

DECEMBER 1988

Australia \$3.25, New Zealand \$4.40 (inc. GST), Malaysia \$6.30,  
Ireland £1R2.13 (inc. VAT)

£1.40

# TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

**Extra inside – The HRS Commodore  
Computer Spares Catalogue**

Available to readers in  
the UK and Ireland only

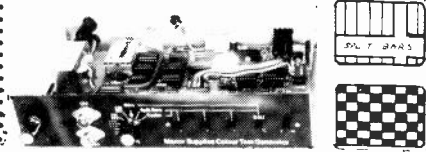


**The Modern TV/VCR Workshop  
Problems with LSI Chips • DX-TV  
Understanding Negative Feedback  
VCR Clinic • TV Fault Finding  
Test Report: The D100 Converter**

# MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR  
FOR DOMESTIC TV & VCR.

TEST  
DEMONSTRATIONS  
AT 172  
WEST END LANE



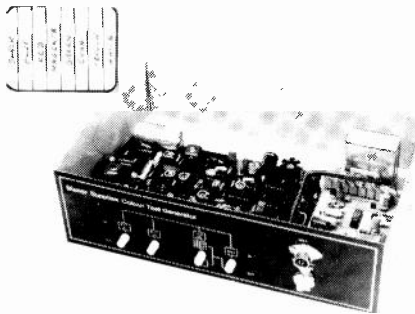
- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with 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 £3.00  
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 £3.00).**

MK 4 (BATTERY) BUILT & TESTED **£58.00 + £3.00 P & P.**  
MK 4 (MAINS) BUILT & TESTED **£68.00 + £3.00 P & P.**  
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS **£5.75.**  
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD  
VAT  
15%

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.  
CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync, and UHF Modulator. Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£13.50** p.p. 80p. (Alum. Case **£3.20** p.p. £1.40.)  
ADDITIONAL GREY SCALE Kit **£2.90** p.p. 45p.  
UHF SIGNAL STRENGTH METER KIT **£22.00** Alum. Case **£3.20**. De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. £2.50.  
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator - can be adapted for latest CRTs **£29.50** p.p. £3.00.

# TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF  
TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

PHILIPS KT3, K30 PANELS, tested, exchange, sound power, frame, RGB **£7.50** each, Decoder (Non-text) **£10.00** p.p. £1.50.  
THORN TX9 PANELS Complete & tested **£28.00** Exchange. (Shop only).  
THORN 8000 TO 8500 Panels tested exchange. Power **£7.80**, 8800, 9800 power **£8.80** p.p. £1.50, Frame **£10.00** p.p. £2.30.  
THORN TX9, TX10 Facia Control Panel Incl Infra Red Remote Receiver **£8.50** p.p. £2.00.  
BUSH 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.  
PHILIPS COLOUR MANUALS p.p. 80p.  
G11, K35, 2A **£3.50**, KT3 **£4.50**, CTX-E, CTX-S, CF1 **£1.50** each.  
THORN REMOTE CONTROL HANDSETS  
TX9, TX10 Infra red (Non-Text) **£18.00**; TX9, TX10 Infra red Teletext **£19.50**, p.p. £1.20. Large selection others available: Sony, Grundig, etc.  
TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. 50p.  
TX Remote panel 1564 (incl. SAA5012) **£5.00** p.p. £1.80.  
THORN TX9, TX10 Saw Filter IF Panel. **£5.00** p.p. 80p.  
TX9, TX10 Remote & tuning control panel (1515) **£7.50** p.p. £1.80.  
TELETEXT DECODER PANELS (TESTED)  
Mullard VM6101 **£25.00**, Philips KT3, K30 **£20.00**, p.p. £2.30  
MULLARD VM6230 TELETEXT DECODER (similar to VM6101) plus additional Prestel units VM6330 and Line Coupler, **£20.00** p.p. £3.00  
GEC 20AX Line Time Base **£18.00** p.p. £2.00.  
ITT CVC30 SERIES, Convergence & Purity Panels, **£2.50** p.p. £1.50.  
ITT CVC30 SERIES PANELS SURPLUS (untested) **£2.50** each. CMP31, CME31, CMA30, CM532, p.p. 80p; CMD33, p.p. £1.80.  
ITT CVC20, 30 Series chassis for spares (shop only) **£2.50**.  
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.  
PHILIPS G9 Power Supply Unit **£5.00** p.p. £2.30.  
PHILIPS G8/G9 IF/Decoder Panels for small spares incl ICs **£2.50** p.p. £1.60.  
GRUNDIG 8630 Series Varicap Tuners **£5.00** p.p. £1.00.  
VARICAP TUNERS U321, U322/204, ELC1043 (equiv.) **£7.80** p.p. £1.00.  
VHF Philips, NSF **£6.80** p.p. £1.00.  
VARICAP UHF-VHF ELC 2000S **£9.80** p.p. £1.00.  
UHF/625 TUNERS, many different types in stock. DECCA Bradford 5 position, MULLARD 4 position **£2.50**, JAP Rotary **£4.80** p.p. £1.80.  
LOPTS New and guar. P/P **£1.50**, Bobbins 80p.

FERG., HMV, MARCONI, ULTRA	R.B.M. T20, T22	£9.80
1590, 1591, 1612, 1613, 1712	R.B.M. T20, T22 Bobbin	£5.60
FERGUSON 3787 (Normende)	DECCA Bradford (state Mod No)	£8.80
THORN 1600, 1615, 1690, 1691, 1790	DECCA 100	£8.80
THORN 3000/3500/SCAN, EHT	FIDELITY ZX2000, 3000 (Not 227)	£15.50
THORN 8000	GEC 2110 series	£10.60
THORN 9000 to 9600	ITT CVC 5 to 9, CVC 20	£9.80
THORN TX9	ITT CVC 25, CVC 30 series	£8.80
THORN TX10	ITT CVC 45	£9.80
	PYE 725 (90°) 731 to 741	£9.20
	DECCA 70, 80	£3.50
	PHILIPS G8	£8.80
	PHILIPS G9	£7.80
	PHILIPS KT3	£9.80
	PHILIPS K30, K35	£27.00
	PHILIPS G11	£5.00
	PHILIPS CTX-E	£22.50
	GEC 2028, 2040, 2100	£2.80
	PHILIPS CTX-S	£22.50
	PYE 691-7 chassis type only	£5.00

OTHERS AVAILABLE, PRICES ON REQUEST.

TRIPLERS Full range available. Mono & Colour.

SPECIAL OFFER TRIPLERS

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 **£8.50** p.p. £1.00.  
PHILIPS G8 6 position selector units (sloping buttons) **£2.50** p.p. £1.00.  
455 CRYSTALS for Remote Control Handsets, 4 for **£1.00** p.p. 50p.  
VHF to UHF Converters **£26.50** p.p. £2.50.  
HELICAL POTS (standard 100K), 6 for **£1.00** p.p. 50p.

CALLERS WELCOME AT SHOP PREMISES

THOUSANDS OF ADDITIONAL ITEMS, ENQUIRIES INVITED  
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS  
Goods available if in stock immediately over shop counter (Mail order between 3 days and 1 week from receipt of order). ADD VAT 15%

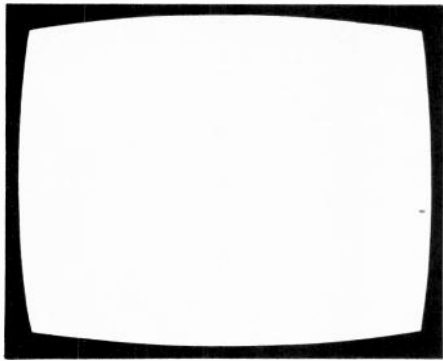
Telephone 01-794 8751, 794 7346

## MANOR SUPPLIES

172 WEST END LANE, LONDON, NW6 1SD

100 yds: W. Hampstead Tube Stn. (Jubilee) Buses 28, 159, C11 pass door  
W. Hampstead Brit. Rail Stn. (Richmond, Dalston, Stratford, N. Woolwich)  
W. Hampstead Brit. Rail Stn. (Bedford, Luton, Kings X, Crawley, Gatwick, Brighton)  
Access from all over Greater London.

PLEASE ADD VAT 15% TO ALL PRICES INCL P+P



# TELEVISION

December  
1988

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Issue 458

On sale November 16th

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## INDEXES

Indexes to Vols. 35, 36 and 37 are available at 80p each from the Editorial Office (address above).

## SUBSCRIPTIONS

An annual subscription costs £18 in the UK, £21 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

## BACK NUMBERS

Subject to availability, copies of issues published during the last 12 months are available at £1.80 each from Television, Vouchcheck Services, Unit A6, Poplar Business Park, Prestons Road, London E14 9LR. Please make cheques/postal orders payable to IPC Magazines Ltd.

## 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

- 93 Leader**
- 94 Understanding Negative Feedback** *S.W. Amos, B.Sc., C.Eng., M.I.E.E.*  
This widely used electronic technique is very often misunderstood. An account of the ways in which feedback signals are derived and injected and the effects of this on other circuit characteristics.
- 96 Corrections**
- 99 The Modern TV/VCR Workshop** *David Botto*  
How to organise and equip a workshop to meet the needs of today's servicing – doing it right makes all the difference when it comes to profitability. Also advice on the business side of servicing.
- 104 Teletopics**  
News, comments and developments.
- 106 Servicing the Panasonic NV333 and NV366, Part 2** *Nick Beer*  
This concluding instalment deals with faults experienced in the electronic side of these popular machines.
- 108 TV Fault Finding**  
Reports from Eugene Trundle, M.K. Hayter, J.R. Armagh, John Coombes, Mick Dutton, Nick Beer and Alfred Damp.
- 110 Test Report: The HS D100 Converter** *Roger Bunney*  
The D100 converter provides tuning throughout the v.h.f./u.h.f. TV bands with up-conversion of v.h.f. signals to u.h.f. and switched variable selectivity. The De Luxe version also caters for the sound signals, with tuning across the standard spacings independently of the vision bandwidth selected.
- 112 The Butt of Lewis** *Les Lawry-Johns*  
SEME's Stan gets sent off to the Outer Hebrides while, closer to home, Beardy and Non-Beardy put in another appearance.
- 114 Letters**
- 116 Servicing with L.S.I. Devices** *Nick Beer*  
Advice on how to deal with the l.s.i./surface-mounted devices increasingly used in domestic electronic equipment.
- 117 Next Month in Television**
- 118 How to run Your Vintage TVs, Part 2** *Jeffrey D. Borin, B.Sc. (Eng.), A.M.I.E.E.*  
This time the r.f. side and useful ancillary equipment.
- 122 VCR Clinic**  
Reports from Eugene Trundle, Nick Beer, Philip Blundell, Eng. Tech. and Ian Bowden.
- 124 Long-distance Television** *Roger Bunney*  
Reports on DX conditions and reception and news from abroad. Details of the Astra Sky Television channel allocations.
- 126 A Day in the Life of . . .** *Mick Dutton*  
Following recent correspondence on the problems of today's servicing, Mick Dutton recounts a typical day's experiences.
- 128 Service Bureau**
- 129 Test Case 312**

OUR NEXT ISSUE DATED JANUARY WILL  
BE PUBLISHED ON DECEMBER 21



VIDEO BELT KITS

Table listing video belt kits with columns for kit number, brand, and price. Includes items like AKAI 9300/9500/8800 and various Sony models.

PRICES DOWN

VIDEO PINCH ROLLERS

Table listing video pinch rollers with columns for brand, model, and price. Includes models like NV7000, VT6300, etc.

PRICES DOWN

VIDEO IDLER TYRES

Table listing video idler tyres with columns for size, D.Dia, L.Dia, Width, and price.

ANTEX

Table listing Antex products such as C15 Iron 240v, C240 Element, etc.

SERVISOL

Table listing Servisol maintenance products like Freeze It, Super Servisol, etc.

TURBO RECHARGEABLES

Table listing turbo rechargeable products like Drill Kit, Solid Iron Kit, etc.

BELLS/BOXES

Table listing bells and boxes products like A75 SHORROCK ACORN 75 PANEL, etc.

SOUNDERS/SIRENS

Table listing sounders and sirens products like S2 712 EXTERNAL SIREN, etc.

VIDEO SPARES

WE HAVE A LARGER RANGE LISTED UNDER SPECIFIC MANUFACTURERS IN CATALOGUE FOR THORN, SONY, HITACHI, FIDELITY, NATIONAL PANASONIC, PHILIPS.

REFURBISHED HEADS (Exchange)

Equivalents Chart in Catalogue THORN NEW LIFE (Most VHS types) 19.00 THORN NEW LIFE (National Panasonic) 21.00

ORDERS WELCOME FROM SCHOOLS, COLLEGES, GOVERNMENT ESTABL.

SPECIAL PRICES ON 5+ MIX VIDEO HEADS PLEASE ASK VIDEO TAPE

REPLACEMENT VIDEO HEADS

Table listing replacement video heads for various brands like AKAI, JVC, etc.

JVC

Table listing JVC video heads with columns for model, price, and description.

NAT. PAN.

Table listing National Panasonic video heads.

TOSHIBA

Table listing Toshiba video heads.

SANYO/FISHER

Table listing Sanyo/Fisher video heads.

PHILIPS

Table listing Philips video heads.

FERGUSON

Table listing Ferguson video heads.

NEC

Table listing NEC video heads.

HITACHI

Table listing Hitachi video heads.

SONY

Table listing Sony video heads.

SHARP

Table listing Sharp video heads.

GENUINE HEADS

Table listing genuine video heads.

SUNDRIES

Table listing sundries products like VHS DRUM MOTOR, etc.

GEN PURPOSE VHS LAMP ONLY

WE HAVE A FULL RANGE OF VIDEO LAMPS AVAILABLE UNDER 'SPECIAL SPARES'

PHILIPS VHS IDLER £3.50

P.V. TUBES FOR ALL YOUR COMPONENTS

P&P 87p up to 1k then 2.50 + VAT over 7.50 + VAT Next day delivery

SWITCHES

Table listing various types of switches with columns for part number and price.

Please send large SAE (30p stamp) for our complete catalogue

EXPORT ORDERS WELCOME

REMOTE HAND SETS FAST - FAIR - EFFICIENT SERVICE

SPECIAL TUBE PRICES

AMSTRAD

Table listing Amstrad remote hand sets.

FIDELITY

Table listing Fidelity remote hand sets.

GRUNDIG

Table listing Grundig remote hand sets.

NEW PRC6000 Programmable Remote Control

Table listing details for the PRC6000 remote control.

DECCA

Table listing Decca remote hand sets.

THORN/FERGUSON

Table listing Thorn/Ferguson remote hand sets.

PHILIPS

Table listing Philips remote hand sets.

SONY

Table listing Sony remote hand sets.

ITT

Table listing ITT remote hand sets.

GEC

Table listing GEC remote hand sets.

JVC

Table listing JVC remote hand sets.

PLEASE NOTE THAT SOME HANDSETS ARE MANUFACTURED WITH BUILT IN FOOTLIGHT ALTERNATIVE TYPE

SECURITY EQUIPMENT

INFRA RED/SECURITY LIGHTS

Table listing security equipment products like SHORROCK, ORION, etc.

RECHG. BATTERIES

Table listing rechargable batteries.

S.A.B. MODULES

Table listing S.A.B. modules.

NEW RACAL EXTERNAL SECURITY LIGHT

Fluorescent (wired to main) £47.50

SUNDRIES

Table listing sundries products like XENON FLASHERS, CONTACTS, etc.

CONFUSED? DON'T BE - IT'S EASY!

TYPICAL PACKAGE FOR 3 BED HOUSE

£120

List of items included in the £120 package: 2 Zone Panel, Rechargeable Battery, etc.

P.V. TUBES

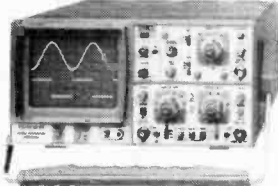
TEL: 0254 36521 24 hour 32611 answer 390936 phone TELEX: 635562 GRIFFIN G FOR P.V. FAX No. 0254 395361

**HOW TO INCREASE YOUR PROFITS, IMPROVE YOUR SERVICE, WITH COST EFFECTIVE TEST EQUIPMENT.**

**HAMEG OSCILLOSCOPES**

HAMEG are Europe's top selling DUAL TRACE OSCILLOSCOPES. Select from four superb models. All, with the exception of the HM 1005, incorporate a useful COMPONENT TESTER. Size - all models - 285mm x 145mm x 390mm. Clear display 8 x 10cm. Mains supply: 110/125/220/240V AC 50/60Hz.  
 All supplied with 2 PROBES, a COMPREHENSIVE MANUAL and a 2 YEAR WARRANTY.

**HM203-6 20MHz STANDARD**

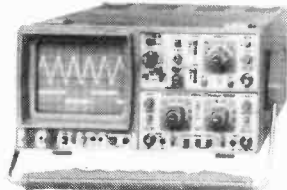


Price £314.00 + £47.10 V.A.T.

- SPECIFICATION**
- \* 2 Channels
  - \* Bandwidth: DC-20MHz
  - \* Sens: Ch1, Ch2, 2mV/cm
  - \* Timebase: 0.2s-20ms/cm
  - \* Triggering: DC-40MHz
  - \* Active TV-Sync-Separator
  - \* Variable hold-off
  - \* Trigger LED indicator
  - \* Calibrator: 1KHz Square wave
  - \* Component tester
  - \* Plus many features

FREE Securicor Delivery

**HM604 60MHz UNIVERSAL**

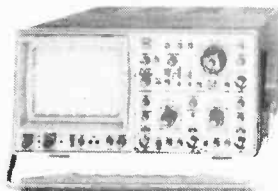


- SPECIFICATION**
- \* 2 Channels
  - \* Bandwidth: DC-60MHz
  - \* Sens: Ch1, Ch2, 1mV/cm
  - \* Timebase: 2.5s-5ns/cm
  - \* Triggering: DC-80MHz
  - \* Active TV-Sync-Separator
  - \* After delay trigger
  - \* Sweep delay
  - \* Delay line
  - \* Trigger LED indicator
  - \* Calibrator: 1KHz & 1MHz Sq Wave
  - \* Component tester
  - \* Plus many more superb features

Price £575.00 + £86.25 V.A.T.

FREE Securicor Delivery

**HM1005 100MHz UNIVERSAL**



Price £726.00 + £108.90 V.A.T.

3 CHANNELS-UP TO 6 TRACES

- SPECIFICATION**
- \* 3 Channels
  - \* Bandwidth: DC-100MHz
  - \* Sens: Ch1, Ch2, Ch3, 1mV/cm
  - \* Timebase A: 2.5s-5ns/cm
  - \* Timebase B: 0.2s-5ns/cm
  - \* Triggering: DC-130MHz
  - \* After delay trigger
  - \* Delay line
  - \* Trigger LED indicator
  - \* Overscan LED indicator
  - \* Active TV-Sync-Separator
  - \* Calibrator: 1KHz & 1MHz Sq Wave
  - \* Plus many more excellent features

FREE Securicor Delivery

**HM205-2 20MHz DIGITAL STORAGE**

- SPECIFICATION**
- \* Digital Storage
  - \* Analogue real time (Same as 203-6)
  - \* Bandwidth: DC-20MHz
  - \* Sens: Ch1, Ch2, 2mV/cm
  - \* Timebase Analogue: 0.2s-20ns/cm
  - \* Timebase Digital: 5s-2µs/cm
  - \* Triggering DC-40MHz
  - \* Active TV-Sync-Separator
  - \* Max sampling rate: 2x5MHz
  - \* Memory: 2x1024x8 Bit
  - \* Dot joiner
  - \* Printer/plotter output
  - \* Component tester
  - \* Plus many more useful features

Price £527.00 + £79.05 V.A.T.

FREE Securicor Delivery

**B.K.'s CRT TESTER-REJUVENATOR**



Tests and rejuvenates blue, green & red guns separately. Fitted with delta and P.I.L. sockets. Compact size 120x65x60 mm. Supply 240V AC

Price £32.00 + £4.80 V.A.T.

**B.K.'s REVOLUTIONARY DYNAMIC 'LOPT' TESTER**

Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal. Size 75x100x40 mm. Supply 240V AC

Price £25.99 + £3.90 V.A.T.



**THANDAR SC110A PORTABLE OSCILLOSCOPE**



Price £195.00 + £29.25 V.A.T.

- \* Full trg. fac. inc. TV frame etc.
- \* Only 2 1/4" thick
- \* Fits in a brief case
- \* Sens: 10mV
- \* Bandwidth 10MHz
- \* Battery or mains adaptor
- \* Size 255mm x 148mm x 50mm

**ACCESSORIES**

- \* Carry Case £6.25 + £0.93 V.A.T.
- \* Probe £7.50 + £1.30 V.A.T.
- \* Mains Adaptor £7.30 + £1.09 V.A.T.

**DIGITAL LCR METER**

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

Price £95.00 + £14.25 V.A.T.



**INSULATION TESTER 500V**



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

Price £65.00 + £9.75 V.A.T.

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The number one CRT Test Instrument. Over 5000 U.K. Television engineers wouldn't be without it.

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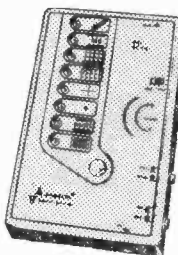
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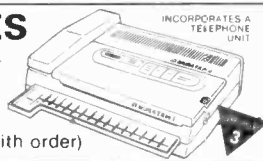
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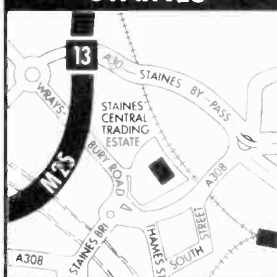
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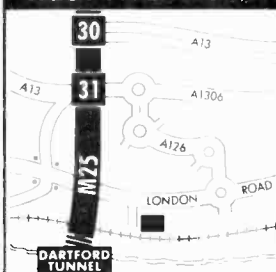
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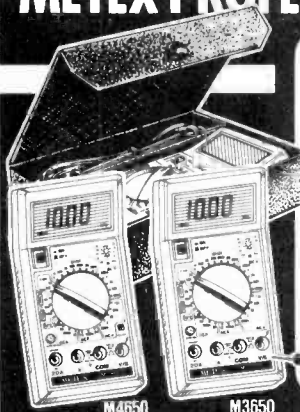
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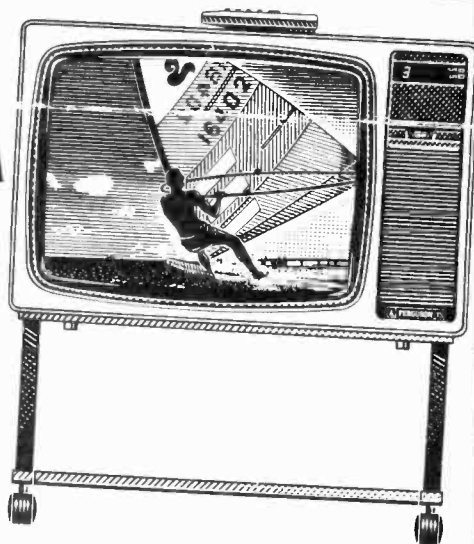
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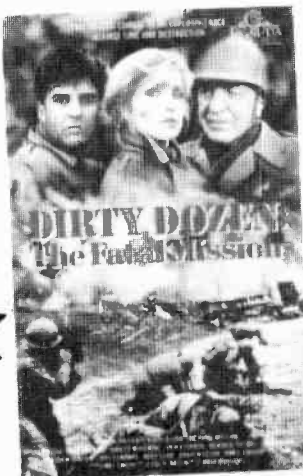
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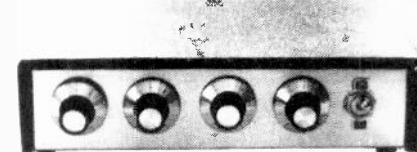


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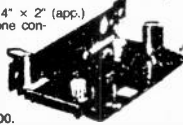
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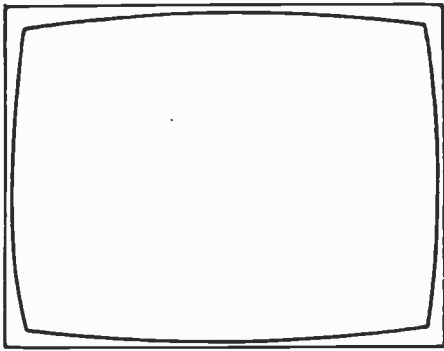
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# TELEVISION

## Broadcasting Revolution?

Publication of the government's white paper on the future of broadcasting in the UK is due in mid-November, a week or so after this is being written. Perhaps one should have waited for the full paper to become available before taking up the subject. The contents of the white paper have already been widely leaked however. In fact it would appear that after virtually each of the Cabinet Committee's meetings on the subject in recent weeks the results were made known. This culminated in a detailed briefing on the contents of the white paper given to the political correspondents of the national dailies on October 27th. The result of that was banner headlines in some newspapers to the effect that the BBC would be moving to "pay TV" funding.

This business of government by leak is increasingly becoming the practice in many countries. One can't help feeling that the aim is to get the fuss over before actual proposals become officially known, by which time the public will have probably lost interest or become totally confused so that unpopular measures can be slipped through without too much notice.

Be that as it may, the government's proposals taken as a whole do not appear to be excessively dramatic, though the Home Secretary Douglas Hurd has promised that they will be "controversial". The BBC and Channel 4 are, for the time being anyway, to be left much as they are. The BBC is to be encouraged to adopt financing methods other than the licence fee, the options to include subscription TV and sponsorship. The BBC is of course safeguarded to some extent by the fact that its Royal Charter does not come up for renewal until 1996. Channel 4 is also likely to remain substantially as at present, though there are suggestions of privatisation and the way in which its advertising time is sold will probably change. The terrestrial Channel 5 is to come into being, probably in the mid-1990s - that was always likely once its technical feasibility had been established - and local TV via microwave distribution is likely to be encouraged.

