MARCH 1989

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TELEVISION

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TELEVISION

March 1989

Vol. 39, No. 5
Issue 461

On sale February 15th

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

INDEXES
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SUBSCRIPTIONS
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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

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 15

POPULAR BAKERS DOZEN PACKS (Still available)

All packs are £1 each, if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extrme left if the pack ref number and the next figures is the quantity of items in the pack, finally a short description.

BD2	5	13A spurs provide a fused outlet to a ring main where device such as a clock must not be switched off
BD7	4	in flex switches with neon on/off lights, saves leaving things switched on
BD9	2	6v. 1A mains transformers upright mounting with fixed clamps
BD11	1	6½" speaker cabinet ideal for extensions, takes your speaker. Ref BD137
BD13	12	30 watt reed switches, it's surprising what you can make with these – burglar alarms, secret switches, relay etc. etc.
BD22	2	25 watt loud speaker two unit cross-overs
BD29	1	B.O.A.C. stereo unit is wonderful value
BD30	2	nicad constant current chargers adapt to charge almost any nicad battery
BD32	2	humidity switches, as the air becomes damper the membrane stretches and oeprates a microswitch
BD34	48	2 meter length of connecting wire all colour coded
BD42	5	13A rocker switch three tag so on/off, or change over with centre off
BD45	1	24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. Original cost £40 each.
BD49	10	neon valves, with series resistors, these make good night lights
BD56	1	mini uniselector, one use is for an electric jigsaw puzzel, we give circuit diagram for this. One pulse into motor, moves switch through one pole
BD59	2	flat solenoids – you could make your multi-tester read AC amps with this
BD67	1	suck or blow operated pressure switch, or it can be operated by any low pressure variations such as water level in water tanks
BD91	2	mains operated motors with gearbox. Final speed 16rpm. 2 watt rated
BD103A	1	6 750MA power supply, nicely cased with input and output leads
BD120	2	stripper boards each contains a 400v 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers etc
BD122	10m	twin screened flex with white pvc cover
BD128	10	very fine drills for p.c.b. boards etc. Normal cost about 80p each
BD132	2	plastic boxes approx, 3" cube with square hole through top so ideal for interrupted beam switch
BD134	10	motors for model aeroplanes, spin to start so needs no switch
BD139	6	microphone inserts – magnetic 490 ohm also act as speakers
BD148	4	reed relay kits you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets
BD149	6	safety cover for 13A msockets – prevent those inquisitive little fingers getting nasty shocks
BD180	6	neon indicators in panel mounting holders with lens
BD193	6	5 amp 3 pin flush mounting sockets makes a low cost disco panel – need cable clips
BD196	1	in flex simmerstat – keeps your soldering iron etc always at the ready
BD199	1	mains solenoid very powerful has 1" pull or could push if modified
BD201	8	keyboard switches – made for computers but have many other applications
BD210	4	transistors type 2N3055 probably the most useful power transistor
BD211	1	electric clock mains operated put this in a box and you need never be late
BD221	5	12v alarms make a noise about as loud as a car horn. Slightly soild but OK
BD242	2	6" × 4" speakers 4 ohm made from Radiomobile so very good quality
BD252	1	panostat, controls output of boiling ring from simmer to boil
BD259	50	leads with push on ¼" tags – a must for hook ups – mains connections etc
BD263	2	oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress
BD268	1	mini 1 watt amp for record player. Will also change speed of record player motor
BD283	3	mild steel boxes approximately 3" × 3" × 1" deep – standard electrical
BD293	50	mixed silicon diodes
BD305	1	tubular dynamic mic with optional table rest
BD667	2	4.7uf, non-polarised block capacitors, pcb mounting
BD400	4	Books. Useful for beginners. Describes amplifiers, test equipment and kit sets
BD653	2	Miniature driver transformers. Ref LT44. 20k to 1k, centre tapped
BD553a	2	3.5 volt operated relays, each with two pairs CO contacts

Most other packs still available and you can choose any as your free one.

POWERFUL IONISER

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

25A ELECTRICAL PROGRAMMER

Learn in your sleep. Have radio playing and kettle boiling as you wake – switch on lights to ward off intruders – have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/ off switch. A beautiful unit at £2.50.

ATARI 65XE COMPUTER

At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only **£45 plus £3 Insured delivery.**

DATA RECORDERS. ACORN for Acorn Electron, etc., reference number ALF03, with TV lead, manual and PSU. Brand new. Price **£10 plus £1.50 post.** Order ref 10P44.
ATARI XC12 for all their home computers. With leads and handbook. Brand new. Price **£15 plus £2 post.** Order ref 15P20.

JOYSTICK FOR ATARI OR COMMODORE for all all Atari and Commodore 64 and Vic20. New Price **£5.** Order ref 5P126

EXTRA SPECIAL OFFER. The ATARI Compendium contains computer 65XE, data recorder XC12, joystick and ten games for **£57.50 plus £4 Insured delivery.**

Ex-Electricity Board. Guaranteed 12 months.

VENNER TIME SWITCH

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

WALKMAN TYPE PERSONAL STEREO CASSETTE PLAYERS. These are not second-hand but are slightly reject and may need some attention. All are complete with stereo headphones and are famous makes: Sanyo, Panasonic, Sony, etc. Stereo cassette type, no radio, £5 each. Our ref 5P132. Ditto but with AM/FM radio, **£7 each.** Our ref 7P8.

PANEL METERS. Beautifully made moving coil instruments in heavy duty casings, much superior to those coming from the Far East. Meter face size is 72mm × 86mm, fixing hole size is 70mm. Price is **£5 each.** The following models are in stock: 0-5amp. Our ref 5P133/5A. 0-10amp. Our ref 5P133/10A. 0-40volt DC. Our ref 5P133/40V. 0-50volt DC. Our ref 5P133/50V. 0-80volt DC. Our ref 5P133/80V. 0-160volt DC. Our ref 5P133/160V 0-200volts DC. Our ref 5P133/200V.

THE AMSTRAD STEREO TUNER. A ready assembled unit is the ideal tuner for a music centre or an amplifier. Some of the features are: long wave band 115-170KHz, medium wave band 525-1650KHz, FM band 87-108MKz, mono, stereo & AFC switchable, fully assembled and fully aligned. Full wiring up data showing you how to connect to amplifier or headphones and details of suitable FM aerial (note ferrite rod aerial is included for medium and long wave bands). All made up on very compact board. Offered at a fraction of its cost, **only £5.** Our ref 5P58.

ORGAN MASTER is a three octave musical keyboard. It is beautifully made, has gold plated contacts and is complete with ribbon cable and edge connector. Brand new, only **£12 plus £3 postage.** Order ref 12P5.

MUSIC FROM YOUR SPECTRUM 128. We offer the Organ Master three octave keyboard, complete with leads and the interface which plugs into your 128. You can then compose, play, record, store, etc., your own music. Price **£19 plus £3 special packing and postage.** Order ref 19P1

CAMERAS. Three cameras, all by famous makers, Kodak, etc. One disc and two different instant cameras. All in first class condition, believed to be in perfect working order but sold as untested You can have the three for £10 including VAT, which must be a bargain – if only for the lenses, flash gear, etc. Our ref 10P58.

SCREENING FOIL. This is copper clad board, is very thin so it can be used as an electrostatic screen. Easily bent, cut or manipulated. In fact a screening box could be made with just a pair of scissors and a soldering iron. Double sided sheets, size 305mm × 254mm. **£3 each.** Our ref 3P52.

PRECISION MOVING COIL PANEL METERS. Very sensitive, 0-100uA. These are beautifully made, very reliable, intended to be used in expensive instruments. Supplied with a plain scale, face size 75mm × 75mm. **Price £4 each.** Our ref 4P32. Ditto, but 100-0-100μA. **Price £4 each.** Our ref 4P32(a). Ditto, but 1mA FSD. **Price £4 each.** Our ref 4P32(b).

1/8th HORSEPOWER 12 VOLT MOTOR. Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 5/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 nuts A very powerful little motor which revs at 3,000rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years Price **£6.** Our ref 6P1, discount for quantities of 10 or more.

PHILIPS LASER

This is helium-neon and has a power rating of 1.6mW. Completely safe so long as you do not look directly into the beam when eye damage could result. Brand new, full spec, £30 plus £3 insured delivery. Mains operated power supply for this tube gives 8kv striking and 1.25kv at 5mA running. Complete kit with case £15. No extra for post if ordered with tube.

HIGH RESOLUTION MONITOR. 9in black and white, uses Philips tube M24/306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others. Brand new, **£16 plus £5 post.** Our reference 16P1.

TANGENTIAL HEATERS. We again have good stocks of this quiet running, instant heat units. They require only a simple case or could be fitted into the bottom of a kitchen unit, etc. 1.2kw, which is a very compact little unit and also a 2.5kw, which is approximately 10in long plus motor Price for either model **£5.** Being rather fragile needs special packing so add **£2** per heater for post and packing. Control switch for 2.5kw model giving full heat, half heat or cold blow. Price **50p.**

12 VOLT BRUSHLESS FAN. Japanese made. The popular square shape (4½in × 4½in × 1¾in). The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc., or for a caravan. **£8 each.** Our ref 8P26.

FDD BARGAIN

3½in made by Chinon of Japan. Single sided, 80 track Shugart compatible interface. Interchangeable with most other 3½in and 5¼in drives. **£28.50 plus £3 post.**

Generous discounts for quantities

J & N BULL ELECTRICAL

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

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1.50 service charge. Monthly account orders accept from schools and public companies. Access & B/card orders are accepted – minimum £5. Brighton (0273) 734648 or 203500.

BARGAINS STILL AVAILABLE

NOISE FILTERS - MAINS INPUT PLUG TYPE. Japanese made, this is a chassis mounting block with a built in noise filter to cut out surges and voltage peaks which could interfere with and possibly even damage your equipment. These are easy to mount and have a flange with two fixing holes. They take the standard 3 flat pin plug. 2amp model. Price £3 each. Our ref 3P50.

LEAD LAMP. Motorists' Special. Normal hand-grip type holder, with glass cover to protect the lamp and further protection in the form of a wire guard with a hook for hanging. Ideal as loft light or for car repairs, etc. Takes 60w lamp. Has good length flex Price £4. Our ref 4P31.

PHONE LEADS. 4 metres long, correctly colour coded, one end has flat plug which fits standard BT socket, other end has tag connectors. 2 for £1. Our ref BD639.

SUB-MIN TOGGLE SWITCH. Body size 8mm × 4mm × 7mm SBDT with chrome dolly fixing nuts 4 for £1 00. Order ref BD649.

VERY POWERFUL MAGNETS. Although only less than 1in long and not much thicker than a pencil these are very difficult to pull apart. Could be used to operate embedded reed switches, etc. Price 50p each, 2 for £1 00. Our ref BD642.

CLEAR LACQUER. Quick drying for the protection of transfers, markings, maps, etc Also protects wood and metal. Exceptionally clear. Large can for £1 00. Order ref BD660.

PAPST AXIAL FAN. MANUFACTURERS REF NO TYP4580N. This is mains operated 15watt rating and in a metal frame with metal blades so OK in high temperatures. Body size approximately 4¾in square × 1⅝in thick. £6.00 each, plus £1.00 postage. Our re 6P6.

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

ASTEC PSU. Mains operated switch mode so very compact (6½" × 4" × 2" approx.). Outputs: +5 Volts 3.5 amp +12 Volts 1.5 amp –5 Volt 1 5 amp. Brand new. Normal price £30+ Our price only £10. Ref 10P34.

APPLIANCE THERMOSTATS – spindle adjust type suitable for convector heaters or similar Price 2 for £1 Ref BD582.

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

3 CORE FLEX BARGAIN No. 2 – Core size 1 25mm so suitable for long extension leads carrying up to 13 amps – or short leads up to 25A, 10m for £2 Order Ref. 2P190.

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

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

TELEPHONE EXTENSIONS – it is now legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable, 100m coil £8 50. Extension BT sockets £2.95. Packet of 50 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones 3 for £2.

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

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

CAPACITOR BARGAIN – axial ended – 4700uf @ 25v Jap made. Normally 50p each, but you will get 4 for £1. Ref. 613

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

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

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

FREE POWER! Can be yours if you use our solar cells – sturdily made modules with new system bubble magnifiers to concentrate the light and so eliminate the need for actual sunshine – they work just as well in bright light. Voltage input is 45 – you join in series to get desired voltage – and in parallel for more amps. **Module A** gives 100mA. Price £1 Our Ref BD631. **Module C** gives 400mA. Price £2 Our ref 2P199. **Module D** gives 700mA Price £3. Our Ref 3P42.

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

METAL PROJECT BOX. Ideal size for battery charger, power supply etc, sprayed grey, size 8" × 4¼" × 4" high, ends are louvered for ventilation other sides are flat and undrilled. Order Ref 2P191. Price £2

BIG SMOOTHING CAPACITOR. Sprague powertytic 39,000uF at 50V £3 Our Ref. 3P41.

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

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

13A ADAPTERS – Takes 2 13A plugs, packet of 3 for £2. Order Ref. 2P187

20v – 0 – 20v – Mains transformers 2½ amp (100 watt) loading, tapped primary 200-245 upright mountings £4. Order Ref. 4P24.

POWERFUL 12V MOTOR was intended for Sinclair Electric Car, rating approx. ⅓ HP Price £15 plus £2 post.

RE-CHARGEABLE NICADS 'D' SIZE these are tagged for easy joining together but tags can easily be removed, virtually unused, tested and gntd. £2.00 each Ref 2P141, 6 for £10. Ref. 10P47

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

QUICK FIX MAINS CONNECTOR – A must for your workshop. Saves putting on plugs as you just push the wires under the spring clips. Automatically off when lid is up. Price £7 50 Our reference 7P5/1.

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

SINGLE SCREENED FLEX 7 02 copper conductors, pvc insulated then with copper screen, finally outer insulation. In fact quite normal screened flex. 10m for £1. Our ref BD668. Ditto, but solid conductor 10m for £1 Our ref BD668A

WHITE CEILING SWITCH 5 amp 2 way surface mounting with cord and tassle. Made by the famous Crabtree Company. Price £1 each. Our ref BD528.

EHT TRANSFORMERS – Normal primary, secondary 3.5v at 3mA continuous or 20mA intermittent. Ideal as a spark generator for boiler lighting, etc., or with a simple voltage doubler circuit would make a good ioniser Price £7 Our ref 7P7 8kv secondary 3mA Price £10. Our ref 10P56.

BARCLAYCARD VISA

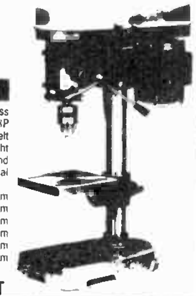
EAST CORNWALL COMPONENTS

Access

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

MARCH SPECIAL OFFER

DRILL PRESS



5-speed single phase bench top drill press for general purpose workshop use 1/6HP motor drives the 13mm chuck via a Vee belt and pulley wheels Table adjustable for height and angle Fitted with depth gauge and depth stop Complete with instruction manual and chuck key

Chuck capacity 0-13mm
Spindle speeds 600, 900, 1250, 1750, 2600 rpm
Spindle travel 50mm
Chuck to table clearance 150mm
Chuck to base clearance 250mm
Dims 575 × 420 × 200mm
Power 240Vac 130W @ 1420 rpm

£75.00 + £1.65 P&P + VAT

T.V. AERIAL ACCESSORIES

	1+ 10+
Co-Ax Cable 75 Ohm 100 Metre Reel £11.00	
Co-Ax Metal Plug	20p, 18p
Co-Ax Line Socket	25p, 22p
Co-Ax Line Connector	12p, 10p
Multiway Splitters	
In-line	85p
Surface Mounting	58p
Socket Splitter/Combiner	95p
Socket Splitter/Combiner Switched	£1.25
3-way	£1.40
4-way	£1.75
5-way	£2.40
6-way	£2.55
8-way Ideal for small hotels etc.	£30.10
Single Flush Mounting Outlet	.75
Double Flush Mounting Outlet	.95
Co-Ax Leads – 2 metres – PL/PL	.98
Co-Ax Leads – 2 metres – PL/Socket	.98
TV/Video/Computer Combiner 7042	£4.05
TV Indoor Amplifier 7253 Improves signal 3 times	£16.95
Second Set Amplifier 7243 Improves signal to 2 sets 50%	£15.75
CB Interference Suppressor 9700 Minimises CB interference on TV	£5.55
TV/FM Diplexer 9006 Separates UHF TV signals from FM radio signals	£4.95

QUARTZ-HALOGEN SPOTLIGHT

Hand held or hanging. Heat resistant poly-carbonate housing, highly polished reflector. Protective lens cover, doubles as base stand. With On/Off switch and 12ft curly cable terminating in cigar lighter plug. Produces 250,000 candle power – 5 times the intensity of average car headlamps.
Power: 12Vd.c. 4.5A. 55W. Dims: 160 × 88 × 110mm.

£5.99

NI-CAD BATTERY CHARGER

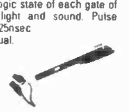
Universal	1+	£4.50 each
PRICE:	10+	£4.25 each
	100+	£3.75 each

NI-CAD BATTERIES

AAA	£1.25	£1.20 ea/10
AA	.90	.85 ea/10
C	£2.10	£1.90 ea/10
D	£2.50	£2.20 ea/10
PP3	£4.10	£3.90 ea/10

HELPING HANDS WITH MAGNIFIER **£3.99**

LOGIC PROBE



Simple to use – good quality – logic probe. Displays the logic state of each gate of TTL, C-Mos, etc. devices. Logic state displayed in light and sound. Pulse enlargement capability allows pulse detection down to 25nsec. Supplied complete with comprehensive instruction manual.
Specification:
Working voltage: 4-16Vdc
Thresholds: HI – 70% Vcc; LO – 30% Vcc
Input impedance: 1 Mohm
Max. input frequency: 20MHz
Order Code – TEST/LOGIC PRICE – **£7.99**

FULL RANGE OF TRANSISTORS, I.C's, CMO's

Electrolytic Capcitors
Disc Ceramic Capacitors
Metal Film Capacitors
Metal Oxide Capacitor
Thick Film Capacitors
Polyester Capacitors
Polystyrene Capacitors
Mylar Capacitors
See our catalogue

LIMITED QUANTITY ONLY!!!

OSCILLOSCOPES

TELEQUIPMENT D755. (NATO approved version of D75). Dual Trace. Delay Sweep. 50MHz.
Price £280.00 each
Carriage £10.00 each Plus V.A.T.

COSSOR CDU150. Dual Trace. 35MHz. Delay Sweep. Dual State. Portable 8 × 10 Display with Manual.
Price £165.00 each
Carriage £10.00 each Plus V.A.T.

MAINS PLUGS 13A FUSED 3 PIN

1 @ 46p each
10 @ 42p each
100 @ 35p each

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

ANOTHER SPECIAL OFFER
UNIVERSAL P.C.B. ASSEMBLY JIG

TO ACCOMMODATE P.C.B. SIZE UP TO MAXIMUM: 265 × 238mm

OUR PRICE £15.00 (NORMAL PRICE OVER £50.00)

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50	Antex 15W iron	5.40
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20	Antex 18W iron	5.60
CS17 Iron Kit	7.99	Antex 25W iron	5.80
C15 Iron Kit	8.30	Antex elements	3.20
XS25 W Iron kit/complete with steel & plug attached	11.00	Antex bits	1.15
CS 18W, as above	10.90	Antex stands	2.20
		Soldersucker	2.99
		Spare nozzles for Soldersucker	0.60

ORVX PORTASOL GAS SOLDERING IRON
PRICE £16.00 each. SPARE TIPS – 1, 2.4, 3.2, 4.8mm £4.00 each

SOLDER: 60% TIN 40% ALLOY

22g. Non-corrosive Multi-core Solder. 500gm Reel £4.99 each. 10 Reels 18g £3.75 each
18g. Non-corrosive Multi-core Solder. 500gm Reel £4.99 each. 10 Reels 18g £3.75 each

BT APPROVED EQUIPMENT

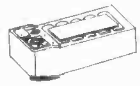
Master Socket (Flush)	£2.90	Extension Lead 5 Mtr	£2.90
Master Socket (Surface)	£2.75	Wiring Tool	36p
Secondary Socket (Flush)	£1.90	Plug – 431A	25p
Secondary Socket (Surface)	£1.70	Slimtel Phone	£17.35
B.T. Cable (per metre)	15p	Viscount Phone	£26.04
Per 100 metres	£12.00	Conversion Kit &	
Line Jack Cord with Plug	£1.25	Wiring Diagram	£6.90

12V Twin Fluorescent Lamp 12" Double Tubes

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

	1+	10+	50+
PRICE	£5.99	£4.99	£4.50

12 VOLT RECHARGEABLE UNIT



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TELEVISION

EDITOR
John A. Reddihough

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CORRECTIONS
Last month's cover photograph showed the JVC GR-C11 camcorder not the GR-C7 as stated on page 253.

In the section on the Panasonic G deck on page 198, January (VCR Clinic) Model NV-G48 should have read NV-D48.

Some misprints occurred in the article on j notation last month. A note on these will appear next month.

COVER PHOTO
This month's cover photograph shows focus bias adjustment being carried out on a JVC compact disc player. See new series starting on page 253.

The Satellite Shambles

Tragedy, farce or just plain bungling? The start of satellite TV broadcasting in the UK should have been a moment of triumph, the start of a new era in TV, leading to new prospects such as high-definition television. Instead, just look what's happened. A makeshift start with almost no receiving equipment in the shops and unedifying bickering between those who will be providing the services, Sky and BSB.

One cannot help but admire the drive that has gone into getting Sky started in a matter of months. It has been almost like the pioneering initiatives that accompanied the start of the BBC's first service in 1936. There are other parallels. First almost no direct viewers — not all that many more than in 1936, though perhaps a few thousand rather than a few hundred. And secondly we have the perennial standards problems all over again.

It's a far cry from the careful planning that has gone into the extension of TV services over the last few years. Channel 4 for example came in beautifully on cue and after the novelty of the first night one might have been forgiven for thinking it has been there all the time. Teletext was introduced with no fuss and few problems, and soon those inclined to do so were busy with their remote control buttons. All different this time. There's confusion amongst viewers, in the press and in the trade, and just where are all those dishes we had been promised? Well, no one is going to go overboard producing new equipment for a new, untried market, but that apart there seems to have been a problem resulting from Sky's ad hoc approach to getting its services started. The channels were all to be unscrambled originally, financed by advertising. But then the owners of the film rights, the main attraction offered by the new services, cottoned on to the fact that much of Europe would also be able to see the movies, and Mr. Murdoch hadn't paid for that. To get over the problem, a hasty decision was taken to adopt scrambling. And that of course affected the design and production of the receivers, especially as it took a time to decide on the form of encryption to use. Presumably the delays are a temporary matter and we shall soon see the High Streets awash with dishes. Maybe.

This sad start reflects the brief history of attempts to get DBS started in the UK. There was one false start after another. Originally the BBC, in early 1982, was given the go-ahead to start a two-channel service, hopefully in 1986. In the following year, 1983, the IBA was authorised to supervise a commercial service. By mid-1984 the BBC, under the usual financial pressure, abandoned its attempt. A consortium that included the BBC, the fifteen ITV companies and others then had a go. By June 1985 the consortium had given up, reporting to the government that the project would not be commercially viable under the conditions laid down. There followed a year when little happened, and then in mid-1986 the IBA was asked to try to start a service. This time there was considerably more interest and several strong groups competed for the franchise. It was awarded to BSB in December 1986.

BSB's planning has been meticulous, as you might expect of an organisation operating under the guidance of the IBA. It has undertaken a lot — to commission and launch its own satellite system and to guarantee services to standards accepted as part of the franchise. The cost has been huge. Exact figures are not available, but informed guesses suggest that over £800 million is being invested in the project. What it didn't plan for was the appearance of Sky on the scene, via the medium-power Luxembourg Astra satellite.

Despite having got there first, Sky has its problems — not only the shortage of dishes. The main problem will be to finance the service until the advertising revenue starts to come in. It's a classic chicken-and-egg situation. No viewers, no advertising revenue; no advertising revenue, no income to splash out on programmes to attract viewers. The schedules so far made available by Sky suggest that second-hand sit-comm, soaps etc. will comprise much of the fare. It's not inspiring to say the least, but what can you expect? Sky doesn't have the funds that say the ITV companies are used to.

The unfortunate aspect of the Sky intervention is that it could end up jeopardising the whole satellite scene in the UK and with it the prospects for further technical progress, programme options and business opportunities. It's questionable whether there is room for one DBS service in addition to the present terrestrial services, but we are to start off with two providing some eight channels between them. Dicey indeed. Especially when you consider what the viewer is being offered. BSB is to charge about £10 a month for its film channel while Sky will be asking £12 a month for its scrambled channels. About £120 and £144 a year respectively compared to the present colour licence fee of £62·50. Hardly a bargain, on these terms alone, regardless of the extra equipment required. And this brings us to the duplication required for both BSB and Sky. The TV systems aren't the same, the encryption systems are entirely different and whereas BSB has conditional access Sky is to rely on a smart card. How many little boxes does that add up to?

To have made the most of the opportunities presented by satellite broadcasting a collaborative effort by all concerned would have been best, to plan carefully, prepare viewers and then start up the new services with the smoothness we had come to expect. But that sort of thing hardly goes with the new era of deregulated broadcasting. Instead we have had to watch Sky and BSB engage in public dispute that's purely counter-productive. It does not augur well for the future of broadcasting in the UK.

Teletopics

MULTI-SATELLITE RECEIVING SYSTEM

Micro-X has become sole distributor in the UK of the Mapro STVS satellite TV receiving system. Since the system is upgradable to provide dish tracking and has infinitely variable polarity selection it can be used for reception of all the available and proposed satellites including Astra, the BSB craft and the Eutelsat and Intelsat series satellites. The basic price is £299 which with £60 for installation brings the total to £359: to add full tracking takes the total cost of an installation to £584. These figures do not include the cost of decoders to provide unscrambling of course. It's certainly a high-quality system with its steel dish, ferrite polariser and HEM (high electron mobility) transistor LNB. The latter has a noise figure of 1·6dB. Mapro systems are being sold through Micro-X's network of dealers – Micro-X can be reached on 01-459 1200.

THINNER VHS TAPE

JVC has developed thinner video tape to extend the playing time with S-VHS-C and VHS-C equipment. These formats at present have a maximum record/playback time of thirty minutes in standard play and an hour in long play (for 625-line signals). Current VHS-C tape is 19 microns thick, consisting of a 5 micron magnetic layer, a 13 micron base film and a 1 micron backcoating. The new tape has a 4·5 micron magnetic layer and a 10 micron base made of a new material called Polystone. This increases the playing time to 45 minutes (SP) and 90 minutes (LP). According to JVC a new high-stiffness binder ensures high tape durability. No price or launch dates have been announced so far.

