

JULY 1988

Australia \$3.25, New Zealand \$4.40 (inc. GST), Malaysia \$6.10
Ireland £1.20 (inc. VAT) **£1.40**

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

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**Digital Video Effects
Servicing with a Variac
Low-power Band I Transmitters
Transistor Load Matching
VCR Clinic • TV Fault Finding**

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR
FOR DOMESTIC TV & VCR.

TEST
DEMONSTRATIONS
AT 172
WEST END LANE



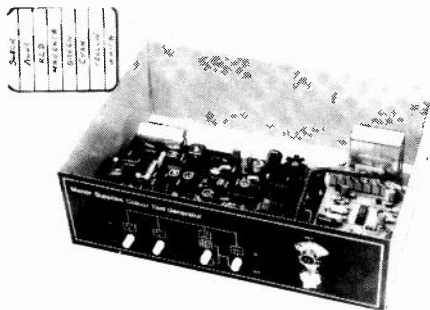
- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with 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 **£30.00**, Philips KT3, K30 **£30.00**, p.p. **£2.30**

PHILIPS G11 PRESTEL TELETEXT UNIT includes Mullard VM6230 Teletext Decoder, 6330 panel, plus Line Coupler and Interface **£30.00**, p.p. **£2.80**

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF
TECHNICAL EXPERTS

LOPTS, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.
PHILIPS KT3 PANELS (non text) tested, exchange Decoder **£10.00**, Sound, Frame, Power, RGB **£7.50** each p.p. **£1.50**.
THORN TX9 PANELS Complete & tested **£28.00** Exchange. (Shop only).
THORN 8000 TO 8800 Panels tested exchange. Power **£7.80** 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 T20/22 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**.
COLOUR MANUALS p.p. 50p.
PHILIPS G11 **£3.50**, 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 popular makes.
TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. 50p.
TX Remote panel 1564 (incl. SAAS012) **£5.00** p.p. **£1.80**.
TX Remote panel 1509G (incl. UAA1008A & Battery) **£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) **£10.50** p.p. **£1.80**.
SAW FILTER IF AMPLIFIER PLUS TUNER complete and tested for T.V. Sound & Vision. **£28.50** p.p. **£1.20**.
PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. **£1.00**.
PAL ENCODER KIT (RGB to Video) **£18.50** p.p. **£1.30**.
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UHF SIGNAL STRENGTH METER KIT **£22.00** Alum. Case **£2.90**. De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. **£2.30**.
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GEC 20AX Line Time Base **£18.00** p.p. **£2.00**.
ITT CVC30 SERIES, Convergence & Purty Panels, **£2.50** p.p. **£1.50**.
ITT CVC30 SERIES PANELS SURPLUS (untested) **£2.50** each. CMP31, CME31, CMA30 CM532, p.p. **80p**; CMD33, p.p. **£1.80**.
THORN TX9 Panels ex factory for small spares. Includes I.Cs & Semiconductors etc. **£3.00** p.p. **£2.00**.
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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VARICAP TUNERS U321, U322/204, ELC1043 (equiv.) **£7.80** p.p. **£1.00**.
VHF Philips, NSF **£6.80** p.p. **£1.00**.
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THORN 3000/3500 SCAN, EHT **£6.90** DECCA 100 **£8.80**
THORN 8000, 8500, 8800 **£12.80** FIDELITY ZX2000, 3000 (Not 22") **£14.50**
THORN 9000 to 9600 **£9.80** GEC 2110 series **£10.60**
THORN TX9 **£12.50** ITT CVC 5 to 9, CVC20 **£9.80**
THORN TX10 **£16.50** ITT CVC25, CVC30 series **£8.80**
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PHILIPS 320 **£2.80** PHILIPS G11 **£18.50**
RBM A823 **£4.80** PHILIPS KT3 **£9.80**
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PHILIPS CTX-S **£22.50**

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THORN 3000/3500 **£2.50** p.p. **£1.20**.
THORN 1500 5 Stick **£1.50**, 1500 3 Stick **£1.50** p.p. **80p**.
6-3V CRT Boost Transformers for Colour & Mono **£5.90** p.p. **£1.40**.
THORN TX10 focus control **£10.00** p.p. **£1.00**.
PYE 713, 731 IF Module **£3.50** p.p. **80p**.
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VHF to UHF Converters **£26.50** p.p. **£2.50**.

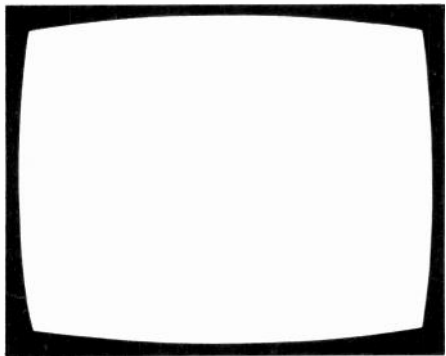
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BACK NUMBERS

Some copies of issues published during the last six months are available from the Editorial Office at £1.50 inclusive of postage and packing. Address requests to Television, Editorial Office, IPC Magazines Ltd., King's Reach Tower, Stamford Street, London, SE1 9LS.

INDEXES

Indexes to Vols. 35 and 36 are available at 80p each from the Editorial Office (address above).

QUERIES

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

this month

- 653 Leader**
- 654 Long-distance Television** *Roger Bunney*
Reports on DX conditions and reception, news from abroad and a review of the Triax active aerial which covers 47-860MHz with omni-directional response.
- 659 Letters**
- 661 Outlook Cloudy** *Les Lawry-Johns*
The specialist didn't have much to report, leaving it still tricky to sort the sets out.
- 662 VCR Clinic**
Reports from Alfred Damp, Eugene Trundle, Dave Dulson, Philip Blundell, Eng. Tech., Nick Beer, Mick Dutton and T.J. Welford.
- 664 Servicing with a Variac – and Bulbs** *Eugene Trundle*
There is no more helpful diagnostic tool than the variac when dealing with strange fuse blowing faults and sets that trip or cut out. Bulbs can also be very useful when dealing with overload conditions.
- 666 Low-power Band I Transmitters** *Chas E. Miller*
Two vintage low-power transmitter circuits to provide vision and sound signals for Band I TV receivers. The transmitters were designed by Radio Rentals and were used for test purposes.
- 667 Next Month in Television**
- 668 More on the Low-cost TVRO System** *Roger Bunney*
A simple and effective way of providing protection for the expensive head electronics.
- 669 Maintaining BS415 Safety** *Denis Mott*
The safety of BEAB approved equipment can be affected by steps taken in the workshop. In the event of a subsequent accident you would be held legally responsible. Some of the factors that need to be taken into account.
- 670 TV Fault Finding**
Reports from Alan Shaw, Ian Bowden, J. Armagh, Nick Beer, Roger Burchett, Mick Dutton, W.H. Clarke and Brian Renforth.
- 672 Teletopics**
- 674 Storing TV Pictures in Chips, Part 2 – Digital Video Effects** *Eugene Trundle*
The techniques used by Panasonic in the NV-D80 VCR to provide freeze frame, strobing, graphics effects and noise reduction. The digital system uses 8-bit quantisation for higher quality AD and DA conversion.
- 677 The Room at the Back** *J. LeJeune*
Ralph Topcut's team provide more servicing insight.
- 678 First Euro S-VHS Demonstrations** *George Cole*
A report on the demonstrations of the European version of the Super VHS system given by JVC and Panasonic.
- 682 Load Matching Conditions** *S.W. Amos, B.Sc., C.Eng., M.I.E.E.*
The devices used in electronic power amplifiers, pentode valves and transistors, don't obey the fundamental law of load matching – that the source and load resistances should be equal. An investigation of load matching conditions.
- 684 Book Notes**
- 685 Service Bureau**
- 686 Test Case 307**

OUR NEXT ISSUE DATED AUGUST WILL
BE PUBLISHED ON JULY 20

VIDEO BELT KITS

★ PRICES DOWN ★

VKIT 1	AKAI	9300/9500/9800	2.40
	JCE	HR3300/3320/3360	2.40
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VKIT 4	SONY	SL3000/8500/8600	3.50
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VKIT 23	SANYO	5500	1.05
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HR7200	3HSSV	21.95
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HR7700	3HSSV	21.95

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383	3HSSPP	26.95
384	3HSSPP	26.95
385	3HSSPP	26.95
386	3HSSPP	26.95
387	3HSSPP	26.95
388	3HSSPP	26.95
481	3HSSPP	26.95
482	3HSSPP	26.95
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9500	3HSSPP	26.95
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V9600	PS3B1	30.00

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PHILIPS

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6520	3HSSUN	25.99

GENUINE HEADS

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SONY SLC3	49.39
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TOSHIBA 9600 (upper cylinder)	14.50
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SANYO 9300/9435/9500	53.00
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PHILIPS 1700	71.00

SUNDRIES

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------	------

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E60	3.05
E120	2.89
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L750	3.85
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MT01	Thorn T591	4.50
MT109	Thorn TX9	2.14
MT04	Thorn TX10	0.97
MS09	Fidelity 7010	2.43
MS31	Fidelity 7013	0.94
MS30	Philips K30	2.60
MS32	Fidelity 70109 Front Panel	0.91
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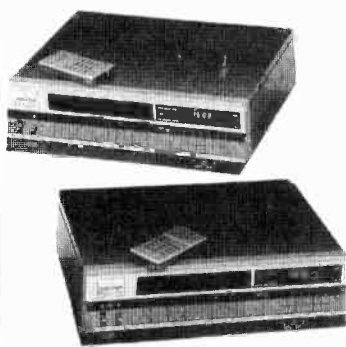
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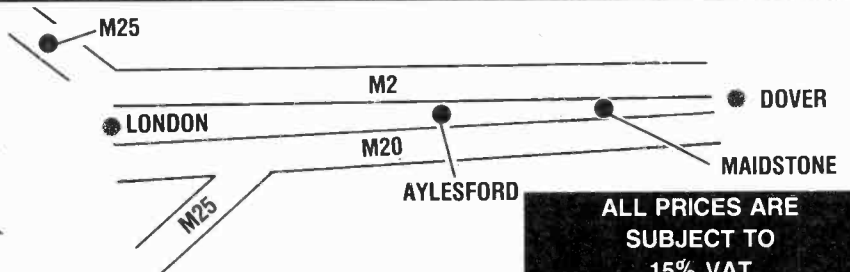
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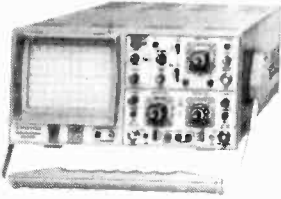
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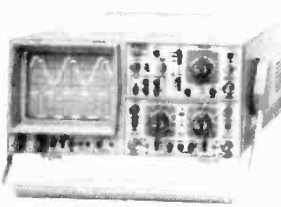
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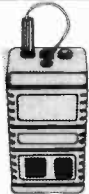
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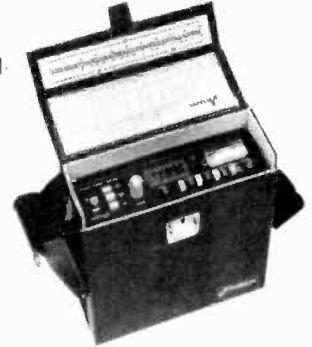
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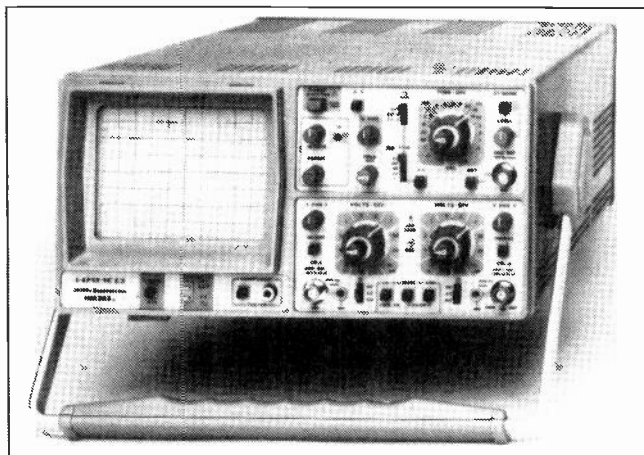
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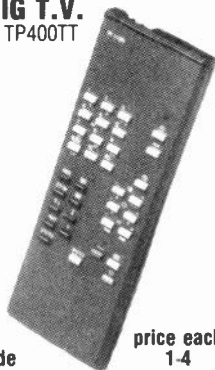
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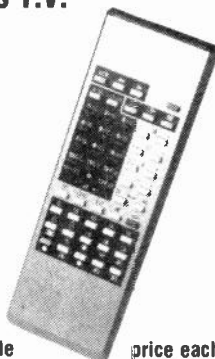
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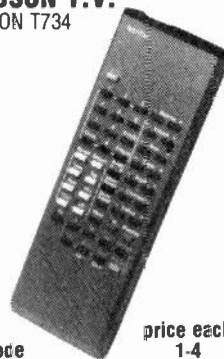
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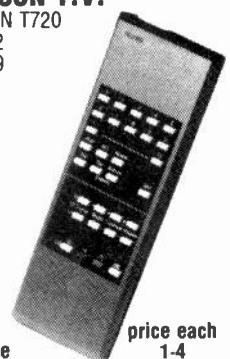
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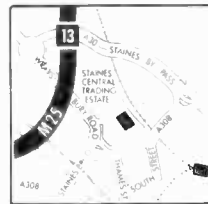
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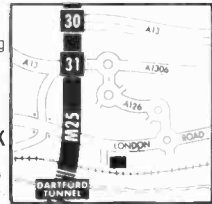
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- BD7 4 in flex switches with neon on/off lights, saves leaving things switched on
- BD9 2 6v. 1A mains transformers upright mounting with fixed clamps
- BD11 1 6 1/2" speaker cabinet ideal for extensions, takes your speaker. Ref BD137
- BD13 12 30 watt reed switches, it's surprising what you can make with these — burglar alarms, secret switches, relay etc.
- BD22 2 25 watt loud speaker two unit cross-overs
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- BD34 48 13A rocker switch three tags on/off, or change over with centre off
- BD42 5 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. Original cost £40 each
- BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. Original cost £40 each
- BD49 10 neon valves, with series resistors, these make good night lights
- BD56 1 mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole flat solenoids — you could make your multi-tester read AC amps with this
- BD67 1 suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks
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- BD139 6 microphone inserts — magnetic 400 ohm also act as speakers
- BD148 4 reed relay kits you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets
- BD149 6 safety cover for 13A sockets — prevent those inquisitive little fingers getting nasty shocks
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CASE — adaptable for 3" or 3 1/2" FDD. has room for power supply components price only £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 price £8 or with case £11. Our ref. 11P2.

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24306W. Which tube is implosion 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 £16 plus £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 £12 plus £2 post. The case will be made from coated sheet steel. overall size approx 10in x 10in x 7in high which will give ample space for the Power Supply and external controls if you fit them.

PROBLEM SOLVED

We have obtained from the manufacturers of the 9" Monitor, the TTL converter which makes it composite input suitable to work with any computer. We have had the printed circuit board made and have all the components and can supply this converter in kit form price £6. Our ref. 6P4.

AN ALLADIN'S CAVE

We have opened another shop in Hove, the address is number 12 Boundary Road which is between Hove and Portslade fairly close to the seaford. When you want to see before you buy and when you want to browse around the special bargains available, this is where you should make for as the Portland Road shop in future will be just mail order. You can of course, collect from Portland Road but you should bring in an order complete with reference numbers so that the stores can attend to it easily.

MINI MONO AMP

on p.c.b. size 4" x 2" (app.) Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each, or £13 for 12.



THIS MONTH'S SNIP

ACORN COMPUTER DATA RECORDER (CASSETTE). This is a morsie data recorder with switchable motor control intended to use with the Acorn Electron or BBC computers but also functions with almost any other computer and can be used for normal record and play-back of music and speech. Six key controls give "PAUSE", "STOP" and "EJECT" "CUE/FAST FORWARD", "REWIND/REWIND" and "RECORD", fast forward and rewind (100 seconds for C60). Also tape counter with reset button. Input signal range 5mV. Input impedance 40k ohm. Can be battery operated but is supplied with a mains adaptor. Brand new still in manufacturer's wrapping £8. Order Ref. 8P18 add £2 postage.

VENNER TIME SWITCH

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



Ex-Electricity Board. Guaranteed 12 months.

AKAI RV-UM300 MIDI-RACK

is a really excellent piece of furniture, ideal to hold your computer or audio equipment. Has three shelves in the upper section and a hinged glass fronted lower section. Height approximately 3ft, width 13 1/2in, depth 14in, on castors, dark walnut veneer finish. £15 plus £8 for Securior delivery. Order Ref. 15P11.

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15A PANEL METER These have been stripped from Government surplus battery charger units made originally for army use. Unused, tested but of course rather old, diameter 2 in can be surface or flush mounted. £3 each. Our Ref. 3P40.

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 l-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 £2 each. Ref. 2P183.

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

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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 £1 each. Ref. BD605.

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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 £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 £2. order Ref. 2P190.

CASE WITH 13A PROMGS — 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 £1. Ref. BD565.

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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 £8.50. Extension BT sockets £2.95. Packet of 50 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones 3 for £2.

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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 £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 £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 £2. Ref. 2P52.

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Yellow insul. handles. Length 4 1/2". Order Code: S0024 Price: £1.00 Per 10. 90p each

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Yellow insul. handles. Length 4". Order Code: S0025 Price: £1.00 Per 10. 90p each

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Dimensions: 125mm x 220mm (Approx). Order Code: S0014 Price: 50p Per 10. 45c each

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Universal. PRICE: 1+ £4.50 each 10+ £4.25 each 100+ £3.75 each

NI-CAD BATTERIES

AA	90	£1.25	£2.00	ea/10
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Secondary Socket (Flush)	£1.90	Simtel Phone	£16.35
Secondary Socket (Surface)	£1.70	Viscount Phone	£26.04
B.T. Cable (per metre)	15p	Conversion Kit &	
Line Jack Cord with Plug	£1.25	Wiring Diag.	£6.90
Extension Lead 5 Mtr	£2.90		

ORVX PORTASOL GAS SOLDERING IRON

PRICE: £16.00 each SPARE TIPS: £4.00 each

RESISTORS - CARBON FILM 5%

1/4W 1R0 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
1/4W pack 5 each value E12 - 10R to 1M 305 pieces 2.95
1/4W pack Popular - 10R to 10M 1000 pieces 6.50
1/2W pack 10 each value E12 - 2R2 to 2M2 730 pieces 7.75
1/2W pack 5 each value E12 - 2R2 to 2M2 365 pieces 4.70
1W pack Popular - 2R2 to 10M 1000 pieces 9.50
1W pack 5 each value E12 - 2R2 to 1M 353 pieces 13.75
2W pack 5 each value E6 - 10R to 2M2 317 pieces 21.75

ADDITIONAL KITS

DISC CERAMIC 50V 125 pieces £3.50
ZENER DIODES 5ea 55 pieces £3.50
ELECTROLYTICS R 100 pieces £7.25
FUSES 0/BLOW 20mm 80 pieces £3.75
FUSES 1/DELAY 20mm 80 pieces £7.50
PRE-SET POTS-H 1.45
PRE-SET POTS-V 1.20 pieces £6.74

SOLDER - 60% TIN 40% ALLOY

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

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (with stand)	72.50
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20
CS17 Iron Kit	1.99
C15 Iron Kit	3.30
XS25 W Iron kit/complete with stand & plug attached	11.00
CS 18W, as above	10.90
Antex 15W Iron	5.40
Antex 18W Iron	5.80
Antex 25W Iron	5.80
Antex elements	3.20
Antex bits	4.75
Antex stands	2.20
Soldersucker	1.40
Spare nozzles for Soldersucker	0.65

SERVICE AIDS

Aero Duster	1.55
Rapid Fire Extinguisher	1.94
Silicone Grease Tube	1.82
Heat Sink Compound	1.20
Light-gauge 0.08mm	0.80
Standard gauge 1.2mm	0.78
Industrial reel 1.2mm	2.96

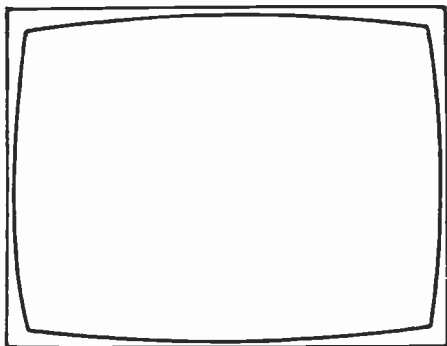
T.V. AERIAL ACCESSORIES

Co-Ax Cable 75 Ohm 100 Metre Reel	£11.00
1+ 10+	20p, 18p
Co-Ax Line Socket	25p, 30p
Co-Ax Line Connector	12p, 10p
Co-Ax In-Line Splitter	86p
TV/Video/Computer Combiner 7042	£4.05
TV Indoor Amplifier 7253	£16.95
Improves signal 3 times	
Second Set Amplifier 7243	£15.75
Improves signal to 2 sets 50%	
CB Interference Suppressor 9700	£5.55
Minimises CB interference on TV	
TV/FM Diplexer 9006	£4.95
Separates UHF TV signals from FM radio signals	

VALVES

Enquiries are well-come for any other valve not listed here.

Type	Price (£)
PC92	3.05
PC900	1.45
PC908	0.85
PC909	0.80
PC189	0.90
PC189	1.00
PCF82	1.00
PCF84	0.80
PCF86	1.30
PCF87	0.60
PCF200	2.00
PCF201	2.00
PCF84	1.25
PCF801	1.10
PCF802	1.10
PCF805	2.05
PCF806	2.95
PCF808	1.65
PCF812	1.05
PCF813	2.55
PCF814	1.25
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TELEVISION

Opening Up the Camcorder Market

It seems a long time since the clumsy and inconvenient two-piece portable VCR/camera arrangement was replaced by the compact camcorder, but sales have not been particularly buoyant. Last year some 95,000 camcorders were sold in the UK. This was an increase of 25,000 on the previous twelve months but hardly represents a burgeoning mass market. Suggested camcorder prices are at present around £1,000 upwards, though there has been some discounting to get stock moving. It now looks as if, with Amstrad's announcement of the Videomatic camcorder at £499 inclusive of VAT and such items as an a.c. mains adaptor/battery charger and a motorised cassette adaptor for playback, all this could be about to change.

Amstrad has certainly been able to get markets on the move in the past, and the Videomatic could well repeat the trick with camcorders. The price is a major breakthrough, and the sales strategy has been carefully aimed to appeal to the family market. What you have to ask is when a product suddenly seems to be affordable rather than a matter of "well maybe sometime at a later date". And of course the product has to be user friendly. The trade can trust Amstrad to have got these matters right. Just under the £500 mark has all the appearance of a good bargain for such a sophisticated piece of equipment. It puts the camcorder in the price range of upper TV and audio equipment and mid-market VCRs for the first time.

Alan Sugar's flare for this sort of thing has made Amstrad an extraordinary success story since he started the company twenty years ago, with the aim of "finding gaps in the consumer electronics market and filling them profitably". Amstrad's turnover reached £9m in 1980, when the firm was floated on the London stock market. Since then sales have virtually doubled year on year, reaching £511.8 in the year ending on June 30th 1987. This has been achieved through a policy of setting price levels that get markets on the move, having a clear image of the customer, directing the advertising appropriately and not stinting on the advertising budget.

In the past there has been a tendency to sniff at products "built to a price". Amstrad has proved that it can be done while maintaining high quality standards. In fact this has been the key to the firm's continued expansion. You have to be able to devise a basic design, then find a means of getting it manufactured. The numerous competent manufacturers throughout the Far East and the Pacific basin have solved the latter problem. Which is not to say that Amstrad relies wholly on overseas production. Its Shoeburyness plant assembles audio products while the joint venture with Funai manufactures VCRs and televideo products in the UK. If a few others in the UK's consumer electronics industry had shown some of Alan Sugar's feel for the market and ability to come up with the goods, maybe the industry wouldn't have ended up in its present sorry state.

The basis of Amstrad's approach to the camcorder market lies in the fact that whereas every second household in the UK now has a VCR only one in a hundred has a camcorder, representing a huge untapped market. The firm feels that in the past camcorders have been aimed at enthusiasts instead of the mass market, and has adopted the marketing message that "the Videomatic is the most rewarding purchase a family can make". Those who watch markets have suggested that at around £500 a unit the UK camcorder market could reach about one million a year by 1991. Amstrad probably expects to do better than that.

While there seems little doubt that Amstrad has got its product and marketing strategy right, there is still room for scepticism as to what the public will actually do with the camcorders it buys. There's a limit to the number of holidays, weddings, new cars/houses etc. that you might wish to record on tape. After that, what? A little creative movie making perhaps? It doesn't seem likely. One remembers many other mass market openings. All those early low-priced reel-to-reel audio recorders that ended up on top of the wardrobe, the home computer in the loft and so on. Living in London at the height of the tourist season I see masses of people going about with expensive cameras around their necks. They don't seem to take many pictures though! One nevertheless wishes Amstrad well with its camcorder, and even if buyers make little use of their camcorders they'll doubtless and rightly feel they've got a bargain.

One interesting point is the effect all this will have on the VHS-C/8mm rivalry. The Videomatic will certainly give a great boost to the sales of VHS-C equipment and will doubtless ensure that this format dominates the ordinary consumer market. It seems likely that 8mm will have to exploit the more specialist end of the market: whether this will be large enough to guarantee a future for 8mm remains to be seen. The compatibility between all that software, the mass of VHS VCRs that have been bought and now the new low-cost camcorders seems certain to leave VHS dominating the entire video market for the foreseeable future.

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 641.

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COVER PHOTO

The off-screen photo on this month's cover shows a graphics still picture display produced by the Panasonic Model NV-D80 VCR. See article on page 674. The lady is some sort of astronaut!

CPC's FREE COMPETITION

For details of the competition mentioned on the front cover, and an entry form, see CPC Ltd.'s advertisement on page 646. By entering this entirely free competition – there's no obligation to CPC Ltd. – you could win a 20MHz, dual-trace Hameg oscilloscope worth over £350 (trade price). In addition there are nine other prizes of hand-held digital multimeters.

Long-distance Television

Roger Bunney

April 1988 certainly won't go into the record books. The few reception reports received reflect the poor conditions, and the traditional mid-April Sporadic E opening failed to put in an appearance. Meteor scatter signals gave us something to enter in the logs, but even the Lyrids shower around the 21st/22nd produced little of note. The Band I SpE log is as follows – a few sustained signals, but no true openings.

- 5/4/88 DR (Denmark) ch. E3.
- 6/4/88 TVP (Poland) R2; CST (Czechoslovakia) R2; SR (Sweden) E3.
- 7/4/88 RTP (Portugal) E3; CST R2.
- 8/4/88 +PTT (Switzerland) E3; TVE (Spain) E2, 3.
- 10/4/88 NRK (Norway) E3.
- 14/4/88 CST R2.
- 15/4/88 SR E3.
- 18/4/88 CST R2; TVE E3; RTP E3.
- 19/4/88 SR E2; + PTT E2.
- 20/4/88 RUV (Iceland) E4; CST R2; TVE E3.
- 21/4/88 CST R2.
- 22/4/88 SR E2; CST R2; TVE E3.
- 24/4/88 TVE E2, 3.
- 27/4/88 TVE E2, 3, 4.
- 28/4/88 SR E3.

A tropospheric lift occurred on the 24th, giving reception of Band III and u.h.f. signals from France and the Low Countries throughout much of the UK. Many enthusiasts had their first reception of the new NOS-3 service on chs. E30/34/35/42.

A large aurora on the 4th produced signals from TSS (USSR) on chs. R1, 2 and 3 and NRK chs. E2, 3 and 4 in Scotland, along with much other Band I activity including 50MHz beacons etc. There was also auroral activity on the 10th and 22nd. The aurora in February, mentioned last month, produced amateur radio contact between Europe and Perth, Australia on the 21st: the 52.3MHz Perth beacon was heard for about an hour from approximately 0900 GMT. A large aurora occurred on the following day. This suggests an increasing sunspot count, and hopefully we'll experience F2 propagation at the lower end of the v.h.f. bands within the next winter or two.

My thanks to Iain Menzies (Aberdeen), Bill Cotterill (Tipton), Simon Hamer (Powys), Roger Fussell (Torpoint) and Ryn Muntjewerff (Holland) for sending in reception reports to supplement my own.

News Items

UK: Test transmissions for the forthcoming late-night BMTV medical programme have been noted via BBC-2. Alternate scrambled, using the Canal Plus type coding, and clear programme material has been seen, with general medical news, feature items, commercials for various medical products etc. The BMTV logo appeared frequently and preceded advert breaks.

As mentioned in Teletopics last month, the use of v.h.f. for additional TV channels in the UK has been ruled out following a feasibility study.

Luxembourg: RTL+ is to establish a transmitter in Wesel, West Germany, channel not yet announced.

Belgium: The RTBF TELE2 service is now known as TELE 21. The PM5544 test pattern carries the identification TELE 21 at the bottom and TOURNAI canal 63 etc. at the top.

Switzerland: The only Canal Plus material now being transmitted by Telecine consists of movies. The La Dole ch. E4 transmitter is testing with dual sound channels: the main sound is Swiss French radio 1, the second channel consisting of a pop music programme. A fourth commercial TV service is expected to start soon, transmitting German language material at u.h.f., with the PTT operating the transmitters.

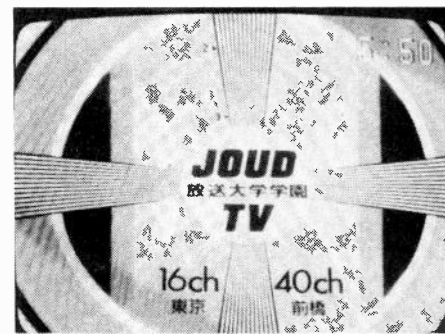
Austria: ORF has started to transmit regional TV programming at u.h.f. More news when available.

USSR: Leningrad TV is now being transmitted via Kostroma ch. R1, Tallinn ch. R3 and Pskov ch. R5. Moskva TV is transmitted on Moscow ch. R3 and the CT-4 educational programme on Gorkij ch. R4. All possible now that the SpE season has started.

India: The second programme Doordarshan TV2 is being transmitted on ch. E7 from Delhi, Bombay and Calcutta. Madras is expected to follow. A stereo radio service is to be started in New Delhi, on 107.1MHz.

Our contact Nanda Kumar reports reception with good signal quality from the Ekran downlink on ch. 54 – this is in addition to the regular ch. 51 transmissions. He comments that his NV300 VCR, which is a popular model in India, will record and play back PAL and SECAM signals though usage is indicated as PAL only.

Radio amateurs: The proposed French 50MHz band is likely to be 50.2-51.2MHz instead of 50-51MHz. The power levels have also been revised, to permit a maximum of 100W e.r.p. where 150km or more from a ch. 2



Left: Asiavision PM5544 test pattern seen at the start of a news exchange via the ECS satellite at 7°E. Photo from Ian Waller. Centre: Tropospheric reception of CST-2 ch. R35 by Ryn Muntjewerff (Holland) in December 1987. Right: Joud-TV test card, photographed by Fred Robins during a visit to Japan.

transmitter, with reductions to 3W maximum at about 70km and no operation permitted closer to a transmitter.

Satellite TV News

The Italian RAI-UNO service is being downlinked to Poland via the ECS satellite at 10°E, initially for cable distribution in the Warsaw area. Poland is one of the few Eastern Block countries that allow domestic satellite TV reception.

A dual language, French/Arabic, RTM-Morocco service is to be provided over an Intelsat downlink, intended for cable distribution in France.

Two Italian cable channels, Italia 1 and Rete 5, are available via Intelsat at 18.5°W. I've received them at fair quality on the 90cm dish, with corner identifications TV TIVU and No. 5. During the early part of April RTL+ was seen via ECS at 10°E, but the signals have disappeared. NRK (Norway) has been testing via the Intelsat satellite at 1°W, at approximately 11.45GHz with horizontal polarisation – the usual PM5544 test pattern has been seen.

The Grand Masters golf play-offs for the finals were linked from the USA to the UK via the Intelsat satellite at 27.5°W. The system M signals were of good quality though with effects only on sound, i.e. no commentary. The hijacking of the Kuwaiti jumbo jet was extensively covered via the ECS satellite at 7°E: the Algerian PM5544 test pattern was screened between live/recorded offerings from the airfield scene.

DTI permission has been given for reception in the UK of TV and other signals from the PAN-AM satellite.

Astra comments that the use of a 60cm dish for reception in the UK assumes a dish efficiency of 65 per cent and an LNB noise figure of 1.5dB. Plane rather than circular polarisation will be used. It's suggested that a second co-sited satellite using the 10.95-11.2GHz and 11.45-11.7GHz bands could provide a further 32-48 channels. Astra is to use careful downlink beam tailoring to obtain the required coverage instead of using spot beams. Eutelsat may adopt this same technique.

A French TV service, Tele-France, is to be made available to African countries via an Intelsat downlink. It will provide news etc. from the French networks and will replace the videocassette service in use at present.

Wideband Aerial

In the February column we drew attention to the wideband log-periodic aerial, Model CLP5130-2, available from Waters and Stanton. Its coverage is 105-1,300MHz. We have been told that orders can now be taken for the CLP5130-1 version, covering 50-1,300MHz. This has 25 elements, a gain of 10-12dBi and a typical front:back ratio of 15dB. The boom is 2m long, the longest element 6m and the weight is 5kg. An N socket connection is provided. The cost is £179 inclusive of VAT. For further details contact Waters and Stanton, 18-20 Main Road, Hockley, Essex SS5 4QS – 0702 206 835.

New EBU Listings

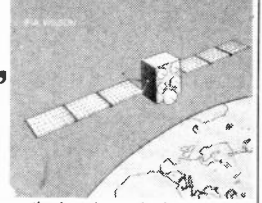
Holland: The following transmitters will be used for the NOS-3 service: Lopik ch. E30 1,000kW; Roermond ch. E34 250kW; Goes ch. E35 250kW; Wieringermeer ch. E42 300/150kW (directional); Arnhem ch. E43 30kW; Smilde ch. E44 1,000kW; Eys ch. E48 1kW; Markelo ch. E51 300kW; Maastricht ch. E59 1kW. Powers e.r.p. and polarisation horizontal in all cases – also stereo sound

AERIAL TECHNIQUES

'An Introduction to Satellite Television'

£5.95

An Introduction to
Satellite Television



A practical and affordable guide to all theoretical and practical aspects of satellite TV reception (TVRO). Covering the orbiting and operational profile of many birds, their footprints signal form and propagation, types of dishes and feeds, LNA/LNB characteristics, the design of typical receiver circuits, together with many illustrations.

With the imminent expansion of satellite transmissions (Astra, BSB, PAN-AM) + along with current ECS/Intelsat activity, this book is essential reading for the enthusiast and trade – and at a remarkably low price for a 100 page + specialist publication. We have a 'post review' consignment of these books available for immediate dispatch, order a copy and learn about the fast approaching receiving technology. Single copies cost UK £5.95 + 65p p&p Europe add £1.50 for postage.

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Transmitter Lists

The 1988 pocket guide to all ITV/ILR stations is now available from the IBA, Engineering Information Dept., Crawley Court, Winchester, Hants SO21 2RQ. For a free copy send a stamped (20p) self-addressed foolscap envelope. The latest RTE TV/radio transmitter list is available from Radio Telefis Eireann, Reception Investigation, Donnybrook 4, Dublin, Eire – send return postage with requests.

From our Correspondents . . .

In my series describing a low-cost TVRO installation I commented on the high cost of imported US F connectors. R.G. Daubney has written to point out that a wide range of connectors, including the F series, is available from Britimpex Ltd. of London – telephone 01-891 6344.

Robert Copeman reports from Australia that pirate TV activity is becoming quite common. Several budget broadcasters seem to be using TV senders coupled to large outside aerials. He reports from the Melbourne area that in addition to the Greek transmissions on ch. 11 other transmissions, with movies and pop, have been seen on chs. 6 and 11 (two transmissions on each channel, from different directions).

