's seen through reeded glass. It's not line slip, nor is there any sound on vision. A check with a second set has proved that the aerial system is in order. The symptom varies with picture content, though not in an obvious way.

We suspect faulty decoupling on either the i.f. or the line timebase panel. Check especially the electrolytics, by bridging a good 100 μ F capacitor across each in turn, especially C10 on the i.f. panel and C1 on the timebase panel.

GRUNDIG 6632

The problem with this remote-control set is that with each change of scene there's a gap in the sound, whole words being lost.

As with most remote-control systems, the sound in this

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set is muted at the instant of channel change – this is done to prevent noise interference in the audio channel. The action is effected between pin C8 on the self-seek module and pin 10 of the sound i.f. module. We suggest you check C2218 on the sound i.f. module and R1408 and Di1408 in the self-seek module. If these are in order it would be best to obtain an exchange self-seek module.

TEST CASE

311

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.

Tatung is a relative newcomer to the business of making and selling TV sets in the UK, but since taking over the Decca operation the firm has been successful despite the difficult market. Certainly Tatung has been successful with the buyer for the shops served by the Test Case service department! The warehouse is stacked out with Tatung products, some of which appear from time to time on the workbench.

The subject of this month's puzzle is a set fitted with the Tatung 170 series chassis. The plaintive voice on the phone described the fault as a "milky picture". Could we attend to it at home? We could indeed. Speedy Gonzales was despatched with all haste, and with half a dozen other calls.

When he arrived he found that the picture was indeed flat and milky. With this chassis there's no on-board contrast control – adjustment is made via the remote control unit, the setting being memorised within the receiver. There was virtually no response when the handset's contrast up key was operated, though all the other functions operated correctly. This gave Speedy something of a problem – he would have been happier with a conventional contrast control, with a carbon track and an analogue voltage coming out of it! After an unsuccessful search in his spares box for such exotica as a TDA3035 CITAC chip, the device that interfaces the digital and analogue parts of the control circuit and seemed to be the most likely culprit, he brought the set into the workshop.

The set soon took its turn on the workbench, with the fault still solidly present. The bench man started with a quick read-up of the circuit description given in the service manual. He discovered that the contrast control action did indeed centre of the TDA3035 chip, whose contrast control output voltage at pin 25 should move up and down in accordance with the information it receives via the I²C serial data bus from the MAB8441 microcomputer chip IR01. Yes, an analogue contrast control potentiometer would have been easier to deal with! There's little point in

trying to analyse the data on the I²C bus with ordinary test equipment. Instead, the bench man concentrated on the contrast control voltage at pin 25 of the CITAC chip. He found that this varied over a range of several volts as the remote control unit's contrast up and down buttons were pressed. It could certainly be set to the figure of 5.5V shown on the circuit diagram.

On then to the TDA3562A PAL decoder chip's contrast control input pin. According to the circuit diagram the voltage here (pin 6) should be about 2.7V. It was in fact much lower, and varied little with the voltage swing at pin 25 of the CITAC chip. Virtually the entire control voltage was being lost in R511, so suspicion fell on the associated smoothing/decoupling capacitor C501. It was checked with a meter but declared itself innocent. Even so a substitute was tried – with no effect on the fault condition. Pin 6 of I501 was still low, so this chip was replaced. The point could perhaps have been better proved by isolating pin 6 and measuring the voltage on the printed track, because the new decoder chip had no more effect than the replacement capacitor.

Speedy Gonzales reappeared and asked about the progress of the job. Having heard that neither the CITAC nor the PAL decoder chip was responsible he studied the picture and put forward the suggestion that the tube was tired – he even went to the length of checking the tube with a tester. Its emission was of course o.k., and he was thrown out of the workshop.

The cause of the trouble was found soon afterwards. What was it? See next month's issue for the answer.

ANSWER TO TEST CASE 310 — page 927 last month —

Our JVC HR7200 (Ferguson 3V29) problem last month was a difficult one. A new video head drum had been fitted but, while each head produced a good output, adjustment of the tracking control had a differential effect on the two outputs, with one rising as the other decreased and vice versa.

When the tracking control is adjusted (or the control track head is moved laterally) the prerecorded video tracks are in effect moved vertically across the scanning paths of the two heads. So long as both heads are tracing the same path, maximum output is achieved simultaneously from both heads at the optimum video track position. In this case however as the track was moved vertically first one head peaked then the other did, a conclusive indication that the two video heads were at different levels.

Sage had realised this, and his turning and examination of the head drum was an attempt to see if it was mounted on a slant. No error could be seen, which is perhaps not surprising since the error could have been one of only a few microns. Sage came to the conclusion that either the drum assembly was faulty, with the two heads mounted at different levels, or (more likely) that a particle or tiny foreign body was lodged beneath the drum, thus preventing it from lying flat on its mounting plate. So it proved to be: some splashes of flux or something similar were found beneath the drum.

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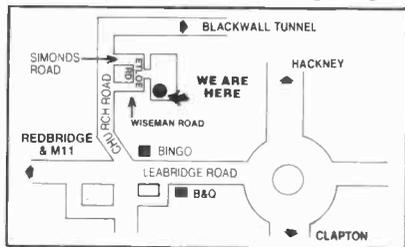
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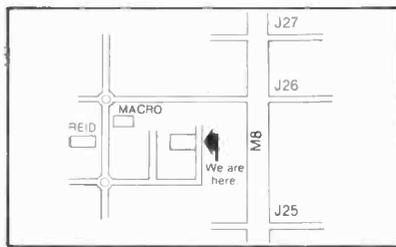
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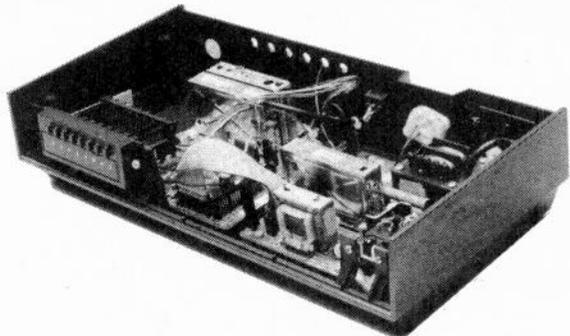
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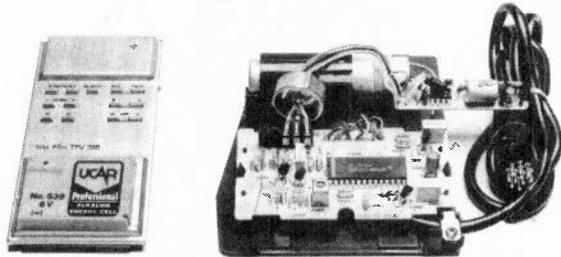
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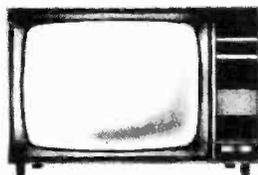