SATELLITE TV LATEST

Sky Television has reduced its estimate of the number of homes likely to be able to receive its transmissions after the first year of operation from 2·5 million to 1·15 million. A total of around 2·5m is considered to be still achievable, but the guarantee figure for advertisers is now 1·15m. On the advertising sales side Sky intends to undercut ITV rates by some 25 per cent. Free repeats will be offered if audiences fall below the guaranteed figure. Advertising agency Saatchi and Saatchi estimates that a total of around 420,000 receiving systems for Sky and BSB will have been installed by the end of the year. At present there appears to be a shortage of equipment, possibly because manufacturers are reluctant to increase production until the orders start to flow in.

The Thorn-EMI rental division (DER, Radio Rentals, MultiBroadcast and Focus) reports a high level of interest and has ordered over 40,000 receivers from Grundig. These will sell at around £349 with remote control. Granada is buying equipment from Salora and Tatung.

BSB has awarded a £50m contract to operate its customer management and advisory service to British Satellite Systems, a joint venture company formed by Next plc and CableData Inc of California. The Customer Service Centre will be at the Arlington Business Centre, Leeds and will initially create 400 new jobs in the city. It will handle the enablement of all BSB receivers, will answer viewer enquiries about equipment and programming and will handle the administration of subscriptions for the BSB Movie Channel and pay-per-view events. Information will be transferred from the Centre to Next's mainframe computer in Bradford then to BSB's computers at its Earth station at Chilworth near Southampton. Each BSB receiver will have a unique number, making it individually addressable over the air so that it can be turned on via the satellite.

Super Channel was saved from bankruptcy when creditors accepted a plan which will mean they are paid only a quarter of the £8m they are owed. New owners Beta Television hope that the channel will now break even with a new programming arrangement consisting mainly of music.

RTEEB 1988 VIDEO AWARD

Steven Gerald Thomas has received an award of £100 after achieving a 100 per cent pass mark in the Radio, Television and Electronics Examination Board's 1988 video recording and playback practical test. Steven is 31 and lives at Wirral. He's been in the trade for twelve years and is at present employed by Servicescope. This is the first time that anyone has obtained a 100 per cent pass mark. Course tutor was none other than Joe Cieszynski, who writes regularly in *Television*.

FAULT GUIDES

Both JVC and Sony have recently published fault guide handbooks, adopting a similar approach with a page to each fault.

The Sony Service Fault Finding Guide Edition 2 is intended as a supplement to Sony's first three guides which have now been reprinted. These are for audio (part no. S-795-100-01), TV (S-796-000-01) and video (S-796-202-01). A page is devoted to each fault symptom and the price is still £4·95 per volume. The new Guide covers more recent Sony models of all types, including CD players, 8mm equipment, TV sets etc. Its part no. is S-795-015-10 and the price is £7·95. These publications can be obtained from Regional Sony Service Centres, SES Ltd. or (account holders only) from the Sony Spare Parts Department at Thatcham.

The JVC Fault Diagnosis Guide Vol. 1, covering VCRs and camcorders, has a similar format but in addition includes check points for each fault, a useful addition. Some 200 faults from the obvious to the obscure are covered. The Guide is available from JVC (UK) Ltd. at £10·80. Write to JVC House, Eldonwall Trading Estate, Priestley Way, London NW2 7BA or 1 Olympia Industrial Estate, Gelderd Road, Leeds 12.

S-VHS-C CAMCORDER WITH HI-FI SOUND

JVC has released details of the first S-VHS-C camcorder to feature hi-fi sound recording. Model GR-S707U has a standard size (62mm) drum instead of the usual 41·3mm drum. This has been made possible by incorporating the direct-drive motor inside the drum itself. The GR-S707U weighs only 1·7kg: its body has been redesigned so that it rests on the shoulder for normal shooting.

Other features include a 360,000 pixel CCD image sensor with 8-lux sensitivity, two-speed ×8 power zoom, a multiple speed fast shutter, time-lapse recording, animation recording, VHS indexing, variable speed search, noiseless still and slow-motion playback, auto/manual iris and white balance, backlight compensator, a stereo microphone, HQ specification, insert editing, audio dub, S-video/AV sockets and optional remote control. It will be launched in NTSC countries later this year – there are no details yet of a European launch.

INTERACTIVE TV SYSTEM

A recent issue of the US magazine *Radio-Electronics* (December 1988) contained details of a proposed interactive TV system to enable viewers to participate in TV game shows. It's called IGN (interactive games network) and makes use of computer technology, an f.m. subcarrier and TV sets. Those participating would use an interactive games console which is linked to a control computer in the studio via a telephone modem and receives instructions on answering via a transmitted f.m. subcarrier. The system apparently meets FCC regulations.

VHS PENETRATION

JVC has released details of the growth and development of the VHS system. By the end of 1988 cumulative shipments of VHS equipment worldwide had reached some 210 million VCRs and 11·2 million camcorders. In the same year blank tape sales were estimated at one billion units with prerecorded software accounting for a further 190 billion units. JVC points out that 60 per cent of the VCR shipments have taken place during the past three years. The format was launched in Japan in the autumn of 1976. A million VCRs had been shipped by 1978, when VHS was launched in Europe. The ten million mark was reached in 1981 and the 100 million mark in 1986.

The regional breakdown is as follows: Europe 45 million VHS VCRs (21·4 per cent of the total); North America 96·6 million (46 per cent); Japan 37 million (17·6 per cent); other areas (including the Middle East, Australasia and South America) 31·6 million (15 per cent). VCR household penetration is estimated as UK 60 per cent, Japan 70 per cent, USA 60 per cent, West Germany 40 per cent and France 30 per cent. The camcorder figures are UK 1 per cent, Japan 8 per cent, USA 6 per cent, West Germany 3 per cent and France 1 per cent.

In NTSC areas S-VHS now accounts for some 20 per cent of total VHS sales. JVC expects European S-VHS sales to reach 15 per cent this year with an annual growth of 10 per cent thereafter.

IN BRIEF

The Cable Authority is to review all franchises that have been awarded for over a year and intends to cancel any that seem to be dormant. No work has been done yet on two of the original franchises awarded in November 1983 – in Belfast and Liverpool. Several other franchises appear to be stalled . . . Tatung is to install a new £4·6m production line in the UK with a capacity to produce 100,000 monitors a year. The existing colour TV receiver manufacturing facility is also being expanded . . . Sixteen US electronics companies have formed a partnership to develop an HDTV system and facilities to produce HDTV equipment. The American Electronics Association has been campaigning for such a move for some time and is hoping to obtain government funding for the research and development required . . . Frequency band allocations in the UK, from 1kHz to 60GHz, can be seen at a glance on a colour-coded bar chart that has been prepared by the Radiocommunications Division of the Department of Trade and Industry. The chart is published by HMSO at £2·50 – quote reference ISBN 0 11 514637 7.

Failure and Success

Les Lawry-Johns

I seem to be giving up more often when confronted with faults I could put right without thinking about it a couple of years ago. Take the Fidelity CTV14R that came in the other day. The rear-mounted 18kΩ wirewound resistor that feeds the 12V zener diode ZD5 was open-circuit so I replaced it. Switching on brought no response however. There was h.t. at the collector of the chopper transistor but it wasn't being switched on. I checked the driver transistor and all the components associated with the TDA2581 control chip, including ZD5. A couple of items didn't read right: I replaced these but the set still didn't work. So I gave up and admitted defeat.

Then look what happened just before Christmas. A woman brought in an ex-rental Multibroadcast set for repair. I told her I'd phone when I'd found out what was wrong. It turned out to be fitted with the Thorn 9000 chassis. The tripler and a couple of other things had gone, par for the course with these sets. I phoned her and gave her an estimate for thirty pounds. At this she said most emphatically that she didn't want the set done because she'd paid only seventy pounds for it about two years previously and had had to spend money on its since. She told me not to do it and the set stayed in the shop into the new year.

Honey Bunch started to moan about the sets that had been left with us. Said they were cluttering up the shop. So when this chap came in and asked if we wanted anything dumped I pointed to the front row and he took them away. This included the Multibroadcast set. Several weeks later a chap came in and asked to collect it. I told him it had been dumped and told him he could take another working set in exchange for it. He took a nice 20in. Ferguson model and I didn't hear any more for a week or so. Then the woman phoned to say that she wanted her Multibroadcast set back. I told her it had been disposed of as she hadn't wanted it done and I couldn't keep sets that weren't collected. She said she'd sue me unless I could produce an identical set. I'm still waiting and the threat has been repeated. Oh dear!

I do have the occasional success however, sometimes after a struggle. Take the Philips G11 that came in recently. I repaired the line output panel and thought that was that. It wasn't. The picture was dark and the brightness control had no effect. Checks showed that there was a short from one end of R6065 to chassis until plug 6C was removed. This led me to the power supply panel where zener diode D4090 (BZX79-C4V7) in the beam limiter circuit had gone short-circuit. Fitting a replacement produced a good picture with full control. I'm still waiting for the set to be collected . . .

Book Reviews

An Introduction to Satellite Television, new edition, by F.A. Wilson, published by Bernard Babini (publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF at £5·95.

Such is the interest in satellite TV that a new extended and updated edition of this book, which first became available early last year, has now been published. It's a useful handbook for any technician thrown in at the deep end by the coming of Astra and BSB, beginning with the basics and ending with the maths. Its prime virtue is that it deals with today's requirements in the UK – so many recent books have been written mostly with the C band used in the Americas in mind. **H.P.**

Getting the Most from your Multimeter by R.A. Penfold, published by Bernard Babani (publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF at £2·95.

Electronics changes so fast that the basics tend to be ignored – with test equipment meters are neglected in favour of more sophisticated gear. A good multimeter will however usually tell you just about all you need to know about a circuit, provided you use the right sort and apply it correctly. This book shows you how. **H.P.**

Newnes Guide to TV and Video Technology by Eugene Trundle, published by Heinemann Professional Publishing, Halley Court, Jordan Hill, Oxford OX2 8EJ. Paperback edition £8·95.

This book is a successor to two well-known Newnes Guides – to colour television and VCRs. The material from the earlier books has been revised, updated and added to for this single-volume presentation. Its well over 400 pages contain a great deal of basic information on television and video including such up-to-date subjects as MAC encoding, satellite TV reception and S-VHS. The book is not intended for those well versed in these matters, but can be recommended as an easy to follow introduction for those new to these subjects. A careful study will provide a good grounding in TV receiver and VCR operation in fair depth, and the book will afterwards serve as a handy reference. It can be obtained by post at an inclusive price (in the UK) of £9·95 from Paul Richards Books, 28 Boscobel Road North, St. Leonards on Sea, E. Sussex TN38 0NZ. **J.A.R.**

More Advanced Power Supply Projects by R.A. Penfold, published by Bernard Babani (publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF at £2·95.

This sequel to "Power Supply Projects" is really intended for the enthusiast. Because it features modern regulator chips however it's a handy book to have around. Particularly useful if you have a power supply problem with an older piece of equipment and decide to replace the whole thing with one of the current three-legged devices. **H.P.**

IBA Technical Review No. 24: The D-MAC/packet System for Satellite and Cable. Available to bona fide technical personnel, engineers and students by application to the IBA, Engineering Information, Crawley Court, Winchester SO21 2QA.

The IBA began publishing this series of Technical Reviews in 1962 – No. 2, the Technical Reference Book, has become almost the standard work defining the parameters of System I. This latest book looks like becoming the standard work of reference on D-MAC, and is a must for those who will have to deal with MAC equipment or explain its operation to others. The overview alone settles a lot of previously unanswered questions, especially as to how the system is intended to be progressively developed

through wide-screen to high-definition compatible TV. Vision, packet multiplex, sound and conditional access all get a chapter to themselves, as does line 625 – on which everything happens. Even energy dispersal is explained in credible terms, surely a first in satellite literature. Did you know that the residual space in the sound/data multiplex block has to be filled up, and that this is done with dummy packets which have the address 1023? Do you know the difference between scrambling and encryption, and how NICAM works? It's all here, but I wish we'd been told more about Viterbi decoding, which improves the noise performance. **H.P.**

Servicing Compact Disc Players

Part 1

Joe Cieszynski

One problem with a series such as this is that readers will have different levels of both knowledge and experience of the subject. Thus there's a danger of either boring those who have serviced compact-disc players and have attended manufacturers' servicing courses or on the other hand blowing the minds of those who have had little to do with them. From my experience however I find that most engineers who have attended short courses on CD players find it difficult to commit to memory the theoretical aspects of the CD system and concentrate more on taking down notes on stock faults with the player in question. This is not a bad thing of course, and does give the engineer struggling to keep abreast of the latest technology a degree of confidence and competence when he's faced with a player back at the workshop. As for the forgotten theory, you might question whether it's necessary. But if you don't consider it necessary to understand the theory of how the equipment you meet every day works you wouldn't buy and read a magazine such as this! It's possible to deal with a great many faults without fully understanding how the system works. What about the difficult faults? Does a knowledge of the theory then make a lot of difference? It's a difficult thing to prove, but I personally believe that it does. So we'll begin at the beginning, and I hope that even the more experienced amongst you will find that some of the points you missed during the courses start to make more sense the second time round. We'll be including plenty of practical hints and fault-finding procedures as we go along.

In starting at the beginning the first thing to make clear is just what it is that the player recovers from the shiny piece of plastic we call the disc. This knowledge is vital for an understanding of some of the track skipping and jumping faults that regularly occur with CD players.

Disc Basics

The disc contains up to sixty minutes of left and right audio information in the form of 14-bit words. In addition to the audio data over 200Mbits of data is added to enable the decoder to carry out error correction and the control microcomputer to operate the front display. In total a typical sixty-minute disc contains over 15,500Mbits of information, in other words fifteen and a half thousand million noughts and ones are mechanically stamped on to the disc. These noughts and ones take the form of pits and land, with a reflective aluminium covering. To play the disc the beam from a gallium arsenide laser is focused on the reflective layer, the reflected beam being picked up by photodiodes. A pit reduces the intensity of the light reaching the photodiodes whose output, after electronic processing, consists of the binary ones and noughts recorded on the disc.

The data on the disc is laid down as a spiral track that starts at the centre of the disc. During playback the laser scans the track at a constant velocity of 1·2m/sec, which means that the disc must rotate faster when the laser is near the centre than it does when the laser is at the outer edge. This method of scanning is known as constant linear velocity (CLV) scanning, which is the opposite of the constant angular velocity (CAV) technique used with traditional audio disc systems.

Fig. 1 shows the arrangement of the track on the disc. It consists of pits and land of varying length, the length depending on the data it represents. Fig. 2 illustrates this. Logic one is represented by an excursion from land to pit or pit to land, logic zero being represented by the absence of an excursion, i.e. for zero the disc acts as a plain mirror. It can be argued that zeros are not in fact stamped on the disc but are added by the player during the signal decoding process. We'll be going into this later on.

Disc Production

The important factors in disc production are that every pit is accurately stamped in and that the surrounding surface (the land) is flat and even. When you consider that the pits are 0·6μ wide, 0·11μm deep and as little as 0·85μm long you will appreciate the degree of accuracy required. Fig. 3 shows how a section of track would appear when seen through an electron microscope.

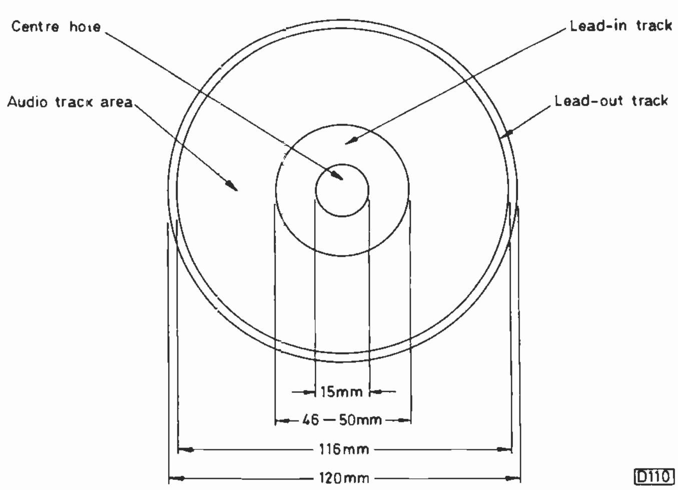


Fig. 1: Layout of the compact disc.

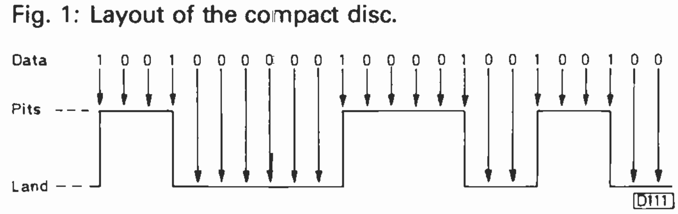


Fig. 2: How ones and zeros are represented in the disc.

When a recording is made the audio signal is first converted into a digital stream. The other data required is then added. This encoding process is highly complex and will be covered in detail later. The data is recorded on a master disc which is used to produce stampers which are in turn used to make the discs supplied to consumers. The complete process, illustrated in Fig. 4, is as follows. (1) A glass plate is smoothed and polished. (2) A photo-resist layer is applied. (3) The recording laser is focused on the photo-resist layer. Its beam is modulated by the digital stream. (4) After development, pits are present in the disc's surface. These pits are $0{\cdot}11\mu m$ deep and, as we have already noted, the transitions from land to pit and pit to land represent the ones in the data stream. (5) The surface is coated with silver to protect the vital pit edges. (6) Nickel is applied to the glass master to produce a metal master. (7) The metal and glass masters are separated. (8) Mother plates are made from the metal master by stamping. (9) The mother plates are used to make stampers. These are a "negative" of the final disc. (10) The stampers are used to mass produce the final discs. (11) A layer of aluminium is vaporised on to the final disc to form the reflective surface on which the CD player's laser will be focused. (12) A thin, non-transparent protective film is added. This also acts as the contents label.

Note that the CD player's laser scans the disc from the transparent side. As a result, so far as the laser is concerned the pits are actually above the surface (see Fig. 2). In other words when the data is read the pits are higher than the surrounding land.

The precise minimum pit length is $0{\cdot}833\mu m$ and the maximum length is $3{\cdot}05\mu m$. We'll consider the factors that determine this format, but first we must understand the way in which the laser scans the disc.

Scanning the Disc

When the laser's light is focused on the land part of the disc the reflected light focused on the photodiodes produces a positive output voltage. The pit height of $0{\cdot}11\mu m$ is about a quarter of the wavelength of the laser light. When the laser beam crosses a pit — see Fig. 5 — part of it strikes the pit while the rest strikes the surrounding land. The simplest explanation of the result of this is to say that the light reflected from the pit is 180° out of phase with that reflected from the land, so that cancellation occurs. In reality the way in which this cancellation takes place is far more complex, but as long as we appreciate that cancellation does occur this is of no consequence. The degree of cancellation depends on the land/pit reflection ratio. Calculation shows that with a pit width of $0{\cdot}6\mu m$ and a focused laser beam (spot) diameter of $1{\cdot}7\mu m$ more light will always be reflected from the land than from the pits — Fig. 5(a) shows this. If this was not the case and there was no output whatsoever from the laser pickup as the spot travelled over a pit there would be no signal, which would play havoc with the focus and tracking servos.

When the spot is focused on land area — Fig 5(b) — maximum reflection occurs and the pickup produces a high output voltage. As the spot begins to pass over a pit — Fig. 5(c) — there's a reduction in the reflected light and when the spot is over a pit — Fig. 5(d) — the reflected light falls to a minimum level. Fig. 5(e) shows the resultant pickup waveform. Notice that the rate of the slopes between the pits and land is constant. Thus the

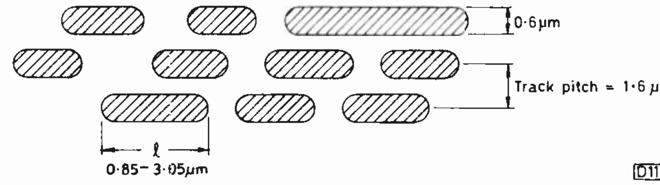


Fig. 3: Track parameters.

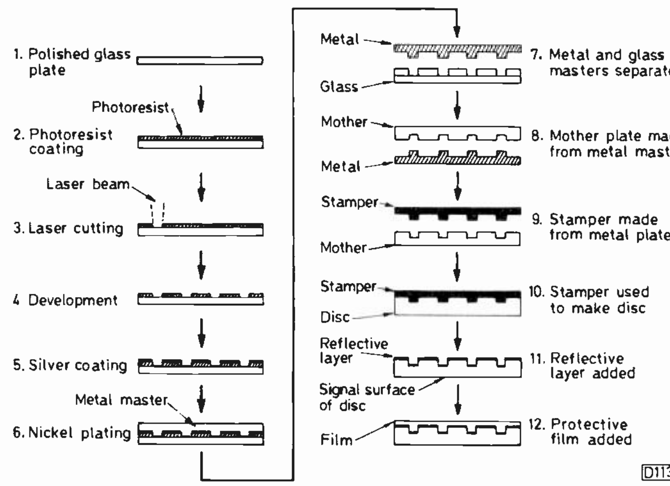


Fig. 4: Steps in the production of a disc.

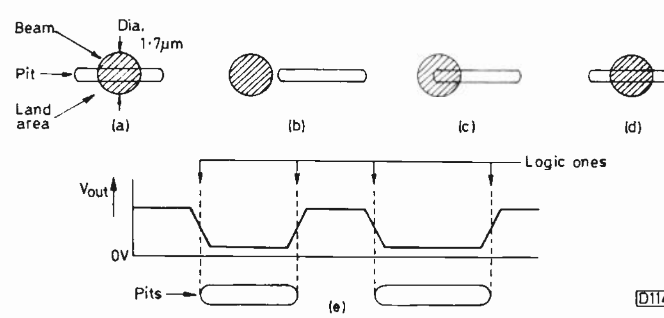
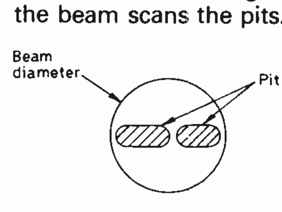


Fig. 5: Relationship between the laser beam and the track pits. (a) Beam passing over a pit. Note that the land area covered by the beam is greater than the pit area. (b) Maximum reflected light – beam entirely on land area. (c) Beam beginning to pass over a pit – the reflected light level is reduced. (d) Beam passing over a pit – the conditions for minimum reflected light. (e) Output waveform produced as the beam scans the pits.



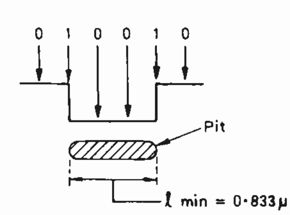


Fig. 6 (left): Adjacent ones would be missed if the beam diameter was such that it was able to cover more than one pit.

Fig. 7 (right): Minimum pit length – there must be at least two zeros between each one.

decoder is able to detect vertical pit edges (logic ones) by sensing the centre of these slopes.

Minimum Pit Length

The minimum pit length is determined by the laser's resolution. At the reflective surface the spot diameter is $1{\cdot}7\mu m$. If the pits were shorter than the beam radius,

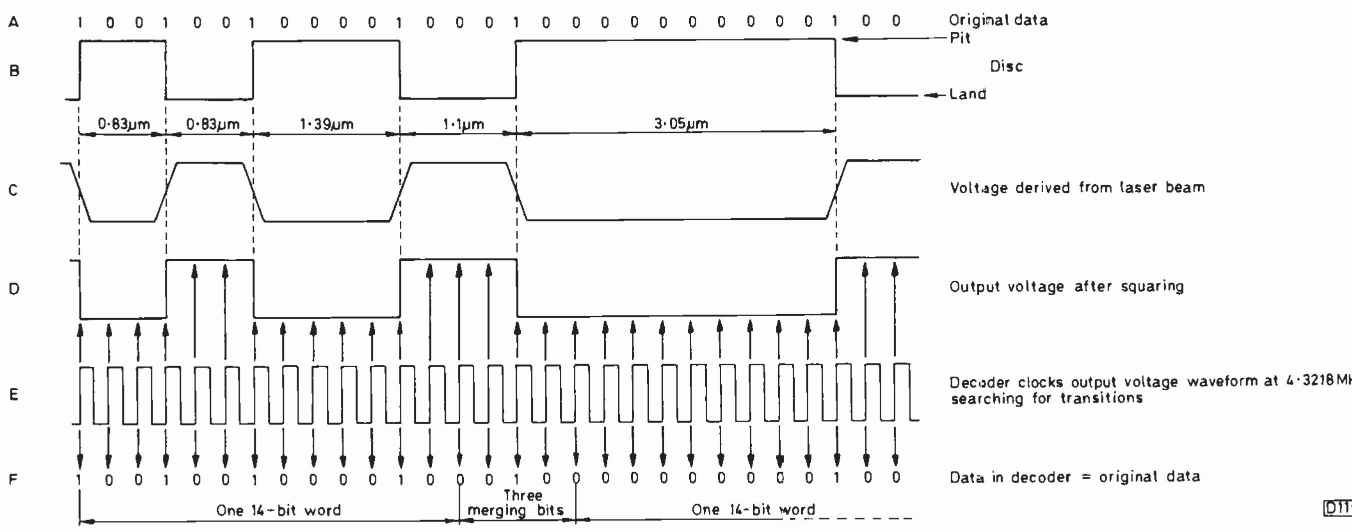


Fig. 8: How the disc is read. This diagram is the key to the whole compact disc system. The decoder detects logic one as coincidence between a clock pulse and an off-disc signal transition.

more than one pit could be covered by the spot and the transition between adjacent ones would be missed — see Fig. 6. As a general rule pit length should be equal to at least the radius of the laser spot. The length of 0·85μm specified for a compact disc is just in excess of this.

A second factor that governs the pit arrangement on the disc is that two adjacent logic ones must not be permitted in the data stream. If this was allowed to occur the frequency of the light fluctations would be above the resolution of present-day domestic lasers. When we look at encoding later we'll see that there are other reasons why the data must not have adjacent ones, and that in practice there must be at least two zeros separating two ones.

Minimum pit length can be found from: length of one bit = disc rotation speed/data rate. For a compact disc this is 1·2m/sec divided by 4·3218MHz = 0·27766μm. With two zeros between ones the pit length must be at least three bits long (see Fig. 7). Thus one pit length = 3 × 0·27766μm = 0·833μm minimum.

Maximum Pit Length

What about maximum pit (or land) length? We've just seen that there must be at least two zeros between ones. The question we now have is "what is the maximum number of zeros that can be present between any two ones?". The answer is ten. The pit rate generates a frequency component that's used as a reference by the tracking servo. We shall see later in this series that a stream of more than ten consecutive zeros would make the laser go off track. When we come to discuss the encoding process we'll see that there are other reasons for limiting the data to ten consecutive zeros. The maximum pit length is thus ten logic zeros plus a logic one multiplied by the length of one bit, i.e. 11 × 0·277μm = 3·05μm.