Gareth Foster (Twickenham) writes about sources of local interference. He comments that the use of cordless baby alarms operating at around 49-85MHz is likely to increase as several major retailers, including Boots, stock

them. These mains-operated alarms have an official range of 100ft or so, but they provide a noise-free carrier with a range of up to half a mile. Most have extending whip or helical "rubber duck" aerials, though a few make use of the mains wiring. It seems that the use of these alarms in the low-power device band is accepted by the DTI.

The Triax UFO Active Aerial

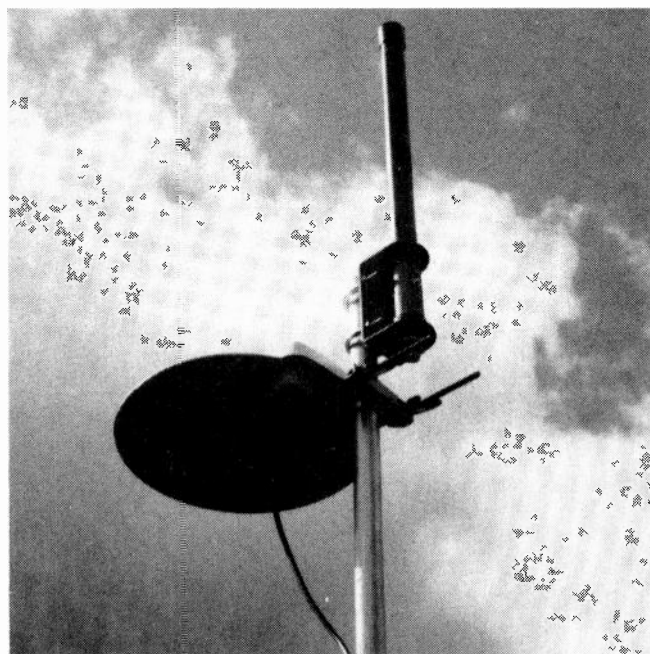
Miniature active aerials that give omni-directional reception have been available for several years. They are mainly used in marine applications where the protective dome is an additional advantage. There can be problems when a ship is moored or berthed, due to signals reflected from dockyard structures, other vessels, masts and even wavetop scattering. Such aerials have a coverage of something like 45-860MHz. Since the units are sealed, their contents are something of a mystery. Some years ago Jim Cook, an active TV-DXer, found the remains of an active marine aerial on a shore in the north east. The aerial elements consisted of a series of rings with inductive loading, etched on a large PCB, the diminishing-sized rings giving coverage of Bands I/II/III and u.h.f. Each ring was diplexed into a common feed to a wideband preamplifier.

Since, other than for u.h.f. reception, the rings will be somewhat smaller than the signal wavelength, the omni-directional characteristic will be more pronounced at the lower frequencies. For some reason the Triax RB16 marine system has a deep 180MHz null at about 200°. The Fuba marine system differs in using a series of discs for the various bands. This is perhaps the most comprehensive (and expensive) system used in shipping circles, having discs for a.m./f.m. radio, Band I, Band III and u.h.f. The optimum efficiencies of these discs, relative to a half-wave dipole, are quoted as -6dB for Band I, -4.5dB for Band II, -3dB for Band III and -2dB at u.h.f. The aerial system itself is passive, intended for use with external amplifiers.

Care has to be taken with the design of ship-borne active aerials since impulse radar and h.f./v.h.f. radio may operate in close proximity and will often be within the aerial's passband. Triax amplifiers usually incorporate a 1GHz + filter. All systems of this type must be able to operate without saturation in the presence of high-level transmissions or have a switched desensitising arrangement. So the omni-directional marine aerial is an interesting device - and usually expensive.

It was with interest therefore that I noticed the recently introduced Triax UFO active aerial, a compact, wideband system that sells, without a power supply, for considerably less than a conventional active aerial. Triax says that this aerial is aimed at the marine and mobile markets, the latter covering lorries, caravans, etc. It could however be used for general reception in situations where large aerials are not permitted.

The aerial has a matt white plastic covering. It's three inches thick, has a diameter of only 10.5in. and weighs 1.5lb, including bracket. The output is via a standard SO329 socket (the CB radio socket) so you need a PL259 plug for connection. The socket is underneath the housing and is without protection: use of suitable weatherproofing such as self-amalgamating tape is advisable. I wasn't too impressed by this lack of protection, and feel that even a small rim should have been incorporated in the housing around the socket. Two brackets are available, a stainless steel one for marine use (you need to drill a hole in the support mast with this bracket) and a mobile use one that



The Triax UFO active aerial, mounted alongside a Les Wallen 55MHz helical aerial.

resembles a standard Continental aerial bracket. This latter bracket is of plated mild steel and fits aerial masts of normal diameters. As with standard masthead amplifier practice, the aerial is powered via the downlead, with the coaxial cable's positive inner conductor taking 30mA at 12V or 60mA at 24V from a standard power supply or a special (to order) 12V battery filter unit. Coverage is quoted as 47-860MHz, i.e. Bands I-V inclusive, and is omnidirectional of course. The internal amplifier has a noise figure of less than 2dB and the overall gain is given as 16dB in Band I, 12dB in Band II, 15dB in Band III and typically 22dB at u.h.f., with an output impedance of 75Ω. Information on the internal construction is unfortunately not available!

I obtained one for test and powered it up from a 24V supply to see whether it really works - it does! Reception at v.h.f. is largely omni-directional but at u.h.f. the pickup varies as the aerial is rotated - the nulls are not deep, the variation measured with a field strength meter under domestic conditions being 4-5dB. Interesting to note that it also receives aircraft communications in the 120-138MHz band.

Using Lille (A2) as a signal source, I found that the Band III signal pickup is somewhat down on a standard Yagi array, which is what you'd expect since the Yagi will have a gain of 10dBd compared to the UFO's likely gain of around -10dBd. Band II f.m. radio reception is excellent - others have confirmed this.

To summarise, this is a useful and interesting aerial. It's not a hot TV-DXing system, but it will provide efficient pickup of local signals and, under appropriate conditions, those that are not so local. There's the perk of air band reception. It serves well in marine use, though the limitation mentioned earlier must be borne in mind. If you decide to use one, take care over weather protection at the SO329 signal output termination to prevent water ingress.

My thanks to Triax Aerial Systems Ltd., Saxon Way, Back Lane, Melbourn, Nr Royston, Herts SG8 6DN (0763 61 755) who kindly supplied a sample aerial for me to try out. The aerial system is available from aerial dealers or ring Triax to find your nearest source.

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Letters

PROBLEMS OF THE FREE-LANCE ENGINEER

Your readers' comments on the viability of present day TV and video servicing have been both interesting and varied, and have given some pointers to the future.

For the last five years I've been a free-lance TV/video engineer. I didn't take this course by choice but out of necessity. Many in this industry have lost their jobs through no fault of their own: the causes have been takeovers and job shedding as a result of increased equipment reliability. It happened to me at the age of 40, and at that age no one seems to want to employ you no matter how able you are. But what do you do at 40 when TV is all you've ever done?

I've done reasonably well over the last five years and can truthfully say that I've found it interesting in all its aspects. But you must be prepared to work hard and do any type of TV, video and music centre that comes your way. It's my experience that a good job done at a fair price will be rewarded with continued work over the years.

This work calls for a comprehensive range of TV, video etc. service manuals and a range of good quality, up-to-date servicing equipment. You can't hope to be thorough without these. I've found that from time to time and at great cost I have to telephone manufacturers for technical information and help. Yes, help – like many others no doubt. I also find VCR Clinic and TV Fault Finding of help from time to time – thanks in particular to E.T. and S.B.

Recently I've found that manufacturers are becoming less willing to supply technical advice and manuals. In fact some manufacturers have withdrawn technical help from non-account holders. I think in particular of Grundig, whose policy has been discussed in your columns in recent issues. I've to date avoided taking in many Grundig TV sets and VCRs though there's a demand for servicing them here – a couple of local Grundig dealers will repair only sets they've sold. The problem is made worse by the fact that Grundig spares are very expensive, making it difficult to do a reasonably priced repair. I can't help feeling that Grundig are not doing themselves a favour by making it difficult for their customers to get their equipment serviced – you can't always go back to the original supplier.

One growing problem is the expense of service manuals. Sanyo and Fisher will supply excellent manuals free of all charges to our door: they are very helpful indeed. Hitachi and Panasonic supply excellent, moderately priced manuals, but others are very expensive. £20-£35 is not uncommon for a VCR manual and some TV manuals cost more. I have to think twice before purchasing such manuals. It's no doubt o.k. if you are a large company that deals with a limited number of makes, but for those like me who take on anything such prices present a real problem. I'll give say £15 for a manual: not happily, but I'll grin and bear it.

Now to knock off the grin. Several readers have pointed out that things will get worse, and I agree with this. Manuals won't get any cheaper and technical information, even when freely available to non-account customers from well-meaning manufacturers, will be expensive since most of us will have to telephone for it.

What would be helpful would be to have a nucleus of free-lance engineers in each area with a view to exchanging manuals at no cost to each other and passing on information. This will certainly be needed in the years to come when high-tech equipment becomes astro-tech. Who will you talk to then? I'm wondering whether it would be an idea to link up with each other via an amateur radio network. Give it some thought, fellow readers. I look forward to your comments in the following months.

*R.T. Barnes-Wallis,
Brighton, E. Sussex.*

THE AMSTRAD CTV2200

I see that the Amstrad Model CTV2200 has come up a couple of times recently in Service Bureau (May). The following notes on my experience with these sets may be of help to others.

The usual symptom is a dead set with a short-circuit line output transistor (Q802). Sometimes you will find that the chopper transistor Q501, the surge limiter R501 and the chopper supply fuse F502 have also gone. Replacing these items usually results in a working set that fails minutes or days later. Amstrad advise that when Q802 fails repeatedly the following electrolytics in the line timebase should also be replaced: C845 (4.7µF, 250V), C853 (1µF, 160V) and C854 (1µF, 250V). I usually replace these capacitors as a matter of course, along with C815 (0.01µF, 1.6kV) and, if fitted, C862 (560pF, 2kV). All parts are readily available from CPC Ltd., who supply a 2SC2791 as a replacement for the 2SC3156 chopper transistor.

Dry-joints are a prominent feature of these sets, and a close scrutiny around the line driver transformer T801, the scan correction transformer T803 and the chopper reservoir coil L503 will pay rewards.

Any further comments/tips on these sets would be welcome.

*S.J. Cain, Valley Electronics,
Holyhead, Gwynedd.*

PHILIPS V2000 SERIES VCRs

In the April issue B.B. Lock described a modification for the Philips Model 2023 VCR to override the three-four minute auto shutdown. I have tried this on my 2022 VCR but it still cuts off. Any ideas?

*Seamus Feeney,
Castleblayney, Co. Monaghan, Ireland.*

Barry Lock, Eng. Tech., writes: All Philips V2000 series VCRs use the same method to control the main 12V power supply. Some power supplies have two SG3524 chips, others one.

The remote shut down works as follows. If there's a high on pin 10 of the SG3524 the device stops working. So in most cases there's no need for any connection to this pin. V2000 machines use the voltage on this pin to turn the VCR on and off. The voltage is controlled by the microcomputer chip which works all the time and produces such functions as the clock and program counter. When the VCR is fully powered the chip carries out about 144 functions, which is why these machines appear to be slow in their operation.

After a study of the power supply circuit I've come to the conclusion that the best way to override the three-four minute shut down is to fit a single-pole switch across the collector and emitter of transistor 7005, which is a BC547.

When the switch is closed the VCR will be on all the time. It could be marked "shut-down override". Transistor 7005 is located above the SG3524 control chip.

The switch must be in the open position at power up so that the microcomputer chip can carry out the correct power-up routine. Then turn the VCR on in the normal way. Next operate the override switch, returning it to the off position when you've finished with the machine.

The VCR must be checked to ensure that all functions work correctly when the switch is in the on position.

MEASURING CRT HEATER VOLTAGES

Many readers may find that their need to measure c.r.t. heater voltages does not justify building the checker described in the January 1987 issue of *Television*. The problem arises because the c.r.t. heater supply in a modern set is derived from the line output transformer and consists of pulses generated in a secondary winding as a result of the resonant flyback voltage in the primary winding. Thus the supply consists of half-sinusoidal pulses that last for about 12 μ sec of the 64 μ sec line scan time. The pulse length and peak voltage can be measured with an oscilloscope (check the calibration if necessary). Calculations show that with a pulse width of 12 μ sec the following apply:

Peak voltage	R.M.S. voltage
23.4V	6V
23.8V	6.1V
24.22V	6.2V
24.6V	6.3V
25V	6.4V
25.39V	6.5V
25.78V	6.6V

A 12V heater will need a peak voltage of 46.88V.
*J.O.N. Burrows,
Havant, Hants.*

THE HITACHI VT63/64

I was interested to read Alfred Damp's report on the noisy Hitachi VT64 in last month's VCR Clinic. This is actually a well known problem with the VT63 and VT64 – Hitachi issued a Technical Bulletin on it dated March 1986. The correct lubricant to use is Hita-sol grease (part no. 7099011) which is available from Hitachi, or Castrol MS3 which contains molybdenum disulphide. I was rather amazed to read of Vaseline being used.

*Keith Pemberton,
Southampton.*

HELP WANTED

I have been trying to obtain a record/play switch for a Ferguson Studio 25D music centre and have been told that this is no longer available. Hopefully someone may be able to help. The slide switch is of the same open construction as used in a 405/625 dual-standard TV set – it has two rows of eight sets of changeover switches, giving 48 contacts in all. It would be a pity to scrap such a good machine for a mere switch, so I would be most grateful for any help.

The advent of stereo TV sound will surely create a demand for stand-alone NICAM decoders for use with hi-fi VCRs. Perhaps an advertiser will take up the challenge

to supply kits, or maybe a contributor could come up with a suitable design.

*Colin McCormick, 21 Manor Road,
Plymstock, Plymouth, Devon PL9 7DP.*

HELP WITH VINTAGE TV

In the April issue you kindly published my letter asking for help with renovating a Bush Model TV22. The response was phenomenal, with mail and telephone calls offering assistance coming from all over the country. I now have the set working via an optical standards converter – the original low e.h.t. problem was traced to an open-circuit boost capacitor.

I hope I've replied to all who contacted me. If I missed anyone, thanks. An apology is required. Due to an oversight, a very small batch of replies was posted without courtesy stamps being attached. Sorry.

The following list of some sources of supply/help may be useful to others in the future.

Gerry Wells, Vintage Wireless Machine Museum, telephone 01-670 3667. Gerry has digital and analogue converters and will try to supply components.

PM Components, Gravesend, telephone 0474 60 521, has extensive stocks of obscure valves at very reasonable prices.

Terry of Brunswick Radio, telephone 01-520 2960, is a fellow enthusiast with a collection of old sets and parts.

Langrex Ltd., telephone 01-677 2424, has a large stock of valves.

The Vintage Wireless Company Ltd. of Bristol, telephone 0272 565 472, has sets and spares.

Joseph Urban and Sons of Fife, telephone 0333 310 471, is an old-established family firm that specialises in the repair and rebuilding of vintage radio and TV receivers.

*David C.J. Tilley, GIUEF,
Stoke Newington, London.*

STATE OF THINGS TODAY

Colin McCormick raises the question of the picture quality with sets that use FS tubes. I must say that I wholeheartedly agree with him, but even conventional tubes are nowadays poorly set up. There's only one set that I personally would consider worth buying, the Sony Profeel – and that was designed years ago! If you compare a modern set with one of the all-time classics, the Panasonic TC275G, the older set – now over eight years old – wins hands down. Modern tubes defocus with plenty of drive, the grey-scale is rarely acceptable and the convergence is generally appalling. It's not usually simply a matter of poor adjustment, but that the design of the set doesn't allow for correct setting up.

This is a very sad state of affairs, and much the same applies with video recorders. The Panasonic NV7200 still gives one of the best VCR pictures – sharp, clear and with natural contrast and colouring. While today's VCRs incorporate innumerable trick features, they nearly all produce a smeary picture with poor colouration and a chroma cast. I wouldn't swap my NV7200 for any of them!

Another case last week made me reflect on the abysmal state of the trade these days. We had to order a new tube for a Sony KV2092 because the old one had an intermittent short. When we unpacked the replacement we found

that it wasn't packed in the usual polystyrene mouldings but in expanded foam. There were also the remains of two permalloy assemblies. When we fitted the tube we found that it was difficult to set up. With the purity set correctly convergence was impossible. I noticed that it would set up better if the degaussing coils were disconnected. Current was obviously flowing through the coils — with the coils out of circuit a scope showed 80V peak-to-peak pulses at line rate. Not having a set with which to make comparisons, we rang Sony technical (SES) to find out whether or not this was normal. They couldn't advise on this. Nor could they say whether it's normal to have blue and green shading from the corners rather than the sides during purity adjustment, something we've not had before. After one or two more fruitless questions we were advised to stick on as many disc magnets as might be required to mask any defects, as that's what they do. Does this

illustrate Mr. McCormick's point?

We haven't had the best of service from SES. On the very rare occasions when we seek information it's usually a case of "too old, before our time" or "too new, no faults known". Panasonic on the other hand have been known to telex Japan for obscure information on industrial products. They can provide voltages and waveforms that are not on our service sheets, and will always ring back if necessary.

Sony's policy on service manuals is another strange one. Only top dealers get automatic mail shots whereas all their dealers used to get these. The administrative work of having to send individual manuals invoiced f.o.c. and the phone calls must surely cost more than sending ten or twelve together for each dealer on the lorry.

Nick Beer,
Bideford, N. Devon.

Outlook Cloudy

Les Lawry-Johns

A customer brought in an ITT set fitted with the CVC30 chassis and full remote control. He complained of no sound or picture, and remarked vaguely about random channel changing after the set had warmed up. I studied the chassis and decided to replace the left-side i.f. panel. Doing this made no difference at all, so I looked at the circuit diagram and saw that I'd marked R28 (820 Ω) with a star. The trouble was that I couldn't find it.

At this point a young friend of mine by the name of Surinder Lakha came in to ask me something. He looked at the set on the bench and asked what was wrong. I told him — basically no sound or vision with the timebases working. "I've had that trouble" he said. "It's the resistor down the bottom." He pointed to the lower left side. I looked there and found R28 looking back at me. Quick as a flash it was out and was replaced with two resistors, of 300 Ω and 520 Ω , in series. I thought they would last longer. The picture and sound then came on and stayed. Thanks a lot Surinder — call in again any time!

If I'd marked it with a star, how come I didn't know where it lived? The clouds are still a bit thick. The set's owner came and collected it. Next day he was back again to tell me I needed sorting out and that he was just the one to do it. I hadn't dealt with his tuning troubles you see. I had a word with Geoff (Moon Lane) about the problem and he referred me to his friend in Welling, an ITT expert. The advice I was given was to replace the SAA1124 chip in the remote control unit. I did this when the set was brought back. It went off again and I've heard no more — I'm still waiting to have my head bashed in . . .

day. He told me to go back to my doctor and continue with the pills. He hadn't been able to find much wrong with me. Perhaps I'm just going barmy — or getting old.

The Ferguson TX9

A colour portable fitted with the Ferguson TX9 chassis came in yesterday and had me by the short and curlies for a little while. Field collapse usually means that the TDA1170S field timebase chip has failed. This time however the field scan was about two inches high, which gave me a moment's hesitation. Having checked the supply I changed the TDA1170S, but I needn't have bothered as the results were just the same. I next checked the height control and found that there was no voltage here at all. R268 (1.5M Ω) which is in series with it was open-circuit. The old adage still holds good: check that the voltages are right before you do anything else.

The Philips G9

A 26in. Roberts set fitted with the Philips G9 chassis came in the other day, with several troubles. They all seemed to clear when I replaced the lower right side timebase panel. Off it went and back it came next day, for field collapse after the set had been on for a time. This surprised me as I'd replaced the timebase panel. The cause of the trouble turned out to be a poor contact at the top of the left side convergence panel — a run round with the soldering iron cleared it permanently. But it had still needed the timebase panel.

Hey What's This?

What's this I hear? Someone was looking through a 1957 issue of *Practical Television*, as we then were, and came across my article of the Etronic Models ECV1523 and ECV1527. He asks whether the Les Lawry-Johns of today is the L. Lawry-Johns of those days and suggests it's maybe a pen name that several people have used. Not so! I wrote about those sets then just the same as I'm writing this now — well, nearly the same. It seems that the reader who enquired is about to retire. That doesn't mean I've got to, though it might not seem a bad idea. I must give it some thought.

July is a month of birthdays. Surinder, whom I mentioned earlier, has his on the first while Honey Bunch's is on the fourth. Independence Day, yes indeed. Happy birthday love.

More Confusion

Just to show you how daft I am, the other day I collected a T20 which suffered from intermittently poor focus. I fitted three focus units before I realised that it was a T20 and that the tube base socket was therefore at fault. I keep these in stock and one was fitted in no time, giving perfect focus that didn't vary.

How loony can I get? Now the psoriasis is coming back, affecting my hands, nose and ears. Once I become the Ugly Man my mind should clear despite what the medical profession tell me. I went back to the specialist the other

VCR Clinic

*Reports from Alfred Damp, Eugene Trundle,
Dave Dulson, Philip Blundell, Eng. Tech.,
Nick Beer, Mick Dutton and T.J. Welford*

ITT VR3906/JVC HRD140

The complaint was no results. There were no switched 12V and 5V supplies as the power control line remained high. The power control input to the microcomputer chip in the mechacon section was correct, going low when the function button was pushed, but the control line to the power supply remained high. Replacing the mechacon micro put matters right. **A.D.**

Hitachi VT410

This machine wouldn't accept tapes. The cassette in indicator was on, and if the cassette housing was removed the play mode could be selected. The cause of the trouble was no supply to the cassette LED – it was shorted to chassis. We found that the ribbon connector between the deck PCB and the main PCB was displaced at the main PCB. **A.D.**

Sanyo VHR3100/VHR3300

A common complaint with these VCRs is no results. In all cases we've found that R5001, a 2.7Ω 0.5W safety resistor, has been open-circuit. No other fault has been found. With R5001 open-circuit the always-12V line drops to 5.5V and the always-5V line to 1.3V. **A.D.**

Hitachi VT11

The drum motor was running continuously as there was apparently no supply to the motor start transistor Q601, possibly because D614 was open-circuit. Replacing this diode didn't cure the fault, but replacing Q601 did – despite the fact that a cold check out of circuit didn't show any leaks. **A.D.**

JVC HRD370

The symptom was intermittent shut down during play. Oscilloscope tests carried out over a long period proved that the supply-reel rotation sensor signal disappeared from pin 35 of microcomputer chip IC601 a few seconds before shut down occurred. The photocouple system has only two connections to the PCB, for LED supply and the output pulses, relying on its mounting screw to earth the emitter and sensor to the deck metalwork. The screw was loose! **E.T.**

JVC HRD230

This seems to be a fairly common fault. The symptoms, from switch on, are no eject and a squealing noise from the loading belt, rapidly followed by machine shutdown. If the machine is in play when the trouble occurs, the tape is unlaced then the squeal comes, followed by shutdown. These things stem from a loose screw that secures the deck terminal PCB under the deck. If it's not tight, earth continuity to the mode switch and the take-up FG is lost – intermittently. **E.T.**

Panasonic NV7000

This machine, a well-worn old soldier, wouldn't play or record a three-hour tape if the supply reel was full or nearly

full. Instead it would shut down and unthread shortly after completion of tape threading. What was happening was that the supply reel was virtually unbraked, and the inertia of a full reel of tape would unwind a few centimetres of tape during threading: normal forward tape motion didn't take up this slack before the lack of supply reel rotation triggered the syscon to produce an emergency stop. On investigation we found that the felt lining had parted company with the back-tension regulator band, and the soft brake had softened to disappearing point . . . **E.T.**

JVC HRD170

The remote control handset was first brought in on its own, with the complaint that it didn't work. It lit up our magic mirror all right, so we asked for the VCR itself. This presented a problem: the owners were quite unable to manage without it . . . A loan machine got round that. The infra-red receiver and preamplifier worked correctly, and strong pulses were reaching pin 26 of the microcomputer chip IC601. Ceramic filter CF601 was all right so the chip was suspect. A replacement – type M50731-610SP, at a net trade cost of £16.50! – solved the problem. **E.T.**

Panasonic NV370

A nice easy problem to diagnose: there was a whopping great hum bar on the picture in all modes – E-E, record and playback. As it was a single hum bar the ripple was at 50Hz. This eliminated the main 12V supply which is derived from a full-wave bridge rectifier. We found that C1102 (2,200μF, 25V) on the power transformer panel was open-circuit, putting large dents on the regulated 12V line from Q1101. **E.T.**

Amstrad VCR4600

This machine recorded and played back at a very slow speed. Whether the standard- or long-play mode was selected, the slow speed never varied. So the capstan motor drive voltage at pin 2 of the output driver chip IC303 was checked. It was low at about 1.2-1.5V. The regulated 18V rail was correct and the next voltage check we made was at pin 8 of the dual operational-amplifier chip IC302. The voltage here was low but the input voltage at pin 4 was high due to QR302 being nearly cut off by the pulse-width output from the servo chip IC301. This should have made the capstan motor run faster. The cause of the trouble was the first operational-amplifier in IC302 (type BA718). With 4V at its input there should have been 3V at its output, but the output voltage at pin 2 was only 1.2V. I subsequently had two more machines with the same fault. **D.D.**

Sharp VC8300

This machine worked fine in the playback mode but its own recordings produced a very distorted, monochrome picture. Most of the i.c.s on the Y/C board had new solder on them so, expecting a difficult fault, out came the coffee, manual and scope. The video waveform at TP204 was squashed, but readjusting the white and dark clip level controls cured that – yes, the phantom twiddler had

struck again! I now had a monochrome picture on record and the frequency counter was required to get the VXO and a.f.c. controls right. But there was still no colour. A chroma signal was present at pin 3 of plug CB, so attention was directed to the head amplifier PCB where I found that the record chroma current control had been turned right down. **P.B.**

Ferguson 3V36/JVC HRD225

Tuning drift was the problem here. When I checked the tuning supply at TP6 on the power supply panel I found that it was low at 20V (the manual states 45V). Various capacitors were checked but all were o.k. I then noticed that an extra 1k Ω resistor had been fitted at the factory, in series with R13. The missing voltage was being dropped across this extra resistor. Suspicion then fell on the i.f. module, where the 33V zener diode D10 was found to be leaky. Replacing this diode cured the fault – with the extra resistor fitted the voltage at TP6 becomes 33V. **P.B.**

JVC HR7300/Ferguson 3V30

This machine had a capstan servo fault – the pull-in range of the phase discriminator control R10 was very poor and it couldn't be set for 6.2V at TP203. The waveform at TP5 was wrong, the positive part of the sampling pulse being much too large. A lot of time was spent checking around IC3, but no reason for the fault could be found. Over lunch I studied the block diagram and discovered that one end of C38 should be earthed in playback – it wasn't. Also pin 15 of IC4 should be at 8.6V and wasn't. IC4 (IR2403) was faulty. **P.B.**

Finlux VR1010/Philips VR6462/Pye DV464

The cassette lift was inoperative as lever 242 had lost its pin. Nothing unusual about that, but when the lever was replaced the cassette lift was found to be rather sluggish in operation. I was convinced that the threading motor was faulty, and finding that an Amstrad lift motor was the same I fitted one of these to no effect. Suspicion then fell on the lift itself, but no pieces were broken off. I finally noticed that the strengthening strut across the top of the lift was bowed down: a quick bend and the tray worked a treat. **P.B.**

Samsung V1-626/V1-616

This brand new stock machine would play back with very noisy chroma and record only in monochrome. I started out by assuming that one fault was the cause of both problems – not so! A scope check showed that chroma was entering IC0301 in the record mode, but it was not coming out at pin 1. Everything around the chip seemed to be o.k. – crystals running, etc. – so the chip was replaced. This gave us colour recording, after slight adjustment of the record chroma level. The other fault was cured by replacing IC0303 (μ PC1536C). One very important point to remember with the μ PC1534C chip (IC0301) is that pin 28 is not connected – it should be bent underneath prior to insertion or cut off. Nasty effects will occur if pin 28 is connected. **N.B.**

Panasonic NV333

This machine wouldn't switch off, even if the timer button was pressed. We found that the 2.5A fuse on the mains transformer PCB was open-circuit – it's in the 14V a.c.

winding which provides the 9V and 5V lines to the syscon. The switching is carried out within IC6002 (M53216P), and when this chip's supply pin was lifted the fuse remained intact. A new chip restored normal operation. **N.B.**

Ferguson 3V44, 3V45/JVC HRD140

Circuit protector CP4 (ICP-N10) being open-circuit has on several occasions been found to be the cause of no red light on the power switch and no drum rotation. It seems to go open-circuit for no apparent reason. When it's open-circuit the switched 5V supply is removed. **N.B.**

Sony SLF1/ACF1

The customer initially sent in just the AC-F1 unit, with the complaint that it would charge batteries but wouldn't power the machine. The correct output voltage was found to be present on the d.c. plug to the VCR, and everything lit up correctly, so the VCR itself was sent for. When it arrived the two units were connected. We found that the AC-F1 unit wouldn't switch on until the SL-F1 was disconnected. On dismantling the latter and checking the circuit diagram to look for the most likely culprit we went straight to the 22V zener diode D809 which was short-circuit. **N.B.**

NEC PVC744

This machine wouldn't accept tapes due to a severed lead to the insert switch. It didn't take long to put that right but the customer had tried to force several cassettes in. As a result several levers were bent and the timing was completely out. The mechanism had to be stripped down, straightened and rebuilt. **N.B.**

Panasonic NV370

The complaint was low-gain TV pictures. We assumed that the problem was failure of the amplifier in the r.f. converter, but a replacement made no difference. A more careful examination revealed that there was a large hum bar when the test signal was switched on. The 12V supply to the converter was found to be low and on moving back to the power supply we discovered that the 18V supply reservoir capacitor C1102 (2,200 μ F) was leaking. Replacing this item put matters right. **M.D.**

JVC HRD140/Ferguson 3V44

The customer complained that the tape wouldn't play. When we tried we found that the tape would lace up and then immediately unlace. The head drum wasn't going round but could be seen to be twitching as if it was trying to start. Voltage checks revealed that the control from the servo was missing (no voltage at pin 2 of CN403). Tracing back we found that the 5V zener diode D408 was short-circuit, but replacing this didn't get the drum running – we also had to replace the AN6671K head motor drive amplifier chip. This required complete removal of the mechanism to gain access to the PCB. **M.D.**

Philips VR6462

Jerky tape motion in reverse play and reverse picture search, with corresponding picture instability, was traced to swivelling wheel item 264 which was slipping. The wheel tyre was found to have traces of dirt on it. Scraping carefully removed the deposits and eliminated the problem. **T.J.W.**

Servicing with a Variac – and Bulbs

Eugene Trundle

One of the greatest difficulties in diagnosing power supply problems, especially with switch-mode designs, is the set that tries to self-destruct at switch on. You close the mains switch, to be rewarded with a brilliant flash from the mains fuse in the set and a dead-short BU326 or whatever chopper transistor. After replacing the fuse and transistor you try again and a couple more transistors get caught in the crossfire. Next you check just about every other component in the power supply and any other area that seems relevant. All measure o.k., so you switch on again. Pow goes the fuse, and maybe all the new transistors are once more blown up. Who hasn't encountered this situation?

Even when components are not actually being destroyed, the action of a trip or cutout will make life difficult. Some sets give one burst of energy at switch on, then shut down until reset by switching the power off then on again.

The solution to many of these problems is the use of a variac, i.e. a variable mains auto-transformer, see Fig. 1. The winding is toroidal, on a laminated steel ring, a manually-rotatable brush permitting a variable voltage to be tapped from the winding – typically from zero to about 110 per cent of the applied input voltage. There is only this single winding, and it's important to appreciate that a variac does not provide mains isolation. A variac with a high power rating takes a very large gulp of mains power at switch on, the momentary surge current being greater than the rating of the fuse (say 2A) typically fitted to a 500VA isolating transformer. If this means that a live mains supply has to be used when carrying out fault diagnosis using a variac, be very cautious of the safety hazard and keep the aerial plug away from the set altogether – you'll be unlikely to want signals while sorting out a kamikaze power supply!

Variacs are rated (and priced!) in terms of their current capability, varying from 2A types at £45 to £50 to 8A and 10A types at twice the price. These prices are without VAT, and do not include fancy cases: a nice steel case, with Safebloc connector and all, can double the price of the package, and still doesn't include meters. Ideally you need a voltmeter and true-r.m.s. ammeter built in for continuous and convenient monitoring of the output voltage and the current drawn. Some years ago we made up a variac (see Fig. 2) incorporating meters capable of working with a.c. or unidirectional pulse current (half-wave thyristor power supplies). A 2A variac will probably satisfy most requirements with TV sets and VCRs, but may not be able to cope with thyristor regulated power supplies that draw a

short and heavy current pulse once or twice per a.c. mains cycle. If a heavier variac can be afforded it will give a "stiffer" and better-regulated output. Certainly nothing less than 2A should be considered.

Using a Variac

The beauty of using a variac is that you can gradually increase from zero the mains input to the circuit under test while monitoring what happens with an oscilloscope and meter. It's also possible to leave the variac at an output voltage setting that corresponds to a safe and limited current and leave things to warm up a bit, faulty components perhaps giving themselves away when their temperature is checked by hand. We once diagnosed a faulty chopper transformer in this way without blowing up the chopper transistor.

If at some point the current drawn by the equipment under test suddenly rises, it could be that a crowbar circuit has come into action. Alternatively, and this is often the case, the power supply's output voltage may rise with applied input voltage, reaching and threatening to pass the normal level while the input is still far short of the normal 240V a.c. This can be destructive in some types of power supply, with direct connection to the mains, notably in the case of self-oscillating power supplies. The problem is dealt with by advancing the mains input to the point where the power supply's output voltage is a fraction above normal – the set should then be working normally – so that the action of the stabilisation loop can be tested. Items to check are the h.t. potential-divider network, the reference zener diode, etc.

A classic though fortunately non-destructive example of this is the Doric/Rediffusion Mk. 3 colour chassis which, with the full mains potential applied to the set, can give you one squawk followed by shut down. With a variac applying an input voltage of around 170V r.m.s. you'll probably find that the set works fine but the "regulator adjust" potentiometer 6RV2 doesn't do anything. Comfortably checking under these conditions will show that the regulating thyristor is without firing pulses, usually due to failure of the reference zener diodes 6D6 or 6D7 or maybe 6C20 or 6R17.

Some circuits have a start-up arrangement based on a capacitor that charges up at switch on. This kick-start system may be found in the power supply or the line timebase, and in some older sets may simultaneously control the line oscillator and driver stages. To satisfy most kick-start systems the variac, in my experience, needs to be set to give an output at some point between 80V and 120V. If possible it's better to override the kick-start arrangement either by connecting a resistive link across the kick-charging capacitor or using an externally derived voltage obtained from a battery or a d.c. power supply unit. Much depends on the set's design and vintage.

If a set works satisfactorily with the full mains voltage after this has been progressively wound up via a variac, but blows up on direct start from the mains supply, the likelihood is that a soft-start circuit has failed. Whether the power supply is i.c.-based or uses discrete circuitry, soft-start action usually depends on a capacitor that forms

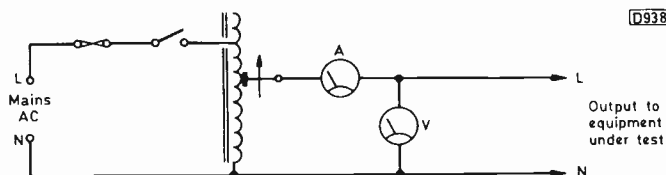


Fig. 1: Variac operating principle, with some peripheral components shown. The fuse should be an anti-surge type rated to match the variac's maximum loading. The mains switch is best mounted in a prominent position with down for off. Ideally, the meters should be moving-iron types built in.