AA117	9p	BD177	30p	BF479	30p	MJ2501	110p	2N1132	28p	ZEMER	AN-316	350p	HA-1125	150p	LA-7027	400p	NE-531	115p	TA-7137	83p	TD4-2532	120p
AA119	9p	BD179	32p	BF493	18p	MJ2955	55p	2N1613	24p	400M	AN-318	460p	HA-1137V	135p	LA-7031	250p	NE-544	170p	TA-7140	130p	TD4-2540	100p
AA120	9p	BD181	45p	BF494	16p	MJ3000	115p	2N1711	24p	BY28 RANGE	AN-331	295p	HA-1144	380p	LA-7032	700p	NE-555	200p	TA-7142	220p	TD4-2560	120p
AC107	40p	BD182	60p	BF495	16p	MJ3001	115p	2N1893	30p	2V7 to 39V	AN-360	100p	HA-1156	110p	LA-7033	400p	NE-556	400p	TA-7145	220p	TD4-2575A	100p
AC125	40p	BD184	60p	BF500	16p	MJ3294	30p	2N2102	50p	60p	AN-366	100p	HA-1158	150p	LA-7034	280p	NE-564	360p	TA-7146	400p	TD4-2581	100p
AC126	20p	BD185	60p	BF506	16p	MJ3295	30p	2N2150	30p	BZK61 RANGE	AN-366	100p	HA-1159	150p	LA-7035	280p	NE-565	110p	TA-7148	200p	TD4-2586	100p
AC127	21p	BD187	60p	BF596	16p	MJ3400	25p	2N2218A	24p	2V7 to 39V 12p	AN-610	150p	HA-1306V	170p	LA-7043	300p	NE-566	130p	TA-7157	140p	TD4-2593	150p
AC128	21p	BD202	38p	BF597	10p	MJE350	80p	2N2219	24p	40p	AN-612	160p	HA-1319	240p	LA-7045	300p	NE-567	115p	TA-7162	300p	TD4-2600	580p
AC129	21p	BD203	42p	BF610	30p	MJE520	30p	2N2221	23p	30p	AN-613	160p	HA-1328	300p	LA-7046	300p	NE-570	380p	TA-7169	400p	TD4-2611A	200p
AC141K	30p	BD204	42p	BF617	30p	MJE520K	30p	2N2261	23p	30p	AN-551	60p	HA-133A	350p	LA-7048	300p	NE-571	290p	TA-7173	240p	TD4-2620	380p
AC142K	30p	BD205	42p	BF620	30p	MPR811	40p	2N2369	15p	40p	AN-540	280p	HA-1342	350p	LA-7050	250p	NE-582	85p	TA-7193	140p	TD4-2670	150p
AC153K	23p	BD225	31p	BF675	40p	MP8112	40p	2N2484	20p	40p	AN-5612	400p	HA-1366V	170p	LA-7051	300p	NE-532P	140p	TA-7200	200p	TD4-2690	100p
AC176	22p	BD232	31p	BF678	41p	MP8113	45p	2N2624	20p	40p	AN-5712	360p	HA-1367	160p	LA-7060	250p	NE-553P	140p	TA-7201	200p	TD4-2760	400p
AC176K	22p	BD233	31p	BF679	40p	MP8204	50p	2N2804	20p	40p	AN-5712	360p	HA-1368	160p	LA-7061	250p	NE-5638	110p	TA-7202	180p	TD4-2780	100p
AC187	21p	BD234	32p	BF680	40p	MPN3404	20p	2N2905	20p	40p	AN-5722	140p	HA-1368	160p	LA-7070	500p	SAS-560	110p	TA-7204	140p	TD4-3300B	480p
AC187K	28p	BD235	28p	BF673	40p	MPS6571	20p	2N2906	18p	28p	AN-5730	160p	HA-1371	300p	LA-7071	500p	SAS-570	110p	TA-7205	80p	TD4-3301B	480p
AC188	21p	BD236	30p	BF689	22p	MPS9012	20p	2N2907	18p	28p	AN-5732	160p	HA-1372	300p	LA-7170	350p	SAA-1008	450p	TA-7208	145p	TD4-3560	350p
AC188K	28p	BD237	21p	BF671	22p	MPN9014	20p	2N3276	8p	8p	AN-5763	160p	HA-1373	330p	LA-7190	400p	SAA-1009B	350p	TA-7210	200p	TD4-3561A	280p
ACV18	48p	BD238	24p	BF672	22p	MPS9015	20p	2N3019	28p	28p	AN-6100	425p	HA-1377	200p	LA-7110	200p	SAA-1024	250p	TA-7212	300p	TD4-3652	300p
AD12	40p	BD239	30p	BF673	22p	MPS9015	20p	2N3053	18p	18p	AN-6135	150p	HA-1389	210p	LA-7205	250p	SAA-1016T	400p	TA-7213	200p	TD4-3710	320p
AD159	60p	BD240	40p	BF661	35p	MPN3006	15p	2N3055	35p	35p	AN-6300	600p	HA-1390	230p	LA-7210	300p	SAA-1220	400p	TA-7214	260p	TD4-3800	350p
AD161	35p	BD241A	40p	BF663	40p	MPSA13	15p	2N3058	40p	40p	AN-6320	300p	HA-1394	280p	LA-7212	300p	SAA-1251	380p	TA-7215	215p	TD4-4420	180p
AD162	35p	BD242	40p	BF664	38p	MPSA20	15p	2N3440	58p	58p	AN-6330	380p	HA-1397	250p	LA-7215	300p	SAA-1272C	280p	TA-7217	145p	TD4-4600	260p
AD164	200p	BD245	50p	BF666	40p	MPSA42	15p	2N3442	85p	85p	AN-6340	830p	HA-1398	240p	LA-7220	300p	SAA-1274	280p	TA-7220	220p	TD4-4603	250p
AF106	40p	BD246A	50p	BF668	41p	MPSA43	15p	2N3525	85p	85p	AN-6340	830p	HA-1399	240p	LA-7221	300p	SAA-1274	280p	TA-7221	220p	TD4-4850	250p
AF109	45p	BD247	50p	BF669	110p	MPSA65	25p	2N3583	90p	78L18	AN-6344	830p	HA-1457	120p	LA-7225	180p	SAA-5004A	280p	TA-7223	210p	TD4-5700	200p
AF124	50p	BD267	45p	BF640	25p	MPSA66	25p	2N3585	120p	78L18	AN-6350	610p	HA-11219	280p	LA-7230	500p	SAA-5004B	400p	TA-7224	270p	TD4-7040	250p
AF125	50p	BD269	45p	BF651	21p	MPSA70	15p	2N3702	90p	78L24	AN-6359	810p	HA-11221	210p	LA-7505	250p	SI-324P	360p	TA-7225	300p	TD4-7050	200p
AF126	50p	BD270	45p	BF652	21p	MPSA70	15p	2N3702	90p	79L05	AN-6360	810p	HA-11221	210p	LA-7505	250p	SI-324P	360p	TA-7225	300p	TD4-7050	200p
AF127	50p	BD271	45p	BF653	21p	MPSA70	15p	2N3702	90p	79L05	AN-6362	810p	HA-11225	170p	LA-7507	250p	SNR-20A13K	200p	TA-7227	190p	TD4-7220	150p
AF139	30p	BD312	100p	BF690	52p	MRS10	35p	2N3705	9p	79L12	AN-6371	510p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD313	100p	BF691	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD314	100p	BF692	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD315	100p	BF693	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD316	100p	BF694	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD317	100p	BF695	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD318	100p	BF696	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD319	100p	BF697	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD320	100p	BF698	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD321	100p	BF699	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD322	100p	BF700	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD323	100p	BF701	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD324	100p	BF702	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD325	100p	BF703	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD326	100p	BF704	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD327	100p	BF705	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD328	100p	BF706	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD329	100p	BF707	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD330	100p	BF708	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD331	100p	BF709	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD332	100p	BF710	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD333	100p	BF711	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD334	100p	BF712	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD335	100p	BF713	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD336	100p	BF714	52p	MRS10	35p	2N3705	9p	79L15	AN-6387	560p	HA-11226	410p	LA-7508	250p	STK-0070	110p	TA-7229	300p	TD4-7270	150p
AF139	30p	BD337	100p	BF715	52p	MRS10	35p															