The main changes will be in the ITV field, where the talk is of "deregulation". This will include the end of the IBA, its residual functions being taken over by a new commercial TV authority which will also be responsible for satellite and cable TV etc. Renewal of the ITV franchises (from January 1st 1993) will be for an eight-year period, as at present, but will be by competitive tendering after an initial assessment of programme plans. It will be possible to buy and sell the ITV companies, whose long-term ownership will thus become an unknown factor. The public service obligations of ITV are to be removed, though extensive obligations will remain - in terms of the quality and variety of programming and the provision of national and international news. It's not clear how these obligations are to be monitored and enforced once the IBA has gone - the aim seems to be to apply a lighter control than at present, via the new commercial TV authority.

Quite why it's thought desirable to alter the present ITV system is difficult to fathom. The service it provides is popular, and the system works well - proved by the passage of time. It seems that the main opposition to the present system comes from the advertising industry, which thinks that it has to pay too much. It's hard to see why much attention should be paid to the feelings of the advertising agencies, especially as the new services, some imminent, will provide plenty of competition and additional opportunities for advertising.

Mr. Hurd claims that the aim of the white paper proposals will be to offer greater choice and more competition while quality is maintained. To do so he has only to leave things as they are and see what the competition from Sky Television and the other Astra channels, the BSB's DBS services and the new Channel 5 brings about. It is in particular puzzling why the IBA, which has been eminently successful in carrying out a tricky task, should be unceremoniously dumped in the way proposed. Maybe the view is that its job will no longer be necessary in the era of satellite TV and the other new services. But since some control is envisaged, the logic of abandoning a proved organisation is curious to say the least.

The government seems at any rate to have moved from earlier views that broadcasting should be treated rather like the provision of newspapers - left to the marketplace to provide what the public will pay for. At the other extreme you could argue that TV is now part of our national heritage, like say the National Gallery, the Royal Opera House and Westminster Abbey. The public doesn't visit these daily and they are not paid for in a commercial sense, but no one disputes that we would be worse off without them. Even those of us who don't watch the stuff have an interest in television's well being. It is rather difficult to decide on the appropriate way of looking at our present broadcasting arrangements, between this view on the one hand and considering them to be akin to newspaper publishing on the other - but the fact is that broadcasting arrangements that have established their ability and worth have a right to be defended against those who can't see further than payment for services rendered. The *Financial Times* recently ran an extremely interesting series on broadcasting in various comparable countries. As on so many previous occasions, the conclusion drawn is that the UK's system works well and provides superior programming. It's early days yet, since the aim of the white paper appears to be to present proposals and options and open up debate, but the radical case has certainly not been made to date. The problem could simply be that the government feels it has to be seen to be doing something. That, in any context, is all too often the road to disaster.

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The modern TV/VCR workshop, spacious, well-lit and featuring a form of combined trolley/workbench. See article starting on page 99.

# Understanding Negative Feedback

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

During a long career spent teaching the fundamentals of electronics I've found that a subject which repeatedly causes difficulty is negative feedback. One of the reasons for this is the use of misleading terminology. For example, it's excusable to think that voltage feedback is feedback of a signal in the form of a voltage, to a valve or f.e.t. perhaps. Similarly you might think that current feedback is feedback of a current, say to a bipolar transistor. Both are wrong. The terms 'voltage' and 'current' in voltage and current feedback refer to the way in which the feedback signal is derived, and have nothing to do with the nature of the feedback signal itself. In fact a voltage feedback signal may well be a current while a current feedback signal can equally be a voltage. Fortunately the terms voltage and current feedback are being abandoned in favour of the less confusing alternatives mentioned later.

Another source of confusion lies in the type of feedback provided by an unbypassed emitter resistor. This is sometimes described as voltage feedback and at other times as current feedback. As we shall see, both can be correct. But in at least one recent edition of a highly-respected textbook the type of feedback is wrongly described. The aim of this article then is to clarify a subject over which even the experts can be wrong.

## Basic Features of Negative Feedback

Negative feedback is essentially a process in which a signal derived from one point in an amplifying chain is reintroduced at an earlier point in opposite polarity to the input signal at that point. This naturally reduces the amplifier's gain. The apparent disadvantage of this is outweighed by fact that negative feedback improves the linearity and frequency response of the circuitry embraced by the feedback loop. Thus distortion is reduced, and in addition the use of negative feedback can give the input and output points the values of input and output resistance required. But perhaps the most useful feature of negative feedback is that, if applied in sufficient degree, it makes the gain, frequency response and terminating resistances independent of the characteristics of the active devices used within the feedback loop. These characteristics are then determined solely by the constants of the feedback loop. This is of course a great advantage with mass-produced equipment.

The precise effect of negative feedback on the input and output resistance depends on the way in which the feedback signal is taken from the amplifier and is then reintroduced into it. In general there are two ways in which this can be done. Let's deal with the derivation of feedback first.

## Derivation of a Feedback Signal

Feedback can be taken from a potential divider connected across the output terminals as shown in Fig. 1(a). If you want to return the whole of the output signal as feedback there is no need for a divider and the feedback signal can be taken directly from the output terminals as shown in Fig. 1(b). In both cases the feedback signal is

directly proportional to the output voltage. This is commonly referred to as voltage negative feedback: a better term is parallel-derived or shunt-derived feedback, since the feedback signal is taken from across the output load itself or from components connected in parallel with the load. Negative feedback derived in this way reduces the effective output resistance of the amplifier, tending to make the output voltage independent of changes in the load resistance.

The second way in which a feedback signal can be taken from an amplifier is to take it from across a resistor (or other component) that's connected in series with the output load, as shown in Fig. 2(a). To minimise loss of output signal, the value of the series component is made small compared with the output load. It's often not necessary to introduce a series component specifically for feedback: as shown in Fig. 2(b), the emitter resistor of a transistor amplifying stage can be used as a feedback resistor without affecting any other function, such as biasing or current stabilising, performed by the resistor. The emitter resistor has to be without decoupling of course. In this case the negative feedback is directly proportional to the current in the output load. For this reason the term current feedback came into use: a better term is series-derived feedback. This time the feedback has the effect of increasing the amplifier's output resistance, tending to make the output current independent of changes in the load resistance.

Since shunt-derived feedback decreases the amplifier's

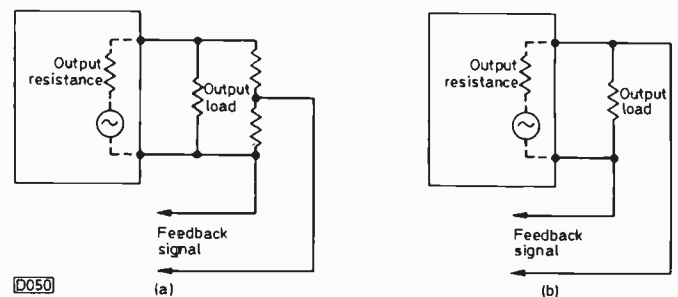


Fig. 1: Basic connections for shunt/parallel-derived feedback (a) using a potential divider and (b) where the entire output signal is returned as feedback. Parallel-derived feedback is often misleadingly referred to as voltage feedback.

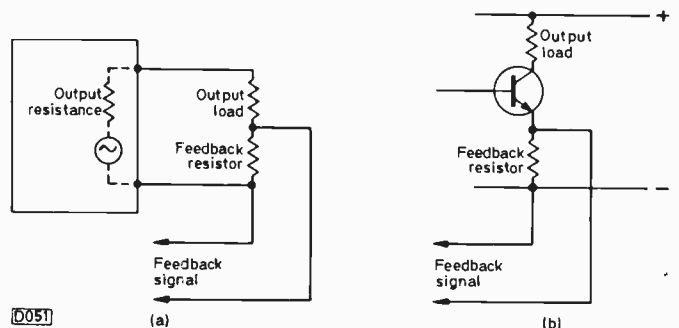


Fig. 2: Basic connections for series-derived feedback, (a) using a small resistor specifically added for the purpose and (b) using an emitter resistor already present. Series-derived feedback is often misleadingly referred to as current feedback.



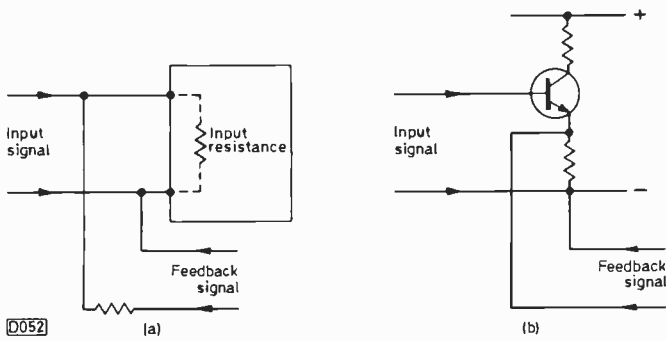


Fig. 3: Basic connections for (a) shunt-injected feedback and (b) series-injected feedback applied to a common-emitter amplifier stage.

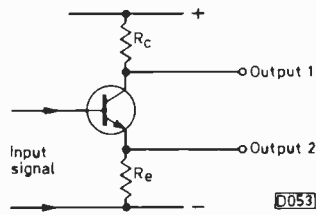


Fig. 4: The emitter resistor  $R_e$ , being undecoupled, provides negative feedback - but is it shunt- or series-derived? See text.

output resistance while series-derived feedback increases the output resistance, it follows that any desired value of output resistance can be obtained by using a suitable amount of one or the other type of feedback.

It's sometimes argued that the distinction between the two types of feedback derivation is an artificial one - that with series-derived feedback the series feedback resistor and the load resistor form a potential divider across the output terminals so that the method is essentially the same as with shunt derivation. That there is a very significant difference between them is however easily shown by considering the effect of varying the load resistance. Suppose for example that the load is inductive, so that its impedance increases as the frequency rises. The increased impedance causes the current in the output circuit to fall: the voltage across the output resistance will thus fall while the voltage across the load will rise. A shunt-derived feedback signal will therefore increase as frequency rises, acting to minimise the rise in voltage across the load. But a series-derived feedback signal will fall as frequency rises, acting to emphasise the rise in voltage across the load. Shunt-derived feedback tries to keep the output voltage constant while series-derived feedback aims to keep the output current constant.

### Injection of Feedback

In the same way the feedback signal can be injected in parallel with or in series with the input signal. In Fig. 3(a) the feedback and input signals are connected in parallel - this is an example of parallel- or shunt-injected feedback. Connection in this way has the effect of reducing the input resistance of the amplifier, making the amplifier more suitable for receiving input signals in the form of currents.

Alternatively, the two signals can be connected in series. This series-injection method is usually put into effect by applying the feedback signal to one of the amplifier's input terminals while the input signal is applied to the other terminal. For example - see Fig. 3(b) - the feedback signal could be injected at the emitter terminal of a common-emitter stage while the input signal is applied to the base. With a bipolar transistor the collector current is determined by the signal applied between the base and the emitter. In the example being considered this

consists of the input signal between the base and supply negative and the feedback signal between supply negative and the emitter, the two being connected in series. Series injection has the effect of increasing the effective input resistance of the amplifier, making it more suitable for receiving input signals in the form of voltages.

### The Concertina Phase Splitter

Let's return to the point mentioned at the beginning of this article, about the feedback provided by an unbypassed emitter resistor. Fig. 4 shows a transistor with two output terminals, one at the collector and the other at the emitter. The emitter resistor  $R_e$  is without decoupling and thus provides negative feedback which, as just described, is series-injected with respect to the input, increasing the input resistance of the stage. But is the feedback provided by the emitter resistor series- or shunt-derived? Is the emitter resistor in shunt with the output load or in series with it?

It depends of course on where the output load is. If the output is taken from the collector, the emitter resistor is in series with the output load (which can be taken as  $R_c$ ) and the feedback is series-derived, increasing the output resistance. If the emitter connection is used as the output terminal however the feedback signal is generated across the output load ( $R_e$ ). This is parallel-derived feedback, which decreases the output resistance - in fact the stage is an emitter-follower.

Does the type of feedback derivation matter? It could. Suppose for instance that  $R_c$  and  $R_e$  are equal-value resistors and that the two output terminals are being used to supply the drive for a push-pull output stage: in other

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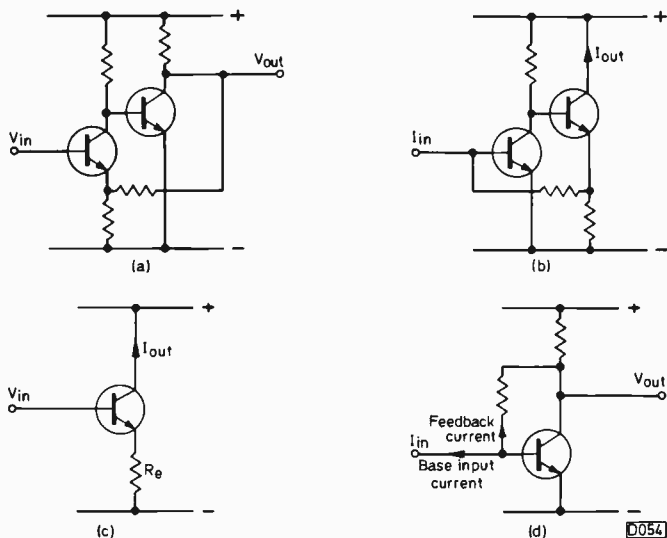


Fig. 5: Skeleton circuits illustrating shunt and series methods of deriving and injecting feedback – (a) shows a voltage amplifier, (b) a current amplifier, (c) a voltage-to-current converter and (d) a current-to-voltage converter.

words suppose that Fig. 4 represents a concertina phase splitter. We thus obtain equal-amplitude signals from the two output terminals but one acts as a high-resistance generator while the other is a low-resistance source. Whether the effective output resistance is high or low can be important if the phase splitter is required to operate at high frequencies, for example in an oscilloscope or a video circuit, where shunt capacitance can have an effect – if both outputs are shunted by the same value of capacitance, the high-resistance output will show progressively increasing loss with respect to the other output as the frequency rises.

The effects of the two types of feedback on the input and output resistance are summarised in Table 1.

### Choice of Feedback

Any form of negative feedback improves the linearity and frequency response, thus reducing distortion. But which of the two methods of deriving and injecting feedback should we use? The choice depends primarily on whether a high or low input or output resistance is required.

If the amplifier is to be used to provide considerable output power, for example to drive a loudspeaker, the damping provided by a low output resistance is useful. Thus shunt derivation is the obvious choice. If the amplifier is required to provide an output in the form of a voltage that is to be transferred to the following stage or equipment without loss, the amplifier's output resistance must be small compared with the input resistance to which it is connected. Thus shunt-derived feedback is again appropriate. If a current output is required, for this to be transferred to the following equipment without loss the output resistance must be large compared to the input

Table 1: Effect of feedback on input/output resistances.

Type of feedback	Input resistance	Output resistance
Series-derived	–	Increased
Shunt-derived	–	Decreased
Series-injected	Increased	–
Shunt-injected	Decreased	–

resistance it drives. Series-derived feedback is thus called for.

Similar arguments apply at the feedback injection point. If the input signal is in the form of a voltage, the input resistance must be large compared with the output resistance of the signal source. So series injection should be adopted. If the input signal is a current, the input resistance should be small compared with the output resistance of the current source and the obvious choice is shunt injection.

An amplifier intended for use with voltage signals at its input and output requires a high input resistance and a low output resistance. This suggests the use of shunt-derived and series-injected feedback. Fig. 5(a) shows in skeleton form a possible circuit for such an amplifier. An amplifier for current waveforms at the input and output calls for a low input resistance and a high output resistance. This means series derivation and a shunt injection, Fig. 5(b) showing the basic form of a current amplifier.

Amplifiers are not always intended for use solely with voltage signals or with current signals. There are occasions where the input signal is in the form of a voltage and the corresponding output signal is required to be in current form. Clearly such an amplifier requires the input and output resistances to be high, suggesting series derivation and series injection – see Fig. 5(c). Alternatively we may wish to accept a current input from which to develop a corresponding voltage output. This time the input and output resistances must be low and the feedback should accordingly be shunt derived and injected – see Fig. 5(d).

As we saw earlier, the feedback injection in Fig. 5(c) is in series since the base-emitter voltage consists of the input and feedback voltages in series. It's interesting to note that this circuit is the dual (see *Television* December 1987, pages 123-5) of the arrangement shown in Fig. 5(d), where the base current consists of the parallel input and feedback currents.

## CORRECTIONS

**A Tifax/VM6101 Conversion (August 1988):** For correct operation of the keypad-decoder interface circuit the strobe input pin 7 of the 74151 data selector/multiplexer chip must be earthed. The video input to the VM6101/6103 module should be taken from pin 6 of plug A in the Manor Supplies unit, with pin 7 of this plug left connected to the output from the i.f. strip. The blanking input from the VM6101 module is connected to pin 9 of plug A, pin 5 is the chassis connection and there are no external connections to pins 1, 2, 3, 4 and 8.

**The Tatung/Decca 120/130 Chassis (October 1988):** It should have been made clear that for VCR compatibility with the 130 series chassis channels 6, 16 or 26 should be used.

**Test Report, Hameg HM205 Oscilloscope (October 1988):** Under the heading Digital Storage "waveforms can be held in this way even when the scope is switched off" should have read "when the storage is switched off", i.e. when switching from store to the analogue mode. Note that the specification for the digital mode applies to the HM205-2 (the HM205 has a maximum sampling rate of 100kHz).

**Letters (November 1988):** In Nick Beer's letter (page 38) the comment on checking the chopper drive waveform in the Decca 70/90 series chassis should have said measure "from TP605 with respect to TP604 with the 1A fuse lifted", not "with the fuse fitted".

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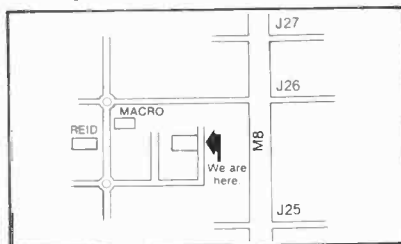
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# The Modern TV/VCR Workshop

David Botto

Steve staggered into the workshop carrying a heavy TV set. He couldn't see a clear space to put it down, so he plonked it on top of another customer's perfectly polished set. He then fought his way to his rickety bench through assorted piles of old scrap sets and derelict chassis. Next he cleared a space just large enough for the set he'd brought in. He then had to pick it up once more and carry it the entire length of the large workshop to get it on to his bench.

After a fruitless search through an enormous pile of manuals for the service data he wanted, followed by a successful search for his Phillips screwdriver, he removed the back of the receiver. The next problem was to locate the tatty test leads of his ancient analogue meter. After a few hefty taps he succeeded in freeing its sticking pointer and started to check the receiver's power supply.

Are there workshops like Steve's today? We hope not. Yet some we've seen come very close to the above description. This kind of workshop never seems to show much profit. "You can't make servicing pay" the argument runs, "so why spend money on improving the facilities?"

## The Profitable Workshop

Is it possible for a TV/VCR workshop to show a substantial profit? The answer is definitely yes — provided it's properly organised and equipped.

It's important to remember that an engineer has just so much energy to use in a day. If this energy is wasted in heaving heavy sets around, stumbling over piles of old sets, parts and other items, and in lengthy searches for tools, parts and data, frustration will build up. His energy is being wasted instead of being devoted to profitable repairs. This applies equally to a large service department employing several TV/VCR engineers and to a small workshop operated by someone who is self-employed.

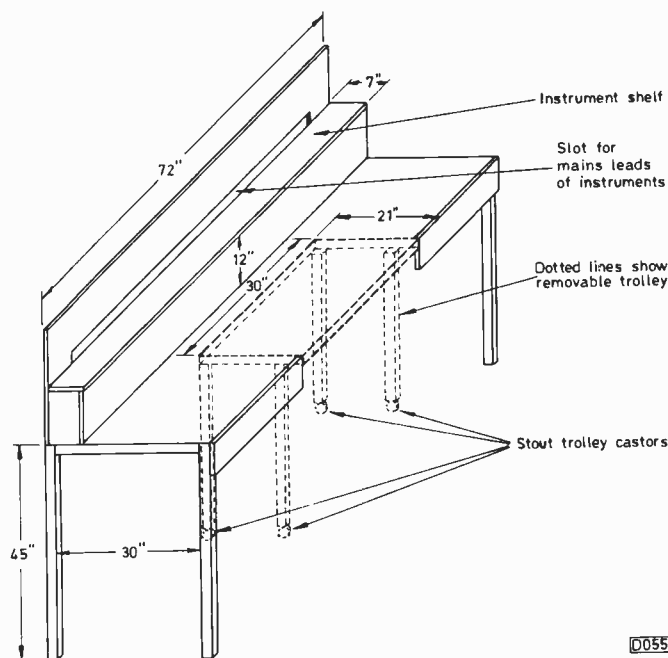


Fig. 1: Workbench with removable trolley section. Dimensions can be varied to suit individual requirements.

Efficient working is possible only when the engineer is happy in his work. The first requirement for this is that the basic workshop conditions are right. This includes being spotlessly clean and properly painted. The ventilation must be adequate, without draughts. You can't work properly if you're shivering with cold, so in winter the heating must be good.

It should not be necessary for others to go through the workshop to reach some destination, maybe banging heavy doors or leaving them wide open. This is distracting to the engineer and all too often happens when he's in the middle of dealing with a particularly trying fault. The workshop location should be carefully chosen, not tucked away in any old place that the sales and office departments don't happen to need.

Some engineers have found that one or more ion generators help to keep the air clean and the engineer's mind clear. It also helps if the engineer looks professional. A clean white coat and neat appearance impress the customer and enhance the engineer's self esteem.

If these common-sense suggestions are followed, at the end of each working day the engineer will still be reasonably fresh and able to enjoy his evening. This is much better than staggering home feeling mentally shattered and physically exhausted.

## Workbench Design

Correct bench design is a key factor in determining whether the workshop makes substantial profits or heavy losses. Despite this, in many workshops little thought is given to the design of the service bench, which often consists of a few planks of wood supported by a wooden framework. This old-fashioned type of bench has no place in the modern TV/VCR workshop.

Many engineers suffer from back problems caused by lifting heavy sets etc. on to and off the bench, on to storage shelves and in and out of service vans. Most of this can be eliminated by using a bench of modern construction.

Fig. 1 shows a suggested design — once you've worked on a bench of this type you'll wonder how you ever managed without it. When a heavy TV set is collected it's placed on a trolley section. This fits exactly into the space shown, where it becomes part of the bench. It can then be withdrawn as required and replaced by another trolley section with another piece of equipment on it. A number of these trolleys can be used to store TV sets and VCRs awaiting attention, awaiting components, on soak test and awaiting collection. The trolleys fit together to form a storage bench. This simple approach cuts out almost all lifting of heavy equipment. It's quite easy to build a bench of this type.

Notice that a shelf for instruments is provided at the back of the bench. The instruments are thus available for use at the flick of a switch. This is much better than having to drag out instruments from some storage space, search for a vacant mains socket, then chase around for the missing test leads. If effort is required to find an instrument to make a single test the tendency is not to bother — yet this test may be vital to a speedy diagnosis.

Cover the surface of the bench with something that's

easy to clean, for example Formica. On top of this use a rubber mat of the type available from Philips Service or RS Components. The use of such a mat prevents cabinet damage and saves hours spent trying to repair scratches. It also avoids unpleasant arguments with customers whose sets were in pristine condition when brought in.

The bench should be well lit, with an efficient lamp of the Anglepoise or similar type. It's important that the fluorescent lights used in the workshop have proper covers — bare fluorescent tubes emit ultra-violet light and can, over a period of time, damage your eyesight.

In many workshops the engineer has only an uncomfortable, backless wooden stool to sit on. It pays to buy a comfortable seat — you'll be spending hours sitting on it! One with a supporting back is best. It should be adjustable to suit the individual engineer.

Make a point of cleaning your bench after completing each repair and replacing any components used for test purposes in their correct storage drawers. No matter how busy you are, this simple procedure will save time, trouble and money.

## Test Equipment

The TV workshops of the 50s inherited their test equipment from the early days when only radio receivers and gramophones/radiograms were serviced. The basic test instrument was the analogue multimeter, usually an Avo Model 7 (later the 8), a Taylormeter or perhaps a Weston Analyser or one of a number of other popular multimeters of the time. Valve emission testers were common. They had a large meter that showed the condition of the valve under test as either good, fair or poor. An oscillator, which we'd now call a signal generator, with a range of about 150kHz to 30MHz was also found in many workshops. A few were equipped with an oscilloscope having a Y amplifier response of perhaps up to 1.5MHz. Capacitance bridges were in common use. Signal tracing equipment later began to be used.

With the arrival of 405-line TV new instruments began to appear on the bench. A pattern generator was needed to test sets and set up the picture, and most workshops had a means of measuring the e.h.t. voltage. The latter usually consisted of a calibrated spark gap — satisfactory if used with solid-state receivers. Electronic multimeters then came into use — often referred to as valve voltmeters. More sophisticated scopes began to appear in the workshop, with a Y amplifier response of perhaps 3-4MHz.

The greater part of all servicing time is spent in fault diagnosis — locating the cause of the fault symptoms. Use of state-of-the-art equipment enables this time to be cut to the minimum. There are two things to avoid when deciding on the equipment you'll need: (1) Don't attempt to work with too limited a range of test gear — you'll certainly lose money if you do this. (2) Don't purchase

expensive equipment you'll seldom if ever use — it will simply gather dust on a shelf and tie up capital that could be better used for other things.

It makes good sense to spend some time deciding which items are really essential and which aren't. Don't let an enthusiastic sales representative rush you into buying equipment that may not be what you require. To help, we'll discuss some of the basic instruments needed in today's TV/VCR workshop and look at a few of the models available.