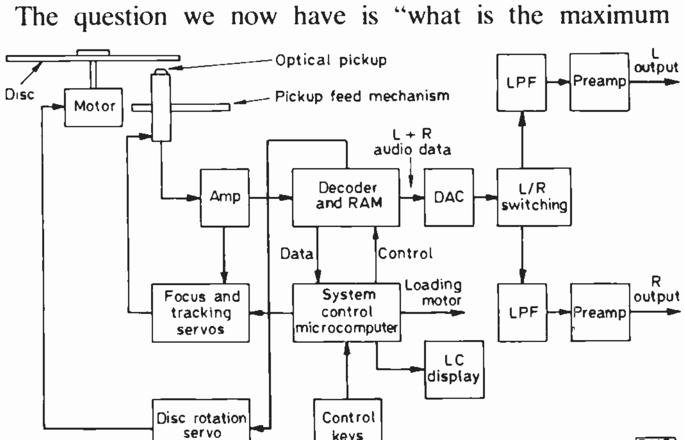


Fig. 9: Simple block diagram of a CD player, showing the signal path through the decoder, DA converter and filters; the four servo loops (the sled servo is included in the focus/tracking block); and the control data take-off for LC display drive.

Binary Code

There are nine different pit lengths between 3 × 0·277μm and 11 × 0·277μm. Each one indicates a different set of binary numbers, and we shall see later that these numbers form 14-bit binary words, each separated by three merging bits.

Reading the Disc

Fig. 8 provides an overall view of how the disc is read. A shows a stream of data representing a portion of audio signal. This is stamped on the disc as shown at B. When the disc is played, the voltage derived from the pickup diodes is as shown at C. This signal is passed through a squaring amplifier to give the signal shown at D. This is then fed to the decoder where it's checked against a 4·3218MHz clock signal (E) generated in the decoder. Signal transitions are thus detected. On detection of a transition the decoder provides a logic one output: when there is no coincidence between a clock and signal transition the decoder's output is logic zero. As mentioned earlier, the zeros are not actually put on to the disc but are added by the player. The original data is thus recovered (F) and is checked by the decoder to determine what is audio data, what is error correction data and what is LCD display data. Once it has been separated, the audio data is checked for errors, decoded and finally converted back to analogue form.

Player Block Diagram

To complete this introductory article, Fig. 9 shows a simplified block diagram of a CD player. Following instalments will examine each section in detail.

Introduction to S-VHS

Nick Beer

Unless you've been on holiday in Outer Mongolia for the past eighteen months you can't have failed to have noticed the coming of S-VHS. It's now with us in practical form. We saw it first with the Pansonic NV-MS1 camcorder. More recently the NV-FS1 VCR, on which the practical aspects of this article are based, has come along. Steve Beeching wrote about the basic S-VHS specification in the July 1987 issue — we'll recap briefly on some of this. Let's first look at the improvements over the basic VHS system and the way in which they are achieved.

As we all know, the horizontal resolution of the basic VHS system is in the region of 240 lines. Thus the recorded picture is noticeably lacking in definition with respect to the original scene. To the average viewer this is no great hardship — they often tolerate poorly focused pictures with a poor grey scale. It can be most annoying to discerning viewers however, particularly those with cameras capable of a resolution performance of over 400 lines. S-VHS provides considerable improvement, with a specified horizontal resolution of some 400 plus lines. This is achieved by increasing the f.m. carrier frequency so that a greater luminance bandwidth is recorded on the tape. The f.m. carrier deviation is 5·4-7MHz compared to 3·8-4·8MHz with standard VHS. The wider deviation of 1·6MHz instead of 1MHz improves the signal-to-noise ratio. Increased resolution/bandwidth will increase the noise level: the wider frequency deviation counteracts this. Noise is further reduced by employing a non-linear sub-emphasis system which varies the emphasis applied in proportion to the amplitude of the signal being recorded.

Fig. 1 compares the VHS and S-VHS signal spectra. Notice that with the S-VHS system the chrominance and luminance signal bandwidths do not overlap. This an important feature of the new system since it means that cross-colour effects can be eliminated as far as recording and playback are concerned. To take full advantage of this the signals have to be kept separate, i.e. fed to the receiver/monitor as baseband signals instead of being PAL encoded, modulated on to a u.h.f. carrier and fed into a receiver via its aerial socket.

All in all the pictures are sharper and better contrasted, with minimal noise. Particular improvement can be seen on edges — such as door frames and the brick/stone detail of buildings.

S-VHS Tape and Heads

Because of the wider bandwidth, newly developed tape is required. Basic details of the tape construction are shown in Fig. 2. George Cole's article in the August 1988 issue described the tape in some detail. The magnetic layer consists of ultra-high density cobalt-coated ferric-oxide particles applied with a binding agent that ensures uniform distribution. The surface is incredibly smooth.

The new tape provides increased output at the higher frequencies and reduced noise. The characteristics that make this possible are an 80 per cent increase in magnetic energy, higher coercivity (800-900 Oersteds) and higher remanence compared to standard VHS tape. The cassette has an identification hole at the bottom, in the rear left-hand corner when viewed from the bottom.

The S-VHS system also requires the use of a different type of head. The amorphous type used has been employed in professional equipment and also in some newer machines. Its laminated structure reduces eddy currents, improving the reproduction efficiency especially at the higher frequencies. Noise is reduced by lowering the friction between the head and the tape.

S-VHS Equipment

All the S-VHS machines released so far are "dual-standard", i.e. they will record/playback to the VHS or S-VHS standard. The identification hole in the cassette prevents VHS recording with S-VHS tape and vice versa. There is of course incompatibility between the VHS and S-VHS tapes and signals.

Keeping the chrominance and luminance signals separate is a feature of the S-VHS system. Use of a low-pass filter to separate the luminance from the chrominance signal to be recorded would have the disadvantage that luminance information above 4MHz is lost while chrominance information is still present in the luminance signal spectrum. Instead, a comb filter is used. It employs a 128μsec (two line period) delay line with addition and subtraction of the delayed and direct signals — the principle is similar to the use of a delay line in a PAL decoder. The chrominance signal is taken off via a bandpass filter.

The comb filter technique gives rise to a problem when there is no line correlation in the video signal — a form of dot interference can be introduced. The problem arises in

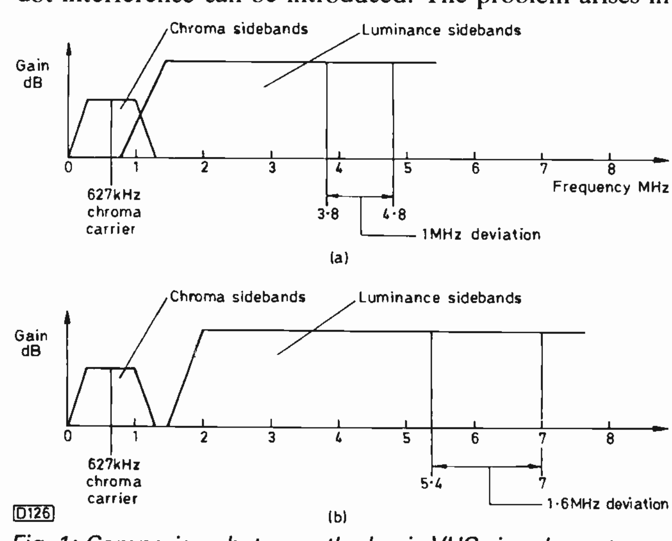


Fig. 1: Comparison between the basic VHS signal spectrum, shown at (a), and the S-VHS spectrum shown at (b).

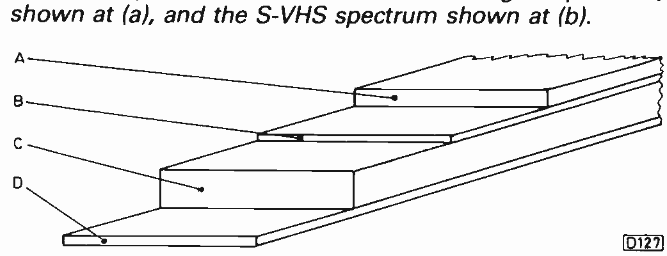


Fig. 2: S-VHS tape construction. A is a 5µm high-level magnetic layer, B is an 0·3µm undercoat layer, C is an improved 14µm ultra-smooth base and D an 0·7µm improved back coating.

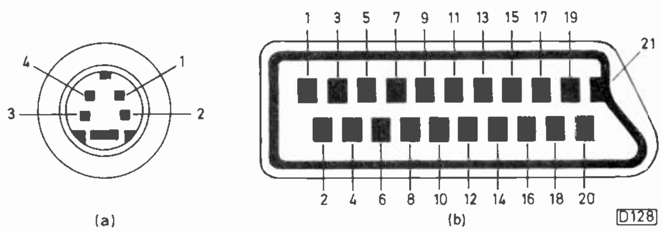


Fig. 3: Connectors for S-VHS, (a) 4-pin and (b) peritel. The 4-pin socket connections are 1 luminance, 2 luminance earth, 3 chrominance earth and 4 chrominance. The peritel socket pinning is as follows: 1 audio out right; 2 audio in right; 3 audio out left; 4 audio earth; 6 audio in left; 8 function switching; 13 chrominance earth; 15 chrominance; 17 composite video or luminance earth; 19 composite video or luminance out; 20 composite video or luminance in; 21 casing/socket earth.

particular when switching from a monochrome to a colour signal and vice versa. To overcome this a non-correlation circuit which detects the presence of the 4·43MHz chrominance signal is used. It generates a non-correlation pulse when it detects this condition.

To ensure optimum conditions, separate luminance and chrominance signals can be fed into and out of S-VHS machines. Fig. 3 gives details of the four-pin S socket and the peritel socket connections for S-VHS use.

A 4·43MHz pilot burst signal is added to the line sync pulse whilst recording and is removed during playback signal processing. Its purpose is to indicate by its phase whether the signal being recorded consists of composite video or component video (luminance plus chrominance). For composite video the pilot burst phase is 90° with respect to the U signal phase axis while for component video its phase is 270°. With composite video a luminance component at about 1MHz is present in the chrominance signal and is not, of course, removed by the bandpass chroma filter. If not removed it gives rise to a dot pattern on the picture. A 1MHz trap is used to delete it, being switched in automatically when a 90° pilot burst is detected.

During playback the machine must establish whether the recorded signal is of the VHS or S-VHS type. This is done by checking whether the output from the playback preamplifier contains a 3·8MHz (VHS) carrier component. A peak detector amplifier is used for this purpose. Its output is integrated and smoothed and is then used to carry out the appropriate switching. With S-VHS the carrier deviation is 5·4-7MHz and the output from the peak detector will be low.

In conclusion, my thanks to Panasonic for providing information. My first impressions of S-VHS are of the undoubted improvement it provides. I think that the boom will come in the camera section of the market as the difference is more noticeable and the price differential is smaller. A camcorder costs around £1,600 compared to £1,300 for the equivalent VHS type. The Panasonic NV-FS1 VCR costs around £1,000 and includes hi-fi stereo sound and a NICAM decoder. At present there's a certain amount of confusion amongst customers as to whether a new TV set and VCR (for camcorders) will be required. This is not being helped by lack of sales staff training. An advantage of having an S-VHS camcorder is that an edited copy of an S-VHS recording can be made on to VHS of equal quality to an original VHS recording, i.e. there's no loss of quality as there would be when copying from a master VHS recording. This means that there is some compatibility between the two systems.

Letters

DEALING WITH SM DEVICES

I read with interest Ian Bowden's letter (January issue) on reworking surface-mounted components. The company I work for has recently invested in equipment for surface-mounted production and as a result I've had to find suitable rework methods and equipment.

I found that a large number of equipment manufacturers were willing to sell me infra-red or hot-air rework equipment, usually including precision X-Y-Z movements, microscopes, compressed-air solder cream dispensers and so on. While these items may be desirable for professional or military applications, they would involve a very large financial outlay (thousands of pounds) and anyway I've found that they are quite unnecessary.

I remove small chip components (resistors, capacitors) using a pair of electrically heated tweezers. These are available from some large electronic component distributors. They are rather like a soldering iron but have two spring-loaded elements and two tweezer-like bits whose temperature is adjustable over a wide range by means of a knob on the associated control box. Components can be removed and replaced in seconds using the tweezers.

Surface-mounted i.c.s most commonly have the gull-wing dual-in-line package. I use a hot-air pencil to remove these. Again there are a number of these items on the market. Points to look for are a hot enough temperature and the ability to set the air flow to a very low value with absolute smoothness and regularity of flow. If this cannot be done the tool is useless for resoldering with solder cream – it gets blown all over the board. Don't assume that well-known manufacturers' items are suitable in this respect. I've not found it necessary to use an inert gas instead of air though some units have provision for this. It would probably give better joints.

Using a hot-air pencil I remove an i.c. as follows. Insert a pair of extractor tweezers (e.g. RS549-820) under the i.c. and heat one row of legs. When all the solder has melted, gently lever the row of legs clear of the board. This obviously stresses the opposite row of legs, so it must not be overdone or you will end up with lifted tracks. Now heat these other legs and lever them up – the i.c. should then lift clear of the board. Clean the PCB pads with desoldering braid and a conventional soldering iron.

I.C.s can be replaced using either solder cream and a hot-air pencil, soldering one row of legs at a time, or low melting-point solder and a conventional fine iron. Don't worry unduly if solder cream appears to bridge adjacent legs – it usually goes to all the right places when heated! Some care is required to apply just the right amount, and here a compressed-air dispenser is useful. Too much cream will certainly lead to bridging and if it gets under the i.c. it will remain there as the heat cannot reach it.

I've not had to remove and replace the square flat-pack i.c.s with legs on all four sides (thank goodness!) but I can see that with these it would be necessary to desolder the individual legs.

To summarise, I would suggest that anyone who repairs equipment using surface-mounted components should consider purchasing the following: electrically heated tweezers, a hot-air pencil and an ultra-miniature soldering iron. Smaller items should include: low melting-point solder (contains silver, which prevents leaching with some components), tweezers and large needles (very useful!). I've found one particular range of surface-mount tools useful and of excellent quality. They are made by a German company, Daturr, and are distributed by STC Components, Verospeed, OKI Industries and perhaps others. The hot-air station costs approximately £500 and the heated tweezers approximately £200.

Finally, try to order components that are marked – it makes life a lot easier. Surface mounting is nothing to fear, though it may be an incentive to get some new glasses!

Paul Barton,
Harrogate, North Yorkshire.

FERGUSON TX10 CHASSIS

Every picture tells a story: how many readers spotted something wrong with the TX10 chassis picture shown on the front cover of the January issue? K. Rutherford's excellent article on servicing the Ferguson TX10 chassis mentioned insulation breakdown with earlier focus controls. This is something of which most of us are by now well aware, and we fit the modified type that includes two plastic pillars to stand the control off the metal chassis. Obviously the repair technician who dealt with the set shown in the picture didn't see the need to fit these!

Alan Shaw,
Bolton, Lancs.

EHT ARCING

I was interested to read the article on dealing with e.h.t. arcing (January issue) and found much of what it said both valid and good sense. I feel I must take the author to task on a couple of points however.

First, it's not true that manufacturers don't see fit to smear silicone grease under the cavity connector's cover. My company handles a lot of repairs to ultra high resolution video monitors, and with these it's by no means uncommon to see large quantities of white silicone grease in this position. Notably one very large Japanese manufacturer who also makes TV sets does this.

Secondly, the use of silicone rubber compound around areas that are likely to discharge is also widespread. While I agree that this compound should not be used to "seal in" faults, I see no valid reason why it shouldn't be used to prevent the ingression of moisture into likely trouble spots. Indeed I have modification instructions, from the same Japanese manufacturer, advocating its use.

Finally I don't believe that just because the manufacturer didn't do it in the first place this is a reason for not subsequently doing it. I could cite many cases where sets are installed in houses belonging to old people who smoke forty cigarettes a day and run a Calor gas heater throwing out about a gallon of water an hour, the result being that they go through an e.h.t. connector about once every three months. The only permanent cure for sets operating under these conditions is to seal the cap so that the moisture canot get under it in the first place.

G.H. Darby, Proprietor Monitech,
Earls Barton, Northampton.

PROBLEMS WITH RANK SETS

May I say thanks to Colin Doman (Letters, January) for his suggested modification to get rid of the accursed teletext lines with sets that use the Rank A823 series chassis? I'd been struggling for some time with one of

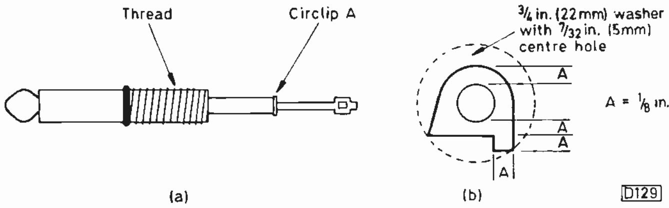


Fig. 1: Making a nylon bush for Rank tuning mechanisms. Cut out the nylon washer as shown in (b).

these sets. I'd tried Mr. Catchpole's suggestion of extra windings on the line output transformer but the lines were still visible. The net result was to increase the field scan by ten per cent, out of the range of the height control. It's a useful idea however if the 40V line is still low after adjusting the h.t. to its correct level of 200V – cheaper and quicker than replacing the LOPT. John de Rivaz's pulse generator circuit didn't help but Colin's modification hit the nail, or perhaps I should say the teletext lines, squarely on the head. Well done Colin Doman. Ten minutes after reading his letter I was out of my misery.

Much has been written about the shortcomings of the Rank-Bush-Murphy channel selector pushbuttons. Here's a way of making those dreaded nylon bushes so beloved by Rank. First obtain a number (as required) of 22mm diameter by 4mm thick nylon washers. Remove the tuner from the set, unplugging all the leads. Dismantle the button unit on a table or bench, noting the positions of all the buttons, washers, springs and screws. Place them out of harm's way before beginning the next phase of the operation, which is to remove the broken bush from the sprindle and also circlip A – see Fig. 1(a). Since the circlip is made of mild steel, with a little care it's unlikely to break.

Place the nylon washer in a vice and drill a 7/32in. diameter hole in the centre. The point to note here is that you will be using the threaded part of the spindle to make a thread in the nylon washer, so gently does it when drilling – if too much material is removed it won't be possible to thread the washer. While the washer is still in the vice, push the spindle into the hole from the cross end and carefully twist it, using pliers if necessary (a small drop of thin oil on the spindle will help), until a thread has been cut.

Remove the washer from the vice and mark it out as shown in Fig. 1(b). Remove the excess material, using a small hacksaw and a file to complete the bush. Fit the new bush on the spindle, taking care over two points. First that the bush is fitted the correct way round, and secondly that it runs smoothly along the thread of the spindle. Remember that you will have to carry out the tuning procedure with the tuner installed in the set, using those horrid buttons. Finally, as all the best manuals say, reassemble in the reverse order.

Incidentally, a friend has for sale a 45ft Versa tower complete with rotator. If anyone is interested let me know and I'll pass the offer on. Buyer collects.

D.R. Isham, Windy Ridge, Mount Pleasant Close, Buckingham, Bucks MK18 1DN.
Telephone 0280 813 770.

FOR DISPOSAL

Due to shortage of space I have for disposal several TV sets – two Thorn 1500s (24in. models), an early Thorn 1500 with 19in. tube, a huge Ekco T420 and a KB Warden – the latter two are dual-standard sets. All are basically sound but require some attention. A line or telephone call before visiting would be appreciated.

W.J. Knight, 532 Rochester Way, Eltham, London SE9 1SQ
Telephone 01-850 4147.

WANTED

As a collector of vintage TV sets I'd like to buy a v.h.f. pattern generator, preferably transistorised, to set them up. I'd also like to buy a pre-war set to add to my collection. If anyone has such items for sale, please let me know.

R. Howells, 6 Dunlin Drive, Spennells, Kidderminster, Worcs DY10 4TA.

Could anyone supply an operating manual and/or service manual for a Sony "S.E.G. 370P" PAL special effects generator? The instrument was made for Sony in 1979 by Shintron in the USA. Photocopies would be acceptable and all costs would be met.

A. Kitching, 67 High Street, Great Broughton, Middlesborough, Cleveland TS9 7EF.
Telephone 0642 710 955.

Can anyone supply a service manual for the Hitachi VT5500E VCR? This is no longer available from the makers. I'd be willing to pay the going price of £22 for a copy.

Steve Field, 82b Cliff Road, Hornsea, E. Yorkshire HU18 1HX.

Can anyone supply a tuning panel for the Ferguson 3V31 VCR – it's the one with the two microcomputer chips on it – and a good A51-570X tube? Second-hand items will do so long as they work.

J. Olijnyk, 9 Woodview Terrace, Weston-super-Mare, Avon BS23 3PF.
Telephone 0934 417 441.

SERVICING PRECAUTIONS

As expected, my article and subsequent letter on the Amstrad CTV2200/2210 produced some comments. My thanks to J.E. Jones (January) for his interest and the tip about C845.

Another point – which could apply to many another TV set or VCR – is that the fuses (F501/2) are often loose in their clips. I always remove both and retension all the clips by bending, at the same time checking the fuse types and ratings. They can easily be overlooked as a result of their inaccessibility. Similarly we always check the plugtops of all items that enter the workshop. Most require refitting. The fuse ratings, clips and cord grip can be inspected at the same time.

If a set has lost its feet we always replace these to ensure adequate ventilation – even if the set lives on a stand (someone may remove it one day!).

In reply to S.J. Cain's interesting letter, anyone who regularly services a large cross-section of CTVs will know that it's often impractical and sometimes impossible to replace semiconductor devices with the original types. This is, after all, why we have equivalents books! Use of these, coupled with experience, will enable a good, sound, safe alternative type to be fitted. A device that is "better" than the original can usually be selected. I keep a very large stock of semiconductor devices, but it's impossible to keep every type and customers are not prepared to wait weeks while the exact part is obtained. It would have been almost a year in the case of the 2SC3156 transistor!

When the first Amstrad CTV2210 came into my workshop I borrowed a service manual and a 2SC3156. A few days later it failed again. At the time spares could be obtained direct from Amstrad, but neither the manual nor the 2SC3156 was available. The latter item was on order from Japan. Maybe Mr. Cain had bought the lot? When I opened an account with CPC it was the same story. I wrote to Amstrad's technical department for advice about a suitable alternative, but didn't receive a reply. As no data on the 2SC3156 was available, the circuit was studied and several alternatives were tried – successfully. The idea of using a D type with a parallel diode and base-emitter parallel resistor was to provide the device with greater protection against mains spikes, which could have contributed to its failure. We can't always assume that electrical installations/adaptors are perfect.

Incidentally the Amstrad spares agent doesn't seem to be able to obtain R814, a special 20W, 27Ω resistor that fixes to the chassis via a steel bracket. Under the part number a standard 17W, 27Ω wire-ended resistor is supplied. I don't consider that this is a valid replacement: not only is it lower rated, but the bracket doesn't fit.

To put the matter of safety into perspective, if a fire did occur negligence would have to be proved. Provided that repairs are carried out in a careful, neat, sound and workmanlike manner (unlike some I've seen perpetrated by so-called trade engineers), that any equivalents fitted are carefully selected, that safety components are replaced with the same types, that fuse ratings and types as well as h.t. rail voltages are checked as a matter of course, then no problems should arise.

Dave Mackrill,
St. Leonards on Sea, East Sussex.

A Simple Channel 1 Modulator

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

In the November and December issues last year I wrote in detail about 405-line TV and mentioned a Rediffusion modulator conversion. A letter in the January issue promised further details of this. The unit concerned is called a translator and is available at very modest cost. It contains a u.h.f. tuner with i.f. strip that provides video and audio (to drive a loudspeaker) outputs, an h.f. converter, an h.f. modulator and a power supply.

Until now most people who wanted a Band I modulator built David Looser's excellent design (*Television*, October 1984). Making use of the Rediffusion units provides a simpler approach with equally high-quality results. You have to buy two of the Rediffusion units to obtain two modulators. This will leave you with two perfectly good off-air tuners – see later.

Modulator Conversion

The first step is to extract the h.f. modulator can – it's the tuner-like can on the right-hand PCB, near the mains transformer. The circuit of this module is shown in Fig. 1. Conversion details are as follows.

Replace R2 (vision modulator only) with a 3.9kΩ resistor.

Replace R8 with a 560Ω resistor.

Replace C7 with a 220Ω resistor.

Replace R13 with a 10pF capacitor.

Replace C8 with a 68pF capacitor.

Replace C9 with a 47pF capacitor.

Delete R22, C16 and C12.

In the sound modulator, remove Tr2 and connect a 47kΩ resistor between the base and emitter connections.

Replace X1 with a 41·5MHz crystal in the sound modulator and a 45MHz crystal in the vision modulator. Add a 2·2kΩ resistor across the crystal on the back of the PCB to provide damping.

Add a 100pF capacitor from the carrier test point to chassis.

In the vision modulator, add a 1N4148 diode in series with R1 (cathode to R1).

These points are all shown in Fig. 1.

Connect the r.f. 0V pin to the modulator's case.

The r.f. output obtained from the circuit shown in Fig. 1 is about 30mV r.m.s. The arrangement shown in Fig. 2 provides two r.f. outputs, with the vision at 22mV peak-to-peak and the sound at 10mV peak-to-peak.

Each modulator is best aligned with the other one turned off. It's easy with a wide bandwidth scope looking directly at the output. Otherwise look at the demodulated video using a receiver or diode probe. Set L1 for maximum output. It tunes very broadly and the tuning is not critical. With the vision modulator feed in a standard video signal (625 will be perfectly o.k.) and set RV1 for positive modulation with zero carrier at the sync tips. If monitoring demodulated video, set RV1 so that sync crushing is just avoided. Without a scope, adjust RV1 until sync fails, then back off a bit. With the sound modulator, use RV1 to set the unmodulated carrier to 10mV peak-to-peak. Alternatively feed in about 100mV of audio tone, with the gain control at maximum, and adjust RV1 until distortion is just heard on the demodulated sound.

If you don't want to order crystals specially you could try using a series *LC* circuit, adjusting on test with a counter. Omit the 2·2kΩ damping resistor.

I have not had a chance to look at the modulator's output on a spectrum analyser – if some lucky person has one, could they please tell me just how revolting the output looks!

These modifications have been thoroughly proved on Channel 1 but not on the higher channels. With appropriate crystals they should work throughout Band I, but the MC1496 modulator chip is not really suited to Band III use.

Sources of Parts

When ordering crystals, specify 41·5MHz and 45MHz, third overtone, series resonant in HC18/U style. There are no tight tolerances involved. Quartslab Marketing Ltd. (PO Box 19, Erith, Kent DA8 1LH – 0322 330 830) can provide 45MHz crystals ex-stock at £2·50 inclusive; 41·5MHz crystals cost £5·25 with a delivery of two-three weeks. McKnight Crystals Ltd. (Hardley Industrial Estate, Hythe, Southampton SO4 6ZY – 0703 848 961) have a same-day service at £11·50 per crystal inclusive.

