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BBC Funding

How to finance the BBC has always been a contentious issue. It's becoming more complex as broadcasting technology advances. BBC funding during the second half of its present ten-year charter, from 2002-2006, is at present being considered by a government panel headed by economist/banker Gavyn Davies. Several possible of boosting ways Corporation's finances, in particular to enable it to increase its digital activities and output, are under consideration. One that has hit the headlines recently is the idea of a digital TV licence supplement. It has the advantages of simplicity and a strong precedent - the colour licence fee. Perhaps however it's already too late: we are now into the digital TV era, with no such licence supplement. That apart, would it have an adverse effect on viewers' willingness to migrate to digital TV?

Evidence presented to the panel by London Economics suggests that a "digital levy" would not have an adverse effect on the public's willingness to purchase digital TV equipment – the London Economics research was commissioned by the BBC. The fact that decoders are now available free and ITDV receivers are subsidised complicates the issue. How would the public react to a digital licence fee in these circumstances? London Economics has suggested a "modest" fee of £30-£35 a year as a digital supplement to the current £101 licence.

The idea of such a supplement has been around for some time, and is favoured by the BBC. The commercial TV companies are, not surprisingly, firmly opposed to it. Digital broadcasters ONdigital and BSkyB have argued that a

levy would have a "devastating effect" on their ability to gain extra subscribers. This seems to be an overreaction to say the least.

During its last financial year the BBC spent seven per cent (£154m) of its £2.2bn licence fee income on digital TV services. This includes setting up digital TV channels and developing the Corporation's internet activities. The Corporation now broadcasts BBC1 and BBC2 in widescreen digital TV format. and has launched BBC Parliament, News 24 and BBC Online, Europe's largest internet site. This obviously has to be paid for and, if we wish to maintain the position of public service broadcasting in the spectrum of broadcasting services available, some means of doing so on a sound, lasting basis has to be found. The BBC says that it needs an additional £200m a year to finance its digital TV activities.

An alternative suggestion, which is also being considered by the panel, is that the BBC should fund digital TV by introducing a limited amount of advertising, possibly during non-peak hours. The panel has been impressed by the experience of German state broadcasters ARD and ZDF, which are allowed to broadcast twenty minutes of advertising every weekday before 8pm.

Again not unexpectedly, the ITV companies have expressed disapproval of this idea. Their case was eloquently put by Richard Eyre, chief executive, ITV Network, in a recent letter to the Financial Times.

He argued that "The BBC is regarded as the prime example of public service broadcasting precisely because it carries no advertising on any of its licence-funded services. Experience on the Continent has been that even a partial dependence on advertising begets changes in the nature of services, to enhance their earning capacity. This is why the chairman of the BBC said, in evidence to the Commons select committee on culture, media and sport in November last year, that allowing any advertising on BBC services would be 'the thin edge of the wedge". Richard Eyre went on to question whether it was "acceptable for the BBC to spend licence payers' money on new programme streams that are not universally available". Any advertising would, he suggested, "reduce the sums available for investment in programming on the commercial channels". This is debatable to say the least. Advertising revenue is not a fixed sum that has to be shared around: it's something that will expand naturally as media opportunities increase. Richard Eyre concluded that "Entirely separate funding is the sine qua non of the BBC's distinctiveness and the guarantor of the diversity of the programmes enjoyed by British viewers'

A hybrid proposal is to go for a small digital licence fee and limited advertising. This sounds like a fudge, neither one thing nor the other, and unlikely to satisfy anyone.

One thing is certain. The debate will become a lot more heated once the Davies panel's proposals are made known. But the basic fact is that you can't have something for nothing. The BBC needs extra funding to enable it to play a part in the unfolding world of digital broadcasting. A digital licence fee seems to be a sensible way of providing it.

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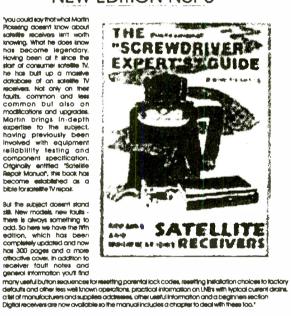
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What Life!

All sorts of video equipment, all sorts of customers. Donald Bullock's day-to-day servicing commentary

The work really started to pile in once Steven had gone away to Cyprus on his honeymoon. Isn't that always the way?

"Tape jammed in Mr Pullet" the shiny-faced man said as he marched in with a newish Toshiba VCR. "Can't be much wrong, because it's not very old. Just as well too, 'cos I can't afford much."

As I booked the repair in, I heard Paul groaning in the background.

At almost the same time that Shiny-face left, a man wearing a cowman's smock came in. He was also carrying a Toshiba VCR. Identical to the first one in fact.

"I put the tape in, Mr Tarbuck, and started it playin'. Then it clicked and went off' he said. "An' I couldn't get the tape out to try another one. Take it out for me, there's a good chap. I'll pop back after market. Won't cost me anything, will it? Not for poppin' a tape out."

Paul, in the background, gave another groan.

"That's two more" he moaned. "What's the matter?" I asked.

The Toshiba Problem

"It's these latest Toshibas" he replied. "I did two of them last week. There's a main cam lever to do with pulling the tape out of the cassette. It's a sort of metal rod with a ball at the end. The ball snaps off, and to carry out the repair you have to take the front off, take out the cam motor and cam, then the mode switch, cassette housing and pinch wheel. These all have to be put back again and set up. It's quite a business!"

The first one to come Paul's way had him guessing. So he'd phoned Toshiba. The technical wizard at the other end said "the ball

will have snapped off the main cam lever. You'll have to fit another one."

The two I'd just taken in had the same fault. So to make Paul's life easier I slipped out and made him a strong cup of tea. And one for myself, too.

Telly/video Thing

While he was busy with the Toshiba VCRs I noticed that Mrs Gabber had bumped into Mrs Sapp outside the open shop door. They were having a great chat, and it was Mrs Gabber I could hear.

"... yes, we came home from our trip up town and found him dead. Absolutely dead! And he was only just three years old. The house is so quiet without 'im. He was on all the time of course ..."

"What are you going to do about it?" asked Mrs Sapp.

"I've got him in the car. I'll get that Mr Bullock to take a look at him."

Then she came in.

"I've brought our telly/video thing for you to have a look at dear" she said. "Dead. But it can't be much. We don't hardly have him on. And another thing, he's only just over a year old. And my husband's a pensioner."

I followed her out to the car. The set was a GoldStar TV/video combination, Model KY14V30.

When she'd gone we put it on the bench. The power supply for both sections is on the TV chassis. It didn't take us long to find that the STR6707 power chip was short-circuit. So we fitted a replacement and tried the unit: the recorder and the TV were both in standby. When we pressed the standby switch the relay shattered.

We eventually found that the cause of the trouble was a leaky

zener diode, ZD802 (6.8V). It's in the base circuit of Q1801, which smooths the DC supply to the power chip. A replacement restored normal operation.

Sport's the Word

Our next customer, Bob Chancer, brought in a Sony TV set, Model KVM1921U (BE2A chassis). He plonked it on the counter.

"See the match?" he asked.
"What did you think of that second
goal? Ref wants shooting if you ask
me. But – fair play – do you kno . . ."

me. But – fair play – do you kno . . . "I don't follow golf" I cut in, tapping the top of the set. "What's wrong with this?"

"Dead as a doornail" he exclaimed. "But – fair play – it's been a good 'un. We bought him to watch the Cassius Clay fight. The one that lasted ten seconds. Waste of time. But – fair play – . . ."

I waved him out and took a look at the set. It was dead with no standby light. When I opened it up I found that there was 330V DC across the mains bridge rectifier's reservoir capacitor but no start-up voltage at the STR54041 chopper chip IC601. We'd have found the culprit, R602 (270k Ω , 0.5W), sooner had it not been hidden under the chopper transformer. In fact we removed the chopper transformer on spec before we found it.

Bob called back for it straight from a local football match. He was red about the gills and hoarse.

"Never had a chance, we didn't. I tell you, no team that puts a half-back in the goalie's place can expect to win. Bloody madness. But – fair play – . . . "

"It's ready, Bob" I said. "A resistor had failed. Twenty five pounds to you."

"Twenty five pounds?" he spluttered. "But them resistor things are only tuppence, aren't they?"

He paused for a minute, then continued.

"Nah – pair play – you got it done quickly. I'm happy at that, fair play."

And he paid up and went.

Transport

Mr Nuggins brought his set along in a wheelbarrow. It was a Matsui 21V1N, about two years old – a 21in. stereo model. He heaved it on to the counter and stood there clawing at his rib cage. Then he stretched and danced around trying to scratch the middle of his back.

"Don't know what makes me itch so" he said.

"Visitors?" I suggested.

"On my own this week. That's why I'm missing the set. It's dead."

As he gyrated out, I took the back off and saw that its 2.5A mains switch had died a violent death. There was a dead short across the mains input. I made for the BY127 diodes in the bridge rectifier circuit and found that they were all shortcircuit. Once replacements had been fitted there was still a short-circuit across their output. The cause turned out to be the IRFBC40 chopper transistor T60020. This MOSFET device is rated at 6.2A. I fitted a BUZ91, which is rated at 8.5A, and also replaced the UC3843 chopper control chip.

As everything now checked out all right I switched the set on. There was an excellent picture.

Electronic Screwdriver

There was a time when few TV sets with the excessive height symptom would have got as far as the bench. But that was the problem with the next set I pulled from the pile, a Sharp DV5161H. The reason why no one had turned the height control down was that there isn't one. In fact the only potentiometer on the chassis is the set-HT one. The picture geometry adjustments are all carried out via the 'electronic screwdriver' chip. I obeyed the instructions, as follows.

At the back of the chassis there's a teletext subpanel which has two connection plugs marked TA and TB. I fitted a wire link between pins 3 and 6 of plug TB. Then I switched the set on and pressed the remote control unit's mode button. The word SERV appeared on the screen. Once the added link has been removed the set is in the service mode and you can use the remote control unit's channel up/down buttons to find the required adjustment.

I called up 'vertical amp' and used the up/down buttons next to the mode button to get the correct setting. You finally press the mode button once to exit from the service mode. All the picture adjustments – grey scale, width, etc. are carried out in this way.

A Decoder Thing

Mrs Rivetto is about seventy five. But she has false eyelashes, blue rinsed hair and an unshakeable belief that she's still eighteen.

"Hello sunshine" she trilled. "I've brought our decoder thing in. It went bang the other night and my silly old hubby says it's faulty."

It turned out to be a Ferguson SRD6. The mains fuse had gone to its maker and the BUT11AF chopper transistor was short-circuit. In addition the $2 \cdot 2\Omega$ fusible resistor was open-circuit. Once these items had been replaced the unit worked perfectly and produced good results.