JAPAN SE TRANSISTORS	2SC-1845 20p	2SA1000 150p	4551 75p	74HC174 38p	74LS113 30p	Z80API0 230p	75172 720p
2SA-473 35p	2SC-1847 120p	2SA200V 165p	4553 140p	74HC175 38p	74LS114 30p	Z80B10 480p	75182 100p
2SA-483 400p	2SC-1848 120p	2SA400V 185p	4555 29p	74HC181 130p	74LS117 38p	Z80ACTC 250p	75183 100p
2SA-490 60p	2SC-1875 260p	2SA600V 200p	4556 36p	74HC182 60p	74LS122 32p	Z80A10 660p	75189 60p
2SA-562 57p	2SC-1881 210p	2SA800V 230p	4557 30p	74HC190 60p	74LS123 32p	Z80AS10-1 700p	75195 185p
2SA-563 45p	2SC-1906 90p	3SA100V 185p	4558 40p	74HC192 60p	74LS126 32p	Z80ADRT 680p	75232 130p
2SA-571 50p	2SC-1907 75p	3SA200V 200p	4559 40p	74HC193 43p	74LS132 32p	74AS18 175p	75234 340p
2SA-634 50p	2SC-1921 100p	3SA400V 220p	4560 10p	74HC194 47p	74LS136 32p	74S281 210p	75365 145p
2SA-636 50p	2SC-1922 100p	3SA600V 240p	4561 10p	74HC195 47p	74LS138 31p	74S282 240p	75450 145p
2SA-673 50p	2SC-1923 25p	3SA800V 260p	4562 10p	74HC221 100p	74LS139 31p	74S287 190p	75451 43p
2SA-684 60p	2SC-1942 260p	1.5A100V 40p	4563 10p	74HC237 50p	74LS141 31p	74S288 180p	75452 42p
2SA-699 100p	2SC-1945 350p	1.5A800V 40p	4564 10p	74HC240 40p	74LS142 31p	74S289 180p	75453 42p
2SA-715 90p	2SC-1946 1500p		4565 10p	74HC241 47p	74LS148 80p	74S290 200p	75454 65p
2SA-720 20p	2SC-1968 160p	PLASTIC CASED TRIACS	4566 10p	74HC242 50p	74LS151 80p	75107 80p	75480 135p
2SA-733 30p	2SC-1969 160p	4A/400V 60p	4567 10p	74HC243 60p	74LS152 80p	75108 80p	75491 60p
2SA-738 55p	2SC-1967 70p	6A/400V 69p	4568 10p	74HC244 44p	74LS155 85p	75109 110p	75492 80p
2SA-844 30p	2SC-1971 400p	8A/400V 68p	4569 10p	74HC245 49p	74LS156 85p	75110 90p	8726 95p
2SA-872A 50p	2SC-1972 60p	12A/400V 85p	4570 10p	74HC246 49p	74LS157 85p	75112 140p	8728 110p
2SA-886 90p	2SC-1973 130p	16A/400V 105p	4571 10p	74HC247 49p	74LS158 85p	75113 105p	8731 330p
2SA-899 90p	2SC-1983 60p	20A/400V 105p	4572 10p	74HC248 49p	74LS159 85p	75114 130p	8795 90p
2SA-907 650p	2SC-2001 80p	25A/400V 205p	4573 10p	74HC249 49p	74LS160 44p	75115 130p	8796 110p
2SA-934 40p	2SC-2002 25p	30A/400V 52p	4574 10p	74HC250 50p	74LS161 44p	75117 125p	8797 90p
2SA-936 40p	2SC-2023 78p	THYRISTORS	4575 10p	74HC251 25p	74LS162 44p	75122 125p	8798 110p
2SA-938 40p	2SC-2028 15p	0.8A/500V 20p	4576 10p	74HC252 50p	74LS163 44p	75123 125p	8799 90p
2SA-939 40p	2SC-2029 120p	0.8A/100V 20p	4577 10p	74HC253 37p	74LS164 40p	75124 110p	8799 90p
2SA-937 40p	2SC-2053 120p	0.8A/200V 29p	4578 10p	74HC254 49p	74LS165 50p	75125 110p	8799 90p
2SA-940 70p	2SC-2059 120p	0.8A/300V 55p	4579 10p	74HC255 47p	74LS166 50p	75126 110p	8799 90p
2SA-950 60p	2SC-2068 90p	0.8A/400V 70p	4580 10p	74HC256 47p	74LS167 50p	75127 110p	8799 90p
2SA-953 60p	2SC-2073 70p	0.8A/600V 79p	4581 10p	74HC257 47p	74LS168 50p	75128 110p	8799 90p
2SA-965 60p	2SC-2075 70p	0.8A/800V 85p	4582 10p	74HC258 47p	74LS169 50p	75129 110p	8799 90p
2SA-966 70p	2SC-2078 90p	1.2A/600V 90p	4583 10p	74HC259 50p	74LS170 50p	75130 110p	8799 90p
2SA-970 50p	2SC-2086 60p	2A/444 76p	4584 10p	74HC260 50p	74LS171 50p	75131 110p	8799 90p
2SA-979 85p	2SC-2098 600p	BR103 37p	4585 10p	74HC261 50p	74LS172 50p	75132 110p	8799 90p
2SA-984 30p	2SC-2106 90p	401A 11p	4586 10p	74HC262 50p	74LS173 50p	75133 110p	8799 90p
2SA-992 30p	2SC-2223 25p	BT106 120p	4587 10p	74HC263 50p	74LS174 50p	75134 110p	8799 90p
2SA-1012 130p	2SC-2229 125p	BT116 80p	4588 10p	74HC264 50p	74LS175 50p	75135 110p	8799 90p
2SA-1013 130p	2SC-2235 60p	BT119 100p	4589 10p	74HC265 50p	74LS176 50p	75136 110p	8799 90p
2SA-1014 130p	2SC-2236 60p	BT122 100p	4590 10p	74HC266 50p	74LS177 50p	75137 110p	8799 90p
2SA-1016 130p	2SC-2238 70p	BT124 120p	4591 10p	74HC267 50p	74LS178 50p	75138 110p	8799 90p
2SA-1105 250p	2SC-2240 45p	BT125 27p	4592 10p	74HC268 50p	74LS179 50p	75139 110p	8799 90p
2SA-1106 250p	2SC-2241 45p	BT126 27p	4593 10p	74HC269 50p	74LS180 50p	75140 110p	8799 90p
2SA-1107 250p	2SC-2242 45p	BT127 27p	4594 10p	74HC270 50p	74LS181 50p	75141 110p	8799 90p
2SA-1108 250p	2SC-2243 45p	BT128 27p	4595 10p	74HC271 50p	74LS182 50p	75142 110p	8799 90p
2SA-1109 250p	2SC-2244 45p	BT129 27p	4596 10p	74HC272 50p	74LS183 50p	75143 110p	8799 90p
2SA-1110 250p	2SC-2245 45p	BT130 27p	4597 10p	74HC273 50p	74LS184 50p	75144 110p	8799 90p
2SA-1111 250p	2SC-2246 45p	BT131 27p	4598 10p	74HC274 50p	74LS185 50p	75145 110p	8799 90p
2SA-1112 250p	2SC-2247 45p	BT132 27p	4599 10p	74HC275 50p	74LS186 50p	75146 110p	8799 90p
2SA-1113 250p	2SC-2248 45p	BT133 27p	4600 10p	74HC276 50p	74LS187 50p	75147 110p	8799 90p
2SA-1114 250p	2SC-2249 45p	BT134 27p	4601 10p	74HC277 50p	74LS188 50p	75148 110p	8799 90p
2SA-1115 250p	2SC-2250 45p	BT135 27p	4602 10p	74HC278 50p	74LS189 50p	75149 110p	8799 90p
2SA-1116 250p	2SC-2251 45p	BT136 27p	4603 10p	74HC279 50p	74LS190 50p	75150 110p	8799 90p
2SA-1117 250p	2SC-2252 45p	BT137 27p	4604 10p	74HC280 50p	74LS191 50p	75151 110p	8799 90p
2SA-1118 250p	2SC-2253 45p	BT138 27p	4605 10p	74HC281 50p	74LS192 50p	75152 110p	8799 90p
2SA-1119 250p	2SC-2254 45p	BT139 27p	4606 10p	74HC282 50p	74LS193 50p	75153 110p	8799 90p
2SA-1120 250p	2SC-2255 45p	BT140 27p	4607 10p	74HC283 50p	74LS194 50p	75154 110p	8799 90p
2SA-1121 250p	2SC-2256 45p	BT141 27p	4608 10p	74HC284 50p	74LS195 50p	75155 110p	8799 90p
2SA-1122 250p	2SC-2257 45p	BT142 27p	4609 10p	74HC285 50p	74LS196 50p	75156 110p	8799 90p
2SA-1123 250p	2SC-2258 45p	BT143 27p	4610 10p	74HC286 50p	74LS197 50p	75157 110p	8799 90p
2SA-1124 250p	2SC-2259 45p	BT144 27p	4611 10p	74HC287 50p	74LS198 50p	75158 110p	8799 90p
2SA-1125 250p	2SC-2260 45p	BT145 27p	4612 10p	74HC288 50p	74LS199 50p	75159 110p	8799 90p
2SA-1126 250p	2SC-2261 45p	BT146 27p	4613 10p	74HC289 50p	74LS200 50p	75160 110p	8799 90p
2SA-1127 250p	2SC-2262 45p	BT147 27p	4614 10p	74HC290 50p	74LS201 50p	75161 110p	8799 90p
2SA-1128 250p	2SC-2263 45p	BT148 27p	4615 10p	74HC291 50p	74LS202 50p	75162 110p	8799 90p
2SA-1129 250p	2SC-2264 45p	BT149 27p	4616 10p	74HC292 50p	74LS203 50p	75163 110p	8799 90p
2SA-1130 250p	2SC-2265 45p	BT150 27p	4617 10p	74HC293 50p	74LS204 50p	75164 110p	8799 90p
2SA-1131 250p	2SC-2266 45p	BT151 27p	4618 10p	74HC294 50p	74LS205 50p	75165 110p	8799 90p
2SA-1132 250p	2SC-2267 45p	BT152 27p	4619 10p	74HC295 50p	74LS206 50p	75166 110p	8799 90p
2SA-1133 250p	2SC-2268 45p	BT153 27p	4620 10p	74HC296 50p	74LS207 50p	75167 110p	8799 90p
2SA-1134 250p	2SC-2269 45p	BT154 27p	4621 10p	74HC297 50p	74LS208 50p	75168 110p	8799 90p
2SA-1135 250p	2SC-2270 45p	BT155 27p	4622 10p	74HC298 50p	74LS209 50p	75169 110p	8799 90p
2SA-1136 250p	2SC-2271 45p	BT156 27p	4623 10p	74HC299 50p	74LS210 50p	75170 110p	8799 90p
2SA-1137 250p	2SC-2272 45p	BT157 27p	4624 10p	74HC300 50p	74LS211 50p	75171 110p	8799 90p
2SA-1138 250p	2SC-2273 45p	BT158 27p	4625 10p	74HC301 50p	74LS212 50p	75172 110p	8799 90p
2SA-1139 250p	2SC-2274 45p	BT159 27p	4626 10p	74HC302 50p	74LS213 50p	75173 110p	8799 90p
2SA-1140 250p	2SC-2275 45p	BT160 27p	4627 10p	74HC303 50p	74LS214 50p	75174 110p	8799 90p
2SA-1141 250p	2SC-2276 45p	BT161 27p	4628 10p	74HC304 50p	74LS215 50p	75175 110p	8799 90p
2SA-1142 250p	2SC-2277 45p	BT162 27p	4629 10p	74HC305 50p	74LS216 50p	75176 110p	8799 90p
2SA-1143 250p	2SC-2278 45p	BT163 27p	4630 10p	74HC306 50p	74LS217 50p	75177 110p	8799 90p
2SA-1144 250p	2SC-2279 45p	BT164 27p	4631 10p	74HC307 50p	74LS218 50p	75178 110p	8799 90p
2SA-1145 250p	2SC-2280 45p	BT165 27p	4632 10p	74HC308 50p	74LS219 50p	75179 110p	8799 90p
2SA-1146 250p	2SC-2281 45p	BT166 27p	4633 10p	74HC309 50p	74LS220 50p	75180 110p	8799 90p
2SA-1147 250p	2SC-2282 45p	BT167 27p	4634 10p	74HC310 50p	74LS221 50p	75181 110p	8799 90p
2SA-1148 250p	2SC-2283 45p	BT168 27p	4635 10p	74HC311 50p	74LS222 50p	75182 110p	8799 90p
2SA-1149 250p	2SC-2284 45p	BT169 27p	4636 10p	74HC312 50p	74LS223 50p	75183 110p	8799 90p
2SA-1150 250p	2SC-2285 45p	BT170 27p	4637 10p	74HC313 50p	74LS224 50p	75184 110p	8799 90p
2SA-1151 250p	2SC-2286 45p	BT171 27p	4638 10p	74HC314 50p	74LS225 50p	75185 110p	8799 90p
2SA-1152 250p	2SC-2287 45p	BT172 27p	4639 10p	74HC315 50p	74LS226 50p	75186 110p	8799 90p
2SA-1153 250p	2SC-2288 45p	BT173 27p	4640 10p	74HC316 50p	74LS227 50p	75187 110p	8799 90p
2SA-1154 250p	2SC-2289 45p	BT174 27p	4641 10p	74HC317 50p	74LS228 50p	75188 110p	8799 90p
2SA-1155 250p	2SC-2290 45p	BT175 27p	4642 10p	74HC318 50p	74LS229 50p	75189 110p	8799 90p
2SA-1156 250p	2SC-2291 45p	BT176 27p	4643 10p	74HC319 50p	74LS230 50p	75190 110p	8799 90p
2SA-1157 250p	2SC-2292 45p	BT177 27p	4644 10p	74HC320 50p	74LS231 50p	75191 110p	8799 90p
2SA-1158 250p	2SC-2293 45p	BT178 27p	4645 10p	74HC321 50p	74LS232 50p	75192 11	