## The Digital Multimeter

Today's most effective measuring instrument for TV/VCR servicing is the digital multimeter (DMM). Don't be tempted to buy an "el cheapo" model. Invest in a good quality DMM — it will get a lot of use. What are the advantages of the DMM, and which points should you consider when selecting one for bench use?

- (1) Accuracy — 0.5 per cent is the minimum tolerance you should accept. The d.c. voltage lines in modern TV sets and VCRs have to be set up to a high standard of accuracy — a standard of accuracy that an analogue multimeter doesn't have. Circuit voltages are often critical, and must therefore be correct. Ensure that resistance can be measured precisely over a wide range.
- (2) A good-quality DMM will be physically sturdy and not easily damaged by an overload should the wrong range setting be selected accidentally.
- (3) A DMM has a high input impedance, typically 10M $\Omega$ , on even low-voltage ranges. This means that it will not present an excessive load to the circuit being tested — a very important consideration with digital circuitry.
- (4) Many DMMs can measure logic levels, frequency and temperature. Many incorporate a transistor/diode checker. Such instruments are extremely useful for field servicing as well as on the bench.
- (5) Because the readout is displayed in the form of large, easy-to-read liquid-crystal figures eyestrain is reduced. This is much easier than peering at the needle of an analogue meter to try to make out the exact reading.

Many DMMs now feature autoranging, with a built-in microcomputer chip for fast range selection. With these models you simply select the function you want — a.c. or d.c. voltage, resistance, current etc. The microcomputer then takes over the job of range selection. This feature is a real time saver.

Until recently most DMMs used in service departments were of the 3 $\frac{1}{2}$ -digit readout type, in other words the maximum reading was 1,999. Newer models often have what's known as a 3 $\frac{3}{4}$ -digit readout. In this case the maximum reading is 3,200, which gives a 4 $\frac{1}{2}$ -digit precision for measurements up to 3,200. For example, when measuring a slightly low 24V d.c. supply a 3 $\frac{3}{4}$ -digit DMM might give a reading of 23.96V. The reading with a 3 $\frac{1}{2}$ -digit DMM would be 24V, which for some purposes might not be sufficiently accurate. So for bench use it's best to buy a DMM with a 3 $\frac{3}{4}$ -digit readout — a 3 $\frac{1}{2}$ -digit readout is adequate for field servicing.

It's also a good idea to select a model that has an analogue display in addition to its digital readout — then you don't need to invest in a second meter of the analogue type.



The Tandy 22-195 autoranging digital multimeter.

A wide range of excellent DMMs is available to the TV/VCR engineer. We'll mention just a few that are suitable for workshop use, concentrating on the features that are of most value to the TV/VCR engineer.

The Tandy 22-195 is a good investment. It has a 3¾-digit readout and a 31-segment analogue bar graph display which makes input peaks and trends easier to follow. It also contains a useful transistor checker and a handy buzzer for audible continuity checks. The input impedance is 10M $\Omega$  for all ranges except the 300mV d.c. range where it's 100M $\Omega$ . Voltage ranges are up to 1kV d.c. and 750V a.c. The current ranges extend up to 10A and the resistance ranges up to 30M $\Omega$ .

The Philips PM2618 is another nice instrument, handy for use both on the bench and in the field. It's an autoranging model with an accuracy of 0.07 per cent. Features include true r.m.s. measurement for a.c., a 200kHz frequency counter, a logic level checker and a temperature measurement range. It also has an "auto-zoom" analogue bar graph display mode which can indicate voltage changes of 0.1 per cent even during autoranging. And it's designed to stand up to the roughest electrical treatment without fear of damage. The hold facility allows a measured value to be frozen on the display: this is very useful when working in a confined space where access to the point you want to check is difficult.

Megger Instruments Ltd. manufacture the extremely useful Avo (R) Model M2006 multimeter. This has an accuracy of  $\pm 0.25$  per cent. It's an autoranging model with a 3¾-digit readout plus an analogue scale. Voltage ranges (a.c. and d.c.) are 300mV, 3V, 300V and 1kV, the current ranges are from 300mA to 10A a.c. and d.c., and the resistance ranges cover 0.1 $\Omega$  to 30M $\Omega$ . There's a data hold button to freeze the reading and a diode checker.

The Fluke 70 series is another excellent range of DMMs. All are autoranging with 3¾-digit readouts and a wide measurement range. Model 77 has a touch-hold facility that freezes the reading.

A check through the advertisement pages will reveal many other excellent DMMs — some measure capacitance as well.

It's a fact that many TV/VCR engineers are very conservative in their ways and won't part with their trusty analogue meters. I'm convinced that if such engineers can be persuaded to use a good DMM for a few days they'll soon appreciate its many advantages.

Before investing in a DMM, or any other piece of test gear, it's best if at all possible to get your hands on it so that you can try it out for yourself. If you can't, study the test reports that regularly appear in *Television*.

## Analogue Multimeters

Despite what I've said it's handy, though not essential, to have an analogue meter available as a secondary instrument. It needn't be a very expensive model. Buy one that's fuse and overload protected on the ohms ranges — it's easy to blow up an analogue meter set to an ohms range by connecting it to the mains supply!

The Tandy 22-214 is suitable for bench use, with its 50k $\Omega$ /V d.c. sensitivity and both fuse and overload protection. It has a nice clear scale and covers a wide range of measurement.

The Avo MM5 is a convenient pocket-sized multimeter with a d.c. voltage sensitivity of 10k $\Omega$ /V. It also has direct current, a.c. voltage and resistance ranges.

Again a check on the advertisement pages is worth-

while. Plenty of good-quality analogue multimeters are available to the TV/VCR engineer.

## High Voltage Probes

TV receiver e.h.t. and focus voltages often need to be checked (be extremely careful — 24kV d.c. or more is lethal). The simplest approach is to use an e.h.t. probe that connects to a DMM, extending its d.c. range to perhaps 30kV or more. When measuring the e.h.t. with such a probe, make sure that the earth lead doesn't pull away from the chassis of the TV set being tested — if this happens there's a risk of damage to an expensive multimeter (and the even more expensive engineer!). In my opinion a better type of e.h.t. probe has the indicating meter built into the probe itself. Probes of this type are available from Heathkit, Eagle, etc.

## Test Leads

Tatty test leads have no place in an efficient workshop. They are time wasting and extremely dangerous. Get the type with finger guards at the end. Push-on insulated alligator clips are handy for connecting one probe to the TV set's chassis.

## Oscilloscopes

An oscilloscope that enables you to view circuit waveforms and make other tests is an essential instrument for TV/VCR servicing: to help you to cope with the complex solid-state and digital circuitry found in modern TV sets and VCRs, buy the best service oscilloscope you can afford.

The minimum specification needed calls for a dual-trace, solid-state instrument with two Y input channels: each should have a bandwidth of at least d.c. to 15MHz. In view of the continuous advances in VCR and TV technology, calling for ever higher specifications, it's advisable to purchase a model with a bandwidth of d.c. to 20MHz or more. There are plenty of excellent scopes on the market. We'll mention just two here.

The scopes in the Hameg range are ideal for the TV/VCR engineer. They feature good sensitivity (essential for VCR testing) and many other features. Each model contains a very useful component tester.

The Philips PM3055 is an example of a state-of-the-art oscilloscope, with its 50MHz bandwidth and a liquid-crystal panel that indicates the ranges and settings. You simply touch a green autoset button and the scope sets itself up according to the signal fed into it.

A component tester will speed up your work, saving hours of time and frustration. This inexpensive item is a must for your bench. Many scopes now contain one. If yours doesn't, you can easily build your own. A suitable design appeared in the June 1984 issue of *Television*. The component tester scores particularly with semiconductor devices: it actually lets you see on your scope the condition of the device under test, and can check many devices in circuit. It takes only minutes to check every discrete semiconductor device on a PCB. Capacitors can also be checked.

## Capacitance Measurement

It's occasionally desirable to have an instrument that measures capacitance. A number of reasonably priced digital capacitor checkers are available, for instance the

B.K. Electronics type at £43-70 inc. VAT, or you could build the wide-range capacitance bridge described in the March 1988 issue of *Television*.

### Pattern Generators

A colour-bar or colour-pattern generator is a must for the TV/VCR workshop. Many of the waveforms you may need to check in TV and VCR circuitry call for a colour-bar input. An off-air signal is often useless for this purpose. One generator will usually suffice for the workshop — if there's more than one bench, the signal can be piped around to the others. Here again you need a good one that produces rock-still patterns. A number of reasonably priced instruments are available for upwards of £100.

The Philips PM5503 is a small and handy colour-bar generator for bench use. It generates rock-steady standard colour bars, patterns, a white raster, a red raster and a monochrome step pattern. If you plan to handle a large number of VCRs it may pay to invest in a more sophisticated pattern generator such as the Philips PM5515 which generates a very wide variety of patterns and has a LED frequency readout.

### Frequency Counter

Off-frequency crystal oscillators can cause headaches when servicing VCRs, so a frequency counter is worthwhile. The Philips PM6666 is a suitable model.

### Logic Probe and Pulser

Complex digital circuitry is encountered in many recent VCRs and TV sets. For this reason a logic probe and a logic pulser are essential items. These can now be obtained quite cheaply — see the November 1985 and August 1987 issues of *Television* for further details.

### CRT Tester/Rejuvenator

Anyone who has changed a suspect c.r.t. and found that the fault is still present will appreciate the usefulness of a c.r.t. tester/reactivator. Make sure that you obtain a model that will handle the newest c.r.t.s. These instruments test the emission of a c.r.t. and locate any interelectrode shorts. Reactivation can often extend the useful life of a tube for a considerable length of time. Suitable models include the Leader LCT910-A, the BMR 90 and the B and K Model 467 precision c.r.t. analyser/restorer.

### The Variac

A variac should certainly find a place in your workshop: it's almost impossible to service some types of switch-mode power supply without the use of one. For further details see the July 1988 issue of *Television*.

### Extras

The above notes have covered the most important test gear for the workshop. As profits increase, you may want to add further items. With an instrument such as B.K.'s dynamic LOPT tester you can check a line output transformer under high-voltage conditions. This saves a lot of time in practical servicing. A degaussing coil for removing unwanted magnetism from the metal parts of c.r.t.s is handy — use it with care. An audio signal tracer is extremely useful when checking audio equipment and the sound sections of TV sets and VCRs. These are just a few

examples of what could be added. But don't go overboard and insist on buying every new instrument that takes your fancy.

### Soldering Irons

When it comes to soldering irons the temperature-controlled type is best. Such irons make a cleaner soldered joint and are far more effective when desoldering components with desoldering braid or a desoldering tool. Once again, you'll save lots of time.

### Tools

Begin by buying only the basic tools. Add to these as the need arises. In this way you won't waste money by purchasing tools you'll seldom if ever use. Tandy UK Ltd. and RS Components carry a good range of tools suitable for the TV/VCR engineer.

It pays to invest in first quality tools which will serve you for many years (if you treat them properly). Tools with chipped ends and battered handles should be thrown out and replaced — they will cost you money through lost time. Even the best tools won't last long if you continually lose them. If you have to keep buying replacements your profits will suffer. So get a proper tool storage cabinet and always put away every tool after use. The old rule of a place for everything and everything in its place is a good and profit making one for the TV/VCR engineer.

Two magnetic screwdrivers with interchangeable bits are invaluable for VCR repairs. A screw dropped into a VCR can be difficult to retrieve: a magnetic screwdriver stops this happening. Buy two so that you won't keep having to change bits. Another handy time-saver is Tandy's magnetiser/demagnetiser (catalogue no. 64-1800) which turns any screwdriver into a magnetic tool.

### Gauges and Jigs for VCRs

If you service Betamax VCRs an eccentricity gauge should be available for use when fitting new heads. Some engineers claim to possess the ability to set the heads up quickly without the use of a gauge: we find that we need one.

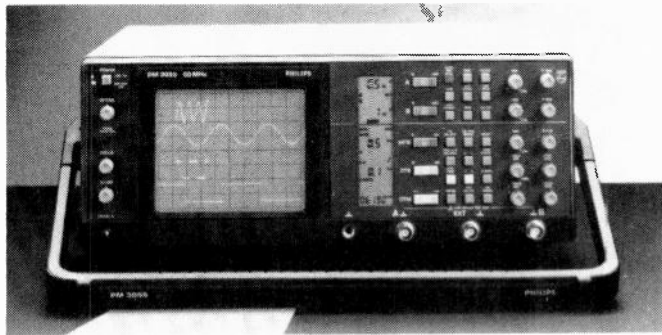
Many manufacturers supply the special kits of gauges etc. required for setting up the mechanical sections of a VCR. These often come complete in a rather nice case. The kinds of jigs and special tools you decide to purchase will of course depend a lot on the makes of VCR you service.

### Service Information

A good set of service manuals is required for profitable servicing of modern TV sets and VCRs. We'll go so far as to say that a TV/VCR engineer is better off with a good digital multimeter and the service manual than with a whole workshop full of instruments but no manual. It's better to have both of course. Service manuals represent quite an investment to use, so look after them. The best method of storage is to use one or more filing cabinets. Store your copies of *Television* in the same way. The servicing articles and notes in *Television* form a handy fault encyclopaedia — why spend time searching for the cause of an obscure fault when someone else has already done it for you? When buying filing cabinets, shop around amongst the local firms that sell office furniture: you'll find that there are wide differences in prices.

When VCRs and TV sets that contain new technology





The Philips PM3055 state-of-the-art oscilloscope has a 50MHz bandwidth and an LCD panel to indicate ranges and settings.

appear, invest some of your time in attending the manufacturers' training courses. This will ensure that your technical knowledge does not become obsolete. It pays in the long run despite the lost workshop time. Regular reading of *Television* is also important!

### The Business Side

It's no good having an efficient workshop if you don't look after the financial side of the business. To avoid problems with the Inland Revenue and the VAT man, obtain a business and account keeping system from a qualified accountant. Don't try to manage without an accountant — it will cost you time and money. Your accountant will also tell you how much an hour you must charge if you want to stay in business.

Enter everything you receive and pay out daily in your account books and VAT records. Always obtain proper receipts for purchases, even for the smallest items. If, at the end of each tax year, you present your accountant with a big pile of receipts and a stack of grubby papers detailing the business done you'll get a big bill from him. If on the other hand everything is neatly entered in your account book(s) and all receipts and bank sheets etc. are neatly filed in date order in a flat file folder your accountancy charges will be much less.

Don't try to do cheap repairs. Charge a sensible but fair amount, and make a first-class job of every set you handle. Ensure that all repairs are promptly paid for on completion. A few bad debts can make enormous holes in your profits.

Keep neat records of every repair done in a proper filing system. These should be retained for at least seven years — longer if you've got the room. Besides the customer's name and address, each record card should include the model and serial number of the TV set or VCR, details of exactly what was done and the components fitted, the condition of the cabinet or case, the total cost of the repair and other relevant information. Then when a customer tells you that the set "you repaired the other day" has failed you can check the date etc. Sometimes "the other day" can be a year or more.

Make sure that your premises are covered by comprehensive insurance against burglary, fire and flood etc. Use an insurance broker who can often save you money as he deals with a number of insurance companies. Ask him whether you are covered for everything that can be insured. Complete coverage costs only a little more than partial coverage. Don't make the what can be very expensive mistake of not being insured.

It's best not to admit the public to the workshop. If an accident should occur or someone gets an electric shock your insurance will probably not cover this.

Don't stock too large a range of spares at first as this will tie up your capital and will be sure to include some items you'll never use. But don't make the mistake of having too few of the basic bread-and-butter items. It's best to have small numbers of a fair range of components rather than large numbers of single items. Fortunately there are many firms that will give you same-day despatch of a needed part in response to a phone call.

To ensure a steady flow of repairs it's sometimes a good idea to advertise. We've found that the most effective way is to put a small ad. in the local evening free paper. A regular column advertisement is better than an occasional large advertisement — people notice regular advertisements and when one day their TV set or VCR gives trouble they remember your advertisement, find it in the paper and telephone you.

Whether you are your own boss or in employment, remember that it's the customer who pays your wage. So you must look after your customers. We find that if you do they're really quite nice people.

Obtain a supply of proper job tickets for each repair that comes into the workshop. You can get these from Willow Vale Electronics Ltd., all nicely printed out. Enter all the fault symptoms on the ticket so that when the TV set or VCR arrives on the bench the engineer has the basic information needed. This saves time, especially with intermittent faults. Hand the customer the receipt portion. This businesslike procedure helps to build confidence in your service.

### Estimates

Most people like to know what the cost of the repair will be when their TV set or VCR requires attention. This is perfectly reasonable. If you prepare an estimate which is then refused you've wasted time and money of course. Some engineers charge for preparing estimates that are not accepted, but we find that this causes bad will. Here's a simple system that overcomes the problem. Tell the customer politely that it's not practical with complex electronic equipment to give a firm estimate. Then tell him that if after checking the TV set or VCR you find that the cost will be less than a certain agreed sum of money you'll go ahead and complete the repair. Suggested amounts might be £15 for a monochrome TV set, £20 for a colour receiver and £25 for a VCR — plus VAT of course. If on the other hand the cost will exceed the agreed amount, refer back to the customer before going ahead.

This system seems to work well in practice. It allows for the people who say they don't mind paying up to £2 but no more! You're better off without these customers. We find however that most people agree to this arrangement and sometimes say that they don't mind paying a higher figure. You will often find that the customer wants the job done even when the cost is greater than the agreed limit figure. If not, there's a very good chance that you'll sell them a replacement TV set/VCR.

### In Conclusion

This article may have sounded dogmatic. It is! But it's based on a lot of experience that goes back to the days of radio servicing. I believe that if you follow the advice given in this article you'll find yourself working less hours and making more money. You'll then have the opportunity to enjoy a well-earned feeling of prosperity.

# Teletopics

## NEW FROM FERGUSON

A new range of monitor-style TV sets, the K series, has been introduced by Ferguson. These new sets incorporate Super Planar black-matrix c.r.t.s and the new ICC5 chassis. The tubes have an anti-reflective screen which is the flattest available, with a perceived radius (measured from the centre) of  $4r$  as opposed to the  $1.7r$  radius with an FS tube. The ICC5 chassis is of Thomson design. Amongst the many interesting technical features are a thyristor field output stage and a shared line/field output transformer. We plan to publish a technical article on this chassis in the next few months. Two of the first models in the range are fitted with NICAM digital stereo decoders, making them ready for the stereo transmissions due to start next year. All models include TV/video remote control handsets that call up on-screen graphics giving instant information on volume, colour, brightness, contrast and channel status. Another feature is "child lock" which enables either the set or specific channels to be locked out – to unlock you key in your own secret personal number.

There is also a new pocket CTV with LC display, Model PTV02/A. This has a 3.2in. screen and weighs just 350gms, excluding batteries. It comes complete with a 600mA rechargeable battery pack and an a.c. mains adaptor/battery charger for around £300. The battery pack gives approximately an hour and a half's use – an audio only switch for listening without the picture extends battery life for up to ten hours. Optional accessories include a 12V d.c. car adaptor and a camcorder mount to enable the set to be used as a colour monitor.

## SATELLITE TV

Sir Clive Sinclair's company Cambridge Computer has entered the satellite TV market with a TVRO system that will sell for £149.95. Sir Clive commented at the launch that "a technological breakthrough has made this high-performance, low-cost receiver possible". A striking feature of the system is the flat, square aerial that measures 60cm across. In addition to the basic version there's a remote control version at £179.95 and a model with stereo capability, a graphic equaliser and remote control at £229.95.

Rupert Murdoch has announced a change of policy at Sky Television. From next July the Sky Movie channel will be scrambled, requiring a decoder costing about £50. It's possible that the Eurosport channel will also be scrambled. Channel allocations for the Sky Television services via the Astra satellite have been announced – for details, see Roger Bunney's Long-distance Television column elsewhere in this issue.

The future of Super Channel has now been settled. It is to be run as a joint venture by Richard Branson's Virgin Group and the Italian Videomusic TV company. The programming will consist of music and news. Videomusic is to take over the channel's net liabilities and will invest a further £6m-£7m.

Clydesdale, Scotland's largest electrical retail group, claims to be the first High Street retailer in Europe to have put on the market a TVRO system. With its 90cm dish, the system is able to receive transmissions from the low-power Eutelsat and Intelsat satellites – its has been

successfully tested as far north as Dingwall. The package comprises a 2026 Susumu rotary tuner, an LNB with a noise figure of 1.5-1.8dB, a feedhorn and polarotor and 90cm fibreglass parabolic dish with all the mounting arrangements required. The system is on sale at Clydesdale's 87 branches at £299.99. Band coverage is 10.95-11.7GHz.

## SUPER-VHS EQUIPMENT

Fuji Photo Film Co. Ltd. claims to be the first video tape manufacturer to have developed PRO-S cassettes for use with the European version of the S-VHS system. The tape incorporates technologies developed from Fuji's Super HG (high grade) and professional Super XG products.

The first S-VHS hardware is beginning to come on the market in the UK. JVC has released a full-size camcorder, Model GF-S1000HE, whose features include a 420,000 pixel CCD image sensor, sensitivity down to 10 lux, four shutter speeds at up to 1/1,000th sec. and hi-fi recording capability. No price details have been released to date. Ferguson has released the FV-39S VCR at £999. Features include hi-fi capability, a NICAM decoder, VHS index search and intro search, an 8-event/365 day timer and twin scart sockets.

The S-VHS system uses, in addition to r.f. and BNC/scart sockets, a four-pin S-connector for separate connection of the luminance and chrominance signals. Fig. 1 shows the pin configuration. The socket usually incorporates a switch so that the monitor switches over to this input when the plug is inserted. The plug and socket arrangement seems to be fairly substantial: the only leads seen so far are moulded ones, so the exact construction of the plug and how easy it will be to fit are not clear. It could also be of use for connecting DBS equipment – with MAC transmissions the Y and C signals are transmitted separately.

## 30GHz TV DEMONSTRATION

British Telecom's research laboratories have carried out a successful demonstration of TV distribution at 30GHz. The demonstration, of what BT refers to as M3VDS (millimetre wave, multichannel, multipoint video distribution service), was carried out at Saxmundham, Suffolk earlier this year – four satellite TV programmes and four broadcast services were beamed to ten homes in the town fitted with special aerials and receiving equipment. A commercial system operating in this band would be capable of carrying 15-25 channels. The system has been made feasible by using gallium arsenide chips designed at BT's Martlesham laboratories. The dish aerials used had a diameter of 15cm. It's estimated that the current transmitting equipment could serve an area of about 2km diameter, covering five to ten thousand homes.

## TRADE SCENE

According to the latest BREMA figures imports of small-screen colour TV receivers almost doubled during the first six months of this year – from 329,000 in the first six months of 1987 to 655,000 in the corresponding months of 1988. Deliveries of UK made small-screen CTV sets fell

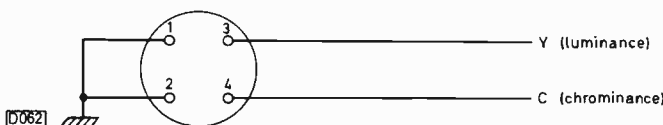
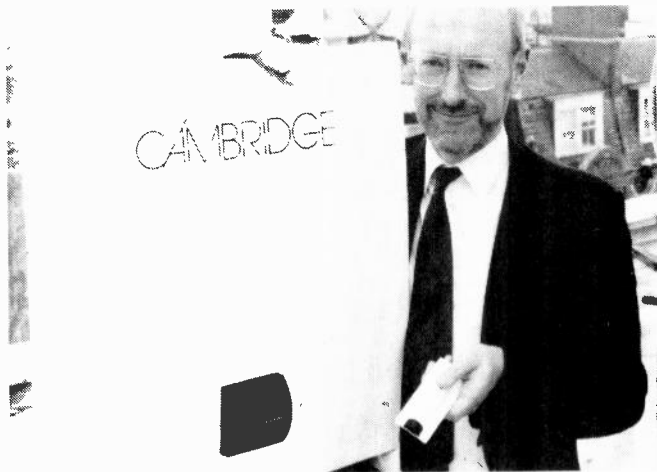


Fig. 1: Connections to the S-VHS connector.



Sir Clive with his £149.95 satellite TVRO system.

by 30,000 to 312,000 during the period. Total UK CTV deliveries during the half year rose by 20 per cent to 1.84m. There was a 36 per cent increase in VCR deliveries to 885,000 units. Camcorder deliveries rose by 15,000 to 48,000.

The European Association of Consumer Electronics Manufacturers has called on the European Commission to carry out an anti-dumping investigation into imports of small-screen CTV receivers from China and Hong Kong. TV manufacturers in the UK have urged the government to take action to curb the surge of imports.

### NEW SECURITY SYSTEM

The new Riscomp CPU9000 security system contains all the necessary components of an alarm system in a single compact steel case. It will monitor an area of 500 sq.ft. or more – protection of the chosen area is achieved simply by siting the unit in a convenient position then switching on. In the event of an intrusion in the protected area a penetrating built-in 103dB siren will sound. The trade price is £67.72 plus VAT, complete with two keys, comprehensive instructions and a twelve-month guarantee. Operation is from the mains or a 12V d.c. source. For further details apply to Riscomp Ltd., 51 Poppy Road, Princes Risborough, Bucks HP17 9DB (telephone 084 446 326).

### VIDEO WATERMARKING

The BBC Research Department has developed a system, called video watermarking, to enable the source of video signals to be identified – the system has been in experimental use on BBC1 and BBC2 networked programmes passing through the Television Centre for the last three years. The identification signals are said to be undetectable by normal test equipment – the BBC uses a cheap decoder in conjunction with a BBC microcomputer. They withstand network processing and VHS copying. The signals indicate BBC1 or 2 plus date and time of recording.