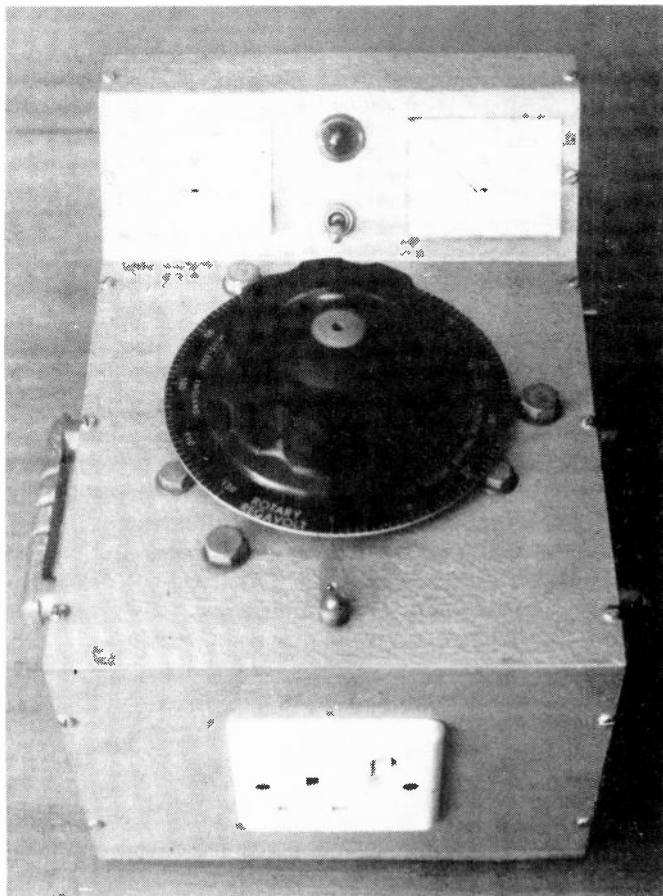


Fig. 2: Fully enclosed variac with meters and pilot lamp. The 1A meter has switched shunt resistors to give f.s.d.s of 1A, 2A and 10A – the variac fitted has a 10A capability.

part of a time-constant network. Failure of the capacitor or an associated component can produce a high inrush current at switch on, with an output voltage spike that may blow a fuse or destroy semiconductor devices.

There are several other uses for the variac in a workshop. Ours is often borrowed by the audio man for use with mains-powered music centres and audio amplifiers. Some of this equipment uses very high powers, and the direct-coupled audio output stages, whether in chip or discrete transistor form, will handle quite high voltages and currents simultaneously. Some have bridge output circuits with d.c. coupling to the loudspeaker. If conditions are wrong, for example due to slight leakage in one of the transistors up stream, there's potential for a lot of damage at full-power switch on – the fuse or electronic cutout doesn't always provide full circuit protection. Use of the variac permits a gradual run-up to full power after repair while the quiescent current is being monitored. Potentially dangerous situations can thus be spotted before damage

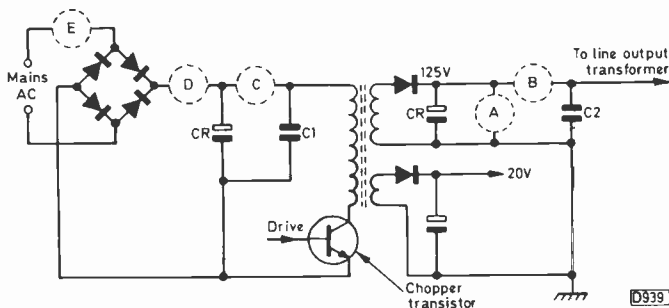


Fig. 3: Typical chopper system, showing various possible positions for using protective light bulbs.

occurs.

An obvious, if occasional, use for the variac is in testing 110V equipment. With care, the variac can be set to provide a low output voltage, taking the place of the secondary winding of a faulty mains transformer. This is particularly useful where the mains transformer has been damaged by lightning or a mains voltage surge, making it possible to check for further damage without going to the expense of obtaining and fitting a new transformer. Variacs are also useful for testing the mains voltage tolerance of power supplies.

Bulbs and their Uses

Variacs are voltage-limiting devices: they don't limit the current at all, except in a dangerous or undesirable overload situation. Given a fixed resistance value, current is of course proportional to voltage, but power supplies and their loads in TV, video and audio equipment seldom behave like a pure resistance, and usually don't operate properly until the applied voltage is reasonably close to normal. Thus current limiting and test loading call for resistors capable of high dissipation.

Ordinary 240V domestic light bulbs provide a cheap and convenient form of high-dissipation resistance, with the bonus that you have a visual indication of current flow and power dissipation. Ordinary bulbs are quite satisfactory, but "rough service" versions are more rugged, electrically and mechanically, and are worth buying for this use – they are not expensive and can be obtained from electrical wholesalers and sources such as Electromail/RS.

In operation a 60W bulb has a resistance of approximately $1k\Omega$ while a 100W bulb has a resistance of about 575Ω . At half the applied voltage, i.e. the 120V that's typical of the h.t. line in a modern TV set, the resulting half current will result in a quartering of the power dissipation so that, ignoring the positive temperature coefficient of the tungsten filament, a 60W bulb will dissipate about 15W while a 100W bulb will dissipate about 25W. These are the conditions when the bulb is used as a substitute load across a 120V line, and pro rata.

A 100W bulb is a realistic load for test purposes where the line output stage whose place it is taking generates the e.h.t. and auxiliary voltages. When the line output stage drives the scan yoke and little else – many modern designs have a diode-split chopper transformer with auxiliary outputs for other sections of the set – a 40W or 60W bulb is nearer the mark. Using a bulb as a dummy load keeps the power supply happy (some designs don't take kindly to zero-load conditions) and eliminates the line output stage and its associated circuitry as a possible cause of excessive loading on the power supply. This is very helpful when diagnosing a fault condition that gives rise to tripping.

A dummy load connected as shown in position A, Fig. 3, is by no means the only possible use for a bulb in fault diagnosis. It can be fitted in series with the line output stage (position B) to limit the current. This will hold the current consumption to a safe level for diagnostic purposes, and the relative proportion of the energy dissipated by the line output transformer and the bulb can be judged by the latter's brightness. It's gratifying to remove a shift choke, leaky diode or faulty tripler and see the bulb dim and the pulse level in the line output transformer rise simultaneously!

Where the problem is in the power supply, the bulb can be fitted in series with the primary supply to the chopper as shown in position C. With this and the series timebase application just described, the tests are more meaningful

when there's a decoupling capacitor down stream, i.e. C1 and C2 respectively. This ensures that the top of the chopper or line output transformer is earthed from the a.c. point of view, an important factor for correct theoretical operation of these circuits. If you connect a bulb in position C, bear in mind that the full 340V available could appear across it in the event of a short around the chopper, a dangerous situation indeed. Bulb position D avoids this and keeps the reservoir capacitor CR in its decoupling role at the chopper transformer's primary winding. Another possibility is to place the bulb(s) in series with the mains input itself, as shown at position E.

All these remarks apply equally to VCR chopper power supplies, some of which can be just as tricky (if not as frequently encountered) as a TV receiver power supply.

If necessary, tricks with lamps can be carried out in conjunction with a variac, though it's seldom necessary to go to this extent of feather-bedding – except, perhaps, with crowbar circuits.

Crowbar systems are not nowadays seen as frequently as was once the case. They represented an effective, if dramatic, means of saving a set from going into orbit if it

had a series chopper device (transistor or thyristor) that had gone short-circuit. The main problem was that in some designs firing of the crowbar was more likely to be the result of a false alarm than a genuine fault, but the fuse blew just as surely!

One such chassis is the Decca 80/100 series, where a coupling link is provided on the power supply panel to enable the crowbar thyristor circuit to be broken. A bulb connected in place of the link prevents fuse blowing and, so long as the picture and sound remain normal when the bulb comes on, shows that the crowbar circuit is operating falsely – the 186V over-voltage monitoring zener diode or the thyristor itself is usually responsible for this.

While no harm ever seems to come from disabling the crowbar circuit in this way in these Decca sets, the same is not necessarily true of all TV circuits. In case there really is an over-voltage or over-current condition, precaution in one of the forms shown in Fig. 3 is recommended. Indeed, sensible use in these ways of lamp bulbs and, where applicable, a variac will permit most types of protection circuit to be disabled for test purposes. Don't forget to restore them when the repair is complete.

Low-power Band I Transmitters

Chas E. Miller

Readers interested in restoring vintage TV receivers may well find useful the following details of the relatively simple transmitters I use to produce "off-air" pictures and sound

on the sets in my own collection. Some of you may recall that about six years ago I acquired the 405-line pattern generation equipment from the Radio Rentals factory at

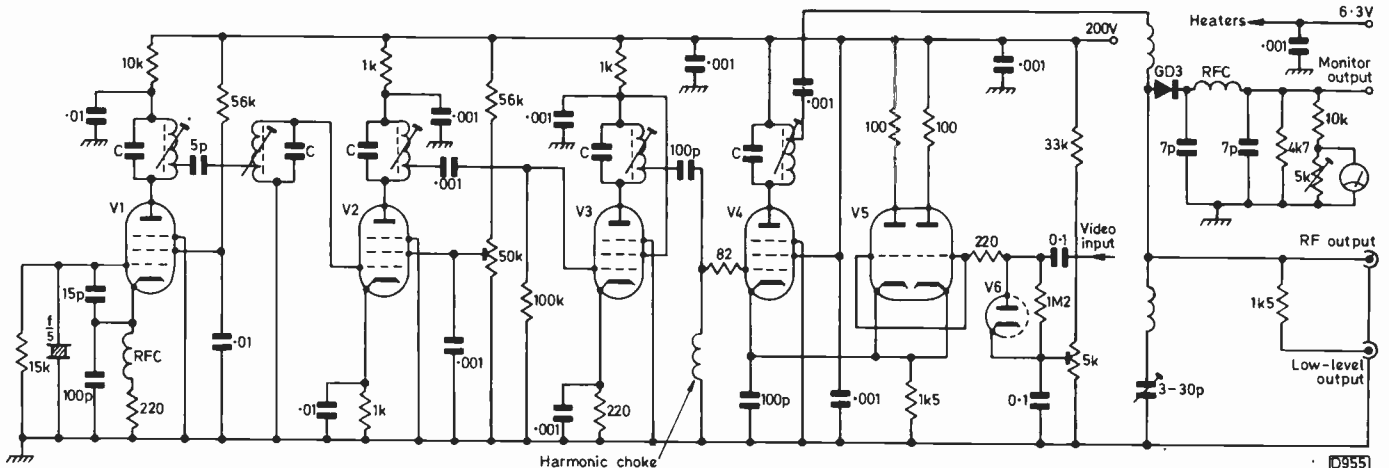


Fig. 1: Circuit of the vision transmitter. V1-3 type 6AM6, V4 type 6CH6, V5 type 12AT7, V6 type EB91. C = 25pF for ch. 1, 15pF for chs. 2-4, 7.5pF for ch. 5. RFC is 32μH at 10kHz. Each tuned LC circuit is in an earthed can.

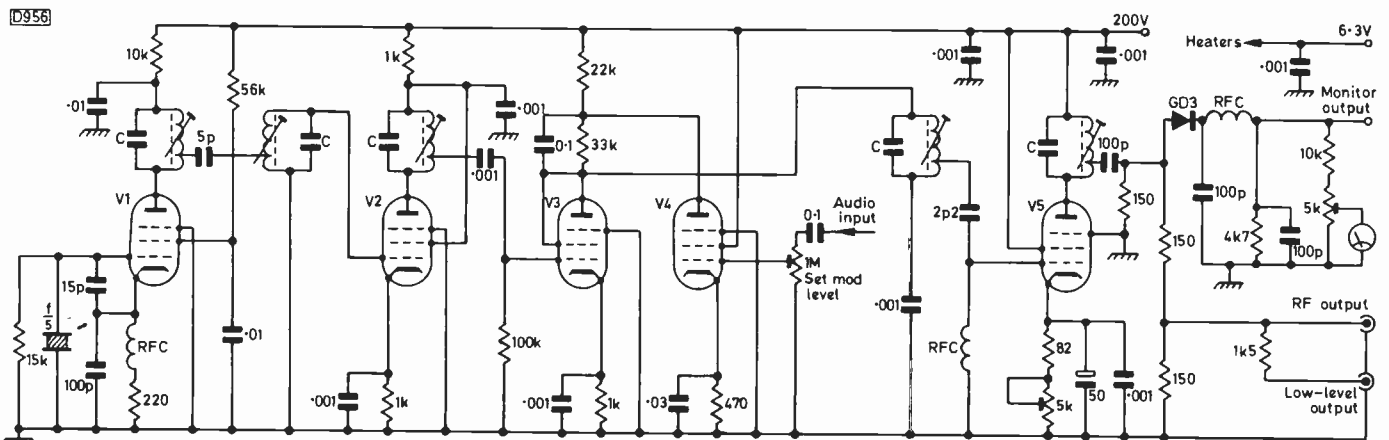


Fig. 2: Circuit of the sound transmitter. V1-V5 type 6AM6. Other details as for Fig. 1 above.

Bristol. Parts of this have been pressed into service to make up the system I'm using at present. It must however be pointed out that a vital ingredient is the 405-line video tape material provided by David Boynes of Newcastle-upon-Tyne, to whom I again offer my grateful thanks.

There were 26 Radio Rentals transmitters in all, one each for vision and sound covering the thirteen channels that made up Bands I and III. Since I live in the area that was served by the genuine channel 4 transmitter – not that completely misnamed upstart! – at Sutton Coldfield the sets I've acquired were mostly tuned to receive that station. So I employ the relevant transmitters, with carriers at 61.75MHz vision and 58.25MHz sound. I hope to add the old channel 8 (189.75MHz vision and 186.25MHz sound) at a later date to permit full use of the early two-station receivers, some of which are now nearly 35 years old.

The vision transmitter circuit is shown in Fig. 1. V1 is connected as a crystal oscillator that works at one fifth of the carrier frequency. V2 and V3 are frequency doublers, i.e. class C amplifiers whose anode loads are tuned to twice the input frequency. A potentiometer in V2's screen grid circuit sets the level of the r.f. output. The output from V3 drives the control grid of the final amplifier/modulator valve V4. The video input signal is capacitively coupled to the cathode-follower valve V5, V6 providing d.c. restoration – the bias applied to its cathode sets the video/sync ratio. There are sockets for high and low outputs, and a built-in meter is included for measuring the full r.f. voltage available. The 6CH6 output valve (V4) is capable of providing several watts output.

The design of the oscillator and doubler stages used in the sound transmitter is similar, see Fig. 2, but this time the sound input is applied to V4 which provides modulation in V3's anode circuit. The final amplifier valve V5 delivers an output of about 1W. High- and low-level outputs are again provided along with a meter.

The material supplied by David Boynes, on Betamax tapes, consists of an electronic test pattern and old black-and-white musical films recorded off-air via David's home-built standards converter. Audio from the playback machine is fed directly to the input socket on the sound transmitter, providing excellent modulation. On the video side however I found that the polarity of the signal from the machine had to be inverted. This was achieved using a very simple EF80 amplifier stage with a high-level output control.

The outputs from the transmitters are applied to single-wire aerials cut to roughly a quarter-wave length: they provide sufficient radiation to operate even insensitive receivers at short distances. The first set to be tried was a Ferguson 941T which had been much attacked by its previous owner and needed a considerable amount of work to get it back into action. Unfortunately the tube proved to have the ion burn of all ion burns, but this apart the set produced reasonable picture quality until the e.h.t. reservoir capacitor exploded so violently that nothing was left to show what had happened.

A single power unit provides a stabilised 200V h.t. supply and a 6.3V heater supply for the two transmitters and the polarity inverter.

As far as can be judged, the frequency stability is excellent.

In due course, once the channel 8 transmitters have come into service, the aim will be to provide alternative programme material for the two Bands. I don't know if any recordings of early ITV material (programmes or commercials) exist: if any reader is able to offer any information on this I'd be grateful to hear from him.

next month in

TELEVISION

● THE FERGUSON TX99 CHASSIS

The TX99 is the latest chassis in the evolution of Ferguson TV receiver designs. The earlier TX90 had been originally introduced as a small-screen chassis but came to be used with c.r.t.s. up to 20in. For small-screen sets it was replaced by the TX85 (see *Television* October 1987). The TX99 chassis has now been introduced as a replacement to drive larger screen tubes with 90° deflection.

Features of the new chassis include auto grey scale correction and non-interlaced teletext. The chassis incorporates SECAM and NTSC possibilities, improved synchronisation, automatic 50/60Hz field rate switching and a free-running TDA4600 chopper power supply circuit that provides mains isolation. A new colour decoder chip, type TDA3301B, is used and the RGD output stages incorporate emitter-follower buffering to provide a low-impedance drive with improved bandwidth. J. LeJeune describes the circuitry used in the TX99.

● PICTURE-IN-PICTURE DISPLAYS

The final instalment of Eugene Trundle's series on storing TV pictures in chips and digital video signal processing describes the way in which picture-in-picture displays are generated. There is more to this than might be expected. The video signal used for the small inset picture has to be decoded to YUV form before being stored, and after readout from the memory and DA conversion must be recoded to PAL or whatever colour system is being used. The PIP picture is not presented in real time: obtaining the inset pictures involves different writing and reading rates.

The comprehensive range of digital features available with the Sanyo VHRD500/700 series VCRs is also described. These include multi-PIP, where the screen centre shows a normal moving picture which is surrounded by eight stills, each representing a frame-advance sequence cycling around the central picture, with adjustable strobe speed.

● BACK TENSION IN VCRs

Incorrect back tension causes picture impairment, excessive head wear, loping and other problems, some of which may be intermittent. Unfortunately many workshops overlook this vital factor. Nick Beer describes faults and adjustment procedures.

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More on the Low-cost TVRO System

Roger Bunney

In the March-May issues I described ways of modifying a standard, inexpensive 11GHz receiving system based on a patio mount package to make it more adaptable, in particular by arranging for easy azimuth and elevation adjustment. I was subsequently a bit concerned about the exposure of the relatively expensive head electronics — the LNB etc. — to the elements.

Protection against rain, snow etc. generally seems to consist of connector covering, using self-amalgamating tape, polythene and such wrappers as may happen to be available. If access to the connectors is required, tape tends to leave a mess. Wrapping with polythene/plastic sheeting on the other hand tends to result in condensation. An LNB runs warm — mine does, anyway — and with the temperature variations we tend to get in this country problems could well arise. The criterion in looking for something more suitable was again cheapness. After considering various possibilities I came to the conclusion that the most efficient arrangement, in terms of weather protection, ventilation and cleanliness, would be to use a 2.5in. (66mm) diameter section of rainwater downpipe.

I originally ran my LNB with a 10dB line amplifier coupled back-to-back via an F male-to-male connector. The low-profile cover was made long enough to suit this arrangement — see photographs. Overloading problems subsequently led to the line amplifier being discarded, as a result of which the protective covering is now several inches shorter.

The LNB and its waveguide feed pass through a solid aluminium mounting hub, the scalar ring assembly being attached to the dish side of this. A bolt through the side of the hub is tightened against the waveguide feed to lock the whole LNB/feed assembly in position. Loosening the bolt enables the assembly to be adjusted for vertical/horizontal polarisation. I've used the hub to mark the settings for the various incoming plane polarised signals, the markings relating to a reference mark on the feed assembly. There are various settings because vertically polarised signals from 27.5°W and 10°E for example require different alignment.

I used downpipe made by Terrapin — the Marley type is also suitable. The length needs to be measured carefully, taking into account the output connector. I've gone

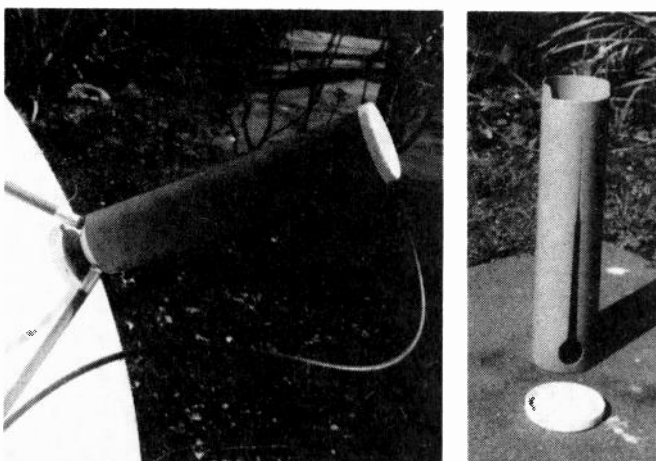
from using a F socket to a BNC connector and more recently to a right-angled BNC connector. With the latter the output is taken away at right-angles to the axis of the assembly, i.e. it comes out at the side. This is an essential part of the design. Note that the cover fits snugly over the aluminium hub: it is sleeved over, the friction being sufficient to support its own weight.

Measure the length of downpipe needed very carefully, taking into account the sleeve fit over the hub and allowing say 1.5-2in. beyond the right-angled exit point. Cut the pipe to this length. Measure again to determine the centre point for the exit hole towards the rear of the cover. Drill a generous hole, taking into account the diameter of the plugs in use — typically 1-1¼in. diameter. Now mark a line down the length of the tube, from the middle of the hole along the axis (see Fig. 1). Cut along this line with a hacksaw, then for about half the length make a slowly tapered slot, to a width of around half an inch, the slot extending to the exit hole. I'm told that some PVC rainwater pipes spring apart when cut while others close up — the Marley and Terrapin types suggested close up, giving a tighter grip around the hub. Cutting is easy if you have access to a circular saw, otherwise it's a matter of hacksawing and filing. The photographs clearly show what to aim for. The tapered slot allows for cable passage when fitting the sleeve.

Since with an inexpensive system the polarisation is manually adjusted, after loosening the bolt through the hub, part of the tube must be removed at the dish end — typically around 130° or so. The cover will still grip the hub, but will now turn when the polarisation is adjusted. The right-angled BNC adaptor I am using swivels, so I can unscrew the bolt and twist the LNB/feed assembly while the exit hole for the most part stays directly underneath, pointing at the ground.

The end of the cover can be capped by a Tupperware lid — I found one that clips on tightly.

To minimise corrosion, the cable/plug exit must also be given weather protection. I originally used some wide PVC heatshrink sleeving, taped over the body of the cover, but eventually discovered a really effective shroud at the local agricultural supply depot. It consists of a calve's feeding teat some two inches long: when the end of



Left: The protective covering in place. Right: The cuts that have to be made in the rainwater downpipe.

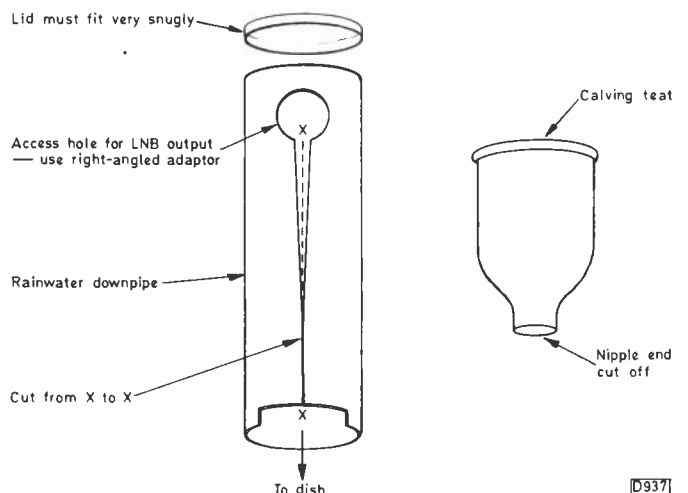


Fig. 1: Constructional details of the protective covering.

the teat is cut off the remainder of the device can be slid over the plug while the rib/rim at the widest part of the teat just clips within the cable exit hole, providing a custom-made cable gland!

Fitting the cover is simple. Grip the downpipe carefully at the dish end, pull it apart and slowly slide the opened slit over the plug/cable outlet. Then push down carefully towards the hub, covering the LNB. The widened part of

the slot towards the hole allows the cover to slide over the cable.

The end result is a professional looking cover made, in my case, from a discarded piece of downpipe and costing just the price of the calving teat — 82p plus VAT! My LNB is kept clean, bright and dry, in fact as new. In a recent gale when the unweighted dish blew over the LNB and output pluggery were protected from damage.

Maintaining BS415 Safety Standards

Denis Mott

The objectives of the British Standards Institute include the specification of safety standards for products sold to the public. In our industry the relevant standard is BS415, the "Specification for Safety Requirements for Mains-operated Electronic and Related Apparatus for Household and Similar General Use". When a piece of equipment has been given BEAB approval it means that the equipment has been tested and found to meet BS415 requirements. BS415 is itself under continuous review to ensure that it takes into account technological changes: the latest version is dated 1987. It splits equipment into two categories. Class one consists of equipment that is earthed via a three-core mains cable. Class two consists of apparatus with double insulation between the mains input and h.t./l.t. circuits, or sufficient isolation between live parts and the user, but no earth connection.

Servicing Implications

Why should this concern the TV service engineer? After all, it's the manufacturer's responsibility to obtain BEAB certification and to ensure that subsequent production meets the BS415 requirements. True, but what happens when the TV set or whatever passes through the service department? Quite subtle changes that affect BEAB conditions may have been introduced by the time it leaves. The set may have had a vision fault or a duff mains switch, and these faults could well have been repaired in a way that's electrically satisfactory, but what about that cable tie you removed to gain better access to the video amplifier, or the adhesive that holds the mains input wires to the switch? They were put there for a purpose, not to make the thing look pretty! Consider for a moment the cost to the manufacturer. With a production run of 100,000 sets and a cable tie cost of 1p the total cost involved is £1,000. In the case of the hot-melt adhesive on the switch, say it takes ten seconds to apply this. With a production run of 100,000 it will have taken 280 hours to apply the adhesive, and at say £2 per hour we get a cost of £560 plus material, say £750 in total. No, these steps were not taken just to make the set look neat and tidy!

There is no point in quoting BS415 word for word here — you can purchase it from the British Standards Institute at BSI Sales, Linford Wood, Milton Keynes MK14 6LE. However it's worthwhile pointing out some of the actions that can negate the BEAB/BS415 conditions of approval and render apparatus potentially lethal. The following is a list of points to which very careful attention should be paid.

Points to Watch

Mains switch replacement: If you are not fitting one supplied by the setmaker, has it been approved by one of the many test issuing houses? Have you replaced the

double insulation, and the cable tie fitted to ensure that the wires do not touch an accessible part should they become detached from the terminals?

Other mains components: Mains filter capacitors, chokes, chopper transformers, fuses and some resistors should be replaced with parts obtained from the manufacturer's service department or with parts that have test house approval. This also applies to line output transformers and other items that handle appreciable currents. Reference to the manufacturer's circuit diagram/components list will identify such components.

Watch out for any wiring in the mains-isolated part of a chassis. For example, a wiring harness that passes near a non-isolated part of the chassis should be retained by a tie or be double insulated so that there is no possible contact with live parts.

Aerial and CRT Rimband isolation components: These must be service replacement types or components that have test house approval.

Fusible resistors: In recent years increasing use has been made of fusible resistors to provide circuit protection, i.e. their rating is such that they go open-circuit quickly in the event of an overload. Do not use non-fusing or higher wattage replacements. For example, a carbon film resistor can dissipate up to 400 per cent of its rated value before it fails. This could give you a well burnt PCB as well as a possible fire. Incidentally, nearly all PCB material is self-extinguishing nowadays. But it still carbonates and becomes conductive.

Cabinet damage and repair: This can be a tricky problem. The aim must be to contain all the dangerous electricity within the cabinet and not allow those with a panache for sticking metal knitting needles and suchlike through any openings to endanger themselves in the process. Hands up everyone who forgot to replace the felt pad behind a slider control, so that a potentially live mounting became accessible when the knob was pulled off.

It's a sad fact that those with low incomes are more likely to have cheap jobs done on their equipment — and cheap can mean dangerous.

The Legal Aspect

Finally, it's worth pointing out that anyone who tampers with equipment, whether he's a professional, an amateur or a "helpful" neighbour, is liable for damages against him if it can be proved that he was negligent in carrying out a repair and that as a result death, injury or damage to property occurred. This is so whether or not money was accepted for doing the job.

TV Fault Finding

Reports from Alan Shaw, Ian Bowden, Nick Beer, J. Armagh, Mick Dutton, Roger Burchett, Brian Renforth and W.H. Clarke

Ferguson TX9 Chassis (PC1044 Panel)

This set would work for hours before the fault occurred. The symptom was line collapse and fade off. The cause of the fault was somewhere in the line output stage, but cleared when any attempt was made to measure voltages. It turned out that the line output transistor TR68, type T9051V, was faulty. A.S.

Ferguson TX100 Chassis

The intermittent dead symptom was soon traced to an intermittent mains supply to the PCB. When the on-off switch was broken open it was seen to have blackened and badly burnt contacts. The set came back a few days later however, with a note saying "same fault". This time the power supply outputs were all present when the fault eventually occurred. The cause of the trouble was an intermittently open-circuit line driver transistor, TR8 type BC372. A.S.

Grundig CUC220 Chassis

Distorted sound was the fault with this teletext model. We found that the supply to the audio chip was only around 5V, though the +G line was correct at 15V in the power supply. A check with the circuit diagram showed that there's a relay switch in the supply line. The contacts were making poor contact, something I've not come across before in these sets. A.S.

Amstrad TVR2

For the no results symptom check whether the surge limiter R1501, 8.2Ω 5W, is open-circuit. This may be fairly obvious, but if you rush out and buy a service manual it will cost you a cool £24. A.S.

Ferguson TX10 Chassis

There was loss of picture after the set had been running for a few hours. We noticed that the c.r.t. heaters were not alight when the fault occurred, but pulling back the chassis restored the picture. There was a dry-joint on the chopper/e.h.t. transformer T705. For intermittent faults with these sets – anything from switching to standby (remote control sets of course) to the sound going full blast – it's always worth checking for dry-joints around T705. A.S.

JVC C210EY FST CTV

The fault with this typical Japanese set, manufactured in the UK, was a slightly defocused picture. The usual diode-split line output transformer has built-in focus and first anode controls. We found that the first anode potentiometer worked normally but the focus control adjusted the first anode voltage and not the focus. Fitting a replacement transformer cured the fault. A.S.

Bang and Olufsen 77XX Series

The fault report was "set dead". We found that the 20V standby supply was present but the chopper circuit didn't start up. In these sets there's a 5.2V regulator circuit on the remote decoder and control panel PCB55. It's switched on

when a signal from the remote control unit or the "step" buttons is present. The regulator is fed from the standby supply and feeds the microcomputer control chip which produces a "set on" signal for the power supply. We found that the 5.2V supply was missing because the 82Ω safety resistor R30 was open-circuit. The cause was an emitter-collector leak in the BD534 regulator transistor TR8. I.B.

Panasonic TC2253 (U5 Chassis)

"Set won't change channel via the remote control unit or the on-board controls" was the customer's complaint, which was accurate. The channel number wouldn't change even though the red LED was flashing to indicate reception of remote control signals. What the customer hadn't mentioned was the lack of sound and raster, with loud buzzing from the power supply. Visual inspection of the underside of the main PCB revealed a perfect dry-joint at the collector of the line output transistor Q551. This was resoldered and to my relief the set then worked perfectly. I.B.

Bang and Olufsen 37XX Series

The problem was slightly reduced height – a loss of approximately 3cm on the 25in. screen. We found that the 10V supply to the vertical drive circuit on PCB53 was low at 9V. The 6.2V zener diode D32 in the 10V regulator circuit was leaky. I.B.

Grundig CUC120 Chassis

An intermittent blank screen with no sound (muted) is usually caused by a dry-joint inside the tuner-i.f. module. The connection involved is at pin 12, where the 12V supply enters. R.B.

Rediffusion Mk 3 Chassis

We've had an epidemic of intermittent non-start and/or stopping and staying dead with these sets. There were no signs of any distress and the sets were not tripping. I took one of the power boards for a two-day trip in the car before checking it over. The cause of the fault was then permanent and obvious – a dry-joint on one of the tags of the mains transformer 6T1's primary winding. R.B.

Salora Ipsalo II Sets

No go is not uncommon with these sets. Usually you'll find that RB713 (22Ω, 7W) is open-circuit and that the two BUW41A switching transistors TB700/1 are both short-circuit. Recently an underlying cause of this trouble has come to light – CB532 (330nF, 250V) will be dry-jointed and will be bulging and hot in operation. Replacing this capacitor should prevent further failure of the devices mentioned. N.B.

Panasonic Alpha-2 Chassis

While soak testing some of these sets prior to delivering them we noticed that if they were left running on teletex

white beating bars would appear over the text. Then a customer complained about this, so we investigated. We found that the trouble was prone to arise when advertisements appeared on ITV and Channel 4. It could also be provoked by interrupting the signal and then restoring it. Our theory is that the text artificial sync generator switches on when signal interruptions occur and that when sync pulses return the ASG doesn't lock to them. On speaking to Panasonic we found that there's a modification kit to overcome a design fault in the MPU chip. The part no. is TZS803001. **N.B.**

Bang and Olufsen MX2000 (31XX Series)

The problem with this set was no sound. After much checking around – access is not good with this chassis – I discovered that the 6MHz coil LD40 was open-circuit. Due to the cramped layout alignment was very difficult. This chassis is manufactured by Thomson (NordMende) and many spares are not available from Bang and Olufsen. **N.B.**

Triumph CTV8210

This 14in. colour portable was accused of taking two hours to produce a picture. The cause was hairline cracks on the c.r.t. base panel interrupting the supply to the c.r.t.'s heaters. **N.B.**

Hitachi NP81CQ Chassis

The trouble was a brilliant display of thirteen beady teletext lines covering the top one third of an otherwise perfect picture. There was no non-linearity and no lack of height. Now we all know that the text information is neatly gathered up into a little package of unused lines at the top of the raster, so I deduced that the problem wasn't a flyback suppression one but one of slow flyback at the end of the field. It must have accelerated sharply after the thirteen lines, since four were clearly seen in the proper place. But then odd things happen with modern technology. Every single component in the field timebase circuit was substituted or tested as appropriate, without success. Better brains in higher places agreed that the problem was slow flyback, but couldn't help me.

So I contacted Hitachi who asked whether I'd checked the flyback suppression. I truthfully said that I had: field and line in that order were o.k. on the scope, going into the little flyback suppression panel at the front of the chassis, and since the scope was still at line speed I got things at line speed out of the panel. Hitachi were adamant however. Must be no field pulses coming out, and not to fret about the slow flyback which is normal with this chassis. So I did what they said and replaced Q2201 (BC548B) and zener diode ZD2201 (BZX79C5V1). And that was that: everything now fine! Question: do all sets show thirteen lines over the top third of the raster when the field flyback suppression is taken out? **J.A.**

Hitachi CPT2050/Salora 22J40 etc.

The picture was normal at switch on, but within seconds dark patches smudged over the screen irregularly – large patches right across the screen, in varying bands; slowly at first but soon pulsating rapidly to give a juddering effect. This wasn't the same as another problem we've had, fast flutter on high contrast scenes and no contrast control action. That was due to D200 (1N4148) in the beam limiter circuit. This time the effect was more profound, and the controls worked normally.

The chassis was lowered, with sinking heart, so that I could heat and freeze around the colour decoder chip etc. Before getting too involved I glanced here and there in the hope of seeing something burnt in a corner. There it was, R508, charred. We correctly deduced that the 12V regulator IC500 was doomed, and after replacing these two items the display was once more correct. **J.A.**

Mitsubishi CT2227BM etc.

A fault which is becoming common on this set and others that use a similar chassis is dry-joints on the line driver transformer. Customer complaints are either that the set goes dead when it has warmed up or that the picture reduces to a vertical band about three inches wide. **M.D.**

ITT CVC45 Chassis

Sound o.k. but no picture was the problem with this set. When the first anode control was turned up we had a blank raster. A scope check revealed that there was a luminance input to the TBA560 chip in the decoder section but there were no line pulses at pin 8. R12 (560Ω) on the main panel was open-circuit. **M.D.**

Hitachi CPT1455

The symptoms here were line tear, line pulling and drift, along with vertical shadows across the screen, similar to a misadjusted line linearity coil. The line output transformer was tried without success, also the various associated smoothing capacitors. We eventually found that the trouble was due to C214 (470μF) which decouples pin 7 of IC201. **W.H.C.**

Thorn 1400 Chassis

Here's a bit of nostalgia for you! The excellent sound on a 21 year old HMV Model 2640 dual-standard monochrome receiver suddenly started to suffer from the common intermittent spluttering fault. This highly annoying problem is usually caused by one of the two sound detector diodes W8/9 in the i.f. can next to the EF184 sound i.f. pentode. New AA119 diodes failed to rectify the fault this time however. We then noticed that the fault, accompanied by "picture flashing", would come and go when the panel was tapped, revealing the source of the problem – it was the system switch of course. The set had been modified for 625-line only operation, with the sliders left in one place. On examination we found that the sliders were blackened with dirt. A thorough clean with Micro cleaning solution cured both problems.