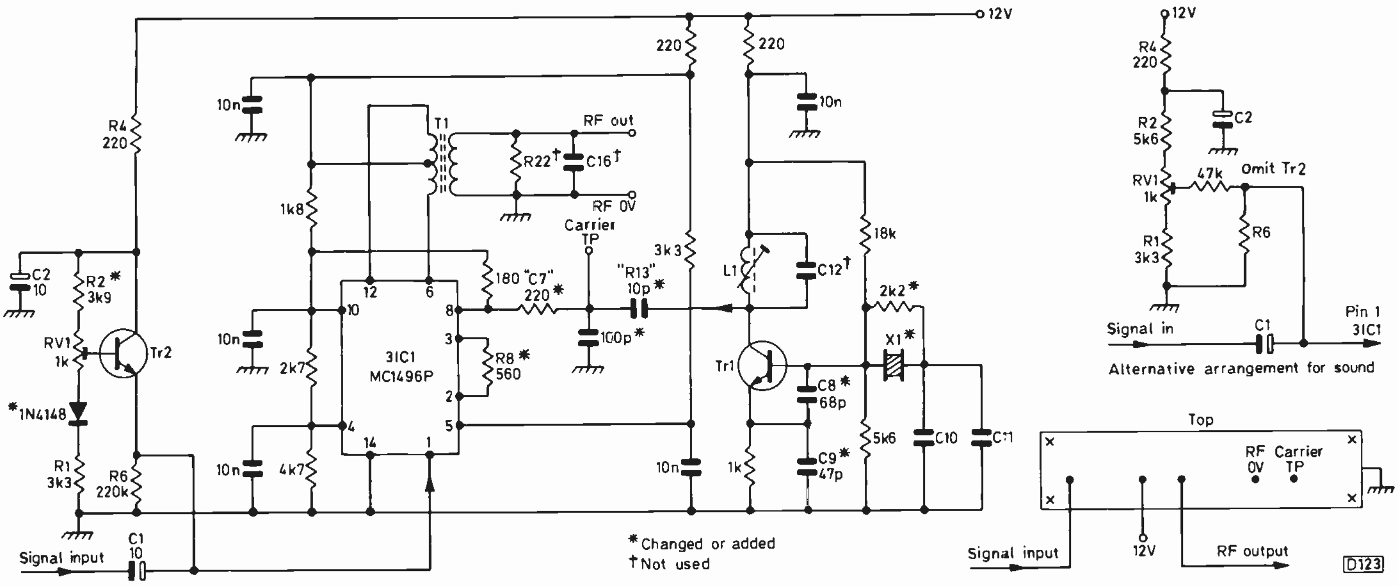


Fig. 1: Circuit diagram of the Rediffusion h.f. modulator, showing the modifications required.

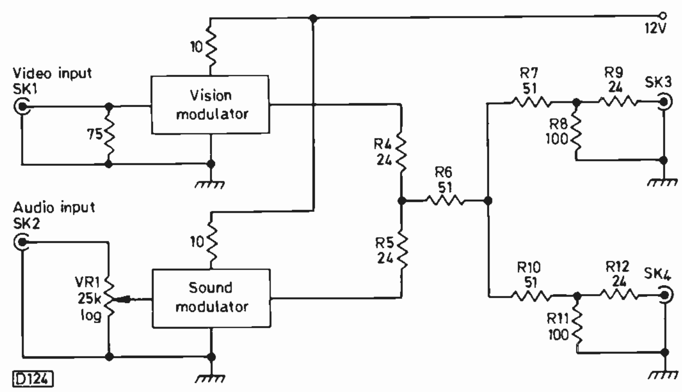


Fig. 2: Suggested input/output arrangements.

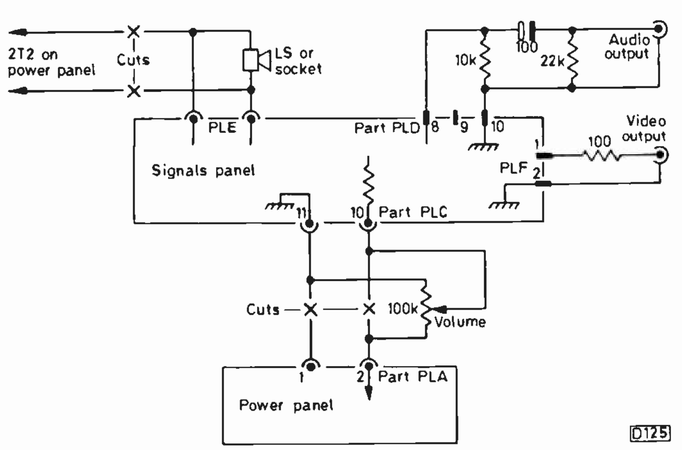


Fig. 3: Making use of the tuner section of the unit.

The translators are available from Stan Willetts, 37 High Street, West Bromwich, West Midlands B70 6PB – 021 553 0186.

Using the Tuner

You now have a working Channel 1 modulator. What about the tuners? Here's how to get the best from them. Fig. 3 illustrates most of the following points.

First ensure that only the mains input flex goes to one side of the mains switch. The other side of the mains switch should go to only the L and N tags on the power supply panel. Mains earth must be connected to the earth tag at the front right of the power supply panel.

Remove all wiring to the "octal" output plug and "octal" socket on flylead. Remove the lead to PLB on the power panel but retain for reuse. If the h.f. modulator is to be converted to a Band I modulator remove it from the power panel.

Install sockets on the back panel for video (suggest BNC), audio (suggest phono or XLR) and loudspeaker outputs. Alternatively a small speaker could be squeezed into the case. I've not tried this, but if you want a line level balanced output T2 on the power panel might be used to match the speaker level output. Volume would then have to be preset.

Clip the wires from SKE on the power panel. This pair originates at PLE on the signals panel. Connect the free end to the loudspeaker or socket.

Use the lead and connector removed from PLB to connect the video output from SKF (virtually at the front, under the tuning button assembly) to the video output socket. Include a 100Ω resistor in the inner to get the level about right. It would be possible to design a T-section network to give an accurate output match.

Take the audio output from PLD – refer to Fig. 3.

Fit a 100kΩ potentiometer on the front panel to act as the volume control. Connect to PLA and PLC as shown in Fig. 3. The preset control previously used as the volume control, on the power panel, can be used to set the maximum volume.

If all eight tuner buttons are stuck in they can be released by pushing the latch bar with a small screwdriver. This is not obviously visible. Looking at the back of the tuning assembly, reach into the left side beyond button seven. The latch bar is level with the buttons, virtually at the front of the assembly.

Under the mechanism, behind each tuning button, there's a fine leaf spring. This is actually the bandswitch used to select between u.h.f. and Rediffusion h.f. Buttons 1-7 are normally set to u.h.f. and button C to h.f. It's simple if rather fiddly to change the C switch to u.h.f. by setting the spring to the same position as on buttons 1-7.

If the door over the tuning presets is missing or the little orange trimming tool is absent, the a.f.c. will not work. A variety of possibilities can be adopted, from matchsticks and sticky tape to a separate proper a.f.c. switch.

TV Fault Finding

Reports from Eugene Trundle, Mick Dutton, Philip Blundell, Eng. Tech., Ian Bowden, Alan Shaw, Roger Burchett, John Coombes and Hugh MacMullen

Rank T24 Chassis/Toshiba C1695B1 etc

This fault fooled one of our engineers since it produced symptoms similar to those with a duff line output transformer – at switch-on the set gave one squawk then shut down in the standby mode. The effect was of heavy loading in the line output stage and was due to zener diode D472 in the overvoltage protection circuit being leaky. It's a 6·2V device, type BZX79B6V2. **E.T.**

Philips 2B Chassis

We have a large number of the version two of this chassis out and are beginning to get a steady stream of them back in the workshop with the BUT12 chopper transistor short-circuit. In all the cases I've seen there have been dry-joints on the chopper transformer. I haven't had a set fail after resoldering these joints. Philips recommend however that if you experience further BUT12 failures for no apparent reason the device should be replaced with a 2SC3973B and the value of R3671 should be changed to 22Ω, 5W.

When the BUT12 fails it sometimes goes short-circuit collector-to-base, which rather upsets the rest of the power supply. Usually it damages T7686, T7685, D6686, D6672, D6671, D6670, D6690, R3687, R3670 and C2690. **P.B.**

Grundig Cinema 9050

The problem with this projection set was intermittent no sound or vision. When the fault occurred the mains voltage didn't reach the TV power supply. Relay 601 wasn't pulling in because T6021 on the "omniplatte" wasn't being turned on.

At the top left-hand side of the set (viewed from the front) there's a microswitch that should operate when the screen is up. It was faulty. **P.B.**

Philips NC3 Chassis

This set came in with a shorted BUT11 chopper transistor. After a fruitless check on the components that could possibly have led to its demise we fitted a replacement which immediately failed. The cause of the trouble was that R418 was open-circuit. This resistor is connected between pin 9 of the chopper transformer and the junction of L403/R409, not in parallel with R425 as in all the circuit diagrams we've seen. **P.B.**

Sony KV2052

One of these sets came in recently with a blown up power supply. A major rebuild cured the problem for two days after which it again blew up. The cause of the trouble turned out to be a pinhole in the chopper transistor's mica insulating washer. **M.D.**

Grundig CUC41 Chassis

There was no output from the power supply, with a ticking noise coming from within the set. The +A rail was pulsing very slightly. H.T. was present at the collector of the chopper transistor and there were no shorts on the output lines. As we couldn't find any obvious fault we resorted to checking components individually. We eventually found that R651, which is in series with the set-H.T. control, had gone open-circuit. **M.D.**

NordMende FIV Chassis

This elderly 26in. colour receiver suffered from reduced height. We spent a considerable time checking around the field output stage only to find that when the field oscillator transistors were given a squirt of freezer the height returned to normal. As there was no tendency to field roll we had initially ruled out the oscillator stage. **M.D.**

Sharp C2092

The customer's complaint was that the picture would go off intermittently. On soak test we found that when the fault appeared the screen went blank white, with some deterioration of the sound. The cause of the problem turned out to be IC401 (IX0118CE) which contains a clamping circuit. **M.D.**

Salora J20 Series

The symptom was no line lock. A scope check at pin 11 of the TDA2594 sync/line oscillator chip ICB501 showed that a suitable video waveform was present – and also cleared the fault! The scope had been set to d.c. input: when switched to a.c. the fault was still present. A look at the circuit suggested that RB514 (2·7MΩ) could be responsible for the trouble and when checked it turned out to be open-circuit. **I.B.**

B and O 33XX Series with Text

There were three problems with this set. First when text was selected the required page number couldn't be obtained – you simply got 100. Secondly the on-screen channel number couldn't be brought up with the remote control unit's TV button. And finally when trying to select a channel above nine the on-screen display would just flash on then off instead of staying there for three seconds so that you can select the second digit of the channel number. All three problems were caused by a faulty 4015 shift register chip (8IC1) on the remote control decoder panel. **I.B.**

Salora 16J20

This set had an odd cyclic fault. Every ten-fifteen seconds the picture would gradually darken then, with a ping from the degaussing circuit, it would jump back to the correct contrast level, usually with a bad purity error. The noise and purity problems would go if the degaussing coils were disconnected, but the picture contrast would continue to vary as before. A check on the beam current limiter voltage (across CB503) showed that this dropped as the picture darkened. This is the opposite of how it should work, i.e. when the beam current rises (high contrast/brightness) the voltage should fall in order to limit the drive from the TDA3562A colour decoder chip, using transistor TB200 to hold down the d.c. brightness and contrast control inputs. The cause of the fault turned out to be a dry-joint on the upper connection of the screening "wall" between the colour decoder and the RGB output stages. This wall is used to link a chassis return from the c.r.t. base to the main panel. Loss of this connection meant that the grid supply potential divider had no link to chassis. **I.B.**

Philips K40 Chassis

We've had a couple of faults on these sets recently. The first one incorporated teletext. It had a dark picture and the contrast control was inoperative. Tr7116 (BC558B) on the teletext interface panel was short-circuit base-to-emitter.

Predominant blue with faint flyback lines visible was the fault on the second set. The blue output transistor's collector voltage was low at 100V instead of 160V because the h.f. compensation capacitor C2216 in its emitter circuit was leaky. **A.S.**

Quick Checks

Loewe MS56: For no sound and vision check whether the line driver transistor's supply resistor R534 (3·3Ω) is open-circuit. If the h.t. is high at around 230V (should be 142V) check C638 (1μF).
Toshiba 221E: For field foldover at the top of the screen check C313 for loss of capacitance.
Toshiba 2226: No line sync – check whether R402 (15kΩ) is open-circuit.
Philips CTX chassis: Tripping has been traced to the BYV95A 26V rectifier D6590 being short-circuit.
Sharp C1871: For intermittent partial field collapse check R525.
Ferguson TX90 chassis (20in. version): For lack of height check whether D106 is leaky.
Amstrad TVR2: This 14in. CTV plus VCR combination came in with the complaint that it was dead. There was a measurable short across the collector and emitter of the line output transistor. D1606, type FR304, was short-circuit.
Hinari VTV100: This combination 20in. CTV plus VCR came in with a high raster brightness fault. We found that the 2SA1015 luminance amplifier transistor Q301 was short-circuit emitter-to-collector. A BC307 proved to be a suitable replacement. **A.S.**

Rediffusion Mk 3 Chassis

For tuning drift don't strip the selector unit or suspect the tuner. Resolder pin 8 of socket 0PLA (at the top of the signals panel). This fault is becoming very common. It will save you time and trouble if you do this with every Mark 3 that comes into the workshop. **R.B.**

Rank T20 Chassis

Intermittent failure to start up from cold was the problem with this set. It would continue to work after bridging the start-up capacitor 4C19 (10μF). 4R16 (910Ω) and 4C19 were original components and were replaced. Numerous dry-joints were resoldered. But after leaving the set for half an hour it refused to start. I noticed a certain reluctance to start up even with the bridge in place. Turning the overvoltage trip control down improved the starting. I then tried to set the overvoltage trip but found this very difficult. It transpired that 5D5 (1N4148) on the trip subpanel was dead short. I've had this before, after a tripler failure, but the set then refused to start at all. Put it down to experience. At least this particular T20 has had all the stock faults attended to.

Similar symptoms to the above – intermittent failure to start, eventually leading to a "dead" set (h.t. present but no line timebase action) – usually means that the collector of the 12V regulator transistor 4VT7 (2N5296) is going open-circuit. **R.B.**

Decca 70 Series Chassis

Very intermittent failure to start, which could not be traced to a bad joint and did not appear to be affected by tapping or flexing the board, was eventually traced to R625 (180kΩ, 1W) in the start-up circuit. It had a crack almost completely around the body. **R.B.**

Sanyo CTP3105 (79P Series)

For no sync check first whether R403 (1kΩ) is open-circuit, then check the sync/line generator chip IC401 (LA1460) by replacement. **J.C.**

Hitachi CPT1444/CPT1446

If the screen flashes red, green or blue when the channel is changed replace IC501 (TDA3562A), reduce the value of R726 (680Ω) to 560Ω and change R610 from 12kΩ to 8·2kΩ.

If there's no sound and no raster and the mains fuse FS901 is open-circuit this item can be uprated from 1·25AT to 1·6AT. **J.C.**

Toshiba C1410

For no signals on all channels, first ensure that 15V is present at the emitter of the 2SC1166 series regulator transistor QE01 on the selector board. Next check the 33V line at the junction of RE06 and DE03 (ZTK33B). If this line is low or absent, replace DE03. Then if necessary check ICA01 (TA7177P) and/or ICA02 (TA7178P) by replacement. **J.C.**

Hitachi CPT2236/CPT2238

If the receiver is permanently in the standby mode check whether R1437 (820Ω, 0·25W) is open-circuit. If so fit a 1W replacement. **J.C.**

Rank Z718 Chassis

There was no line drive. After quite a bit of searching on the scan drive panel we found that the printed link from the anode of the 8·2V zener diode 4D12 to chassis had blown off. There was thus full h.t. on 4D11 and at pin 4 of the TBA950 sync/line generator chip 4SIC1. We made good the chassis connection and changed the chip only to find that in addition 4D12 was open-circuit. **H.MacM.**

Philips G8 Chassis

The h.t. was 250V and couldn't be adjusted. The set employed the very early power supply panel with the zener diode in the BC147 control transistor's base circuit. R1365 had increased in value from 47kΩ to 60kΩ. **H.MacM.**

Camcorder Servicing

Part 2

Steve Beeching, T. Eng.

There are two basic sections of the JVC Videomovie camcorder, the camera section and the VCR section. As the two are contained within the same housing some simplification is possible, with shared facilities. The result is a reduced component count and less power consumption compared with the use of separate pieces of equipment. The power supplies are shared, with use made of d.c.-d.c. converters to develop the various voltages and supply lines required. This makes for easy switching between the record and playback circuits. It also enables the camera section to be controlled via the microcomputer syscon (system control) circuitry associated with the main deck. Fig. 1 shows an overall block diagram of the camera and recorder sections.

Camcorder Block Diagram

For recording purposes the video signals are obtained from a half-inch, high-band Saticon pickup tube or a CCD (charge-coupled device) image sensor. The signals have to be decoded, then processed to be PAL compatible in a form suitable for recording. We will be describing the individual processes involved later. The luminance and chrominance components of the signal are fed to separate recording circuits and are then added for application to the heads via the switching system described last month.

The sync signal generator (SSG) produces all the timing signals. It provides outputs to drive the deflection circuits, which also produce the high voltages needed for correct Saticon tube operation. Sync, clamping and 4·43MHz carrier signals are supplied to the video processing circuitry by the SSG.

Before application to the frequency modulator the luminance signal is passed through a low-pass filter and then a dynamic aperture corrector (DAC). The chrominance signal is passed through a bandpass filter (BPF) not so much to provide filtering – the signal is already at 4·43MHz – but to provide correct timing. A small delay is required to match the timing of the luminance signal during record. Down-conversion and colour level control follow standard practice.

Part of the luminance and chrominance signal is tapped off prior to the recording circuits to provide a composite colour signal which is used for E-E monitoring. The electronic viewfinder is also linked to this line, via a low-pass filter to prevent colour dot patterning.

Playback follows standard VHS practice. The signals from the video heads are switched, as we saw last month. The luminance signal is limited and demodulated while the chroma signal is up-converted and phase corrected. The two signals are then added to provide a composite output signal.

Record only camcorders are somewhat different. The SSG provides timing signals to encode the R – Y and B – Y colour-difference signals at the down-converted frequency of 625kHz. There's no 4·43MHz colour signal available within these machines for setting up, so an up-converting jig is required to connect to the camera head to power it and provide a composite, baseband output.

Audio recording and playback are fairly standard. Recording is possible only via the inbuilt microphone and can be monitored from the main output socket or via earphones. Naturally there are variations on this arrangement. Some machines allow an external microphone to be used and in rare cases there's provision for external AV inputs.

The Saticon Tube

This instalment will deal mainly with the Saticon tube used in models that employ a thermionic pickup device.

Fig. 2 shows the basic items associated with the tube. The incoming light passes through the camera's zoom lens, a colour-temperature filter, iris, master lens and crystal filter, being focused on to the tube's faceplate and photosensitive target area. Within the tube an electron beam scans the opposite side of the target area. It's deflected electromagnetically, conforming with a standard scanning system, i.e. in Europe 625 lines, 50Hz – the principle is the same as with TV tube scanning. As the electron beam scans the target, variations in the light intensity at various points of the target cause variations in the beam current. Some beam current flows even without any light. This is very small, in the range of picoamperes, and is called the dark current. Signal current from the tube is taken from the target. It's a very small current from a high-impedance source and is highly susceptible to external interference. For this reason the preamplifier is mounted on the tube, within a screened container that includes the very short target connection.The target itself

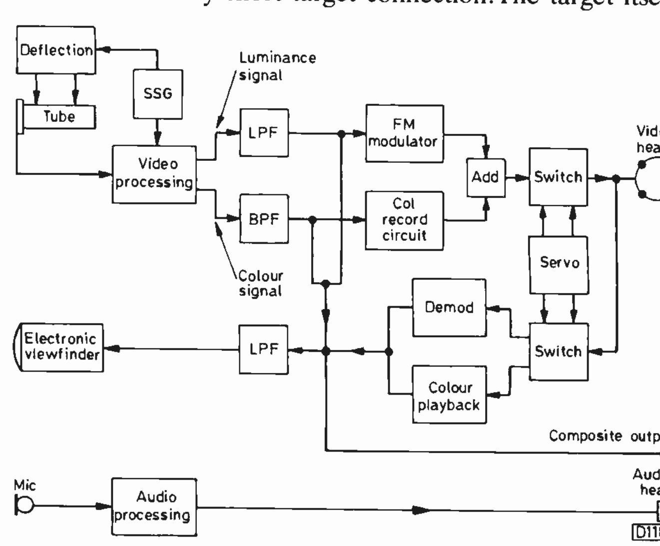


Fig. 1: Overall block diagram of a camcorder using a pickup tube.

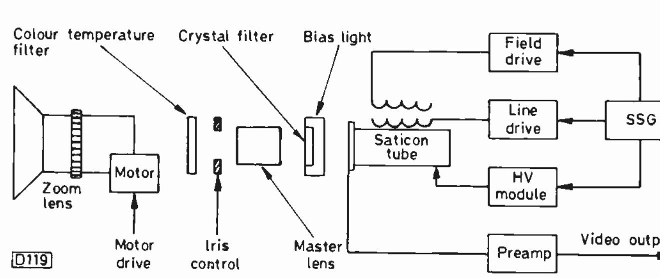


Fig. 2: Basic items associated with the tube.

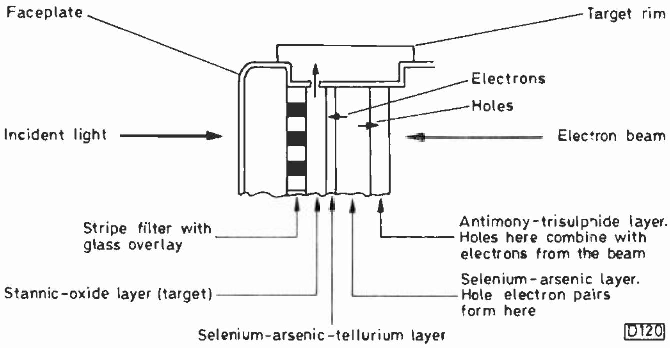


Fig. 3: The target part of a Saticon tube.

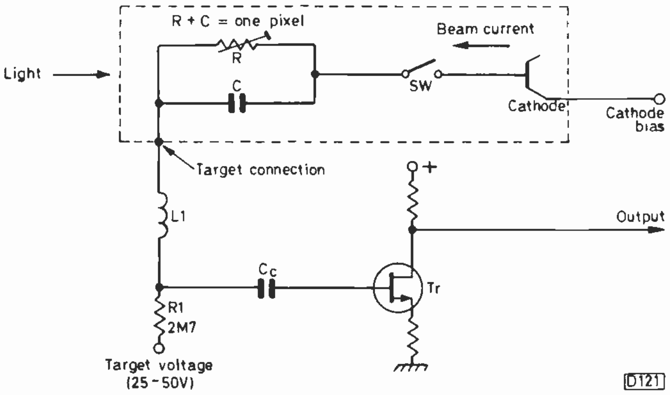


Fig. 4: Operation of the target.

consists of a complex sandwich layer of selenium-arsenic-tellurium (hence SATicon) film bonded to other semiconductor layers – see Fig. 3.

The first item after the glass faceplate is a stripe filter. This consists of diagonal cyan and yellow stripes which are deposited on the inside of the faceplate and overlayed with glass – we'll have more to say about the action of this filter later on. Next comes a transparent layer of stannic oxide which is the target output electrode. This forms a hetero-junction (cross-coupled) with the selenium-arsenic-tellurium layer and the chalcognide glass material. Between the selenium-arsenic-tellurium layer and a layer of antimony trisulphide on the beam side there's a thick layer of a selenium-arsenic mixture.

Light passes through the faceplate, the stannic-oxide and SAT layers to the selenium-arsenic layer where holes and free electrons are produced. The electrons flow back towards the faceplate, into the stannic-oxide layer via the SAT layer. Holes cannot penetrate the stannic-oxide layer due to the selenium film deposited on it by the SAT layer. The holes can travel in the opposite direction however. In doing so they combine with the scanning electron beam via the antimony-trisulphide layer. The electrons in the scanning beam cannot pass through the antimony-trisulphide layer due to a film of selenium on the opposite side. Beam current is thus dependent on the number of holes created by the light and available for combining. In effect the holes form a capacitive "charge" representing pixel elements. For each hole that combines with a beam electron an electron is released via the stannic oxide layer and the target output connection.

To recap briefly, light produces equal numbers of holes and free electrons in the selenium-arsenic layer. For each hole that combines with an electron from the scanning beam an equivalent electron is released via the target connection. Hence the current output from the target depends on both the amount of incident light and the beam current.

So much for the theory. Fig. 4 provides an equivalent circuit that illustrates in a more practical manner what goes on. It represents a single pixel element of the photosensitive target layer. The Saticon's target layer in effect forms a parallel RC circuit. The value of R varies with the intensity of the light falling on it. With no light, R has a finite value which is designed to be as high as possible to minimise the standing dark current. As the target is scanned by the electron beam, each pixel is linked to the beam once per frame. Contact between the beam and a pixel is represented by switch SW. When the electron beam arrives at the pixel the switch is in effect closed. The capacitive element is then charged via the target and the tube's cathode – the beam effectively connects one side of C to the cathode. When the beam has passed, C begins to discharge via R whose value, as we've seen, is light-dependent. With no light R has a high resistance and C can discharge only a little. If the light level is high the value of R is small and C's discharge can be high. The next time the electron beam passes the pixel, the amount of beam current that flows through the target load resistor Rl is the current required to recharge C. Thus with a high light level the current flowing via Rl is high and the signal voltage developed across Rl is relatively high.

The target output signal is therefore dependent on the recharging current at each pixel capacitor and the light-dependent value of the associated resistance. As the Saticon's electron beam scans a TV line, many hundreds of small capacitive elements charge. The varying charge current that flows via the load resistor develops a signal voltage which is connected to the camera's preamplifier transistor Tr via the coupling capacitor Cc.

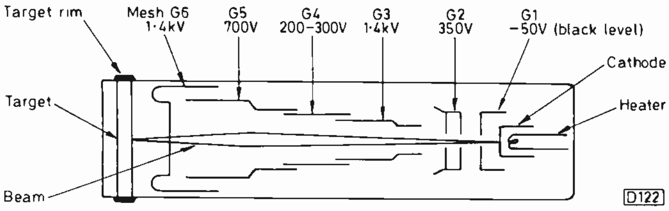


Fig. 5: The Saticon tube's gun structure, showing the electrode operating conditions. The target is connected to the front rim and the mesh (G6) is internally connected to G3. Blanking is carried out at the cathode. A scope connected to G1 will show the blanking pulses at about −70V.

While the signal voltage developed across Rl is very small, it has a very good signal-to-noise ratio, i.e. an extremely low noise content. To maintain this low-noise condition, the first stage of the preamplifier uses a low-noise junction field-effect transistor selected for its low-noise characteristic. Ll is called a Percival coil. It resonates with the target's capacitive output, lifting the output at the higher frequencies. With a colour camera the resonant frequency is 4·3MHz, which is the R/B colour carrier frequency obtained from the tube (more on this next month).