### VINTAGE MATTERS

The Vintage Wireless Company Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN is operating a retail counter/showroom which is open for business on Saturdays only, from 10 a.m. to 4 p.m., closed for lunch from 1.30-2 p.m. At any time the company has available about a hundred vintage radio receivers and some TV sets, valves and vintage components, old books etc. etc.

*The RadioGram*, the magazine for valve radio enthusiasts, has changed its name to *The Radiophile*. It's published bi-monthly and each issue contains much historical, servicing etc. information, including complete circuit diagrams, for vintage radio equipment. The subscription rate in the UK and Ireland is £8 for six issues, £15 for twelve issues. For Europe/Scandinavia the rates are £10 and £19 respectively. Elsewhere by arrangement. Write to *The Radiophile*, Larkhill, Newport Road, Woodseaves, Staffs ST20 0NP.

### NEW CATALOGUES

New catalogues have been published by Cirkit and Greenweld. Cirkit's 1988/89 Winter edition constructor's catalogue costs £1.30 and has 184 pages featuring over 3,000 products. For further information contact Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts EN10 7NQ (telephone 0992 444 111). The 100-page Greenweld 1989 catalogue covers a product range extending from the humble resistor to complex audio mixers and oscilloscopes. It's available for £1 from Greenweld Electronics Ltd., 443S Millbrook Road, Southampton SO1 0HX (telephone 0703 772 501).

### IR DETECTOR CARD

Electronic Consultant Services (406 Main Road, Glascote, Tamworth, Staffs B77 2BY, telephone 0827 64861) is supplying at £11.72 inclusive of VAT and post/packing an infra-red radiation detector card for use when checking TV remote control units, video recorder sensors and CD players. "Magic Mirrors" as they have been called were previously supplied by Philips and Charles Hyde but are no longer available from these sources. The cards can also be bought from ECS's vans operating in the Midlands area.

### SPARES

The supply of spares for NEI/Network TV sets etc. has been taken over by HRS Electronics Ltd., Garretts Green Lane, Garretts Green, Birmingham B33 0UE (telephone 021 789 7575).

New spares ordering phone numbers have been installed by Hitachi for those holding accounts. Phone 01-569 1843 where the part number is known, 01-569 1975 where the part number is not known.

McLelland-Datatext is supplying to independent dealers Polish manufactured TV sets which carry the McLelland or Neptune brand name. Spares are available from the associated company Ampmace Ltd., Falkland Close, Coventry (telephone 0203 471 241).

Spares and servicing facilities previously supplied by Service All Electronics (see Spares Guide supplied with the April issue) are now carried out by Plusmaster (Electronics) Ltd., No. 26 The Craft Centre, West Wilts Trading Estate, Westbury, Wilts (telephone 0373 826 739).

### NEW VIDEO PRODUCTS

Team Audio Ltd. (Haverscroft Industrial Estate, Attleborough, Norfolk NR17 1YE – telephone 0953 454 544) has introduced in the UK a device known as the Video Eeze to enable TV and video signals to be distributed around the house. The unit is connected to the main TV set and VCR and enables the signals from these to be made available in two other rooms. Selection of TV/video at the remote station is by means of a simple switch. The unit requires no power supply and gives flexibility

where there is only one VCR in a household. Its suggested retail price is £49.95.

Team Audio has also introduced the Freitag 2053 distribution amplifier which enables the audio and video signals from a VCR to be fed to up to seven TV sets via scart sockets. It can also be used to make seven recordings from a single tape via seven VCRs. 2053s can be used in series to drive up to 49 TV sets/VCRs. The trade price is £59.95 plus VAT.

A new camcorder, the Fujix-8 Model F610, has been introduced by Fuji. Features include a 320,000 pixel CCD image sensor, a TCL (through camera lens) auto-focus system and a facility for superimposing up to two titles or credits. The camcorder is expected to sell for around £900.

Fuji showed a prototype electronic stills camera at Photokina '88. The Fujix DS-1P records images on a digital memory card and is extremely compact, weighing only 0.4kg. The 16Mbit SRAM memory card, developed jointly with Toshiba, enables ten still images to be recorded in the field recording mode or up to five in the frame recording mode. The images can be erased and the card reused an unlimited number of times. Fuji is working on the development of a card that stores up to forty images in the frame recording mode.

The Fujix TV-Photo system was also shown at Photokina '88. This is intended mainly for business use and employs a world industry standard video floppy disc to store the images.

The latest Sharp VCRs, Models VCT310 and VCT510, come complete with a talking remote control handset. The idea is to guide the user on how to programme the timer.

### TELETEXT ADAPTOR

A new teletext adaptor, sponsored by the Department of Health and Social Security and the Department of Trade and Industry, has been developed as an aid for disabled people. It can be used with a non-teletext receiver to produce subtitles and also enables a VCR to record subtitles. The adaptor has the usual range of teletext facilities. For further details contact Nufax Ltd., Arnos Buildings, 495 Bath Road, Brislington, Bristol BS4 3JU (telephone 0272 724 040).

### IN BRIEF

Paper-free operation is the aim at Multibroadcast's new Wellingborough service centre where all records are computerised. Though the centre will be run as a pilot scheme initially Multibroadcast expect that the system will be introduced in all its service centres within two-three years . . . A new commercial radio service is to be introduced in Ireland by next spring, with a new TV channel by the autumn . . . Birmingham Cable Corporation has been awarded the largest UK cable franchise. The area has 456,000 homes and an investment of £150m over eight years is involved.

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## Servicing the Panasonic NV333 and NV366

### Part 2

Nick Beer

Last month we covered the mechanical side of these machines. This time we'll provide details of the various troubles we've experienced on the electrical side.

### Electronic Features

The syscon microcomputer chip IC6001 is type MN1405VKF in the NV333 and type MN1405VKK in the NV366. It's easy to confuse these two numbers – remember that the difference is in the suffix. In the NV366 the chip has extra responsibilities.

Tape start and end sensing in these machines is done by means of an IR diode – a lamp was used in earlier models. The diode is type LN58 and we've only rarely had one fail. The device actually consists of two LEDs back-to-back to provide two-way emission. On the odd occasion when one has failed the trouble has been one half going open-circuit, causing tape transport faults in one direction.

The drum servo circuit is based on the  $\mu$ PC1504C and AN6677 chips (IC2001 and IC2002). In the NV366 there are three extra chips, IC2004/5/6, for the super-still picture mode. The capstan servo circuit is based on the  $\mu$ PC1505C chip (IC2003). As in the NV2000, capstan direction switching is carried out by means of a relay – again as in the NV2000 problems can arise due to dirty contacts.

### Faults Encountered

Here's a list of the electrical faults we've encountered.

(1) Machine won't switch on. Power on/off at pin 3 of P1003 not switching due to a faulty M53216P chip (IC6002) in the syscon circuit.

(2) Won't tune in. No 30V supply at pin 10 of P7005 as D7005 (MA26WCB) in the 30V regulator circuit on the demodulator PCB is short-circuit.

(3) No go. No 9V and 6V outputs from the STR1096 chip IC1001 at pins 4 and 5 respectively. Check whether the unregulated 15V supply is present at pin 1. If this is present and the supplies don't return when the loads are disconnected suspect that IC1001 is faulty.

(4) No go. If pin 8 (power off) of IC6001 is high, suspect Q6010 (2SB641) of being faulty.

(5) Failure to eject. If the switch mentioned under mechanical faults last month is not the cause, check C6011 (18nF) and IC6002 (M53216P).

(6) No field sync on playback. Check the signal at pin 1 of IC3003 (AN6327). If missing, suspect the chip. The signal should measure 2V peak-to-peak. If it's less than 1V p-p, again suspect the chip.

(7) No clock display. Almost certainly IC7501 on the front panel is faulty. In the NV333 it's type MN1435VXB and in the NV366 it's type MN1455BUB. Getting the suffix right when ordering a replacement is vital.

(8) No tuner operation or channel LEDs. The 3.9 $\Omega$ , 0.5W safety resistor R7020 is probably open-circuit.

(9) The clock does not relight after a short mains supply interruption, i.e. it has to be off for a long time to reset. Replace IC7501 – see (7) for details.

(10) No tuning. Tuning voltage missing as the 10 $\Omega$ , 0.25W safety resistor R7019 is open-circuit. The  $\mu$ PC574JK stabiliser IC7001 and Q7005 (2SB642) will probably be short-circuit.

(11) Poor field sync on playback of own recordings, with slight hum on sound and ripple down the edge of the picture. Hum on the l.t. lines because one of the EM1Z

rectifier diodes D1001-4 is open-circuit.

(12) Does not erase previous sound track and new picture has chroma washover. No erase bias, probably because of dry-joints on Q4014 and T4001 on the audio panel. If the problem persists, or low bias seems to be incurable, link across R4049 (4.7Ω) in Q4014's emitter circuit.

(13) Intermittent loss of capstan lock in the record mode, playback o.k. Suspect an intermittent fault in IC2003 (μPC1505C).

(14) Intermittent loss of colour or intermittent colour bars on screen. If the pulses at TP8006 are less than 6V peak-to-peak, adjust R8036 to correct.

(15) Drum and capstan servos pulsing and out-of-sync. Check whether the track of R2017 is dirty.

(16) Loading motor stops during loading. IC6005 (μPD4069UBC) probably faulty. Also check that C6008/9 have been changed from 100pF to 300pF.

(17) Tuning drift. Remove C7010 (0.22μF) on the demodulator PCB.

(18) No reel drive. No motor drive as Q6022 (2SB641) and Q6023 (2SD1273) are short-circuit.

(19) Hum on sound. IC4001 (TA7325P) developing hum internally. To prove, check the inputs and outputs with a scope.

(20) No chroma in the record mode. Use a scope to check through the circuit to TP8003. If the chroma is present here, check at pin 8 of IC8001 (AN6360). If the chroma is missing here and the d.c. level is high (should be approximately 4.5V) D8005 (MA165) is probably leaky – it links IC8001 to the colour-killer in IC8003.

(21) Capstan speed varies, sometimes intermittently. Monitor the capstan FG pulses at pin 5 of P6001. If the pulses disappear intermittently, suspect a faulty FG generator. This is within the capstan motor – check the interconnections first!

(22) No capstan lock in playback. Check the d.c. level at pin 16 of IC2003 (μPC1505C). If low suspect no 9V supply as Q6003 (2SA719) in the syscon circuit is open-circuit.

(23) Slight hum on E-E sound, amplified to an obliterating buzz on recorded material. Check with a scope for hum on the 17V rail. If present suspect that D1013 (1SS16) is faulty.

(24) Intermittent head switching line runs through picture, with drum speed varying. VSS signal missing due to a dry-joint at pin 1 of IC301.

(25) Head switching line runs through picture. 50Hz reference switched on during record because of a fault within IC8004 (AN6342N).

(26) No capstan motor rotation. RY1 on the servo panel faulty.

(27) Take-up spool rotates in the stop mode. Check for dirty connections at the supply photosensor connector P6010.

(28) Intermittent failure to eject tape. Key scan inhibited due to C6011 (ECQV05184JZ) or IC6002 (M53216P) being faulty.

(29) Machine intermittently stops and rewinds during playback or record. Usually due to the supply phototransistor Q1503 (PN150NV) being faulty. Sometimes IC6004 (AN6912) is responsible.

(30) Capstan speed wanders in playback (i.f. variation). Check whether tracking control R2064 is open-circuit.

(31) No rewind or fast forward. D1009 (MA165 or 1SS133) faulty as a result of which Q6013 comes on incorrectly.

(32) No power after ten seconds, with no loading. No loading motor drive as IC6005 (μPD4069UBC), Q6026

(2SB819) and Q6029 (2SD1051) faulty. Replace C6008 and C6009 (both 300pF) as well.

The following notes apply to Model NV366 only.

(33) No memory back-up. The timer back-up memory consists of three gold, 3.3F, 2.3V capacitors which are mounted on the small, extra timer decoder panel behind the front operation panel. They tend to leak all over the board. Always check them when working on one of these machines – you can often deal with the problem before the gunge damages the board.

(34) The picture is very noisy after the still, cue or review modes are released and the deck returns to play, taking several seconds to settle own. The cause of this is dirty contacts on switching relays RL3501/2. Cleaning with switch cleaner can be fairly successful but for greater reliability it's best to replace them (part no. VSY2029) – the cost is minimal.

(35) Channel change faulty, wrong LED lights up etc., especially when cold. Replace Q7553 (2SD637) with improved type 2SD637S or T or type 2SC1685S or T. In addition fit a 2.2kΩ resistor in unused position R7565.

(36) Still mode picture has black spikes. The cause is overmodulation. Replace C3529 and C3530 with 40pF type ECV1ZW40X53N capacitors and change R3522 to 100Ω. Fit a 22pF, 50V capacitor (C3535) across pins 1 and 2 of P002. Finally, readjust the head amplifier peak frequency (TP3508) to 4.9MHz instead of 4.5MHz.

## Remote Control

Wired remote control is used in both models, working on the principle of switching in a different resistance for each function. This enables connection is made via a single screened lead, terminated by a 2.5mm jack plug. The only difference between the two models is the inclusion of a still advance button on the NV366 version. The NV333 version is part no. NV-A33E, the NV366 version part no. VSQ0257.

The usual problems are that the cat has chewed through the lead or someone has tripped over it and the plug has snapped off or the socket in the machine is loose – this can stop the on-board controls working, as occurs when the remote control unit is plugged in. A very common complaint is that the unit doesn't work at all and the lead has gone open-circuit – not the core but the screen! The cable strain relief can easily be removed from the old lead and should be fitted to the new one.

## In Conclusion

In conclusion, these machines are typically Panasonic and are a delight to work on. The main emphasis in this article has been on the mechanical side, as those with little experience of these machines will be more likely to encounter faults here, but the list of electrical faults shows that you could well be confronted with one of these.

These models were superseded by the first Panasonic front-loading models – the NV370, NV688, NV777 etc., which will be the subject of future articles.

## Corrections

Under the heading Access last month the comment "to replace the reel idler the cassette carrier has to be removed" should have read "to gain access to the idler/reels/intermediate gear will be much easier after removing the cassette carriage". Under Mechanical Faults (1) the oil type should be RZZOL05#56.

# TV Fault Finding

Reports from Eugene Trundle, M.K. Hayter, J.R. Armagh, John Coombes, Mick Dutton, Nick Beer and Alfred Damp

## Finlux 1101 etc.

The symptoms that this fault produces are not so easy to describe! It's always intermittent: the picture may flash or flicker, pull at the top, show a chequerboard effect or bands of varying contrast. The problem is on the teletext board, where the through-board link pins are dry-jointed – they protrude from the board in test-point fashion. Clean, retin and solder the lot. E.T.

## Thorn 9600 Chassis

The customer said he'd bought this set from a friend for £15 but couldn't get a stable picture, the sound being all right. He said he'd call the following week to collect it and settle up. As he left I said it was probably an a.g.c. fault.

So I put the set on the bench and removed the back cover. The first thing I saw was the tuner's earthing strap flapping up and down. I connected this to chassis, switched on and discovered that my guess had been correct – there was no a.g.c. The obvious suspect was the TCA270S vision demodulator/a.g.c./a.f.c. chip IC1 or an associated component, but after checking the voltages around IC1 I came to the conclusion (rightly) that the fault was not on the inside left i.f./decoder/RGB panel and turned to the outside left tuner panel. My first suspect (wrong) was the r.f. amplifier transistor in the tuner, so I replaced it with a spare I have. The fault remained. A check was then made on the voltages at the tuner pins. There were only a few millivolts at pin 2, which is connected to the BZX79C5V6 zener diode W25. After disconnecting one end of W25 I found that it was virtually short-circuit. Replacing this put matters right and a soak test confirmed that the trouble had been cured.

Channel selection with this chassis is by means of touch pads. The tuning controls are mounted on the tuner panel. On channels 5 and 6 only noise was present. I'd no Thorn 9600 potentiometers so an equivalent was sought. The potentiometers in a scrap GEC C2110 series chassis appeared to be the same, and when two of these were fitted channels 5 and 6 became operational. M.K.H.

## Hitachi CPT1454

There was a fine, bright vertical line about a third of the way across the screen, on top of an otherwise perfect picture. It was neither stringy nor running, and a circle display from the signal generator revealed not the slightest foldover. So it seemed that rather than a line scan weirdo we'd a radiation problem. Scope checks in the RGB output stages failed to reveal anything that could account for the line, and extra decoupling at the c.r.t.'s first anode and across the various supply lines made no difference. Incidentally, in these days of precarious and fickle chips one doesn't just earth one end of a can of microfarads and dab the probe from the other end on to every likely point. One switches off, discharges, makes a new connection and switches on again. Not like the old days when a few moments sufficed!

Having drawn a blank we decided to contact the kind man at Hitachi. He suggested further checks on the RGB output panel and that the blanking input at pin 7 of the TDA3562A colour decoder chip should be checked. When we scoped the latter we got a fine line frequency

pulse of the correct amplitude, but there was no 3-4V pedestal, i.e. no shoulders to the waveform. This led us to make checks in the sandcastle pulse generator circuit, where zener diode ZD702 (10V, 500mW) turned out to be leaky. Should anyone else be troubled with this white line, a very quick test is to check for about 4V at the cathode end of ZD702, right close to the line output transformer. A missing voltage tells all! J.R.A.

## Grundig TP400TT Remote Handset

My thanks to Nick Beer who a few months ago mentioned the cause of a few flashes then nothing from these units – the 470 $\mu$ F, 8V electrolytic (incorrectly quoted as 47 $\mu$ F in the May issue – *Editor*). He found it difficult to get one that fitted and Grundig didn't believe that the electrolytic ever failed. The next four units that came my way were as Nick said, the 470 $\mu$ F electrolytic being to blame. I found a few RS 104-988 25V 470 $\mu$ F electrolytics in the box. If you leave about 0.75in. of the leads and dress them carefully the electrolytic can be manoeuvred to clear the other bits and not short them. The cover feels a wee bit tight to clip up, but mine survived when only minimal force was used. J.R.A.

## Some Quickies

**Sony KV2052UB:** In the event of picture foldover down the centre of the screen, check for a high-resistance connection on the earth rail around the line output transistor. This fault can be intermittent and can destroy the line output transistor.

**National Panasonic TC202:** For teletext lines at the top of the screen check the decoupling capacitor C412 (3.3 $\mu$ F) which may be open-circuit.

**Toshiba 141E3E:** For intermittent no sound or raster at switch on check the start-up resistor R811 (220k $\Omega$ ), which may have gone high in value, then if necessary check the STR5214 power regulator Q801 by replacement.

**Toshiba 140R3E:** A case of standby only operation was traced to zener diode D808 (B46) being short-circuit.

**Hitachi CBP260:** This set would go into the standby mode intermittently. The problem was caused by the 4.43MHz crystal X1401 on memory board PC895.

**Panasonic TC2207 (U2 chassis):** The only sign of life was that the standby light was on. Diode D552 (TVSC2715M) in the EW modulator circuit was open-circuit.

**Mitsubishi CT2227BM:** This set would operate normally for many days after which it would go into the standby mode and couldn't be switched by means of the remote control unit. The cause of the trouble was the M50124P ETS chip IC7A0. J.C.

## Philips 20CT3723 (KT3 + teletext)

This 20in. teletext model suffered from intermittent text corruption and occasionally no text at all. When "text" was pressed in the fault condition there were flashes on the screen then the display went back to the picture. The voltages applied to the text board read correctly but we found that there was a dry-joint on one of the mains transformer pins in the text/remote control power supply. The rectifier circuit uses a centre-tapped transformer

arrangement: the output voltage was approximately correct but with very poor regulation and a high ripple content. **M.D.**

### **GEC C1407**

A case of intermittent loss of colour led us a merry dance with one of these portables. The cause of the problem was eventually traced to C527. **M.D.**

### **ITT CVC1200 Chassis**

This set was dead with Si651 (1A) blown. We found that the chopper transistor T713 was short-circuit but after fitting a replacement we could still measure a very low reading between the fuse and the power supply "earth". C701 (4.7 $\mu$ F) was short-circuit. **M.D.**

### **ITT CVC1100 Chassis**

This set suffered from a very intermittent blank raster with flyback lines. We checked the RGB output stages in the fault condition and found that all three transistors were hard on. When we checked back to the decoder chip we found that its supply was missing at pin 25. This comes from the 12V regulator on the stand-up side panel. There was 12V here but not on the main panel, due to a crack in the printed track where it passes close to the edge of the PCB on the side of the panel. **M.D.**

### **Panasonic TC2110**

This was the first time we've had a fault on one of these sets. The complaint was no results, but when we switched on the noise produced by the power supply suggested that it was being heavily loaded. A check on the line output transistor produced very low readings in every direction. It measured all right when removed and the short was still present on the panel. The line output transformer was thus suspect and fitting a replacement provided a complete cure. When doing this make sure that you get the phase of the power supply feedback winding correct. If you don't the result will be line pairing and singing from the power supply. **M.D.**

### **Sanyo CTP6130 (80P Chassis)**

The initial problem with this set was no results. H.T. was present at the collector of the chopper transistor Q304 but there was no output from the power supply. The trouble was caused by R302 (330k $\Omega$ ) which biases Q304's base.

The set was returned to the customer who then complained of picture break up at the top of the screen. We found that the cause of this was poor soldering on three of the leads that join the little subpanel above the line output transformer to the main chassis. Incidentally the tube was in very poor condition though the set was only about three years old. **M.D.**

### **B and O LX2800 (37XX Chassis)**

This monster was brought in by two exhausted field engineers with the complaint that there was no line sync. When it had been on for a few minutes it appeared to lose field lock as well. Sync separation is carried out in the TDA1940 chip 26IC5, which also contains the line and field generator circuits. A video signal of correct form and amplitude was present at pin 11, but there was no composite sync output at pin 9. Some of the voltages

around the chip were slightly low but none of the peripheral components seemed to be faulty. Fitting a new chip restored correct operation. **N.B.**

### **Salora 20L30 (L Chassis)**

This set developed intermittent sound while running in the shop. Needless to say it worked perfectly as soon as it was on the bench. So we put it aside on soak test. Two days later the fault appeared. A scope was hastily coupled to the output of the switching i.c./input of the TDA1013H audio output chip. The audio signal was present but while I was looking the other way the output chip failed completely (smoked!) and the set went dead. Replacing the chip still left us with a dead set, but it didn't take long to discover that the 18V supply rectifier DB606 was short-circuit. This supply, for the audio output chip, is derived from pin 18 of the Ipsalo transformer. **N.B.**

### **Philips 10CX1120/05**

This little 10in. set had a distorted raster and no field sync for ten minutes after switching on. The encapsulated bridge rectifier was faulty - intermittently open-circuit. It's a standard SKE type. **N.B.**

### **B and O 33XX Chassis**

This set wouldn't start. The usual dry-joints had been attended to so further investigation was required. Q3 on the power supply panel turned out to be open-circuit. **N.B.**

### **JVC 7860**

This one is an oldie but as a meter check revealed that the tube was in fair condition we went ahead and investigated the fault - an overbright raster. The decoupling capacitor C104 (10 $\mu$ F, 200V) is very often the cause of such troubles and sure enough was crusty. But the main cause of the trouble was the video amplifier transistor Tr204. A BC327 fits the bill. **N.B.**

### **Hitachi CPT1446**

There were two faults on this set, a field fault and the memory not storing channels. But there was only one defective component, IC201 (ZTK33B) which had only 11V at its cathode. Fitting a replacement restored normal operation. **A.D.**

### **Ferguson TX10 Chassis**

This set would intermittently trip and shut down. We checked for the usual dry-joints on the chopper transformer and found the connections to be all right - we resoldered the legs anyway as a precautionary measure. Whilst checking the high-value resistors in the chopper circuit we discovered that R810 (150k $\Omega$ ) was open-circuit. Replacing this restored normal operation. **A.D.**

### **Toshiba 145R7B**

This set had a most unusual sound fault. There was pitch, not volume, distortion. Some voices were o.k. but others would distort. The cause of the trouble was that the sound mute transistor Q860 would sometimes conduct due to a bias of some 0.6V at its base - this should be present only during channel change or when tuning the set. A leaky 1N4148 diode (D203) was producing this bias. **A.D.**

# Test Report: The HS D100 Converter

Roger Bunney

The TV receivers sold in the UK in the late sixties and early seventies were mostly of the dual-standard (405/625-line) type, incorporating both a v.h.f. and a u.h.f. tuner. One advantage for the TV-DXer was the fact that the relatively narrow 405-line vision i.f. bandwidth could, with a bit of modification, be used throughout the TV bands — a narrow bandwidth improves the selectivity and noise performance. This happy situation was not to last. As u.h.f. only reception became the norm in the UK, so the manufacture of dual-standard sets came to an end. All was not lost however. In addition to keeping older sets going there came the option of using an upconverter. These had come into use to enable the signals on cable networks, distributed mainly at v.h.f., to be frequency converted and fed into a standard u.h.f. receiver. The DX-TV enthusiast could therefore use an outboard v.h.f. tuner unit, an upconverter and a standard u.h.f. TV set to receive Band I/III transmissions. However this arrangement deprived him of the advantage of having available a narrow-band i.f. strip. It didn't take long to discover that adjustable bandwidth filtering could be added between the tuner's output and the upconverter. A suitable design appeared in the February-April 1982 issues of *Television*.

## Basic Features

The D100 converter produced and sold by HS Publications of 7 Epping Close, Derby DE3 4HR makes this technique readily available, all the items required being incorporated in a single, compact box (see accompanying photograph). There have been several versions of the D100. The latest, the De Luxe, differs from earlier versions in having facilities for sound reception in conjunction with a f.m. radio receiver. Fig. 1 shows a simplified block diagram of the D100 De Luxe converter.