Shortly afterwards another sound problem, of an entirely different nature, occurred. What now! I sighed. The sound became distorted five minutes after switching on. R97 (470Ω) in the h.t. feed to the 30PL1 sound output valve was found to be charred and there was a leak in C78 (1,000pF) which decouples the supply to the triode section of the valve. Superb results all round were obtained following replacement of these items – a 1kΩ, 2W resistor was fitted in the R97 position, as in later production. **B.R.**

Thorn 1500 Chassis

These sets are becoming hard to find nowadays. Even Thorn Rentals (Baird etc.) seem to be selling them off. The c.r.t.s never lasted too long, the usual problem being corner defocusing which would get so bad that the picture could be viewed with only a very low brightness level. A

later (green PCB) 20in. Ultra model which was being used as a computer VDU was no exception. The focus over the whole picture was poor due to the notorious focus supply resistor R120 (1.5M Ω) having gone open-circuit. Replacing this restored tolerable results, though it was obvious that a new c.r.t. would soon be necessary. **B.R.**

Teletopics

FIDELITY REBORN

Amstrad has bought the Fidelity brand name from Caparo Industries which in turn bought Fidelity Radio for £14m in late 1984. Fidelity made a loss in each financial year after 1984-85 despite considerable efforts by Caparo to establish profitable operation. There were certain manufacturing difficulties originally, and more recently Caparo has blamed the exchange rate for its difficulties with Fidelity.

Amstrad paid £3.1m for the Fidelity brand name which it will use for its range of consumer audio, video and TV products. The company's marketing strategy will be based on three brands — Sinclair, which Amstrad bought in April 1986, for the home computer market, Amstrad for business products such as word processors, personal computers and printers, and Fidelity. There could be a bit of confusion initially since Caparo retains the right to use the Fidelity brand until the end of the year — there is still quite a lot of Fidelity/Caparo stock in the pipeline, and the company went ahead with its May trade show. During this interim period Amstrad will be branding its consumer electronics products "Amstrad Fidelity".

Amstrad has not taken over any responsibility for servicing and spares for Fidelity Radio products, or for the company's plant and personnel. Caparo has set up a new subsidiary Intersound Consumer Products plc to wind down the Fidelity operation. It will provide a back-up service and spares for major products for a five year period. The Fidelity manufacturing plant in North Acton, London is being closed down with a loss of up to 500 jobs.

Fidelity is thought to have some 14 per cent of the small-screen colour TV market in the UK. Amstrad has been expanding its range of consumer leisure products, which in the last financial year accounted for 45.8 per cent of the company's sales. Amstrad equipment is currently on sale in 75 countries worldwide. The Amstrad story has been one of considerable success: the company was founded just twenty years ago, in 1968, and in the last financial year turnover reached £511.8m, of which more than 56 per cent consisted of overseas sales.

DBS RECEIVING EQUIPMENT

British Satellite Broadcasting, which holds the UK DBS franchise, has announced four steps that it has taken with a view to ensuring the availability of low-cost domestic DBS receiving equipment by the time its three-channel service starts in late 1989.

Two major contracts have been signed for the provision of key receiver components in bulk quantity. The idea is that these components will be made available to the manufacturers of DBS receiving equipment with the benefit of quantity discounts. The first order, worth around £50m, has been placed with Intermetall of West Germany for the supply of D-MAC decoder chip sets. These will consist of two i.c.s, one to decode the incoming

D-MAC signal and the other to carry out signal descrambling. Prototype chip sets should be available to setmakers this autumn, with bulk production starting next spring. All four million sets, which will be supplied on a call-off basis, are expected to have been delivered by 1993. BSB's aim is to keep the cost of equipment for DBS reception at around £200. It expects 2.5m installations to have been sold by 1992. BSB has also commissioned Intermetall to develop a D/D2-MAC chip set for use in integrated TV receiver designs and VCRs.

The second agreement, with the US General Instrument Corporation, is a long-term contract worth over £100m for the development and supply of conditional access modules. Conditional access is an encoding technique that will enable BSB to control reception of its broadcasts, which will be receivable only on authorised equipment that incorporates a GI module. GI previously developed a conditional access standard for use in the USA, and will now develop a new system compatible with the European MAC-packet TV transmission standard. BSB has proposed to the EBU that the new system is adopted as a European standard for TV conditional access. The EBU is still considering this subject — other proposals have been put forward. Prototype GI modules should be available early next year with full production starting in the summer.

As a further step BSB has formed a joint venture company with GI to hold the distribution rights for their MAC-packet conditional access system throughout the EBU area. The joint venture company will establish a European subscriber authorisation centre from which reception of BSB/GI encoded signals will be controlled.

BSB has also launched the final stage of its international tender arrangement to select three-five electronics companies to design and manufacture BSB DBS receiver units during the first three years of the service, after which restrictions on manufacture will be lifted. BSB has sent fifteen electronics companies a technical specification guideline on which proposals are to be based.

BSB concludes its announcement with the comment that the arrangements "reflect our unique ability as an integrated management team to take decisions about all aspects of our business". It seems however that there is nothing to prevent other semiconductor firms manufacturing MAC decoding chip sets — Philips and Plessey have



The Amstrad Fidelity Videomatic camcorder which will be in the shops this autumn at £499 inclusive of VAT.

already produced a chip set for this purpose. The conditional access module is another matter, and seems to be something of a grey area. There could well be legal complaints about restriction of trade, and setmakers are understood to be rather unhappy about the unusual arrangements BSB is proposing, though there have been precedents with PAL, VHS etc. For its part BSB is concerned about the prospect of a fifth terrestrial u.h.f. TV network in the UK, and has asked the government to reconsider the implications of this.

AMSTRAD ENTERS CAMCORDER MARKET

Amstrad is expected to make a major impact on the camcorder market with its Amstrad Fidelity Videomatic model, which has been designed to sell at £499 inclusive of VAT. In keeping with the company's philosophy of simplicity and value, the Videomatic is a VHS-C record-only multi-feature one-touch "point and shoot" model with HQ circuitry. It's switchable to long play to give an hour's recording time from an EC30 tape. Optional extras include additional battery packs at £29.99 and a soft carrying case for £14.99. The basic price includes a rechargeable 1.5 hour battery, a dual-voltage combined a.c. mains adaptor/battery charger, an EC30 tape, a shoulder strap and a motorised VHS-C cassette adaptor for instant playback. The Videomatic will be available in quantity in High Street multiple outlets and independent specialist stores by September, ready for the pre-Christmas sales uplift. A £3.6m consumer advertising campaign will start in October, using TV, tabloid newspapers and national colour magazines.

CONGRATULATIONS CPC

CPC Ltd. of 194-200 North Road, Preston PR1 1YP is this month celebrating its twenty-first anniversary, having been founded on July 17th, 1967 by its present chairman Keith Duckett. CPC carries a powerful line-up of consumer electronics spares and operates both nationally and internationally. Brands for which the firm acts as an authorised spares distributor include Amstrad, Ferguson, Fidelity, GEC Radio and TV, Hinari, Logik, Matsui, Saisho, Triumph, Philips, Pye, Sinclair and Sony. The firm also carries a vast range of items from aerials and aerial products to video accessories and heads — over 20,000 lines in all. CPC has just issued its first catalogue, an impressive and well illustrated publication that runs to 250 pages. The stores are manned on a 24-hour a day basis and orders from UK account customers placed by 5.30 p.m. are despatched that day by first class letter post or Securicor for next day delivery.

BROADCASTING MANOEUVRES

The government has registered with the International Telecommunications Union its intention to transfer channels 35 and 37, which are at present used for radar, to broadcast TV use. This would provide additional frequencies for the proposed fifth TV network. The Luxembourg-based broadcasting company RTL has expressed an interest in running the network and has held discussions with possible partners.

Super Channel, which was started just over a year and a quarter ago to provide a satellite TV service to European cable networks, based on BBC and ITV programming, has been reorganised and refinanced. The Virgin Group now has the major stake and Robert Devereux, managing director of Virgin Communications, has taken over as

executive chairman. Super Channel has been running at a substantial loss which many of its founder members were unwilling to support.

Carlton Communications has postponed plans to run two channels via the Astra satellite. Chief executive Michael Green is reported as saying "I don't see millions of dishes out there immediately and I don't want negative cash flow for six years".

Rupert Murdoch's News International group is carrying out a feasibility study on the possibility of starting a TV service covering the north west from transmitters on the Isle of Man. The operation would be run as a commercial service in conjunction with Rupert Murdoch's Sky Channel and would go ahead only if the UK government raised no objections.

The BBC has reached an out-of-court agreement with Unisat over the latter's claim for compensation for work done before the BBC abandoned its plans for a two-channel DBS service in late 1983. It's understood that the BBC paid Unisat a sum in the region of £10m. Unisat had been claiming over £57m.

ALBA BUYS BUSH

Alba has bought Bush Radio from Prestwich Holdings for £6m in cash and shares. Thus two traditional TV brand names not previously associated have been brought together. Prestwich Holdings had bought Bush Radio for £15m just over two years ago. It retains the 2.5 acre, freehold Bush site in Enfield, North London and will continue to use the Bush brand name for prerecorded video cassettes — Prestwich is a leading tape distributor. Alba currently manufactures 14in. colour TV sets in the UK. Bush's TV sets are manufactured by Poly Peck International's Turkish subsidiary Vestel. Bush has the right to continue to use the Enfield site for two years.

EURO S-VHS EQUIPMENT

S-VHS equipment for use with European TV standards has been demonstrated in London by JVC and Panasonic. JVC's HRS5000 VCR will be on sale for around £1,000 later this year. Panasonic will be releasing a VCR and a camcorder. Details are given elsewhere in this issue.

BATC CONTESTS

BATC contests for the remainder of the year are as follows:

IARU ATV (International) 1800 GMT Saturday, September 10th to 1200 GMT Sunday, September 11th. FSTV, all bands.

Slow-scan TV, Autumn vision combined, 0001-2359 local time Sunday, November 13th. Slow scan, FSTV, all bands. The club hopes that this will be a truly international event.

Winter ATV, joint European band, 1800 GMT Saturday, December 10th to 1200 GMT Sunday, December 11th. FSTV, all bands.

SPARES INFORMATION

Sanyo now has a telephone number, 0923 222 244, specifically for spares ordering and enquiries. Our apologies to Charles Hyde and Son Ltd. for giving their telephone number incorrectly in our May issue. The number given was their old one: it's been changed to 0759 303 068.

Spares for Philips and Pye consumer electronics products are no longer available from Philips Service to trade

customers who do not have an account. Spares can be obtained from the following official spares distributors: CPC Ltd., HRS Electronic Components Ltd., Charles Hyde and Son Ltd., SEME Ltd. and Willow Vale Electronics Ltd.

Hitachi dealers in any part of the country will be able to order spare parts at the press of a button. Hitachi Sales (UK) is linking with the nationwide videotex communications network Fastrak to provide a fast, efficient service. Ambassador dealers will be linked to Hitachi Service initially.

IN BRIEF

Goodmans first VCR, Model GVR2000, is intended for sale by independent dealers at around £249 . . . Sony is now manufacturing a 14in. colour TV receiver at its Bridgend, South Wales plant, the first time it has produced small-screen CTV sets in the UK. The plant is expected to produce 500,000 receivers in all screen sizes during the present financial year . . . ITT's new TPU2734 teletext chip, providing full level one text implementation, is being sampled by setmakers. It enables much faster text changing and automatic storage of the next seven logical pages of information . . . A new advanced teletext adaptor unit to BBC specification has been developed by General Information Systems Ltd. of Croxton Park, Croxton, Cambridgeshire PE19 4SY (048 087 464). One advantage of the computer-controlled unit is that it allows downloading of telesoftware to BBC microcomputers via

8-bit parallel connection to the user port. The price of £149 includes a comprehensive manual . . . Thomson plans to set up VCR manufacturing facilities in the Far East. The company's agreements with Hitachi in the USA and JVC in Europe could be terminated . . . Memtek Products Europe of 2 Ascot Road, Bedfont, Feltham, Middx TW14 8QH (0784 247 241) has introduced in the UK the Memtek universal remote control handset. The £100 unit has a number of features not previously available in such units, including five seven-day daily-repeat timers and 24 programmable sequences that enable the user to carry out complicated instructions with just a couple of button pushes.

DE-LUXE DX-TV CONVERTER

HS Publications of 7 Epping Close, Derby DE3 4HR (0332 381 699) has introduced a de-luxe version of its well known D100 DX-TV converter. The basic D100 provides reception, under suitable conditions, of foreign v.h.f. and u.h.f. TV signals on a standard 625-line receiver at full or reduced i.f. bandwidth. The new de-luxe version also covers Band II and u.h.f. down to the 435MHz ATV band, and will resolve sound irrespective of the i.f. bandwidth selected. For sound at 4.5MHz, 5.5MHz, 6MHz or 6.5MHz you simply connect to the rod aerial of an f.m. radio receiver. Further details of the D100 converters and other DX-TV products can be obtained from the above address by sending two first class stamps or (overseas readers) two IRCs.

Storing TV Pictures in Chips

Part 2: Digital Video Effects

Eugene Trundle

In Part 1 of this series last month we described the way in which a field of video information can be stored in an i.c. memory system, and in particular looked at the digital freeze frame system used in the Toshiba Model DV-80 VCR. Before it can be stored in a memory chip the video information has to be converted to digital form: in the Toshiba DV-80 and many other models the video information is converted to six-bit words, which enable 64 signal levels to be defined.

8-bit Quantisation

Although six-bit quantisation is adequate for many purposes, an eight-bit system is better. Let's examine the reasons for this. In converting a varying analogue signal into a series of discrete steps for digital processing, there will be a degree of "dither" where an analogue level is not close to one or other of the steps available. The reproduced picture, after digital to analogue conversion, will still be based on the exact step levels used when the signal was digitised. This gives rise to a noise-like error component that varies from sample to sample in a random way. It's called "quantising noise" and is inversely proportional to the number of quantising steps, which in turn depends on the number of bits used in the digital words. For the effects of digitising the signal to go unnoticed the quantising noise should be below the level of the noise already present in the original signal – hence the use of 16-bit words for the audio signals in the CD format, where the signal-to-noise ratio is around 90dB.

Each halving of the quantising step size requires one

more bit in the digital words used. This reduces the quantising noise by 6dB. Six-bit quantisation gives a signal-to-noise ratio (peak-to-peak signal to r.m.s. quantising noise) of about 42dB, which is just below the point where noise becomes perceptible on a TV display and is comparable to the signal-to-noise ratio of an off-tape analogue signal from a domestic VCR. Eight-bit quantisation offers a signal-to-noise ratio of 54dB. This is the arrangement used in the Panasonic NV-D80 VCR, which amongst its repertoire of effects offers digital noise reduction.

Panasonic System

In the NV-D80 the signal is digitised in composite PAL CVBS form – its digital pictures and effects are all full-screen ones. Eight-bit quantisation means that the AD and DA converters must have 256-step capability, so each converter has a high-precision 256-stage resistor ladder network. Sampling takes place at the usual 13.3MHz rate (three times the colour subcarrier frequency).

During the 64µsec line scan period the 13.3MHz clock rate will result in 851 digital video samples or picture elements – we'll call them pixels. There are 312.5 lines per video field, so the memory system should theoretically be able to store $851 \times 312.5 \times 8$ bits, a total capacity of 2.1275Mbits. The memory system used in the NV-D80 consists of a pair of 1Mbit DRAMs, giving a total storage capacity of 2.097152Mbits. So as with the Toshiba DV-80 VCR described last month there's not quite enough room for all the data in the video field. If they had only known

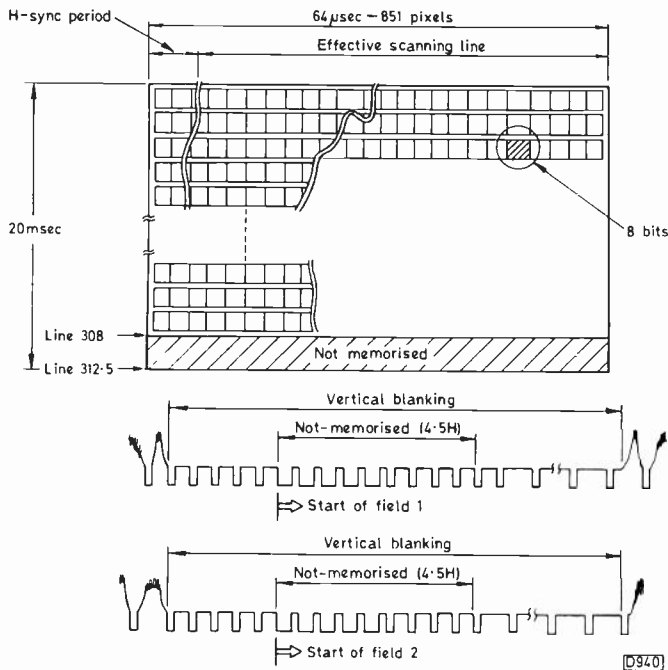


Fig. 10: Picture sampling area for the freeze-frame mode. 308 lines are sampled. Each line has 851 samples which are converted to 8-bit digital words. The memory capacity required is thus $308 \times 851 \times 8 = 2.096864\text{Mbits}$.

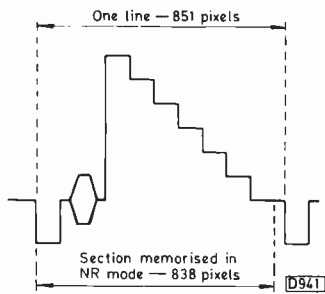


Fig. 11: In the noise-reduction mode all the transmitted lines are sampled up to a point just before the line sync reference. There are thus 838 samples per line, calling for a memory capacity of $312.5 \times 838 \times 8 = 2.095\text{Mbits}$.

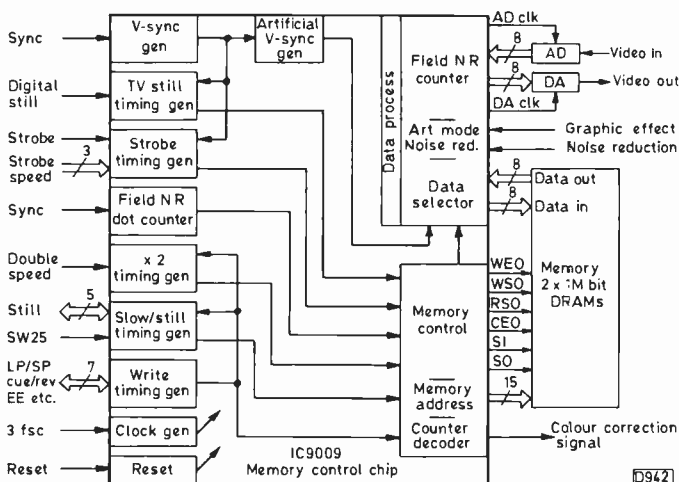


Fig. 12: The memory control and storage system used in the Panasonic NV-D80 VCR. The heavy line encloses the memory control chip, type $\mu\text{PD65031F175}$.

this years ago, perhaps we'd have had a 615-line picture! Thus some information must be discarded: the choice of what to discard depends on which digital mode is in use.

In the memory/freeze modes the four and a half lines

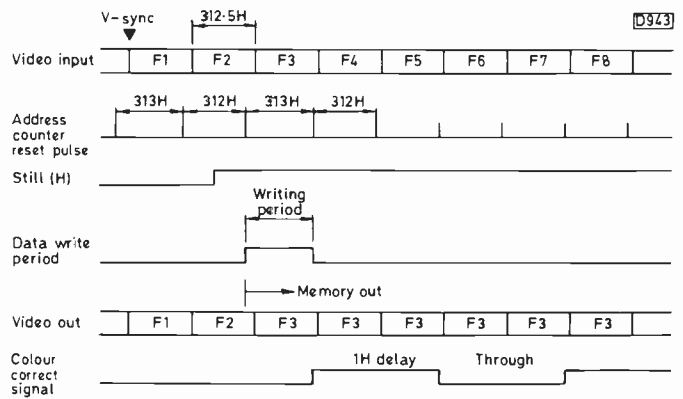


Fig. 13: Digital freeze-frame timing chart.

containing the field sync pulse and some of the post-sync equalising pulses are left out – see Fig. 10. To compensate for this an artificial field sync pulse train is generated within the memory control chip and is tacked on to the end of each field read out. In the noise reduction mode the complete set of lines, including the field sync and equalising pulses, is stored, but only 838 instead of 851 pixels per line are memorised, leaving a small gap of less than $1\mu\text{sec}$ at the front porch before the line sync pulse to be filled with black during the breaks in the readout – see Fig. 11. This section of signal is always at the black level anyway, hidden off screen to the right of the display.

Memory and Control

The NV-D80's field store consists of two fast 1Mbit DRAMs, type MN4700 – see last month's cover photograph. Each is arranged as $256\text{K} \times 4$ bits and is addressed in parallel by a 15-bit address bus (A0-A14) – strobe addressing is again used. The four least significant bits of each word are stored in one memory chip while the four most significant bits are stored in the other chip. There are separate read and write data buses and a separate 6-bit control bus which provides a route for the following signals, RSO (read strobe output), WSO (write strobe output), WEO (write enable output), CEO (chip enable output – paralleled to the two memory chips), SO (shift out clock) and SI (shift in clock).

Once again the memory control chip is a purpose designed device, having in this case 98 pins and incorporating, in addition to the memory addressing, facilities for still, strobe, graphic effect and noise reduction. Each of these will be described in turn. Fig. 12 shows a much simplified block diagram of the gate array (memory control) and memory system.

Freeze Frame

At a command from the remote control handset the picture from the tape, off-air transmission or an external video source is instantly frozen, giving a very high quality noise-free still picture, while the sound continues where appropriate. The command enters the sub-microcomputer chip as a serial data train from the VCR's syscon section, and is decoded to provide the memory control chip with a high signal – see line three in Fig. 13. Following this the next full field of picture data is written into the memory, less the field sync pulse – 308 video lines are memorised in the 313-line period between the address counter reset pulses. The memory control chip then resets its address counter at 312- and 313-line periods to time the memory

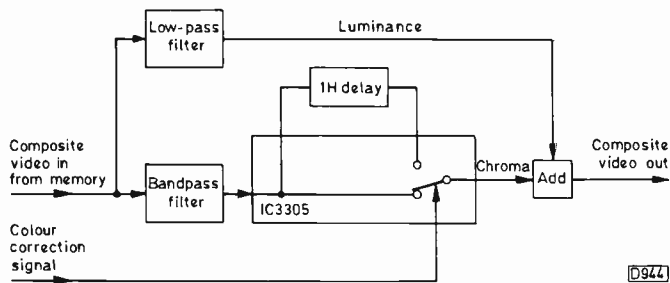


Fig. 14: Chroma phase switching required in the freeze-frame mode. The colour-correction signal comes from IC9009 – see Fig. 12.

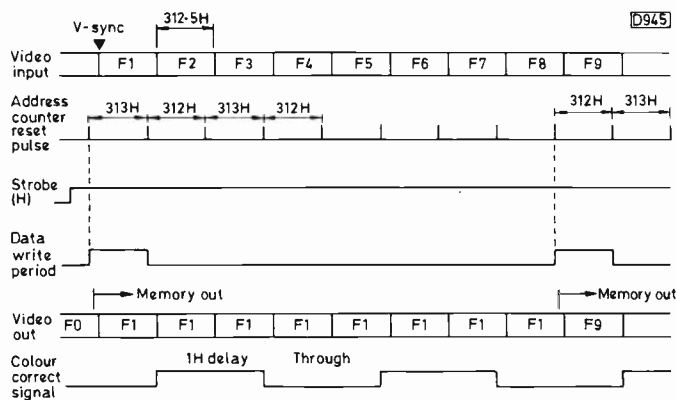


Fig. 15: Digital strobe mode timing chart.

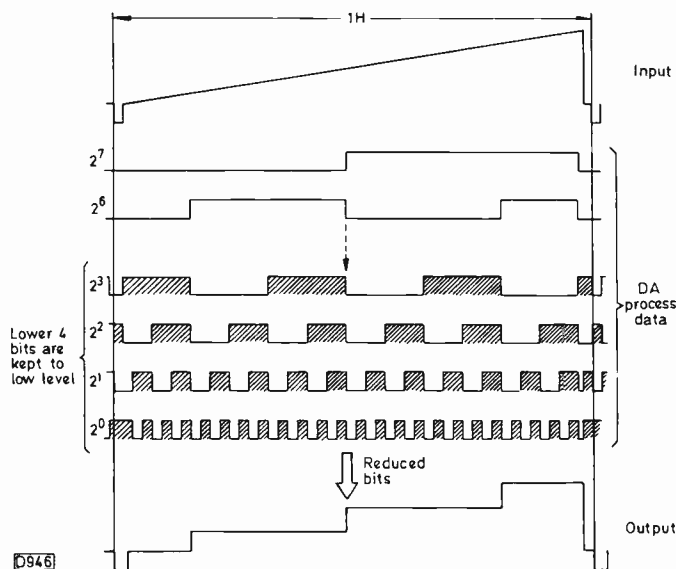


Fig. 16: Graphic effect. This effectively reduces the picture data available to 4-bit form.

readout, adding a suitably timed field sync pulse train at the end of each readout. The absence of a half-line offset results in a non-interlaced display, but the horizontal alignment is maintained to prevent skew error in the reproduced picture.

Colour Correction Signal

This simplified picture structure does not maintain correct PAL blanking however. The specification for a CCIR PAL signal calls for a well-defined field-by-field sequence of colour burst phases over a four-field cycle. To restore correct burst phasing from the continuously reread memory output with its F3 phasing, a colour correction signal consisting of a squarewave with an 80msec period

(row six in Fig. 13) is generated within the memory control chip. It's sent to a two-way switch which gates a 64µsec delay line into the separated chroma signal path on a two-field by two-field basis, after which the luminance and chrominance signals are recombined in an adder as shown in Fig. 14. Correct chroma burst phase order is thus restored and the reconstituted CVBS signal is acceptable for a TV set or monitor.

Digital Strobe

In the strobe mode a series of still images are presented on the screen, updated at intervals that can be varied between one eighth to 1.28 seconds in eight steps. Strobe-select and strobe-interval commands are sent to the memory control chip as 1-bit and 3-bit data respectively. Fig. 15 shows the timing of the memory control action, with a write period every eight fields and continuous readout between updates.

The intervals between write periods can be 8, 16, 24, 32, 40, 48, 56 or 64 fields, the choice of 8-field steps being governed by the fact that this enables colour signal alignment to be maintained in both the SP and LP playback modes. In other respects the circuit operation is similar to the freeze-frame mode.

Graphics Effect

The digital graphic mode (see cover photograph this month) is a deliberate picture degradation for effect! From the technical point of view however it's interesting in that it shows what happens when the number of brightness and colour levels in the picture are reduced. The basic process is the same as those already described, but the least significant four bits in each 8-bit picture word are held at zero. This reduces the available video signal range to only sixteen levels, as illustrated in Fig. 16. The level reduction is carried out by the DA converter chip and gives the picture an "oil-painting" effect. Rather unfair to Raphael, Titian and the others maybe, but the effect does resemble the results obtained using the cheapest "paint by numbers" outfits, whose palettes are very limited!

Noise Reduction

The noise-reduction facility can be used during the record and E-E modes to clean up a noisy input signal from a TV transmission or another VCR, or during playback to improve the results with worn or poorly-recorded tapes. It works by comparing every pixel with its counterparts in successive fields, the theory being that pixel values (with a still picture, anyway) add in terms of peak-to-peak values while random noise contributes only its average value to the composite picture. A system that adds n fields pixel by pixel then divides the resultant by n reduces the overall noise by a factor of \sqrt{n} . This can be well illustrated by taking a very long-exposure photograph of a noisy stationary TV picture such as a test pattern. The developed photograph will have a smoothness and freedom from noise that is not seen when watching the screen. The problem of course is that TV pictures move. Thus this kind of noise reduction has to be compromised to avoid blur with moving images – unless complex digital filter movement detectors that call for considerable computing power are used.

The NV-D80 employs a relatively simple digital noise-reduction process in which the 8-bit digital video input data is "subtracted" from the 8-bit data read out from the

memory, i.e. the same pixel in the previous field. The "difference" data is deemed to be noise, and undergoes a process determined by internal ROM, selected by the user in either of two steps. Its effect is similar to that of a limiter in an analogue circuit. The modified noise data is then "subtracted" from the main digital signal, the effect being

greatest on the two or three least significant bits. This cleaned up data is fed back into the memory to be compared with the data from the next incoming field, and so on.

Next month we will look at the techniques used to obtain picture-in-picture displays.

The Room at the Back

J. LeJeune

Ralph Topcut drummed the desk with his fingers, awaiting Sid's reply. As Sid tried to start, Ralph butted in once more.

"Well, Sid, what am I . . . no, what are you going to do about this pesky woman?" Mrs. Overton was a persistent complainer about electrical equipment that seemed to work perfectly for years in other people's homes, but not in hers. From light bulbs to microcomputers, all inexplicably failed in a short time.

"Perishing nuisance she is" moaned Sid. "I think she's incapable of leaving anything alone for more than ten minutes."

"But she can't 'get at' an electric light bulb" Ralph cut in once more. "You'd better go up to Lime Kiln Farm yourself. Take a voltmeter with you and check their generator. See what you can do to persuade her that Dazzling Discounts at Falgarth are cheaper than us."

Meanwhile Gareth the apprentice was having trouble with a flashy Philips – e.h.t. was spraying everywhere from under the tube's final anode cap, and the occasional flashover crack threatened the line output transistor.

As Sid came in he yelled "don't just stand there waiting for the thing to pack up. Switch it off and get some sealer to it."

Norman came in from his rounds carrying a dead CVC30. As he did so Sid picked up an Avo and went out, slamming the door. A moment later the van was heard to start and drove off.

"How's your temper then?" Norman asked Gareth.

"It would be a lot better if I could find the e.h.t. sealer."

"What do you want it for?"

"Sealing e.h.t."

"Ask a stupid question, I suppose" Norman returned.

"We don't have any more of that stuff. It's sort of out of fashion."

"So what do I stop the fireworks with?" asked Gareth.

"I use silicone rubber like they use around the edges of baths and sinks" replied Norman. "It works a treat and you can get it almost anywhere. Trouble is my tube's in the van Sid's just taken. You'd better look at this ITT CVC30 until he comes back."

"How would you park this disconnected e.h.t. cap to stop the stuff fizzing everywhere?" asked Gareth.

"What I use is a clean, dry, empty jam jar stuck to a piece of wood" replied Norman. "Just pop the e.h.t. cap inside it."

"Any ideas about this CVC30 then?" Gareth enquired.

"Well, it's not quite dead. There's h.t. at the chopper transistor, but no drive" answered Norman. "It could be the chopper control chip. It plugs in so it's easy to change."

When this had been done the set sprang to life and produced quite a good picture for its age. But the whole set was incredibly dirty and smelt badly of tobacco smoke.

"Chances are that it's the i.c. socket" said Norman.

"Switch it off, put the old chip back and see what happens."

Gareth did as suggested and when the CVC30 was switched on again it worked.

"Solder the original chip directly into the PCB" said Norman, "and I'll wager it will go for ever despite the ravages of nicotine."

Ralph Topcut always insisted that every item serviced was thoroughly cleaned before being sent back. Cabinets were polished even though they mightn't have seen a duster for years, knobs were degreased, noisy controls replaced or given some cleaning fluid and the mains cable was checked and if necessary replaced. "All part of the service" he'd tell customers loudly, though he'd charge them for doing it.

Gareth started the restoration work on the CVC30 while Norman gazed at the open back of the Philips set. "I smell ozone" he said and went to remove the e.h.t. cap from the tube. There was a splat as a short, bright arc leapt towards his fingers. He shook his arm in pain. "Lesson number one" he said, "always discharge the tube first." He took a closer look. "This one really needs a new rubber cap" he pronounced. He scrubbed the area around the final anode connector on the tube bowl with an old toothbrush soaked in methylated spirit, then dried the area thoroughly with a cloth he kept on the radiator for the purpose. A new cap was found in a drawer and was quickly fitted in place of the smaller original. "There" said Norman, "we'll finish it off with some silicone rubber when Sid gets back with the van."

Andy, without so much as a wind-up gramophone to repair, let alone any digital audio, had picked up a 3V53 that wouldn't load the tape fully to the upper drum. Digital audio was Andy's specialist subject, the reason for his recruitment to the growing Topcut empire, but a few weeks had broadened his scope. Now he would tackle almost anything.

The VCR's mode control motor was turning, but the drive belt was slipping madly. A new belt made no difference, so he turned his attention to the mode control gear assembly and to the loading arm guide slots. The simple answer was found here – the black grease used to lubricate the mechanism during assembly had hardened and was now acting like glue. It was a strip down job, taking about half an hour.

"Do we have any grease suitable for this VCR?" Andy asked.

Norman thought about it. "We need a grease that doesn't go solid, particularly in cold weather and with age" he reasoned. "My cousin's a rough-shooting fanatic and the molybdenum-based grease he uses in his guns has those properties. Looks like someone's going to have to make a trip to the gunsmith's."

Things quietened down as the Philips set awaited the silicone grease and the 3V53 the moly grease while the CVC30 worked happily on soak test.

First Euro S-VHS Demonstrations

George Cole

Two companies, JVC and Panasonic, held official demonstrations of the European (625-line) version of the Super VHS format just a few days before the start of this year's May trade shows. Both companies released information on the S-VHS system and demonstrated the S-VHS picture quality under various conditions. They also gave details of S-VHS equipment to be released this autumn.

For those readers who may have missed or mislaid Steve Beeching's account of the basic S-VHS system in the July 1987 issue, we'll provide a brief recap. S-VHS is a high-resolution version of the standard VHS system. Several factors contribute to the improved picture quality.

First, a higher-frequency carrier is used for the luminance signal. As a result the luminance bandwidth is over 5MHz instead of 3.2MHz. This has the effect of increasing the horizontal resolution to over 400 lines as opposed to 250 lines – this is the number of vertical lines that can be displayed without blurring. The carrier's frequency deviation is increased from 3.8-4.8MHz to 5.4MHz-7MHz, i.e. 1.6MHz. The main effect of this wider deviation is to increase the signal-to-noise ratio. A non-linear sub-emphasis circuit is used to reduce noise at the higher frequencies. Interference between the luminance and chrominance signals, giving rise to cross-colour effects, is reduced by handling the signals separately throughout most of the record and playback signal processing. Separate luminance and chrominance input/output sockets are provided by means of what is called an S connector.

This improved specification calls for better quality tape. Ferric oxide tape with super fine particles just 0.18 microns in size is used in S-VHS cassettes. For comparison, the particle size with VHS hi-fi grade tape is around 0.24 microns. The new tape has a higher coercivity of 900 Oersteds compared to 680 Oersteds. S-VHS cassettes have an identification hole which tells the machine that the tape is suitable for high-resolution recording.

The rest of the S-VHS specification remains as for conventional VHS.

The compatibility between VHS and S-VHS can be a little confusing. S-VHS VCRs and camcorders will be able to play and record in both S-VHS and standard VHS modes. VHS features such as long play, hi-fi sound recording, HQ and CTL coding for fast programme search will be standard with S-VHS equipment. Ordinary VHS machines will be unable to play back S-VHS recordings: they will be able to use S-VHS tape for normal recording, but the higher price of the S-VHS tape will make this uneconomic.

The 625-line system developed by the VHS companies cuts across the PAL/SECAM standards. For example, an S-VHS tape recorded in France will play back normally via a UK S-VHS machine. PAL VHS and SECAM VHS recordings are partly compatible. NTSC S-VHS and VHS recordings remain incompatible with European machines.

The JVC Presentation

The World's first showing of 625-line S-VHS outside Japan was conducted by the VHS system's inventor, JVC, at the Science Museum on May 12th. Before the demon-

stration began Bill Walker, training manager of JVC (UK), provided some background information on the VHS and S-VHS formats.

Over 170 million VHS recorders are now in use world wide, and over 160 million prerecorded cassettes were released last year. S-VHS was launched in Japan in the spring of 1987. It accounted for 11 per cent of the Japanese video market last year. JVC estimate that this percentage will rise to 67 per cent by 1992 and 85 per cent by 1997.