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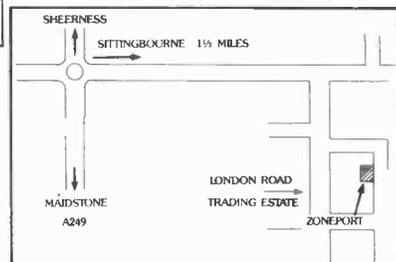
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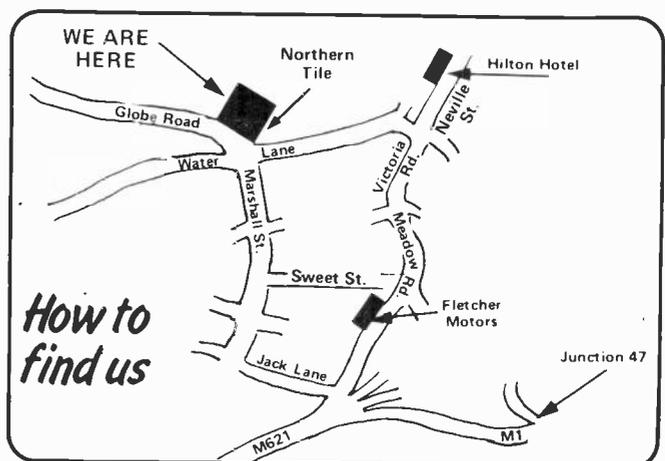
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SL8000, SL8080 £6.50

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VC8300 £6.50

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VTC5300, VTC5400 £2.50

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Sony

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SLC6 £4.95

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Sharp

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VC8300 £3.90

VC9100, VC9300, VC9500 £3.90

VC381, VC383, VC386 £3.90

Hitachi

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VT8000, VT8300, VT8500 £1.50