One's first impression on unpacking the D100 is of its compactness — the attractive white/grey Verobox measures just 180 × 120 × 90mm. Three cables emerge at the rear. There are two 90cm coaxial cables, with terminating plugs, for the u.h.f. video and f.m. sound outputs and a 1.2m three-core mains lead. The aerial input at the rear uses a chassis-mounted Belling type socket.

The front mounted controls (see photograph) are as follows, from left to right starting with the upper row: Band I/III/u.h.f. selector switch; "osc" (sound tuning); main v.h.f. tuning; main u.h.f. tuning — note that at v.h.f. the u.h.f. tuning knob doubles as a v.h.f. fine tuner and vice versa. The bottom row controls, again from left to right, are: r.f. gain; a toggle switch for sound on/off; i.f. gain; then two toggle switches that provide the various vision i.f. bandwidth settings available; and finally a red LED to indicate mains on/off. There is no mains on/off switch. The tuning controls are standard potentiometers with 270° rotation.

A look inside revealed the very compact layout, with wiring looms and a fully protected mains power supply. The input signals — v.h.f. or u.h.f. — are fed to a very small tuner where the appropriate band is selected. With the sample unit we had for test the coverage was measured as 44-98MHz Band I, 150-244MHz Band III and 420-876MHz u.h.f. Overseas versions can be supplied to order, for example covering the Australian ch. 5. The

u.h.f. coverage includes the 435MHz ATV band, extending to include the ch. A80 US Forces outlet in Holland!

## Operation

Apart from sound tuning the use of the front panel controls is fairly obvious. There are separate r.f. and i.f. gain controls. Generally, you operate at almost full gain, with perhaps a reduction with very strong local signals to avoid overloading the bipolar tuner transistors. HS tell us that an earlier version of the D100 incorporated a.g.c., but that as customers wanted knobs to turn they came back. My own system has no a.g.c. prior to the receiver itself: I've not found manual gain control to be inconvenient — I leave it at maximum unless a strong local signal is present.

The double use of the v.h.f./u.h.f. tuning knobs is ingenious, allowing ease of calibration at v.h.f. and u.h.f. The v.h.f. calibration is excellent and reasonably accurate: at u.h.f. I'd have liked additional channel indications at chs. 25, 35, 45 and 55. The fine tune variation might benefit from further thought. At 60MHz there's a ±2.5MHz variation of fine tune centre, at 220MHz a ±14MHz variation and at 750MHz a ±2MHz variation. Band I and u.h.f. could do with expanded coverage, with Band III perhaps reduced to give a similar variation throughout.

For vision bandwidth adjustment two miniature toggle switches introduce tuned circuits via pin diodes. Both switches up gives wide bandwidth, the right-hand switch down gives medium bandwidth while both switches down gives narrow bandwidth — the bandwidths are 5MHz, 3.3MHz and 2MHz respectively. Progressively reducing the bandwidth improves the signal-to-noise ratio and the selectivity dramatically. Signals that are only just visible in the wide position lift out of the noise/interference in the narrow position. The narrow position is also very useful when trying to tune in a weak signal on a channel adjacent to a very strong local signal.

## Sound Reception

One difficulty with DX-TV is reception of the sound signals. Several different sound-vision spacings are used in Europe — with system B/G the spacing is 5.5MHz, with system I it's 6MHz while with the East European system



The HS D100 De Luxe converter.



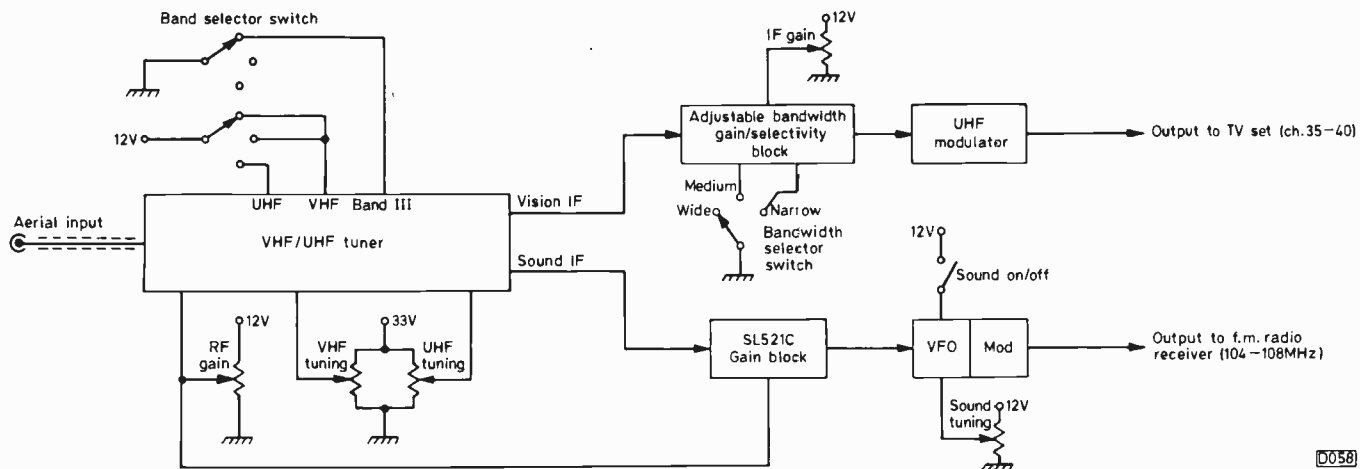


Fig. 1: Simplified block diagram of the HS D100 De Luxe converter.

D it's 6.5MHz. If you want to tune in a US system M signal the spacing is 4.5MHz. A receiver that could handle all these standards would be an expensive item, capable of receiving the full transmission bandwidth of the appropriate standards. For DX-TV purposes we prefer reduced bandwidth working in order to be able to resolve the weakest signals. The D100 De Luxe combines the advantages of narrow bandwidth working while retaining full sound tuning capability — on test the sound offset tuning range was from zero to 12MHz! The usual 5.5/6/6.5MHz spacings are thus well covered. Operation is simplicity itself. Having tuned the converter to the required channel you move the sound toggle switch to the on position then tune the "osc" control accordingly.

On test with a 60MHz signal we obtained the following results, taking the system I 6MHz spacing as zero: 60MHz -10dB, 61MHz -5dB, 62MHz 0dB, 63MHz +2dB, 64MHz +2dB, 65/66/67MHz each 0dB, 68MHz -1dB, 69MHz -5dB, 70MHz -8.5dB, 71MHz -13dB, 72MHz -17dB. It will be seen then that there's a uniform, high response over the important system M/B/G/I/D spacings. Perhaps more importantly, these results are obtained with the vision bandwidth reduced to 2MHz.

With a system I signal the sound output from the unit is typically 35µV at 106MHz, which is adequate to drive any f.m. radio receiver.

### Assessment

We queried the absence of a mains on/off switch with HS. The reason for its omission is to ensure that the curious who may open the case are not exposed to any terminal, tag etc. that is at mains potential — the connections to the mains transformer are covered with three layers of heatshrink. In addition, the d.c. LED indicates safe or otherwise.

Adjusting the TV receiver to suit the converter's output is also simple. Tune the receiver to ch. 21, connect the converter's u.h.f. output and switch on. As you tune up the band a noise peak will be found at approximately ch. 30, followed by a heavy, blanked out carrier at ch. 35 and a further noise peak at approximately ch. 40. Select either of the noise peaks, with the aim of avoiding local signals. If you do get problems with patterning, the modulator's oscillator can easily be tuned to move the output farther up the band. At ch. 40 we found that the output measured 0.3mV across 75Ω.

The unit is easy to set up: once the appropriate noise peak is found, tuning is straightforward. It's important

that the fine tuning controls are set midway, particularly in Band III, to ensure accurate correlation between the tuning and the scale indications. Provided that care is taken to prevent overloading with strong signals no undue problems should be experienced. I found that adjacent channel reception next to the strong local Rowridge signals here was perfectly satisfactory — experience will indicate the appropriate r.f./i.f. gain settings to prevent breakthrough and cross-modulation.

Switching from wide to medium bandwidth provides a useful improvement of the vision but when narrow is selected the change is dramatic. Careful tuning is required in the narrow position since optimum quality is critical. With the narrow setting the weakest signals can be raised to an identifiable level, which is of course the whole point of having switched selectivity.

The variable sound tuning gives flexibility with the various transmission standards and I found it interesting to feed in a satellite downlink via the TVRO equipment and tune across the whole set of subcarriers.

The signal-to-noise performance is a few dB down in comparison with the well known ET021 MOSFET tuner, which provides a somewhat cleaner signal with a known Band I source. My only other criticism is that I feel some additional gain following the tuner would have been helpful, say 12-15dB.

### In Conclusion

In conclusion, the D100 De Luxe is a very versatile r.f./i.f. tuner system providing a wide sound tuning range and a sensible selection of vision bandpass characteristics. The wide r.f. coverage, with extended upper u.h.f. range, is excellent and the unit's compactness is impressive. The units are individually built, so it's possible to ask for variations such as different frequency coverage, supply voltages, etc. A descriptive booklet is included. The unit does not provide standards conversion of course, but you can nevertheless get a strong system L signal to appear — details are provided with the unit. Many of these units have been sold over the past few years. They have been used in the UK and elsewhere, with all types of signal propagation. The pedigree is good and the units can be recommended. The UK price of the De Luxe version is £89.99 inclusive of VAT, postage and packing. The non-sound "standard" version is available at £77.99. A leaflet on the D100 is available from HS Publications (address given earlier) — please include an s.a.e. with any enquiries.

# The Butt of Lewis

Les Lawry-Johns

I'd spent an interesting morning repairing three colour sets and a Pye cassette recorder, all for next to nothing because their owners always seem to be able to give me a good reason why they shouldn't be charged and, being the fool that I am, I always seem to see their point of view. Why doesn't my bank manager see mine?

## SEME Stan

Just as I finished the last one Stan (from SEME Ltd.) came in to take my order (small). I gave him the list and while he was writing it down I noticed the thing sticking out of his top pocket. It had a little red light on it, and suddenly started to bleep. "Why don't you answer it?" I asked.

"It won't talk to me" Stan said. "I have to phone them."

"Well phone them then and stop that racket" I said crossly.

"O.K." said Stan, "can I use your phone?"

"Of course you can" I replied. "I'll go and make your coffee with no milk and sugar."

So Stan phoned back to base while I plied my way in the kitchen. When I came back Stan looked white and shaken.

"I don't know" said Stan, "I've to go to the Outer Hebrides to placate a bloke called Tim Tiny or something like that. I know it's a familiar name, but I can't recall upsetting anyone that far away."

"I hope the sea is calm for you" was all I could think to say.

So Stan staggered out whilst I sat behind the counter wishing I'd not phoned SEME the previous day, saying I'd been dissatisfied with Stan's service on his last visit to me at the Butt of Lewis. I hope Mr. Bullock will bump into him and calm him down. I know he's up that way but I can't remember where exactly. Sorry Mr. Bullock. Hope Stan makes it across those waters. I wonder why I feel a little guilty?

## The GEC 3135

I felt guilty about this little GEC monochrome portable too — Model 3135. When it came in it refused to work at all, but it's a nice little set so I got on with it with the best of intentions.

The fact that it didn't work at all suggested to me that the trouble was in the power supply. I checked everything on the rectifier panel then decided to look up the circuit — in the 1976-77 volume of *Radio and Television Servicing*. With my muddled mind it took me a long time to make sense of it — it's the set with the switch-mode pump circuit, a single transformer being driven by the pump and line output transistors.

I decided to try it out with a battery supply. With 12V d.c. input the sound burst out and I concluded from this that the set would operate with a battery. This was silly, because I hadn't checked whether a picture would appear. I then reverted to mains operation and continued my search, beginning to realise what an idiot I'd been.

There was 250V at the collector of the switch-mode pump transistor TR451, which is adjacent to the switch-mode/line output transformer, but nothing at its base or emitter. A more careful study of the circuit suggested that a fault in the line output side could cause this condition. After a bit of a struggle I checked the line output transistor TR203 and found that it was short-circuit. At this point I decided to give the customer an estimate and wrapped up the job until I'd got his O.K. to proceed. When he came back he declined and took the set away. Another waste of time. Only mine so it doesn't matter.

## The Decca Portable

Shortly afterwards a young chap carried in a Decca colour portable. He said it had just arrived and was brand new but couldn't be tuned in.

I plugged it in and fitted the aerial plug. One front button selected the channels: the next two to it were for tuning up or down and the right side single button was for memory store. I selected channel 1 and pressed the lower search button. The screen lit up with a mass of grain and faint (TVS) channels drifted through. London BBC-2 appeared and I pressed the button once more in case the set lingered. Down we subsequently went and Channel 4 appeared, only to vanish as the set continued on its way down. BBC-1 appeared next, and I pressed the memory button to keep it on switch position 1. I then selected position 2 and repeated the previous procedure, pressing the memory button when BBC-2 appeared. This business was repeated for ITV and Channel 4. The young man was amazed.

"How did you do that? I'd tried for hours."

"You were probably going up instead of down" I suggested.

So having paid me a pound for the job he packed up the set and whilst doing so mentioned that it had arrived by parcel post that morning, having been ordered from a club. This explained why he hadn't be able to call for help from the suppliers.

## Return of the Intrepid Duo

Shortly after this a large, expensive car drew up outside (like I used to drive but can't afford to now). Out got Beardy and non-Beardy. "Oh my Gawd" I groaned.

They brought in a 22in. Amstrad of the type that has been haunting me lately.

"Will you just have a quick look at this?" said Beardy.

I stared at it hard.

"No, don't look at it. Find out what's wrong with it while we wait."

So I took the back off and freed the chassis, pulled it out and turned the whole thing up to get access to the chopper transistor etc. The latter was short-circuit, as was the line output transistor. Making allowances for finding the cause of the trouble and the resoldering etc. that would be required I told them that it would cost about forty quid.

Beardy's hair stood on end. "You are joking with us. Forty pounds to repair a TV set?"

"Yes. It was forty pence last time I think but this one will be forty pounds — or maybe more. If you're not happy you can take it and see whether you can get it done cheaper elsewhere. Only don't bring it back here."

So off they went, having found that Uncle Les isn't as daft as they'd thought he was.



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# Letters

## AMSTRAD AND REDIFFUSION CTVs

In reply to J.S. Ruwala (Letters, October), I've used the BU208D as a replacement chopper transistor in a number of Amstrad CTV2200 and CTV2210 receivers and found it to be trouble free. Although it's rated at 12.5W, I think that the important factor is the junction temperature rather than the specified power dissipation. These sets do have a large, efficient heatsink. After all, Grundig find the BU208A a suitable device for use in the switch-mode power supply in the CUC series chassis, while Ferguson use a BU208B in the TX10 chassis. They should know! The only reason why I advocated the use of the BU500D, which is rated at 75W, in my recent article on these Amstrad sets is that it's available from Sendz at £1.

One point I forgot to mention in my article was that if the owner of one of these sets, or his mate who understands computers, keeps replacing the d.c. fuse F502 (2AT) while the chopper transistor is short-circuit, or wraps it with wire or cigarette packet foil (and some of them do!), the surge limiter R501 (5.6Ω, 5W) will go open-circuit.

On a different subject, Nick Beer stated in the October TV Fault Finding column that he cut off the diode lead when fitting a universal tripler in a Rediffusion Mk. 3 chassis. The official Granada policy is to connect the diode lead to the input lead that goes to the line output transformer.

These sets are prone to dry-joints. I always resolder the pins of the line output stage chokes 5L1 and 5L2. If their ferrite core tops have fallen off, due to heat, stick them back on with Superglue. In view of the age of these sets I find that it pays to remove 5C20 (2,500μF, 40V) on the same panel, using desoldering braid, as the end often bulges electrolyte, indicating the need for replacement. Also check 5C15 (47μF, 350V) for the same symptoms. If you find that the line scan thyristor 5ITR1 — the one nearest the chokes — has blown, the usual cause is dry-joints on the pins of the EW transformer 6L4 on the power supply panel.

*Dave Mackrill,*

*St. Leonards on Sea, East Sussex.*

## BEAB AND THE HOME OFFICE

In answer to John Coombes' query about safety resistors (November, page 35) I would like to suggest that the cause lies elsewhere than in Devon's warmer weather. A few years ago I worked for a well-known Japanese TV manufacturer in South Wales. The failure of safety resistors in otherwise non-faulty new sets was quite common, to the extent that I christened it the "BEAB Syndrome". It's my opinion that the first law of BEAB must read something like this: in the exaggerated pursuit of safety, a major current-carrying component must be constructed so that it is inherently unreliable.

I would also like to comment on L.A.C. Dopping-Hepenstal's letter. He says that "Home Office reasons seem unconvincing". Surely this is true of most "reasons" given by the Home Office on a variety of topics. Unconvincing "reasons" usually come from those who wish to conceal their true motives. The Home Office loves

to exercise control over people, and the licensing system is designed with that in mind. Why otherwise have such a cumbersome arrangement? Every budget day the Chancellor remits in income tax allowances to the basic rate taxpayer a sum that's close, per week, to the net receipts from the TV licence fee. Why not simply omit one year's allowance increase (or more if necessary) and wind up the TV licence altogether? The "reason" given for not paying the BBC out of general taxation is that it would remove the BBC's accountability. But there's no accountability to the general public at present. If we are dissatisfied we can't withhold part of our licence fee, and if we don't take out a licence we can't watch anyone else's rubbish either!

The BBC's only real accountability is to the government, which has to arrange the financing in one way or another, yet every government for the last twenty or more years has complained about the BBC's lack of accountability — and of anti-government bias! The "reason" seems more of an excuse to me.

*Philip Lane.*

*Aberaeron, Dyfed.*

**Editorial comment:** The idea of the licence fee as a method of financing the BBC is surely to give it a degree of independence from general government control. The system has not worked well for many a year, and seems to be on the verge of breaking down. I have a feeling that it's the "least worst" approach though!

## HELP WANTED

Could anyone provide information on the pin connections for the TI TMS1000MP096 musical processor chip? I have been unable to obtain this information from the supplier and there is no TI representative here.

*S.C. Kinnoo, c/o Mauritius Inst. of Education,  
Reduit, Maritius.*

Could anyone supply me with a core for the f.m. coupling transformer L7 in the Cossor Model 523 radio receiver. It's connected to a spring at one end and to the dial cord at the other and has broken in half.

*Nick Beer, 27 Devonshire Park,  
Bideford, N. Devon EX39 5HZ.*

Could anyone supply a service manual or circuit diagram for a Centronics colour monitor Model 1415, code ABAA. It's a 14in. medium-resolution RGB monitor. I'd of course be willing to pay for this or a photostat. Also does anyone have a service manual for the Scopex 4D10A oscilloscope?

*John Walker, Eng. Tech., 14 Leamside,  
Leam Lane Estate, Gateshead,  
Tyne and Wear NE10 8NT.*

I've been trying to obtain back copies of *Television* from April 1979 to June 1986 inclusive. If anyone has these issues for disposal or is willing to part with them for a few pence, please contact me.

*P. Burgess, 2 Pepys Crescent,  
Barnet, Herts EN5 3EG (telephone 01-441 5126).*

## PLANNING RESTRICTIONS

Strange planning restrictions by local authorities and pointless by-laws can be the cause of the demise of family radio and TV businesses. At one time here in Plymouth a serviceman could have a shop in the city centre and live

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over or behind it with his family — pleasant accommodation too, for in some cases there were large gardens. But the planners altered all that. They decreed that no one can live on business premises in the city centre. So the family home has to move to the suburbs. The result is that you have to pay two lots of rates etc. and a lot of unnecessary travelling is required.

How does this affect the consumer? The old style dealer knew his products inside out and couldn't afford to sell junk. With all due respect to present-day retailers, they seem to be unaware of the shoddiness of the electrical goods they are selling and the shop assistants are too remote from the engineers to be able to get any advice on the quality of the goods on offer.

The only consolation is that a number of television engineers have been able to open shops in the suburbs and make a success of it.

*K.J. Treeby,  
St. Judes, Plymouth.*

### AVO BATTERIES

There have been several references to the cost of the 15V battery used in the Avo Model 8 in past issues. I've found that two 9V PP3 batteries and a 6.8k $\Omega$  resistor connected in series can be used instead. The procedure is as follows. Strap the two batteries side-by-side with opposite polarity. Connect one set of positive and negative terminals with say 5A fuse wire. Wrap some stiffer wire round the positive terminal of one battery and connect the leadout of the resistor to the negative terminal of the other one. You'll find that this assembly will fit longways into the battery compartment. The wire from the positive terminal

will push between the battery side and the meter connection, and the other end of the resistor will likewise push between the negative connector — lay the resistor on top of the battery. You'll find that it's easier to remove the 1.5V cell before fitting the batteries. An alternative arrangement is to remove the resistor in series with the adjuster and fit a 10k $\Omega$  hi-stab resistor in its place.

I've checked my meter with various hi-stab resistors and have found no difference in the accuracy of measurement.

*Fredrick J. Hay,  
Stockton-on-Tees, Cleveland.*

### SHARP VC9300

In the November Service Bureau the problem of intermittent loss of colour with the Sharp VC9300 VCR is mentioned. Having just spent a great deal of time on this problem I can sympathise. It may seem illogical, but the trouble went away after replacing IC301 (SA8063). The machine showed the fault only when the top cover was in place. It would seem that this thick-film unit, which lives in the head preamplifier screened box, gets overheated by the components below it.

*R. Marshall,  
Tonbridge, Kent.*

### SERVICING VIABILITY

May I add to the opinions expressed in recent letters on spare parts prices and servicing viability? I've been involved in servicing consumer electronic products since 1961 and find that certain basic factors haven't changed much. People have never wanted to pay a viable rate for repair work. This is mainly because of other "competitive

repairers" doing work at ridiculously low prices in order to maintain a work flow. In business you either make a profit (large or small) or you go bankrupt, so to condemn genuine engineers and dealers as being greedy rip-off merchants is short-sighted and narrow-minded.

If anyone reading this cares to start up a new business in the audio/TV/video consumer electronics trade he's more than welcome to try to make a living out of it. It will not be easy, and never has been. On the subject of spares costs, very large organisations have to employ larger numbers of people and their overheads — covering premises, vehicles, despatch, etc., etc. — are con-

sequently large. This will inevitably be reflected in the cost of spares.

If the public wants good service with properly trained staff and engineers it must be prepared to pay for this. Personally, I've never stopped learning and retraining since I entered the industry. My current take-home pay is £108 a week, which I suspect many of those "highly qualified electronic engineers" would laugh at. But I can repair car audio, home audio, TV sets, VCRs plus all tape recording equipment etc. Can they?

*M.J. McHugh, Eng. Tech.,  
Hednesford, Staffs.*

## Servicing with LSI Devices

**Nick Beer**

You have no doubt noticed the dramatic increase in the use of larger and larger scale integrated circuit chips in everything from microwave ovens to VCRs and compact disc players. Such devices may replace a couple of i.c.s and a handful of transistors or maybe a lot more in an earlier design, so servicing calls for a rather different approach. Manuals differ considerably from one setmaker to another in the amount of information given on what goes on inside such i.c.s. It may be worth noting that Salora employ the widely used Philips TDA and SAA series chips and provide very helpful diagrams for them in their circuit descriptions. These are obviously applicable elsewhere. The purpose of this article however is to pass on practical advice based on the considerable experience we've now had with these devices. Others may or may not agree with the views put forward here, but I've been using these methods for some time and have found them best in the context of workshop practice.

of the low resistance of the iron's element a 60W bulb is wired in series with it. This acts as a sort of temperature gauge. An improvement will be made in the future!

### Removing Surface-mounted Devices

Removing a surface-mounted device is tricky at the best of times. We use two methods. Should you want to save the device — if for example the diagnosis is tentative and the chip is an expensive one — proceed as follows.

First, remove as much solder as possible with desoldering braid (e.g. RS type 555-049) used in conjunction with extra flux (RS 558-869). Most workshops have flux but if you haven't it's invaluable and costs only about £3. Don't leave the braid on the joint any longer than is necessary — modern print will lift if you as much as look at it! Then touch a fine-tipped iron of not more than 15W on each leg while at the same time lifting the leg from beneath using a suitable device (see Fig. 2). There are loads of tiny, hooked probes that are suitable. It will need to be thin though. Failing that, flatten out a long staple —

### Anti-static Work-station

By now we should all be aware of the problems associated with devices that are sensitive to static. To facilitate replacement we've installed an anti-static work-station. Before doing so, much deliberation was given to the need for such an area. Having gone ahead we've found that it has been in everyday use and that on more than one occasion our three workshop engineers have had to queue to use it. Timber construction was used, as shown in Fig. 1. The dimensions may seem large, since in most cases a panel can be removed for repair, but we decided to cater for even the largest TV sets likely to need to be put on it.

We used the RS 550-022 anti-static work-station kit — floor mat, bench mat, quick-release wrist strap, three interconnecting leads and an interconnection plate with an earthing post and an earthing wire to link the plate to an independent earth. The bench and floor mats were cut down to size and stuck down with Evostick carpet adhesive. The two mats are linked to the interconnection plate via resistive straps, and this is where the wrist strap is connected. As a result these are all earthed to the same point. If you should require them, replacement parts are available from RS.

Another requirement is an earthed soldering iron. To make sure that it isn't used with an unearthed point and that nothing else is connected to its outlet, the mains connection is made via an MK three-pin clock connector.