Two 33in. monitors were used for the demonstration. Each was connected via an S connector to an HR-S5000 S-VHS VCR and via AV sockets to an HRD-530 VHS VCR. For comparison, pictures from the two recorders were switched in and out. The S-VHS material consisted of a mixture of pictures shot with an S-VHS camcorder and material sourced from one inch formats.

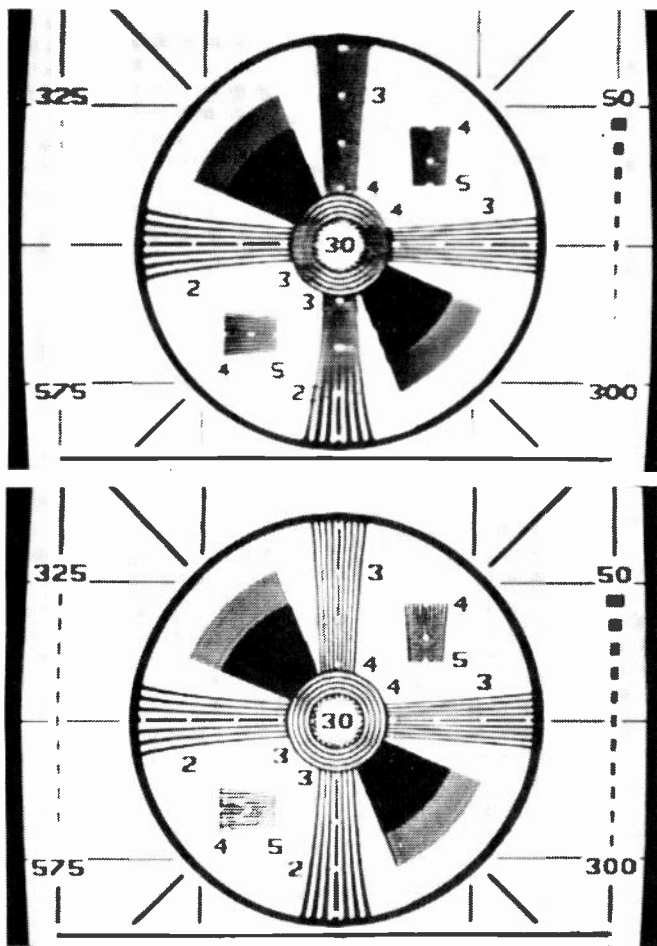
The first display was of a test card recorded in the standard play mode. The S-VHS picture could be seen to resolve over 400 lines and when the picture was switched to VHS the resolution clearly dropped to around 250 lines. Next on the agenda was a test card recorded in the long-play mode. There was barely any reduction in the S-VHS resolution but when switched to VHS the resolution was about 220 lines.

There followed a series of pictures that illustrated graphically the difference between the standard VHS and the S-VHS formats. You could clearly distinguish the fine petal lines of a flower shown in S-VHS: in standard VHS the lines blurred into one another. This was the case with all the examples presented to us. With S-VHS skin tone was clear and fine detail such as roof tiling and brickwork appeared like magic, only to disappear when switched to VHS. Two particular examples stood out for me. The first was a shot of a piece of fabric, clearly showing the weave pattern and the individual fibres at the fraying edges. The other was of the engraving on the base of a camera. I was viewing all this from the front row, less than three feet away from the monitors, and could see little evidence of chroma disturbance or grain.

The next demonstration consisted of scenes from three films, *Top Gun*, *Beverly Hills Cop 2* and *Day Off*. The results this time were disappointing, with a drop in resolution and a noticeable increase in grain. This is a problem I'll return to when commenting on the Panasonic demonstration.

The question of scart socket compatibility came up during a question and answer session. Anyone using a scart connector with an S-VHS machine will get a composite video output. JVC claims that cross colour will still be reduced when going via this route. There are plans to modify the scart output so that Y and RGB signals are fed to the monitor to improve the colour picture quality. JVC may produce a "black box" which can be fitted between an S-VHS recorder and an existing TV set with scart connector, though S-VHS recorders with switchable scart outputs are a more likely prospect.

No S. Korean companies have been granted an S-VHS licence so far, so we are unlikely to see cheap S-VHS machines in the near future. JVC will be the first to launch Euro S-VHS, in W. Germany this autumn. The UK launch date is likely to be in the pre-Christmas



Test cards showing standard VHS resolution (top) and S-VHS resolution (below). Photos courtesy Panasonic.

period, with the HR-S5000 costing around £1,000. There will also be a range of TV sets with S connectors. S-VHS camcorders are due in early 1989.

Demonstration by Panasonic

Panasonic's demonstration was held next day, at the Kensington Hotel. An S-VHS VCR and a full-sized S-VHS camcorder, Model NV-MS1, were used.

The picture demonstrations were similar to JVC's, so I won't dwell on these but instead move on to the revealing question and answer session and the additional tests that Panasonic performed on our behalf.

Panasonic were asked whom they saw as potential customers for S-VHS. The reply was camcorder enthusiasts, semi-professionals and perhaps the broadcasting companies.

There was no mention of four hour S-VHS tape in the specifications, and Panasonic said that this was unlikely to appear because of the nature of the tape. When asked about tape prices the answer was about three times the normal price, though they didn't say whether this estimate was based on £2.99 standard tape or the £5.99 high-grade variety! Rumour has it that an SE180 tape will cost around £10.

Panasonic claimed to have no plans to modify the scart output and knew of no plans to do this. At one time there had been a rumour that Panasonic intended to release an S-VHS machine with PCM digital sound, but this was denied. There are also no plans at present to produce S adaptors to assist with tape editing, though they exist in Japan.

The interesting question was raised that since there's so little picture degradation in the SP and LP S-VHS modes wouldn't it be possible to add an additional slower speed? Panasonic commented that this was technically feasible but commercially undesirable!

To their credit, the Panasonic representatives then demonstrated S-VHS under less than ideal conditions. First, the S-VHS VCR was connected to the monitor via its scart socket. Picture resolution was reduced and there was an increase in chroma shift, but the picture remained an improvement over standard VHS. An ordinary VHS tape played back via the S-VHS machine produced a standard VHS picture. But when an S-VHS recording was played back via the standard VHS machine there was loss of colour, jitter and picture tearing.

Finally, an off-air recording of *Top of the Pops* was played. Frankly, the results were poor – there was virtually no difference between the S-VHS and the VHS pictures. Of course, any system can be only as good as the signal quality it receives, and this is particularly noticeable with S-VHS. Users simply interested in time-shifting will probably be disappointed with S-VHS, but camcorder enthusiasts will be delighted with the results.

Prospects and Hardware

How will S-VHS fare in the market? Since software will be scarce initially it's likely that for the first couple of years at least S-VHS will be used primarily with camcorders. One suspects that the trade will have some difficulty in persuading the public to buy an expensive recorder that uses expensive tape and requires a new TV receiver for best results. But in time, as prices fall and software becomes more readily available, S-VHS will surely take over from standard VHS.

Finally, some of the hardware that will be in the shops this Christmas.

In addition to its S-VHS record/playback system the JVC Model HR-S5000 will have VHS hi-fi, VHS HQ, flying-head erase, long play, double speed play, reverse play and a DA-4 head system. There will be a real-time tape counter with go-to and time search, and a VHS index search system with intro search. Other features will include an audio dub facility, a NICAM decoder, auto play, a 48-channel tuner and a one year/eight event timer. The machine will have r.f., scart and S connectors. All for around £1,000.

The Panasonic Model NV-FS1 will have amorphous heads as used in industrial VCRs. This should improve the signal-to-noise ratio by around 2-3dB. Also included will be VHS hi-fi, a NICAM decoder, audio dub, a flying erase head, long play, VISS, VHS HQ, a bar code timer system, a 99-channel tuner and a one year/eight event timer. There will be the same array of sockets and again a suggested price of around £1,000.

Features of the Panasonic NV-MS1 S-VHS camcorder will include a new 420,000-pixel CCD image sensor with a resolution of 420 lines and capable of operating at down to 7 lux, a times ten power zoom with macro facility, a four-step variable speed shutter (1/50th to 1/1000th of a second), a flying erase head, VISS, a synchro edit facility, audio dubbing, insert editing, VHS HQ and various standard accessories. There will be r.f., AV and S connectors. The suggested price is around £1,500.

There will also be three Panasonic TV sets with S connectors – the 33in. Model TX-3380GR and two 24in. models, the TX-C84 and TX2480. The first two models will have a built-in NICAM decoder.

ECONOMIC DEVICES PO BOX 5 WIMBORHAMPTON, WV24AZ

1580R1	3.30	25C1826	0.67	AN206	2.98	BC207	0.14	BDX54B	2.16	BU226	1.75	MC1357P	2.36	SAS58T	5.42	TH880	4.78	TA8949	1.87	TA8951	1.27
1585R	2.50	25C1828	2.22	AN207	3.55	BC212B	0.24	BDX54B	2.16	BU226	1.75	MC1357P	2.36	SAS58T	5.42	TH880	4.78	TA8949	1.87	TA8951	1.27
1705Z	5.61	25C1875	4.50	AN210	2.28	BC213L	0.10	BDX54A	2.16	BU207	1.65	HA13006	2.73	SAS590S	2.51	TR4543	8.16	TA8950	3.56	TA8952	4.15
1705Z	5.61	25C1883	3.02	AN211	3.25	BC214	0.10	BDY20	1.21	BU208	1.21	HA13042	2.87	SAS580	2.25	TR4544	8.95	TA8950	3.56	TA8952	4.15
17074	9.30	25C1906	0.98	AN210	4.40	BC225	0.40	BDY21	1.05	BU2080Z	1.97	HA13360	2.65	MC14001	2.40	TR4545	9.30	TA8950	3.56	TA8952	4.15
17089	3.45	25C1921	1.37	AN234	5.92	BC237	0.10	BF115	4.00	BU208A	1.92	HA13365	4.02	MC14013	2.41	TR4546	9.30	TA8950	3.56	TA8952	4.15
17127	2.50	25C1923	0.30	AN236	3.78	BC238	0.10	BF117	0.66	BU208B	1.15	HA1366WR	1.51	MC1443P	7.65	SAS5670	2.37	TR4547	9.30	TA8950	3.56
17176	1.76	25C1928	0.08	BF118	0.28	BC239	0.08	BF119	0.08	BU209	0.08	BF120	0.08	MC1447P	2.75	SAS5670	2.37	TR4548	9.30	TA8950	3.56
1N4001	0.04	25C1942	1.65	AN241	1.71	BC239B	0.25	BF121	0.25	BU226	2.45	HA1368R	2.45	MC1447P	2.75	SAS5670	2.37	TR4549	9.30	TA8950	3.56
1N4002	0.06	25C1959	0.76	AN245	4.50	BC251A	0.21	BF123	0.21	BU236	2.00	HA1368A	1.76	MC14510BAL	3.16	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N4003	0.06	25C1967	1.00	AN253	1.80	BC294	0.50	BF127	0.13	BU236A	2.20	HA1370	3.00	MC14511BCP	3.15	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N4004	0.05	25C1963	1.93	AN260	3.85	BC300	0.50	BF137	0.29	BU406	1.69	HA1374	4.80	MC14528BCP	2.15	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N4005	0.05	25C1962	1.50	AN272	5.25	BC301	0.45	BF153	0.58	BU406D	1.79	AA117	1.79	MC1712	3.88	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N4006	0.08	25C1969	2.04	AN295	4.50	BC302	0.53	BF154	0.53	BU407	1.84	AA117	1.79	MC1712	3.88	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N4007	0.07	25C1983	1.21	AN301	2.00	BC303	0.45	BF157	0.33	BU412	5.28	HA1398R	2.05	MC1774AC	2.95	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N4148	0.03	25C1985	1.55	AN302	1.93	BC307A	0.08	BF158	0.18	BU426A	1.13	HA1389	2.38	MC1818C	2.18	SG613	10.75	TR4550	1.61	TR4551	1.61
1N4448	0.05	25C2009	0.34	AN305	3.20	BC388A	0.11	BF159	0.18	BU500	1.45	HA1392	2.17	MC1906 S/6	0.95	SG629	8.27	TR4550	1.61	TR4551	1.61
1N5401	0.14	25C2029	2.33	AN315	1.29	BC309	0.17	BF160	0.31	BU508A	1.25	HA1394	1.95	MC2201	2.28	SG633	11.96	TR4550	1.61	TR4551	1.61
1N5402	0.15	25C2028	2.11	AN316	3.50	BC317A	0.13	BF167	0.38	BU508	1.65	HA1397	2.17	MC2411	0.28	SL1125H	7.90	TR4550	1.61	TR4551	1.61
1N5403	0.16	25C2063	0.99	AN318	4.11	BC327	0.13	BF173	0.34	BU508	1.65	HA1398	2.25	ME6002	0.26	SL1225HD	18.25	TR4550	1.61	TR4551	1.61
1N5404	0.15	25C2073	1.11	AN320	4.47	BC328	0.10	BF177	0.35	BU705	2.95	HA1400	1.80	HA1400	1.80	TR4550	1.61	TR4551	1.61	TR4552	2.25
1N5408	0.35	25C2073	2.25	AN321	5.25	BC337	0.09	BF178	0.40	BU806	1.79	HA1452	0.85	ME8001	0.34	SKZF1/04	1.29	TR4550	1.61	TR4551	1.61
1N5411	0.04	25C2085-D	1.65	AN322	5.85	BC338	0.10	BF179	0.36	BU807	0.80	HD4538	2.07	ME6011	0.75	SKZF2/04	0.85	TR4550	1.61	TR4551	1.61
1S1555	0.31	25C2091	1.30	AN327	5.37	BC368	0.24	BF180	0.36	BU826A	1.95	HD2702 A2	7.95	ML2501	3.30	SKG1/06	0.35	TR4550	1.61	TR4551	1.61
1S154	0.10	25C2141	0.44	AN340P	1.17	BC440	0.09	BF181	0.32	BU826A	1.95	HD2702 A2	7.95	ML2501	3.30	SKG1/06	0.35	TR4550	1.61	TR4551	1.61
1S221	1.98	25C2156	0.58	AN341	1.98	BC441	0.04	BF182	0.34	BU826A	1.95	HD2702 A2	7.95	ML2501	3.30	SKG1/06	0.35	TR4550	1.61	TR4551	1.61
22C1231A	0.33	25C2216	2.88	AN362	3.12	BC454	0.38	BF183	0.38	BU826A	1.95	HD2702 A2	7.95	ML2501	3.30	SKG1/06	0.35	TR4550	1.61	TR4551	1.61
2N3053	0.35	25C2233	1.80	AN370	3.95	BC460	0.42	BF184	0.43	BY126	0.13	HD38805A0	14.09	MLJ2955	1.89	SKF4C/202	0.96	TR4550	1.61	TR4551	1.61
2N3054	0.99	25C2236	1.65	AN311	3.43	BC461	0.35	BF185	0.39	BY127	0.08	HD4801A05	15.05	MLJ2955	1.89	SKF4C/202	0.96	TR4550	1.61	TR4551	1.61
2N3055	0.61	25C2278	1.69	AN5120N	4.50	BC462	0.15	BF194	0.14	BY133	0.12	HS11010	19.98	MLJ340	0.49	SKJ1/10	2.15	TR4550	1.61	TR4551	1.61
2N3052	1.56	25C2314	2.17	AN5132	5.38	BC463	0.64	BF195	0.14	BY164	0.44	HS11010	19.98	MLJ340	0.49	SKJ1/10	2.15	TR4550	1.61	TR4551	1.61
2N3057	0.14	25C2355-Kit	1.98	AN5138	3.33	BC464	0.10	BF196	0.10	BY176	0.62	HS11010	19.98	MLJ340	0.49	SKJ1/10	2.15	TR4550	1.61	TR4551	1.61
2N3073	0.18	25C2551	1.26	AN5610	5.50	BC479	0.41	BF197	0.18	BY179	0.18	HS11010	19.98	MLJ340	0.49	SKJ1/10	2.15	TR4550	1.61	TR4551	1.61
2N3075	0.16	25C2655	3.92	AN5612	3.00	BC532	0.28	BF198	0.17	BY182	0.95	HM6231	6.00	ML231B	2.41	SL422A	3.84	TR4550	1.61	TR4551	1.61
2N3076	0.14	25C2570	2.88	AN5613	4.00	BC546	0.08	BF199	0.17	BY187	0.77	HM6232	5.25	ML238	5.77	SL429	2.48	TR4550	1.61	TR4551	1.61
2N3077	0.16	25C2577	1.60	AN5630	3.95	BC547	0.10	BF200	0.37	BY189	1.79	HM6251	5.25	ML233	3.00	SL471	2.50	TR4550	1.61	TR4551	1.61
2N3711	0.13	25C2578	6.75	AN5701N	1.66	BC548	0.12	BF218	0.36	BY198	1.62	HM7103	4.85	ML236	3.98	SL480	3.98	TR4550	1.61	TR4551	1.61
2N3711	0.70	25C2579	1.98	AN5750	1.40	BC549	0.10	BF219	0.37	BY207	0.22	HM9032	9.98	ML239	3.80	SL480	3.98	TR4550	1.61	TR4551	1.61
2N3712	0.14	25C2788A	1.85	AN600	4.00	BC550	0.10	BF237	0.10	BY231	0.10	HS11002	19.98	ML239B	4.00	SL1231B	1.98	TR4550	1.61	TR4551	1.61
2N3713	2.00	25C3153	6.94	AN6310	4.54	BC556	0.10	BF240	0.19	BY210 A00	0.19	HM9015	3.24	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61
2N3819	0.54	25C3272	1.40	AN6340	10.14	BC557	0.10	BF241	0.15	BY210 A00	0.19	HM9015	3.24	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61
2N3823	0.17	25C373	1.16	AN6341	14.3	BC558	0.10	BF245	0.50	BY210 A00	0.19	HM9015	3.24	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61
2N3904	0.62	25C383	1.33	AN6383	16.00	BC559	0.10	BF245	0.49	BY210 A00	0.19	HM9015	3.24	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61
2N3908	0.62	25C383	1.33	AN6383	16.00	BC559	0.10	BF245	0.49	BY210 A00	0.19	HM9015	3.24	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61
2N4101	1.73	25C394V	0.81	AN6551	1.35	BC625	0.28	BF246	0.14	BY244	0.60	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61	TR4552	2.25
2N4240	3.30	25C403C	0.60	AN6556	0.68	BC636	0.28	BF246	0.14	BY244	0.60	MM5318N	3.11	SL181A	0.07	TR4550	1.61	TR4551	1.61	TR4552	2.25
2N4444	0.99	25C458	0.15	AN6610	2.40	BC637	0.24	BF257	0.34	BY227	0.20	LA1210	1.75	MP1192	5.07	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N5293	0.50	25C495	0.92	AN1111	1.25	BC639	0.20	BF258	0.38	BY226	0.60	LA1210	1.75	MP1192	5.07	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N5294	0.50	25C515A	2.85	AN1115	3.38	BC640	0.24	BF259	0.34	BY229 1000	1.12	LA1210	1.75	MP1212	5.07	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N5295	0.49	25C526	0.79	AN1145	2.05	BC641	0.18	BF262	0.28	BY229 500	0.92	LA1210	1.75	MP1212	5.07	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N5297	0.50	25C536	0.45	AN1146	2.05	BC641	0.18	BF262	0.28	BY229 500	0.92	LA1210	1.75	MP1212	5.07	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N5298	0.61	25C537	0.54	AN1151	2.37	BC642	0.10	BF271	0.30	BY295 500	1.03	LA1363	3.05	MPF256C	0.40	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N6109	1.56	25C605L	1.16	AN1156	2.85	BC643	0.10	BF273	0.20	BY298	0.36	LA1364	3.05	MPF256C	0.40	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N6130	0.80	25C620	0.95	AN1158	2.34	BC644	0.57	BF274	0.20	BY299	0.45	LA1365J	3.00	MPF256C	0.40	SN2972Z	11.95	TR4550	1.61	TR4551	1.61
2N6133	1.25	25C624A	1.54	AN1218	1.64	BC645	0.20	BF324	0.35	BY407	0.90	LA1385	2.58	MPF5A6	0.27	SN2978B	5.96	TR4550	1.61	TR4551	1.61
2N6135	0.95	25C628	1.25	AN1223	4.25	BC646	0.33	BF328	0.33	BY409	1.49	LA1387	2.58	MPF5A6	0.27	SN2978B	5.96	TR4550	1.61	TR4551	1.61
2N6292	1.65	25C681	4.00	AN1107	3.50	BC647	0.36	BF337	0.37	BY409	1.49	LA1387	2.58	MPF5A6							

★ HIGH QUALITY VIDEO SPARES ★

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<p>AKAI Machine Nos.: VP77 VP88 VP7100 VP7200 VS1 VS2 VS3 VS5 VS10 VS9300 VS9500 VS9700 VS-P1 VS-P5</p> <p>AMSTRAD Machine Nos.: VCR4500 VCR5200 Machine Nos.: VCR7000 VCR4600 VCR9000</p> <p>FERGUSON/JVC Machine Nos.: 3292 8903 3V00 3V01 3V06 3V16 3V22 3V23 3V24 3V29 3V30 3V31 3V35 3V36 3V38 3V39 3V49</p> <p>FISHER Machine Nos.: FVH — D520 D530 D620 D720 P420 P510 P520 P530 P615 P620 P622 P710 P720 P721 P722</p> <p>GEC Head Part Nos.: 5458161 5458165 Machine Nos.: 4000H 4001H 4002H Head Part Nos.: 5458282 5458413 5458415 5458992 Machine Nos.: 4001H 4004H</p> <p>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</p> <p>Head Part Nos.: 5458282 5458413 5458415 5458992 Machine Nos.: VT11 V14 VT33 VT34 VT330 VT340 VT5030 VTP10 VTP30</p> <p>ITT Machine Nos.: VR3605 VR3033 VR3905 VR3913 VR3914 VR3935 VR3943 VR3963 VR3993 VR3975 VR3985 VR3986 VR3983</p> <p>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</p> <p>MITSUBISHI Machine No.: HS200 HS7008</p>	<p>NATIONAL PANASONIC Head Part Nos.: VEH0099 0103 0115 0121 0131 Machine Nos.: NV300 NV322 NV332 NV333 NV340 NV390 NV2000 NV3000 NV7000 NV7200 NV7500 NV7800 NV7850 NV8170 NV8200 NV8400 NV8600 NV8610 NV8620</p> <p>Head Part Nos.: VEH0171 VEH0218 Machine No.: NV370 NV3708</p> <p>Head Part Nos.: VEH0171 Machine No.: NV330 NV777</p> <p>Head Part Nos.: VEH0286 Machine No.: NV430</p> <p>Head Part Nos.: VEH0174 Machine No.: NV366</p> <p>SHARP Head Part Nos.: DDRMU 0002 HE17/21/27 Machine No.: VC581/2/3 651 681/2/3/5 659 699</p> <p>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</p> <p>Head Part Nos.: DDRMU 0001 HE09 Machine No.: VC7300 VC7700 VC7750</p> <p>Head Part Nos.: DDRMU 0001 HE10 Machine No.: VC6300</p> <p>Head Part Nos.: DDRMU 0001 HE12 Machine No.: VC8300</p> <p>Head Part Nos.: DDRMU 0001 HE14 Machine No.: VC2300</p> <p>SANYO Head Part Nos.: 1430242 T01700 1430242 T22300 Machine No.: VTC5000 VTC5150 VTC5300 VTC5400</p> <p>Head Part Nos.: 1430242 T02200 Machine No.: VTC5350 VTC5500</p> <p>Head Part Nos.: 1430762 T02000 Machine No.: VTC9300 VTC9455 VTC9500</p> <p>Head Part Nos.: 143072 T02100 Machine No.: VTC9300PS VTC9350</p> <p>SONY Head Part Nos.: A6762 044A, 044E, 054A, 147A Machine No.: SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME</p> <p>Head Part Nos.: A6762 012A, 038A, 055A, 129A Machine No.: SL5W, 5000 5100 SLC5, C6, C7</p> <p>Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A Machine No.: SLC20, C30, C33, C40, C44 SLF1, F30, HF72, HF100, T20, T30</p>	<p>HEADS</p> <table border="1"> <tr><th>Head Part No</th><th>Price 1 +</th></tr> 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Housing) T3V23/PU49042</td><td>4.50</td></tr> <tr><td>VID7</td><td>01X0-040-007</td><td>Take up idler 3V29/30/PU48967B</td><td>2.90</td></tr> <tr><td>VID8</td><td>01X0-040-017</td><td>Reel motor assembly 3V29/30/PU51381V</td><td>27.95</td></tr> <tr><td>VID9</td><td>01X0-065-009</td><td>Capston motor 3V35/36/38/39/PU55371V</td><td>27.00</td></tr> <tr><td>VID10</td><td>01X0-065-016</td><td>Cass. housing Assy. 3V35/36/38/39/PU29825</td><td>27.00</td></tr> </table> <p>GEC/HITACHI</p> <table border="1"> <tr><td>VID11</td><td>V5577355</td><td>GEC 4100/Hitachi VT11E capston motor</td><td>21.90</td></tr> <tr><td>VID12</td><td>V6413663</td><td>GEC 4000/Hitachi VT33 ff rewind arm</td><td>2.10</td></tr> <tr><td>VID13</td><td>V6861471</td><td>GEC 4001/2/Hitachi 93/9500 ff rewind arm</td><td>1.70</td></tr> <tr><td>VID14</td><td>V6861482</td><td>GEC 4001/2/Hitachi 93/9500 play idler assy.</td><td>4.75</td></tr> <tr><td>VID15</td><td>V6886971</td><td>GEC 4004/Hitachi VT33 ff rewind arm</td><td>1.80</td></tr> <tr><td>VID16</td><td>V2423461</td><td>ET541 Tuner Unit</td><td>21.90</td></tr> </table> <p>NATIONAL PANASONIC</p> <table border="1"> <tr><td>VID17</td><td>VXP0329</td><td>Fast forward idler NV2000</td><td>0.85</td></tr> <tr><td>VID18</td><td>VXP0344</td><td>Idler NV7000/7200</td><td>0.85</td></tr> <tr><td>VID19</td><td>VX20078</td><td>Tension Band NV7000</td><td>2.95</td></tr> <tr><td>VID20</td><td>VXP0521</td><td>Idler NV370</td><td>2.50</td></tr> <tr><td>VID21</td><td>VXP0463</td><td>Reel Idler NV777</td><td>3.25</td></tr> <tr><td>VID22</td><td>VXP0432</td><td>Pinch Roller NV333</td><td>8.50</td></tr> <tr><td>VID23</td><td>VXP0401</td><td>Idler wheel NV333</td><td>0.90</td></tr> </table> <p>SANYO/FISHER</p> <table border="1"> <tr><td>VID24</td><td>4529V10800</td><td>Reel motor VTC5000/5150</td><td>8.00</td></tr> <tr><td>VID25</td><td>1430662T01201</td><td>Reel drive pulley</td><td>5.00</td></tr> <tr><td>VID26</td><td>PR2758</td><td>Pinch roller VTC5000/5150</td><td>3.85</td></tr> <tr><td>VID27</td><td>1430490400900</td><td>Gear idler Fisher FVH-P615</td><td>6.50</td></tr> <tr><td>VID28</td><td>1430420400300</td><td>Heart idler Fisher FVH-P615</td><td>6.05</td></tr> </table> <p>SHARP</p> <table border="1"> <tr><td>VID29</td><td>RMOTP1029</td><td>Capston motor 73/9300</td><td>33.55</td></tr> <tr><td>VID30</td><td>RMOTV1008</td><td>Reel motor VC9700</td><td>16.85</td></tr> <tr><td>VID31</td><td>NIDL0006</td><td>Idler VC387H etc</td><td>1.95</td></tr> <tr><td>VID32</td><td>NIDL0005</td><td>Reel idler VC9300 etc</td><td>1.85</td></tr> <tr><td>VID33</td><td>NIDL0004</td><td>Idler wheel VC2300</td><td>1.60</td></tr> </table> <p>VIDEO LAMPS/BULBS</p> <table border="1"> <tr><td>VID34</td><td>LA9292</td><td>Universal lamp without socket 290mm</td><td>0.45</td></tr> <tr><td>VID35</td><td>LA9210S</td><td>Universal lamp with socket 310mm</td><td>0.75</td></tr> <tr><td>VID36</td><td>NAT/PAN.</td><td>P.C. MTG. leadless lamp</td><td>0.50</td></tr> <tr><td>VID37</td><td>SHARP 9300</td><td>Etc. lamp plus plastic shroud.</td><td>2.53</td></tr> </table>	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 bell T3V29/30/PU48941-2	0.50	VID6	01X0-033-454	Roller Assy. (cass. 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MTG. leadless lamp	0.50	VID37	SHARP 9300	Etc. lamp plus plastic shroud.	2.53	<p>DRIVE BELTS</p> <p>AKAI</p> <table border="1"> <tr><td>VP 77</td><td>2 D&K135</td><td>£0.95</td></tr> <tr><td>VP 68</td><td>2 D&K135</td><td>£0.95</td></tr> <tr><td>VP 7100</td><td>1 D&K103</td><td>£1.95</td></tr> <tr><td>VS 1</td><td>2 D&K134</td><td>£1.20</td></tr> <tr><td>VS 2 EG</td><td>5 D&K101</td><td>£1.95</td></tr> <tr><td>VS 3</td><td>2 D&K134</td><td>£1.20</td></tr> <tr><td>VS 5 EG</td><td>6 D&K101</td><td>£1.95</td></tr> <tr><td>VS 10</td><td>2 D&K136</td><td>£0.75</td></tr> <tr><td>VS 9300</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>VS 9500</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>VS 9700</td><td>6 D&K102</td><td>£2.20</td></tr> <tr><td>VS 9800</td><td>7 D&K103</td><td>£1.95</td></tr> </table> <p>FERGUSON</p> <table border="1"> <tr><td>3292</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>3 V 00</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>3 V 01</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>3 V 16</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>3 V 22</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>3 V 23</td><td>3 D&K106</td><td>£1.95</td></tr> <tr><td>3 V 24</td><td>2 D&K137</td><td>£0.75</td></tr> </table> <p>FISHER</p> <table border="1"> <tr><td>VBS 7000</td><td>4 D&K146</td><td>£2.95</td></tr> <tr><td>VBS 7600</td><td>5 D&K105</td><td>£2.60</td></tr> <tr><td>VBS 7000</td><td>6 D&K105</td><td>£2.60</td></tr> <tr><td>VBS 9000</td><td>3 D&K108</td><td>£1.95</td></tr> </table> <p>GEC</p> <table border="1"> <tr><td>V 4000 H</td><td>3 D&K129</td><td>£0.75</td></tr> <tr><td>V 4001 H</td><td>3 D&K129</td><td>£0.75</td></tr> <tr><td>V 4002 H</td><td>3 D&K129</td><td>£0.75</td></tr> <tr><td>V 4100 H</td><td>5 D&K125</td><td>£1.80</td></tr> </table> <p>HITACHI</p> <table border="1"> <tr><td>VT 11</td><td>5 D&K126</td><td>£1.50</td></tr> <tr><td>VT 3000</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>VT 6000</td><td>7 D&K126</td><td>£2.60</td></tr> <tr><td>VT 6500</td><td>4 D&K142</td><td>£0.75</td></tr> <tr><td>VT 7000</td><td>3 D&K143</td><td>£0.75</td></tr> <tr><td>VT 8000</td><td>3 D&K129</td><td>£0.75</td></tr> <tr><td>VT 8500</td><td>3 D&K144</td><td>£0.75</td></tr> <tr><td>VT 9300</td><td>3 D&K129</td><td>£0.75</td></tr> <tr><td>VT 9500</td><td>3 D&K129</td><td>£0.75</td></tr> </table> <p>SANYO</p> <table border="1"> <tr><td>VTC 5300</td><td>5 D&K106</td><td>£2.60</td></tr> <tr><td>VTC 5400</td><td>3 D&K106</td><td>£2.60</td></tr> <tr><td>VTC 5500</td><td>3 D&K106</td><td>£1.95</td></tr> <tr><td>VTC 9300</td><td>4 D&K104</td><td>£2.95</td></tr> <tr><td>VTC 9350</td><td>4 D&K145</td><td>£2.95</td></tr> </table> <p>JVC</p> <table border="1"> <tr><td>HR 2200</td><td>2 D&K137</td><td>£0.75</td></tr> <tr><td>HR 3300</td><td>9 D&K107</td><td>£2.95</td></tr> <tr><td>HR 3330</td><td>7 D&K126</td><td>£2.50</td></tr> <tr><td>HR 3360</td><td>7 D&K103</td><td>£1.95</td></tr> <tr><td>HR 3600</td><td>7 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<tr><td>SLC 6</td><td>6 D&K100</td><td>£1.95</td></tr> <tr><td>SLC 7</td><td>6 D&K100</td><td>£1.95</td></tr> <tr><td>SLC 9</td><td>6 D&K130</td><td>£1.95</td></tr> <tr><td>SLJ 7</td><td>6 D&K100</td><td>£1.95</td></tr> <tr><td>SLT 7 ME</td><td>6 D&K100</td><td>£1.95</td></tr> <tr><td>SLT 7 MER</td><td>6 D&K100</td><td>£1.95</td></tr> </table> <p>TOSHIBA</p> <table border="1"> <tr><td>V 7540</td><td>5 D&K123</td><td>£1.95</td></tr> <tr><td>V 8600</td><td>6 D&K124</td><td>£1.95</td></tr> </table>	VP 77	2 D&K135	£0.95	VP 68	2 D&K135	£0.95	VP 7100	1 D&K103	£1.95	VS 1	2 D&K134	£1.20	VS 2 EG	5 D&K101	£1.95	VS 3	2 D&K134	£1.20	VS 5 EG	6 D&K101	£1.95	VS 10	2 D&K136	£0.75	VS 9300	7 D&K103	£1.95	VS 9500	7 D&K103	£1.95	VS 9700	6 D&K102	£2.20	VS 9800	7 D&K103	£1.95	3292	7 D&K103	£1.95	3 V 00	7 D&K103	£1.95	3 V 01	7 D&K103	£1.95	3 V 16	7 D&K103	£1.95	3 V 22	7 D&K103	£1.95	3 V 23	3 D&K106	£1.95	3 V 24	2 D&K137	£0.75	VBS 7000	4 D&K146	£2.95	VBS 7600	5 D&K105	£2.60	VBS 7000	6 D&K105	£2.60	VBS 9000	3 D&K108	£1.95	V 4000 H	3 D&K129	£0.75	V 4001 H	3 D&K129	£0.75	V 4002 H	3 D&K129	£0.75	V 4100 H	5 D&K125	£1.80	VT 11	5 D&K126	£1.50	VT 3000	7 D&K103	£1.95	VT 6000	7 D&K126	£2.60	VT 6500	4 D&K142	£0.75	VT 7000	3 D&K143	£0.75	VT 8000	3 D&K129	£0.75	VT 8500	3 D&K144	£0.75	VT 9300	3 D&K129	£0.75	VT 9500	3 D&K129	£0.75	VTC 5300	5 D&K106	£2.60	VTC 5400	3 D&K106	£2.60	VTC 5500	3 D&K106	£1.95	VTC 9300	4 D&K104	£2.95	VTC 9350	4 D&K145	£2.95	HR 2200	2 D&K137	£0.75	HR 3300	9 D&K107	£2.95	HR 3330	7 D&K126	£2.50	HR 3360	7 D&K103	£1.95	HR 3600	7 D&K107	£2.95	HR 3660	7 D&K103	£1.95	HR 4100	7 D&K127	£2.50	HR 7200	3 D&K139	£0.95	HR 7600	3 D&K138	£0.95	HR 7650	3 D&K132	£0.95	HR 7700	3 D&K108	£1.95	NV 300	5 D&K110	£1.95	NV 330	5 D&K110	£1.95	NV 777	4 D&K131	£1.95	NV 2000	5 D&K109	£1.95	NV 3000	6 D&K113	£1.95	NV 7000	5 D&K111	£1.95	NV 7200	5 D&K140	£1.50	NV 8600	7 D&K112	£1.95	VC 381	4 D&K116	£2.95	VC 383	4 D&K116	£2.95	VC 385	4 D&K116	£2.95	VC 388	4 D&K116	£2.95	VC 6000	5 D&K117	£1.95	VC 6300	5 D&K117	£1.95	VC 6500	5 D&K117	£1.95	VC 7300	5 D&K117	£1.95	VC 7700	5 D&K118	£1.95	VC 7750	5 D&K118	£1.95	VC 8300	5 D&K119	£1.95	VC 9300	5 D&K120	£1.95	VC 9500	5 D&K120	£1.95	VC 9700	3 D&K121	£3.30	SL 8000	6 D&K115	£2.95	SL 8080	6 D&K115	£2.95	SL 8500	6 D&K115	£2.95	SL 8600	6 D&K115	£2.95	SLC 6	6 D&K100	£1.95	SLC 7	6 D&K100	£1.95	SLC 9	6 D&K130	£1.95	SLJ 7	6 D&K100	£1.95	SLT 7 ME	6 D&K100	£1.95	SLT 7 MER	6 D&K100	£1.95	V 7540	5 D&K123	£1.95	V 8600	6 D&K124	£1.95
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 bell 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																																																																																																																																																																																																																																																																																																																																																																																																																				
VID11	V5577355	GEC 4100/Hitachi VT11E capston motor	21.90																																																																																																																																																																																																																																																																																																																																																																																																																				
VID12	V6413663	GEC 4000/Hitachi VT33 ff rewind arm	2.10																																																																																																																																																																																																																																																																																																																																																																																																																				
VID13	V6861471	GEC 4001/2/Hitachi 93/9500 ff rewind arm	1.70																																																																																																																																																																																																																																																																																																																																																																																																																				
VID14	V6861482	GEC 4001/2/Hitachi 93/9500 play idler assy.	4.75																																																																																																																																																																																																																																																																																																																																																																																																																				
VID15	V6886971	GEC 4004/Hitachi VT33 ff rewind arm	1.80																																																																																																																																																																																																																																																																																																																																																																																																																				
VID16	V2423461	ET541 Tuner Unit	21.90																																																																																																																																																																																																																																																																																																																																																																																																																				
VID17	VXP0329	Fast forward idler NV2000	0.85																																																																																																																																																																																																																																																																																																																																																																																																																				
VID18	VXP0344	Idler NV7000/7200	0.85																																																																																																																																																																																																																																																																																																																																																																																																																				
VID19	VX20078	Tension Band NV7000	2.95																																																																																																																																																																																																																																																																																																																																																																																																																				
VID20	VXP0521	Idler NV370	2.50																																																																																																																																																																																																																																																																																																																																																																																																																				
VID21	VXP0463	Reel Idler NV777	3.25																																																																																																																																																																																																																																																																																																																																																																																																																				
VID22	VXP0432	Pinch Roller NV333	8.50																																																																																																																																																																																																																																																																																																																																																																																																																				
VID23	VXP0401	Idler wheel NV333	0.90																																																																																																																																																																																																																																																																																																																																																																																																																				
VID24	4529V10800	Reel motor VTC5000/5150	8.00																																																																																																																																																																																																																																																																																																																																																																																																																				
VID25	1430662T01201	Reel drive pulley	5.00																																																																																																																																																																																																																																																																																																																																																																																																																				
VID26	PR2758	Pinch roller VTC5000/5150	3.85																																																																																																																																																																																																																																																																																																																																																																																																																				
VID27	1430490400900	Gear idler Fisher FVH-P615	6.50																																																																																																																																																																																																																																																																																																																																																																																																																				
VID28	1430420400300	Heart idler Fisher FVH-P615	6.05																																																																																																																																																																																																																																																																																																																																																																																																																				
VID29	RMOTP1029	Capston motor 73/9300	33.55																																																																																																																																																																																																																																																																																																																																																																																																																				
VID30	RMOTV1008	Reel motor VC9700	16.85																																																																																																																																																																																																																																																																																																																																																																																																																				
VID31	NIDL0006	Idler VC387H etc	1.95																																																																																																																																																																																																																																																																																																																																																																																																																				
VID32	NIDL0005	Reel idler VC9300 etc	1.85																																																																																																																																																																																																																																																																																																																																																																																																																				
VID33	NIDL0004	Idler wheel VC2300	1.60																																																																																																																																																																																																																																																																																																																																																																																																																				
VID34	LA9292	Universal lamp without socket 290mm	0.45																																																																																																																																																																																																																																																																																																																																																																																																																				
VID35	LA9210S	Universal lamp with socket 310mm	0.75																																																																																																																																																																																																																																																																																																																																																																																																																				
VID36	NAT/PAN.	P.C. MTG. leadless lamp	0.50																																																																																																																																																																																																																																																																																																																																																																																																																				
VID37	SHARP 9300	Etc. lamp plus plastic shroud.	2.53																																																																																																																																																																																																																																																																																																																																																																																																																				
VP 77	2 D&K135	£0.95																																																																																																																																																																																																																																																																																																																																																																																																																					
VP 68	2 D&K135	£0.95																																																																																																																																																																																																																																																																																																																																																																																																																					
VP 7100	1 D&K103	£1.95																																																																																																																																																																																																																																																																																																																																																																																																																					
VS 1	2 D&K134	£1.20																																																																																																																																																																																																																																																																																																																																																																																																																					
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VS 5 EG	6 D&K101	£1.95																																																																																																																																																																																																																																																																																																																																																																																																																					
VS 10	2 D&K136	£0.75																																																																																																																																																																																																																																																																																																																																																																																																																					
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3292	7 D&K103	£1.95																																																																																																																																																																																																																																																																																																																																																																																																																					
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Load Matching Conditions