VT9300, VT9500, VT9700 £1.50

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VT33E £3.90

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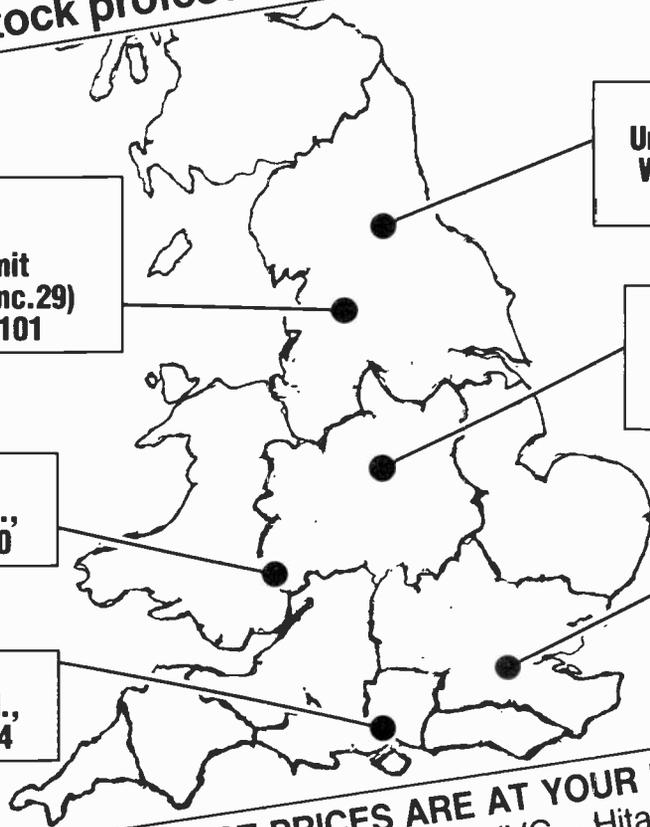
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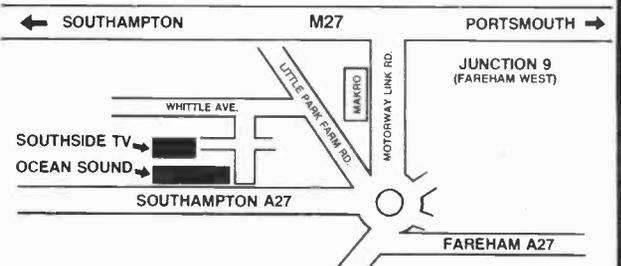
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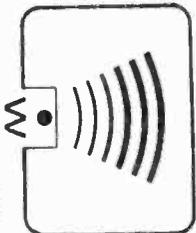
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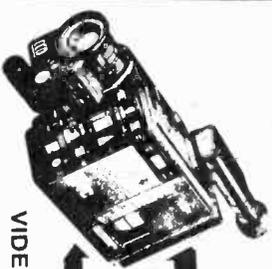
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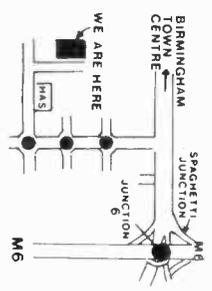