Saticon Operation

The internal arrangement of the Saticon tube is shown in Fig. 5. At the faceplate end there's an external target connection, the target flange or rim. A small leaf spring contacts the rim and is soldered to the Percival coil at the other end.

One danger when servicing cameras fitted with a Saticon tube is the presence of high voltages on the innocent looking PCBs. While a shock is not lethal, it can result in demise of the camera if the camera is dropped as a result of receiving a shock. This is especially the case when there's a capacitor that doesn't discharge at switch-off connected to grid G6.

The highest voltage is the mesh voltage. This is usually in the range 1·4-1·6kV and is internally connected to grid G3. Grid G5 is a collimator lens to narrow the beam as it approaches the target, and is at 700V. It operates in conjunction with the voltage, which is variable between 200-300V to provide electrostatic focusing, at grid G4. If the beam is not focused the tube's resolution drops and the R/B colour carrier falls to zero, leaving a green picture. Adjusting the focus control will rotate or twist the picture about the centre. It can be used in conjunction with external beam shift magnets to centralise the beam landing. A spot in the centre of the picture must stay put when the focus is adjusted and not shift off the centre axis. This sort of adjustment will however create purity and shading problems that will take hours to sort out!

Grid G2 is the first high-voltage electrode, its purpose being to accelerate the electrons that leave the cathode. G1 is a reverse biased grid: the bias voltage is variable to set the beam current to a value which is sufficient to charge the target capacitance at full white, without being excessive so that the target is saturated. The visual effect of reducing the beam current below the nominal value is to clip the peak whites. The correct setting is for just above maximum peak white voltage at the signal output. Too much beam current will adversely affect the focusing and twist the picture.

The cathode sits at about 6V above chassis potential. Field and line blanking are carried out at the cathode – the blanking pulses have an amplitude of about 64V peak-to-peak. If the cathode blanking drive chip fails it will shut off the tube.

An oscilloscope connected to the beam current grid G1 will display negative-going blanking pulses down to about −70V, with a black level of about −50V upon which the video signal can be seen. This check will indicate whether the tube is operational even when there's no output due say to failure of the preamplifier.

Beam Deflection

While the focusing is electrostatic the deflection is electromagnetic, achieved by means of a deflection yoke around the tube. Shorted turns in the yoke can stop deflection, resulting in no output from the target and no signal at G1. Loss of field drive will produce the same effects. Line deflection is linked to the high-voltage circuits, as with a TV set, and failure of the line scan usually results in no high voltages.

No Camera Picture

What do you do if there's no picture from the camera? First check that the high voltages are about right, next check that the scan outputs to the deflection yoke are present, then check that the cathode drive pulses are present and correct. If these things are all right, turn attention to the tube's preamplifier. This can be checked only by access to the target connection, involving partial removal of the tube. If the preamplifier is o.k. there will be massive amounts of noise when you go near it, due to the very high impedance and sensitivity.

Bias Light

The bias light – see Fig. 2 – is present to reduce lag or after-image effects as a result of the dark current being too small. It illuminates the target. The theory here is as follows. When there's a rapid change from bright light to dark, it's possible for the target's capacitive elements to be left with residual charges that cannot be discharged via the associated resistance between beam scans because the resistance value is too high. These charges show up as an after image. The effect can be reduced by using a small light to bias the target, thus maintaining a lower resistance level and hence increased discharge of the capacitive elements. The bias lights can be LEDs, mounted around either the tube face or the tube base to backlight the target.

Crystal Filter

The crystal filter is used to reduce cross-colour effects or moiré patterning in scenes that incorporate small chequered patterns or fine stripes. If fine patterns at around 4·43MHz in the luminance channel of a TV set are allowed into the colour circuits random blue/purple moiré herringbone patterns will be seen. Similar problems arise with a camera. Scenes that create luminance signal components at around the R/B carrier frequency of 4·3MHz will produce similar effects. The crystal filter is included to prevent this. It consists of an optical spatial filter with gratings effective at 4·3MHz, thus effectively blocking fine patterns before they reach the target.

Next month we will take a look at colour signal processing.

The Pros and Cons of LocoScript 2

Vivian Capel

When the Amstrad PCW8256 was launched it was hailed as the poor man's word processor. And so it was, for at £399 plus VAT few who regularly used words and put them down on paper couldn't afford one. This was particularly the case since most word processors were priced in thousands rather than hundreds of pounds. Understandably those who had laid out thousands went loco over it, and so did the competition. The program, LocoScript 1, was described by some as non-professional and amateur, and its limitations were fully aired. It did have limitations, but it also had many features not found with the more expensive outfits – the critics had little to say about these. In an article in the December 1986 issue of *Television* I endeavoured to give a balanced view, mentioning its pros and cons as well as those of word processing in general.

Since then Amstrad has brought out other models. There was first the upgraded PCW8512 with its second disc drive and double RAM M-drive capacity, increased from 256K to 512K (incidentally these numbers explain the model numbers adopted, the 8 referring to the Z80 8-bit microprocessor which is the heart of these machines). The 8512 was also supplied with LocoScript word processing. Subsequently Amstrad turned to IBM compatible arrangements. Being thus succeeded the PCW8256 came on offer at prices down to £299, representing an excellent opportunity for anyone wanting to start with word processing.

Development of LocoScript

Unlike many firms that lose interest in their older models, Amstrad continued to refine the LocoScript program. LocoScript 1 was taken through several suffix numbers, then in July 1987 the completely revamped LocoScript 2 was released. Some of the initial reviews in the computer magazines were clearly done in a hurry and inevitably some of the trivial points were emphasised while important ones were missed. In view of LocoScript 2's complexity and the large number of facilities available, it seemed prudent to get well acquainted with it before doing a follow-up to my original article.

My copy of LocoScript 2 has been in daily use now for a good few months – often for up to ten hours a day. The following comments are primarily intended for LocoScript 1 users who may be wondering whether or not to make the change to LocoScript 2. They should also be helpful to anyone contemplating a first plunge into word processing. One can start word processing with LocoScript 2 at a very elementary level – you don't have to learn a host of commands as you do with some other word processing systems. As you become familiar with the operation of LocoScript 2 you can start to use and master other features.

The Manual

The instruction manual was a problem with LocoScript 1. It was difficult for the beginner to follow. As a result many books and courses came on offer to help those who were as baffled by it as I was. Strangely the manual now doesn't seem so bad and I can follow most of it – but then I'm no longer a newcomer.

The LocoScript 2 manual is a big improvement. After the preliminary setting up and connection instructions it outlines the main differences between LocoScript 1 and 2, referring to the appropriate sections of the manual to consult for detailed information on the changes. Thus it first gives LocoScript 1 users an overall picture of the differences, after which they can go into the detail.

The main part of the manual is a step-by-step tutorial for newcomers. It strikes about the right tone, being neither patronising nor too formal. Anyone starting from scratch should have few problems.

There's a postscript with tips on using LocoScript 2 for particular applications – business letters, memoranda, magazine articles, technical reports, invoices, circulars, newsletters and so on. Appendices include a glossary of all the technical and operating terms used, a list of all the characters available and how to obtain them, a quick-reference guide with basic instructions for each function, and a trouble-shooting section. All in all it's a comprehensive, well thought out and easily understood manual.

Disappointments

One disappointment for me with LocoScript 2 is the lack of a word count, something that's very useful for authors, journalists, reporters, etc. I find this surprising as a number of features of limited use are included – the complete Russian alphabet, playing card symbols, male/female symbols and even black and white smiling faces! A word count is included with the spelling-checker dictionary LocoSpell however. This is available as a separate program that works within the LocoScript format with direct access when working on a document, unlike other spelling checkers that have to be loaded separately after the document is complete. It's twice the price of some others however, and the main dictionary takes up so much space that it cannot be loaded into the 256K memory of the PCW8256 – it requires either an upgraded 8256 or an 8512. Otherwise the smaller dictionary included on the disc is loaded and used. This combination of a word count and spelling checker is not such a good idea – professional users who would get most benefit from a word count are least likely to require a spelling checker.

Another disappointment is the fact that you can't change existing text from lower case to capitals and vice versa. You can do this with some word processors and I'd hoped the facility would be included with LocoScript 2. It's easy when typing adjacent letters to touch the shift lock accidentally and thus type a line or so of capitals before you notice them. Instead of being able to change them you have to erase and retype the lot.

Menus

There are three ways in which you can operate and choose the various LocoScript facilities: by menus, by keystrokes, and by using an intermediate method which we'll ignore here. The menus consist of a group of related options that appear on the screen when the appropriate f key is pressed. There are four such keys which with the shift key give numbers f1-8. Having called up the right menu you move the cursor down it, with the cursor moving key, to the option required. You then press the plus and the enter keys. To cancel the option you do the same again, this time pressing the minus key. With the alternative keystroke method you simply press the plus key followed by a one- or two-letter code: to cancel you press minus followed by the same code. One wonders why the longer and more laborious menu method was the one taught throughout the whole LocoScript 1 manual, the simpler keystroke method being mentioned almost as an afterthought in half a page towards the end. With the LocoScript 2 manual keystroking appears throughout, but is still presented as an alternative to using menus.

The reason given for this is that the beginner uses the menus until he can learn the codes for keystroking. Nearly all the codes however are the initial letters of the options required – I for italic, B for bold, CE for centring, RA for right align, LS for line space, U for underline, etc. One hardly needs a photographic memory for these! This is unlike some word-processing systems with which the letter codes bear little resemblance to the functions.

My grumble about all this is that there are actually more menus with LocoScript 2 than with LocoScript 1. You can avoid many of them by keystroking of course, but many of them pop up without being asked. For example to print a document you first press the letter P. Then a menu asks whether you want high quality or draft, more than one copy and whether all or part of the document is to be printed. These are all useful options, especially the last one which was not available with early versions of LocoScript 1. Having chosen from these another menu appears to ask whether you want to use the current paper (the one to which the printer is set) or the one for which the document was set up. As the current paper option heads the menu you have to move the cursor and enter that option if you want to use the document designed paper, as in most cases you would. The menu thus seems to be superfluous, but should at any rate have had the designed paper at the menu head. After this yet another menu appears asking if you want to proceed with the printing (as if you didn't) and you have to affirm.

Other functions which now have to be done via a menu are copying, moving and erasing a file. With LocoScript 1 these were done by a single keystroke. When setting up the document the different tabs could be set by individual keystrokes with LocoScript 1. This too now has to be done via a menu, and the menu comes right over the top ruler, obscuring the tab position. The cursor must therefore be set to the required position before calling up the menu. This also applies to setting the left-hand margin, which is similarly obscured.

Another extra menu that requires an acknowledgement and can thus be irritating to the careful user, though no doubt a life saver for others, is the one which warns that a finished document on the M drive will be lost if you switch off without copying it on to a disc. In view of what is at stake however this is perhaps justified.

More irritating are the messages that appear in windows when certain functions are selected. For example, when inserting text from another source the message "insert document: select document using cursor keys then press enter or cancel to abandon" is displayed. As precisely the same wording appears at the same time in the header at the top of the page this message is superfluous. The annoying bit is that, as with some of the menus, the window obscures the very part of the screen you want to use. The message clears after a while, but introduces an unnecessary delay. The same thing happens when copying or moving a document – it didn't with LocoScript 1.

Too Amateurish?

The overall impression given by these extra menus and messages is that LocoScript 2 is less professional than LocoScript 1, which is rather a pity since in many other respects it improves on LocoScript 1's amateur image and includes facilities that rival and excel most professional word processing programs. The makers clearly felt it important to appeal to the beginner and the experienced user, but in so doing have tended to fall between two stools. One solution would be to issue the disc with the full existing program on one side and a streamlined version on the other. There would be room for this along with the tutorial examples that occupy part of this side.

Function Keys

The function keys and their options have been changed. This has been done mainly because of a rationalisation in the way in which the functions are classified, but one or two seem to have been altered for no apparent reason. Disc change for example is now f7 instead of f1. Tables 1 and 2 show the differences. The keystroke codes have changed little except for a few additional letters.

Setting up Documents

Setting up document templates and establishing the layouts is quite different with LocoScript 2. One effect is that the layouts become part of the text rather than being stored in the document header. So when the text is transferred or copied on to another document, or a different position in the same document, the layout goes with it. Layouts can also be given names as well as numbers. The advantages of the new system seem to be minimal, and to make it easier for users I think this should have been left as it was.

Improvements

My comments so far seem to have been mainly criticisms. I wanted to get these out of the way before mentioning the numerous improvements that more than balance them out.

Pagination

I always felt that too much attention was paid to pagination – the messages you might want to put at the top and bottom of each page – in LocoScript 1. Apart from page numbers this is not an oft-used facility. Yet when setting up every document or template you had to go through a pagination routine whether you wanted it or not. With LocoScript 2 the facility is there but can be side-stepped apart from a display of the pagination boundary lines.

With LocoScript 1 the header and footer zones included the top and bottom gaps, the top inch and bottom half inch on which you cannot print. These had to be allowed for when calculating the space to be allocated to headers, footers and main text. They are now treated separately, so that the usable zones can be assigned as required without

Table 1: Comparison of f-key functions when disc manager is displayed

Key	*LocoScript 1*	*LocoScript 2*
f1	Disc change	Actions – make ASCII file; show/load/save phrases; show blocks.
f2	Inspect	Disc – copy; verify; format; rename.
f3	Copy	File – move; erase; rename; recover from limbo.
f4	Move	Group – rename.
f5	Rename – document; group; disc; recover from limbo.	Document – inspect; set first pages; set total pages.
f6	Erase	Settings – paper type; character styles.
f7	Modes – edit; print; create; direct; ASCII file.	Disc change
f8	Options – show limbo; show hidden files.	Options – show limbo; show hidden files.

Table 2: Comparison of f-key functions during edit

Key	*LocoScript 1*	*LocoScript 2*
f1	Show – codes; rulers; blanks; spaces; effectors.	Actions – document set-up; edit identity text; insert text; disc manager; show phrases; show blocks.
f2	Layout – new layout; layout no.; base layout; edit current/layout no.	Layout – centre; right align; justification; new layout; change layout; layout exchange; layout replacement.
f3	Emphasis – underline; bold; double; reverse video.	Style – underline; word underline; bold; double; italic; superscript; subscript; reverse video.
f4	Style – half height; italic; character pitch; normal/double width.	Size – character pitch; normal/double width; line space; CR extra spacing; line pitch.
f5	Lines – centre; right justify; soft/hard space; soft/hard hyphen; line spacing; line pitch.	Page – find; end; last line; current line with no. of lines above/below.
f6	Pages – last line; end page; lines together; page no.	
f7	Modes – edit header; identity text; insert text; disc manager.	Spell (for use with LocoSpell program).
f8	Blocks – blocks; save block no.; phrase; save phrases.	Options – show codes/rulers/blanks/spaces/symbols.

These comparative tables illustrate the major differences in operations between LocoScript 1 and 2. Many options call up submenus which are also different. There are other modes of operation such as printing and document set-up which have their own different key functions. While the functions are displayed across the top of the page for reference with both LocoScript 1 and 2, a LocoScript 1 user will take a while to get used to the changes.

the need for mental arithmetic. As with LocoScript 1 the screen indicates the number of lines available for the main text after the headers and footers have been determined.

Printers

While LocoScript 1 can be used with only the dot-matrix printer supplied, LocoScript 2 can be used with a wide variety of printers, of the matrix or daisy-wheel type. In fact you can connect a matrix and daisy-wheel printer at the same time and select from the keyboard which is to be used for a particular print-out. The supplied matrix printer gives perfectly satisfactory results however – in the high-quality mode the results are not far short of those obtained with a daisy wheel. The big advantage with the matrix printer is that an enormous range of characters and signs, letter styles and sizes is available. With the exception of one or two letters the styling of LocoScript 1 was good. The styling of all letters has been revised with LocoScript 2, the visual effect being even better than before.

With LocoScript 1 the printer had to be set for the type of paper to be used, so this had to be done when creating and when printing a document. LocoScript 2 has a built-in memory of various named paper sizes which can be inspected, altered or added to. When a document is to be printed the printer recognises its paper size from the memory. If it has just been printing another size a menu tells you that it's not set to the document paper. A single keystroke plus enter sets the printer to the required size. If the document is created for a paper not present in the memory the printer will find the nearest listed size and offer it on the menu.

As A4 is the most commonly used size this is the one to which the printer is set at switch on. If you more frequently use another size you can change the memory to select this instead. This gives you automatic selection of the preferred size without a succession of printing menus – after three quick taps on the enter key the printer will start without further ado.

Page Numbering

When the page number code is inserted in the document set up, page numbering is carried out automatically as before. Now though with a long document such as a book, in which the chapters are more conveniently prepared as separate files, the page numbering can be made consecutive instead of each file starting at page 1.

Phrases and Blocks

As with LocoScript 1, blocks of text or individual phrases can be copied out, given code numbers and inserted elsewhere as many times as required by typing the code. Previously phrases could be inserted into other documents but blocks couldn't be unless they were specially saved. Now blocks are automatically saved and can be used in different documents. If required in the future they must still be saved on disc – the internal memory is lost when the PCW is switched off.

When it was asked to show what phrases and blocks were stored LocoScript 1 listed just the code numbers or letters. The first few words now appear along with the letters. This is very useful as unwanted or obsolete items can be identified and removed to make room for new ones.

Find and Exchange

A snag with the find and exchange feature with LocoScript 1 was that the word typed in had to match the one sought exactly. Thus if it sometimes appeared in the text with a capital initial but you typed it into find in lower case it would be ignored. If the word also occurred as part of a longer word the cursor would stop at all these too. With LocoScript 2 the find facility has been made more flexible. If told to do so it will find words irrespective of case. It will also find only complete words if so set. This makes the feature much more useful.

Cursor Movement

One of the criticisms of LocoScript has been the rather limited scope for moving the cursor around the screen. It can be moved to the next character, word, line, paragraph, unit, page or to the end of the document. These movements can also be reversed to go back through the document. This may seem to be a comprehensive list but two very useful moves are omitted, from one phrase to another (stopping at commas or semicolons) and from one sentence to another (stopping at full stops). When corrections are made the portions to be erased are usually phrases or sentences, so such moves would be very helpful. It's possible to use the find facility to locate the next and subsequent full stops or commas, but if you change from one to the other you have to reinstruct find accordingly.

Speeding things up

Other word processors permit erasure of a line to the right of the cursor, to the left of the cursor, or the whole line under the cursor. With LocoScript you have to define the portion to be erased by placing the cursor first at the start and then at the end of the section, operating the cut key in each position. This is not too onerous if the line and end-of-line keys are operated to produce quick cursor movement. Some users may get confused about these keys and not use them to the full. The line key takes the cursor to the end of the line while the end-of-line key (line plus shift) takes it to the start of the next line. If pressed with the alt key the cursor moves to the start of the same line. It's a pity that these keys were not given less confusing designations.

Another tip worth remembering is that a single dab on either of the horizontal cursor movement keys with the shift key will move the cursor by forty characters, i.e. about half a line to left or right. The vertical keys with shift give movement of forty lines up or down for a single press. This is the case with both LocoScript 1 and 2. If you practice these manoeuvres a few times you soon get the hang of it, greatly speeding your movement around the text. This makes LocoScript as fast as any other word-processing system.

An aid to speedy movement with LocoScript 2 is the facility enabling you to select a required page from the start of a file. The chosen page appears on the screen in just under half the time it takes to scroll through to the page with the cursor movement key.

Characters

With LocoScript 2 there are special registers known as super-shifts to make a greatly enlarged range of characters available. These are entered by pressing the alt key with one of the f numbers 1, 3, 5 or 7. Amongst the characters obtainable in this way are the complete Greek alphabet in lower and upper case, which is very useful for technical writers – LocoScript 1 had just a few. There is also the complete Cyrillic (Russian) alphabet in both cases with several Ukrainian alternative characters: other special language characters available include examples from Turkey and Greenland. A wide range of accent marks can be amalgamated with any letter simply by typing one after the other.

A considerable number of textual symbols, including special continental ones, and the symbols for the world's leading currencies are included. Over seventy mathematical symbols can be obtained, including the one that was conspicuously missing from LocoScript 1 – the radical or square root sign. There are even sixteen varieties of arrows and, yes, those card symbols and smiling faces!

With such a vast array of characters provided it seems ungrateful to grumble, but it's now harder to get eighth fractions. Thirds fractions are now included however.

Discs

A much vaunted facility with LocoScript 2 is the ability to format or copy discs with the LocoScript system, though I feel that it's a marginal advantage. It's performed by key f2 which produces a menu of options – copy disc, verify disc, format disc and rename disc. The verify option is the only omission as far as I can see from the otherwise excellent manual. There's no information as to what it does – it seems to check whether a disc is properly formatted.

Editing

What I consider to be a major improvement seems to have gone largely unheralded. When an existing file is edited you need at least the same amount of space to be available as that taken up by the file. This is because the edited version is recorded on a disc before the old one is scrapped. Thus for a few seconds both versions are present. If the file is a long one you need plenty of spare room. It's all too easy to overlook this and with LocoScript 1 the first intimation you have of insufficient space is when you try to exit and store the result whereupon the "disc full" notice appears. There's no information or advice in the old manual about what to do next. After two experiences of losing a morning's work I discovered how to suspend recording while moving or erasing files from the disc to make room.

When you start an edit with LocoScript 2 the disc is scanned to see if there's enough space. If there isn't, the notice "warning, document may not fit" appears and the options to cancel or continue are given. This is one menu I heartily welcome! In this situation the easiest course is to copy the document to drive M, work on it there, then move it back to drive A while erasing the original.

Another very useful new feature relates to the use of the same file name. You cannot have two files with the same name in the same group as the addressing and indexing facilities would be unable to distinguish between them. With LocoScript 1 if you want to replace an obsolete file with an updated one having the same name you have to give it a temporary, different name, move it into the required group, erase the old file then change the name of the new one to that of the old one. Now when a new file is moved into the same group as an old one with the same name a menu appears pointing out that the name is already in use and offering the options of replacement with the new file, choosing another name or cancelling the operation. Choosing to replace erases the original file and instals the new one at the same time. This facility can be used when moving an edited document in drive M back to replace the original version in drive A. I've found it to be a very convenient feature and a considerable time saver.

Documents made in LocoScript 1 cannot be printed or edited with LocoScript 2. If an edit is attempted, the file will be converted automatically to LocoScript 2. Only the paper size may need to be reset. Conversion is necessary only the first time, after which the file becomes a permanent LocoScript 2 document. This means that it cannot afterwards be worked on in LocoScript 1. If you want to preserve that option it's best to copy the document, then convert the copy to LocoScript 2, retaining the original LocoScript 1. All templates should be converted otherwise every document made from them will be in LocoScript 1 format and will need converting. Not all the details come out right however: I've found it better to remake all templates in LocoScript 2.

Conclusion

So much then for the main differences between LocoScript 1 and 2. I feel less than enthusiastic about some of the changes and am disappointed over the omissions, but the fact remains that it's an excellent word-processing system. The many advantages over LocoScript 1 clearly outweight the drawbacks.

Compact Disc System Developments

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

Some interesting technical details of the Philips CD-Video system were presented at a recent talk at the Institution of Electrical Engineers. The lecturer was Simon Turner, head of the Home Interactive System Division of the Philips Research Laboratory, Redhill. His talk, entitled "Voice, Data and the Compact Disc", started with a general view of the evolution of CD technology from its beginnings at Eindhoven in 1969. Since the launch of CD digital audio in 1982 thirty million players and 450 million discs have been sold worldwide (eight per cent of UK households own a player). CD audio has been called the fastest-growing consumer electronics product: its success has been helped by the common standard, which ensures that all discs can be played on all players.

CD-Video

CD-Video is now in the shops. It combines digital audio with analogue video on the same disc. The standard 5in. CD-Video disc (gold coloured to differentiate it from its audio counterpart) contains five minutes of video with digital sound on the outside of the disc and twenty minutes of digital audio on the inside. A single laser head reads the sound and vision signals simultaneously. The video signal is handled in the same way as with LaserVision: the PAL signal is modulated on to a 7MHz carrier with the baseband digital audio underneath — it takes up about 2MHz. The digital audio portion of the 5in. disc can be played on an ordinary CD player.

CD-Video players can take any size of disc up to 12in. (a 3in. disc is planned). LaserVision discs are compatible — most players can handle an analogue sound track. Setting up of the required tracks is done on the TV screen with the remote control unit.

CD-Interactive

There's no transatlantic compatibility with the analogue video signal, which is a drawback. It will limit the choice of CD-Video discs, or software as we have to call them. This however is not the case with Philips' next development, CD-Interactive. CD-I is being planned with the domestic market firmly in mind. Audio, graphics, data and video are stored on the same disc, with the difference that this time the video is digital. This makes for true compatibility between TV standards. The pixel standards are 384 × 280 for normal pictures, 768 × 280 for double size and 768 × 568 for "extended" studio-quality pictures. For most applications the video consists of stills, but moving effects such as a talking head within a stationary frame can be generated. The recording techniques are very much related to computer images rather than TV. However the picture display will always be via a TV set rather than a computer monitor as CD-I is seen as a primarily domestic product.

The first CD-I players are now being demonstrated. At present they consist of two boxes, the CD player and the MMC (Multi-Media Control) module. The latter links the player to the TV set and hi-fi system and is operated by remote control. The remote control unit incorporates a pointer control for on-screen selection. The hardware is based on a 68000 microprocessor which runs the OS-9 operating system. A dedicated piece of hardware is used for file handling, though the data transfer rate is fairly slow at about 150kbytes/second. It shouldn't be too long before the two boxes become one!

The CD-I players will not sell unless there's good software for them, i.e. plenty of discs to go with them. To this end Philips has set up a company called AIM (American Interactive Media) which is linked with Polygram. Two other similar companies are being set up in Europe and Japan. The main applications envisaged are interactive talking books, educational aids and superior adventure games. Replication cost is small, but the data gathering and setting up is an expensive and time-consuming business. No doubt Philips will be supplying development tools to make it as easy as possible to exploit this interesting new technology.