Temperature control is by means of a dimmer. Because

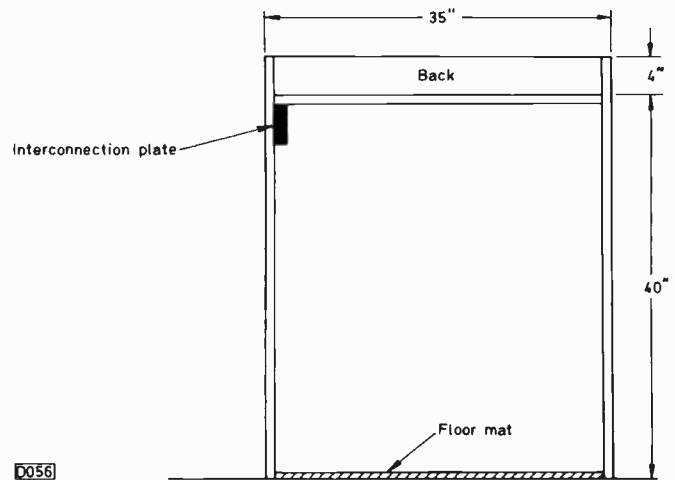


Fig. 1: Layout and dimensions of the anti-static work-station. Quarter inch plywood/blockboard is suitable.

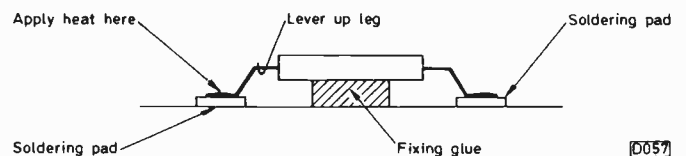


Fig. 2: Removing an LSI chip.

this works surprisingly well. When all the legs have been lifted (but none of the print!), carefully apply heat to the edges of the device to melt the glue that holds it to the PCB. Lever the device off the board while heating it in this way: this should be a quick action, not like stripping a door!

The other method is barbaric but is my personal favourite and is the safest approach when it comes to print damage. Run a *sharp* Stanley knife over the legs of the device, as close to its body as possible, cutting through the legs. Don't try to do the job in one go. Apply light, very even pressure and go in both directions. This should avoid print buckling, and after a dozen or so goes the legs will be cut. If you do it in less you're pressing too hard and one day you'll have to link up print with an 84-pin chip! When all sides are free, remove the body as before. Then unsolder each leg from the board in a quick "flick" action so that virtually no heat is applied to the print.

Finally, with either method, after removing the device tidy up the solder pads using braid and RS solvent cleaner (555-134) to remove the flux.

### Fitting Replacements

Now to fitting the replacement device. Having prepared the PCB you must decide on which method of soldering you're going to use. In my opinion it's best to use solder cream. This is a 62/36/2% tin/lead/silver solder suspended in flux. You apply it via a syringe to the PCB then you show the device to the board — ensure that it's the correct way round and perfectly square. Then, as you solder, you push the leg of the i.c. on to its pad through the cream and the joint is made by the solder amalgamating on the pad.

When applying solder paste/cream, apply it only to the outer halves of the pads and apply sparingly — experience will show you how much to use. To solder, you just touch the pins: if you apply the paste to the inner halves of the pads the heat won't reach this area so the paste remains and there's a danger of shorts. The RS stock number for a 25g syringe is 551-693. After soldering all the pins thoroughly, remove the excess with a swab soaked in solvent cleaner. Because of its nature, provided you've used the paste in a suitable amount shorts and dry-joints won't occur.

The alternative method is to tin the pads with a low melting-point solder such as RS 551-665 then place the i.c. on and touch each leg with the iron, making sure that the solder melts properly and that the leg fits flat on to the pad. The main disadvantages of this method are first that a lot more heat is required, with a greater risk of damage to the print, and secondly that when you try to fit the i.c. the pins tend to "roll off" the pads because they are rounded with the tinning solder. The latter can be particularly annoying when you are trying to line up 84 pins.

After soldering the chip in, check each leg for a good joint and no shorts — use a magnifier for this. Then clean around with solvent cleaner and cover your joints with PCB lacquer.

One final point. When you fit the i.c., it may be preferable first to glue the replacement device in place. This prevents movement of the i.c. when you start to solder.

You won't go far wrong if you follow the guidelines given above. RS products are available by mail order on a cash with order basis from: Electromail, PO Box 33, Corby, Northants NN17 9EL (telephone 0536 204 555).

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### ● SERVICING THE FERGUSON TX10 CHASSIS

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### ● HOW TO DEAL WITH EHT ARCING

E.H.T. arcing is a common enough problem, but it's often dealt with in a rather haphazard way. Nick Bær provides guidance on the best way to go about stopping the trouble.

### ● IBC '88 REPORT

The main theme of the 1988 International Broadcasting Convention was high-definition TV. Geoff Lewis reports on the latest developments in this field and the debate on standards, also on other recent innovations.

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# How to Run Your Vintage TVs

## Part 2

Jeffrey D. Borin, B.Sc. (Eng.), A.M.I.E.E.

In Part 1 last month we looked at the video frequency side of providing signals for vintage TV equipment. In this concluding part we will consider first the r.f. side then various ancillary topics.

### RF Modulators

Most people seem to use David Looser's r.f. modulator design (see *Television* October 1984) which is a perfectly good circuit. Experimenters may care to try Colpitts oscillators in the design to minimise coil winding. A novel approach is to use intercarrier sound modulation. The standard LM1889 chip can be readily operated with positive vision modulation. For intercarrier sound the subcarrier oscillator is run at 3.5MHz, but we have no more details of this technique.

My own approach is to use a couple of modified Rediffusion h.f. modulators, one each for sound and vision. They came from the previously mentioned Telebox tuners, though there may be other sources. If you have just one of these tuners, a co-operative friend will be needed to supply the second modulator. Removing the modulator doesn't harm the tuner – it's a metal can on the power supply PCB. The crystal must be changed to the appropriate carrier frequency and any h.f. tuned circuits removed. The new crystals tend to oscillate at their fundamental frequency: connecting a 2.2k $\Omega$  resistor across the crystal should prevent this. Remove the d.c. restorer in the sound modulator. A simple resistive combiner will mix the vision and sound. If there's a demand, further details of this design will be published.

For channel 1, the most useful frequency, the vision carrier is 45MHz and the sound carrier 41.5MHz. Specify third overtone series resonant crystals. The can size will normally be HC18/U with wire ends or HC25/U to plug in. McKnight Crystals offers an excellent service for amateur users, with fair prices. Lower prices are possible if a group of people make up a large order and/or by accepting longer delivery times. Other crystal suppliers may be willing to help. See addresses at the end of this article.

An LC tuned circuit will often work adequately in place of a crystal, especially if a frequency meter is available. Table 3 lists Band I carrier frequencies. The devices used in these modulators may start to be unhappy at the top end of Band I and are not suitable for Band III channels.

### Signal Levels

Most modulators produce an r.f. output of 20-100mV. The unmodulated sound signal should be 6dB (i.e. 50 per

cent) down with respect to peak white vision. The full modulator output will overload many sets, so attenuators are needed. Aim for 3-5mV at the set. The full output is often useful with an old set in poor condition.

Distribution arrangements are necessary with ambitious rigs using several sets. Most commercial amplifiers and splitters will cope with Channel 1, though some modern equipment may roll off below 70MHz. With the high output provided by a modulator an amplifier should only rarely be needed. Coaxial cable is not a problem these days – even the cheapest grades are suitable.

It's worth putting an aerial isolator on a v.h.f. output. This will prevent a dud receiver exterminating the modulator. Use one from an old v.h.f. set – modern isolators tend to be for u.h.f. only.

Many sets predate the standard Belling and Lee coaxial plug, so modify or improvise as necessary.

### Transmission

If you connect your modulator to an aerial you'll be transmitting illegally, so don't. An amateur licence allows you to send 405 on the 70cm and other bands. I understand that only two of the old 405-line transmitters have survived – the low-power Isle of Man relay is at the Vintage Wireless Museum and the Dover transmitter is at the Dover Transport Museum. Can anyone prove me wrong?

### Conversion to 625

If you can't get a 405-line signal, make your set work at 625 – no abusive letters, please. Your v.h.f. modulator will be quite happy with a 625-line signal. Pictures will tend to be soft due to the 3MHz receiver bandwidth, and the h.f. bits of 625-line video may cause buzz-on-sound.

Pre-war sets are probably the easiest ones to modify – no complex tuned energy recovery line output stage circuits here. Sets with electrostatic deflection, such as GEC models, should be simple. The HMVs look very promising. 625 is almost within range of the line hold control. Thyatron timebases may be more reluctant.

On post-war sets the line output stage tuning can be a problem. Some Bush TV22s have been simply modified to operate on 625 lines. Many other sets must be possible. A helpful two-part article on converting 405-line sets to 625-line operation appeared in the January-February 1969 issues of *Practical Television*.

This sort of thing has to be done by trial and error of course. Check the e.h.t. before and after to save the line output transformer from too much stress. The e.h.t. rectifier's heater may operate at the wrong power. This is something that's not measurable with an ordinary Avo or digital multimeter. Extra/fewer turns on the heater winding is one answer: a BY140 or similar silicon e.h.t. rectifier is another.

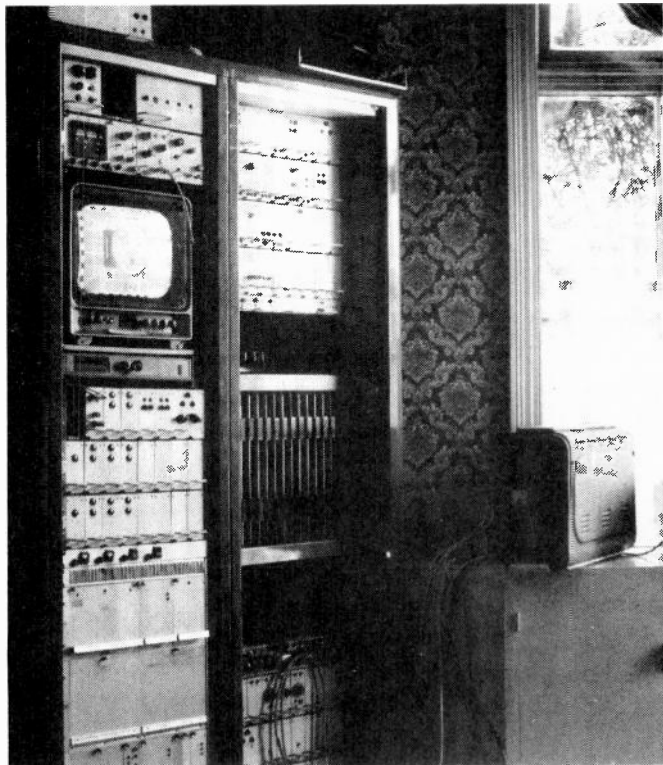
### Monitors

It's always handy to be able to check a 405-line video signal before modulating it. This calls for a 405-line monitor. Most of the monitors from the valve era will

Table 3: Band I carrier frequencies.

Channel	Vision (MHz)	Sound (MHz)
1	45	41.5
2	51.75	48.25
3	56.75	53.25
4	61.75	58.25
5	66.75	63.25





General view of the standards converters and ancillary equipment at the Vintage Wireless Museum. On the right, a Test Card C monoscope. The right-hand equipment bay contains an analogue standards converter and 625-line sync pulse generator. The left-hand bay contains, from the top, test waveform generators, a waveform monitor, a dual-standard monitor, an off-air tuner, a modulator plus signal switching section, part of the analogue converter, the mains switching and a digital standards converter.

work at 405 either by simple modification or switching, which may be either manual or automatic. Names to look for are Peto Scott (an excellent range from 8.5 to 21in., all with automatic standards switching), Rank Cintel, Marconi and Pye. The little, solid-state 8.5in. Pye 082 has a 405-line option, but the Rolls Royce must be the Prowest PM14/1 series. These are first class solid-state monitors, but not all are fitted with the 405-line option.

If you decide to modify a 405-line receiver for monitor use, remember the usual safety rules in connection with mains isolation.

## Sound

Sound does not present many problems. If you put a rather wideband signal into your vision modulator you may get buzz on sound. The complete cure for this is a good low-pass filter, but this is a complex device. Just avoid troublesome signals such as test patterns with sharp edges. The ultimate deterrent is a direct sound feed at a.f. Cheating again, but very effective on pre-war sets with a gramophone input.

## Sync Pulse Generator

If you run 405-line cameras or test generators you may need a sync pulse generator. Old 405-line and multistandard SPGs do turn up. None are young and reliability may be a problem. Everyone except the real masochists should avoid a valve SPG.

The standard pulses required are as follows:

Mixed sync – the full sync waveform.

Mixed blanking – defines the black edge around the picture.

Line drive – to trigger the camera's line scan.

Field drive – to trigger the camera's field scan.

Standard levels are 2V peak-to-peak negative-going at 75Ω. 4V pulses were sometimes used.

DIY designs have been published in *CQ-TV*. If you want to have a go at designing an SPG a good master crystal frequency would be a multiple of 2.53125MHz. This will divide down to both 10,125Hz and 15,625Hz.

## Studio Equipment

Very little 405-line studio equipment survives and I don't think there's much interest in this subject. No one has restored a pre-war Emitron camera for many years and the chances of doing this again seem to be remote. Later cameras have survived, and a fair number of image orthicon types are in amateur service.

Early ancillary equipment such as SPGs and VDAs can be problematic. 1V peak-to-peak at 75Ω is a wretched standard for valve circuits. The honourable exception is the previously mentioned monoscope test card generator. If there are any other fans of early studio equipment willing to prove that this view is wrong, would they please get in touch.

## Programme Material

As a long term project I am trying to get together a tape of interesting early material. This could be issued on 625 and/or 405. The two problems are getting decent quality copies of relevant material and, far more difficult, obtaining copyright clearance for distribution. If anyone can help with either problem, please write to me care of *Television*. For reasons of copyright I cannot distribute any of the material I've so far collected.

## Acknowledgements

Finally my thanks to John Gillies for much useful information, to Reg Lovick for taking photographs and to Gerald Wells for allowing me to make a nuisance of myself at the Vintage Wireless Museum. The latter is run by the British Vintage Wireless Society at 23 Rosendale Road, London SE21 (01-670 3667). Anyone wishing to pay a visit should phone and book beforehand.

## Addresses

*CQ-TV*, mentioned several times in this article, is the magazine of the British Amateur Television Club and is available only to members. Many useful designs for SPGs, test pattern generators etc. have been published in the magazine and the Club's other publications. For membership details apply to Dave Lawton, Grenehurst, Pinewood Road, High Wycombe, Bucks HP12 4DD (0494 28899). For details of publications apply to Ian Pawson, 14 Lilac Avenue, Leicester LE5 1FN (0533 769425).

The following firms can supply crystals:

McKnight Crystals, Hardley Industrial Estate, Hythe, Southampton SO4 6ZY (0703 848961).

IQD Ltd., North Street, Crewkerne, Somerset TA18 7AR (0460 74433).

Euroquartz Ltd., 5/7 Church Street, Crewkerne, Somerset TA18 7HR (0460 76477).

C.R.T. regunning can be undertaken by Display Electronics, Unit 4, Swan Wharf, Waterloo Road, Uxbridge, Middx. (0895 55800).



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Machine No.: SL5W, 5000 5100 SLC5, C6, C7

Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A  
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# VCR Clinic

Reports from Eugene Trundle, Nick Beer,  
Philip Blundell, Eng. Tech. and  
Ian Bowden

## Sharp VC9700

So long as operating power etc. is available, failure of a front-loading machine to accept a cassette is usually caused by a faulty cassette-in switch. Not this time however! The main microcomputer chip 1801 was receiving the cassette-in message, and indeed was telling the associated output expansion chip 1803 that the message was present. Output pin 12 (CASS-M-CTL) of 1803 was going high, but not pin 17 (CASS-M-DRIVE) of 1805. The message was being lost in R892 because Q810, which prevents conflicting loading and cassette motor actions, had gone short-circuit from collector to emitter, thus holding down the CASS-M-ON line. E.T.

## JVC GRC7

The symptom was almost like that produced by dirty heads – nothing but snow and streaks on the screen during playback. We noticed from its whine that the head drum was going much too fast – slowing it by hand produced some vestige of a picture.

This effect is generally caused by problems in the drum-motor drive speed-control loop. In this case IC103, which is actually a tiny module on the servo board, was responsible. A good FG signal was present at pin 6 (frequency-to-voltage converter input) but a fixed, low output voltage – less than 1V – was present at pin 7. E.T.

## Panasonic D1 Deck

This excellent deck is used in Models NV430/730/810/830, NVG7/10/12/18 and possibly others. It's sturdy and reliable, but there is one recurrent problem – the mode-select (mechaposition) switch, part number VSS0110. When it fails the symptoms, which are usually intermittent, are failure to retract tape into the cassette during tape unload, intermittent shutdown during playback or record, or shutdown after tape loading due to no take-up. The spools are belt driven from the capstan motor, and it's incorrect capstan motor function switching that causes the problems. E.T.

## Sony CCD-V7/V8/AF

The camcorder in question was actually a Pioneer clone, Model VE-M800. Its problem was intermittent mistracking and tape damage. At the fully-threaded position the buckle-shaped pressure lever that pushes the pinch roller into contact with the capstan would sometimes become jammed under the end-cheek of the pinch roller. The cause of the problem was a warped loading ring. This was obvious when the ring was removed and laid on a flat surface. It can be flattened and put back in the machine. E.T.

## Sony SLC5/6/7

These models are getting to be rather old now. Many are being scrapped as expensive head and motor replacements become due. A common problem in their old age is loss of capstan servo lock, with cycling noise bars and wow on sound. For some reason my customers seem to complain about the sound but don't mention the regular mini-snowstorm! Adjustment of the capstan free-run speed

always cures the problem — it's an easy adjustment to make. The problem must be caused by component ageing rather than breakdown, since we've never had a come-back. E.T.

## Hitachi VT63

This was an unusual one. The fluorescent display worked except for the third block from the left (3 and Sunday) which remained blacked out at all times. If a finger was firmly pressed along the tube's leadout pins this block, amongst others, would light up, so the tube was exonerated. The 3/Sunday section is designated grid 8 (tube pin 11) and should be fed by a pulse/strobe signal from pin 46 of the timer control chip IC101 (M50757-681SP). This signal was missing and replacing IC101 restored the full display. E.T.

## Grundig VS180

The complaints noted on the job card were failure to record and the keyboard LEDs not lighting up. Sure enough the record button had no effect, also the tape counter didn't work. The common item was IC235 (4066) on the control board, where its inputs from IC240 were being held down. To be on the safe side I replaced both IC235 and IC240.

The problem with another of these machines was that sometimes at switch on the tape would be spooled very fast for twenty seconds. If the tape was near the start the end sensors didn't work and the tape would be broken. If record was selected the machine would thread up then immediately unthread and the pause light would flash. The common clue was that when either fault occurred the +12F supply was missing. The power supply was sensing an over-current on the +12F line because C769 (100µF) on the video module was short-circuit. P.B.

## Grundig V2000 Models

If you encounter any of the older Grundig VCRs with ripple on one of the supplies, spend a few minutes checking for ripple on the others. Fit Grundig supplied capacitors as necessary. You'll be glad you did! P.B.

## Ferguson 3V55

For intermittent no E-E or record vision check that R105 on the tuner/i.f. panel has been correctly inserted in the PCB. P.B.

## Salora SV6500/Sanyo VHR1100

This machine damaged tapes – the two supplied by the customer had creased sections hanging out of the cassette, both very near the beginning of the tape. When a workshop Panasonic tape was inserted, rewound and play was selected everything appeared to be all right. We then tried the customer's Scotch tape. After a few seconds a loop of tape started to grow slowly between the pinch roller and the take-up side of the cassette. The tape was rewound to remove the loop, then taken out. We again tried with the Panasonic tape, in the playback mode. As the tape swung round the swing guide (the one between the pinch roller

and the cassette) it could be seen to lift clear then tighten up again cyclically, but it didn't form a loop. The problem was that at the beginning of the tape the take-up drive wasn't going fast enough to keep the tape taut, though the drive could cope farther through the tape. The cause was a defective reel drive motor. Interesting the different effects with the two types of tape. I.B.

### Salora SV6500/Sanyo VHR1100

The report was of a poor playback picture. After replacing the video heads the results were much better but the picture still didn't look as good as it should have done — in fact it was better with a prerecorded tape than with one of its own recordings. When I tried to adjust the tracking control at the front of the machine I found that it didn't alter the tracking at all. The control consists of a 100kΩ slider with a centre notch for the normal setting. A resistance check revealed that in the centre position the potentiometer read around 1kΩ instead of 50kΩ.

The cause of the problem was revealed when the potentiometer was removed from the panel and taken apart. There are four connections to the potentiometer, one for each end of the track, one for the slider rail and one for the unused centre tap (see Fig. 1). Some material had collected between the slider rail and the internal land, making a link to the centre tap. After removing this material with a cotton bud and refitting the control the tracking worked perfectly. The original heads were also found to be o.k. when they were refitted. The tracking control had been set at one end on playback, so that even with its own recordings the picture was poor — it just so happened that the prerecorded tape was recorded with the correct tracking offset. I.B.

### B and O VHS82 (Philips machine)

This was a nasty fault. The symptoms were no picture in the E-E or playback modes from either the r.f. output or the scart socket. Sound was o.k. in both modes. There was also no test signal, which should appear when play is pressed with no tape inserted. A colleague had found the point where the video waveform disappeared. These

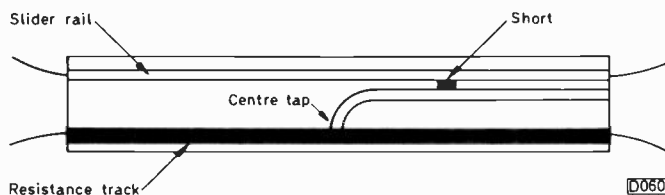


Fig. 1: Salora SV6500/Sanyo VHR1100 tracking control.

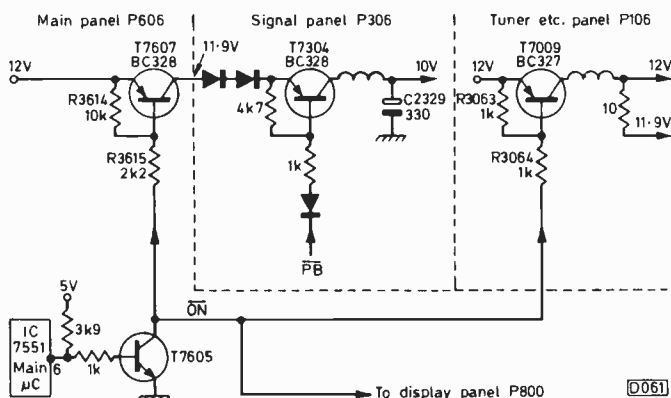


Fig. 2: B and O VHS82 (Philips machine). Failure of C2329 led to a number of problems.

machines use an HEF4053 analogue switching chip, IC7953 on panel P606, to select whether the E-E video signal or the playback signal is fed to the modulator and scart socket. There was no output from this chip and its switching pin 11 was in the wrong state. The output goes to display panel P800 which produces the on-screen menus etc. It requires the picture (or part of it) to be blanked when information is inserted. Perhaps the fault was here? Checks revealed that the video signal was in fact being blanked by the display chip. As there was another VHS82 in the workshop the panels were swapped over. But the video signal was still blanked!

The machine was then passed to me as my colleague went on holiday. After spending some time checking on what was happening I found that there was another symptom. When the machine was switched to standby there was a blank raster on the monitor screen instead of snow. This led to a check on the modulator/tuner panel P106 where I found that the +12V supply was present whether the machine was on or in standby. It should be switched on and off by transistor T7009. Fig. 2 shows the relevant circuitry. When the /ON line is high T7009 should be off as its base will be at 12V. I found that in standby the /ON line went to only 6V, so the transistor was always on. The cause of all the trouble was traced back to signal panel P306 where C2329 was short-circuit. As a result T7304 had gone short-circuit emitter-to-collector while T7607 on the main panel P606 had gone short-circuit base-to-collector. Resistors R3063, R3064 and R3615 were therefore connected between the 12V rail and earth, giving T7009 a fixed base bias. Replacing the faulty components cleared all the problems. I.B.

### Sony CCD-V50

Playback of previous recordings was o.k. but there was no picture from the camera section. I soon found that there was no unregulated feed to the camera d.c.-d.c. converter. In Sony units the supplies for the power zoom and auto-focus tend to be derived from elsewhere so that these will work even when the converter is out of action. This was indeed the case. The cause of the problem was that ICP PS901 was open-circuit. This is the only interruption to the unregulated feed which comes straight from the battery: it's mounted on the small PCB in the camera grip — if you don't realise this you could be searching for hours!

Complete operation was restored when PS901 was replaced so, after a bit of adjustment, the unit was left recording. After a few minutes it tripped off. It worked for a few seconds after being switched back on, then went off again. PS901 remained intact, though I suspected that after a few more goes it wouldn't have done. It was clear that there was a fault in the d.c.-d.c. converter, so a CCDV30 type was hung in. We keep these in stock, along with the CCDV100 type, as they've proved to be troublesome. As the unit now ran till the end of the tape the correct unit was ordered and fitted. N.B.

### Corrections

There were one or two errors in the editing of my VCR Clinic items last month. First the Ferguson 3C03 camcorder. There was power zoom operation as this is not fed from the d.c.-d.c. converter. Also the pickup device is not a tube! Secondly the Ferguson 3V58 VCR. R2 was open-circuit but D4 was all right, the cause of the trouble being, as stated, that C5 was leaky. N.B.

# Long-distance Television

Roger Bunney

September traditionally produces improved tropospheric conditions. Once again, thanks to a settled high-pressure system, the UK and central Europe experienced a good opening that lasted for several days. There was also a certain amount of Sporadic E propagation, though much less than in earlier months, and the first signs of improved F2/TE activity, with the maximum usable frequency (m.u.f.) rising through 30MHz up to the very low 40MHz spectrum. Excluding meteor scatter signal pings the UK reception log is as follows, SpE unless otherwise stated.