Mrs Rivetto was delighted when she called back for it. "He'll be able to bury himself in his silly old telly again" she sang. "Me, I like to get off out. No good sitting about getting old, is it?"

Sympathy

We've seen Mr and Mrs Hudson before. He's mild and well mannered, while his wife is loud and insensitive. He looked poorly, and the Philips CP110 TV set he was carrying was clearly almost too much for him. I helped him ease it on to the counter.

"You shouldn't have bothered Mr Bullock" she said, "good heavens, whatever next?"

"Aren't you too well today, Mr Hudson?" I asked.

"He's all right. Just likes a bit of sympathy" she replied.

He smiled faintly and looked embarrassed. Then they departed.

The set was 'dead', but there was plenty of life in it. Checks showed that the mains bridge rectifier's output was low at only 190V. The cause was reservoir capacitor C2656. It should have been 150µF but read only 70µF. A replacement restored normal working.

When they called back for the set I carried it out to their car. He was rebuked for his "laziness".

Authority

Mr MacPhail, an ex-military man, strode in. He's used to authority and shows it. He looked at Paul and pointed to his car.

"In the boot my boy" he said,



"bring it in will you?"

Paul looked at me, then MacPhail, then went for the set.

"On here" MacPhail said, tapping the counter. "Blasted thing's playing games with me. I'll have none of that. When I switch it on it bursts into life. Then, before I've had time to sit down, it goes off. Three nights it's done that. I want it right, or out it goes."

Once he'd departed we tried the set, an Hitachi C2114T. The EHT came up, then the set switched itself to standby. I tried it again. Same thing. Then I opened it up, expecting to find a dry-joint in the line output stage or something like that. But everything looked fine. So I adopted a more professional approach and studied the circuit diagram.

Next time I switched the set on I had an analogue voltmeter connected across its 27V supply, which is used for the field output stage. The supply came up then decayed. I let the set cool down, upped the first anode control's setting then tried again, with one eye on the meter and the other on the screen. I was just able to detect field collapse before the set died.

In this chassis a protection circuit comes into operation when there's a short across the 27V supply. I replaced the TA8427K field output chip IC601 and tried again. This time the set came on normally.

TELETOPICS

Interactive Satellite TV

Successful launch of the Astra 1H satellite into orbit at 19.2°E has brought closer the start of interactive TV via satellite, using the Ku and Ka bands. The Hughes Space and Communications HS601HP satellite was launched in late June from the Cosmodrome at Baikonur, Kazakhstan. It has thirty transponders with an output power of 98.5W in Ku band, 70W in Ka band, from travelling-wave amplifier tubes. Ka-band operation is to be used for broadband interactive applications, in conjunction with low-cost user terminals. There are already two names for the interactive technology - Return Channel Technology (RCT) and

Astra Return Channel System (ARCS). Interactive services are due to come into use early next year.

For interactive use a Satellite Interactive Terminal (SIT) with a small fixed dish will be required. The present plan is to make SITs with three dish sizes available: a 1.2m dish will provide a data transmission rate of at least 2Mbits/sec, a 90cm dish a data rate of up to 384kbits/sec and a 60cm dish a data rate of up to 150kbits/sec. Communication will initially be based on existing Internet Protocols (IPs), with terminals requesting a time and frequency slot for transmission "on demand". Future develop-

ments will include the use of asynchronous-transfer mode technology for the return channel to improve system performance.

The user return channel will be handled by SES's Network Operation Centre in Luxembourg. A number of uses are envisaged: for large and small businesses, the public sector and individual viewers. Services could include data collection and transfer between branch offices and a head office; delivery of prerecorded news feeds from remote sites; return channel services from temporary sites, for example for emergency operation; remote learning and training and many others.



Two precision video monitors in the Leader 5000 range are now available from TTi. The 5212 vectorscope and 5222 waveform monitor offer multi-channel inputs for both composite and component signals, with automatic PAL/NTSC selection. Line selection with the 5222 enables BITS, VIR and teletext lines to be observed. For further information apply to Thurlby Thandar Instruments Ltd., 2 Glebe Road, Huntingdon, Cambs PE18 7DX. Tel 01480 412 451, fax 01480 450 409.

Business News

The proposed transfer of Daewoo Electronics to Samsung as part of a government-sponsored industrial rationalisation has fallen through. Samsung's car manufacturing company, which was to be transferred to Daewoo under the restructuring agreement, has been put under court receivership. Daewoo plans to sell its consumer electronics operation to foreign investors.

Thurlby Thandar Instruments (TTi) has acquired the test equipment business of Black Star from Prima Electronic Services. Black Star's range, much of which complements the current TTi range, includes TV and video test equipment, oscilloscope probes, frequency counters, function generators and precision measurement products. For further information contact Thurlby-Thandar Instruments Ltd., 2

Glebe Road, Huntingdon, Cambs PE18 7DX. Tel 01480 412 451, fax 01480 450 409 or check web site

www.ttinst.co.uk

Prima Electronics Services is to concentrate on contract manufacturing.

A.R.D. Electronics has been appointed an official distributor for Pace spares. A separate catalogue is available for these. It includes the more popular spares for analogue receivers plus full parts listings for the ONdigital and Sky Digibox models. Other Pace spares can be obtained to order. A.R.D.'s main 1999 trade catalogue has over 600 pages with comprehensive technical information and pictures to help with product identification. A.R.D. Electronics Plc is based at Shorten Brook Way, Altham Business Park, Altham, Accrington, Lancs BB5 5YL. Tel 01282 683 000, fax 01282 683 010.

Lead-free Soldering

An EU ban on the use of lead in solder is expected to come into effect in 2004. The PCB industry has called for a delay, and dumping of scrap electronic products in landfills to be outlawed instead.

The ITRI, formerly known as the International Tin Research Institute, has launched what is believed to be the world's first Lead-Free Soldering Technology Centre at Brunel Science Park, Uxbridge, Middx. Research into lead-free soldering is not new at the ITRI: a scientific team has been investigating alternative solutions for over a decade. The new centre is to be officially opened next month.

Video News

A number of new products have been announced by Sony. Four are based on use of the company's Memory Stick, a recordable IC memory card designed for use with PCs and digital audio-visual equipment. They are the Cybershot DSCF55 digital still camera, which uses JPEG compression to store images in the memory. At the highest resolution, 1,600 x 1,200 pixels, 40 images can be stored in the 16MB stick. The same 16MB stick can hold ten and a half minutes of movie filming with MPEG compression. The other products are a digital camcorder, Model DCRTRV10, a digital photo frame, Model PHDA55, and the DPPMS300 digital photo printer.

The Sony VCR Model SLVSE 80UX has several interesting features including a new Smart Dial Timer system and Super Trilogic Picture Control. To set the timer, a dial is turned to set the start and stop times and channel number: the sys-

tem enables up to eight different programme recordings to be made over a 24-hour period. Those with a long memory will recall that the first Philips VCRs used a system that worked like an over-clock timer! The picture control system analyses the tape quality then adjusts the video head output for optimum picture quality.

Sony has launched its first DTT IDTV sets. The KV28DS60 and KV32DS60 are 16:9 28 and 32in. models respectively, with 100Hz scanning, Dolby Pro-Logic and an EPG. Both can be upgraded to receive ONdigital pay-TV channels by using a PC-card module.

A new digital video recorder (DVR) developed by Replay Networks is to be distributed by Matsushita under the Panasonic label. It uses solid state and hard-disk memory for storage. A DVR that works on similar principles, developed by TiVo, is being distributed by Philips.



This new range of products is based on the Sony Memory Stick (centre), a recordable IC memory card that holds 16MB of data. There's a digital still camera (top left) called the Cybershoot, a digital photo frame (top right), a digital photo printer (bottom right) and a camcorder (bottom left).

Could it be the start of a post tape/disc era?

Satellite TV

Eutelsat and SES have come to an agreement over the use of the disputed 29°E orbital position. Eutelsat claimed rights to the slot, but SES disputed this and launched Astra 2A at 28.2°E. Under the terms of the agreement SES will continue to use the BSS band (11.7-12.5GHz) and some frequencies (10.7-11.2GHz) in the FSS band for services and DTH broadcasting at 28.2°E. Eutelsat will use frequencies (11.2-11.7GHz) in the FSS band, and the telecom band (12.5-12.75GHz), at 28.5°E, in particular to ensure continuation of services currently carried by the DFS Kopernikus satellite. SES will use 12.5-12.75GHz at 28.2°E for operation outside Europe. Eutelsat's W1R satellite, to be launched next year, will occupy the 28.5°E slot. The agreement also covers mutually interference-free operation within the arc 16-21.5°E.

Eutelsat's Board of Signatories has given the go-ahead for the Atlantic Bird 1 satellite, which will take up position at 12.5°W in late spring 2001. This 20 Ku-band transponder satellite will cover Europe, North Africa, the near

Middle East, North and South

Recent announcements from BSkyB suggest that it will sign up a million SkyDigital subscribers well before the original target date of end-October. Some 800,000 subscribers had signed up by midJune. A significant boost was given by the offer of free STBs.

By late summer the Open TV/BSkyB digital teletext service SuperText will have replaced the current analogue-based version. Viewers will have access to some 2,000 pages of news, sport, finance, weather, travel and leisure information, with page access at approximately two-five seconds instead of six to thirty.

Eurosat has launched the Manhattan Plaza, a compact stereo satellite receiver with low threshold and multilingual on-screen graphics. Features include 600 programmable TV and radio channels, dual input, DiSEqC version 1.0, machine-to-machine data transfer and auto tuning. For further information contact Eurosat Distribution Ltd., 1 Oxgate Centre, Oxgate Lane, London NW2 7JA. Tel 0181 452 6699, fax 0181 452 6777.

Mobile TV

Hitachi is developing a system that enables TV signals to be transmitted via satellite to moving vehicles – for the benefit of passengers of course! The system, which will be able to provide up to 50 channels, is expected to be launched in Japan in 2002. Hitachi is establishing a consortium of companies to work on the project, including Toyota, Honda, Matsushita and NTT. A separate company will be formed, and Hitachi plans to apply for a broadcasting licence next spring. A satellite would be launched in 2001. Hitachi hopes to attract 46m subscribers for the service by 2010.

The BBC has demonstrated a mobile TV system using digital terrestrial transmission. The main problem is that the DTT transmission standard used in the UK is not sufficiently rugged for mobile reception – the bit rate has to be reduced by about 50 per cent. In addition, because vehicle aerials are mounted at a relatively low level, typically 2m, either higher-power or more transmitters would be needed. The BBC feels that mobile reception could be introduced when UHF spectrum space becomes available following the move from analogue to digital TV.