VCR Clinic

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

Philips VR6462

This machine had two faults as follows: first at power up with no cassette the tray moved in and out more times than usually, secondly the machine remained in the rewind mode and refused to do anything else. The cause of the first fault was that the threading motor counter signal was missing due to a faulty Hall-effect sensor on board P671. The second symptom was present because the head drum didn't rotate – IC7001 (L272) was open-circuit. **P.B.**

Grundig VS440

The problem with one of these machines was intermittent no erase or sound bias. It would clear if the PCB on the back of the audio/control/erase head was pressed. When the PCB was removed we found that there was a solder bridge from one of the pins to the screening can. **P.B.**

Sanyo VHR1100

If you encounter one of these machines that won't lace up and/or produces a nasty smell or puff of smoke when asked to record or play, check R3110 which is associated with IC3005 on the SY-1 board. If it's overheating, the loading motor is drawing excessive current. Depending on how many goes the user has attempted, the motor drive chip IC3005 (BA6238A) may or may not have survived. **E.T.**

Panasonic NV-M1

We've encountered the following situation on more than one occasion: the capstan motor starts running at switch on then after a few seconds the syscon switches the camcorder off again. The cause is that the 9V supply to the main PCB is missing — check at TP1002. You'll find that the circuit protector fuse PR1002 is open-circuit. This seems to happen for its own internal reasons, since we've never found that excessive current has been flowing and have never had a replacement fuse fail. **E.T.**

Sony CCD-V100

Since the same accessories are used, the design and pinning of the recessed multi-output plug on this model is the same as for the CCDV7/8/AF range. Even though the readily-conductive metal caps are omitted from the locating pins with the later production r.f. unit, clumsy insertion of the modulator can bend and short-circuit the delicate connection pins. Thus whenever the main 3·15A fuse inside the camcorder has blown, carefully examine pin 3 of the multi-connector for signs of arcing or burning. Unless the pin is broken or badly bent, the fuse (in this model F381 on board SC-6) is the only casualty. **E.T.**

Grundig VS180

Grundig VCRs are rare visitors to our workshop. This one was said to be stuck in pause. What happened was that the machine would have a brief go at any function selected and would then shut down with the pause LED alight. This is an "emergency" indication, drawing attention to lack of reel sensor pulses, and in this case came on because the reel brake solenoid didn't operate. A pull-in current is routed via a switch (behind the solenoid) which opens when the armature has moved over. Its contacts were dirty, leaving only the hold-in current in the solenoid. Giving the switch contacts a good clean restored normal operation. **E.T.**

Hitachi VT410

Many customer descriptions are merely the first clue in the guessing game that occupies an engineer during the first part of his diagnostic session. "Sound slurs" is one of the better ones, usually indicating problems in the capstan department. On this machine the capstan ran slowly and erratically. A meter connected to the speed control line to the motor showed that the servo was working flat out to speed up the motor. The motor itself was faulty, though it ran very freely when turned by hand. **E.T.**

Fisher FVH-P710

If you find that fuse F902 (500mAT) on the mains transformer PCB has blown for no apparent reason, check for dry-joints at the PCB connections of pins 10 and 12 of connector PV903 on the regulator panel. Considerable current passes through these pins, and some of it will be diverted through F902 and C928 in the event of a momentary open-circuit. The other joints on the plug/socket connections to this board are also worth checking. **E.T.**

Ferguson FV20

The fault with this machine was no colour. Use of another machine proved that it was recording the chroma signal, so the fault was only on playback. From the head amplifier circuit the chroma passes to the playback processing circuitry via a couple of filters. There was an input to the first filter LPF201 but no output. As a check, the filter was removed and an $0{\cdot}1\mu F$ capacitor was used to couple its input and output connection points. This restored colour, so a new filter was ordered. **I.B.**

Ferguson FV20

There were two fault symptoms with this machine, no playback picture (blank screen, sound o.k.) and what looked like a low luminance level in the E-E mode. Both problems were caused by the same faulty component, low-pass filter LPF102 which is connected between pins 10 and 21 of IC101 and is used for both E-E and playback. **I.B.**

Ferguson FV11

Sound but no playback picture was the reported fault with this machine. From this description I suspected clogged video heads, so before trying a tape I took a look at them. There was some oxide present, but it wasn't too bad. The drum was next warmed to remove any moisture and a tape was played back. The picture was fine! It was only when I moved the luminance/chroma board – I had to fold it up to the vertical position to remove the video head screening can – that the fault occurred. The effect was similar to an off-tune monitor TV set – just off the higher end of the r.f. output. The fault could be made to come and go by slightly twisting the panel. Close examination revealed a dry-joint on a small luminance coupling capacitor (C134) which is next to the right-hand subpanel. **I.B.**

Philips VR6362

This machine came in with a broken cassette lift and the complaint of no rewind or reverse picture search. In fact what happened was that when the VCR entered the rewind mode the tape tightened and was then unloaded. The drive coupling, item 214, was at fault. **A.D.**

Akai VS112

This machine would play back prerecorded tapes but there were no E-E signals and the channel indicator LEDs didn't light. The LEDs and the tuning potentiometers had 33V on all sides, includng the chassis connection. When we traced the earth return back to the main board, via connector P601, we found that an earth tag on the tuner unit was dry-jointed – the tuner's case is used as a link to the earthy side of the tuning presets. We decided to resolder all four mounting lugs on the tuner as well. **A.D.**

Sharp VCA100

The capstan motor in this VCR refused to work. We found that the 15V and 5V supplies were present and correct and that the 2·5V reference voltage was correct, but the capstan drive voltage was low at 1·5V instead of 2·4V. The capstan stop signal at pin 57 of the system control chip IC827 was then found to be permanently low. When this monster chip was replaced the capstan motor worked correctly. **A.D.**

Hitachi VT33

This VCR generated a noise in most modes. The symptom was similar to that produced by a dry capstan flywheel bearing in the later VT64 series. As suspected, the flywheel bracket was fitted with the nylon bearing. Further pushing, prodding and listening revealed that the noise was coming from a pulley on the clutch assembly, item 301. **A.D.**

Ferguson 3V30

The rather unusual complaint with this machine was no sound in the E-E, record or playback modes. We soon found that the 10·5V supply to the audio section was way down at only 0·344V. There was no excessive loading and it turned out that the regulator transistor Q17 was open-circuit. It's a 2SD636 but we fitted a 2SD637 (60V version) as this is a much used device we stock for Panasonic VCRs. **N.B.**

Panasonic NV-100/NV-10B

The problem with this portable VCR and tuner/timer combination was failure to record. On test we found that there was no sound or vision in the E-E mode – only the test signal could be produced. Playback direct from the VCR was fine. A look at the V10 unit was thus required. As the test signal was present that path from P7002-3 was o.k., including the thick interconnecting lead. There was no video output from pin 2 of IC701 (BN5115). It was present at the base of Q733 but not at its emitter. When it was tested we found that Q733 (2SC945/BC547) was short-circuit collector-to-emitter. The sound was muted because of the no video signal problem. The NV100 was then cleaned, and after replacing the noisy transmission pulley and belt it too performed perfectly. **N.B.**

Panasonic NV-G25

After a recent repair the customer complained that the clock/counter display faded out. Our field engineer (we call him Enid Blyton because of the fairy tales he tells us about the faults he sees) said he'd seen the fault. After many hours on soak test the display went dim, the final digit of the counter being even dimmer than the rest. The heater voltage was correct but the grid drive was incorrect. The drive comes from the MN15283VJU timer chip IC7501. Replacing this restored correct operation. **N.B.**

Ferguson FV11

A couple of faults are becoming very common with these machines. First is intermittent failure to eject, or other intermittent mechanical faults, caused by a loose earthing screw on the mecha connection PCB. The other is intermittent going into rewind from play during a tape. This is caused by dry-joints on the supply photosensor. Both faults can be exceptionally intermittent. **N.B.**

Panasonic NV366

A fault you may be faced with in these machines is the channel one LED flashing and inability to change channels. This can very often arise after replacing the three gold memory back-up capacitors. If you remove these by twisting them off the board (as you should if they are leaking) you can break R7693 (22kΩ) in half, producing the new fault. **N.B.**

Panasonic NV2000

This one came in with no comments under "fault" on the job card — always a bad sign! After switching it on the first fault noted was that the machine didn't switch from E-E to V-V. This was because the EXCEPT REC 9V supply was missing, soon traced to Q6043 (2SA719) which had a 4·7kΩ collector-emitter leak. Next the drum speed took about forty seconds to settle down. Adjustment of the drum free-run control took care of this.

I then decided to refix the two main panels to the metal frame, which was hanging around them loosely as someone had removed all the screws. I'd previously noticed that three out of seven chassis fixing screws were missing and bolts were fitted where there should have been screws and vice versa. Next I found that there was no colour in the playback mode — the chroma reference set trimmer had been "graunched". A replacement was fitted and set up within minutes, but the a.f.c. also had to be realigned — a twiddler had been at large . . .

We're not through yet: there was no sound in E-E or playback because the REC 9V supply was permanently present, due to Q6041 in the syscon being short-circuit. When all this had been put right and the whole thing had been reassembled correctly the machine worked well. The correct screws were fitted! I hope the idiot responsible for putting the deck in this state is reading this and is thoroughly ashamed of himself. **N.B.**

Dish Alignment by BBC Computer

J.T. Beaumont

The following program for use with the BBC microcomputer has been written to help satellite TV aerial fitters to determine the azimuth and elevation angles for dish alignment at a particular site. Many articles on the subject have appeared over the last three years, but the data given usually applies for only major cities. This program should provide the required data for any satellite visible from the UK, at any location, provided the longitude and latitude are known – this information can be obtained from an Ordnance Survey map.

When the program is run a menu listing a number of satellites appears on the screen – see Fig. 2. If required this list can be changed between program lines 1,390 and 1,640. When the satellite is not listed option number seven enables its longitude to be entered.

Use

The program is "user friendly". An example of a typical calculation, in this case for the Astra satellite, is as follows:

(1) Select Astra from the menu by entering number six (without pressing the return key). The screen will clear and the satellite's position, "19·2 degrees East", will appear at the top of the screen.

(2) A prompt at program line 520 requests that the longitude of the receiving site is entered. In this example the site is Land's End, which is longitude 5·75°W. Enter the number 5·75 then press the return key. Prompt line 560 will then request that E for east or W for west of Greenwich is entered. Type W but don't press the return key.

(3) The final prompt at line 630 requests the site latitude to be entered. Type 50 and press the return key.

The elevation – the angle at which the front plane of the dish has to be tilted back with respect to the vertical – is then displayed on the screen. In this example it's 27·972°.

The azimuth angle is calculated and displayed in degrees of rotation from true north and also as an angle east or west of true south. As can be seen (Fig.3) the azimuth bearing is 148·728° from true north, which is 31·272° east of true south.

It's important to know the geographical location in degrees and decimals, not degrees and minutes. To convert minutes to decimal, divide by 60. For example, thirty minutes is equal to 30/60 = 0·5°. Note that longitude as drawn on Ordnance Survey maps is with respect to "grid north". This must be converted to true north: the conversion constant is shown in the map's legend.

Before the dish can be pointed east or west of true south it's necessary to find true south. A compass needle will point to magnetic north and the correction angle can be found from the latest edition of an Ordnance Survey map. For Land's End the magnetic variation is currently 8°W. Once the magnetic variation has been found azimuth correction can be applied. Subtract the variation from azimuths east of south, add it to azimuths west of south. A rough indication of true south in the UK can be found by mounting a vertical stick on a flat surface and noting the shadow produced by the sun at 1200 hours GMT (noon).

If you wish to change the satellites listed in the menu (options 1-6), the latitude in degrees is held in variable theta and E or W of true south (Greenwich meridian) in variable A$ (lines 1,570-1,620).

Program

```
10  REM ****************************
20  REM *                          *
30  REM *      SATELLITE DISH      *
40  REM *   AZIMUTH/ELEVATION      *
50  REM *   J. T. Beaumont 1988    *
60  REM *                          *
70  REM ****************************
80  MODE1
90  *KEY 10 OLD:MRUN:M
100 VDU23,225,28,34,34,28,0,0,0,0
110 REM Define Degree symbol
120 VDU19,0,4,0,0,0
130 VDU23;8202;0;0;0;
140 REM Remove flashing cursor
150 PROC_Geost
160 PRINT TAB(13,18);"SATELLITE DISH"
170 PRINT TAB(10,20);"AZIMUTH/ELEVATION"
180 PRINT TAB(14,22);"CALCULATIONS"
190 PRINT TAB(10,26);"John Beaumont (1988)"
200 PROC_Border
210 COLOUR 1
220 PRINT TAB(2,30);"Press any key to start the
    program"
230 COLOUR 3
240 *FX15,0
250 S$=GET$
260 CLS
270 PROC_Geost
280 PROC_Menu
290 CLS
300 COLOUR 2
310 PRINT TAB(3,1);"Satellite Dish AZ/EL calculations"
320 PRINT TAB(3);"----------------------
    -----------"
330 COLOUR 3
340 REM Earth Radius
350 LET Rad=6376.77
360 LET Altitude = 35786
```

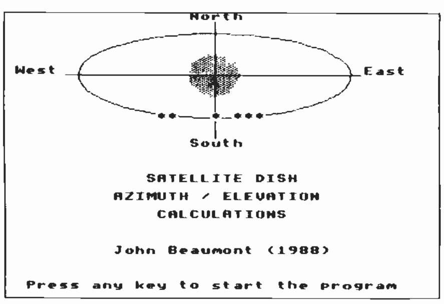


Fig. 1: Program start.

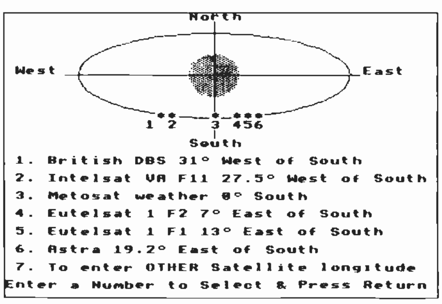


Fig. 2: The menu.

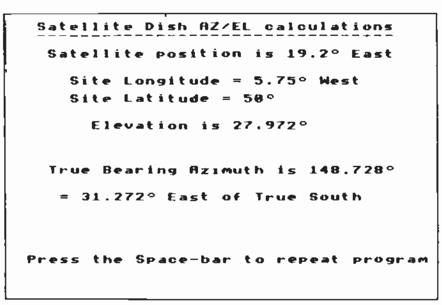


Fig. 3: Typical calculation.

```
370 REM Altitude of Satellite in GEO-STATIONARY
    ORBIT
380 IF Q=1 THEN GOTO 450
390 PRINT TAB(2,5);"Enter Satellite position in Degrees"
400 PRINT TAB(2,6);"and press the RETURN key";
410 INPUT Theta
420 PRINT TAB(0,5);SPC(40);TAB(0,6);SPC(40)
430 PRINT TAB(2,5);"Is the Satellite E or W of South ?"
440 A$=GET$
450 IF A$="E" OR A$="W" GOTO 460 ELSE PROC_
    Error:GOTO 440
460 IF A$="E" THEN B$="East"
470 IF A$="W" THEN B$="West"
480 PRINT TAB(0,5);SPC(40);TAB(0,6);SPC(40)
490 COLOUR 1
500 PRINT TAB(4,4);"Satellite positions is";Theta;
    CHR$(225);" ";B$
510 COLOUR 3
520 PRINT TAB(2,7);"Enter the site Longitude in
    Degrees"
530 PRINT TAB(2,8);"and press the RETURN key ";
540 INPUT Long
550 PRINT TAB(0,7);SPC(40):PRINT TAB(0,8);SPC(40)
560 PRINT TAB(1,7);"Is site Longitude E or W of
    Greenwich?"
570 C$=GET$
580 IF C$="E" OR C$="W" GOTO 590 ELSE PROC_
    Error:GOTO 570
590 PRINT TAB(0,7);SPC(40):PRINT TAB(0,8);SPC(40)
600 IF C$="E" THEN D$="East"
610 IF C$="W" THEN D$="West"
620 PRINT TAB(6,7);"Site Longitude = ";Long;
    CHR$(225);" ";D$
630 PRINT TAB(3,9);"Enter the site Latitude in Degrees"
640 PRINT TAB(3,10);"and press the RETURN key ";
650 INPUT Lat
660 PRINT TAB(0,9);SPC(40):PRINT TAB(0,8);
    SPC(40):PRINT TAB(0,10);SPC(40)
670 PRINT TAB(6,9);"Site Latitude = ";Lat;CHR$(225)
680 IF A$="E" AND C$="W" THEN Orbit = Theta+Long
690 IF A$="E" AND C$="E" THEN Orbit = Theta-Long
700 IF A$="W" AND C$="W" THEN Orbit =
    Theta-Long
710 IF A$="W" AND C$="E" THEN Orbit = Theta+Long
720 LET Constant = Rad/(Rad+Altitude)
730 LET A = COS(RAD(Lat))*COS(RAD(Orbit))
740 LET B = A - Constant
750 LET C = SQR(1-(A^2))
760 LET Elev = DEG(ATN(B/C))
770 LET Elev=INT(Elev*1000+0.5)/1000
780 IF Elev<0 THEN PRINT TAB(2,12);"The Satellite is
    over the horizon":GOTO 940
790 COLOUR 2
800 IF Lat<=0 THEN PROC_Zero
810 PRINT TAB(8,12);"Elevation is ";Elev;CHR$(225)
820 COLOUR 3
830 LET Angle = TAN(RAD(Orbit))/SIN(RAD(Lat))
840 LET Azimuth = ABS(DEG(ATN(Angle)))
850 PROC_Azi
860 LET Bearing=INT(Bearing*1000+0.5)/1000
870 PRINT TAB(4,17);"True Bearing Azimuth is
    ";Bearing;CHR$(225)
880 COLOUR 2
890 IF Bearing>180 THEN Bg=INT((Bearing-180)*
    1000+0.5)/1000
900 IF Bearing>180 THEN PRINT TAB(5,20);"=
    ";Bg;CHR$(225); " West of True South"
910 IF Bearing=180 THEN PRINT TAB(7,20);"which is 0";
    CHR$(225);" TRUE SOUTH"
920 IF Bearing<180 THEN Bg=INT((180-Bearing)*
    1000+0.5)/1000
930 IF Bearing<180 THEN PRINT TAB(5,20);"=
    ";Bg;CHR$(225); " East of True South"
940 PROC_Border
950 COLOUR 1
960 PRINT TAB(2,27);"Press the Space-bar to repeat
    program"
970 COLOUR 3
980 *FX15,0
990 Z$=GET$
1000 IF Z$=" " CLS:GOTO 260
1010 GOTO 990
1020 END
1030 DEFPROC_Azi
1040 IF A$="E" AND C$="W" LET Bearing =
     180-Azimuth:ENDPROC
1050 IF A$="W" AND C$="E" THEN LET Bearing =
     180+Azimuth:ENDPROC
1060 IF A$="E" AND C$="E" AND Theta<=Long THEN
     LET Bearing=180+Azimuth:ENDPROC
1070 IF A$="E" AND C$="E" AND Theta>Long THEN
     LET Bearing=180-Azimuth:ENDPROC
1080 IF A$="W" AND C$="W" AND Theta<=Long THEN
     LET Bearing=180-Azimuth:ENDPROC
1090 IF A$="W" AND C$="W" AND Theta>Long THEN
     LET Bearing=180+Azimuth:ENDPROC
1100 DEF PROC_Geost
1110 radius=75:angle=0
1120 S=620:T=800
1130 MOVE radius+S,T
1140 GCOL1,1
1150 REPEAT
1160 MOVE S,T
1170 PLOT85,radius*COS(angle)+S,radius*SIN(angle)+T
1180 angle=angle+0.1
1190 UNTIL angle>2*PI+0.1
1200 PLOT69,1020,800
1210 GCOL1,3
1220 FOR I=0 TO 2*PI+0.1 STEP 0.1
1230 DRAW 400*COS(I)+620,150*SIN(I)+800
1240 NEXTI
1250 MOVE 620,550
1260 DRAW 620,1000
1270 MOVE 1050,800
1280 DRAW 180,800
1290 PRINT TAB(1,6);"West"
1300 PRINT TAB(33,6);"East"
1310 PRINT TAB(17,0);"North"
1320 PRINT TAB(17,14);"South"
1330 COLOUR 2
1340 PRINT TAB(21,11);"***"
1350 PRINT TAB(14,11);"**"
1360 PRINT TAB(19,11);"*"
1370 COLOUR 3
1380 ENDPROC
1390 DEF PROC_Menu
1400 PRINT TAB(21,12);"456"
1410 PRINT TAB(13,12);"1 2 3"
1420 PRINT TAB(1,16);" 1. British DBS 31";CHR$(225);"
     West of South"
1430 PRINT'" 2. Intelsat VA F11 27.5";CHR$(225);" West of
     South"
1440 PRINT'" 3. Meteosat weather 0";CHR$(225);" South"
1450 PRINT'" 4. Eutelsat 1 F2 7";CHR$(225);" East of
     South"
1460 PRINT'" 5. Eutelsat 1 F1 13";CHR$(225);" East of
     South"
1470 PRINT'" 6. Astra 19.2";CHR$(225);" East of South"
1480 COLOUR 2
1490 PRINT'" 7. To enter OTHER Satellite longitude"
1500 COLOUR 1
1510 PRINT'"Enter a Number to Select & Press Return"
1520 *FX15,0
1530 PROC_Border
1540 COLOUR 3
1550 P$=GET$
1560 LET Q=0
1570 IF P$="1" THEN Theta=31:A$="W":Q=1
```

```
1580 IF P$="2" THEN Theta=27.5:A$="W":Q=1
1590 IF P$="3" THEN Theta=0:A$="W":Q=1
1600 IF P$="4" THEN Theta=7:A$="E":Q=1
1610 IF P$="5" THEN Theta=13:A$="E":Q=1
1620 IF P$="6" THEN Theta=19.2:A$="E":Q=1
1630 IF P$="7" LET Q=2
1640 IF Q=0 GOTO 1550
1650 ENDPROC
1660 DEF PROC_Border
1670 COLOUR 3
1680 MOVE0,0: DRAW1279,0: DRAW1279,1023:
     DRAW0,1023: DRAW0,0
1690 ENDPROC
1700 DEF PROC_Error
1710 COLOUR 2
1720 PRINT TAB(2,18);"Make sure the CAPS LOCK key is
     ON !"
1730 PRINT TAB(5,20);"and press the keys requested"
1740 FOR W=1 TO 3000:NEXT W
1750 PRINT TAB(1,18);SPC39;TAB(1,20);SPC39
1760 COLOUR 3
1770 ENDPROC
1780 DEF PROC_Zero
1790 COLOUR 2
1800 PRINT TAB(1,18);"You cannot divide by zero on a
     computer"
1810 PRINT TAB(8,20);"don't enter silly data"
1820 FOR W=1 TO 3000:NEXT W
1830 COLOUR 3
1840 PRINT''TAB(5)"PRESS ANY KEY TO START AGAIN"
1850 *FX15,0
1860 A$=GET$
1870 RUN
1880 ENDPROC
```

Long-distance Television

Roger Bunney

December provided a relatively quiet close to the year, reflecting the conditions during much of 1988. Sporadic E reception wasn't wonderful except for early June when over a three-day period ch. A2/3/4/5 signals from North America were seen in the UK and identified as coming from various locations along the eastern Canadian/USA seaboard. There was also a remarkable lunchtime period when North African Band III signals were seen in the UK – in the lower half of the band. Conditions in late October/early November were lively, with increasing sunspot activity and ch. E2/R1 reception from deep into Russia and the Middle-Far East. Since then F2/TE reception has occurred from time to time when the m.u.f. has risen into the lower end of Band I.

December's log has a little of everything. SpE had its moments as follows:

4/12/88	ORF (Austria) ch. E2a; RAI (Italy) ch. IA.
5/12/88	NRK (Norway) E2.
6/12/88	TVE (Spain) E3; RAI IB.
7/12/88	TVE E2; 3.
9/12/88	SVT (Sweden) E2; NRK E2.
10/12/88	TVE E2, 3, 4.
11/12/88	TVE E2.
13/12/88	TVE E2, 3.
14/12/88	TVE E2, 3; RAI IA; ORF E2a; CST (Czechoslovakia) R1; TVP (Poland) R1; SVT E2.
15/12/88	TVE E2.
16/12/88	NRK E2, 3.
17/12/88	ARD (West Germany) E2; JRT (Yugoslavia) E3; ORF E2a; RAI IA; TVE E2, 3.
19/12/88	TVE E2; CST R2; TSS (USSR) R2.
20/12/88	CST R1; TVP R1; TSS R1; SVT E2.
21/12/88	CST R1.
22/12/88	TVE E2, 3, 4; TVE-2 E2; unidentified programmes on chs. R1, 2, 3.
24/12/88	TVE E2; NRK E2, 3.
30/12/88	SVT E2.
31/12/88	SVT E2.

On the 16th an aurora was observed, with disturbance in Band I. There was improved tropospheric propagation on the 11th, with mainly West German Band III/u.h.f. and Danish Band III signals received in central/eastern UK. The 22nd produced several Swiss Band III and many West German Band III signals. January 2nd/3rd gave W. German/Benelux reception and ducting on the 2nd produced Danish Band III signals in the midlands.

There was lively meteor activity during the month with the Geminids shower. Tim Anderson logged SWF (W. Germany) ch. E7 on the 12th during this event, though there was naturally much activity in Band I – sufficient to prove the efficiency of the Les Wallen 49MHz helical aerial!

F2 activity has unfortunately been at a low level. Tim Anderson received what he believes to have been Malaysia ch. E2 between 0825-0923 on the 23rd, at levels to P4. The programme content was western with subtitles of Indo-Chinese origin. During this time Finnish radio amateurs were in contact with their Australian counterparts in the 50MHz band. The next morning (24th) produced weak, scanner-level sync information on chs. R1, E2 and E3. With the m.u.f. rising to 50MHz, American amateurs are commonly reporting reception of ch. R1/E2 video information. On the 20th for example very high level ch. E2 signals were received for some four hours in Canada, though there was only weak backscatter here in the UK. Hugh Cocks in Portugal reports that Brazil ch. A2 and African ch. E2/3/4 signals are received almost daily – signal propagation is mainly by late afternoon/evening TE. One pointer for transatlantic reception is a broadcast link now operating in Columbia at 45·7MHz. The RSGB *VHF/UHF Newsletter* reports that transatlantic openings at 50MHz were frequent during November/December. Unfortunately the TV bands start at a lower point in the spectrum in Europe than in America, where the lowest channel is A2 (55·25MHz), so the m.u.f. really has to rise for transatlantic TV reception in Europe.

Anthony Mann (Perth, Western Australia) reports F2/TE reception from China/Malaysia, with some SpE enhancement over the final path. What is of importance for the record books is the news that Brian Clark, a TV/FM DXer in Auckland, New Zealand, received the following transmissions on October 4/5th: Cairns 4ABC-FM at 105·9MHz, 80kW, a distance of 2,260 miles;Mackay ABMQ-4 TV, 100kW, at 1,900 miles;Rockhampton 4ABC-FM at 93·7MHz, 50kW, 1,700 miles; and Brisbane f.m. and ch. A10 TV at 1,400 miles!

During the tropospheric opening on the 22nd a scrambled System B ch. E8 TV signal was noted, possibly from RTB-F (Belgium) or ARD. Can anyone comment on this?

The RSGB *VHF/UHF Newsletter* suggests that the present sunspot cycle, no. 22, will peak late this year with a smoothed count of around 180. This would represent the second best since records began. The last peak of around 165 in 1978/9 produced signals reaching to about 60MHz over long F2 paths. In the late fifties cycle no. 19 produced a smoothed count of around 200, so things look good for us later this year!