- 4/9/88 TVE-1 (Spain) chs. E2, 4; TVE-2 E2; RAI (Italy) IA, B; RTS (Albania) IC; JRT (Yugoslavia) E3, 4; CST (Czechoslovakia) R1, 2; MTV (Hungary) R1, 2; ORF (Austria) E2a, 4; RTP (Portugal) E3; TVR (Rumania) R2; TDF (France) L3; TSS (USSR) R1, 2, 3; NRK (Norway) E3 – a good day for SpE!
- 5/9/88 TVE E3; NRK E2, 4; SVT (Sweden) E3.
- 6/9/88 RAI IA, B; TVE E2, 3; RTP E3. Improved tropospheric reception in the south east from RTL (Luxembourg) ch. E7 and W. German Band III/u.h.f. stations.
- 7/9/88 NHK E3; TVE E2. Improved tropospheric reception from Benelux, French, Swiss and W. German Band III/u.h.f. stations. AFRTS (US Forces) Holland ch. A80 received in Powys.
- 8/9/88 CST R2. Tropospheric reception, less intense than the 7th, from France and Switzerland in Bands I/III and at u.h.f.
- 11/9/88 NRK E2 received via Auroral scatter.
- 16/9/88 Tropospheric reception from RTE (Ireland) in the west and Benelux stations in the east.
- 17/9/88 TSS R1, 2.
- 18/9/88 TSS R1. Improved tropospheric reception with RTE, NRK (Band III), SVT-1, SVT-2, DR (Denmark), West and East Germany and France. Band III/u.h.f. signals throughout much of the UK included the second Danish chain ch. E53 "KBH Vest".
- 19/9/88 An excellent tropospheric opening with Band I/III and u.h.f. signals throughout much of the UK from France, West and East Germany, Denmark, Switzerland and Luxembourg.
- 20/9/88 Another excellent day much as the 19th but with stronger W. German signals from all regions. Anthony Wrycza received TVP (Poland) ch. R38 in Reading.
- 21/9/88 The tropospheric opening fades away, with W. German Band III/u.h.f. stations and Switzerland chs. E7, 9.
- 28/9/88 TSS R1; SVT E2; TVP R1; RUV (Iceland) E3, 4; YLE (Finland) E4; CST R1; RAI IA.
- 29/9/88 TVE E2; RTP E3.

During the good tropospheric opening over the 19-21st Ryn Muntjewerff in Holland received a great many distant Band III/u.h.f. signals including TVP-1 chs. R9, 12; TVP-2 R38; CST-1 R10; CST-2 R38; SVT-1 E6, 7, 8, 9, 11 and 33.

With solar cycle no. 22 now well advanced and the sunspot count rising, this winter should be producing m.u.f.s into the low 40MHz range and evening TE propagation could well reach 50MHz on a north/south path. It will therefore be worth checking on ch. E2

towards the south from 1600-1900 GMT – you may get ZTV (Zimbabwe) ch. E2 or ch. E2/3 signals from Ghana/Nigeria. The sunspot maximum is being predicted for Sept.-Dec. 1989 or perhaps early 1990, with a smoothed count of 170-190.

A letter from Anthony Mann (Perth, Australia) confirms the rise in F2 activity, with daily US reception at up to 37MHz. On September 3rd he received China ch. C1 with French/English sound and patchy video. The programme consisted of educational material at 1626-1730 local time. The Australian medical paging frequency at 40-68MHz could be a good pointer for the possibility of ch. A0 reception – these pagers have been received in the UK, and Australian TV on ch. 0 was seen here during the last sunspot maximum.

Hugh Cocks (Algarve, Portugal) also reports improved F2/TE conditions during September. On many nights ZTV ch. E2 was received at up to 2000 BST while ch. E2, 3 and 4 signals from Nigeria and Ghana were received during the evenings. On some nights there was the additional bonus of Brazil ch. A2! Ch. A2 signals were also received from the south east, possibly from Saudi Arabia.

While Iain Menzies was on holiday in the south of France he observed an excellent tropospheric opening using his 2in. multiband Sanyo TV set. There was a mass of Band III/u.h.f. signals with every u.h.f. channel full, mainly with signals of Italian origin – there were up to four signals in some channels!

Kevin Phillips (Bexhill) is using a wideband five-element Antiference Band III aerial with a D100 converter (see review elsewhere) and an XG14W u.h.f. array for TV-DXing. He is also an f.m. DXer. Doubtless he will by now have received "Contact 94", a 24-hour station operating from Lessay, Normandy, mainly in English and directed at the Channel Islands. Originally on air at 94.4MHz, the station seems to have settled at 93.75MHz.

During September I dismantled my aerial system and fitted replacement arrays – a single-boom wideband Band I/III/u.h.f. system and the 55MHz Les Wallen helical aerial. The initial results from this rather smaller than usual system are encouraging.

My thanks to the following for sending in reports: Iain Menzies (Aberdeen), Peter Schubert (Rainham), David Oliver (Birmingham), Roger Fussell (Torpoint), Tim Anderson (St. Leonards), Simon Hamer (Powys), Anthony Wrycza (Reading), Bill Cotterill (Tipton) and Ryn Muntjewerff (Holland).

## News Items

**Spain:** The Communications Ministry has leased two downlinks on Eutelsat I-F5 to provide an alternative distribution system pending a major overhaul of the network. Telecinco has been adopted as the name for the TVE teletext service. New regional services are planned by Antena 3, Tevisa and Univision Canal 1. In addition to the three private services now in operation (TV3 in Catalonia, TV Galizia and Euskal Telebista in the Basque area) a further three are to come into operation over the next eighteen months – RTVM in Madrid, TVV in Valencia and Canal Sur in Andalusia.

**Hungary:** A third TV network is expected to be launched in 1994/5 to provide regional programming. Extended hours are being sought for the MTV-1 and MTV-2 services.

**France:** New EBU listings are as follows: Vannes M6 ch. E48 75kW; Saint Etienne M6 ch. E55 10kW; Paris-Nord

M6 ch. E62 3kW; Saint Etienne La 5 ch. E65 10kW; Paris-Nord La 5 ch. E65 3kW. Polarisation horizontal in each case.

### Satellite News

The BBC is to expand its satellite TV coverage. A compilation of BBC-1 and BBC-2 material will be aimed at Europe in general as a 24-hour service. At present a limited service via the 27.5°W satellite is available to Scandinavian cable networks and the Iberian Peninsula, using SAT-SAVE scrambling. The service is likely to move to Eutelsat I-F1 at 16°E. Premiere, which also uses SAT-SAVE, may move to the Astra satellite and change its scrambling system. This would leave only the BBC and Canal 10 (Spain) using SAT-SAVE. Super Channel's transponder on Eutelsat I-F5 refused to fire up: to accommodate Super, TVE-1 has moved to 11.15GHz (horizontal).

AFRTS has been seen by Ian Waller at 11.5GHz on Eutelsat I-F5, with MAC-B signals. He has also seen new scrambled/unscrambled test signals at 1°W, on 11.66 and 11.04GHz respectively, both horizontal. With RAI-2 now on 11.62GHz, both RAI services are available at 10°E.

Hughes Aircraft is to build two new satellites for AUSSAT, each with fifteen 50W Ku band transponders. Eight will be steerable for Australian/New Zealand traffic.

The Astra sound subcarriers are to be arranged as follows:

Subcarrier	Mode 1	Mode 2	Mode 3
7.02MHz	Language 1 (L)	Language 1 (L)	Language 1 (M)
7.20MHz	Language 1 (R)	Language 1 (R)	Language 2 (M)
7.38MHz	Language 2 (L)	Language 2 (M)	Language 3 (M)
7.56MHz	Language 2 (R)	Language 3 (M)	Language 4 (M)

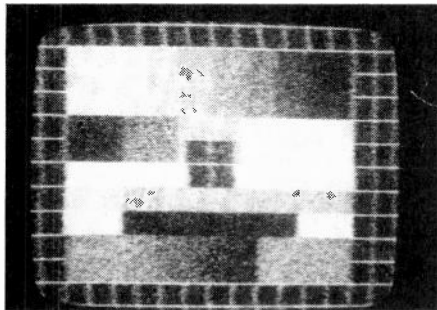
M = mono, L = left stereo, R = right stereo.

Channels have initially been allocated as follows:

Service	Channel	Audio
Eurosport	4 (V)	Mode 3
Sky Channel	8 (V)	Mode 1
Sky News	12 (V)	Mode 1
Sky Movies	16 (V)	Mode 1

V = vertical polarisation. The Sky Radio stereo service will be carried by the language 2 subcarriers of channel 8.

On test at the Astra HQ a recent LNB with a noise figure of 1.1dB maximum showed that a 50cm dish will provide an adequate signal and noise performance.



An unusual fault condition with the FUBK test pattern from BRT (Belgium) received by Tim Anderson (St. Leonards, East Sussex) in late August on ch. E10.

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### New Products

We understand from Aerial Techniques (for address see advertisement) that a new Yoko 6in. colour set is about to become available from them at under £300 inclusive of VAT. It will have v.h.f./u.h.f. coverage, PAL/SECAM capability and operate on systems B/G/I/L. Power is from the mains or an external 12V source.

The MFT Company Ltd., 164 Station Road, Lower Stondon, Henlow, Beds SG16 6JH has introduced in the UK a u.h.f. head amplifier with very low noise and good adjacent channel selectivity. When it was tested by MFT a few miles from Sandy Heath, Group A London signals were handled with negligible adjacent channel interference. A Band I/II version is to be introduced, though at a much higher price (around £150 plus VAT, with F connectors). The system consists of a remotely tuned

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# A Day in the Life of . . .

**Mick Dutton**

There's been much comment of late in *Television* on amateur repairs and pirates, the supply of parts and all the associated arguments. This has caused much talk amongst us professionals. I speak as someone who's now spent seventeen years in the trade. Others I know have spent a lifetime doing a job that at one moment can be totally disheartening while the next minute it can be very rewarding.

In a typical day I start work at 8.30 a.m. only to find a steady flow of customers expecting repairs to be carried out almost instantly and for next to nothing in cost. By 9 a.m. there are six or more items to be done quickly while I'm still trying to get the Grundig VS310 lift mechanism back together after having spent two hours the previous afternoon removing a small rubber that had jammed under the operating bar, then realigning the lift and loading mechanism. The phone starts to ring and several outside calls are requested.

The next job is a Pye 5487 fitted with the K40 chassis. Customer's complaint is no results. I take the back off and look at the dry-joints on the line output transformer — two beauties. A quick solder job and switch on, but there are still no results. The power supply is providing an output voltage, so I consult the manual and work back from the line output transistor. As there's no line drive waveform I try to find the line driver stage which turns out to be on the power supply panel. Locate the collector feed resistor R3192 (680Ω), find it open-circuit and fit a replacement. The set now works, so leave it in the corner of the workshop on soak test. It sits next to the GEC/Hitachi set which the customer says goes dead when warm. That one's been there a week without showing any fault.

Next a Panasonic VCR. It's an NV370 and the customer said that the clock was on but nothing else worked. As I was opening the lid I was thinking about the small safety resistors that go open-circuit on the power supply panel. A quick look at the power supply showed that lots of work had been carried out. An hour and a half later the machine worked. The original fault had undoubtedly been that the small safety resistor R1105 (0.56Ω) had been open-circuit, but the machine had suffered from the attentions of the "experts" at the local RAF base. These fifteen grand a year boys had removed every transistor in the power supply, replacing them as they saw fit (mainly backwards!). The microcomputer chip had suffered a death blow and the clock display had been broken. This sort of thing is quite normal. We get a steady flow of all sorts of items in a similar state from this base. It's amazing really when they appear to have unlimited resources and access to test equipment, spares and phone time to makers' technical departments. All paid for by the taxpayers. We have a similar problem with repairs that come from the man up the road who is on a job start scheme or whatever the current name is. He's the only person I've

ever met who can extract £35 from a customer for not doing the job.

A customer calls for his set which was repaired yesterday. This was a Decca portable (DN1615A), about two years old, with the usual poor joints and burnt contact under the on/off switch. He complained bitterly about the bill for £18, which included sorting out the meter wiring that had been applied to the set during installation (a double-pole meter with only the live wires connected and the two neutrals joined and left bare under the chassis!). This was one of about 3,000 sets of this sort sold in our area to guest houses and hotels on a five-year contract. The firms concerned have gone to the wall, leaving the customers with no service contract but a bill to the finance company of about £400 per set over five years.

The next job is a nice quickie — an open-circuit 4.7Ω surge limiter resistor in a Philips KT3 chassis set. I noticed that the decoder had the single plug-in chip so it seemed like a good idea to clean the pins to save a come back later.

Time to go and do some outside jobs. First a call to a Pye receiver with a snowy picture. Sure enough the picture is grainy, so I turn it around to look at the aerial connections. The customer has a Panasonic NV333 VCR and the aerial attenuator is switched to low. I turn it to high and the customer shouts "that's better!" A quick check through the set and tune in the VCR correctly and the job is done. I give the customer a bill for £12, which is our standard charge for an outside job — hardly excessive. The customer complains about the charge when there was nothing really wrong, and then goes on to say that the VCR has only just been repaired by another engineer who'd charged £30. I asked why, if he'd been charged £30, he didn't call the engineer back? The reply was that the engineer wasn't a professional and had just cleaned the heads and didn't know much else!

The day continues in much the same sort of way. On returning to the workshop there's another heap of things awaiting attention. I notice a couple of Betamax VCRs with notes saying "estimate for insurance" written on them. We're wise to this now. The customer wants a VHS machine so he fills his Beta with water, asks us for an estimate for his insurance, then goes off down the road to the local discount shop to buy a cheap VHS machine. There's a Philips VR6467 VCR — the one with the all-plastic mechanism that needs a miracle to be able to load the tape more than twice . . .

A woman comes in to collect her Philips radio-cassette. She's most upset about the bill for £9.20. This is for stripping down the cassette unit and repairing the autostop mechanism.

It was nearly time to call it a day when an American gentleman comes in with an RCA camcorder. Could we look at it? There wasn't much wrong, it just wouldn't load a tape. We asked him to leave it, saying we would look at it next morning, but he wanted us to look there and then. Said he was on holiday and wasn't prepared to waste his time calling back tomorrow. So we showed him the door and suggested he might try the firm in the next town.

It's not all bad however. A lot of our customers are glad of our service, and this tends to make it all worthwhile. I delivered a new Panasonic TV set and VCR to a customer



the other day and while I was setting it up she said they'd decided to buy the set from us because she'd asked around and everyone had said we were most reliable and helpful.

The servicing scene is changing. While there's still a place for the caring amateur the days of anyone being able to poke about in the back of electronic equipment and make it work are gone. Most jobs require a service manual, and in a lot of cases detailed knowledge of the habits of the particular product is necessary. This is certainly true of microcomputer controlled equipment such as the Grundig VCR where the display flashes "F1" and then shuts down. What chance have you of repairing this without information?

Another problem is the supply of spares. Most of the manufactureres are very good, particularly now that they tend to deal only with account holders. The parts distributors however will supply anybody at trade price, and in a lot of cases claim to hold stock they haven't actually got. One firm sent us a newsletter with a list of parts stocked for Matsui and Saisho equipment, but every time we asked for a part it wasn't in stock. We no longer deal with these people since they supplied a Ferguson TX100 transformer to a customer for less than they wanted to charge us.

We have a continuing battle with Willow Vale over a c.r.t. We ordered a Thorn New Life A66-510 for a specific job and an A67-200X arrived. We phoned and pointed out that it wouldn't fit. The girl at the other end went away and checked with the technical man who said it was a direct replacement. That was several months ago. We've long since completed the job using a tube from another supplier. The Willow Vale A67-200X is obviously too big

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and sits on our shelf awaiting collection. We've been charged and to date have received no credit. Last time the rep (who, we must agree with Nick Beer, is most helpful) called he phoned up and spoke to the boss about it. If it's still here when he calls again it'll go in the back of his car.

Other suppliers we deal with are SEME, who are excellent (their rep Roger is most helpful and is himself technical), and HRS who seem to be most efficient.

We've now stopped offering free advice, and we don't lend out manuals except to other engineers. We are reluctant to sell spares, other than fuses, because it usually means a return visit from the customer and an argument about the suitability of the part for the job he's doing.

All in all it's not a bad life, but as the technology moves on we have to move with it. Those who are not properly trained to do the work must realise this.

# THREE ACES FROM ALCON!

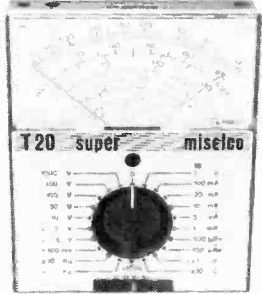


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*Requests for advice in dealing with servicing problems must be accompanied by a £2 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.*

## **JVC HRD140/FERGUSON 3V44/5**

This machine usually works correctly but sometimes the play or record function isn't completed, i.e. the voltage across the CTL motor drops off when play is pressed and the guide poles stop half way around the heads. The motor then returns the poles to the stop position. After two or three attempts the machine will go into play, though the speed of the poles to the end of their run seems to be slow (approximately 8V is developed across the CTL motor during the take-up action). I've tried applying freezer to IC601/2 but the problem is intermittent rather than thermal. The power supply voltages have been checked. The only significant change during the take-up action is in the unregulated 17V supply which, when play is pressed, falls to about 14.5V, the CTL motor losing its take-up voltage before the wrap is completed. On the occasions when the take-up action is completed the 17V line drops by only about 1V.

It seems to us that the CTL motor is faulty. Connect an ammeter in series with it. If the current increases when the torque and the 17V line drop, replace the motor. If the motor current drops in this condition, check the unswitched 12V line at pins 7/9 of IC602. If this falls, check the components in the unswitched 12V supply: if it doesn't, suspect IC602.

## **SONY KV2000 Mk II**

This set came in with the mains fuse blown and cold checks showed that the chopper transistor was short-circuit. These items were replaced but blew again when the set was powered up. After fitting further replacements we loaded the power supply with a 100W bulb which lit at half brightness, indicating correct operation of the power supply. Cold checks have failed to reveal any shorts across the h.t. rail so we are rather stumped.

We have known this problem to be caused by high-voltage breakdown of the line output GCS Q901, its parallel capacitor C901 or the mica insulating washer beneath Q901. Ideally, these should be checked by substitution, with your bulb in series with the h.t. feed to the line output stage to provide protection. If the problem persists, short-circuit turns in the line output transformer T801, the e.h.t. transformer T851 or choke L806 could be the cause. The latter two can be checked by withdrawing plug E1, when some life should return to the line output stage if one or both of these items is faulty.

## **PANASONIC NV830**

This machine has an intermittent fault that's been present since new. Occasionally, when selecting play, rewind or fast forward, the display will acknowledge the selected mode but apart from threading no tape movement occurs.

The mode is then aborted after a few seconds and in almost every case a second attempt is successful. An irritating consequence is to find that a timer recording has not been made.

The syscon section is plainly not getting the threading completed message. Try replacing the loading belt, part no. VDV0148. If the problem persists, adjustment, cleaning or replacement of the mode select switch (VSS0091) may well provide a cure.

## **AMSTRAD CTV1401**

This set doesn't always start up immediately, the delay varying by up to half an hour. It then runs through the channels and settles on the one it's switched to - this sequence is repeated after a period of five-ten minutes. When stationary the picture is very good.

Confirm that the 103V line at C504 is slow in coming up, then check R503, R505 and C503. If these are in order suspect the STR451 power supply chip IC501.

## **SHARP VC7750**

This machine plays its own recordings and recordings from other machines normally but there's colour with only about thirty per cent of hired tapes.

This problem is often caused by incorrect setting of the 4-435572 or 4-433619MHz crystal oscillator in the colour signal processing circuitry. Resetting calls for the use of a very accurate frequency counter. If either setting can't be achieved the associated crystal is suspect.

## **FIDELITY F14**

All stations can be tuned and stored on this colour portable but retuning is always required on the following day. Replacing the TAA550 tuning voltage regulator has had no effect.

This problem is almost certainly due to failure of the remote control processing/memory chip IC201. Two types have been used, M490B1 and M490BB1. If you don't change like for like circuit modifications are required.

## **SHARP VC387**

When power is applied the drum starts to rotate and the on/standby LED lights but there are no deck functions. The clock is o.k. but the operating light is off.

These symptoms suggest that the load end/unload end switches are faulty, giving the syscon false information that the cassette is present and tape is in transit. Check the sensor inputs to the syscon. If necessary check the drum on/off control pin of the main syscon microcomputer chip before suspecting the chip itself.

## **PHILIPS KT3 CHASSIS**

This set is permanently tripping (ticking). Disconnecting the line scan connector stops this, and the h.t. is correct at 129V, but disconnecting the tripler and scan coils has no effect. All likely items in the line output stage have been replaced. The supplies from the line output transformer have been disconnected separately and, in desperation, all together. But the set still trips. A colleague suggested that it would be helpful to override the trip system to see "where the smoke comes from", but experiments have led only to failure of the chopper transistor.

Because of the various feedback loops, tripping faults can be difficult to deal with. There's no way of bypassing the protection circuit to see what starts to overheat, but

there's a modification to the switch-mode power supply panel to desensitise it. Replace C329 and R329 with a wire link and increase the value of R354 to 470Ω. If the tripping persists, try removing all the plug-in boards to see whether the cause is on one of them – the fault could be on the RGB board.

# TEST CASE

312

*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.*

The man on the phone asked us to come and service his TV set, a Sony receiver we'd sold him some years ago. As it turned out to be a nasty intermittent fault we suggested that, to save the cost of what would almost certainly be a fruitless call to the house, he brought the set in to us. He grumbled a bit, saying that it could be only a little thing since the set worked all right most of the time. Wow!

The symptom was described as follows. From time to time the picture brightness would decrease, and at the same time the sound volume would increase. This seemed odd to us, but dry-joints can do strange things. We vaguely suspected that perhaps something was coming off-earth, or that there was a bad joint in the power supply or control section. Hope springs eternal! The set in question was a KV2204UB, chassis type SCC-244A-A.

The fault took a long time to appear when the set was put on the soak-test bench. When it did, sure enough the picture dimmed and the sound level rose. The nearest technician rushed over to the set and started to knock seven bells out of its chassis and PCBs with a screwdriver handle. This had no effect on the fault, but now that the back cover was off the brightness and sound levels gradually returned to normal. The set was left running with two test meters connected – to the main h.t. (135V) and l.t. (12V) lines. After replacing the back cover the set was left on soak. Next time the fault appeared neither meter showed any significant change – and a frenzied attack on the PCBs again revealed no sign of any joint or connection problems.

Time to look harder at the circuit diagram. Volume is controlled by the remote control decoder chip IC003, under the command of the front-panel mounted volume up/down keys and the remote control handset. The brightness level is set by an analogue user control, RV402. We transferred the meters to the slider of the brightness control and the smoothed output from IC003, at C007, and left the set to simmer. After a while up came the volume, down went the brightness and there was a thunder of feet across the workshop to look at the meters. The voltage level at the slider of the brightness control hadn't changed, while the voltage on the volume control

line had risen somewhat. What were we to make of this?

There's a brightness control output from the control chip IC003, but this is actually used for contrast control, entering the chroma chip at pin 7. The true brightness control enters this chip at pin 4. A voltage drop was seen here when the fault occurred. What could simultaneously affect the brightness and volume in opposite directions? There's a mute line, operated from Q001 on board M2, but this can only pull the brightness and volume down – to avoid disturbances during channel change. Its action was found to be correct when Q001 was momentarily shorted collector-to-emitter.

A careful study of the circuit diagram and the control lines that are common to both sound and vision suggested a possible culprit – especially as the fault seemed to be influenced by time and temperature more than anything else. In went a man with a hairdryer and a can of aerosol freezer. He soon had a definite diagnosis. What was it? See next month for the answer.

## ANSWER TO TEST CASE 311 – page 48 last month –

The problem described last month can occur with all sorts of TV set, whether or not microcomputer control is used. No matter how exotic the circuitry, the c.r.t. and e.h.t. generator must be protected against the possibility of excessive current, and it was in this section of the circuit that the fault lay.

You'll remember that the CITAC chip was doing its stuff, producing a good voltage swing when provided with a command from the remote contrast control keys. There's another influence however on the colour decoder chip's contrast control input pin. It comes from the beam limiter circuit, via R513. With a normal picture brightness level, no current flows through R513 because the series diode D502 is cut off by a voltage of about 5.6V at its cathode.

In this set D502 was conducting and shorting most of the contrast control voltage to ground, a point that had been quite overlooked by the man on the bench. The cause of the trouble was that zener diode D503 was leaky. Replacing this item restored normal operation. An alternative cause of the problem could have been failure of the 120kΩ resistor R430, connected to the h.t. line. Intermittent tube flashover could have been responsible for D503's failure: we've had no more trouble so far . . .