Internet Offers

BSkyB has launched Sky Now, a free internet service that offers e-mail, a hub for on-line services and content from Sky News and Sky Sports. A PC is required for access.

BBC Worldwide's web service beeb.com has formed an alliance with ScottishTelecom, which owns Demon Internet, to provide a free internet access service, 'freebeeb.net', with unlimited internet access, free e-mail accounts and free webspace for personal websites. The package works with PC or MAC computers.



By carrying out repairs to these sets you could probably make as good a profit as Tesco did. The circuitry is straightforward and most faults predictable. Chris Watton reports on his experiences with them

Tellys

or years we've grumbled about other businesses getting involved in ours, about garages and supermarkets and so on selling audio and video products. But it's a fact of life that we just have to accept. We can still gain some advantage. The small repair business can make a bit of cash from repairs that Tesco and the like cannot do. After all, these items do go wrong. And forty quid from a repair is as good as forty quid from a sale.

Most of the sets sold in these outlets are of Far Eastern origin. They are generally quite simple to repair, as they use mainly lowish technology. Most have only simple text and mono sound. Fortunately they are simple to operate and don't have loads of features that viewers never use. They present a few problems for us, but then that's why we are here, isn't it? You find the sets riddled with poor solder joints, particularly on subpanels. These cause simple failures.

One popular set is the Amstrad-badged PT9601 chassis. This article takes a look at the circuitry used in the chassis and some of the faults that can be encountered. The 28in. version is similar but has a different panel layout

The Power Supply

We'll start with the power supply, see Fig. 1, as this has to work before anything else will. The circuit is of a well-known type, being based on a TDA4605 chopper control chip (IC1) and a FET chopper transistor (Q1). Features of the IC include soft start, a supply voltage level detector and burst operation during an overload condition.

A start-up supply for IC1 is provided by R2, D8 and C11. The running supply is produced by D6 with C11. Once this supply has been established, regulation is provided by feedback from pin 3 of the transformer to pin 1 of the IC via R9, D7, R12, ZD1 and P1, with C12 for smoothing. The output pulses at pin 5 of the IC drive the chopper transistor Q1: P1 adjusts the drive pulse width and thus sets up the output voltages. These are 115V (+B), 33V (+D), 16V (+E), 12V (+A), 8V (+C), 5V (+F) and 12·5V (+G).

The standby switching voltage comes from pin 41 of

the microcontroller chip. It's applied to the base of Q20, which controls the voltage at pin 1 of the LM317 regulator chip IC3.

When Q20 is switched on, there is no 12V supply. The chopper FET fitted is type STH5N80. We've not seen it listed anywhere. A BUK454 is a suitable replacement.

The Line Timebase

The line driver and output stages are conventional. An EW diode modulator is included in the 28in. version. Line drive is generated by a TDA8362 chip, which in addition to incorporating the timebase generator stages includes the IF strip and the colour decoder circuitry. The line drive output is at pin 37.

Various voltages are generated in the line output stage, as follows: EHT, focus, first anode (screen), CRT heater, 180V (+M) for the RGB output stages and 26V (+K) for the field output chip. Feedback pulses for the TDA8362 and microcontroller chips are derived from pin 3 of the line output transformer (smaller screen version). In addition, a voltage for the beam limiter circuit is derived from the earthy end of the transformer's EHT section.

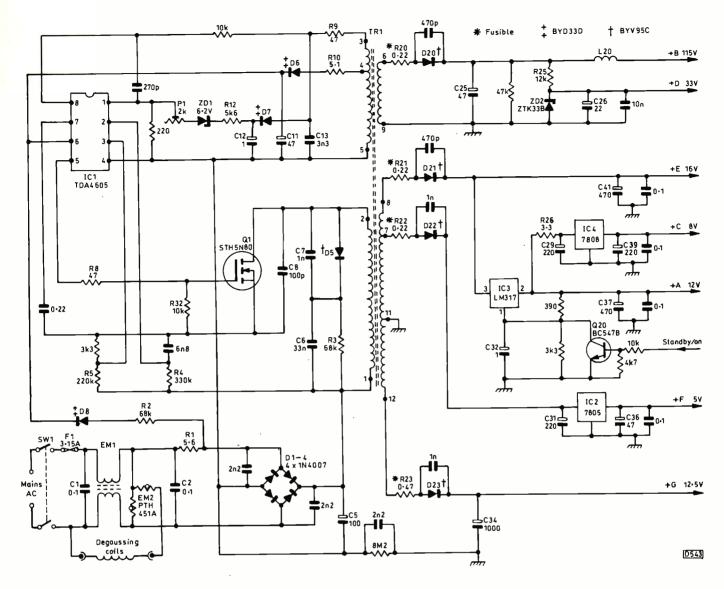
The line output transistor is type BUH515D or BU2508D in smaller-screen sets, type BUH515 or BU2508A in the 28in. model.

Field Output Stage

Smaller screen sets use a TDA3653B field output chip while the 28in. version uses a TDA3654. The field drive comes from pin 43 of the TDA8362 chip. The field ramp is generated at pin 42 of this chip, while pin 41 is used for linearity feedback.

RGB Drive

The RGB output stage arrangement, on the tube base panel, also varies with tube size. In the basic chassis a TDA6103Q chip, IC201, provides the tube's RGB drives at pins 9, 8 and 7 respectively. There are $82k\Omega,$ 0.5W feedback resistors between the IC's input and output pins. The 180V supply is fed to pin 6 of the chip via



R213 (47 Ω), with C206 (10 μ F, 250V) for smoothing. Potential divider R211 (220k Ω)/R212 (2.2k Ω) provides a supply for pin 5 of the chip – this is smoothed by C205 (0.22 μ F).

The 28in. version uses discrete-component cascode output stages – a JC547A/BF869 pair of transistors in each case.

Audio Output

The remaining power circuit is the audio output stage. In mono only models a TDA7056A chip is used. It requires a 12V supply at pin 2. Stereo models have a TDA7507A audio output chip. This has the 12V input at pin 4.

The Jungle Chip

The IF strip, the luminance and chrominance signal processing and the timebase generator stages are all contained within the TDA8362 jungle chip. There is only one adjustment, for the vision demodulator. Chroma processing is carried out in conjunction with a TDA4665 64µsec delay line chip. The jungle chip also carries out internal/external signal switching – for scart sockets and teletext. Table 1 provides pin-connection details.

The Microcontroller Chip

Simple sets use a CTV322 microcontroller chip, stereo sets a CTV352. It controls the analogue voltages for viewer adjustments, internal/external switching, chan-

nel tuning (voltage synthesis) and remote-control operation. An I^2C data bus provides links to the memory chip, the teletext circuit and, with stereo sets, the Nicam subpanel.

Pin 1 provides a pulse-width modulated output for channel tuning. The pulses are fed to the base of Q301, whose collector is linked to the 33V supply. This arrangement controls the charge developed by C302, i.e. the varicap tuning voltage. Filtering is provided by R305/6 and C303.

Pins 2-5 are the volume, brightness, saturation (colour) and contrast control outputs.

Pins 13-20 are used for on-board control keys.

Pins 22-24 provide RGB outputs for on-screen displays. These are buffered by Q304-6 then fed to pins 18-20 of the TDA8362 chip.

Pins 31 and 32 are connected to a 10MHz crystal, which is often dry-jointed.

Pin 35 is for the remote-control input.

Pins 39 and 40 are the I²C bus connections SDA and SCL. Connection is via the overload protection resistors R338 and R339.

Pin 41 provides standby/on control. The output goes to Q20 in the power supply.

Pin 42 is connected to the 5V supply.

Teletext

The simple text circuit uses a single SAA5254P chip, IC451. Pins 24 and 25 (SCL and SDA) are connected to

Fig. 1: The chopper power supply circuit used in Amstradbadged PT9601 sets, which have been sold in Tesco stores.

the I²C bus for mode and page selection instructions. The video input is at pin 8, via an AV/TV switching circuit and an emitter-follower (Q451-3). Pins 1 and 10 are connected to the 5V line. The 27MHz crystal is connected to pin 3. RGB outputs appear at pins 15-17, with a fast-blanking output at pin 19.

Audio Demodulation and Processing

In mono sets the demodulated audio signal appears at pin 50 of the TDA8362 chip. Tuning is set by a 6MHz filter at pins 5 and 7. With stereo sets there's a separate Nicam board which receives its input from the tuner

Table 1: Jungle chip (TDA8362) pin connections.

| Pin | Use |
|----------|---|
| 1 | Decoupling |
| 2-3 | Video demodulator coil |
| 4 | Video signal ident output |
| 5 | 6MHz sound/volume control DC input |
| 6 | Audio switching |
| 7 | Output to 6MHz filters |
| 8 | Decoupling |
| 9 | Chassis |
| 10 | Supply voltage |
| 11 | Chassis |
| 12 | Decoupling |
| 13 | Off-air composite video input to switch |
| 14 | Luminance delay peaking |
| 15 | External composite video input to switch |
| 16 | Input to chroma switch |
| 17 | Brightness control input |
| 18 | R outp <mark>ut</mark> |
| 19 | G output |
| 20 | B output |
| 21 | RGB switching |
| 22 | R input |
| 23 | G input |
| 24 | B input |
| 25 | Contrast control input |
| 26 | Colour control input |
| 27 | Hue control input |
| 28 | B – Y input from chroma delay chip |
| 29 | R - Y input from chroma delay chip |
| 30 | R - Y output to chroma delay chip |
| 31 | B – Y output to chroma delay chip |
| 32 | Crystal oscillator output |
| 33 | Filter for crystal oscillator PLL |
| 34 | Crystal 1 |
| 35 | Crystal 2 |
| 36 37 | Start supply |
| 37 38 | Line drive output |
| 39 | Line flyback pulse input Filter for line PLL 2 |
| 39 40 | Filter for line PLL 1 |
| 41 | Field linearity feedback |
| 42 | Field ramp generator components |
| 43 | Field drive output |
| 44 | AFC output |
| 45-6 | Input to IF amplifier |
| 45-0 | AGC output |
| 48 | AGC duput AGC reservoir capacitor |
| 49 | Tuner adjust (to AGC circuit) |
| 50 | Audio output |
| 51 | Decoupling |
| ٥, | - Josephing |

unit. There are three chips on this board, a TDA3845 IF amplifier/demodulator, an SAA7283 Nicam decoder and a TDA8425 for stereo switching.

Dry-joints

The Nicam subpanel suffers from dry-joints. Symptoms can be no sound, low sound or one channel intermittent. The problems usually occur at the wire links, and as usual will show up when the joints are heated (they splatter) though they look OK. They must be cleaned and resoldered.