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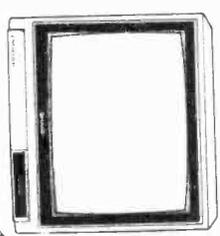
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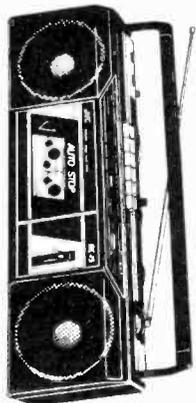
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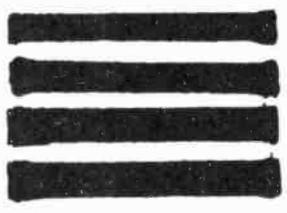
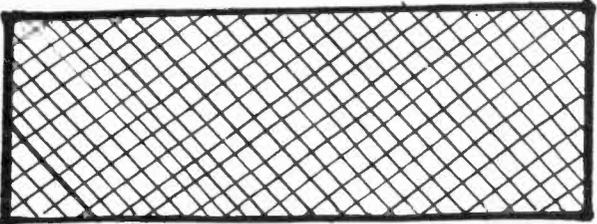
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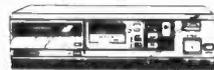
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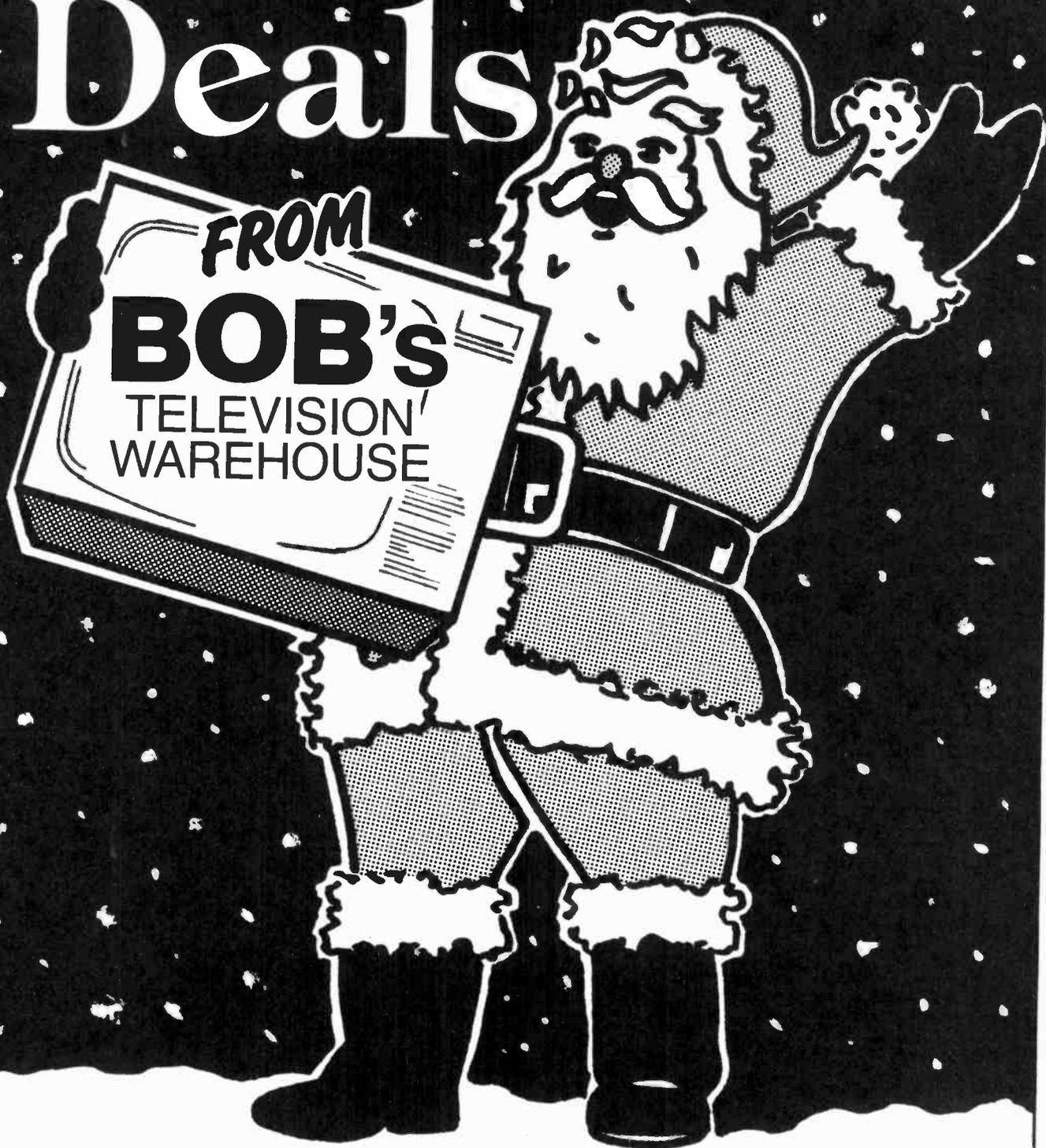
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FLAT 60 x 0.5 x 3 40p
19 x 1.2 20p
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AN203 220p	HA1350 375p	STK080 750p	TA2030 160p	25B-557 225p	25C-1213 65p	25C-2546 20p
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AN214 180p	HA1372 250p	STK084 800p	TA2571 450p	25B-562 40p	25C-1222 35p	25C-2555 175p
AN253 100p	HA1374 250p	STK430 550p	TA2593 300p	25B-566 120p	25C-1226 80p	25C-2564 250p
AN252 150p	HA1377 230p	STK431 600p	TA2599 300p	25B-568 40p	25C-1317 25p	25C-2565 280p
280ACPU 170p	HA1384 350p	STK433 525p	TA2600 575p	25B-568 80p	25C-1318 30p	25C-2575 25p
2114 210p	AN301 350p	58K435 550p	TA2653A 400p	25B-595 85p	25C-1327 25p	25C-2579 130p
2532 350p	AN302 350p	58K436 525p	TA2655 550p	25B-646 40p	25C-1328 25p	25C-2579 130p
2716 210p	AN303 275p	58K437 600p	TA2656 400p	25B-648 65p	25C-1345 30p	25C-2611 50p
2732 300p	AN315 225p	58K439 250p	TA2657 400p	25B-649 65p	25C-1368 40p	25C-2551 280p
2764 350p	AN318 495p	58K441 775p	TA2658 400p	25B-681 250p	25C-1383 40p	25C-2944 150p
AN340 160p	HA1396 250p	58K443 775p	TA2659 400p	25B-688 125p	25C-1384 40p	25C-3078 40p
AN360 125p	HA1397 275p	58K457 625p	TA2662 280p	25B-705 250p	25C-1403 150p	25C-3182 250p
AN610 175p	HA1398 260p	58K459 660p	TA2665 400p	25B-716 40p	25C-1413 300p	25C-3284 150p
AN612 175p	HA13001 275p	58K461 750p	TA2666 280p	25B-717 70p	25C-1445 125p	25C-3298 150p
AN5151 700p	LA4220 180p	58K463 825p	TA2667 400p	25B-718 80p	25C-1446 70p	25C-3506 230p
AN440 225p	LA4221 180p	58K465 825p	TA2668 400p	25B-722 130p	25C-1454 350p	25C-3519 150p
AN5430 300p	LA4222 180p	58K466 825p	TA2669 400p	25B-772 50p	25C-1509 45p	25C-8050 25p
AN5440 225p	LA4400 250p	58K468 660p	TA2670 400p	25B-837 60p	25C-1567 50p	25C-198 200p
AN5151 700p	LA4445 275p	58K469 660p	TA2671 400p	25B-857 60p	25C-1568 60p	25C-200 310p
AN430 300p	LA4461 180p	58K470 660p	TA2672 400p	25B-870 70p	25C-1577 70p	25C-235 40p
AN5151 700p	LA4505 280p	58K471 660p	TA2673 400p	25B-872 60p	25C-1580 550p	25C-240 310p
AN5151 700p	LA4506 280p	58K472 660p	TA2674 400p	25B-873 60p	25C-1585 550p	25C-240 310p
AN5151 700p	LA4507 280p	58K473 660p	TA2675 400p	25B-874 60p	25C-1590 45p	25C-240 310p
AN5151 700p	LA4508 280p	58K474 660p	TA2676 400p	25B-875 60p	25C-1627 70p	25C-250 310p
AN5151 700p	LA4509 280p	58K475 660p	TA2677 400p	25B-876 60p	25C-1628 70p	25C-250 310p
AN5151 700p	LA4510 280p	58K476 660p	TA2678 400p	25B-877 60p	25C-1629 70p	25C-250 310p
AN5151 700p	LA4511 280p	58K477 660p	TA2679 400p	25B-878 60p	25C-1630 70p	25C-250 310p
AN5151 700p	LA4512 280p	58K478 660p	TA2680 400p	25B-879 60p	25C-1631 70p	25C-250 310p
AN5151 700p	LA4513 280p	58K479 660p	TA2681 400p	25B-880 60p	25C-1632 70p	25C-250 310p
AN5151 700p	LA4514 280p	58K480 660p	TA2682 400p	25B-881 60p	25C-1633 70p	25C-250 310p
AN5151 700p	LA4515 280p	58K481 660p	TA2683 400p	25B-882 60p	25C-1634 70p	25C-250 310p
AN5151 700p	LA4516 280p	58K482 660p	TA2684 400p	25B-883 60p	25C-1635 70p	25C-250 310p
AN5151 700p	LA4517 280p	58K483 660p	TA2685 400p	25B-884 60p	25C-1636 70p	25C-250 310p
AN5151 700p	LA4518 280p	58K484 660p	TA2686 400p	25B-885 60p	25C-1637 70p	25C-250 310p
AN5151 700p	LA4519 280p	58K485 660p	TA2687 400p	25B-886 60p	25C-1638 70p	25C-250 310p
AN5151 700p	LA4520 280p	58K486 660p	TA2688 400p	25B-887 60p	25C-1639 70p	25C-250 310p
AN5151 700p	LA4521 280p	58K487 660p	TA2689 400p	25B-888 60p	25C-1640 70p	25C-250 310p
AN5151 700p	LA4522 280p	58K488 660p	TA2690 400p	25B-889 60p	25C-1641 70p	25C-250 310p
AN5151 700p	LA4523 280p	58K489 660p	TA2691 400p	25B-890 60p	25C-1642 70p	25C-250 310p
AN5151 700p	LA4524 280p	58K490 660p	TA2692 400p	25B-891 60p	25C-1643 70p	25C-250 310p
AN5151 700p	LA4525 280p	58K491 660p	TA2693 400p	25B-892 60p	25C-1644 70p	25C-250 310p
AN5151 700p	LA4526 280p	58K492 660p	TA2694 400p	25B-893 60p	25C-1645 70p	25C-250 310p
AN5151 700p	LA4527 280p	58K493 660p	TA2695 400p	25B-894 60p	25C-1646 70p	25C-250 310p
AN5151 700p	LA4528 280p	58K494 660p	TA2696 400p	25B-895 60p	25C-1647 70p	25C-250 310p
AN5151 700p	LA4529 280p	58K495 660p	TA2697 400p	25B-896 60p	25C-1648 70p	25C-250 310p
AN5151 700p	LA4530 280p	58K496 660p	TA2698 400p	25B-897 60p	25C-1649 70p	25C-250 310p
AN5151 700p	LA4531 280p	58K497 660p	TA2699 400p	25B-898 60p	25C-1650 70p	25C-250 310p
AN5151 700p	LA4532 280p	58K498 660p	TA2700 400p	25B-899 60p	25C-1651 70p	25C-250 310p
AN5151 700p	LA4533 280p	58K499 660p	TA2701 400p	25B-900 60p	25C-1652 70p	25C-250 310p
AN5151 700p	LA4534 280p	58K500 660p	TA2702 400p	25B-901 60p	25C-1653 70p	25C-250 310p
AN5151 700p	LA4535 280p	58K501 660p	TA2703 400p	25B-902 60p	25C-1654 70p	25C-250 310p
AN5151 700p	LA4536 280p	58K502 660p	TA2704 400p	25B-903 60p	25C-1655 70p	25C-250 310p
AN5151 700p	LA4537 280p	58K503 660p	TA2705 400p	25B-904 60p	25C-1656 70p	25C-250 310p
AN5151 700p	LA4538 280p	58K504 660p	TA2706 400p	25B-905 60p	25C-1657 70p	25C-250 310p
AN5151 700p	LA4539 280p	58K505 660p	TA2707 400p	25B-906 60p	25C-1658 70p	25C-250 310p
AN5151 700p	LA4540 280p	58K506 660p	TA2708 400p	25B-907 60p	25C-1659 70p	25C-250 310p
AN5151 700p	LA4541 280p	58K507 660p	TA2709 400p	25B-908 60p	25C-1660 70p	25C-250 310p
AN5151 700p	LA4542 280p	58K508 660p	TA2710 400p	25B-909 60p	25C-1661 70p	25C-250 310p
AN5151 700p	LA4543 280p	58K509 660p	TA2711 400p	25B-910 60p	25C-1662 70p	25C-250 310p
AN5151 700p	LA4544 280p	58K510 660p	TA2712 400p	25B-911 60p	25C-1663 70p	25C-250 310p
AN5151 700p	LA4545 280p	58K511 660p	TA2713 400p	25B-912 60p	25C-1664 70p	25C-250 310p
AN5151 700p	LA4546 280p	58K512 660p	TA2714 400p	25B-913 60p	25C-1665 70p	25C-250 310p
AN5151 700p	LA4547 280p	58K513 660p	TA2715 400p	25B-914 60p	25C-1666 70p	25C-250 310p
AN5151 700p	LA4548 280p	58K514 660p	TA2716 400p	25B-915 60p	25C-1667 70p	25C-250 310p
AN5151 700p	LA4549 280p	58K515 660p	TA2717 400p	25B-916 60p	25C-1668 70p	25C-250 310p
AN5151 700p	LA4550 280p	58K516 660p	TA2718 400p	25B-917 60p	25C-1669 70p	25C-250 310p
AN5151 700p	LA4551 280p	58K517 660p	TA2719 400p	25B-918 60p	25C-1670 70p	25C-250 310p
AN5151 700p	LA4552 280p	58K518 660p	TA2720 400p	25B-919 60p	25C-1671 70p	25C-250 310p
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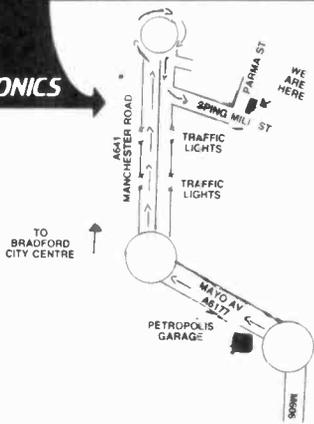
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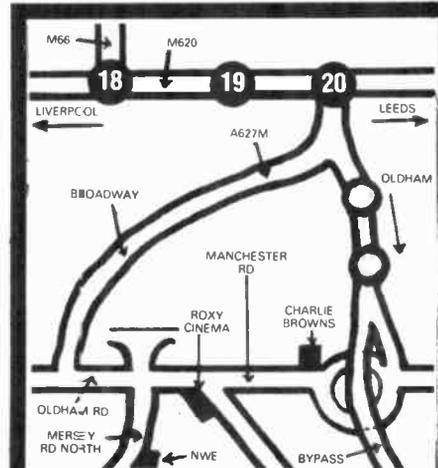
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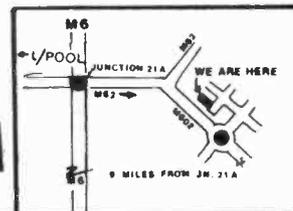
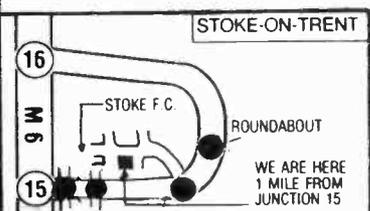
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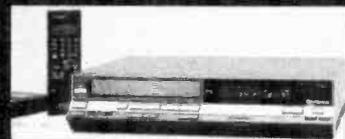
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BB 105B x12 £1	R 2484 40p	BYV 95B 10p	520 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
BB 105C x12 £1	R 2485 40p	BYV 95C 12p	530 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
BB 121a 10p	R 2486 40p	BYV 96D 10p	540 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
47 10p each	R 2487 40p	BYZ 101 10p	550 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
IA/1600V 10p	R 2488 40p	BPW 41 15p	560 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
DG3P EQV-BY228 10 for £1	R 2489 40p	BYW 56 2A/1000V G11 8p	570 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
2 amp bridge rec. wire end 15p	R 2490 40p	BYW 29/50 15p	580 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2491 40p	BZU 15/24 54p	590 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2492 40p	BZY 93/75 50p	600 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2493 40p	BZV 15/18 30p	610 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2494 40p	BZV 15/30 30p	620 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2495 40p	BZW 70x6.2 10p	630 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2496 40p	BZX 79.3v 10p	640 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2497 40p	Bush thyristor RCA 76122 £1	650 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2498 40p	Transformer 240v/21n-500Ma 75p	660 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2499 40p	Chassis type Transformer 240v/12 Volts 500mA 75p	670 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2500 40p	Tube Base Rank & G11 £1.20	680 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2501 40p	Infra red led LD57CA 15p	690 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2502 40p	15K-20 turn pots 20p	700 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2503 40p	Thorn 3500 2A cut out 50p	710 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2504 40p	BBH/SAFETY MAINS ISOLATING TRANSFORMER 250V-250V/A £10	720 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2505 40p	BRIDGES	730 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2506 40p	KBI 005 30p	740 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2507 40p	KBI 02 30p	750 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2508 40p	KBP 04 30p	760 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2509 40p	W02 15p	770 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2510 40p	W04 15p	780 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2511 40p	W05 20p	790 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2512 40p	800V Bridges 2 1/2 Amp 30p	800 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2513 40p	MAINS MICRO SWITCH GEC & Double etc. £1	810 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2514 40p		820 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2515 40p		830 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2516 40p		840 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2517 40p		850 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2518 40p		860 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2519 40p		870 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2520 40p		880 mixed tube bars £5.00	T/V V/Aerial 300Ω or 75Ω * D/P push mains switch 20p each	Philips Scientific SBC1730 Calculator £12
	R 2521 40p				