My thanks to the following for their comments and reception reports: Hugh Cocks (Portugal), Bill Cotterill (Tipton), Mark Baldwin (Rushden), Iain Menzies (Aberdeen), Tim Anderson (St. Leonards), Simon Hamer (Powys) and Roger Fussell (Torpoint).

Andrew Emmerson (BATC) hopes to start a "405-line" circle. If any readers are interested, please write in so that letters can be forwarded. One reader at Lea on Solent (Hants) tells us that he now has two working 405-line cameras with correctly timed pulse/blanking and can record System A slides on to VHS tape. If anyone has 8/16mm films/telerecordings for transfer, please write in.

Astra Channel Allocations

We have received, via Kesh Electronics, the latest Astra channel allocation list. Details are as follows. Note that this list supersedes previously published information.

Channel	*Frequency (GHz)*	*Transponder*	*Polarity/ mode*
Sky	11·318	8	V1
Sky News	11·376	12	V1
Sky Movies	11·435	16	V1
Disney	11·258	4	V1
Eurosport	11·332	9	H1
Sky Arts	11·391	13	H1
UK TBA	11·421	15	H2
Screen Sport	11·214	1	H1
Lifestyle	11·273	5	H1
Filmnet	11·362	11	H2
Scansat	11·303	7	H2
Scansat-TV3	11·244	3	H2
German	11·229	2	V2
German	11·288	6	V2
German	11·347	10	V2
German	11·406	14	V2

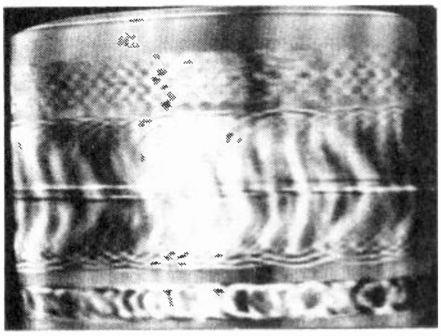
Screen Sport and Lifestyle will be clear initially, then in MAC. UK TBA (to be advised) could be Premiere or the BBC. Scansat should be the same as now on Intelsat. No information at present on the German channels.

News Items

East Germany: The BDXC reports that the main DFF-1 ch. E4 Cottbus transmitter (100kW e.r.p.) has closed down. A low-power relay provides a local service on the same channel. This transmitter, a favourite for MS reception, will be missed.

France: A Belgian contact reports that all new French TV networks have their transmitter channel information carried by the Minitel videotex service. Transmitters are grouped in two-digit department codes, e.g. 75 = Paris region, 59 = Nord/Pas de Calais etc. We've received a print-out on a modified Prestel terminal from a BBC computer.

In brief: Philips is to supply 15,000 decoders to the medical profession for reception of the daily hour-long



Typical F2/TE reception in the UK, by Andrew Tett in June 1980. Note the multiple images. The signal was received from the south, on ch. E3 – perhaps from Sokoto, Nigeria.

news and information service run during "dead" BBC-2 time. There's a £50 annual subscription for the service . . . TRN reports that a ch. E2a (49·75MHz vision) 0·2kW e.r.p. transmitter is now in operation in the Lebanon . . . The first Belgian commercial TV station, Vlaamse Televisie Maatschappii, was due to come on air on February 1st.

New EBU Listings

W. Germany: Rosengarten ch. E52, 501kW e.r.p. horizontal. This is a private station.
France: Le Mans-Mayet ch. E32 150kW La 5; Metz-Luttange ch. E39 200kW La 5; Troyes ch. E50 250kW M6; Auxerre ch. E55 100kW La 5; Amiens ch. E52 100kW M6. Powers e.r.p. and polarisation horizontal in all cases.

Publications

HS Publications, 7 Epping Close, Mackworh Estate, Derby DE3 4HR has published a second edition of the "Teleradio News – Data File Bands 1 and 2". This is an extremely useful guide for SpE and general DXing. It includes transmission standards, a channel allocation/frequency section, main Band I/II transmitter locations/technical data with a map, seven pages of test patterns and captions and general notes on the Band I/II transmissions in various countries. Very good value at £5·99 postage paid in the UK.

Bernard Babani (publishing) Ltd. has published a second, updated and expanded edition of "An Introduction to Satellite Television" by F.A. Wilson. It provides a great deal of information on the subject for just £5·95. Available from the publishers at The Grampians, Shepherds Bush Road, London W6 7NF, from booksellers or from Aerial Techniques.

Meteor Shower/Scatter Propagation

From time to time in this column we describe for newcomers the basic signal propagation modes that make long-distance reception possible. This month we'll consider meteor shower/scatter propagation.

When the E layer of the ionosphere, about seventy miles above the world's surface, is sufficiently ionised v.h.f. TV signals can be reflected back to Earth, giving long-distance reception at up to say 1,200 miles from the transmitting site. Sporadic E propagation occurs when patches of the ionosphere become intensely ionised. This happens mainly during the summer months, when SpE openings can produce high-level, long-duration signals in Bands I-III. A similar phenomenon is caused by meteorites that enter the ionosphere. When they reach the E layer they burn up and vaporise, producing ionisation sufficient to support signal reflection. Such ionised areas lie in trails along the paths of the decaying meteorites. The ionised trail is relatively small, and as a result the distant reception site will have an area of only about six miles by twenty five miles. Thus a signal received by one DXer via this mode may well not be present at another DXer's location perhaps twenty miles away. This second DXer may receive a signal of minimal strength or perhaps a signal from a different transmitter.

Meteor scatter propagation works best with Band I signals. Higher frequency signals can be reflected by very high density trails – Band III TV signals are reflected at times, particularly during the regular meteor showers, but in Band III the signals are of short duration and infrequent.

It's interesting to note that military communications systems exploit the random MS trail phenomenon for regular data communications, using digital techniques. In modern duplex systems a continuous probe signal is radiated. When the intended receiving site detects the probe signal an acknowledgement is sent back to the transmitter which then sends out a digital burst signal along the MS reflection path. The ionisation density lasts long enough to support reflection for between half a second to a minute. According to military information a data rate of a hundred words a minute can be averaged over a 24-hour period. In the USA information on snow levels and other weather data is transmitted via the MS SNOTEL system, and in Alaska military information from remote radar sites is transmitted via MS propagation. There is particular military interest in MS propagation since a nuclear strike could cause disruption of h.f. communications through E/F layer destruction.

MS propagation makes DX-TV reception possible throughtout the year, though the duration of the signals received will be short, ranging from "pings" of a second or so to "super pings" that give reception for approaching a minute. One problem with Band III MS reception is that DX aerials tend to be of the multi-element type, with reduced vertical capture.

Apart from daily random MS activity there are periods of intense MS when the regular meteor showers occur – the main meteor shower dates for 1989 were listed in the January issue (see page 208).

For MS DX-TV reception the receiver must have very fast sync action since the signals may last for only seconds. Many of the signals are weak, so aerial gain and a low-noise amplifier are necessary. Accurate tuner calibration is essential. The early morning hours tend to be best for MS, though results depend on the transmitters that happen to be on air at the appropriate time – with increasing "breakfast TV" in Europe, Band I MS reception is these days a lot more common than it used to be.

Radio Amateur Operation at 50MHz

The RSGB reports that Dutch radio amateurs have been given permission to use SSB transmission at 50MHz – formerly only c.w. had been permitted. Some 420 applications for permission to operate at 50MHz have been received by the French authorities. Strict operating limits are in force to prevent interference to ch. L2 TV transmissions. Over 100 permits have been issued to date. 50MHz operation was considered in Luxembourg but apparently there have been interference problems with cable systems. The Danish authorities have not yet reached a decision on 50MHz operation. Twenty five experimental permits have been issued in Sweden, allowing operators to use 50W e.r.p. for stations 250km from a ch. E2 transmitter and lower powers at closer distances. Cyprus has extended 50MHz operation. Farther afield, at least one UK amateur is operating at 50MHz in Nigeria and a further amateur is operating in the Falklands.

The 50MHz amateur band has caused TV-DXers few problems to date – unless you happen to live within a few miles of an operator, when ch. E2/R1 reception can become difficult. The problem is not as bad as a nearby 49MHz baby alarm however. We understand that Dave Lauder is working on a new notch filter design with a very sharp response to help with rejection of adjacent sources of interference and hope to be able to pass on more details shortly.

Service Bureau

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.

TANDBERG CTV3 CHASSIS

This set trips continuously and although the feeds from the power supply and the line output stage have been disconnected I cannot isolate the cause. The power supply panel has been checked for dry-joints and various smaller semiconductor devices have been replaced. With the 160V line isolated from the main panel the h.t. pulses up to about 80-90V. The 12V supply to the TBA920 chip is also low and pulsing. Obviously the overvoltage trip is not operating or the fuse would blow.

It sounds as if the excess current trip is operating. First check that R754 (0·47Ω) hasn't increased in value, then check Q736 (BC548). To prove that the line output stage etc. isn't loading the power supply excessively, wire a 60W, 240V bulb across the main output from the power supply.

SONY SLF30

This machine plays prerecorded tapes all right but its own recordings produce a picture that is grainy for a second or two then a good picture with wow on the sound, as though the speed is varying. The fault is the same when the tape is played back on another machine.

The cause of the trouble could well be poor transfer of the control track pulses – clean the control track head. If this doesn't cure the problem, try setting up the capstan servo. If difficulty is experienced in doing this check the capstan shaft bearings for free running.

BUSH BC6004

There's no vision or sound – even the tube's heaters are out. The supply into the set is all right but it seems to use some rather unusual circuitry.

This set was produced by Saba and uses a combined line output/power supply regulation arrangement called a Wessel circuit. Check with an ohmmeter whether T686 (BU208) or D687 (SKE4F/10) is short-circuit. If they are o.k., check for 300V at the mains rectifier's reservoir capacitor C858. If this voltage is missing the surge limiter resistor R854 (6·8Ω, 11W) is probably open-circuit. If it's present the protection circuit associated with thyristor Thy697 could well have come into operation. Investigation of this calls for the use of a variac and oscilloscope.

GRUNDIG 2 × 4 SUPER

When picture search is selected, in either direction, the picture rolls continuously. Occasionally the picture locks for a split second. When this happens the picture is good.

This affect is usually due to need for tape servo adjustment. This should follow a check on video head height offset – a dual-beam oscilloscope is required for this. Servo adjustment also requires an oscilloscope and a method different from that described in the manual – refer to page 76 of the Grundig Technical Bulletin issue no. 5, 1983 (part no. 00002-360.05).

FERGUSON TX90 CHASSIS

This is one of the 14in. models. The fault is a thin white line rising from the bottom of the picture. Sometimes there are two such lines.

We suggest that you check the 95V supply decoupler C191 (22μF), then D107, R203 (33Ω) and TR105 (TIP112H) in the field output stage before suspecting the expensive TDA4500 chip. Use of gentle heat from a hairdryer and a freezer aerosol may help to pinpoint the faulty component

PANASONIC NV788

The heads were replaced using genuine Panasonic parts. The result: excellent standard play operation, along with slow-motion effects etc., but on long play the picture is very noisy, as though one head isn't functioning. Inspection of the f.m. envelope waveform showed that the output from one head is about half that from the other one. A second set of heads has made no difference.

The heads have separate preamplifiers — IC3502 caters for LP operation. Suspect it once you've proved that the tracking is perfect in the SP mode and that the drives to the bases of Q3501 and Q3502 are correct.

GRUNDIG CUC720 CHASSIS

After fitting a new tube the picture was found to be off-centre vertically, by about ⅝in. (too high). The problem is that there's no field shift control. All the controls available work normally.

The tube tolerances are such that with correct setting up the picture should be within a few mm of the correct centring. The purity adjustment has the biggest influence on centring. The other c.r.t. neck rings also affect it. These items should be adjusted.

FERGUSON 3V48

We have the same trouble with two of these machines. The fault is with hi-fi audio and occurs with both own recordings and prerecorded tapes. Intermittently a slight buzz/crackle is heard on both channels, for approximately a half to a second. This can happen every ten seconds or not be heard for about five minutes. All the relevant adjustments have been carried out. If a scope is connected anywhere in the playback circuit a ripple can be seen when the noise is present. Slight pressure on the deck produces a similar fault but slight adjustment of the entry/exit guides only makes matters worse.

IC204 could well be the culprit. Apart from this a good deal of information on the problem was published in issue no. 29 (February 1987) of *Ferguson Feedback*.

QUERY COUPON

Available until 15th March 1989. One coupon, plus a £2 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION MARCH 1989

HITACHI CRP143 (NP6C CHASSIS)

Sound and picture are periodically lost. After switching off, sometimes for an appreciable period of time, everything is o.k. when the set is switched on again. Any suggestions?

First check the soldered joints around the chopper transformer T902 and the line output transformer T703, preferably by disconnecting them then resoldering. If necessary replace the voltage divider/reference source unit CP901 (HM9102) and the error amplifier transistor TR907 and check all associated joints. Occasionally rectifier diode CR705 (V09C) or R733 fails, killing the 12V line.

TEST CASE

315

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.

David the Downtrodden was about to leave the yard on this bitterly cold morning. Out of his warm den the Service Manager trotted with a further job in his hand. One more in Crowfield – a rental Toshiba VCR with a "poor picture". What does a "poor picture" mean? Anything! Why can't the hens in the office get more specific details?

David arrived to find a Toshiba Model V66 (similar to the JVC HRD140, Ferguson 3V44 etc.). He was told that the playback picture was "wobbly". His own test tape, with a recording of the IBA test pattern, was inserted and the playback picture on the TV screen was then examined. The picture showed a lateral twitch effect, with watery verticals, especially in the lower part of the screen. This can arise from incompatibility with the TV set, but the one installed was correctly set up for VCR use – indeed the off-tape picture was considerably worse when tuned in on one of the off-air channels. Just to make sure, another TV set from the van was brought in and hooked up. The results were exactly the same. Anyway, TV compatibility problems usually cause a twitch at the top of the screen rather than the bottom.

David cleaned the lower drum, the capstan, the pinch roller, the guides and the head drum cylinder. This did not improve the playback pictures, and a recording made on the machine showed that the jitter effect was even worse! On to the van with the machine then.

With the VCR in the workshop the symptom was carefully studied and analysed. It was plainly due to timing jitter in the playback signal – the effect of minute changes in the speed at which the recorded tracks were being scanned. This can arise from irregularities in the tape's progress or in the head drum's peripheral speed.

The second possibility was investigated first. The drum was carefully rotated by hand, while "feeling" and listening for any roughness or rumble in the bearings. None was apparent. A scope was next hooked to the drum motor's error control line. The ripple level here was found to be no higher than in a similar model whose playback picture *was* o.k. Could it be that the head motor, a direct-drive type, was faulty? Perhaps the only real test for this is by substitution, so at this stage we decided to investigate the alternative possibility, tape judder.

The entire tape path was again cleaned and polished, and the 1kHz tone from a test tape was listened to carefully for signs of flutter. No clues emerged from these steps, or from a check of head eccentricity with an improvised mounting for the gauge. The running of the impedance roller (beside the full-erase head) was next checked. When spun fast it rattled and roared somewhat. Could this be the cause of the trouble? A single drop of light lubricant was run down its shaft, after which it ran as sweet as a nut. The playback picture was no better however!

Workshop Sage was consulted on the matter. The fact that the jitter was worse in the lower part of the picture seemed to him to be an important clue. With no tape in the machine he prodded, poked, felt and listened. He then loaded a test tape into the machine and, while watching the TV screen, applied a miniscrewdriver tip to a certain part of the deck. This had some effect on the jittery picture. Sage suggested a possible culprit, a small but high-precision component, which did indeed turn out to be the cause of the trouble. What was it? See next month's issue for the answer.

ANSWER TO TEST CASE 314
– Page 284 last month –

An incredible set of symptoms was present in the Panasonic NV7200 VCR described last month. In playback the machine behaved exactly as if a blank tape was loaded, except that there was sometimes a snatch of sound and vision at the beginning of the playback and that there were good pictures in the review mode provided the tape being reviewed hadn't previously seen an attempt at playback in the machine!

The machne was of course "reading" blank tape in the playback mode. As the tape approached the video head drum it was being erased by the full-erase head, which was operating even during playback. Thank goodness the alignment tape hadn't been fed into the machine at any stage!

Normally the full-erase head comes into action only when the machine is in the record mode. The erase oscillator is switched on by a voltage at pin 3 of P4001. This voltage turns on switching transistor Q4019 on the Y/C/audio panel. When tested this "relay" transistor was found to have developed a virtual short-circuit, with the result that the erase oscillator was powered at all times.

During the testing and head-scratching in the workshop the rogue machine had wiped clean sizeable portions of some of our favourite tapes, and had done the same to some of those belonging to the owner. The worst news however was for the proprietor of the video rental shop . . .

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79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p
79GU1C	190p
79GU1C	215p
79HGKC	800p
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LED 3MM	
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AN-7110	130p
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AN-7115	150p
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AN-7410	250p
AN-7420	250p
AN-7140	450p
AN-7145	195p
AN-7146	210p
AN-7154	180p
AN-7156	240p
AN-7158	310p
AN-7168	260p
AN-7178	270p
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AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
AY5-3600	570p
BA-301	65p
BA-302	90p
BA-308	100p
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CX-130	450p
CX-136	610p
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CX-143A	580p
ER-1400	200p

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LAM-508	200p
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LF-347	110p
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LF-353	48p
LF-355	60p
LF-356	60p
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LF-398	300p
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LM-334Z	115p
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LM-337	250p
LM-339	37p
LM-348	55p
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LM-377	220p
LM-380	100p
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LM-383	300p
LM-384	130p
LM-386	85p
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LM-393	55p
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MC-1494	670p
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MC-1569	210p
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MC 3423	75p
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UPC-1230	210p
UPC-1238	120p
UPC-1263	230p
UPC-1277	240p
UPC-1278	240p
UPC-1350	115p
UPC-1353	160p
UPC-1363	190p
UPC-1365	320p
UPC-1373	85p
UPC-1378	210p
UPC-1380	450p
UPC-1382	110p
UPC-1383	250p
UPC-1384	260p
UPC-1394	170p
UPC-1397	450p
UPC-1470	200p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN-426	260p
ZN-427	560p

LINEAR IC'S — Cont.

ZN-428425
ZN-429215
ZN-435340
ZN-448510
ZN-459190
ZN-1034170
ZN-1040640
ZNA-134H2150
ZNA-234E920
2SJ-48480
2SJ-49425
2SJ-50425
2SJ-77350
2SJ-122580
2SK-15350
2SK-1945
2SK-4950
2SK-55100
2SK-68100
2SK-133480
2SK-134415
2SK-135415
2SK-147160
2SK-176800
2SK-191160
2SK-19245
2SK-195150
2SK-197140
2SK-210130
2SK-211130
2SK-217130
2SK-291300
2SK-294400
2SK-312750
2SK-322300
2SK-323130
2SK-555480
2SK-557650
3SK-8870

JAPANESE TRANSISTORS

2SA-473	35p
2SA-483	400p
2SA-490	60p
2SA-562	57p
2SA-563	45p
2SA-571	500p
2SA-634	50p
2SA-636	50p
2SA-673	20p
2SA-684	60p
2SA-699	100p
2SA-715	90p
2SA-720	20p
2SA-733	30p
2SA-798	55p
2SA-844	30p
2SA-872	40p
2SA-872A	50p
2SA-886	90p
2SA-899	60p
2SA-907	650p
2SA-909	700p
2SA-933	40p
2SA-934	40p
2SA-935	40p
2SA-937	40p
2SA-940	70p
2SA-950	30p
2SA-952	50p
2SA-953	60p
2SA-965	60p
2SA-966	70p
2SA-970	50p
2SA-979	85p
2SA-984	50p
2SA-992	30p
2SA-1012	130p
2SA-1015	30p
2SA-1102	190p
2SA-1103	200p
2SA-1104	200p
2SA-1105	250p
2SA-1106	250p
2SB-022	80p
2SB-324	55p
2SB-370	45p
2SB-546	70p
2SB-557	225p
2SB-561	50p
2SB-566	130p
2SB-595	80p
2SB-598	80p
2SB-600	500p
2SB-600	500p
2SB-616	190p
2SB-621	85p
2SB-646A	90p
2SB-647	30p
2SB-649	40p
2SB-688	120p
2SB-703	125p
2SB-705	200p
2SB-707	200p
2SB-716	30p
2SB-727	200p
2SB-754	80p
2SB-755	310p
2SB-761	170p
2SB-764	60p
2SB-772	45p
2SB-775	160p
2SB-791	280p
2SB-792	70p
2SB-795	60p
2SB-825	135p
2SB-861	160p
2SB-882	180p
2SB-884	120p
2SB-886	225p
2SB-895	120p
2SB-950	180p
2SB-951	190p
2SB-1009	110p
2SB-1037	110p
2SB-1077	180p
2SB-1091	100p
2SC-97A	380p
2SC-454	45p
2SC-458	15p
2SC-461	30p
2SC-495	60p
2SC-536	30p
2SC-681	340p
2SC-710	50p
2SC-733	30p
2SC-790	125p
2SC-792	380p
2SC-828	25p
2SC-830	50p
2SC-943	160p
2SC-945	40p
2SC-1010	300p
2SC-1050	300p
2SC-1060	99p
2SC-1061	100p
2SC-1070	65p
2SC-1096	60p
2SC-1106	180p
2SC-1114	415p
2SC-1115	400p
2SC-1116	290p
2SC-1161	110p
2SC-1162	35p
2SC-1164	600p
2SC-1172	150p
2SC-1173	60p
2SC-1213	50p
2SC-1214	40p
2SC-1226	75p
2SC-1279	30p
2SC-1306	90p
2SC-1308K	350p
2SC-1317	25p
2SC-1318	25p
2SC-1327	20p
2SC-1342	120p
2SC-1383	50p
2SC-1384	50p
2SC-1398	80p
2SC-1413	265p
2SC-1419	150p
2SC-1444	360p
2SC-1454	320p
2SC-1472	40p
2SC-1505	80p
2SC-1507	140p
2SC-1509	80p
2SC-1514	65p
2SC-1515	60p
2SC-1520	120p
2SC-1573	95p
2SC-1586	540p
2SC-1624	140p
2SC-1675	100p
2SC-1678	120p
2SC-1729	900p
2SC-1730	540p
2SC-1740	40p
2SC-1741	45p
2SC-1755	90p
2SC-1756	40p
2SC-1758	30p
2SC-1775	20p
2SC-1809	40p
2SC-1815	30p
2SC-1826	60p
2SC-1845	20p
2SC-1847	120p
2SC-1865	120p
2SC-1875	280p
2SC-1881	210p
2SC-1906	75p
2SC-1907	75p
2SC-1909	250p
2SC-1921	60p
2SC-1923	25p
2SC-1941	40p
2SC-1942	260p
2SC-1944	350p
2SC-1945	350p
2SC-1946	1500p
2SC-1947	450p
2SC-1957	70p
2SC-1969	160p
2SC-1971	400p
2SC-1972	600p
2SC-1983	130p
2SC-2001	80p
2SC-2002	40p
2SC-2003	25p
2SC-2023	180p
2SC-2026	60p
2SC-2028	75p
2SC-2029	120p
2SC-2053	120p
2SC-2060	60p
2SC-2068	90p
2SC-2073	70p
2SC-2075	80p
2SC-2078	95p
2SC-2086	60p
2SC-2098	600p
2SC-2166	90p
2SC-2228A	80p
2SC-2229	25p
2SC-2233	125p
2SC-2235	60p
2SC-2236	60p
2SC-2238	70p
2SC-2240	45p
2SC-2259	80p
2SC-2271	60p
2SC-2275	50p
2SC-2290	1800p
2SC-2314	70p
2SC-2324	120p
2SC-2329	480p
2SC-2334	240p
2SC-2335	120p
2SC-2335	120p
2SC-2369	100p
2SC-2371	45p
2SC-2373	210p
2SC-2407	110p
2SC-2408	120p
2SC-2470	65p
2SC-2482	40p
2SC-2484	240p
2SC-2509	580p
2SC-2545	55p
2SC-2547	65p
2SC-2550	70p
2SC-2551	70p
2SC-2562	90p
2SC-2564	245p
2SC-2565	280p
2SC-2570	60p
2SC-2577	125p
2SC-2578	220p
2SC-2579	200p
2SC-2580	240p
2SC-2581	290p
2SC-2608	620p
2SC-2611	40p
2SC-2611	65p
2SC-2625	380p
2SC-2681	270p
2SC-2688	70p
2SC-2695	2100p
2SC-2719	80p
2SC-2749	350p
2SC-2785	60p
2SC-2810	360p
2SC-2837	380p
2SC-2922	610p
2SC-2979	320p
2SC-2988	280p
2SC-3025	500p
2SC-3039	140p
2SC-3040	260p
2SC-3042	300p
2SC-3060	900p
2SC-3148	410p
2SC-3150	200p
2SC-3151	230p
2SC-3152	250p
2SC-3153	350p
2SC-3156	400p
2SC-3158	260p
2SC-3173	150p
2SC-3178	340p
2SC-3181	240p
2SC-3210	480p
2SC-3212	510p
2SC-3264	510p
2SC-3277	280p
2SC-3293	85p
2SC-3299	120p
2SC-3318	500p
2SC-3355	90p
2SC-3358	80p
2SC-3402	50p
2SC-3416	80p
2SC-3417	90p
2SC-3422	110p
2SC-3467	70p
2SC-3468	70p
2SC-3503	90p
2SC-3568	200p
2SC-3675	160p
2SC-3685	490p
2SC-3789	75p
2SD-024	60p
2SD-313	70p
2SD-325	60p
2SD-348	460p
2SD-371	240p
2SD-401	130p
2SD-438	100p
2SD-600	120p
2SD-613	70p
2SD-718	100p
2SD-1277	190p
2SD-1398	250p
2SD-1453	180p
2SD-1609	110p

BRIDGE RECTIFIERS

1A/50V	16p
1A/100V	18p
1A/200V	19p
1A/400V	21p
1A/600V	23p
1A/800V	28p
2A/100V	33p
2A/200V	33p
2A/400V	37p
2A/600V	43p
2A/800V	43p
3A/200V	43p
3A/400V	43p
3A/600V	44p
6A/200V	80p
6A/400V	72p
25A/100V	150p
25A/200V	165p
25A/400V	185p
25A/600V	200p
25A/800V	240p
35A/100V	185p
35A/200V	200p
35A/400V	220p
35A/600V	230p
35A/800V	260p
1.5A/100V	40p
1.5A/800V	40p

PLASTIC CASED TRIACS

4A/400V	60p
6A/400V	69p
8A/400V	68p
12A/400V	85p
16A/400V	105p
20A/400V	190p
25A/400V	205p
8A/400V	52p

THYRISTORS

0.8A/60V	20p
0.8A/100V	28p
0.8A/200V	29p
4A/400V	28p
8A/300V	59p
8A/400V	70p
8A/600V	79p
12A/400V	75p
12A/600V	90p
2N4444	76p
BR103	37p
BR303	85p
BT106	120p
BT116	80p
BT119	100p
BT120	100p
OT121	120p
TIC44	22p
TIC45	27p
TIC47	32p
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG613	850p
SG264A	300p