Dry-joints tend to be present at all the crystals used in the chassis. I assume that they get tarnished during storage, with the result that the solder doesn't flow correctly.

The Cabinet

The back cover can be extremely tedious. Don't feel too bad if it takes four or five goes to get it back on, as it slots on to the PCB and into the front half of the set. It's best to place the set on its face and lower the cover on to it. With 28in. sets the front is so springy when the back is off that we find it best to place something beneath the tube, for fear that the set will snap in two!

To withdraw the chassis you will have to unsolder the lead from the tube's Aquadag earthing band to either the tuner or the can over the IF circuit. Remember to put it back.

When refitting the chassis, make sure that leads to the front panel don't get trapped in the plastic slots, as you won't be able to get the back on.

When the set is powered it will be in standby. To switch it on, press a remote-control unit number button or one of the channel up/down buttons on the set. If no signal is received, the set will revert to standby after five minutes.

Fault Notes

Dry-joints at the chopper transformer TR1 are the usual cause when you find that the set is dead with the chopper FET Q1 short-circuit. Always replace the TDA4605 control chip as well when Q1 has failed.

If there's no start up check R2 (68k Ω) and R22 (0.22 Ω) in the power supply.

Check for dry-joints at L20 if there is no supply to the line output stage.

For no results, check the voltage at pin 41 of the microcontroller chip IC301. If it remains high (standby) when the channel-change buttons are pressed, proceed as follows. Short the base of Q20 to chassis. This should produce the 12V supply. Then check for 5V at pin 42 of IC301. If this supply is missing, check the 5V regulator IC2 and R22 (0·22 Ω). If the 12V and 5V supplies are OK, check for the 10MHz clock signal at pins 31 and 32 of IC301: if this signal is missing, resolder the crystal. If the 10MHz signal is OK, check at pins 39 and 40 (SDA/SCL). If either is low, the memory chip may have failed. Suspect IC301 if these checks are all OK.

In the event of no picture with the EHT OK, check for dry-joints in the text area of the PCB. Also check the 27MHz crystal, which may be intermittent.

The line driver transformer could be faulty if the line output transistor is short-circuit. Check its leadouts. Also check the line output stage tuning capacitor C607 (7.2nF, 1.6kV) in smaller-screen sets.

For intermittent spots on the picture, check whether C1 is dry-jointed.

Intermittent line tear can be caused by faulty connections to the line driver transformer. Remove the transformer and resolder its leadouts.

For tuning drift check ZD2 and R25 (12k Ω).

52

Decoupling

ECG MACHINES?/6v 10AH BATTS/24V 8A TX Ex

government ECG machines! Measures 390X320X120mm, on the front are controls for scan speed, scan delay, scan mode, loads of connections on the rear including video out etc. On the front panel are two DIN sockets for connecting the body sensors to Sensors not included, Inside $2 \times 6 \times 10$ 10AH sealed lead acid batts (generally not in good condition), pcb's and a 8A? 24v torroidal transformer (mains in) sold as seen, may have one or two broken knobs etc due to poor storage. £15.99. ref VP2

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WINDOWS 95 CD As supplied with Hewiet Packard PC's these CD shave all the window files on them and were intended to be used to restore windows on a PC after a crash etc £15 REF SX06

ALTERNATIVE ENERGY CD, PACKED WITH HUNDREDS OF ALTERNATIVE ENERGY RELATED ARTICLES, PLANS AND INFORMATION ETC £14.50 REF CD56

aerial photography kit This rocket comes with a built in cameral it files up to 500 feet (150 m) turns over and takes an aenal photographofthe ground below. The rocket then returns afely with its film via its built in paracute. Takes standard 110 film. Supplied complete with everything including a launch pad and 3 motors (no film) £29.98 ref

SATELLITE MODULATOR MODULES prices from just 9p Surface mount modulators full of components Fitted with an F type connector and a wift type connector. Pack of 100 £9 95 ref SS20

PROJECT BOXES Another bargain for you are these smart ABS project boxes, smart two piece screw together case measuring approx 6"x5"x2" complete with panel mounted LED. Inside you will find loads of free bits, tape heads, inotors, chips resistors, transistors etc. Pack of 20 £19 95 ref MD2.

REMOTE HEATING CONTROLLERS WITH 30A MAINS RELAY from just 99p These units were designed to be plugged into a telephone socket. You then called the phone and some how it

into a telephone socket. You then called the phone and some how it turned the heating on. Each box contains lots of bits including a mains 30A relay, pack of 20 £20 ref. SS34.

PIR CAMERABuilt in CCTV camera (composite output) IR strobe light, PIR detector and battery backup Designed to 'squirt' pictures down the 'phone line but works well as a standalone unit Bargain price £39.95 ref SS81J. These units are brand new modules designed to take' pictures' of intruders and then transmit the pictures down the telephone line. The PIR detects the intruder fires the strobe light this ensures a perfect picture even in total darkness. The picture is stored in memory inside the module and then sent by modern (not included) down the telephone line. The units also have a nicad battery pack included presumably to maintain operation in the event of mains power failure. Output from the camera is standard baw composite 320x240 pixels with a 90x65 degree field of view, the picture quality is excellent Each PIR also contains a video capture and compression unit The infira red strobe has a range of 15m The pir has a range of 12m Power requirements are 12v do 400mA. Power supplies available at £5 ref SS80 The units are supplied with connection details etc but we do not have any information on using the compression and capture unit interfacing to moderns etc. The units do have operational PIRs, strobes and camera's (camera is 12vdc and gives out standard composite 1vp-pvdeo) how you adapt these to work together is entirely up to you/Retail price for the units was in excess of £200 each sale price £39.95 ref SS81JPower supplies £5 ref SS80.

TELEPHONES Just in this week is a huge delivery of telephones. all brand new and boxed. Two piece construction with the following features: Illuminated keypad, tone or pulse (switchable): recall: redial and pause, high/low and off ringer switch and quality construction finished in a smart off white colour and is supplied with a standard international lead (same as US or moderns) if you wish to have a BT lead supplied to convert the phones these are also available at £155 each ref BTLX. Phones £4.98 each ref PH2 10 off £30 ref \$52

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CHIEFTANTANK DOUBLE LASERS 9 WATT+3

WATT+LASER OPTICS Could be adapted for laser listener long range communications etc Double beam units designed to fit in the gun barrel of a tank, each unit has two semi conductor lasers and motor drive units for alignement 7 mile range, no circuit dagrams due to MOD, new price £50,000? us? £199 Each unit has two gallium Arsenide injection lasers 1 x 9 watt 1 x 3 watt, 900nm wavelength, 28vdc, 600nz pulse frequency. The units also contain an electronic receiver to detect reflected signals from targets. £199 Ref LOT4

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ENCODING MANUAL £9.95 Cased with flyleads, designed to read standard credit cards! complete with control eletronics PCB and manual covering everything you could want to know about whats hidden in that magnetic strip on your card! just £9 95 ief BAR31

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ELECTRONIC SPEED CONTROLLER KIT For the above motor is £19 ref MAG17. Save £5 if you buy them both together, 1 motor plus speed controller rrp is £41, offer price £36 ref

SONY STEREO TV CHASSIS assemblies comprising complete TV PCB excluding tube and scan coils. Nicam stereo, mains input. Appear to be unused but sold as seen! Would probably be good for spares or as a nicam stereo TV sound receiver, and amplifier For KV29F1U and KV25F1U(BE3D). PCB nois 1-659-827-12

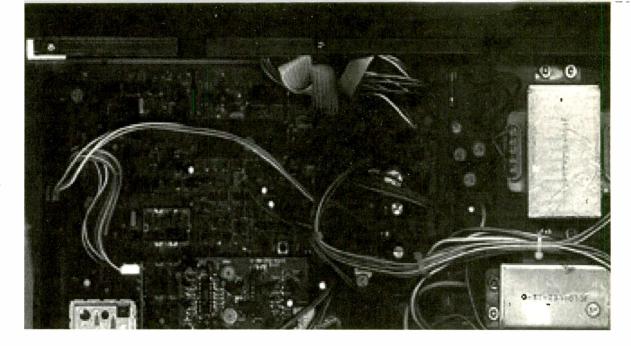
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1-659-826-14 1-711-800-11 £20 ref STV1

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VOICE CHANGERS Hold one of these units over your phone mouth piece an you can adjust your voice using the controls on the unit! Battery operated £15 ref CC3



Satellite Notebook

Digibox: reception on only some channels

The owner of a fairly recently installed Sky digibox rang to say that he was getting the message "no satellite signal being received" on some channels, others being OK. The ones he particularly mentioned as being absent were the BBC and Discovery channels. He confirmed that when 501 (Sky News) and 513 (CNN) were selected via the electronic programme guide they were received.

My initial conclusion was that the LNB was faulty, as the polarisation is horizontal with all the BBC programmes while vertical polarisation is used for Sky News and CNN. This fault, reception failure with one polarisation, is of course common with analogue transmissions. But changing the LNB made no difference. I then checked at the digibox end and found that the output went to 18V (for horizontal polarisation) when 101 (BBC1) was selected via the remote control unit. The no-signal message was still there however.

The cable was the one originally used for the analogue installation. It went to the dish via an involved route through the loft. When a new length of cable was temporarily run from the dish to the receiver via the sitting room window the horizontal channels immediately appeared. So there was a cable problem.

The owner wanted the new cable taken via a similar route through the loft. While we were installing it we came across the source of the trouble, a pair of Belling-Lee male and female connectors. Neither connector had the inner conductor

of the cable soldered to it. Loss of the horizontally-polarised signals was clearly because some of the higher voltage was dropped across the connectors.

At some stage we may come across the opposite fault, failure to receive the vertically-polarised channels. Theoretically the BBC channels would be received, but since the receiver's default frequency is a vertical channel it might not lock on to anything unless the default frequency is altered to a horizontal channel in the installation menu. C.H.

Pace SS9200 Series Receivers

During the past few weeks we've had several of these receivers, including the MRD920 MAC version, that according to their owners suffered from "tuning to the wrong station". A tap on the cabinet would restore results temporarily.

In each case we found that soldered joints between the chopper transformer and the PCB had worked loose. The first joint to suffer is on the low-voltage side of the transformer, next to the edge of the PCB. This connection provides the tuning voltage. When the supply is removed, the tuner will go to the bottom of its tuning range. The audio tuning supply will not be present either - the result of this is hissing and some weak sound. Channel changing doesn't make any difference, apart from polarisation change.

It's taken several years for this condition to show up. It must be the result of heat from the transformer over the long term. H.C.

Nokia 9600: no sound

A customer who subscribed to the Norwegian TV International channel via Intelsat 707 at 1°W complained that the sound was very weak. Analogue satellite channels received from Astra via a separate dish and receiver were fine.