S.W. Amos, B.Sc., C.Eng., M.I.E.E.

The word matching has several meanings in electronics. The one we are concerned with here is the selection of a load resistance value that will take maximum power from a signal source.

Fundamental Law of Matching

A fundamental law states that to obtain maximum power into a load the load's resistance should be equal to that of the generator. It's easy to show mathematically that this is true. But the interesting thing is that the signal generators electronic engineers are mostly concerned with, namely transistors, don't obey this law. For any transistor that's used to deliver appreciable power, the normal load value with which it works is a small fraction of its output resistance. As we shall see, there are perfectly good reasons for this.

Fig. 1 provides a diagrammatical representation of the current and voltages in a simple generator and load circuit. The slope OP represents the internal resistance of the generator: in other words, the values of V and I at any point along this line are such that V/I equals the generator's internal resistance. OQ represents the generator's open-circuit voltage and the line QP, drawn towards the I axis, represents the load resistance. The slope QP is such that at any point along it the values of V and I, measured from Q, have a ratio equal to the load resistance. Note that the closer the slopes OP and QP are to the horizontal the higher are the resistances they represent – a horizontal line represents an open-circuit. Conversely, the closer slopes OP and QP are to the vertical the lower are the resistances represented, a vertical line representing a short-circuit.

The two lines meet at P, and this point of intersection tells us several things about the circuit. For example, the height of P above the V axis indicates the maximum current in the circuit. At this point OA is the voltage across the generator's internal resistance and AQ is the voltage across the load. If the generator consists of a battery with the load connected across its terminals, AQ is the voltage across these terminals and OA is the voltage across the battery's internal resistance. We can't measure the latter voltage directly, but we can measure it indirectly as the difference between the battery's open-circuit voltage (OQ) and the terminal voltage AQ.

If the load resistance is very high the diagram takes the form shown in Fig. 2(a). This indicates that there is very little current and that the voltage across the load is similar to the open-circuit voltage across the generator. With a very low load resistance Fig. 2(b) applies. This time the current is high and there is only a very small voltage across the load. When the load and the internal generator resistances are equal (Fig. 3), as in matched conditions, the two slopes are equal and the diagram is symmetrical – an isosceles triangle in fact. The voltage across the load is now half the generator's open-circuit voltage. We are all familiar with one consequence of this: it's the reason why the car lights dim when we operate the starter.

These IV diagrams are helpful in showing power relationships. As we are dealing with direct current, the power dissipated in any part of the circuit is equal to the product of the current in it and the voltage across it. Thus in Fig. 4 the power dissipated in the load is equal to AQ

times AP, and is numerically equal to the area of the rectangle AQCP which contains the load line. Similarly the area of the rectangle OAPE measures the power dissipated in the generator's internal resistance. For matched conditions therefore, the diagram is symmetrical and the power dissipated in the generator is equal to that dissipated in the load. We would loath to have such conditions in an electronic amplifier: imagine losing 35W in the output transistors in order to generate that much power in the loudspeakers! Fortunately, as mentioned earlier, transistors don't have to obey the fundamental law. Another rectangle in Fig. 4, OQCE, is of interest: its area is the product of the generator's open-circuit voltage and the load current, i.e. it's the sum of the power wasted in the internal resistance and the useful power delivered to the load.

So far we've been talking about idealised generators for which the VI relationship is a very convenient straight line. Electronic generators don't have such perfect characteristics. The closest approximation to a straight line is provided by a triode valve, and it's true that if a triode is used to drive a direct-coupled resistive load the maximum power is delivered when the valve's anode resistance and the load resistance are equal.

Class A Amplifiers

Up to this point we've considered only direct current. With analogue equipment it's changes in direct current that concern us. A sinusoidal waveform is a convenient one to use as an example. Maximum a.c. power is delivered into a resistive load when the sinewave representing the operating conditions occupies the entire length of the load line from the onset of grid current on positive peaks of the input signal to anode current cut-off on the negative peaks. To permit this maximum signal excursion, the valve must be biased at the mid point of the load line, i.e. point C in Fig. 5. Thus the total power applied to the valve and its load consists of the area of the rectangle ODCE. The power delivered to the load is of course given by one half the

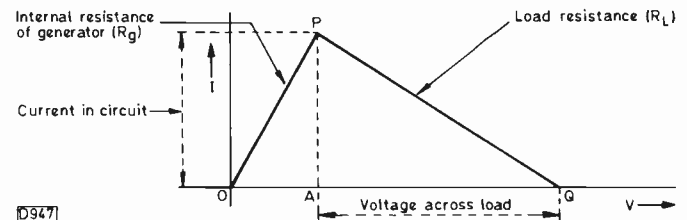


Fig. 1: Current and voltage relationships in a simple generator and load circuit.

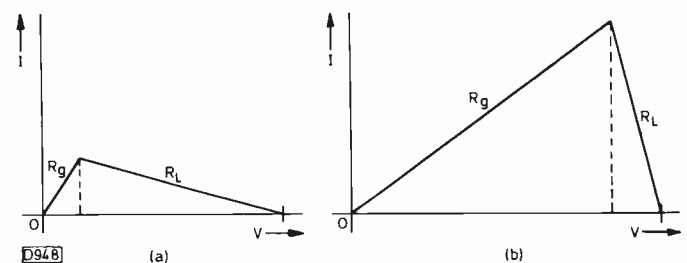


Fig. 2: Repeat of Fig. 1 for (a) a very high and (b) a very low load resistance.

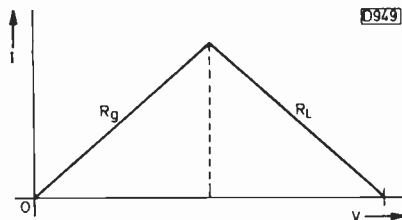


Fig. 3 (above): Symmetrical appearance of Fig. 1 when the generator and load resistances are equal.

Fig. 4 (below): Power relationships in a simple generator and load circuit.

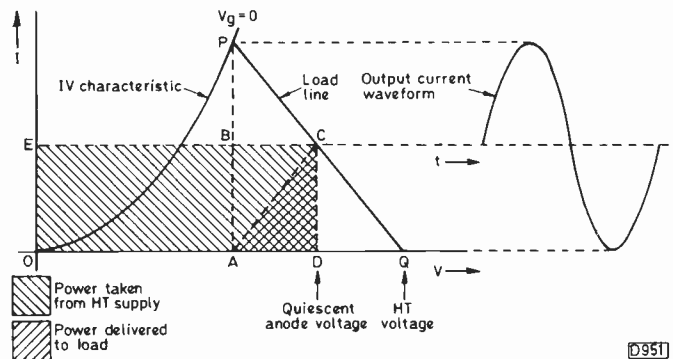
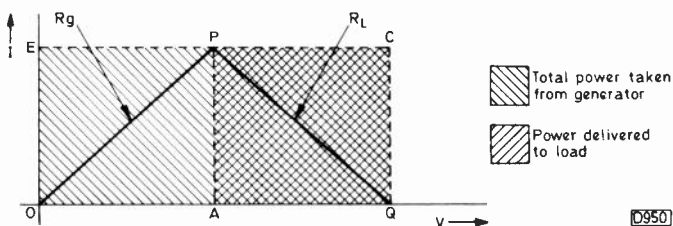


Fig. 5: Power relationships in a class A triode amplifier directly coupled to a resistive load.

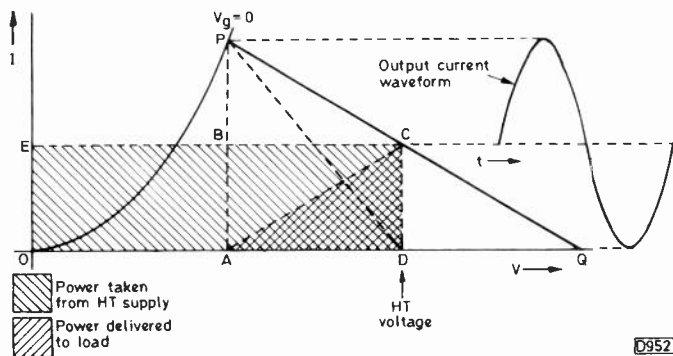


Fig. 6: Power relationships in a class A triode amplifier transformer coupled to a resistive load.

product of the peak voltage across the load and the peak current in it. There are several triangles in the diagram with an area equal to this power. One such is BCP, another DQC, but the most useful triangle to consider is ADC because this falls within the rectangle ODCE. This output power is taken from the supply, which means that less is dissipated within the valve. We can see in fact that the power wasted in the valve itself is equal to the area of the trapezium OACE, showing that the efficiency of this form of class A amplifier is very low.

However because we are now using an a.c. amplifier the

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load need not be directly coupled to the valve. We can use a transformer, and this introduces a new concept because the anode voltage can now swing above the h.t. voltage: in fact for distortionless amplification of a sinusoidal signal the swing above the h.t. value should equal the swing below it. Fig. 6 shows the power relationships under these conditions. For the same peak anode current as in the previous diagram the anode voltage now has double the swing that it had with direct coupling. The slope of the load line is less, corresponding with a doubled load value, and the output power is doubled. It should perhaps be mentioned that a larger input signal is needed to obtain the higher output power. Even so the output power is still only a fraction of the power taken from the supply, which again illustrates the low efficiency of a class A stage. So to obtain maximum output the matching condition is $R_L = 2r_a$, an equation that will be very familiar to those who worked with valves.

Pentodes and Transistors

Diagrams such as those in Figs. 5 and 6 show that much power is wasted because of the inability of the anode voltage to swing to near zero. The pentode valve and the transistor both overcome this difficulty, having an IV characteristic of the general shape shown in Fig. 7. This can be regarded as being made up of two near-linear sections, one of high slope (low resistance) at low voltages and one of low slope (high resistance) at higher voltages. If we try to apply the fundamental law for maximum output power, should we make the output load equal to the low or the high resistance condition? If we make it equal to the low resistance condition the output device will be driven into excessively high currents should we attempt to apply more than a tiny voltage. If on the other hand we opt to make the load equal to the high resistance condition we shall need excessively high voltages to obtain a reasonable operating current. Clearly the fact that the characteristic of these devices is so markedly non-linear defeats attempts to apply the fundamental law.

To obtain maximum output power from a device with such a characteristic we must ensure that maximum use is made of the available current and voltage swings. Thus in Fig. 7 the ideal load line is PQ, which extends from I_{max} (the maximum permitted current) at one extreme to zero current at the other and is symmetrically disposed about the supply voltage D. The resistance of such a load is given by $2V/I_{max}$, where V is the supply voltage. This is independent of the resistance of the two near-linear parts of the characteristic, and is therefore unrelated to the device's output resistance. So the answer to the problem we set

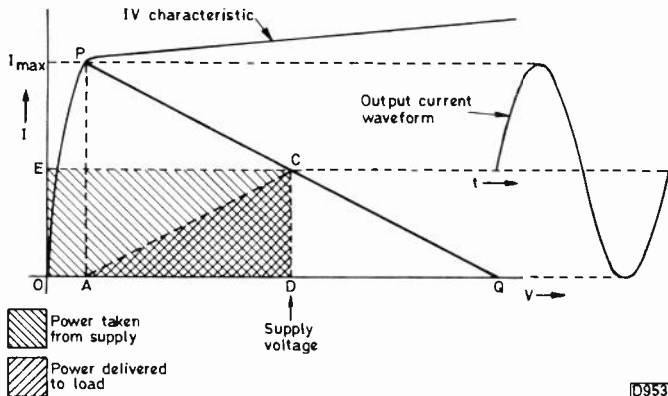


Fig. 7: Power relationships in a class A transistor amplifier transformer coupled to a resistive load.

ourselves at the beginning is that these active devices have non-linear characteristics while the fundamental law assumes that the generator has a linear characteristic.

This explains another query sometimes encountered in electronics. By applying negative feedback to an amplifier we can make its output resistance any value we please. We often make the output resistance very low to provide good damping of the load. But whatever value we choose for the output resistance we don't change the amplifier's optimum load. We can now see why. The optimum load is determined by the supply voltage and the peak current permitted in the output device. It is therefore unaffected by the application of negative feedback.

As in earlier diagrams the rectangle ODCE in Fig. 7 represents the power taken from the supply while the triangle ADC represents the power delivered to the load. We can see that the triangle is a much larger fraction of the rectangle than in the earlier examples. In fact it approaches half, indicating an efficiency of nearly 50 per cent, the theoretical maximum for a class A amplifier.

Class B Amplifiers

We expect better efficiency than this in electronics, and for this reason the majority of transistor power amplifiers use a class B output stage. We can represent the operating conditions of an output device used in such a stage as shown in Fig. 8. The IV characteristic has the same shape as in Fig. 7, but the output pentode/transistor is biased to cut-off so that the signal voltage and current defined by the load line consist of half sinusoids. PD is only half the load

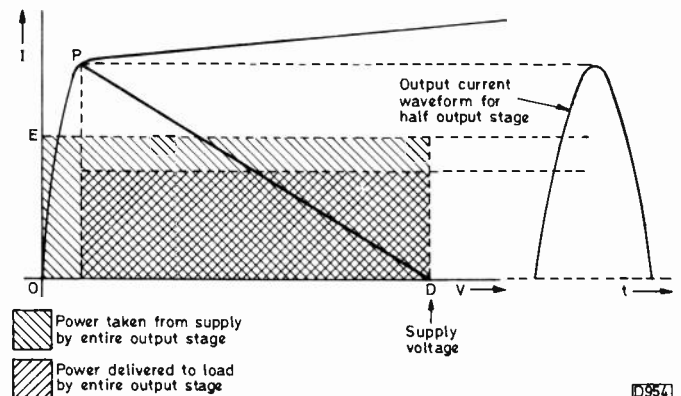


Fig. 8: Power relationships in a transistor class B output stage.

line of course, the other half lying on the characteristic for the other device used in the class B output stage – to provide the other half of the sinusoidal signal.

So the entire waveform is amplified but the current taken from the supply by the two transistors in such a stage consists of a succession of half-sinusoidal pulses. Such a wavetrain has a d.c. component with an amplitude of $2/\pi$ (0.63) of the peak value of the pulses. The rectangle representing the power taken from the supply is therefore shown in Fig. 8 with this amplitude. We could show the power generated in the load by the two transistors as the area of a triangle, as in earlier diagrams, but the peak of the triangle (which has the same amplitude as the current pulses) would then lie above the top of the rectangle representing the supply power. Thus it would not be easy to see what fraction of the supply power had been converted into useful power in the load. Instead, we'll represent the output power as a rectangle on the same base as the triangle. To keep the area the same we must of course make the height of the rectangle half that of the triangle, i.e. half the peak amplitude of the output current pulses. This has been done in Fig. 8 and shows that the useful output power is considerably greater than half that taken from the supply. In fact under ideal conditions the output power with a class B pair can be 78 per cent of the power taken from the supply, the remaining 22 per cent being wasted in the output transistors. The useful output power is thus nearly three and a half times that dissipated in the generator – a considerable improvement over the battery plus resistor circuit with which we started, where the ratio was 1:1!

Book Notes

Oscilloscopes, how to use them and how they work, second edition, by Ian Hickman. Published by Heinemann Professional Publishing Ltd. at £5.95.

This revised edition has been brought up to date so that it covers the current range of oscilloscopes available. It provides a good basic guide to scope use and the sort of circuitry used in oscilloscopes.

Optoelectronics Circuits Manual by R.M. Marston. Published by Heinemann Professional Publishing Ltd. at £10.95.

This useful book explains in a practical manner the operation and uses of optoelectronic devices and the associated circuitry used with them. There are chapters on LED display circuits, LED graphics circuits and seven-

segment displays. The chapter on remote control systems should be of particular interest to TV/video technicians. The circuits given have component values and device types so that they can be put to practical use.

Electronic Circuits Handbook by Michael Tooley. Published by Heinemann Professional Publishing Ltd., 22 Bedford Square, London WC1B 3HH at £14.95.

If you require a book to act as a basic reference source on electronic circuitry this one is well worth considering. In addition to circuitry it covers components and their specifications, PCBs and basic servicing. The final chapter provides practical circuits for ten items of test equipment. The book has a sub-title, "design, testing and construction", and this indicates its range. The author may be known to readers for his previous excellent book on Servicing Personal Computers, also published by Heinemann.

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PHILIPS VR6462

There's a problem with the sweep tuning. When search is pressed it sweeps up the band, stopping at weak stations as it should. Channel 4 and BBC-1, the first two local stations, tune in and can be stored, but it then sweeps straight past ITV, which appears very briefly and seems to be normal, stopping at BBC-2 which again can be stored. We've replaced the i.f. panel and the TDA3791 and SAB3013 i.c.s.

Termination of sweep depends on the self-seek circuit seeing strong sync pulses from the post vision detector circuit. These can be suppressed by failure of the a.g.c. circuit or, remotely possible, the tuner. Check C2051 and C2058 before trying a substitute u.h.f. tuner.

ITT CVC1215 CHASSIS

The symptom is white lines which are very pronounced in the top quarter of the screen, less so in the bottom quarter and are quite faint across the middle half. They are almost horizontal and are clearly teletext since their composition changes continuously – they are made up of dots and dashes. We have changed the field timebase chip and various components in this area.

The TDA2653A field timebase chip incorporates a flyback generator whose operation depends on D404 and C406. Check these by substitution. If the fault persists with new ones fitted, check that the voltage on the 26V line is correct and that it's reasonably free of ripple. If so, the electrolytics around the TDA2653A are top of the suspect list – start by replacing C404 and C415.

AKAI VS2

For the first ten seconds of a recording the previous sound is present. After this the sound is recorded correctly.

Watch the relay on the audio PCB – it should click over one second after starting to record. If the relay isn't sticking or dirty, check that 12V is present on connectors 32 and 36 of the audio board and that X18 is conductive (try bridging its collector and emitter and making a recording). The oscillator could be lazy due to X17 or X19 having low gain or D18 high forward resistance.

PHILIPS CTX-S CHASSIS

The picture jitters intermittently shortly after switch on. After about five minutes it collapses to the centre as though switched off, but then comes back on immediately. This happens three or four times during the first three quarters of an hour, then the set seems to settle down apart from an occasional roll. Also, the sound has recently started to increase in short bursts two or three times after an hour or

so. The nature of these faults makes it difficult to carry out tests. I have checked for dry-joints and loose plugs.

Our experience of these sets leads us to suspect the connections to the line output transformer. It's worth resoldering the complete board in the area of the transformer – this takes only about half an hour. The sound problem could be caused by poor connections on the plug from the control panel. A good pull on each wire will reveal any that are crimped to the plastic rather than the wire itself.

ITT VMC3875AF CAMCORDER

There are speckly lines across the screen throughout most of the picture, giving the appearance of interference. The picture is in sync and holds all right. The only waveform that's incorrect is the switch pulse 4 from IC3 on the servo board. It seems to be perfect on playback, but in the record mode every fourth pulse is only about half the width of the other three, so that Q10/Q2 in the preamplifier section would not be switched correctly. Is the chip suspect, or could it be something else?

The substandard switching pulse would seem to be responsible for the symptom and the chip is clearly suspect. Before replacing it, try interchanging the switching pulse feeds to see whether a loading fault in the switching transistors etc. could be responsible. Ignore the effect on the picture – look only at the switching pulse trains as they emerge from the chip.

HITACHI NP82CQ CHASSIS

When the a.g.c. control is set for 9.2V at R204, as specified in the manual, the gain seems to be low, with lack of contrast. Instead, I've injected a test pattern and adjusted the preset control to just clear the noise on the picture. The reading is 4.5V but the gain is better. Is this in order?

The method given in the manual is valid only when the signal input is precisely -48dBm. It's not easy to arrange this! We would agree that without a precisely calibrated signal source your method is better.

SANYO VTC9300

The only problem I've had in the past was failure of the stabilised 12V rail. This was restored by replacing Q702, using a higher-rated transistor. Now there's a very intermittent fault on wind, play or record. The stop button will come up and the tape then stops running.

It seems likely that the forward sensor circuit is faulty. When oscillation stops the syson interprets this as end-of-tape, invoking the stop mode. An oscilloscope check at TP803 would confirm this. Check R803 for a noisy track or loose rivets, and adjust it correctly. If the problem persists, the CX141 i.c. is suspect – once print faults and plug/socket troubles have been eliminated.

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TELEVISION JULY 1988

REDIFFUSION Mk 3 CHASSIS

The tripler and the 1AV30 first anode supply rectifier have failed and we are having trouble getting replacements. Any suggestions?

The 1AV30 can be replaced by the more common BYX10, or by a BY184. One of the many "universal" types of tripler on offer can be used, e.g. the HRS TVRU2, TVRU1 or the SEME EHT23.

TEST CASE

307

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.

There's little incentive to get on with TV bench work during high summer! The warm weather outside, and the fact that almost everyone except yourself seems to be on holiday – how different from the winter months when the warm haven of the workshop is one of the main attractions of the job! It's now that Sage, Sleuth and Hubo (a new man) envy the outside men gliding around the sunlit countryside, stopping for lunch at some wayside pub, cleaning video heads and tuning in TV sets for bikini-clad housewives . . .

Back to the bench. Plonk plonk plonk plonk plonk woof. It was a GEC set fitted with the PIL tube chassis, Model C2026H. There would be five or six "pump pulses" at switch on, after which the set would shut down and lie dormant until switched off and on again. Pumping TV sets usually have an overload problem of some sort. The serviceman languorously reached for his meter and checked inside the set for shorts. There was no perceptible short or leakage across the BU208 line output transistor – this test also covers the h.t. rectifier diode D510 which, from the d.c. point of view, is in parallel with the line output transistor.

The next step might typically be to disconnect the tripler, an action that's often fruitful with the contemporary ITT CVC20/CVC30 etc. series sets which have an almost identical TDA2640-based chopper power supply. You can't do this with the GEC chassis however, as the e.h.t. is produced by a diode-split line output transformer. Disconnecting the e.h.t. flower from the c.r.t. bowl seemed to be a good idea, but was abandoned on sight of a very healthy spark when the first attempt was made.

Various diodes were then checked for leakage, pursuing the notion that an overload was the cause of the trouble. D602 which provides the 33V supply and D603 which provides the 200V supply were checked, then D511 and D507 on the chopper power supply panel. They were all o.k. D507 provides reference voltages for the TDA2640 chip. Its reservoir capacitor is C523 (4.7 μ F). If this had gone open-circuit there would be a peak rather than an

average output, and this would upset the operation of the power supply. C523 wasn't open-circuit however, and fitting a replacement had no effect on the fault. Plonk plonk plonk . . .

Maybe the tripping was not caused by excess current. The power supply also has an over-voltage trip. Twiddling the over-voltage preset made no difference, so it was left at its original setting. This sort of muddling about could have gone on for ever! Another technician was consulted. Things then got moving. The horizontal shift choke L602 was removed in the confident expectation that it was loading the line output stage. It wasn't! There was every sign that e.h.t. was being generated on each pump cycle, and that the sound stages were also working – a loud grunt came from the speaker on each pump.

A d.c.-coupled oscilloscope was next connected across the h.t. reservoir/smoothing electrolytic C527. It revealed that the h.t. voltage would sometimes peak at the correct level, sometimes fall short of it, but would never exceed it. All these things taken together provided a very strong pointer to the cause of the fault. Adding a shorting link across a certain low-value component, or perhaps by twiddling another of the power supply presets, would have provided confirmation. Scoping another point in the power supply would have provided an accurate diagnosis. What was going on? See next month.

ANSWER TO TEST CASE 306 – page 610 last month –

Last month's problem related to a Sanyo VHR3300 with a colour fault in the record mode only. Tapes recorded by this machine produced no colour at all, or a streaky mess of incorrect hues. The frequency of the voltage-controlled crystal oscillator in the colour circuit and the chroma writing current had been found to be o.k., while much of the colour circuitry had been excluded from suspicion by the fact that playback of a colour-bar test tape was perfect.

In the VHS system the colour-under signal is translated to the low frequency of 627kHz before being recorded on the tape. In addition, the B head signal is phase-retarded by 90° per TV line. To carry out this process correctly, which is essential if the chroma signal is to make any sense during playback, the chroma chip needs two pulse feeds: a flip-flop squarewave from the servo section, to identify head sweeps, and a composite sync pulse to trigger the line-rate phase shifting and steer the phase-locked loop. The source of the flip-flop pulse is the same on record and playback, but the source of the sync pulse feed depends on the mode in use.

In the record mode the composite sync pulse fed to the chroma chip is derived from the off-air signal. In this machine we found that three rapid-fire pulses were being applied to pin 1 of the colour-under chip during the 4.7 μ sec line sync pulse period. We decided to check back to the video output (pin 1) of the video processing chip IC1001 and found that it was spikey. This was fooling the sync separator in IC1101, as a result of which spurious pulses were appearing on the C SYNC line. Replacing IC1001 restored normal operation.

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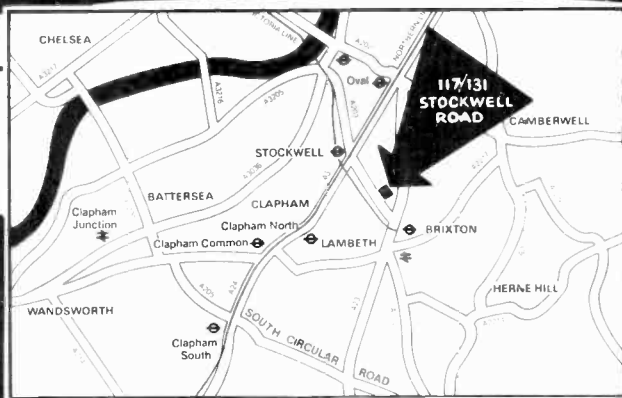
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VP129	1	Pick up Tool: spring loaded	£1.75
VP217	1	Helping Hand	£1.00
VP218	1	Watchmakers Screwdriver Set: 6 pieces	£4.75
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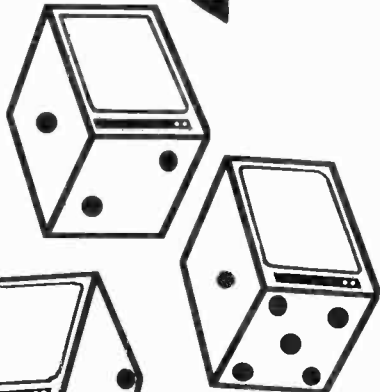
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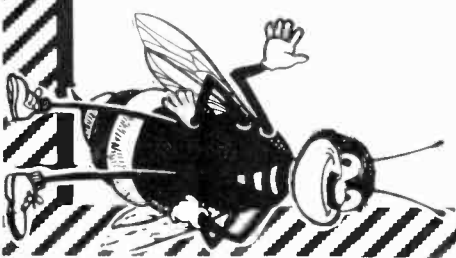
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Sanyo
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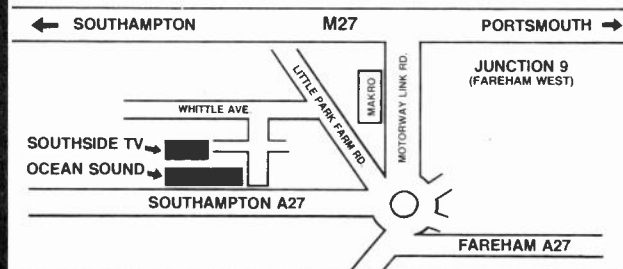