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Matsushita P134220 Tuner	£7
C Cam Decoder with TDA3591 Toshiba VHF/UHF EG522F	£6
Mitsumi ME-C1-F51	£5

Thorn Spares	
New 9000 Decoder	£8.50
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8900 convergence panel	£6
8900 convergence panel	£6
4000 Power supply	£3
1600 Mains lead, switch	£3
1605 1A/5N 1066 80V/6A	10p
9000 Sound Unit	£1
3500 Focus Unit	£1.50
3500 Mains Trans	£4
3500 cut outs	10 for £4
3500 H-panel	£2
3500 Frame panel	£3
3500 Line panel	£3
3500 A1 Diode	20p
Export 3500 H-panel	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V	£5.50
7.5V/300mA	£3.50
Rank/Toshiba prech unit 0354	£9.50
4 Push button unit prech	£1.00
6 Push button VHF/UHF for v/cap. G/C-Decca type	£7.00
7 Push button for CVC5 FT1	£8.00
K13 12 Push button unit	£2.00
K13 (Export) 12 P B.u.	£2
CVC32	£1.00
6 Push button Unit, Thorn	£6.00
6 Push button G1RC	£6.00
6 Push button PYE 731	£6.00
Hearing aid unit	£3
Rank Z718 4 P/B Unit MF-CT1	£4
7 Button Unit G/C with Lamps	£7
697 Push Button Unit	£6.00
Z916B panel	£5.00
TS13AP panel	£5.00

Mains Droppers	
Pvc 731 3+56+27R	50p
Thorn 5017/1K5	£1.00
120/20/24/41/17	£1.00
270/106 for Thorn 4000	50p
18 320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ac Socket & Lead	25p
G/C, ITT Philips, Pvc	£1.50
7x333 Thorn	£1.50
Rank 1600-1700	50p
Rank Toshiba Tube Bases	30/100 Per Volt
1H1420 Hmk Meter	10 Amp AC/DC
1000 and ohms range	£10

AEG K12000641-005	
Hand Sets	
Fidelity All Types £15 to £35	
K13-K30	
01-425	1 W
01-580	correction
01-513	
01-557	

DIODES	
BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 176	25p
BY 179	40p
BY 184	40p
BY 187	40p
BY 190	40p
BY 196	40p
BY 198	40p
BY 2044	10p
BY 206-1B 407 1ap	8p
BY 208/800	5p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600, 4.8A/600k bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500V	20p
Flat BY229 black	15p
BY 299 Red	20p
BY 299/400	30p
BY 590/400p lag	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407A	10p
BY 527	10p
BY 602	10p
F-247	10p
GP20G	5p
GR188G (1X10)	60p
NK 3102	30p
BYX 28/200	20p
Bridge 1X10/800 5amps	20p
KBFC35/02 D53B	£1.50
Bridge Rec D53B10	40p

International Rectifier 1H1F Diodes (770) 1V/34 6KV	3 for 8p
6A/1000V Stud Diodes	20p
6A/1000V Stud Diodes	20p

Rank 120 ZL36 Panel	£6.00
NEW G/C 20AX Power Supply Switch Mode	£12.00
Field + Jungle panel for G/C 3133/3135	£1.50
G/C 2110 line panel with transformer	£7.00
G/C 2110 tuner unit + IF Panel	£12.00
Pvc/Cheslea Line op panel	£12.00
Pvc 705 Tuner	£3.00
Pvc 713 H-panel and tuner	£7.00
Pvc 713 Chroma	£10.00
Pvc/Cheslea Timebase panel with LOPT1	£10.00
Pvc 731 Frame Panel	£5.00
Pvc 731 Convergence Panel	£10.00
Pvc 731 Chroma	£5.00
Pvc 731 H-panel + Tuner	£10.00
G/C portable chassis + LOPT1 2114 New	£4.00
G9 Power Panel	£6.00
Alomo RANK Chassis 127A NE-W	£4.00
NE-W G9 Frame Panel	£4.00
NE-W G11 IF Panel	£4.00