The solution to the problem was simple. Nokia 9200/9600 series satellite receivers have a volume control on the remote control unit. The customer had inadvertently turned this down. When the TV set's volume control setting was increased there was very little difference, as very little sound was reaching the set.

Pace analogue receivers have a similar control. We make a habit of warning customers about this: it's good practice to keep the satellite receiver's volume control at around three quarters up, as indicated by the on-screen volume-bar display, then use the TV set's volume control. H.C.

BT SVS300

I get quite a few of these disgusting Chinese-made receivers in for repair, probably because no one else will touch them. Most repairs are confined to power supply refurbishment, or replacing various electrolytics in the video stages or the decoder.

This one had a different fault however: when switched on from standby it went off almost immediately. It didn't take long to discover that the 12V supply was missing, because the regulator transistor Q807 had no base bias. R842 (1k Ω) was then found to be opencircuit. It was burried under a pile

Reports from Christopher Holland Hugh Cocks Colin J. Guy and Pete Haylor of carbonised hot-melt glue that was intended as support for Q807. C.J.G.

BT SVS250/260/Matsui OP10

Here's my experience with these receivers to date. The number one complaint is that when the receiver has been in a "TV cabinet" for a few months its decoder section starts to play up, switching between scrambled and clear. This is because the electrolytic capacitors in the decoder have dried out. The best solution is to fit a reliability kit from one of the suppliers that advertise in *Television*. After doing this, don't refit the receiver in the enclosed cabinet: give it some fresh air.

You can copy from one of these receivers to another one provided it's the same model. The procedure is as follows – do it carefully. Connect both receivers to the mains supply, but don't switch on yet. Connect a 21-pin scart lead between the receivers. Switch the mains supplies on and put both

receivers in standby.

The receiver you copy from is referred to as the master, the other one the slave. Turn the slave receiver so that its front panel is shielded from the master receiver — so that when the remote control is pointed at the master receiver the slave receiver can't respond. There's a recessed button called "download" on the remote control unit. Place the remote control unit against the master receiver's sensor window and press download, using a pen or similar pointed tool.

The master receiver will start to flash the three horizontal bars "---", while the slave flashes "-". When downloading is complete, the master receiver flashes "end" and the slave receiver has the normal standby "-". Switch both receivers off and remove the scart lead. They will now have the same programme information.

These models will all work with a Philips CTU916 twin-card D2-MAC decoder, but have to be connected via a modified lead. Obtain a lead with a scart plug at one end and three phono plugs, connected to pins 20, 2, 6 and 4, at the other. 20 is video, 2 audio, 6 audio and 4 earth. Connect the phono plugs to the satellite receiver and the scart plug to the Philips D2-MAC decoder's AUX1 socket. Connect a standard 9-pin scart-to-scart lead between the TV set being used and the Philips D2-MAC decoder's AUX2 socket. Select "Flat B/B" at the back of the decoder (usually by inserting a phono plug in a socket at the back) and you should have a good, clear picture.

Model SVS300: This model has a dedicated decoder socket, but you will still have to modify the scart lead at the satellite receiver end. Mark this end and remove pin 12. Carefully remove pin 19 and fit it in the hole vacated by pin 12. Reassemble the scart plug and fit it to the satellite receiver, with the other end of the lead to the D2-MAC decoder.

In use with a Philips D2-MAC decoder, when changing channels press "AV" until the picture appears. **P.H.**

Cable TV News

The latest ITC report reveals that cable TV take-up has risen to 24.5 per cent of homes past, the highest level ever (the previous year's take-up was 22.4 per cent). Take-up has risen during each of the previous six quarters. On April 1st cable TV services were available to 12.15m homes: 4.24m took TV and/or telephony services. But subscriptions are down, at an average of £23.87 a month, from £24.29 in the previous year. Viewers seem to be taking smaller packages, with fewer premium channels. As a result the pay/basic ratio continued to decline to 129 per cent, the lowest since 1992. This may also represent a migration to pay-per-view instead of monthly subscription to premium channels.

Kingston Vision (Hull) is testing an interactive TV service using asymmetric digital subscriber line (ADSL) technology, which makes use of ordinary telephone lines. The trial, involving sixty of the company's employees, includes video-ondemand, home shopping and internet access.

NTL has announced business plans for its digital cable TV service – initial trials started in June, with a full commercial trial during July/August. The company expects to have 250,000 subscribers taking a low-cost, bundled service (TV, high-speed internet, interactive services and telephony) by mid-2000. NTL has set a target of 60 per cent total take-up in its franchise areas by 2003, with a high proportion of digital subscribers. The company is working with Real Media to create a broadband interactive advertising service for digital TV.

CWC, the UK's largest cable operator, is offering viewers in Manchester and the north west 130 digital channels, telephony and an on-line package for £9.98 a month, considerably undercutting BSkyB's entry-level digital package.

Within a matter of weeks British Telecommunications is expected to launch a multimedia service, including video and fast internet access, using ADSL technology over ordinary domestic telephone lines. The company has been testing the technology at a number of sites in West London since 1994.



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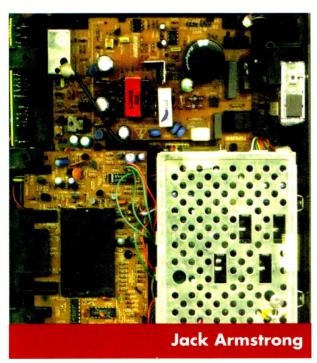


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Satellite WORKSHOP



Amstrad SRD520

Barry, an electrician, has a rather cavalier attitude towards safety and a somewhat simplified view of scientific matters. His Amstrad receiver appeared to be well cooked.

"You've had this in the oven!" I declared.

"Nah. But I keep 'im covered up all right. Heat needs oxygen t' burn, and I ain't having none o' that."

I refrained from pursuing this subject and told him to leave his receiver with me. Barry toddled off to replace Mrs Jenkins' fuse. He makes his own, by cutting four-inch nails into pieces.

"My fuses is cheap an' 'em never melt' he once pointed out to me. Well, it was logical. While I was thinking about it, I took the top off his receiver's mains plug, removed the roll of aluminium foil and, for my own peace of mind, fitted a 3A fuse.

The receiver's right channel audio output was distorted. The RF audio output was as well, since the left- and right-channel signals are mixed before being sent to the modulator.

It took me almost an hour to

find the cause of the fault. R89 (15k Ω), which is connected to TR21 behind the sync separator board, was open-circuit and hidden under black glue.

BT SVS300

The note attached to this British Telecom badged receiver said "dead". On inspection I found that some idiot had replaced the 4.7Ω and two 2.2Ω fusible fuses with $47k\Omega$ high-voltage types! The 10Ω , 5W ceramic resistor was open-circuit, which wasn't surprising as the plastic-bodied chopper transistor had been replaced with a metal-tag BUT11A which was firmly bolted to the metal heatsink.

I replaced the ceramic resistor and fitted all the parts in Satkit 17, including the BUT11AF transistor, the optocoupler and the TL431 adjustable-voltage zener diode. Checks on the other components on the primary side of the power supply suggested that everything was now OK, so I connected the set to the mains supply. The result: perfect operation.

This was somewhat surprising. The decoder in this model often fails, with the result that you have to fit the items in Relkit 17 to get it going again.

Internet Advantages

As you may have noticed, I'm a great fan of the internet. Web site order forms are becoming common, and often provide a quick and easy way of doing business. Some firms offer a discount if you use their web site order forms, because it enables them to automate the invoicing system.

One major supplier advertised a discount "if you order via the internet". Unfortunately this description was too broad, since orders sent by e-mail also fulfil the "via the internet" requirement, but require human intervention in the invoicing process. Consequently discounts with e-mail orders were being refused. One wonders how this would stand up in court! The order form system refused to accept certain order codes, despite the fact that these parts were listed in the

computer (this was confirmed by telephone). Promises to "ring back shortly" to sort out the problem were not fulfilled. Consequently orders had to be faxed through to avoid further delay.

Another problem, which is common with many 'professional' web sites, was the excessive use of pictures. These create long delays before the order form can be displayed on the screen. Luckily I had previously had excellent service from the company. Otherwise I might have gone elsewhere.

Many smaller companies, such as Telepart (www.telepart.co.uk) and SatCure (www.netcentral.co.uk/satcure) provide easy-to-use order forms that list the available spares and appear on the screen without excessive delay.

Many repairers ignore the advantages offered by the internet. There is little excuse for this nowadays. A suitable computer or "internet set-top box" (www.satelliteuk. com) can be bought quite cheaply and used for other purposes as well. Internet connection can be free, and even the cost of the phone call can be eliminated if you agree to accept a few adverts each week (www. freecall-uk.com). The advantages include free technical help from manufacturers and like-minded repairers worldwide (contact satcure@netcentral.co.uk) as well as the possibility of discounts on

Finally I should mention that my e-mail address is now

jacksat@netcentral.co.uk

I change it from time to time to eliminate the build up of junk mail. It also ensures that those who buy *Television* on a casual basis don't continue to receive free help for very long! (The old address will continue to work for a few more weeks for the benefit of overseas readers who have to wait longer for their favourite magazine!)

Rectified SVS260

The SVS260, another receiver from the British Telecom stable, is made by The Orient Power Video Manufacturing Company Ltd." which is based in Kowloon, Hong Kong. I found its web site by using the Sherlock search system on my Apple Mac computer. Unfortunately I didn't get a reply to my e-mail message, so we are still lacking some service information – apart from the booklet that's available from SatCure (01270 753 311).

This particular SVS260 came in with the complaint that it was "humming". I thought this might refer to a buzzing noise from the mains transformer's laminations – there's no nasty chopper power supply in this receiver – but the transformer was silent. The audio output from the TV set's speaker was perfect, so I left the receiver on soak test for a few hours.

When I returned to it every channel was marred by a loud hum from the TV set's speaker. On a hunch, I squirted the large electrolytic capacitors with freezer spray. This had no effect – until the spray hit the rectifier diodes behind the capacitors. The noise then vanished instantly Replacement of D405 and D406 at the rear right corner of the lower PCB provided a permanent cure. The diodes are black with a silver or white stripe to indicate the cathode end. I fitted two BYV95A diodes. This is a fast soft-recovery type with glass bead construction.

Amstrad SRD700

I had a phone call from Wossname up Church Street about this receiver. It's identical to the Fidelity SR920+, with a power supply and main board that differ from those used in earlier Amstrad models.

"What's the transistor that's soldered underneath the power supply?" he asked.

"It's not a transistor. It's a TOP202 integrated circuit."

"Ah. OK. I'll see if I can order one." At that the line went dead – before I could offer him the Satkit 16 I had in stock. A week later however he appeared with the offending receiver.