4000B SERIES CMOS IC's

4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4008	38p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4015	32p
4016	18p
4017	29p
4018	30p
4019	28p
4020	33p
4021	36p
4022	36p
4023	13p
4024	25p
4025	13p
4026	60p
4027	18p
4028	29p
4029	34p
4030	17p
4031	90p
4032	52p
4033	60p
4034	76p
4035	42p
4036	180p
4037	75p
4038	46p
4039	180p
4040	30p
4041	36p
4042	30p
4043	36p
4044	36p
4045	72p
4046	42p
4047	45p
4048	27p
4049	18p
4050	20p
4051	38p
4052	35p
4053	35p
4054	53p
4055	52p
4056	52p
4060	40p
4063	52p
4066	20p
4067	120p
4068	13p
4069	13p
4070	13p
4071	13p
4072	13p
4073	13p
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4095	58p
4098	50p
4099	42p
4501	27p
4502	36p
4503	30p
4504	55p
4505	180p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4513	80p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	36p
4521	86p
4522	43p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4551	75p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40100	120p
40101	78p
40102	150p
40103	120p
40104	90p
40105	140p
40106	35p
40107	50p
40108	260p
40109	74p
40110	170p
40114	180p
40117	180p
40147	240p
40160	55p
40161	65p
40162	55p
40163	55p
40174	48p
40175	60p
40181	170p
40182	70p
40192	48p
40193	48p
40194	58p
40208	240p
40257	120p

74 SERIES

7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	40p
7407	40p
7408	25p
7409	20p
7413	35p
7414	45p
7416	40p
7417	32p
7420	22p
7421	25p
7425	15p
7430	25p
7437	28p
7438	35p
7442	45p
7447	60p
7450	22p
7451	10p
7454	25p
7470	30p
7473	30p
7474	40p
7475	25p
7481	90p
7482	70p
7485	30p
7486	28p
7489	80p
7490	35p
7492	45p
7493	35p
7495	48p
7497	80p
74107	30p
74111	52p
74116	85p
74119	85p
74122	40p
74123	20p
74125	40p
74126	45p
74132	42p
74141	55p
74145	70p
74153	45p
74155	45p
74157	45p
74160	50p
74164	50p
74167	35p
74173	50p
74174	70p
74175	65p
74176	45p
74180	50p
74182	45p
74192	40p
74196	40p
74197	45p
74393	70p

74HC SERIES HIGH SPEED CMOS

74HC00	14p
74HC02	14p
74HC03	14p
74HC04	15p
74HC08	18p
74HC10	20p
74HC11	14p
74HC14	28p
74HC20	20p
74HC21	20p
74HC27	20p
74HC30	20p
74HC32	20p
74HC42	32p
74HC51	20p
74HC73	26p
74HC74	26p
74HC75	30p
74HC76	30p
74HC77	40p
74HC85	33p
74HC86	29p
74HC93	50p
74HC107	31p
74HC109	31p
74HC112	31p
74HC113	31p
74HC123	43p
74HC125	35p
74HC126	36p
74HC131	38p
74HC132	37p
74HC133	35p
74HC137	55p
74HC138	36p
74HC139	24p
74HC147	45p
74HC148	40p
74HC151	36p
74HC153	35p
74HC154	110p
74HC155	50p
74HC157	36p
74HC158	36p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	58p
74HC166	70p
74HC173	55p
74HC174	38p
74HC175	38p
74HC181	130p
74HC182	60p
74HC190	48p
74HC191	60p
74HC192	60p
74HC193	43p
74HC194	47p
74HC195	47p
74HC221	100p
74HC237	50p
74HC238	65p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC244	44p
74HC245	49p
74HC251	25p
74HC253	37p
74HC257	41p
74HC258	50p
74HC259	55p
74HC273	42p
74HC279	37p
74HC280	65p
74HC283	65p
74HC297	950p
74HC298	52p
74HC299	105p
74HC354	38p
74HC356	45p
74HC365	34p
74HC366	36p
74HC367	36p
74HC368	36p
74HC373	47p
74HC374	50p
74HC375	60p
74HC377	55p
74HC386	20p
74HC390	55p
74HC393	50p
74HC423	70p
74HC533	68p
74HC534	65p
74HC540	73p
74HC541	73p
74HC563	73p
74HC564	73p
74HC573	73p
74HC574	70p
74HC583	90p
74HC595	85p
74HC597	85p
74HC620	110p
74HC623	110p
74HC640	90p
74HC643	90p
74HC646	150p
74HC648	150p
74HC651	110p
74HC652	110p
74HC670	90p
74HC688	150p
74HC690	120p
74HC691	120p
74HC4002	25p
74HC4015	85p
74HC4016	75p
74HC4017	43p
74HC4020	50p
74HC4022	40p
74HC4024	34p
74HC4028	40p
74HC4040	34p
74HC4049	50p
74HC4050	50p
74HC4051	95p
74HC4052	95p
74HC4053	55p
74HC4059	85p
74HC4050	33p
74HC4066	33p
74HC4072	33p
74HC4075	26p
74HC4078	32p
74HC4094	50p
74HC4316	100p
74HC4351	110p
74HC4352	180p
74HC4310	120p
74HC4511	35p
74HC4514	140p
74HC4515	130p
74HC4516	130p
74HC4518	70p
74HC4520	80p
74HC4533	90p
74HC4543	120p
74HC7266	75p
74HC22106	580p
74HC40104	190p
74HC40105	250p

74LS SERIES LOW POWER SCHOTTKY T.T.L.

74LS00	14p
74LS01	14p
74LS02	14p
74LS03	14p
74LS04	14p
74LS05	14p
74LS08	14p
74LS09	15p
74LS10	14p
74LS11	14p
74LS12	14p
74LS13	22p
74LS15	15p
74LS20	15p
74LS21	15p
74LS22	15p
74LS24	38p
74LS26	15p
74LS27	15p
74LS28	15p
74LS30	15p
74LS32	17p
74LS33	17p
74LS31	16p
74LS38	17p
74LS40	16p
74LS42	28p
74LS47	56p
74LS48	52p
74LS51	15p
74LS54	15p
74LS55	17p
74LS73	26p
74LS74	20p
74LS75	26p
74LS76	26p
74LS78	26p
74LS83	40p
74LS85	40p
74LS86	28p
74LS90	29p
74LS91	60p
74LS92	35p
74LS93	28p
74LS95	45p
74LS96	56p
74LS107	30p
74LS109	30p
74LS112	30p
74LS113	30p
74LS114	30p
74LS122	38p
74LS123	38p
74LS124	85p
74LS125	32p
74LS126	32p
74LS132	32p
74LS133	32p
74LS136	32p
74LS138	31p
74LS139	31p
74LS145	70p
74LS147	100p
74LS148	80p
74LS151	30p
74LS153	36p
74LS154	85p
74LS155	36p
74LS156	41p
74LS157	28p
74LS158	31p
74LS160	44p
74LS161	44p
74LS162	44p
74LS163	40p
74LS164	40p
74LS165	56p
74LS166	60p
74LS168	68p
74LS169	60p
74LS170	75p
74LS174	36p
74LS175	38p
74LS190	51p
74LS191	48p
74LS192	46p
74LS193	47p
74LS194	47p
74LS195	50p
74LS196	55p
74LS197	48p
74LS221	50p
74LS240	50p
74LS241	46p
74LS242	50p
74LS243	55p
74LS244	45p
74LS245	48p
74LS247	46p
74LS248	48p
74LS249	78p
74LS251	28p
74LS253	40p
74LS256	58p
74LS257	38p
74LS258	40p
74LS259	55p
74LS260	38p
74LS266	26p
74LS273	50p
74LS279	37p
74LS280	100p
74LS283	55p
74LS290	30p
74LS293	30p
74LS365	30p
74LS366	35p
74LS367	33p
74LS368	35p
74LS373	50p
74LS374	50p
74LS375	52p
74LS390	46p
74LS393	41p
74LS399	75p
74LS629	105p
74LS641	100p
74LS642	140p
74LS644	140p
74LS645	140p
74LS670	68p
74LS674	320p
74LS687	260p

COMPUTER IC'S

2114	200p
2532	330p
2716	200p
2732	280p
2732A	300p
2764	240p
27C64	550p
27128	350p
26256-25	400p
41256-15	450p
256DRAM	450p
4116	75p
4164	150p
6116	200p
6264-15	300p
6502	300p
6502A	400p
65C02	930p
6503	570p
6520	170p
6522	330p
6530	1050p
6532	460p
6545	880p
6551	530p
6800	210p
6802	220p
6803	800p
6808	500p
6809	600p
6810	150p
6818	380p
6820	140p
6821	140p
6840	310p
6845	620p
6850	110p
8080A	400p
8085A	300p
8155	360p
8156	360p
81LS95	120p
81LS96	130p
81LS98	130p
8224	270p
8226	270p
8228	270p
8243	250p
8250	850p
8087	11000p
8251	320p
8253	320p
8255	310p
8256	1200p
8257	350p
8259	360p
8271	3400p
8272	1200p
8279	450p
8282	300p
8283	400p
8284	440p
8287	360p
8288	650p
8748	1100p
8755	1400p
AY3-1015	290p
AY5-3600	570p
SP0256AL2	500p
Z80ACPU	180p
Z80BCPU	500p
Z80ADMA	650p
Z80AP10	230p
Z80BP10	480p
Z80ACTC	250p
Z80AS10	660p
Z80AS10-1	700p
Z80BP10-2	700p
Z80ADRT	680p
74S188	175p
74S189	210p
74S201	240p
74S287	190p
74S288	160p
74S289	180p
74S387	200p
75107	80p
75108	80p
75109	110p
75110	80p
75112	140p
75113	105p
75114	130p
75115	130p
75121	125p
75122	125p
75150	110p
75154	110p
75158	140p
75159	200p
75160	400p
75161	400p
75162	700p
75172	720p
75182	100p
75183	100p
75188	60p
75189	60p
75195	185p
75322	130p
75324	340p
75325	155p
75365	145p
75450	45p
75451	42p
75452	42p
75453	65p
75454	65p
75480	135p
75491	60p
75492	60p
8T26	95p
8T28	110p
8T31	330p
8T95	90p
8T96	110p
8T97	90p
8T98	110p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO RUBBER BELTS

AKAI	
VS-2EG/5EG 5 belts/kit	180p
VS-9300 7 belts/kit	220p
VS-9700EG 6 belts/kit	200p
VS-9500/9800 7 belts/kit	220p
JVC	
HR-3300/3600 9 belts/kit	220p
HR-3330 7 belts/kit	200p
HR-3360/3660 7 belts/kit	190p
HR-4130 7 belts/kit	195p
HR-7200 3 belts/kit	75p
HR-7600 3 belts/kit	145p
HR-7730 3 belts/kit	77p
NATIONAL	
NV-300 5 belts/kit	160p
NV-333 5 belts/kit	135p
NV-777 4 belts/kit	130p
NV-2000 5 belts/kit	155p
NV-3000 6 belts/kit	180p
NV-7000 5 belts/kit	100p
NV-7200 5 belts/kit	90p
NV-8600 7 belts/kit	200p
SONY	
SL-C72SL-J7 6 belts/kit	140p
SL-T7ME/T7MER 6 belts/kit	170p
SL-T9/P7/J9 7 belts/kit	210p
SL-8000-8080 6 belts/kit	240p
SANYO	
VTC-5300 5 belts/kit	190p
VTC-5500 3 belts/kit	95p
VTC-9300 4 belts/kit	240p
HITACHI	
VT-5000 7 belts/kit	155p
VT-8000 3 belts/kit	110p
VT-11 5 belts/kit	190p
FISHER	
VBS-7000 6 belts/kit	245p
VBS-9000 3 belts/kit	120p
TOSHIBA	
V-5250/5280 5 belts/kit	230p
V-5480 7 belts/kit	210p
V-5475 6 belts/kit	190p
V-7540 5 belts/kit	190p
V-8600 6 belts/kit	150p
SHARP	
VC-6300 5 belts/kit	195p
VC-7300 5 belts/kit	160p
VC-8300 5 belts/kit	175p
VC-9300 5 belts/kit	155p

CASSETTE MOTOR

6V	290p
9VCW	290p
12VCCW	290p
12VCW	290p
13.2VCW	290p
13.2VCCW	290p

CASSETTE TAPE HEADS

Mono Head	90p
Stereo Head	150p
Mono Mini Head	230p
Auto Reverse Head	260p

VIDEO MOTORS

Sanyo	
Reel Motor (RM11) P/N 4-529V-10800	790p
Capstan Motor 4-527V-51000	2400p
Sony	
Capstan Motor BHF-1100D	2500p
Sharp	
Reel Motor RMOTB 1007 Gezz	1750p
Reel Motor RMOTM 1008 Gezz	1750p
Loading Motor RMOTM 1017	1000p
JVC	
Capstan Motor PU-55371V	2200p
Capstan Motor PU-45979	2250p
Drum Motor PU-46414	2250p

VIDEO PINCH ROLLERS

National	
NV-300	475p
NV-7000	475p
Sanyo	
VTC-9300	475p
VTC-5500	475p
Sony	
SL-T7	475p
SL-C7	475p
JVC	
HR-3300	500p
HR-3330	500p
HR-3360/3660	500p
HR-7200	500p
HR-3300	500p
Akai	
VS-9700EG	360p
Hitachi	
VT-5000	475p
Sharp	
VC-6300/6500	

IDLERS & PULLEYS REPLACEMENTS

Sanyo	
Reel, Pulley 143-0-662T-01201	520p
Gear Idler 143-04904-00900	450p
Take Up Idler 143-0-4204-00100	650p
Idler 143-256T-03200	450p
Sony	
Rew Pulley A-6706-348-B	400p
Rew Pulley A-6706-391-A/B	300p
Sharp	
Idler Assembley NIDL0005 Gezz	325p
Idler Assembley NIDL0006 Gezz	325p
Idler Sharp NIDL0005 Gezz	225p
Hitachi	
Idler Assembley 6886971	300p
Idler Assembley V-68661482	385p
JVC	
Idler Assembley PU-47752	480p
Take Up Idler PU-51402A	145p
Take Clutch PU-55373	225p
Idler Arm PU-55374-3-8	285p
Fast Forward Idl PU-45896C	210p
National	
Idler	300p

SERVICE AIDS

SERVISOL PRODUCTS

V. Head Cleaner	85p
Switch Cleaner	100p
Silicone Grease	115p
Freeze It	105p
Foam Cleaner	105p
Anti-Static	105p
Aerokleane	90p
Aero Duster	115p
Plastic Seal	105p

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SONY on/off SWITCHES 250p
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UNIVERSAL VIDEO LAMP 12V 60mA (300mm Wires) RED OR BLUE	30p
VIDEO LAMP FOR PANASONIC	60p

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22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	50p
2200 MF	60p
4700 MF	110p
25 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	50p
2200 MF	70p
35 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	20p
220 MF	25p
470 MF	30p
1000 MF	60p
2200 MF	100p
40 Volts	
10 MF	15p
15 MF	15p
22 MF	15p
47 MF	20p
100 MF	25p
220 MF	30p
470 MF	35p
1000 MF	50p
2200 MF	190p
50 Volts	
1 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	20p
22 MF	25p
63 Volts	
0.47 MF	15p
1.0 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	15p
22 MF	20p
47 MF	25p
100 MF	30p
220 MF	35p
470 MF	50p
1000 MF	100p
100 Volts	
0.47 MF	15p
1.0 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	15p

ELECTROLYTIC CAPACITORS

AXIAL LEAD

16 VOLTS	
47 MF	25p
100 MF	30p
220 MF	35p
470 MF	45p
1000 MF	60p
2200 MF	120p
4700 MF	160p
10 VOLTS	
470 MF	40p
1000 MF	50p
2200 MF	70p
25 VOLTS	
22 MF	25p
47 MF	35p
100 MF	35p
220 MF	40p
470 MF	45p
1000 MF	70p
2200 MF	125p
35 VOLTS	
10 MF	25p
22 MF	25p
47 MF	30p
100 MF	35p
220 MF	40p
470 MF	90p
1000 MF	110p
2200 MF	160p
40 VOLTS	
10 MF	25p
22 MF	30p
47 MF	35p
100 MF	40p
220 MF	50p
470 MF	60p
1000 MF	100p
2200 MF	160p
63 VOLTS	
1.0 MF	25p
2.2 MF	25p
4.7 MF	25p
10 MF	30p
22 MF	35p
47 MF	40p
100 MF	50p
220 MF	60p
470 MF	100p
1000 MF	160p
100 VOLTS	
1.0 MF	25p
2.2 MF	25p
4.7 MF	30p
10 MF	35p
22 MF	35p
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SOLDER

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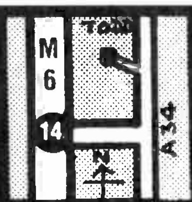

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AN360	£1.30	AN7161	£3.75	HA1367	£3.25	LA1368	£2.50	LA7806	£2.75	STK2028	£7.50	TA7271P	£2.75	UPC1263C	£2.50
AN362L	£1.60	AN7166	£3.95	HA1368	£1.90	LA1385	£1.95	LA7808	£2.95	STK2029	£5.75	TA7272P	£2.95	UPC1277H	£2.75
AN363N	£3.50	AN7168	£2.75	HA1368R	£1.95	LA1387	£3.60	LA7820	£2/75	STK2038II	£9.50	TA7273P	£3.20	UPC1278H	£2.75
AN366P	£1.70	AN7178	£2.95	HA1370	£3.70	LA1460	£2.50	LA7910	£2.20	STK2125	£6.75	TA7274P	£2.95	UPC1363C	£2.75
AN374P	£2.20	AN7213	£1.95	HA1372	£3.50	LA1464	£3.20	LA7920	£1.75	STK2129	£6.75	TA7280P	£3.50	UPC1364C	£4.75
AN377	£2.00	AN7218	£1.75	HA1374	£2.50	LA2100	£2.95	LB1405	£2.20	STK2230	£6.50	TA7281P	£2.95	UPC1365C	£3.60
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AN5701	£1.80	BA313	£0.80	HA11219	£3.25	LA4031P	£1.95	M51513	£1.80	STK4352	£6.50	TA7628P	£2.95	BRY56	£0.20
AN5722	£1.60	BA314	£2.20	HA11221	£2.75	LA4032P	£1.90	M51514	£1.95	STK4392	£7.50	TA7640AP	£1.75	BT106	£1.00
AN5730	£1.85	BA318	£1.50	HA11223W	£3.80	LA4100	£1.20	M51515BL	£2.50	STK4803	£8.50	TA7658P	£1.75	BU208A	£1.20
AN5732	£1.85	BA328	£2.50	HA11225	£1.95	LA4101	£1.00	M51516BL	£2.80	STK4833	£9.50	TC9106BP	£4.95	BU208D	£1.80
AN5750	£3.75	BA333	£1.50	HA11226	£4.50	LA4102	£1.40	M51517L	£2.80	STK4843	£8.95	TD62105P	£3.50	BU326A	£1.95
AN5753	£1.95	BA335	£3.60	HA11235	£2.30	LA4110	£1.75	M51518L	£2.20	STK5211	£6.75	TDA1010A	£2.25	BU500	£1.80
AN6250	£2.30	BA340	£2.50	HA11251	£2.75	LA4112	£1.75	M51521L	£1.90	STK5315	£6.75	TDA1011A	£2.50	BU508A	£1.80
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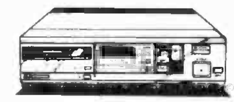

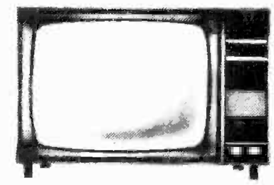

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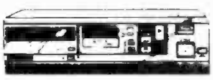

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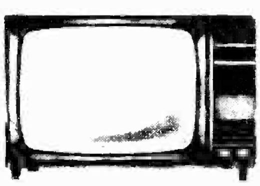

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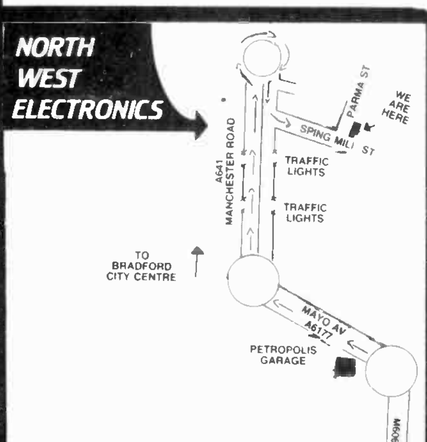

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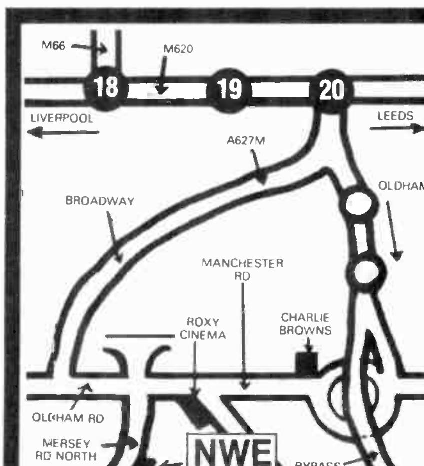

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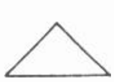

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HA411485 £1.00
UPC1373 50p
M50143 £1.00
4491BB1 £1.00
458657P 25p
50441/550 3p
58658P £1.00

Delay Line TDK Small Gray 10p
DK Blue Type 50p

420M 400V £1.00
470M 380V £1.00
220/400V £1.00
1200PF 15KV 10p
.01 2KV 10p
1+1 MFD Mains Filter ITT 3 Pin 15p
1/100 × 10 30p
22/100 10p
4 7M/100 5p
470/100 20p
4700/100 75p
47/160 10p
300 300/300V 80p
800/160 50p
.1/250 Pulse 5p
2.2 250v 10p
7N5 1500V 15p
5n3/250 A.C. 10p
33/250V 20p
.39/250V 15p
4n7/250 tested 5KV 25p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
GEC600/250 60p
700/250 £1
300+300 MFD 350v £1.00
800/250 40p
32/300 20p
4/350 5p
8/350 8p
4.7M/350v 10p
33/350 20p
220/350 30p
300/350 40p
400/350 50p
22/375 15p
220/385 (ITT) 75p
330/385 CVC 820HT 60p
0.1/400 15p
KT3 E/W .39/400 15p
.56K/400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K/400V 20p
220/450 40p
.47/500 25p
0.1/600 15p
0.1/1200V wire end 20p
0.1/450 A/C wire end 20p
.22/1000 20p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.47/1000v 65p
.47/250V A.C. 10p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 10p
1n8/1500 15p
2n2/1500 15p
.01/1600 15p
G11.8200/2KV 15p
0.1/2KV 20p
3n9/2KV 15p
0.0015/2KV 10p
6n2/2KV 15p
2n2/2KV 15p
470pf 4KV 10p
7500pf/2KV 10p
3000PF/3000V 10p
4n7/2KV 15p
6n2/2KV 10p
7n1/1500V 10p
8n2/1500V 10p
9n1/2000V 10p
8n2/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p
.47/100V 80p
Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF T115A £13.00
10 off 91 CAP G11 £2.00
Philips K4 CAP 150M/385V 50p

CVC 20-25-30 Mains Switches 60p
Int'a Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
G8 Mains Switch 75p
G11 Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC-2011 50p
Mains Switch ITT Long Type Print 75p
Mains Switch Philip Long Type TAG 75p
Mains Switch GEC Long Type TAG 75p
2000 Chassis Fidelity Mains Switch (4 TAG) 60p
250V/4A White Lorlin Mains Switch 60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG) £1
Teletext Adaptor Kit TY-500 Panasonic £12
Philips Battery Tester All Types and charger vis £6

Multi-Caps

220 MFD Sprague 385V 50p
350V 300M + 300M £1.00
400V 400M 60p
350V 400M 60p
Thorn 3500
175/100/100/350v £1.00
KT3/200/25/25/385v £1.00
KT3-K30 220+40+40 75p
200+200+75+25M 325V £1.00
300+300+150+100+50MFD 350V £2.00
G11 CAP 470/250 £2.50
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
150/200/200/300v 70p
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
200/200/75/25M 375V £1.00
Thorn TX9 Caps 500+500M 175V £1.00
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT 8 and 6 Push Button £1.00
Pye 725 LOPTs £6.00
Pye 731 LOPTs £6.00
Thorn 8500-8800 LOPTs £5.00

CMC 301 front panel £5.00
CMC 303 front panel £5.00

CMC 302 Panel with TC mains switch etc £5.00

CMD 800 Decoder £8.00

G11
1 I.C. Receiver Panel £1.50

3 I.C. Power Supply G11 Full Remote Receiver Panel £3.00

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £10.00
Hills HD5000 Digital Meter 1000V DC
750AC 10 Amp 20 MRG Rangers £28
HT100 Multimeter £6.75
HT300 Multimeter £7.75
HT500 Multimeter £9.00
HT700 £15.00
HD1000 Digital £20.00
HD3000 Digital £25.00
HD5000 Digital £25.00
HD5500 £29.00
HD6000 Digital £32.00
HD8000 Digital £37.00
HD9500 Digital with capacity Temp
Trans Volts Ohms and Amps ranges £60

Infra Red
Hanset Tester
Works at 24 feet – Sound repeater.
Works off 9 volt battery £8.00
Fits in top pocket.

Handset Tester with LED £4.50

Repaired Handsets
Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

NEW Type RC4001 9 CH not 12 £6.00

GEC Full Remote Infra-red, 1983 models £15.00

Timers, 60 mins, small £1.00

TOSHIBA
HAND SETS
24 Button CT938 Fullremote £5.00
32 Button CT983 Videotext £6.00

THORN
VCR Front Display Panel £7.00

Large type ITT TV and V.C.R. Handset £15.00

GEC Ultrasonic 8CH Full Remote £10.00

G11 Full Remote Ultrasonic £32.00
G11 Ultrasonic Teletext Handset £20.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £20.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
G11, Full remote top button assy. £12.00
G11, Full remote repair service (exchange unit) £18.00
GEC infra red full remote 8 channel (I.C.SAA1250) £14.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T/Text £15.00
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
GEC infra-red 2236-2026 £4.00
GEC 8 button full remote £14.00
GEC push pad handset button hlobs 10p **each**
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
Special Price £13.00
RC4001 KT3 and Teletex £14.00
IT CVC 32 handset repaired £15.00
CVC 32 Hand Set £15.00
CVC 45 3 and 2 Pin
TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00

ITT
T/V & Video Processor 1200 Type £10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

RC5353 £15.00
RC5300 £12.00
Philips RC5 £15.00

TEXT-TYPE
Replace Hand Set for
Philips KT3-K30, K4 etc £12.30

THORN HAND SETS
9000 – 9600 – TX9 – TX10 – TX100
Text and Non-Text £10.00

PHILIPS
RC5171 £12.00

K35-K4 HAND SET
Repaired for £5.00