G8 Tuner/Unit + Panel	£4.00
G8 H & Chroma	£6.00
G8 Chroma	£3.00
G11 B-Detector	£3.00
G11 Selector gam module	£5
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC	1100 x 100 = 30p
SAN660 SAN670	22/100
Z714 RANK IF Panels 6MHz IFC	4.7M/100 = 5p
SL437F	470/100 = 2p
Z909B RANK IF Panels	470/100 = 2p
Export 5.5MHz 2 I.C.'s	30/2500V = 80p
1B.A1205B 1C.A27050	800/100 = 50p
K35 II	1/250 Pulse = 5p
Z743 RANK IF Panel	2.2/250 = 10p
Export 5.5MHz 3 I.C.'s	7N5 1500V = 15p
1B.750+SC9504P	3p/250V = 20p
SC983P	30/2500V = 25p
Pvc G11 Front panel with transformer	4n7/250 tested 5KV = 15p
pots, tuner switch, 6ph switch+lead	22/250 = 25p
Pvc 6 button switch portable	32/250 = 12p
G/C V-cap VHF/UHF tuner and IF +	47/250 = 20p
sound OP PC 706B3 (Export)	£12.00
G/C Line O/P PC 659B3	£6.00
2110 G/C Power Panel	£8.00
CVC 201 front panel with sliders +	£1.00
mains input panel	£4
CVC 40 PUSH BUTTON ASSY with	£1.00
sliders complete with lamp assy + pots	£9.00
S/button units	50p
CVC 40 sliders pots panel	50p
Universal Focus, Fats Pvc, Thorn and	£1.00
Decca Units	£1.00
1147 Rank tube base on panel	£1.00
Z718 Focus Unit	£1.50
120 Focus Unit	£1.00
Large Type	75p
Decca Small	75p
K13 Focus Unit	75p
K30 Focus Pot	75p
K30 Tube base on panel	£1.00
TX10 Focus Units	£8.50
CVC 32 Focus Unit	75p
Fidelity Focus Unit 14R-14S	75p
5804 Thorn Focus Unit	£1.00
1H1 Small for use with Split	£2.00
Z718 Bush Focus	£2.00
Dial	50p
Reno 1V12SP	50p
1600 Thorn F1H1 Rec and Lead	50p
1V14	50p
1V20	50p
1V15	50p
Thorn 14 1500V rec stick	5p
TX10 8 Button Unit	£10.00
TX10 TX100 16 Button	£10.00
G11 drawer ASS 3 pots Mains switch	£2.00
and lead	£2.00
K30 Drawer Ass with pots cable	£1.00
tone	£1.00
TX10 Drawer with 8 way pots ass	£2.50
TX10 Ex-port with band switch	£2.50
(drawer)	£2.50
Line O/P panel G/C 2217 2218 2213	£10
2214 2226 2227 2228	£10

PHILIPS BATTERIES	
(Small Types) HAND SETS	
SR41	25p
SR43	25p
SR44	25p
SR54	25p
SR54	25p
R44	25p
R44	25p
R45	25p
CR2032	25p
10 500P1 2KV	20p
22 1000	20p
1 250AC	20p
1 100	5p
1MH1D-250AC	25p
1AA7750	£1.00
1AA11485	£1.00
1PC1373	50p
M50143	£1.00
1M91BB1	£1.00
M58657P	25p
M50441 550	3p
M58658P	£1.00
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CVC 20 25 30 Mains Switches	60p
Intra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (Z70R)	£1.50
RANK & ITT Remote Switch 2800(chm)	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
G/C Mains Switch 4 amp	30p
K13 Mains Switch	£1.00
G8 Mains Switch	75p
G11 Fresh Red LLD P Button for C.H. Change	20p
RANK TOSHIBA Transistors TPC-2011	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type IAG	75p
Mains Switch G/C Long Type IAG	75p
2000 chassis Fidelity Mains Switch (4 IAG)	60p
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K13 K30 K35 Full Remote Mains Switch (6 IAG)	£1
Teletext Adaptor Kit TV-500 Panasonic	£12

141 MFD Mains Filter ITT 3 Pin 15p	£1.00
1100 x 100 = 30p	30p
22/100	22/100
4.7M/100	5p
470/100	2p
470/100	2p
300 300/301V	80p
800/100	50p
1/250 Pulse	5p
2.2/250	10p
7N5 1500V	15p
3p/250V	20p
4n7/250 tested 5KV	15p
22/250	25p
32/250	12p
47/250	20p
G11 470/250V	£1.75
G11 C700/250	60p
700/250	£1
300+300 MFD 350V	£1.00
800/250	£1.00
32/300	20p
4.5/50	5p
8.5/50	10p
4.7M/350V	8p
33 350	20p
220 350	30p
300/350	40p
400/350	50p
22 375	25p
220/385 (ITT)	75p
330/385 CVC 8301IT	60p
0.1/400	15p
K13 LEW 30/400	15p
56K 400V	20p
470p/400	10p
22/400	10p
33/400	15p
33/400	15p
400/400	40p
394K/400V	20p
220/450	25p
47/500	20p
0.1/600	15p
0.1 1200V wire end	20p
0.1/450 A/C wire end	20p
20/100	10p
047/600	10p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
47/1000K	65p
47/250V A.C.	10p
001K 1250	10p
0.0047/1500	10p
0015/1500	10p
0105/1500	10p
160/1500	15p
260/1500	15p
2n2/1500	15p
0.1/1000	15p
G11 8200/2KV	20p
0.1 2KV	15p
0.0015/2KV	15p
6n2/2KV	15p
20n2/2KV	15p
2n2/2KV	15p
470p/4KV	10p
750p/2KV	10p
3000p/1-3000V	10p
4n7 2KV	10p
6n2/2KV	10p
7n1 1500V	10p
8n2 1500V	10p
9n1/2000V	10p
8n2 2KV	15p
0.0082/2500	15p
150/3500	15p
1800/4KV	5p
4.7n1 5KV	£4.00
1708KV	10p
1808KV	10p
2108KV	10p
1000/10KV	10p
4n7 10KV	80p
4n7 100V	£1.00
Tube Thermopath 167	£1.00
Rank Secam Decoder Panel UHF	£13.00
VHF 1115A	£13.00
10 off '91 CAP G11	£2.00
Philips K4 CAP 150M/385V	50p

Multi-Caps	
220 MFD Sprague 385V	50p
350V 300M + 300M	£1.00
100V 400M	60p
350V 100M	60p
Thorn 3900	£1.00
175/100/350V	£1.00
KT 2/200/25/25/385V	£1.00
KT 3/30 30 220+300+40	75p
150/150/100/100/100/320k	£1.00
300+300+150+100+50MFD	£1.00
350V	£2.00
G11 CAP 470/250	£2.50
47/250 350V	60p
150/150/100/100/100/320k	£1.00
2500/2500/6V	50p
150/200/200/300V	70p
300/100/100/16/275V	£1.50
100/200/325V	40p
150/150/100/375V	£1.50
200/200/75/25M 375V	£1.00
Thorn 1 N9 Caps 500+500M 175V	£1.00
300/300/100/22/32/300V	£2.00
1500/2000/30V	50p
150/150/100/100/320k	£2.00
100/350 + 300/200/100/16/275V	£2.00
225 + 25/300 G11A	£1.00
300/100/350V	£1.50
500/500/25V	50p
150/150/100/300V	75p
300 150/150/300V	1.00
ITT 8 and 6 Push Button	£1.00
Pvc 728 1 GPT'S	£6.00
Pvc 731 1 GPT'S	£6.00
Thorn 8500-8800 1 GPT'S	£5.00
CMC 303 front panel	£5.00
CMC 303 front panel	£5.00
CMC 302 Panel with TC mains switch	£5.00
etc	£5.00
CMC 800 Decoder	£8.00
G11	£1.50
G11 C Receiver Panel	£3.00
G11 C Power Supply G11 Full Remote	£3.00
Receiver Panel	£3.00
PHILIPS SBC 169 Stereo Microphone	£2.00
Meters H115 520	£17.00