"No joy. Have a look at it for me, there's a good chap. I'll be at The Lion and Swan. You can buy me a drink when you've fixed it!"

I muttered under my breath and carried the receiver to the workshop. It took no time at all to remove the screws, because as usual he'd lost them. The power supply tried to work, but the front panel LED was flickering – as was the blank raster on the monitor's screen. I removed the power supply and found that he had made quite a neat job of the repair, though I felt that he'd been over generous with solder on the TOP202. Hopefully he hadn't destroyed it with the heat!

A working power supply from

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems via e-mail. You can reach him via the Internet at:

jacksat@netcentral.co.uk

One model per message – state make/model and fault symptoms. If you have no e-mail facilities you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

another receiver produced pictures and sound, so I investigated the receiver's own power supply further. It appeared that he had used 85°C capacitors (OK temporarily), and hadn't replaced the optocoupler or the TL431 adjustable-voltage zener diode (judging from the lack of black teacle around the pins). When I replaced these two items the power supply sprang to life.

For improved reliability I fitted high-temperature capacitors in the power supply. I also replaced the electrolytics in the tuner module (as supplied in Relkit 16), because the decoded pictures had been very streaky. The Lion and Swan now seemed very inviting. I hoped Wossname had brought his wallet with him!

Test Case 440

TV repair jobs are sometimes easy, sometimes difficult and sometimes – well, we don't use that sort of word in a respectable magazine, do we? This is the story of a job that seemed to be nice and easy but turned out to be in the unmentionable category. With hindsight we'd have done better to give the customer a tenner to take the set away at the outset.

The set concerned was a Mitsubishi Model CT2146TX (Euro 6 chassis). It was no youngster, but was in good condition with a good tube. The customer was certainly happy to pay the repair charge for the dead-set fault – we replaced the 2AT mains fuse and the four bridge rectifier diodes. Only one of them had failed (short-circuit), but to be on the safe side we replaced them all. A tweak on the set-HT potentiometer VR901 and the grey-scale presets on the tube base panel completed the job, or so Television Ted thought.

But the set was back a few days later with the same symptom – no go. This time the cause was quite different: the 2SD1878 line output transistor Q552 had gone short-circuit collector-to-emitter (and to its base for that matter). After fitting a replacement, Television Ted switched the set on cautiously. It worked, and the HT voltage at TP91 was spot on at 112V. No other problem could be found. Ted put the cause down to a one-off fault, or maybe something to do with the previous power supply failure. The set went back on to the repaired-out bench. There was no charge, as goodwill is an important factor in the Test Case workshop's business.

When the customer returned to reception with his set a cou-

ple of weeks later, for the third time, the goodwill had worn very thin! Once again the set had failed because its line output transistor was short-circuit. It had failed for reasons unknown.

At this stage the economic situation was such that the total repair cost would exceed the value of the set. Had it been a rental set it would have been scrapped then and there, exchanged for something newer. But it was necessary to take the 'customer factor' into account. If possible, the set had to be repaired. So TV Ted set to work again.

He checked for dry-joints at the chopper transformer, the line driver and output transformers and other relevant points. Nothing that could have contributed to the transistor's failure could be found. Thinking that there might be a drive fault, Ted checked the values of R551 and C572 in the line driver stage. Both were OK, and the waveform at the collector of the driver transistor Q551 (waveform 10) was correct at 150V peak-topeak, with very sharp rise and fall times. Further confirmation that the drive and loading conditions in the line output stage were OK was provided by the fact that the latest replacement transistor didn't get excessively hot while in operation.

Even so, it failed a few days later! It seemed likely that the cause of the trouble was some sudden event rather than continual heavy loading or excessive flyback voltage. A long monitoring session – of the supply voltage, the chopper transformer waveform, the line flyback waveform etc. – was required, with the help of a camera and a VCR, to find the culprit. What was it? For the solution, turn to page 727.

At Cable & Satellite Mediacast '99

This year's Cable & Satellite show attracted thousands of visitors. There were some 260 exhibitors. Last year the focus was on digital TV programming. This year the emphasis was on interactive TV and internet services. George Cole reports



he two European satellite operators SES, which owns the Astra series satellites, and Eutelsat, which operates the Hot Bird and other satellites, both had large stands that were dominated by internet and data delivery services. The move from analogue to digital broadcasting means that satellite operators can offer data services in addition to TV channels. It is significant that some telecoms operators are already carrying more data than voice traffic via their telephone lines. Before long data traffic could become an important source of revenue for companies such as SES and Eutelsat. Hence the emphasis on promoting the internet and data transmission at this year's show.

Astra-Net

SES is offering Astra-Net, which can be used to deliver data, streaming audio or video and provide high-speed internet access. It operates in the Ku band at data rates up to 38Mbits/sec. Astra-Net is designed as a direct-to-home, small office/home office (SOHO) and direct-to-office service, though the primary markets are seen as being commercial.

Service/content providers send information to the Astra-Net Network Operations Centre (NOC), which transmits it to users via satellite as DVB/MPEG-2 compliant data, the 'return' path between users and the ser-

vice providers and NOC being terrestrial, either via telephone/modem, ISDN or an internet service provider. Users require a PC equipped with a DVB/MPEG-2 card and a 50cm dish with a universal LNB. Those who want to be able to receive both Astra-Net and satellite TV services require a twin universal LNB.

The PC requirement is relatively modest: a 90MHz Pentium processor or better, Microsoft Windows 95/98/NT, a sound card, a CD-ROM drive, a web browser such as Netscape Navigator or Internet Explorer (for fast internet services), 30MB of hard disk space and a modem or ISDN connection.

The Astra-Net PC card is supplied with software for the installation and positioning of the dish, and several types of delivery systems: package delivery (file transfer), streaming delivery (for real-time delivery of audio, video or updated information such as a 'financial ticker') and high-speed internet. The latter is capable of data speeds up to 400kbits/sec, which is about seven times faster than the fastest telephone modems and three times faster than ISDN. Data can be encrypted using the 56-bit Data Encryption Standard, and a sophisticated error detection/correction system checks that the data packets have been delivered correctly. If an error is detected, the Astra-Net receiver requests retransmission.

A Number of companies that offer services based on Astra-Net were present at the show. They included 4th Wave which provides high-speed internet access, Espresso which is a multimedia learning and teaching service aimed at schools, Europe Online Networks which has launched an 'internet in the sky', and deuromedia which offers digital TV and internet services.

ARCS

SES was also showing prototypes of its forthcoming Astra Return Channel System (ARCS), which is due to be launched early next year. As the name suggests, ARCS is a two-way digital communications system. Ku band is used for forward data transmission via satellite at rates up to 38Mbits/sec. Ka band is used for transmission from a user dish at data rates up to 2Mbits/sec. This is is more elegant than existing satellite data services, which often use a public-switched telephone line, ISDN or an internet service provider as the return path.

The first satellite to offer Ka-band capacity, Astra 1H, was launched on June 18th. Its orbital position is

19.2°E. Astra 1K, to be launched next year, will also offer Ka-band capacity and extend ARCS' coverage to Eastern Europe. SES says that ARCS will be aimed at broadcasters, businesses and the public sector.

In order to use the ARCS service, users or groups of users will require a PC connected to a dish and a Satellite Interactive Terminal (SIT). Dish size determines the maximum transmission bit rate: with a 60cm dish the maximum data speed is 150kbits/sec, with a 90cm dish it's 384kbits/sec and with a 120cm dish it's 2Mbits/sec. All ARCS systems can receive data at rates up to 38Mbits/sec. Nortel and Philips plan to launch SITs next year.

Other Satellite Data Services

A DVB/internet service from EasyNet was on show at the Eutelsat stand. The system uses a PC, dish and DVB card for downloading data and digital TV programmes. Armstrong Data Services showed Web-Sat, a two-way service like ARCS. It requires a SIT, 70cm dish and PC. If users leave their PCs permanently switched on, they receive e-mails and data files addressed to them.

Interactive TV

Interactive TV enables viewers to send data or instructions to the broadcaster or service provider. All interactive TV systems require special software, known as an Application Program Interface (API), to organise and manage the data.

One of the leading interactive software systems is OpenTV, which is used by a dozen digital TV networks including, in the UK, BSkyB, the BBC and Open. OpenTV software has been incorporated in over two million digital receivers: manufacturers that have licensed the technology include Matsushita, Pace, Philips and the French-based company Sagem. OpenTV was demonstrating interactive TV services from a number of broadcasters including TPS. This French broadcaster offers one of the most sophisticated interactive TV services in the world. Its services include home shopping, home banking and an interactive weather channel.

Music Choice, which offers some fifty music channels via SkyDigital, demonstrated a prototype music shopping service based on OpenTV technology. Using an on-screen guide, users would be able to purchase CDs, tickets and other items while listening to a music track. Music Choice hopes to have the service in operation by early next year.

Canal+ Technologies developed the Mediahighway API, which is used by a number of digital broadcasters around the world, including ONdigital in the UK and the various Canal+digital TV services across Europe, including France, Spain, Italy and the Scandinavian countries. The French Canal+ digital service includes an 'interactive notepad' that gives viewers access to information related to a programme being viewed, for example match statistics with a sports programme.

Hull's Telecom TV

Element 14, formerly part of Acorn Computers, demonstrated an interactive TV system designed for use with a telecoms system rather than a cable, satellite or terrestrial TV service. The Active 3875 set-top box incorporates MPEG-2 decoding. Element 14 has signed a deal with Kingston Vision, a subsidiary of Kingston Communications which runs Hull's telephone service. The technology used is ADSL (Asymmetric Digital Subscriber Line): it enables data to be transmitted via twisted-pair copper cables at speeds of typically about 2Mbits/sec. ADSL uses an HF data carrier that doesn't interfere with normal voice communication.

The interactive TV service is being provided by Yes Television, which is owned and operated by Elmsdale Media. The Kingston service will include TV programmes from BBC Worldwide, Pearson and Trans World International, films from Sony Pictures, Warner Brothers



and Buena Vista (part of Disney), educational services and travel services provided by British Airways. There will also be local and community services plus e-mail and internet access. A trial service involving 60 employees of Kingston Vision started in Hull in June.

Element 14 was showing, in a back room, a prototype MPEG-2 system that uses software only for decoding and demodulation. First impressions suggest that there is still some work to be done, but it could turn out to be an interesting development.

The Active 3875 STB is part of Element 14's system for delivering digital TV via existing telecoms networks.

Set-top Boxes and IDTVs

There was an impressive array of STBs and IDTVs on the Pace stand. No surprise, considering that the company is manufacturing STBs for digital cable, satellite and terrestrial services and for several IDTV manufacturers.