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AN1270	£2.20	AN6676	£7.50	BA1330	£1.00	HA11750	£3.00	LA4445	£2.75	STK332	£7.50	STR6620	£6.75	DA2653A	£3.80
AN203	£2.20	AN6677	£6.30	BA1360	£1.80	HA11753	£3.50	LA4460	£1.80	STK084	£7.60	TA7063P	£1.50	DA3306	£5.20
AN210	£1.75	AN6780	£2.30	BA5102A	£1.75	HA11758	£8.50	LA4461	£1.80	STK430	£5.50	TA7068P	£1.50	DA3340	£3.85
AN211A	£2.30	AN6811	£1.60	BA5204	£2.75	HA11768	£4.50	LA4500	£2.50	STK431	£5.95	TA7073AP	£2.75	DA3341	£3.60
AN217B	£2.20	AN6873	£4.50	BA5402A	£2.75	HA11788	£4.50	LA4505	£2.80	STK433	£5.25	TA7074P	£1.95	DA3360	£4.50
AN228W	£2.90	AN6875	£3.50	BA5406	£3.20	HA11816	£6.50	LA4507	£4.25	STK435	£5.25	TA7122AP	£0.90	DA3361A	£4.95
AN236	£2.50	AN6884	£2.75	BA5435	£2.75	HA11828	£9.50	LA4508	£2.85	STK436	£5.25	TA7135P	£1.90	DA3362A	£6.00
AN240P	£1.50	AN7105	£2.80	BA6104	£2.80	HA11829	£6.50	LA4520	£2.50	STK437	£2.50	TA7140P	£1.75	DA3365	£2.70
AN241P	£1.50	AN7106K	£2.95	BA6124	£2.80	HA12001	£6.50	LA4570	£3.75	STK439	£5.95	TA7145P	£2.50	DA3365Z	£3.35
AN259	£1.50	AN7110	£1.50	BA6208	£2.95	HA12002	£2.95	LA5112	£1.85	STK441	£7.95	TA7193P	£4.00	DA4420	£3.30
AN260P	£2.20	AN7111Z	£2.95	BA6209	£3.75	HA12035	£9.50	LA5527	£1.95	STK443	£7.95	TA7205AP	£1.90	DA4500	£3.95
AN262	£1.60	AN7112E	£1.50	BA6304	£2.20	HA12038	£6.75	LA6324	£2.50	STK457	£6.50	TA7207P	£1.75	DA4600/2	£2.95
AN264	£3.75	AN7114E	£2.50	BX342	£5.00	HA12402	£2.95	LA6385S	£1.20	STK459	£6.75	TA7208P	£1.75	DA4600/2D	£2.95
AN271A	£2.50	AN7115E	£1.60	HA1124A	£2.75	HA12413	£2.75	LA6480D	£1.20	STK461	£7.50	TA7214P	£2.60	DA47270	£2.20
AN274	£2.75	AN7120	£1.50	HA1124S	£1.50	HA13001	£2.95	LA7016	£2.75	STK463	£8.40	TA7215P	£1.30	UPC035C	£1.00
AN277	£2.50	AN7130	£1.30	HA1125	£1.75	HA13007	£4.95	LA7031	£2.75	STK465	£8.50	TA7217AP	£1.60	UPC1001H	£2.20
AN295	£3.60	AN7131	£2.75	HA1137W	£1.75	HA13007	£4.95	LA7032	£4.50	STK501	£6.25	TA7220P	£1.60	UPC1018C	£1.95
AN301	£3.50	AN7132	£2.20	HA1144	£4.25	HA13432	£4.50	LA7215	£2.75	STK0025	£4.95	TA7222AP	£1.30	UPC1025H	£1.30
AN302	£3.30	AN7140	£2.75	HA1151	£2.50	LA1111	£0.95	LA7224	£2.95	STK0029	£4.75	TA7223P	£1.20	UPC1031H	£1.95
AN303	£2.75	AN7145M	£2.80	HA1167	£3.75	LA1140	£2.20	LA7507	£2.95	STK0039	£4.75	TA7225P	£1.20	UPC1032H	£0.50
AN305	£3.50	AN7146M	£2.80	HA1196	£1.75	LA1222	£1.60	LA7520	£3.25	STK0049	£6.50	TA7227P	£2.20	UPC1230H	£2.50
AN313U	£2.95	AN7149N	£2.95	HA1197	£3.70	LA1230	£1.50	LA7521	£4.50	STK0059	£7.00	TA7230P	£1.95	UPC1263C	£2.50
AN315	£2.30	AN7154	£1.90	HA1199	£1.85	LA1231	£2.00	LA7571	£4.75	STK0060U	£9.50	TA7232P	£2.95	UPC1358H	£2.20
AN316	£3.30	AN7156N	£2.50	HA1319	£2.50	LA1240	£1.95	LA7575	£3.20	STK0080	£7.75	TA7233P	£2.95	UPC1387H	£2.75
AN318	£4.95	AN7158W	£2.75	HA1366W	£1.80	LA1260	£1.70	LA7800	£1.95	STK1060	£7.95	TA7240AP	£2.95	UPC1225H	£2.75
AN337	£2.95	AN7160	£3.75	HA1366WR	£1.85	LA1353	£2.50	LA7801	£2.95	STK2025	£7.50	TA7241AP	£2.95	UPC1385C	£3.40
AN340P	£1.50	AN7161	£3.75	HA1367	£3.25	LA1365	£1.50	LA7806	£2.75	STK2028	£7.50	TA7269P	£5.50	UPC1263C	£2.50
AN360	£3.60	AN7166	£3.95	HA1368	£1.90	LA1368	£2.50	LA7808	£2.95	STK2029	£9.75	TA7270P	£2.75	UPC1277H	£2.20
AN362L	£1.50	AN7168	£2.75	HA1368R	£1.95	LA1385	£1.95	LA7820	£2.75	STK2038U	£9.50	TA7271P	£2.75	UPC1278H	£2.25
AN363	£1.60	AN7178	£2.95	HA1370	£3.70	LA1387	£3.60	LA7910	£2.20	STK2125	£6.75	TA7272P	£2.95	UPC1363C	£2.75
AN363N	£3.50	AN7213	£1.95	HA1372	£3.50	LA1460	£2.50	LA7920	£2.95	STK2129	£6.75	TA7273P	£3.20	UPC1364C	£4.75
AN363P	£1.70	AN7218	£2.75	HA1374	£2.50	LA1464	£3.20	LA8145	£2.95	STK2205	£6.25	TA7274P	£2.95	UPC1385C	£3.40
AN374P	£2.20	AN7223	£3.95	HA1384	£3.95	LA2101	£3.30	LC4066B	£2.95	STK2250	£9.50	TA7281P	£2.95	UPC1387C	£2.50
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AN612	£1.80	AN7273	£3.95	HA1389	£2.20	LA3201	£0.95	LC7131	£3.75	STK3042	£6.50	TA7283AP	£2.95	UPC1394C	£1.95
AN5010	£4.75	AN7310	£2.20	HA1392	£2.50	LA3210	£2.95	LC7132	£3.75	STK3044	£9.95	TA7288P	£2.95	UPC2002	£2.40
AN5151N	£6.50	AN7311	£1.20	HA1394	£3.95	LA3300	£1.65	LC7137	£4.50	STK3062U	£6.75	TA7296P	£2.95	UPC1358C	£3.00
AN5265	£2.30	AN7410	£3.00	HA1396	£3.75	LA3301	£1.30	LC7137	£4.50	STK4026	£6.75	TA7317P	£2.75	BC639	£0.20
AN5410	£3.50	AN7415	£2.95	HA1397	£2.75	LA3310	£2.75	M5134P	£3.25	STK4131U	£6.75	TA7343AP	£2.95	BF990	£0.20
AN5411	£5.50	AN7420	£3.25	HA1398	£2.75	LA3350	£1.30	M5150P	£1.85	STK4141U	£7.50	TA7358P	£2.80	BF991	£1.70
AN5430	£2.95	BA301	£0.80	HA1457W	£2.75	LA3361	£1.20	M51102L	£3.95	STK4151U	£7.50	TA7607AP	£2.95	BFY90	£0.50
AN5510	£2.75	BA311	£0.95	HA11215W	£4.35	LA3370	£2.80	M51104L	£2.80	STK4332	£3.75	TA7608P	£3.95	BR303	£0.50
AN5512	£2.75	BA313	£0.80	HA11219	£2.25	LA4030P	£2.00	M51513	£1.80	STK4352	£6.50	TA7609P	£2.70	BR356	£0.20
AN5612	£3.75	BA314	£2.20	HA11221	£2.75	LA4031P	£1.95	M51514	£1.95	STK4392	£6.50	TA7613AP	£2.95	BT106	£1.00
AN5620X	£3.50	BA318	£1.50	HA11223W	£0.80	LA4032P	£1.90	M51515BL	£2.50	STK4803	£8.50	TA7628P	£2.75	BU208A	£1.20
AN5701	£1.80	BA328	£2.50	HA11225	£1.95	LA4100	£1.20	M51516BL	£2.80	STK4833	£9.50	TA7640AP	£3.95	BU208D	£1.80
AN5722	£1.60	BA333	£1.50	HA11226	£4.50	LA4101	£1.00	M51517L	£2.80	STK4843	£9.95	TA7658P	£1.75	BU326A	£1.95
AN5730	£1.85	BA335	£3.60	HA11235	£2.30	LA4102	£1.40	M51519L	£2.20	STK5211	£6.75	TC91068P	£4.95	BU500	£1.80
AN5732	£1.85	BA340	£2.50	HA11251	£2.5	LA4110	£1.75	M51521L	£1.90	STK4352	£6.50	TA7609P	£2.70	BU508A	£0.95
AN5750	£1.95	BA343	£2.75	HA11401	£2.80	LA4112	£1.75	MB3705	£1.80	STK5324	£6.50	DA1010A	£2.25	2N3055	£0.50
AN5753	£1.95	BA402	£0.95	HA11423	£4.75	LA4120	£2.95	MB3712	£1.50	STK5325	£6.75	DA1011A	£2.50	2N3733	£1.50
AN6250	£2.30	BA403	£1.85	HA11440	£4.95	LA4125	£2.20	MB3713	£1.60	STK5421	£6.50	DA10174A	£2.75	2SA733	£0.40
AN6326N	£3.70	BA511A	£1.85	HA11701	£3.50	LA4126	£1.60	MB3714	£2.95	STK5451	£6.75	DA1151	£1.20	2SA1104	£2.50
AN6327	£4.75	BA516	£1.60	HA11703	£4.50	LA4127	£2.95	MB3722	£1.95	STK5471	£6.50	DA1170N	£1.50	2SA1106	£2.75
AN6330	£2.95	BA521	£1.80	HA11705	£6.95	LA4145	£1.70	MB3731	£3.50	STK5720	£6.80	DA1170S	£1.50	2SB536	£0.95
AN6340	£7.85	BA524	£2.75	HA11706	£4.75	LA4160	£2.40	MB3756	£2.60	STK5730	£4.25	DA1515	£4.50	2SB946A	£1.50
AN6341N	£4.00	BA526	£3.50	HA11710	£3.75	LA4170	£3.50	MB3759	£3.20	STK7216	£6.50	DA1515A	£4.50	2SC867A	£2.95
AN6342N	£2.50	BA527	£1.75	HA11711	£9.50	LA4178	£2.20	MB8719	£3.85	STK7308	£3.95	DA1906A	£1.75	2SC1364	£0.50
AN6344	£4.75	BA529	£1.60	HA11713	£5.50	LA4182	£2.20	STK011	£3.95	STK7404	£6.95	DA2002	£0.80	2SC1942	£2.95
AN6350	£7.50	BA536	£2.50	HA11714	£9.95	LA4183	£2.95	STK014	£7.25	STK8250	£9.95	DA2003	£1.50	2SC1969	£1.75
AN6356N	£3.85	BA546	£2.20	HA11716	£4.75	LA4192	£1.95	STK015	£5.20	STK8250H	£10.75	DA2004	£2.20	2SC2166	£1.00
AN6357N	£4.95	BA547	£2.50	HA11717	£5.75	LA4201	£1.60	STK016	£6.25	STR380	£3.80	DA2005	£1.75	2SC2580	£2.75
AN6360	£4.50	BA612	£1.80	HA11718	£4.75	LA4220	£1.50	STK020	£5.75	STR440	£5.80	DA2006	£2.50	2SC2581	£2.95
AN6362	£5.50	BA631A	£5.75	HA11724	£3.25	LA4230	£2.25	STK025	£7.50	STR441	£5.80	DA2020	£1.40	2SC3156	£1.50
AN6363	£9.50	BA656	£4.50	HA11727	£9.50	LA4420	£1.75	STK043	£10.50	STR451	£5.80	DA2030	£1.40	2SD401A	£1.50
AN6371	£4.25	BA643	£4.50	HA11745	£9.00	LA4422	£1.75	STK077	£6.50	STR2012	£6.75	DA2170	£2.75	2SD1398	£2.50
AN6387	£5.95	BA1310F	£1.75	HA11747	£9.50	LA4430	£1.50	STK078	£6.75	STR4090	£6.75	DA2581	£2.50	2SD1453	£1.85

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25A-482	400p	25C-1847	120p	25A/200V	185p	4552	140p	74HC175	38p	74LS114	30p	Z80B10	480p	75182	1000p
25A-490	60p	25C-1848	20p	25A/400V	250p	4553	29p	74HC181	130p	74LS122	38p	Z80CACT	250p	75183	1000p
25A-483	35p	25C-1875	20p	25A/600V	240p	4556	36p	74HC182	60p	74LS123	38p	Z80AS10	650p	75188	60p
25A-561	50p	25C-1881	210p	25A/800V	240p	4557	140p	74HC190	46p	74LS124	85p	Z80A10-2	700p	75195	185p
25A-571	500p	25C-1906	75p	25A/100V	185p	4564	190p	74HC191	46p	74LS125	85p	Z80B10-2	700p	75224	340p
25A-534	50p	25C-1910	20p	25A/200V	240p	4568	36p	74HC192	60p	74LS126	32p	Z80ADRT	800p	75322	155p
25A-636	50p	25C-1923	25p	25A/400V	240p	4584	140p	74HC193	43p	74LS132	32p	74S188	175p	75324	340p
25A-673	20p	25C-1942	260p	25A/600V	230p	4600	100p	74HC194	47p	74LS133	32p	74S189	210p	75326	145p
25A-684	60p	25C-1944	350p	25A/800V	230p	4601	100p	74HC195	43p	74LS134	31p	74S201	240p	75450	45p
25A-698	100p	25C-1945	350p	25A/100V	185p	4602	100p	74HC201	100p	74LS135	31p	74S287	150p	75451	42p
25A-715	90p	25C-1946	1500p	25A/200V	240p	4603	100p	74HC202	100p	74LS136	31p	74S289	150p	75452	42p
25A-720	20p	25C-1947	450p	25A/400V	240p	4604	100p	74HC203	65p	74LS137	31p	74S290	150p	75453	42p
25A-733	30p	25C-1957	70p	25A/600V	230p	4605	100p	74HC204	44p	74LS138	31p	74S291	150p	75454	42p
25A-744	30p	25C-1969	160p	25A/800V	230p	4606	100p	74HC205	44p	74LS139	31p	74S292	150p	75455	42p
25A-872	40p	25C-1972	60p	25A/100V	185p	4607	100p	74HC206	44p	74LS140	31p	74S293	150p	75456	42p
25A-872A	50p	25C-1983	130p	25A/200V	240p	4608	100p	74HC207	44p	74LS141	31p	74S294	150p	75457	42p
25A-899	60p	25C-1991	400p	25A/400V	240p	4609	100p	74HC208	44p	74LS142	31p	74S295	150p	75458	42p
25A-907	650p	25C-2002	25p	25A/600V	230p	4610	100p	74HC209	44p	74LS143	31p	74S296	150p	75459	42p
25A-909	70p	25C-2023	180p	25A/800V	230p	4611	100p	74HC210	44p	74LS144	31p	74S297	150p	75460	42p
25A-933	40p	25C-2026	60p	25A/100V	185p	4612	100p	74HC211	44p	74LS145	31p	74S298	150p	75461	42p
25A-934	40p	25C-2028	75p	25A/200V	240p	4613	100p	74HC212	44p	74LS146	31p	74S299	150p	75462	42p
25A-935	40p	25C-2029	120p	25A/400V	240p	4614	100p	74HC213	44p	74LS147	31p	74S300	150p	75463	42p
25A-940	40p	25C-2053	120p	25A/600V	230p	4615	100p	74HC214	44p	74LS148	31p	74S301	150p	75464	42p
25A-940	40p	25C-2060	50p	25A/800V	230p	4616	100p	74HC215	44p	74LS149	31p	74S302	150p	75465	42p
25A-952	50p	25C-2068	90p	25A/100V	185p	4617	100p	74HC216	44p	74LS150	31p	74S303	150p	75466	42p
25A-966	70p	25C-2072	80p	25A/200V	240p	4618	100p	74HC217	44p	74LS151	31p	74S304	150p	75467	42p
25A-965	60p	25C-2078	95p	25A/400V	240p	4619	100p	74HC218	44p	74LS152	31p	74S305	150p	75468	42p
25A-970	50p	25C-2086	60p	25A/600V	230p	4620	100p	74HC219	44p	74LS153	31p	74S306	150p	75469	42p
25A-979	85p	25C-2166	90p	25A/800V	230p	4621	100p	74HC220	44p	74LS154	31p	74S307	150p	75470	42p
25A-984	30p	25C-2228A	60p	25A/100V	185p	4622	100p	74HC221	44p	74LS155	31p	74S308	150p	75471	42p
25A-992	30p	25C-2229	25p	25A/200V	240p	4623	100p	74HC222	44p	74LS156	31p	74S309	150p	75472	42p
25A-1012	130p	25C-2235	60p	25A/400V	240p	4624	100p	74HC223	44p	74LS157	31p	74S310	150p	75473	42p
25A-1012	130p	25C-2236	60p	25A/600V	230p	4625	100p	74HC224	44p	74LS158	31p	74S311	150p	75474	42p
25A-1102	190p	25C-2236	60p	25A/800V	230p	4626	100p	74HC225	44p	74LS159	31p	74S312	150p	75475	42p
25A-1103	200p	25C-2238	70p	25A/100V	185p	4627	100p	74HC226	44p	74LS160	31p	74S313	150p	75476	42p
25A-1104	200p	25C-2245	70p	25A/200V	240p	4628	100p	74HC227	44p	74LS161	31p	74S314	150p	75477	42p
25A-1105	250p	25C-2259	80p	25A/400V	240p	4629	100p	74HC228	44p	74LS162	31p	74S315	150p	75478	42p
25A-1106	250p	25C-2271	60p	25A/600V	230p	4630	100p	74HC229	44p	74LS163	31p	74S316	150p	75479	42p
25B-022	80p	25C-2275	50p	25A/800V	230p	4631	100p	74HC230	44p	74LS164	31p	74S317	150p	75480	42p
25B-324	55p	25C-2276	50p	25A/100V	185p	4632	100p	74HC231	44p	74LS165	31p	74S318	150p	75481	42p
25B-370	45p	25C-2282	180p	25A/200V	240p	4633	100p	74HC232	44p	74LS166	31p	74S319	150p	75482	42p
25B-546	70p	25C-2324	120p	25A/400V	240p	4634	100p	74HC233	44p	74LS167	31p	74S320	150p	75483	42p
25B-557	225p	25C-2324	120p	25A/600V	230p	4635	100p	74HC234	44p	74LS168	31p	74S321	150p	75484	42p
25B-561	50p	25C-2329	480p	25A/800V	230p	4636	100p	74HC235	44p	74LS169	31p	74S322	150p	75485	42p
25B-562	130p	25C-2335	120p	25A/100V	185p	4637	100p	74HC236	44p	74LS170	31p	74S323	150p	75486	42p
25B-595	80p	25C-2335	120p	25A/200V	240p	4638	100p	74HC237	44p	74LS171	31p	74S324	150p	75487	42p
25B-596	60p	25C-2335	120p	25A/400V	240p	4639	100p	74HC238	44p	74LS172	31p	74S325	150p	75488	42p
25B-600	500p	25C-2369	100p	25A/600V	230p	4640	100p	74HC239	44p	74LS173	31p	74S326	150p	75489	42p
25B-600	500p	25C-2373	210p	25A/800V	230p	4641	100p	74HC240	44p	74LS174	31p	74S327	150p	75490	42p
25B-616	190p	25C-2407	110p	25A/100V	185p	4642	100p	74HC241	44p	74LS175	31p	74S328	150p	75491	42p
25B-688	180p	25C-2408	120p	25A/200V	240p	4643	100p	74HC242	44p	74LS176	31p	74S329	150p	75492	42p
25B-649	30p	25C-2470	60p	25A/400V	240p	4644	100p	74HC243	44p	74LS177	31p	74S330	150p	75493	42p
25B-654	30p	25C-2484	240p	25A/600V	230p	4645	100p	74HC244	44p	74LS178	31p	74S331	150p	75494	42p
25B-649	30p	25C-2509	580p	25A/800V	230p	4646	100p	74HC245	44p	74LS179	31p	74S332	150p	75495	42p
25B-705	200p	25C-2545	110p	25A/100V	185p	4647	100p	74HC246	44p	74LS180	31p	74S333	150p	75496	42p
25B-705	200p	25C-2550	70p	25A/200V	240p	4648	100p	74HC247	44p	74LS181	31p	74S334	150p	75497	42p
25B-716	200p	25C-2551	70p	25A/400V	240p	4649	100p	74HC248	44p	74LS182	31p	74S335	150p	75498	42p
25B-727	200p	25C-2562	245p	25A/600V	230p	4650	100p	74HC249	44p	74LS183	31p	74S336	150p	75499	42p
25B-754	80p	25C-2565	245p	25A/800V	230p	4651	100p	74HC250	44p	74LS184	31p	74S337	150p	75500	42p
25B-755	310p	25C-2570	60p	25A/100V	185p	4652	100p	74HC251	44p	74LS185	31p	74S338	150p	75501	42p
25B-764	60p	25C-2570	60p	25A/200V	240p	4653	100p	74HC252	44p	74LS186	31p	74S339	150p	75502	42p
25B-772	45p	25C-2571	220p	25A/400V	240p	4654	100p	74HC253	44p	74LS187	31p	74S340	150p	75503	42p
25B-775	160p	25C-2579	200p	25A/600V	230p	4655	100p	74HC254	44p	74LS188	31p	74S341	150p	75504	42p
25B-791	280p	25C-2580	240p	25A/800V	230p	4656	100p	74HC255	44p	74LS189	31p	74S342	150p	75505	42p
25B-792	70p	25C-2580	240p	25A/100V	185p	4657	100p	74HC256	44p	74LS190	31p	74S343	150p	75506	42p
25B-795	60p	25C-2582	240p	25A/200V	240p	4658	100p	74HC257	44p	74LS191	31p	74S344	150p	75507	42p
25B-795	60p	25C-2582	240p	25A/400V	240p	4659	100p	74HC258	44p	74LS192	31p	74S345	150p	75508	42p
25B-825	135p	25C-2611	40p	25A/600V	230p	4660	100p	74HC259	44p	74LS193	31p	74S346	150p	75509	42p
25B-861	160p	25C-2611	40p	25A/800V	230p	4661	100p	74HC260	44p	74LS194	31p	74S347	150p	75510	42p
25B-882	120p	25C-2611	65p	25A/100V	185p	4662	100p	74HC261	44p	74LS195	31p	74S348	150p	75511	42p
25B-882	120p	25C-2611	65p	25A/200V	240p	4663	100p	74HC262	44p	74LS196	31p	74S349	150p	75512	42p
25B-882	120p	25C-2611	65p	25A/400V	240p	4664	100p	74HC263	44p	74LS197	31p	74S350	150p	75513	42p
25B-896	225p	25C-2688	70p	25A/600V	230p	4665	100p	74HC264	44p	74LS198	31p	74S351	150p	75514	42p
25B-895	120p	25C-2688	70p	25A/800V	230p	4666	100p	74HC265	44p	74LS199	31p	74S352	150p	75515	42p
25B-900	180p	25C-2699	2100p	25A/100V	185p	466									

AA117	9p	BD177	30p	BF479	30p	MJ2501	110p	2N 1132	28p	ZENER	AN-316	350p	HA-1125	150p	LA-7027	400p	NE-531	115p	TA-7137	83p	TA-2532	120p
AA118	9p	BD179	32p	BF483	18p	MJ2955	55p	2N 1613	24p	400MV	AN-318	460p	HA-1137V	135p	LA-7031	250p	NE-544	170p	TA-7140	130p	TA-2540	100p
AA120	9p	BD181	45p	BF485	18p	MJ3090	55p	2N 1711	24p	5V788 RANGE	AN-332	295p	HA-1144	30p	LA-7032	700p	NE-555	200p	TA-7142	220p	TA-2560	120p
AC107	40p	BD183	60p	BF495	16p	MJ3091	115p	2N 2101	50p	0V140 39V 8p	AN-360	100p	HA-1156	110p	LA-7033	400p	NE-560	110p	TA-7146	400p	TA-2565	150p
AC125	25p	BD184	60p	BF506	25p	MJE29A	30p	2N 2102	50p	1.3W	AN-362	140p	HA-1197	150p	LA-7040	280p	NE-564	380p	TA-7148	350p	TA-2570	180p
AC126	25p	BD187	30p	BF595	16p	MJE30A	30p	2N 2160	30p	BZK61 RANGE	AN-366	100p	HA-1199	145p	LA-7042	280p	NE-565	110p	TA-7150	140p	TA-2580	200p
AC127	21p	BD201	33p	BF597	10p	MJE350	80p	2N 2218A	24p	2V710 39V 12p	AN-610	160p	HA-1306V	170p	LA-7043	300p	NE-566	130p	TA-7157	140p	TA-2593	150p
AC128K	26p	BD203	42p	BF615	30p	MJE520	80p	2N 2219	50p	5V800	AN-612	160p	HA-1308	170p	LA-7044	300p	NE-567	115p	TA-7160	140p	TA-2600	150p
AC141K	30p	BD204	42p	BF617	30p	MJE295K	90p	2N 2222	23p	7805	AN-5151	600p	HA-1339A	350p	LA-7048	300p	NE-571	290p	TA-7176	240p	TA-2611A	180p
AC142K	30p	BD222	31p	BF630	30p	MJ811	90p	2N 2225	15p	7806	AN-5430	280p	HA-1342	350p	LA-7050	250p	NE-593	85p	TA-7193	400p	TA-2620	150p
AC151K	23p	BD225	31p	BF757	40p	MF812	45p	2N 2435	42p	7808	AN-5612	40p	HA-1366V	170p	LA-7052	250p	NE-595	440p	TA-7200	300p	TA-2630	150p
AC176	22p	BD232	31p	BF758	41p	MP813	55p	2N 2646	40p	7812	AN-5620	330p	HA-1367	160p	LA-7060	250p	NE-5533P	110p	TA-7201	200p	TA-2760	400p
AC176K	28p	BD233	30p	BF759	40p	MP8612	50p	2N 2904	20p	7815	AN-5712	350p	HA-1368	160p	LA-7062	250p	NE-5534P	110p	TA-7203	180p	TA-3190	100p
AC187	21p	BD234	32p	BF780	40p	MPN3404	30p	2N 2905	20p	7818	AN-5722	140p	HA-1368	160p	LA-7070	500p	SAS-560	110p	TA-7204	140p	TA-3300B	480p
AC187K	21p	BD235	32p	BF783	40p	MP56571	30p	2N 2906	18p	7905	AN-5719	150p	HA-1371	160p	LA-7071	500p	SAS-570	110p	TA-7205	140p	TA-3318	380p
AC188	21p	BD236	30p	BF869	22p	MP59012	30p	2N 2907	18p	7906	AN-5732	160p	HA-1372	160p	LA-7072	500p	SAA-1009B	450p	TA-7207	150p	TA-3350	350p
AC188K	28p	BD237	21p	BF870	22p	MP59013	30p	2N 2926	8p	7907	AN-5753	170p	HA-1374	230p	LA-7090	300p	SAA-1009S	450p	TA-7208	145p	TA-3561	280p
AC198	45p	BD238	24p	BF871	22p	MP59014	20p	2N 3019	28p	7908	AN-6101	425p	HA-1377	200p	LA-7110	400p	SAA-1024	250p	TA-7210	200p	TA-3651A	290p
AD142	100p	BD239	30p	BF872	23p	MP59015	20p	2N 3053	13p	7912	AN-6105	150p	HA-1388	320p	LA-7112	300p	SAA-1024	250p	TA-7211	200p	TA-3652	300p
AD149	60p	BD241A	40p	BF961	35p	MP5A06	15p	2N 3054	40p	7915	AN-6135	150p	HA-1389	210p	LA-7205	250p	SAA-1024	250p	TA-7213	200p	TA-3710	320p
AD161	35p	BD242A	50p	BF963	40p	MP5A13	15p	2N 3055	38p	7918	AN-6300	600p	HA-1389	210p	LA-7210	300p	SAA-1220	400p	TA-7214	260p	TA-3800	350p
AD162	35p	BD243A	50p	BF964	40p	MP5A13	15p	2N 3055H	58p	7924	AN-6320	300p	HA-1394	280p	LA-7212	300p	SAA-1220	400p	TA-7215	215p	TA-4420	180p
AD164	200p	BD244	50p	BF966	40p	MP5A42	15p	2N 3442	85p	78L05	AN-6340	830p	HA-1398	240p	LA-7220	300p	SAA-1272C	280p	TA-7220	220p	TA-4600	260p
AF106	50p	BD245A	50p	BF968	40p	MP5A43	15p	2N 3525	150p	78L08	AN-6341	350p	HA-1452	120p	LA-7224	150p	SAA-1300	400p	TA-7222	120p	TA-4950	200p
AF109	45p	BD265	45p	BF973	110p	MP5A65	25p	2N 3525	150p	78L15	AN-6344	400p	HA-1457	120p	LA-7225	188p	SAA-5040A	280p	TA-7223	210p	TA-5700	200p
AF125	50p	BD267	45p	BF975	110p	MP5A70	25p	2N 3702	90p	78L18	AN-6350	400p	HA-1521	210p	LA-7250	250p	SAA-5040B	280p	TA-7224	200p	TA-7046	250p
AF176	50p	BD278	50p	BF982	21p	MP5A82	15p	2N 3703	90p	78L24	AN-6359	810p	HA-11221	210p	LA-7505	250p	SAA-0161	400p	TA-7225	300p	TA-3110	320p
AF177	30p	BD311	100p	BF983	25p	MP5A93	20p	2N 3704	90p	78L24	AN-6360	400p	HA-11223	210p	LA-7506	250p	SI-7300A	1400p	TA-7226	290p	TA-7211	150p
AF178	30p	BD312	100p	BF984	25p	MP5A93	20p	2N 3704	90p	78L24	AN-6362	480p	HA-11225	170p	LA-7507	250p	SNR-20A130K	200p	TA-7227	190p	TA-7220	150p
AF199	45p	BD313	100p	BF985	25p	MP5A93	20p	2N 3705	90p	78L24	AN-6367	560p	HA-11225	170p	LA-7508	250p	STA-301A	200p	TA-7228	200p	TA-7270	150p
AF201	70p	BD314	100p	BF986	25p	MP5A93	20p	2N 3707	90p	78L24	AN-6430	390p	HA-11251	240p	LA-7590	250p	STA-301A	200p	TA-7229	200p	TA-7230	150p
AF279	45p	BD315	100p	BF987	25p	MP5A93	20p	2N 3708	90p	78L24	AN-6431	400p	HA-11423	210p	LA-7620	500p	STA-301A	200p	TA-7230	250p	TA-7232	150p
AL110	45p	BD317	100p	BF988	25p	MP5A93	20p	2N 3709	90p	78L24	AN-6520	380p	HA-11426	210p	LA-7621	500p	STA-301A	200p	TA-7231	250p	TA-7232	150p
AL112	300p	BD316	150p	BF989	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6811	130p	HA-11703	390p	LA-7652	500p	STA-301A	200p	TA-7232	400p	TA-7233	150p
AM150	28p	BD318	150p	BF990	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6812	130p	HA-11703	390p	LA-7652	500p	STA-301A	200p	TA-7233	400p	TA-7234	150p
AM151	30p	BD331	40p	BF991	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6813	130p	HA-11703	390p	LA-7652	500p	STA-301A	200p	TA-7234	400p	TA-7235	150p
AM154	30p	BD332	40p	BF992	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6814	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7241	260p	TA-7242	150p
AM156	35p	BD333	40p	BF993	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6815	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7242	260p	TA-7243	150p
AM158	50p	BD362	60p	BF994	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6816	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7243	260p	TA-7244	150p
AS215	100p	BD370	30p	BF995	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6817	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7244	260p	TA-7245	150p
AS217	100p	BD371	30p	BF996	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6818	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7245	260p	TA-7246	150p
AU113	600p	BD373	30p	BF997	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6819	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7246	260p	TA-7247	150p
BA145	10p	BD433	28p	BF998	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6820	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7247	260p	TA-7248	150p
BA148	10p	BD434	30p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6821	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7248	260p	TA-7249	150p
BA154	60p	BD435	31p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6822	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7249	260p	TA-7250	150p
BA157	10p	BD436	31p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6823	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7250	260p	TA-7251	150p
BA178	250p	BD437	28p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6824	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7251	260p	TA-7252	150p
BA182	20p	BD438	28p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6825	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7252	260p	TA-7253	150p
BB101	13p	BD439	40p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6826	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7253	260p	TA-7254	150p
BB103	10p	BD440	40p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6827	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7254	260p	TA-7255	150p
BB105B	18p	BD441	40p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6828	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7255	260p	TA-7256	150p
BB205B	24p	BD442	40p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6829	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7256	260p	TA-7257	150p
BC107	8p	BD520	60p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6830	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7257	260p	TA-7258	150p
BC108	8p	BD521	60p	BF999	25p	MP5A93	20p	2N 3711	12p	78L24	AN-6831	240p	HA-11710	340p	LA-7770	300p	STA-301A	200p	TA-7258	260p	TA-7259	150p
BC109	8p	BD522	60p	BF999</																		

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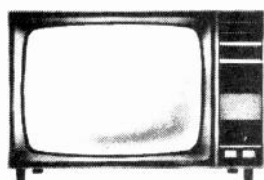
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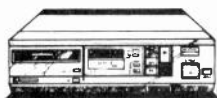


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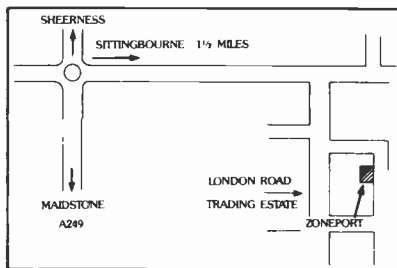
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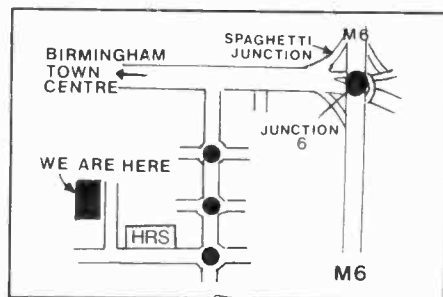
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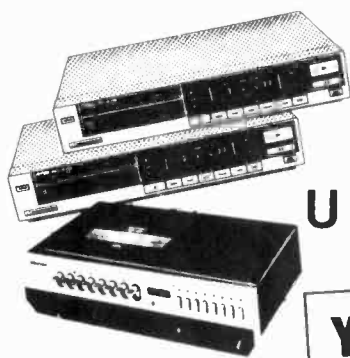
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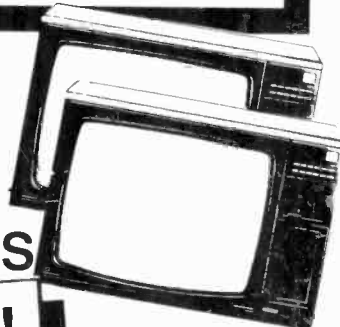


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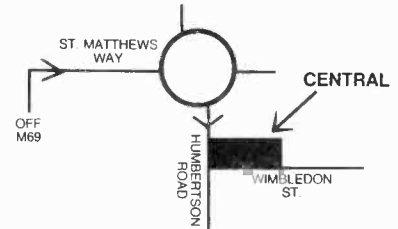
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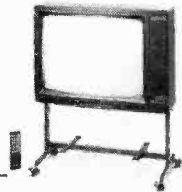


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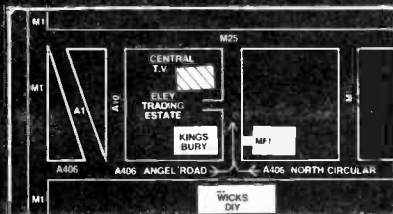
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Colour TVs from £25 working.
Regunned tubes, most types available
including Japanese.

Large selection of Working Stock in
our Showroom.

0394 670115

BRIDGE ROAD,
FELIXSTOWE,
SUFFOLK IP11 7FL

DHOUPER VISION

Wholesaler in TV's and VIDEO's.

TV's

	Working	Untested
B.W. £4 1500-1600		
G11, Philips, GEC Starline, ITT CVC 25-32	£24.00	£14.00
8800	£12.00	£8.00
9K	£14.00	£12.00
9200 Basic Monitor - Two function Remote	£20.00	£16.00
9200 Full Infra Red Remote	£40.00	£30.00
9900 Two function Remote	£25.00	£18.00
9900 Full Infra Red Remote	£30.00	£20.00
TX9-10 Basic Remote	£60.00	£50.00
TX90-100	£60.00	£50.00
Text TV's with new Remote G11 Philips-Pye	£50.00	£45.00
Portable Colour Basics	£55.00	£45.00
TX9-10 Text	£85.00	£70.00
Text Portable	£100.00	£85.00
TX100 Text	£85.00	£65.00
Stereo Text	£110.00	£90.00
Professional Stereo Text + Speakers	£130.00	£100.00
ITT FST Text	£140.00	£110.00
And all Japanese TV's in stock from £15.00		

VIDEOS

3V22	£50.00	£45.00
3V23 + New Remote	£85.00	£70.00
3V29-30	£80.00	£70.00
JVC-SHARP-AKAI-MITSUBISHI-HITACHI-PHILIPS-AMSTRAD	£80.00	£65.00
GRUNDIGS-ORION-HANIRI-SAMSUNG-FUNAI		
All Front Loaders 3V32-35-43-55-65 & All Brand Names. From £100.		

LORRY LOAD AVAILABLE AT CHEAPER PRICES

DHOUPER VISION, 674 COVENTRY ROAD, SMALL HEATH, BIRMINGHAM B10 0TJ.

Tel: 021 772 2743

SERVICE PAGES

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TELEVIEW 01-994 5537
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VHF/UHF TELEVERTERS - £22.50 each
Quantities P.O.A.

VHF/UHF TUNER KIT DIRECT REPLACEMENT
THORN TV's AND VCR's - £16.50
CERAMIC FILTERS FOR UK & EXPORT
CONVERSION ADD £2 POST AND PACKING
PER ORDER.

JOMILL ENTERPRISES
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ICs transistors etc. into cash. Immediate settlement. We also welcome the opportunity to quote for complete factory clearance.

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COLES-HARDING & CO
103 South Brink, Wisbech, Cambs.
Tel. 0945 584188 Fax. 0945 588844
★ ESTABLISHED OVER 15 YEARS ★

MARK 3 DORIC'S

20", 22", 26" at £10.00
+ VAT DELIVERED

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ACT NOW!

DISCOUNT ON
QUANTITY

CALL TODAY FOR
YOUR EX-RENTAL TV'S
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WE SERVE TRADE ONLY

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We stock spares for PHILIPS, PYE, RANK, GEC, SHARP, SONY, HITACHI & DECCA

And also THORN & ITT
FIDELITY SPARES MAIN DISTRIBUTOR.