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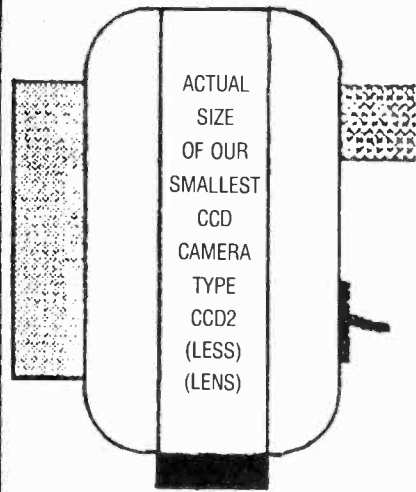
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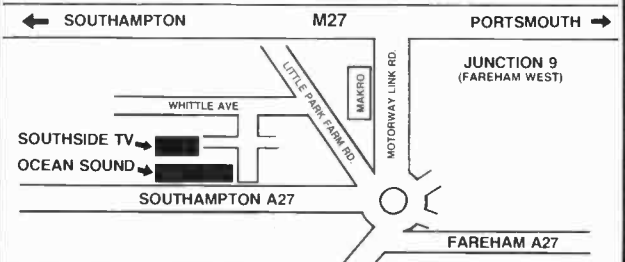


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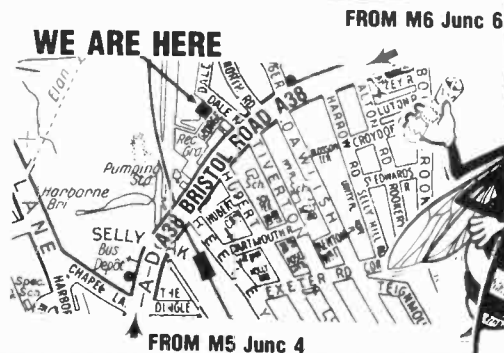
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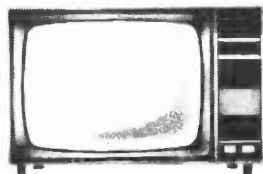
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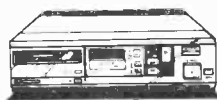
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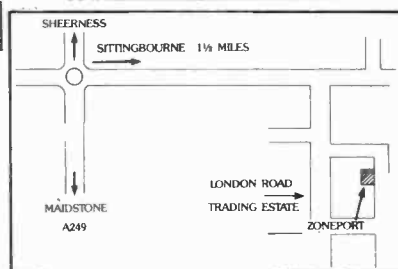
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<b>Sony</b>	SLC20, SLC30 £54.50	SLC20, SLC30 £54.50	<b>Sharp</b>	<b>Sony</b>	<b>Sony</b>
PS3B(S) £24.90	SLC9 £54.50	SLC9 £54.50	VC7300, VC7700, VC7750 £6.50	VC9100, VC9300, VC9500 £6.50	VC9100, VC9300, VC9500 £6.50
Fits model numbers: SLC5, SLC6, SLC7, SL3000 also various NEC models	<b>Toshiba</b>	<b>Toshiba</b>	VC8300 £6.50	VC381, VC383, VC386 £6.50	VC381, VC383, VC386 £6.50
<b>P84B(2S) £34.50</b>	V9600 £59.90	V9600 £59.90	<b>Hitachi</b>	<b>Hitachi</b>	<b>Hitachi</b>
Fits model numbers: SLC20, SLC30, SLC40, SLF1	V8600 £69.90	V8600 £69.90	VT5000, VT5500 £6.50	VT5000, VT5500 £4.50	VT5000, VT5500 £4.50
<b>PS5B(3S) £44.20</b>	V31, V33 £59.90	V31, V33 £59.90	VT8000, VT8300, VT8500 £2.90	VT8000, VT8300, VT8500 £1.50	VT8000, VT8300, VT8500 £1.50
Fits model numbers: SLC9, SLT50, SLC8, SLF60	V55, V56 £59.90	V55, V56 £59.90	VT9300, VT9500, VT9700 £3.30	VT9300, VT9500, VT9700 £1.50	VT9300, VT9500, VT9700 £1.50
<b>Amstrad/Saisho</b>	<b>Hitachi</b>	<b>Hitachi</b>	VT11E, VT14E, VT17E, VT19 £6.50	VT11E, VT14E, VT17E, VT19 £3.90	VT11E, VT14E, VT17E, VT19 £3.90
3HSS(R) £29.50	VT5000, VT5500 £49.50	VT5000, VT5500 £49.50	<b>Akai</b>	<b>Akai</b>	<b>Akai</b>
Fits model numbers: VCR7000 and all models using Orion chassis	VT6500, VT8000, VT8300 £49.50	VT6500, VT8000, VT8300 £49.50	VS9700 £6.50	VS2, VS3, VS4, VS5 £4.90	VS2, VS3, VS4, VS5 £4.90
<b>3HSS(F) £34.50</b>	VT8500, VT8700 £49.50	VT8500, VT8700 £49.50	VS9300, VS9500, VS9800 £5.50	VS9300, VS9500, VS9800 £3.50	VS9300, VS9500, VS9800 £3.50
Fits model numbers: VCR4500, VCR5200, VCR9000 etc.	VT9300, VT9500, VT9700 £49.50	VT9300, VT9500, VT9700 £49.50	Many others available	Many others available	Many others available
<b>Fisher/Fidelity</b>	VT11E, VT14E £45.50	VT11E, VT14E £45.50	<b>SENSOR LAMPS</b>	<b>SENSOR LAMPS</b>	<b>SENSOR LAMPS</b>
3HSS(SF) £29.90	VT17E, VT19E £54.60	VT17E, VT19E £54.60	All Panasonic £1.80	All Panasonic £1.80	All Panasonic £1.80
Fits model numbers: FVHP615, FVHP710, V1000	VT33E £49.50	VT33E £49.50	All Ferguson/JVC £0.65	All Ferguson/JVC £0.65	All Ferguson/JVC £0.65
	<b>Philips</b>	<b>Philips</b>	Sharp VC9300 etc. £2.90	Sharp VC9300 etc. £2.90	Sharp VC9300 etc. £2.90
	VR6460 £44.00	VR6460 £44.00	Sharp VC7300 etc. £1.80	Sharp VC7300 etc. £1.80	Sharp VC7300 etc. £1.80
	VR6462 £44.50	VR6462 £44.50	Amstrad 7000 £2.30	Amstrad 7000 £2.30	Amstrad 7000 £2.30
	Please call if your model is not listed.	Please call if your model is not listed.	All Hitachi £1.80	All Hitachi £1.80	All Hitachi £1.80

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<b>Sony</b>	SLC5, SLC7 £5.95
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<b>Sharp</b>	VC7300, VC7700, VC7750 £4.95
	VC8300 £4.95
	VC9100, VC9300, VC9500 £4.95
	VC381, VC383, VC386 £4.95
	VC651 etc. £4.95
<b>Hitachi</b>	VT5000, VT5500 £5.95
	VT8000, VT8300, VT8500 £4.95
	VT9300, VT9500, VT9700 £4.95
	VT11E, VT14E, VT17E, VT19 £4.95
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<b>Sanyo</b>	VTC9100, VTC9300 £1.90
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<b>Hitachi</b>	VT8000, VT8300, VT8500 £4.72
	VT9300, VT9500, VT9700 £4.75
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	VT33, VT63, VT64, VT65 £3.96
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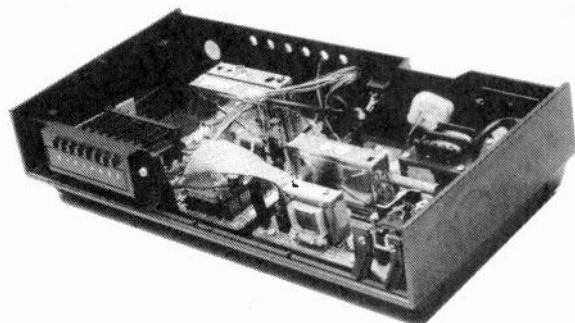
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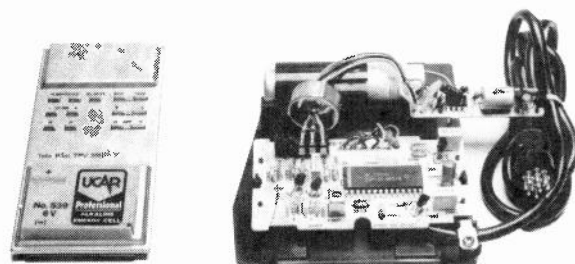
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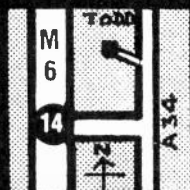
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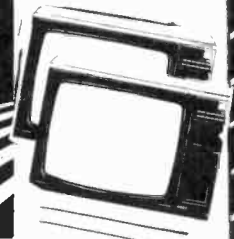
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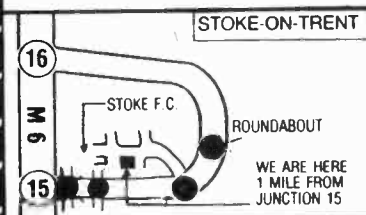


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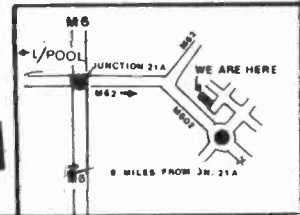
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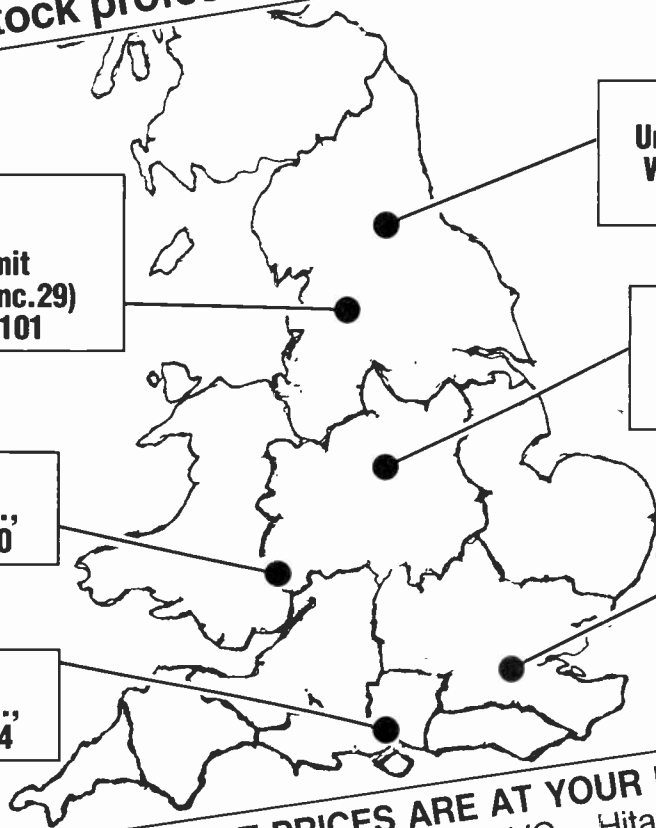
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3HSSV - JVC/Ferguson most models	£18.00
3HSSVA - Ferguson 3V42/44/45/46 etc.	£38.00
3HSS4VB - Ferguson 3V3/HR7655	£45.00
3HSS4VC - Ferguson 3V48/HRD565	£46.00

<b>Panasonic</b>	
3HSSN - Panasonic most models	£18.00
3HSSU1N - Panasonic NV370/380/100	Philips £20.00
VR6460	£20.00
3HSSU2N - Panasonic NV230/470/480/G9/G10/G11/G15PX	£34.20
3HSSU3N - Panasonic NV430/460	£22.75
3HSS3N - Panasonic NV777/330	£32.20
3HSS4NB - Panasonic NV730	£46.00
3HSS4NA - Panasonic NV366	£45.00

<b>Hitachi</b>	
3HSSHA - VT8000/9500 etc.	£22.00
3HSSHB - VT11/33/63 etc.	£22.00

<b>Amstrad</b>	
3HSSR - VCR4600, 7000, 9000 also Saisho, Orion, Triumph etc.	£24.10
PSF1 - VCR4500/5200	£22.85

<b>Sanyo</b>	
3HSSSY - VHR1100/1110/1300	£39.50
3HSS3SY - VHR1500	£52.00

<b>Other Models</b>	
3HSSSP - Sharp VC9300/9500 etc.	£22.00
PS3B - Sony SLC5/C6/C7/8000 etc.	£22.00
PS3BT - Toshiba V9600/31/33	£23.75
3HSSSF - Fisher FVH710/510 etc.	£24.50

## VIDEO MOTORS

<b>Drum Motors</b>	
Ferguson/JVC (Mechanical models)	£21.45
Sharp VC7300/7700/7750/8300	£21.00

<b>Reel Motors</b>	
Sanyo VTC5000/5150/5300/5400	£7.90
Sharp VC9300/9500 etc.	£15.90
Panasonic NV333/366	£13.20
Ferguson 3V29/30 JVC HR200/7300	£22.70

<b>Capstan Motors</b>	
Ferguson/JVC (mechanical models)	£21.45
Ferguson 3V35	£22.50
Sony SLC7/C5 (BHf11000)	£28.20
Sharp VC7300/7700/7750	£26.90

## REMOTE CONTROLS

Ferguson, Grundig, ITT, Philips, Pye, Sony and Hitachi various models TV & Video..... £13.50

## CAR RADIO/AUDIO MOTORS

6V, 9V, 12V and 13.2V clockwise or anticlockwise. Three sizes available  
 (1) Shaft 10mm, Height 34mm, Width 38mm..... £3.50  
 (2) Shaft 7mm, Height 21.5mm, Width 34mm..... £3.50  
 (3) Shaft 8mm, Height 25mm, Width 36mm..... £3.50

## LINE OUTPUT TRANSFORMERS

Decca 100..... £8.50  
 ITT CVC 25/30/32..... £8.50  
 Rank Bush T20A..... £9.25

## OTHER SPARES

IC STR6020 Mod. kit for Hitachi CPT1471/1473..... £6.95  
 Universal Video Copying Kit..... £3.60  
 Universal Video Copying Kit (scart)..... £5.20  
 Video Cassette Lamp suitable for Ferguson/JVC with/without plug..... £0.50  
 Cassette Lamps suitable for Sharp/Panasonic..... £0.50  
 Cassette Lamp suitable for Sharp 9300 etc. complete with plastic moulding..... £1.25  
 Cassette Lamp suitable for Amstrad 7000..... £0.50  
 Cassette Lamp suitable for Hitachi 9300/9500..... £0.50  
 Universal Cassette Lamps 40ma or 60ma..... £0.50  
 CRT Anode Caps..... £0.60  
 Universal Tripler..... £4.50  
 Thorn TX10 Focus Unit..... £8.50  
 Video Tape Splicing Kit..... £5.25  
 Hitachi TV Frame Module HM6251..... £4.60  
 Cassette Housing Assembly for Ferguson 3V35/36/38/39/42/43/44/43 etc..... £25.25

## TV ON/OFF SWITCHES

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 Sony Universal with two brackets..... £3.75  
 Philips G11, G8 plastic..... £0.95  
 Thorn 1690, 3000, 3500, 8000, 8500, 9000, TX9 etc..... £0.90

\*\*\*\*\*  
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BC214A	£0.07	BU126	£0.70
BC214B	£0.07	BU208	£0.70
BC237	£0.07	BU208A	£0.75
BC238	£0.07	BU208B	£0.75
BC308B	£0.07	BU326A	£0.75
BC327-25	£0.07	BU407	£0.50
BC328-40	£0.05	BU426A	£0.75
BC337	£0.07	BU500	£0.95
BC547A	£0.07	BU508A	£0.75
BC548	£0.07	BU508D	£0.95
BC549	£0.07	BU806	£0.75
BC559B	£0.07	BU807	£0.75
BD237	£0.22	BU111	£0.75
BD238	£0.22	BUX84	£0.60
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BD243C	£0.30	TIP31	£0.30
BD244	£0.30	TIP32	£0.30
BD244C	£0.30	TIP41	£0.27
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BF196	£0.15	TIP42C	£0.40
BF197	£0.15	TIP112	£0.45
BF199	£0.07		

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TDA1044	£1.50	TDA3562A	£2.80
TDA1170S	£1.20	TDA3650	£3.50
TDA1190Z	£1.90	TDA3652	£2.50
TDA1412	£1.00	TDA3950	£3.00
TDA1940	£1.80	TDA4500	£3.80
TDA2521/3	£1.65	TDA8180	£4.45
TDA2560Q	£3.80	TDA9503	£2.55
TDA2581/2581Q	£1.55	UPC1365	£3.50

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 VC481/581 etc..... £1.90  
 VT9300/9500 F/F Idler..... £1.50  
 VT8000/8300/8500/8700 F/F Rew Idler..... £1.90  
 VT8000/8500 etc. Play Idler Assembly..... £2.85  
 VT8000/8500 etc. FF/Rew Pulley..... £0.70

**Ferguson**  
 Take up Clutch (mechanical models)..... £4.95  
 3V29/30 Take up Idler..... £1.20  
 3V29/30 Take up Clutch..... £2.10  
 3V29/30 Reel Idler..... £2.50  
 3V35 Reel Idler..... £2.40  
 3V35/36/38/39 Take up Clutch..... £2.00

**Sanyo**  
 VTC5000/5150/6500 Idler roller assembly..... £1.95  
 VTC5000/5150/6500 Reel Drive Pulley Unit..... £5.00

**Panasonic**  
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 NV8600/8610 Play Idler (VXP0243)..... £0.95  
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 NV600/688 Idler (VXP0515)..... £3.75  
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**Fisher**  
 FVHP615 Idler Assembly..... £5.40  
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 FVHP520/530 Idler..... £2.60  
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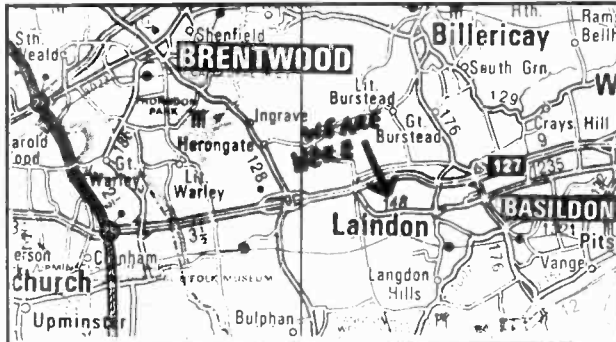
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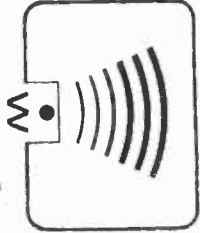
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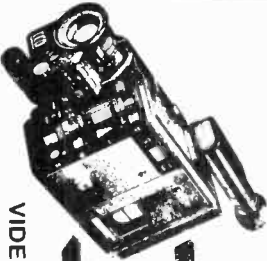




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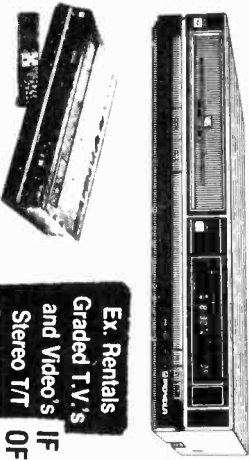
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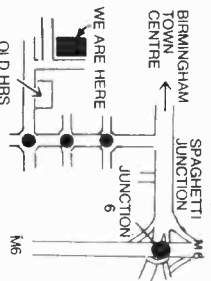
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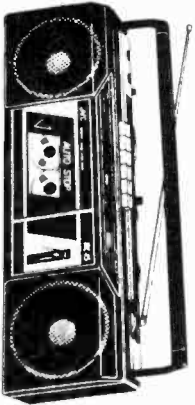
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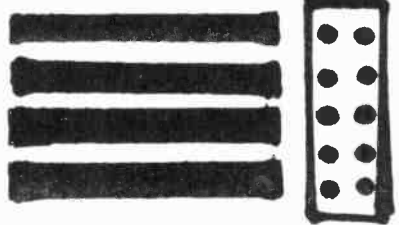
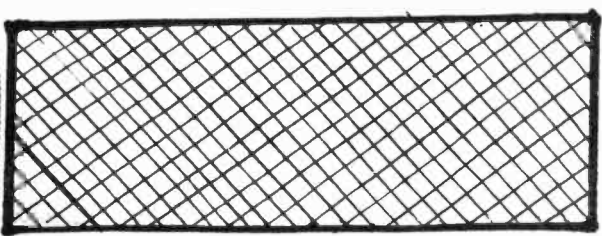
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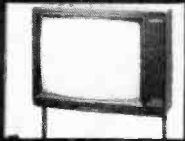


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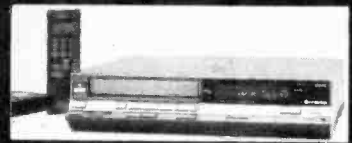
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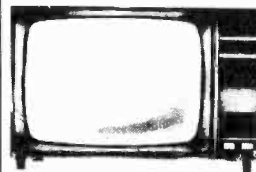


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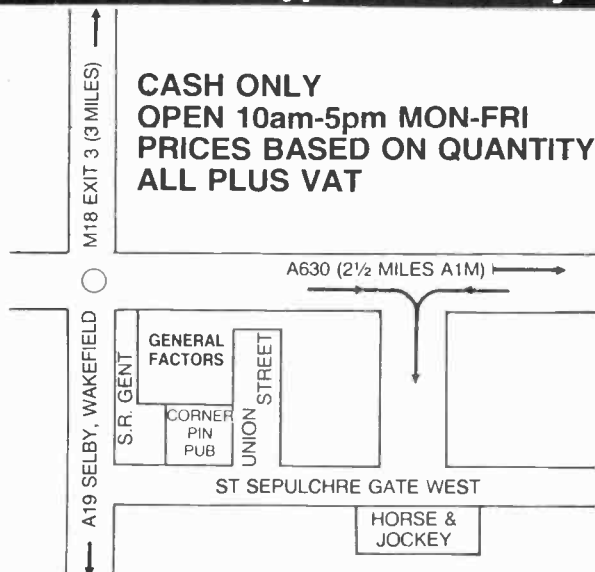
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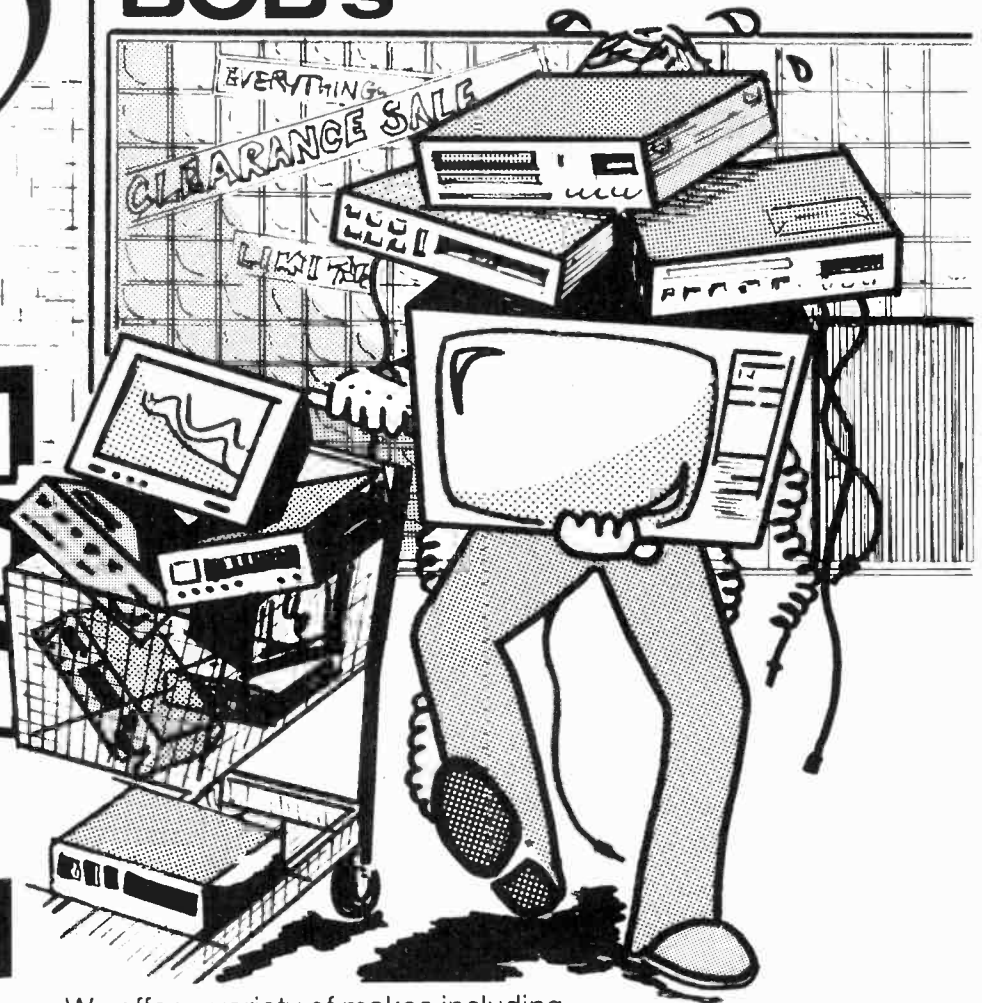
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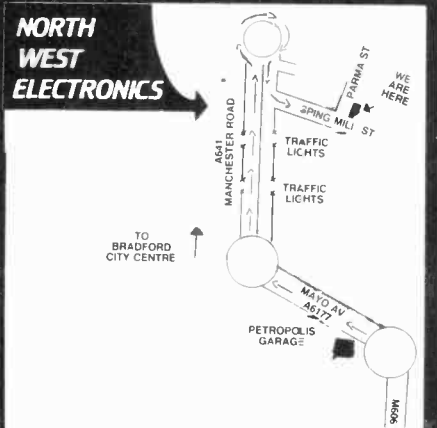
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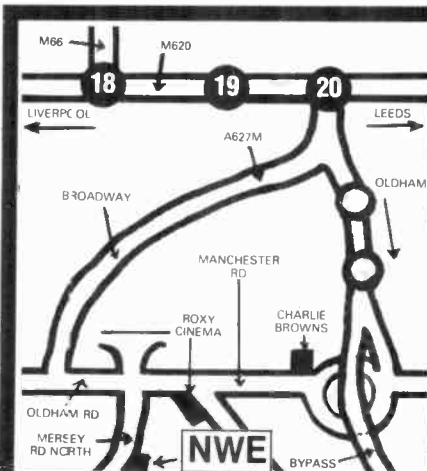
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