The Pace show included the first live demonstration of the STB used with Cable & Wireless's digital cable service. It includes a cable modem developed by Cisco Systems. There was also a prototype cable box developed for NTL. This uses an Hitachi RISC (Reduced Instruction Set Computer) processor chip

LG showed IDTVs for the SkyDigital and ONdigital services.

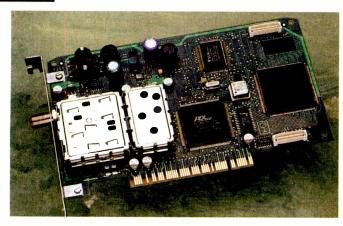
Nokia announced that owners of its new digital receiver, Model 9800, could receive software downloads from four major European satellite sites, Astra, Eutelsat, Sirius and Thor. Users call up the installation menu, select software upgrade and follow the on-screen instructions. The downloading process takes about 5-15 minutes.

French manufacturer Sagem displayed a full range of digital terrestrial, satellite and cable STBs. The ISD3100 and ISD3400 can receive all European free-to-air channels plus pay-TV packages that use Viaccess or Nagravision conditional access control. The company has been supplying digital TV equipment that complies with the MPEG-2/DVB standards to the professional and consumer markets since 1995. It has already supplied hundreds of thousands of digital consumer decoders – some 700,000 were delivered in 1998. The Sagem Telsat Turbo is a DVB-compliant satellite-to-PC receiver card. It provides demodulation and demultiplexing and transfers IP (Internet Protocol) data to a PCI bus. Internet access is at speeds up to a hundred times faster than the average PC modem (Fast Internet).

Prototype Sidecar

SCM Microsystems demonstrated a prototype sidecar module that will enable SkyDigital STBs to receive digital terrestrial TV, using a plug-in PC type card. The module, slightly larger than a PC card, was connected to a box containing an RF front-end and demodulator. This was linked to an LNB.

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The Sagem Telsat Turbo DVBcompliant satellite-to-PC receiver card. Once the required chip set is available the module will be smaller. SCM Microsystems also plans to launch an ONdigital sidecar to enable DTT viewers to receive SkyDigital programmes – subject to an appropriate subscription package being taken up.

There are still questions about the future of sidecars however. Development was prompted by the ITC, which wants interoperability between the digital satellite and terrestrial services. But there is still no simulscript agreement, which would enable one STB to decode both types of signals, between SkyDigital and ONdigital. There are also STB architecture differences – ONdigital's STB has less memory for example – while the available bandwidth (the DTT service has much less) will also limit the degree of interoperability. And now that the STBs are being provided 'free', it could be difficult to get people to buy sidecar modules.

The Video Browser

Danmere, a UK company, demonstrated the Video Browser, a new software technology for STBs to provide VCR control.

One function is to make it easier to set a VCR's timer when recording programmes via a digital STB. Those using a SkyDigital decoder have to set the VCR timer and set the decoder to the correct channel. This means that it is not possible to record programmes on different channels when using a VCR timer. ONdigital's STB is more flexible in this respect, having a built-in timer, but users still have to set two timers. Most VCR-satellite control systems, which automatically switch on the decoder at the required time and set the correct channel, are designed for analogue STBs. In addition, not all satellite systems work with all decoder brands.

To record programmes using the Video Browser you simply select the programme you want to record from an on-screen programme guide then press a button on the remote-control handset. Timer data is sent from the STB to the VCR via an infra-red link, and the Browser checks that the VCR has received the correct information. Danmere says that its Browser system can work with all VCR brands.

The Video Browser also provides a tape-indexing system that lets users see what is recorded on a tape. As a tape is being played, the Browser takes a series of 'snapshots' to create a video database of what's on the tape. This database consists of a set of thumbprint images that can be displayed on a TV set's screen. When a thumbprint is selected, the VCR

The Pace digital cable STB currently being used in CWC's first UK digital cable trial.



automatically finds the scene on the tape.

The Video Browser makes use of the fact that today's digital TV STBs are really powerful computers, with a processor, memory and an operating system. The Video Browser makes use of the operating system, employing tape positioning and indexing algorithms to control a VCR's functions. These algorithms can be used to create a unique signature database for each tape. The video database could be stored in the STB's memory: the database size and the number of tapes that can be indexed in this way depends on the amount of memory allocated to this purpose.

If memory space is limited, a cut-down version of the database could be stored inside the box, with the thumbprints held on tape. But in practice relatively little memory space would be required because the images are compressed. An STB manufacturer could also design a system that stored thumbprints at say five-minute intervals. In addition it's highly likely that future STBs will have a built-in hard drive for storing large amounts of data.

The tape-index system will work with both new and existing tapes, and recordings made with the Video Browser can be played back on any VCR. Danmere says that the tape-positioning system is accurate to within four seconds. The company has a lot of experience in the control of tape-transport mechanisms – several years ago it developed a data back-up system that enables a PC user to store hard disk data on a VHS cassette.

A scart cable is used for general communication between the Video Browser and the VCR. The Browser could also be used for downloading data such as pages from a web site. This would require only a small amount of tape storage, as about 9Mbytes of data can be stored per minute of tape time.

At present the Video Browser works with Microsoft's Windows CE operating system, as used by WebTV and OpenTV. Windows CE is used in millions of STBs around the world, including those for SkyDigital. But Danmere says that its software could be ported to other STB operating systems. Danmere is currently in discussion with broadcasters and STB manufacturers about licensing its technology.

Danmere says that the Video Browser, because it's soft-ware-based, would add little to the cost of an STB. It could also be used in future digital TV sets. The system cannot be built into a VCR however, because VCRs lack the architecture (processor, operating system, etc.) required for it to work. Danmere considers that though developments like recordable DVDs are in the pipeline the VCR will remain the dominant home video recording format for many years to come.

Video Browser seems to be a good idea, and the demonstration at the show was impressive. The problem for Danmere is that broadcasters such as BSkyB are known to be developing their own STB recording systems.

Dish and Tuner Technology

Sharp Germany had on display several pieces of technology that caught the eye, including a compact four-outlet LNB for feeding four separate households from a single dish. It can be used with both analogue and digital transmissions. The LNB will be available in Germany this autumn: no UK launch details were available.

Sharp has also developed a new satellite tuner, Model BS2W7XXXX, which can be used with both analogue and digital signals. It has two inputs, enabling viewers to receive signals via separate LNBs for say Astra and Hot Bird. The tuner should contribute to the development of compact, inexpensive STBs.

Next Year

In all it was another year of considerable progress. What will next year bring? The dates for Cable & Satellite Mediacast 2000 are May 15-17th 2000, at the same venue – Earls Court 2.

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Multiple Outlet Wallplates

In Part 2 of his article on TV wallplates Bill Wright describes the problems that can occur when the screening provided is inadequate, with a number of examples and advice on what can be done

s domestic TV/video installations become more complex, good screening of all coaxial feeds is ever more important. In this article I'm primarily concerned with the screening properties of output plates, but most of what follows also applies to masthead amplifiers, downlead cables, splitters and flyleads.

The traditional wallplate is fitted with one or at best two coaxial sockets. There's no screening, but the better designs minimise the amount of unscreened inner conductor and, assuming that the cables are prepared with proper regard to good RF practice, they work perfectly well almost all the time. But unwanted signal pick-up from outside sources does occasionally occur, and crosstalk between the two circuits is always a danger.

Inferior Outlet Plates

Badly designed wallplates cause all sorts of problems. There are some truly awful ones on the market. Some manufacturers either don't know or don't care about good RF practice.

One particular double-outlet plate has a PCB (including a printed inductor, but with the other components not fitted) connected to one of the inner conductors. It appears to be intended for a diplexer or something similar. Because of the large area of unscreened copper track connected to the coaxial inner conductor, the PCB radiates and receives signal very efficiently, which is a great detriment to the outlet's proper function. The UHF through loss is between 6-15dB! The amount of crosstalk between the two sockets is simil-arly disastrous.

Outlets like this will introduce an impedance mismatch, leading to standing-wave effects. I've cured many a strange reception fault merely by removing one of these beastly things and fitting a decent outlet. Other culprits have included an outlet in which the soldered

Table 1: Interference from cellphone transmissions.

Cellphone transmission

Satellite frequency that could suffer interference transmission

9.75GHz LO 10GHz LO 10.6GHz LO

950MHz 10.7GHz 10.95GHz 11.55GHz 11.850MHz 11.6GHz 11.85GHz 12.45GHz

screen connection easily but invisibly breaks, and one where the centre pin pushes back and contacts the rear of the steel back-box.

Pre-echo

In strong-signal areas enough signal can be picked up directly by a poor-quality outlet plate (and flylead) to compete with the signal from the aerial. This effect is called 'pre-echo', and is particularly a problem with communal aerial systems (see *Television* March 1996).

Interference from Satellite Receivers

Some satellite receivers radiate an alarming amount of UHF noise, particularly on ch. 25. This became a common problem a few years ago, and we were advised to fit double-screened coaxial leads. You might think that if the aerial feed is looped through the satellite receiver in the usual way any signal pick-up at the outlet plate would be insignificant, but this is not the case. Interference can even come from next door's satellite receiver – and other equipment.

With a semi-detached house the outlet plate is likely to be back-to-back with the one in the adjoining property, and not much farther from the neighbour's satellite receiver, games machine or computer. In blocks of flats, the TV set and associated equipment in a flat is likely to be spaced only 3m apart from similar equipment above and below.

Interference to the Satellite IF

LNB output frequencies (the satellite first IF) coincide with various transmissions. If these signals find their way into the feed from the LNB to the satellite receiver they will cause interference. Cellphone masts have become a particular problem, with transmissions centred on 950MHz and 1,850MHz. Photo 6 illustrates this, and Table 1 lists the frequencies affected.

An LNB's output is at a very high level, with carriers as much as 35dB above the minimum receiver input. This provides good immunity from interference, but these levels are sometimes greatly attenuated by the time the signal reaches the outlet, flylead and receiver. This can happen if the satellite downlead is very long, or if an inferior type of cable is in use.

Satellite IF distribution systems are normally designed to deliver at each outlet a signal level that's only 12dB or so above the receiver's minimum input. Because of varying carrier levels, the signal can occasionally fall to a much lower level. In such a case there is vulnerability to interference that enters at the outlet plate and flylead.

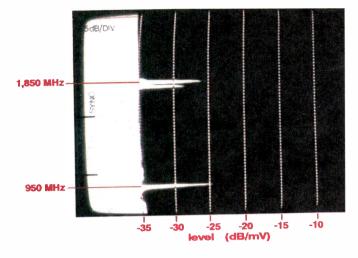


Photo 6: A spectrum analyser display of cellphone transmissions in the satellite IF band. The signal levels shown here are low: they can be much higher in the vicinity of a cellphone mast.