Did you know we also stock

FUSES	ICs
TUBES	TOOLS
AERIALS	VIDEO LEADS
AEROSOLS	AUDIO LEADS
RESISTORS	SEMICONDUCTORS
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VIDEO HEADS	TELEPHONE ACCESSORIES

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TRADE ONLY

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EMPRESS STREET,
MANCHESTER M16 9EN.
Tel: 061-872 5438; 061-848 0060.

Sonic TV Distributors

Unit 4a, Abberley St., Smethwick Birmingham B66 2QU Tel: 021-565 1727

GAFFER GONE MAD SELLING EVERY THING CHEAP

GII-£15
KT3-£35

ITT TRIMLINE £35
G.E.C. INLINE £25

LATE MODELS T.V.
IN STOCK

3V30

£70

WORKING

3V23

£70

3VT8300

£70

VC8300

£70

NV333

£70

HOT NEWS AUDIO IN STOCK

BRAND NEW 5 1/2" T.V./RADIO (COLOUR T.V.) IN STOCK

MIDDI SYSTEM
TWIN TAPE WITH SPEAKERS
£32

TWIN STEREO
£16

MUSIC CENTRE
TWIN TAPE WITH SPEAKERS
£28

MANY MORE AUDIO ITEMS IN STOCK NOW. CASSETTE PLAYER £3.50

NORTH WEST ELECTRONICS

**VISIT OUR NEW PREMISES AT
SPRING MILL STREET,
MANCHESTER ROAD, BRADFORD 5
5 MINS FROM MOTORWAY**

ALWAYS IN STOCK

Philips KT3, KT30, K35, G11, etc
Bush T20, T26, T24
Hitachi 2216 etc
Thorn TX9, TX10, 9000, etc
Many more to choose from.

Teletext TV's

Philips, Ferguson, GEC etc.

VIDEOS

Electronic front loading video's from
£75.00 working perfectly, try before
you buy !!!

ALWAYS IN STOCK

Sharps 7300, 8300, 9300, 381 etc
Hitachi VT11E, 8300, VT331E, etc
National Panasonic
Thorn 3V29, 3V30 etc.

Due to our excess video stock and limited time we have
electronics VHS videos with slight faults from only **£50.00**
makes incl' Sharps, Thorn, Hitachi etc.

SPECIAL OFFER THIS MONTH

**PYE/PHILIPS KT3 ONLY £35.00
OR WORKING IN 10's £45.00 ea.
PYE/PHILIPS K30 ONLY £40.00
OR WORKING £50.00 ea.**

WORKING EX-EQUIPMENT PANELS

	IF	Con- verger	De- coder	Line scan	Power	Frame
T20/22	X	5	14	18	17	14
T26	X	5	16	20	17	X
718	7.50	5	14	20	3	14.00
Philips G11	14.50	5	12	20	20	11.50

All prices include Postage & Packing. But + VAT

H.P. Repossessions and Ex-Rentals
TRADE SHOWROOM

Come and see our range of working TV's and Video's
ready for sale or rent.

SPECIAL

Let us quote you
for Bulk Orders on Bush T20/22.
Delivered to your door

Selection of colour TV's from £5.00
Decca, Ferguson, G8, ITT, GEC, Bush, etc.

Pay us a visit, you will be delighted!

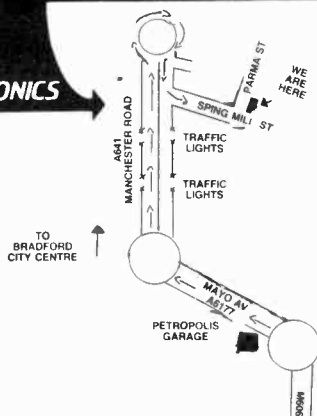
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**100's PX
HOOVER JUNIOR
VACS**

All models in stock

**Tel (0274)
308186**

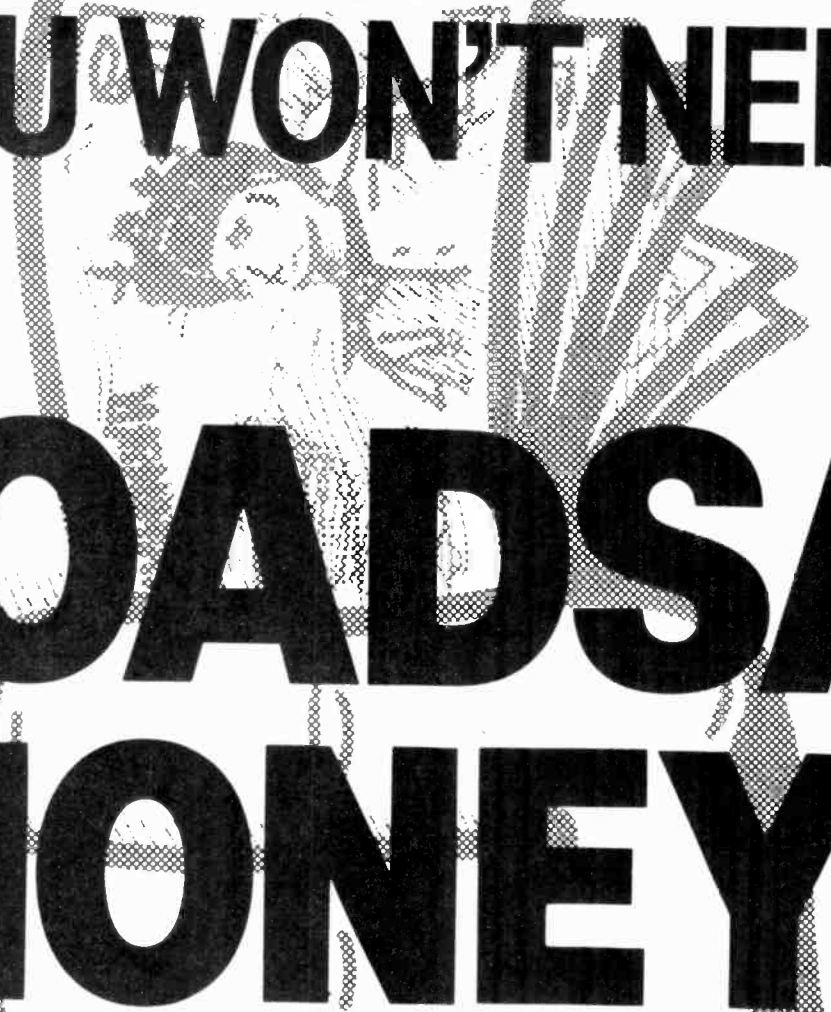
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WEST
ELECTRONICS**



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ACCEPTED WITH
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**OPEN
6 DAYS
SAT 9-5.30**



YOU WON'T NEED LOADS A MONEY!

**WHEN YOU BUY YOUR TELEVISION & VIDEO
FROM BOBS TELEVISION WAREHOUSE**

We carry an extensive range of machines from "off the pile"
to fully refurbished ready to install.

We offer a variety of makes including National Panasonic, Ferguson, Philips, Sharp, Hitachi, Grundig etc. plus B grade Philips machines.

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TEL: Basildon (0268) 728966

You will find our prices very competitive and probably the lowest in Essex. We offer greater reductions on quantity purchases.

INDEPENDENT TELEVISION & VIDEO CO.

DON'T TRAVEL THE COUNTRY LOOKING AT "BUTCHERED JUNK"
ALL OUR COLOUR TELEVISION'S & VIDEOS ARE IN EXCELLENT CONDITION, WITH UNMARKED
CABINETS AND ARE SUPPLIED WITH REMOTE CONTROL
WE ALWAYS HAVE **1000s** IN STOCK OF ALL FAMOUS MAKES
WE DON'T JUST SAY THAT - SEE FOR YOURSELF AT YOUR LOCAL BRANCH
FRANCHISES NOW AVAILABLE WITH MINIMUM INVESTMENT

BULK PURCHASE:-

V.H.S. Electronic Working	From £75.00
V.H.S. Electronic Untested	From £55.00
V.H.S. Electronic For Spares	From £35.00
Mechanical V.H.S. Video's Untested	£35.00
Mechanical V.H.S. Video's For Spares	£25.00
All Beta Videos.....	From £10.00

WE ARE EXPERIENCED IN EXPORT MARKET REFURBISHED TELEVISIONS & VIDEO'S

Enquiries welcome C.I.F. & F.O.B. Prices - **Telex: 378414 BLBIRDG** - **Fax: 0602 861027**

TELEVISIONS

Thorn 9000	
Thorn 9200	
Thorn 9600	
Thorn TX9-TX10	
Decca 80 & 100	
G.E.C.	
I.T.T. R/C	
Philips G11 & Pye G11	
Philips G11 & Pye G11 Text with Handset	
KT3	
KT3 Text with Handset	
KT35	
KT35 Text with Handset	
TX9 & TX10 Text with Handset	
Grundig	
Grundig Text with Handset	
I.T.T. - Ferguson Stereo Text	

WORKING

£20.00
£25.00
£25.00
£50.00
£20.00
£20.00
£30.00
£28.00
£55.00
£50.00
£70.00
£55.00
£90.00
£70.00
£55.00
£90.00
£130.00

UNTESTED

£15.00
£18.00
£18.00
£40.00
£15.00
£10.00
£20.00
£18.00
£45.00
£40.00
£45.00
£45.00
£65.00
£60.00
£45.00
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£105.00

**PLUS MANY MORE LATE MODEL T.V.'s TOO LONG LIST TO LIST THEM ALL.
ALL PRICES ARE PLUS 15% VAT.**

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BANKRUPT AND SURPLUS STOCKS OF
TV'S AND VIDEOS

NOW OPEN IN LEEDS

Due to our excessive stocks
we have both V.H.S. electronic
Videos & TV's with slight faults
to dispose of at
SILLY PRICES

TV'S

9000	£12
9200 Basic Monitor 2 function remote	£20
9200 Full infra red remote	£30
9600 Basic 2 function remote	£15
9900 2 function remote	£25
9900 Full infra red remote	£30
Text TV's	£50
Stereo Text	£80

MANY MORE TOP BRAND NAMES ● HITACHI ● JVC
● PANASONIC ● SONY ● TOSHIBA ● FERGUSON ● PHILIPS ● GEC

VIDEOS

3V22	£35
3V23 Full infra red remote	£60
3V29/30	£60
JVC, SHARP, AKAI, HITACHI	£65

NEW VIDEO HEADS

Ferguson/JVC Universal Heads	£17
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THE ABOVE OFFERS APPLY ONLY WHILE STOCKS LAST

RING OUR HOT LINES NOW!

NORTH
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SOUTH
01-769 1029

All prices subject to VAT

FRESH STOCK EVERY WEEK — PAY US A VISIT
YOU WILL NOT BE DISAPPOINTED!

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2 GLOBE ROAD, LEEDS LS11 5QG
OFF WATER LANE, NEAR HILTON HOTEL (FORMERLY DRAGONAR)

NEWSFLASH!!! New contract with one of the UK's
leading rental companies enables us
to offer a constant supply of TOP QUALITY VIDEOS & TV'S.

VIDEO SPARES

PLEASE NOTE NEW ADDRESS

Stock items despatched by return Access & Visa welcome

VIDEO HEADS

3HSSV - JVC/Ferguson etc.	£18.00
3HSSN - Panasonic. Most 2 head models	£18.00
3HSSU1N - Panasonic NV370	£24.95
PS3B - Sony SLC5 C6/C7, SL8000 etc.	£22.75
3HSS(H) - Hitachi VT5000 etc.	£27.95
3HSS(HA) - Hitachi VT8000, VT9500 etc.	£22.00
3HSS(HB) - Hitachi VT11, 33, 63 etc.	£22.00
3HSS(SF) - Fisher FVH510, 710 etc.	£28.50
3HSS(SP) - Sharp VC9300, VC9500 etc.	£22.00
PS3B(T) - Toshiba V9600, V31, V33 etc.	£27.80
3HSS(R) - Amstrad, Saisho, Dron etc.	£28.50
3HSS4(NJA) - Panasonic NV366	£45.00
3HSS4VB - Ferguson 3V32/JVC HR7655	£46.00
3HSS4NB - Panasonic NV730	£46.00

The above equivalent video heads are new. For
reprocessed heads send old head Sharp and
Mitsubishi models @ £37.50 and most 4 head VHS
types @ £45.00.

VIDEO MOTORS

Drum Motors

Ferguson/JVC (Mechanical models)	£21.45
Sharp VC9300, VC9500 etc.	£26.60

Reel Motors

Sanyo VTC5000, 5150, 5300, 5400	£7.90
Sharp VC9300, 9500 etc. (most models)	£15.60

Capstan Motors

Ferguson/JVC (mechanical models)	£21.45
Ferguson 3V35	£22.50
Sony SLC5, C7 (BHF11000)	£28.20
Sharp VC9300, 9500 etc.	£27.60

BELT KITS

Most Models	From £0.95
Sanyo VTC5000	£0.55

IDLER ASSEMBLIES

Sharp VC9300, VC9500 etc. (NIDL0005GEZZ)	£1.75
Sharp VC481, VC581 etc. (NIDL0006GEZZ)	£1.90
Hitachi VT11/14/33/17 etc.	£1.75
Hitachi 9300/9500 FF Idler	£1.50
Hitachi 9300/9500 Play Idler	£3.65
Ferguson TU Clutch (mechanical models)	£4.95
Ferguson 3V29/30 Take up idler	£1.20
Ferguson 3V29/30 Take up clutch	£2.00
Ferguson 3V29/30 Reel idler	£2.40
Ferguson 3V35 Reel idler	£2.30
Ferguson 3V35/36/38/39 Take up clutch	£1.95
Sanyo VTC5000, 5150, 6500 Roller assembly	£1.95
Sony C5, C7 Rewind kit	£4.10
Fisher FVHP615 Idler assembly	£5.20
Fisher FVHP615 Gear idler assembly	£4.20
Panasonic NV370 etc (VXP0521)	£1.75
Panasonic NV333/366 etc (VXP0401) NV7000, 7200/7800 (VXP0344) NV2000/3000 (VXP0331) (VXP0329)	£0.70

PINCH ROLLERS

Most models from	£2.70
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MISCELLANEOUS

IC STR6020 Modification kit for Hitachi CPT1471, 1473	£6.95
Universal Video Copying kit	£3.50
Universal Video Copying kit (scart)	£5.00
Cassette Lamps Ferguson/JVC type with or without plug	£0.50
Cassette Lamps Sharp/Panasonic	£0.50
Universal Cassette Lamps	£0.50
Universal Tripler	£4.75
Sony Switches (non remote)	£3.40
Sony Switches (remote)	£4.60
Video Cassette Lamp for Sharp 9300 etc.	£1.25

Please add 75p per order for p&p and then add 15% VAT



A.Z. ELECTRICS

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Telephone (0604) 847800



B.G. COMPONENTS

HILL STREET, OLDHAM
TEL. 061 624 1753

(Incorporating Relife T.V. Tubes)

SUPPLIERS OF T.V. AND VIDEO SPARES

I.C.'s	SHARP	AKAI	
TRANSISTORS	NAT. PAN.	SANYO	★
DIODES	THORN	VIDEO	
L.O.P.T.X.	HITACHI	BELT KITS	47-342 £5
TRIPLERS	G.E.C.	PINCH	47-343 £5
TUNERS	I.T.T.	ROLLERS	56-510 £40
VALVES	DECCA		56-540 £48
CAPACITORS	SONY		66-540 £50
RESISTORS			56-701 £48
			67-701 £50
			51-570 £40
			51-580 £45
			51-590 £45
			51-231 £45
			560-DZB22 £48
			560-EGB22 £46
			Sony 520-SB22 £60
			Sony 570-HB22 £60
			Sony 680-DB22 £80

NEW VIDEO HEADS £21.95

SHARP REEL MOTORS £15.75

FERGUSON CASSETTE
CARRIAGES £26.50

WORKING
ELECTRONIC
VIDEOS
FROM
£90.00

4 YR
EXTENDED
GUARANTEE
AVAILABLE
ON ALL TUBES

RING FOR QUOTE
ON ANY C.R.T.

9K £10
9600 £15

30 AX - IN-LINE
PRE-CONVERGED
IF REQUIRED

**SOUTH WALES CRT
DISTRIBUTOR 0222-484006**

FACTORY RE-GUNNED C.R.T.'s

ELC EAST LONDON COMPONENTS
AUDIO TELEVISION VIDEO
COMPONENTS AT VERY KEEN PRICES
TEL: 01-472 4871

LOOK AT THESE PRICES

VIDEO HEADS

JVC 3HS	£22.50p
PANASONIC	£23.50p
HITACHI VT 000/9000	£23.85p
HITACHI VT 1/14/33	£24.85p

VIDEO IDLERS

JVC	£4.75p
VT 9300	£3.85p
VT 11 14 17	£3.50p
VC 0005GEZZ	£2.50p
VC 0006GEZZ	£2.50p
NV 333	£1.50p
NV 2000	£1.50p
NY 333	£1.50p
IDLER TYRES FOR MOST MODELS	0.50p
UNIVERSAL LAMPS	50p
JVC LAMPS	60p
SHARP LAMP	£1.00p
UNIVERSAL TRIPPERS	£5.00p
PINCH ROLLERS FOR MOST MODELS	3.00p

ON/OFF SWITCHES

SONY ON/OFF SWITCH	£2.75p
G11 ON/OFF SWITCH WITH REMOTE	£2.00p
TX10 ON/OFF SWITCH WITH REMOTE	£2.00p

CASSETTE MOTORS

6-9-12-13.2 VOLTS	£3.00p
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CASSETTE HEADS

MONO CASSETTE HEAD	95p
STEREO CASSETTE HEAD	£1.80p
AUTO REVERSED HEAD	£2.55p

DRIVE BELTS FOR AUDIO CASSETTE RECORDERS TURNTABLES

FLAT	
68 x 0.5 x 4	30p
to	
86 x 0.5 x 4	30p
86 x 0.5 x 5	70p
86 x 1.2	15p
120 x 1.2	15p

ELC EAST LONDON COMPONENTS
63 PLASHET GROVE, EAST HAM,
LONDON E6 1AD. TEL: 01-472 4871
OPEN 9AM TO 8PM.

two minutes walk from Upton Park Tube Station
PLEASE PHONE US IF WHAT YOU NEED
IS NOT LISTED AS WE HOLD THOUSANDS
OF ITEMS IN STOCK
ADD 70p P/P ADD 15% VAT
ALL GOODS DESPATCHED SAME DAY
PRICE SUBJECT TO CHANGE WITHOUT NOTICE
VISA ACCESS ACCEPTED

COMPUTER IC'S

AN203	220p	HA1368R	180p	STK080	750p	TDA2030	160p	ZSB-557	225p	ZSC-1213	65p	ZSC-2546	20p
AN210	175p	HA1370	175p	STK082	750p	TDA2170	300p	ZSB-560	40p	ZSC-1214	45p	ZSC-2550	75p
AN214	180p	HA1372	350p	STK084	800p	TDA2581	300p	ZSB-562	120p	ZSC-1222	35p	ZSC-2555	175p
AN253	100p	HA1374	250p	STK089	550p	TDA2600	570p	ZSB-566	40p	ZSC-1226	80p	ZSC-2564	250p
AN262	150p	HA1377	230p	STK431	600p	TDA2653A	400p	ZSB-568	40p	ZSC-1317	25p	ZSC-2565	280p
AN272	500p	HA1384	400p	STK433	525p	TDA3505	550p	ZSB-595	80p	ZSC-1318	30p	ZSC-2575	25p
AN301	350p	HA1388	350p	STK435	550p	TDA3520	400p	ZSB-596	85p	ZSC-1327	25p	ZSC-2577	125p
AN302	350p	HA1389	230p	STK436	525p	TDA3541	400p	ZSB-647	40p	ZSC-1328	25p	ZSC-2579	130p
AN303	275p	HA1389R	230p	STK437	650p	TDA3560	400p	ZSB-648	65p	ZSC-1345	30p	ZSC-2611	50p
AN315	225p	HA1392	250p	STK439	600p	TDA3561A	525p	ZSB-649	65p	ZSC-1384	40p	ZSC-2651	280p
AN322	450p	HA1394	300p	STK441	775p	TDA3562A	450p	ZSB-681	250p	ZSC-1384	40p	ZSC-2944	150p
AN340	160p	HA1396	395p	STK443	775p	TDA3562A	450p	ZSB-688	125p	ZSC-1403	150p	ZSC-3078	40p
AN360	125p	HA1397	275p	STK457	625p	TDA3652	280p	ZSB-705	250p	ZSC-1413	300p	ZSC-3182	250p
AN610	175p	HA1398	260p	STK459	600p	TDA4420	660p	ZSB-716	80p	ZSC-1445	125p	ZSC-3298	150p
AN612	175p	HA13001	275p	STK461	750p	TDA4500	495p	ZSB-717	70p	ZSC-1446	75p	ZSC-3506	200p
AN5151	700p	LA4230	150p	STK463	825p	TDA4698	300p	ZSB-718	130p	ZSC-1454	350p	ZSC-3519	150p
AN5440	225p	LA4420	280p	STK06001	1000p	TDA7270	295p	ZSB-772	40p	ZSC-1558	60p	ZSC-3520	25p
AN5510	280p	LA4422	150p	STK0600	800p			ZSB-837	60p	ZSC-1567	60p	ZSC-198	200p
AN5612	450p	LA4430	150p	STK1060	900p			ZSB-857	55p	ZSC-1568	60p	ZSC-200	310p
AN5712	375p	LA4440	250p	STK2025	750p			ZSC-372	70p	ZSC-1577	770p	ZSC-235	40p
AN5720	150p	LA4445	275p	STK2028	750p			ZSC-380	25p	ZSC-1584	550p	ZSC-288	80p
AN5722	180p	LA4460	300p	STK2029	550p			ZSC-480	15p	ZSC-1584	550p	ZSC-299	160p
AN5730	175p	LA4461	200p	STK2129	675p			ZSC-496	45p	ZSC-1584	550p	ZSC-313	40p
AN5732	175p	LA4500	250p	STK2230	650p			ZSC-496	45p	ZSC-1584	550p	ZSC-313	40p
AN5738	125p	LA4505	280p	STK2240	950p			ZSC-496	45p	ZSC-1627	30p	ZSC-315	75p
AN5900	150p	LA4507	400p	STK2250	950p			ZSC-496	45p	ZSC-1667	140p	ZSC-325	45p
AN6248	125p	LA4508	280p	STK2250	950p			ZSC-496	45p	ZSC-1668	85p	ZSC-352	50p
AN6249	125p	LA4509	280p	STK3041	650p			ZSC-496	45p	ZSC-1670	85p	ZSC-357	40p
AN6250	240p	LA7800	195p	STK3042	650p			ZSC-496	45p	ZSC-1675	20p	ZSC-358	40p
AN6320	350p	LA7800	195p	STK3044	650p			ZSC-496	45p	ZSC-1722	60p	ZSC-381	90p
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Z968 £10	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
Z582 I.F. Panel £5	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
KT3 Teletext Power Supply £10	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
BA 301 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
TA 4127 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
HD 3884 2A23 £3	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
TA 4184 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
TA 2125 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
TA 4190 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
TA 4138 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350 BYX 71/600 BYX 72/300 BYX 36/600 BYV 95B BYV 95C BYV 96D BYZ 106 BPW 41 BYW 56 2A/1000v G11 BYW 29/50 BZU 15/24 BZY 93c75 BZV 15/18 BZV 15/30 BZW 70c6v2 BZX 79.3v		Can of Anti Static, Degrease Cleaner and Anti Corona Lorlin Full Remote Relay Switch fit most TV sets, mains 4 tag, 2 tag 12 volt Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket Screen locking agent, large can Red E.H.T. LAED and Anode Cap Weller solder iron 15 watt/25 watt Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 100 Coax Plugs De-solder pump + 2 nozzles Philips Flat Red LED and Green 500gm 60/40 solder reel Solder 1 kilo reel Dual v/u meter -20 - +10db K30 thermistor 232266298009 De-solder Pump Portable Flameless Gas Soldering Iron Green & Red, LED pack mixed	£1.00
TA 4196 £1	R 2323 15p	U 19885 U 3832 U 3845 MR 508 MR 501 MR 502 BCW 71R BYF 1202 BYF 1204 BYF 3126 BYF 3214 BYX 10 BYX 36/600 BYX 38/300 BYX49/600R BYX 55/350 BYX 55/600 (Bead) BYX 71/350			

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Matsushita PY34220 Tuner	£7	K35 Decoder	£8.00
C. Cam Decoder with TDA3591	£5	K35 Sound OP	£4.00
Toshiba VHF/UHF EG522F	£6	Thick Film Daughter KT3 3122-4389	£3
Mitsumi MECL-F51	£5	12 C 11 K30 Tex Rec Front Panel with IC	£5
Thorn Spares			
New 9000 Decoder	£8.50	K35 IF	£5.00
9000 Frame panel	£8		
9000 Cyclops panel	£1.50		
8800 convergence panel	£6		
8500 convergence panel	£6		
4000 Power supply	£3		
1600 Mains lead, switch	£1.00		
T1605 1NPN Tube 806/6A	10p		
9000 Sound output panel	£1		
3500 Focus unit	£1.50		
3500 Mains Trans	£4		
3500 cut outs	10 for £4		
3500 IF panel	£2		
3500 Frame panel	£2		
3500 Line panel	£3		
3500 AT Diode	£20p		
Export 3500 IF 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 V regulated adaptor 240V 6V	£3.50		
7.5V/900mA	£3.50		
Rank/Toshiba preh unit 0354	£9.50		
4 Push button unit preh	£1.00		
6 Push button VHF/UHF for v/cap. GEC/Decca type	£7.00		
7 Push button for CVCS ITT	£8.00		
KT3 12 Push button unit	£2.00		
KT3 (Export) 12 P.B.U.	£2		
6 Push button Unit Thorn	£6.00		
6 Push button GRC	£6.00		
6 Push button PYE 731	£6.00		
Hearing aid unit	£3		
Rank Z718 4 P/B/Unit MECH	£4		
7 Button Unit GEC with Lamps	£7		
697 Push Button Unit	£6.00		
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Mains Droppers			
Thorn 731 3A 56+27R	50p		
Thorn 50171/K2	£1.00		
120/202/048/117	£1.00		
270/106 for Thorn 4000	50p		
18/320/0/39	£1.10		
Thorn 50-40R-1K5	50p		
Ae Socket & Lead			
GEC, ITT, Philips, Pye	25p		
7x3/4 1000/1700	£1		
Thorn 1000/1700	£1.50		
Rank Toshiba Tube Bases	30p		
Speakers			
6x4 G11	25 ohm	£1.00	
5x2x2 1/2	3 ohm	£1.00	
5x3	80 ohm	70p	
5x3	50 ohm	50p	
5x3	35 ohm	70p	
4x4	8 ohm	£1	
6x4	15 ohm	£1.00	
6x4 speaker	16 ohm	£1.00	
7x3	70 ohm	£1.00	
8x5	8 ohm	£2	
8x5	8 ohm	70p	
5x3	16 ohm	£1	
5" dia	16 ohm	£1.00	
5" dia	8 ohm	£1.50	
6 1/2" dia	4 ohm	£1.50	
2 3/4" dia	3 ohm	£1.50	
4 1/2" sq.	15 ohm	75p	
KT3 speaker	K30	75p	
3" dia	15 ohm	£1	
1690 5x3	12 ohm	£1	
K45 Philip	15 ohm	75p	
K30 15 watt		£1	
KT3-K30			
OF-425		10p	
OF-550	E/W	10p	
OF-513	correction	10p	
OF-557		50p	
DIODES			
BY 126	10p		
BY 127	10p		
BY 133	10p		
BY 134	10p		
BY 164	50p		
BY 176	25p		
BY 179	10p		
BY 180	25p		
BY 187	10p		
BY 194	10p		
BY 196	30p		
BY 198	10p		
BY 204/4	8p		
BY 206	8p		
BY 208/800	8p		
BY 210/400	5p		
BY 210/800	10p		
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BY 224/600: 4 8A/600k bridge	15p		
BY 227	15p		
BY 228 1500k	10p		
Flat BY229 black	20p		
BY 299 Red	15p		
BY 299/400	30p		
BY 299/600 Tag	30p		
BY 237	10p		
BY 254	10p		
BY 255	10p		
BY 298	10p		
BY 299	10p		
BY 406	80p		
BY 527	20p		
BY 407a	10p		
BY 527	10p		
BY 602	10p		
F-247	10p		
GP20G	5p		
GRP80G (1X10)	60p		
XK 3102	50p		
BYV 28/200	20p		
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KBFCS102 Bridge	£1.50		
Bridge Rec D35B10	40p		
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6A/600V Stud Diodes	20p		
6A/1000V Stud Diodes	20p		

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NEW GEC 20AX Power Supply Switch Mode	£12.00		
Field + Jungle panel for GEC 3133/3135	£1.50		
GEC 2110 line panel with transformer	£7.00		
GEC 2110 tuner unit + IF Panel	£12.00		
Pye/Chelsea Line up panel	£12.00		
Pye 205 Tuner	£3.90		
Pye 713 IF panel and tuner	£7.00		
Pye 713 Chroma	£10.00		
Pye/Chelsea Timebase panel with LOPT1	£10.00		
Pye 731 Frame Panel	£5.00		
Pye 731 Convergence Panel	£5.00		
Pye 731 Chroma	£10.00		
Pye 731 IF panel + tuner	£10.00		
GEC portable chassis + LOPT1 2114 New	£4.00		
G9 Power Panel	£6.00		
Mono RANK Chassis 127A NEW	£10.00		
NEW G9 Frame Panel	£4.00		
NEW G11 IF Panel	£10.00		
G8 Tuner Unit + Panel	£4.00		
G8 IF + Chroma	£6.00		
G8 Chroma	£3.00		
G11 IF Detector	£3.00		
G11 Selector gain module	£3		
Complete CVC 825 Chassis (both panels)	£40.00		
AEC V/Cap Resistor Unit UHF with IC	£3.00		
SAS600/SAS670	£3.00		
Z714 RANK IF Panels 6MHz 1 L.C.	£3.00		
SL437F	£3.00		
Z900B RANK IF Panels	£3.00		
Export 5.5MHz 2 L.C.'s	£2.50		
TBA1205B TCA2705Q	£2.50		
K35 IF	£1.50		
Z743 RANK IF Panel	£6.00		
Export 5.5MHz 3 L.C.'s	£6.00		
TBA750+SC9504P+	£1.50		
SC9503P	£1.50		
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch + lead	£5.00		
GVC V/cap VHF/UHF tuner and IF+	£1.00		
sound OP PC 70693 (Export)	£12.00		
GEC Line OP PC 659B3	£6.00		
2110 GEC Panel	£8.00		
CVC 20 Front panel with sliders + mains input panel	£4		
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots	£9.00		
8 button units	50p		
CVC slider pots panel	50p		
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T147 Rank tube base on panel	£1.00		
Z718 Focus Unit	£1.50		
Z718 Focus Unit	£1.00		
Large Tube	75p		
Decca Small	75p		
KT3 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	30p		
3500 Thorn Focus Unit	£1.00		
ITT Small for use with Split	£2.00		
Z718 Bush Focus	£2.00		
Diode	50p		
Remo TV12SP	50p		
1640 Thorn FITT Rec and Lead	50p		
TV14	50p		
TV20	£1.00		
TV45	50p		
Thorn 14/1500 rec stick	5p		
TX10 8 Button Unit	£10.00		
TX10TX100 16 Button	£10.00		
G11 drawer ASS 3 pots Mains switch and lead	£2.00		
K30 Drawer Ass with pots cable formie	£1.00		
TX10 Drawer with 8 way pots, ass.	£2.50		
TX10 Ex port with band switch (drawer)	£2.50		
Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228	£10		
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SR41	40p		
SR43	40p		
SR44	40p		
SR45	40p		
LR43	40p		
LR44	40p		
LR54	40p		
CR2032	40p		
10 500PF 2KV	20p		
.22/100K	20p		
1/250AC	20p		
1/100	5p		
1MFD 250AC	25p		
CVC 20-25-30 Mains Switches			
Infra Red and Ultrasonic G11 Teletext Decoder Panel			
RANK & ITI Mains Remote On-Off Switch (720R)			
RANK & ITI Remote Switch 2800 ohm			
G11 Mains Switch			
4 amp Mains Switch			
GEC Mains Switch 4 amp			
KT3 Mains Switch			
G11 Preh Red LED P/Button for C.H. Change			
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Mains Switch ITT Long Type Print			
Mains Switch Philip Long Type TAG			
Mains Switch GEC Long Type TAG			
2000 Chassis Fidelity Mains Switch (4 TAG)			
750V/4A White 6 pin Mains Switch			
K13-K30-K35 Full Remote Mains Switch (6 TAG)			
Teletext Adaptor kit TY-500 Panasonic			

230 MFD Sprague 385V	50p		
350V 300M 8 300M	£1.00		
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350V 400M	60p		
Thorn 3500	£1.00		
1750/100/350k	£1.00		
K13/200/25/25/385v	£1.00		
KT3-K30 220/40/40	75p		
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300V 300H 150V 100V 50MFD	£1.00		
350V	£2.00		
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47/250/50V	£60p		
150V/500V/100/100/320k	£2.00		
2500/2500/63V	50p		
150V/200V/300V	70p		
300V/100V/16/275v	£1.50		
100/200/325V	40p		
150V/500V/375V	£1.00		
200V/200/75/25M 375V	£1.50		
Thorn TX90 Caps 300V 500M 175V	£1.00		
300V/100V/32/32/300V	2.00		
150V/200V/30V	50p		
150V/500V/100/320k	£2.00		
100V/50V + 300V/200V/100/16/275v	£2.00		
225V 25/300 GEC	70p		
200V/100V/300V	£1.50		
500V/500/25V	£1.00		
150V/500V/300V	75p		
200V/500V/300V	1.00		
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Pye 725 10P	£6.00		
137 13 LOFTS	£6.00		
Thorn 8500-8800 LOPTS	£5.00		
CMC 301 front panel	£8.00		
CMC 303 front panel	£8.00		
CMC 302 Panel with IC mains switch etc	£8.00		
CMC 301 Decoder	£8.00		
G11	£1.50		
L.C. Receiver Panel	£3.00		
L.C. Power Supply G11 Full Remote Receiver Panel	£3.00		
PHILIPS SBC 469 Stereo Microphone	£23.00		
Meters H185 530	£17.00		
Meters H185 420	£15.00		
H185 HD5000 Digital Meter 1000V DC	£28.00		
750AC 10 Amp 20 MRG Rangers	£28		
ITT 100 Multimeter	£6.75		
ITT 300 Multimeter	£7.75		
ITT 500 Multimeter	£9.00		
ITT 1000 Digital	£20.00		
ITT 1000 Digital	£25.00		
ITT 5000 Digital	£25.00		
ITT 30000 Digital	£32.00		
ITT 80000 Digital	£37.00		
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Trans Voltz Ohms and Amps ranges	£60		
Infra Red Handset Tester			
Works at 24 lect - Sound repeater.			
Works off 9			

Tuner Units

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240 Volts Aerial Amps VHF-UHF 3 Way	£18.00
VHF-UHF with Data Tuner MEC1-F51	£3
F501 Family with Data Modest	
Thorn TX10 Export V/Cap UHF - VHF £3	
V/Cap Rank UHF Z7761/Unit	£6
V/Cap Rank UHF Z7731/Unit	£5
NEW G8 Tuner V/Cap	£3.50
1206 Push Button Unit	£2.50
ELC2000 on Panel	£2.50
GE2 2110 V/Cap	£5
EL16180	£20.00
ELC1042 NLW	£2.00
ELC1043 (Ex Panel)	£3.75
ELC2000	NEW £4.00
ELC2003	NEW £4.00
ELC2006	NEW £4.00
GE2 Tuner V/Cap Hitachi After	
1979 E FS48, FT547, ET541B	£8.00
ET546	£6.00
FT614 UHF Tuner	
ET560P UHF Very Small	£5.00
ET588P VHF/UHF Very Small	£5.00
UHF ET560P, small	£6.00
AST1-C UM1163	£10.00
V314 (VHF)	£5.00
V317 (VHF)	£5.00
V334 (VHF)	£5.00
U321	£6.00
U322	£8.00
U341 (UHF)	£6.00
U342 (UHF)	£5.00
U343 Phono	£4.00
U343C	£6.00
U343C	£10.00
U341 UHF	£4.00
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