It seems that nowadays virtually every high-rise building has a cellphone transmitter on the roof. Although cellphone transmissions are not high-powered, in my experience they can cause problems within the building itself and at sites up to a quarter of a mile away.

How can the outlet plate receive enough cellphone signal to cause interference? A quarter-wave dipole, perhaps the most efficient aerial of all, is only 38mm long at 1,850MHz. The length of unscreened inner conductor behind the outlet can be a significant fraction of this length.

Crosstalk in Double Outlets

It's quite common for crosstalk to occur between the two circuits in a double outlet, even where a good-quality wallplate is used. The amount of crosstalk depends to some extent on the way the connections have been made at the back of the plate. If an unnecessary amount of inner conductor is left unscreened, the outlet can allow UHF signals to pass from one port to the other with as

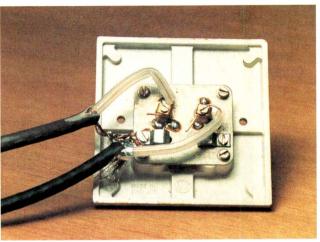


Photo 7: How not to wire an outlet plate! The large amounts of unscreened inner conductor cause unwanted radiation and reception, impedance mismatching, severe through-loss and crosstalk.

little as 20dB attenuation.

Photo 7 shows a typical attempt by a site electrician, who to be fair can't be expected to know about the peculiarities of RF, to wire a double outlet. The plate itself is a good-quality one, and the manufacturer has positioned each saddle clamp and terminal screw close together to minimise the necessary amount of unscreened inner core. This was, alas, in vain. This particular example was the sole cause of severely degraded reception.

Interference from Satellite IF

A satellite IF feed and an unscreened double outlet form a very unhealthy combination. From this point of view an LNB is no more than a noise source followed by about 50dB of amplification. The noise output from most LNBs extends down well into the UHF TV band. If this noise gets into the UHF aerial feed, the signal-to-noise ratio will be reduced and the picture will become snowy, just as if the UHF signal is too weak. Cheap fly-

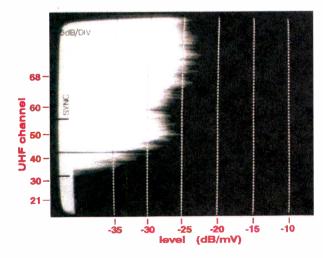


Photo 8: The UHF output of an LNB with a 9.75GHz local oscillator. If this noise finds its way into a UHF aerial feeder the picture will be snowy, as if the UHF signal is weak. In this example the satellite downlead loss was 10dB. Note that there is 20dB less input attenuation than in Photo 6.

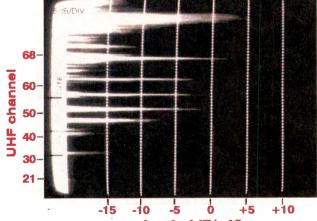


Photo 9: The UHF output of an LNB with a 10-6GHz local oscillator. Even after 10dB downlead loss the satellite carriers can touch +5dB/mV. If a satellite carrier happens to coincide with an occupied UHF channel there is severe interference potential. Despite the differing transmission standards, a satellite signal can even produce an identifiable picture on a UHF TV set.

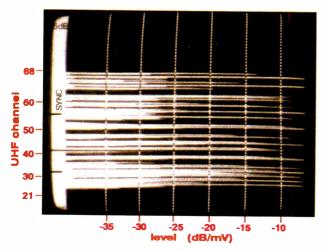


Photo 10: The output of a multi-channel UHF distribution system. In this and in Photo 11 the signal levels have been temporarily reduced by 6dB.

leads can be the culprit here as well as dodgy outlets.

An LNB with a local oscillator frequency of 9.75GHz isn't too bad in this respect, see Photo 8, but the older 10GHz LNBs down-convert the lower satellite channels to frequencies within the UHF group C/D spectrum. This has obvious interference-causing potential. In this respect the 10.6GHz local oscillator, intended for reception of the higher satellite channels, appears to be even worse. When the LNB's local oscillator frequency is switchable between 9.75GHz and 10.6GHz it's called a universal type. These LNBs are often used for reception from Hot Bird at 13°E.

I measured the UHF output of an 0.8dB (noise figure) universal LNB set to 10.6GHz and aligned, with a 1m dish, at 13°E. The results, see Photo 9, show that significant leakage of the LNB's signal into the UHF feed will cause severe reception problems. The satellite carriers leave the LNB at +10dB/mV or more. With allowance for a satellite downlead loss of 10dB, a double outlet crosstalk figure of -30dB could result in a signal-tonoise ratio of say 35dB. This will seriously degrade analogue UHF reception. Photos 10 and 11 show the effect of crosstalk as seen using a spectrum analyser. The result, on a TV screen, tends to be a strange mixture of snow and cross-modulation, see Photo 12. Even when



Photo 12: A satellite D-MAC signal makes a nice mess of UHF ch. 47 reception. In this case the outlet plate crosstalk was –30dB. Matters were made worse by a UHF signal at –10dB/mV.

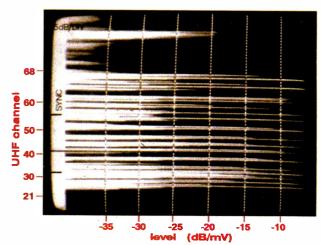


Photo 11: The UHF spectrum shown in Photo 10, but with interference from an LNB with a 10.6GHz local oscillator. The interference was introduced via a badly-wired double outlet, the result being crosstalk that measured –26dB. In addition to the obvious spikes above ch. 68, lesser signals and noise can be seen almost to the bottom of the band.

the UHF channel in use is affected by LNB noise only, with no satellite carrier present, the result, as you might expect, is a very noisy picture.

The point of all this is that when the feed from a dish passes through the same double-outlet plate as the signal from a UHF aerial, screening within the outlet is vital. There are on the market double outlets with one Belling and one F-type socket. Although these are expressly sold for dual satellite IF/UHF use, the two circuits are not screened from each other. Beware!

SkyDigital

Reception from 28·2°E requires a universal LNB. At present all the transmissions are near the top of the band, with little or nothing lower down. When digital transmissions at the lower frequencies start, a 10·6GHz LNB will convert them to the UHF band. I think this will cause no end of trouble.

Satellite IF Crosstalk

Crosstalk can occur between two satellite IF feeds when both LNBs are powered continuously. If both feeds pass through the same outlet plate, crosstalk is almost inevitable – because the length of unscreened inner conductor will be a significant fraction of a wavelength. The effects may be subtle. They are best avoided.

In Conclusion

I hope that this article has succeeded in explaining some of the odd little peculiarities we all encounter from time to time. Sometimes there's only a minor fault: a little bit of patterning or a slightly grainy picture. It's tempting to shrug your shoulders and hope that the customer won't notice, especially if you have no idea what the cause might be. Unfortunately a minor fault can turn into a major one as soon as your back is turned.

How much better to get it right in the first place! Diagnosing the cause of this sort of thing is usually fairly simple, for example by disconnecting each possible source of interference in turn.

As the satellite and aerial installation business becomes ever more complicated, competent installers have a chance to distance themselves from the cowboys. The way to do this is to work to high standards. Don't ask yourself if the customer has noticed. Ask yourself if you've noticed.

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Philips VR838

The problem with this top-of-therange machine was no tape movement in play or wind/rewind. When the tape was fully laced the supply spool wouldn't turn, though the brakes were seen to be off when a clear service cassette was tried.

An inspection under the deck soon revealed the cause of the problem: the kicker gear (item 129 in the exploded view in the manual) was wrongly timed. This gear is not present in basic models that use the Turbo deck. **P.B.**

JVC HRJ225 and others

The deck used in this and other JVC models can jam in the fully-laced position. When this happens you will see that the pinch roller hasn't fully closed on the capstan shaft. The cause is a broken capstan lever assembly (item 50 in the exploded view in the manual), which is under tremendous stress from its spring. The replacement for this plastic part is made of cast metal. E.T.

Akai VSG240 and others

Here's another common deck fault, which once again is not confined to this particular model. The symptoms are intermittent deck shut down, with ERR2 showing in the display panel. It usually happens when the machine changes mode: from stop to play or rewind, from rewind to stop, etc. The cause is

VCR Clinic

the mode switch, which is readily accessible on the underside of the deck after removing the deck's five securing screws. E.T.

Akai VSG295

These machines can cut out intermittently in the LP record mode. The cure is to fit TR413 and TR414 (both DTC144TK), R520 and R521 (both $47k\Omega$), C505 and C506 (both 10nF) and remove links JS401 and JS402. **R.B.**

Sanyo VHR778

The fault with this machine was intermittent loss of sound when a Nicam broadcast was being recorded. The cause was dry-joints at oscillator X6701. **R.B.**

Finlux VR3724

If the problem with one of these machines is intermittent no rewind or fast forward, replace the cam slide assembly – part no. 8681 4927. **R.B.**

Ferguson 3V32

Some people think that these VCRs are better than new ones. The fault with this machine was failure to come out of standby. Q22 on the mecha board was short-circuit: as a result the voltage at the cathode of D29 was high, preventing the data pulses passing through. Once Q22 had been replaced and a service kit had been fitted the machine worked as well as many new ones. **R.F.W.**

Hitachi VTM620E

The switching point varied in both the play and record modes. The cause of the trouble was C616 and C617. **R.F.W.**

Sharp VCH81

There was no capstan rotation. Before ordering a new motor I examined the old one carefully and found that the 12V supply was prersent at the connector but didn't reach the IC. A small electrolytic capacitor had become leaky, and the leakage had eaten through the copper print. **R.F.W.**

Ferguson FV77

This machine was dead because the UC3842 chopper control chip IP01 had failed. As it's not a common failure, I looked for a reason and found that CP1 (220µF) was faulty. As a result the voltage at pin 7 of IP01 was low. **R.F.W.**

Samsung SV80IK

This VCR was dead apart from four dashes on the clock display. It didn't respond to the standby switch or attempts to insert a cassette. If a cassette was inserted when the power was off, it would be ejected when the power was switched on again. The booster worked, but there was no test signal and no E-E operation.

My first thought was to clean the mode switch, but when I removed the deck I found that it doesn't have one. So I removed the PCB to check the power supply and noticed that one of the end sensors was unsoldered. After resoldering it I looked around for any other dry-joints then reassembled the machine. It now worked. Must have been one of my lucky days. **R.F.W.**

GoldStar P131

"Dead" was the customer's complaint. As through-RF was fine I removed the power supply and concentrated on the secondary-side electrolytics. CP19 $(1,000\mu F)$ proved to be useless when checked with a bridge. Once it had been replaced everything worked though the display was very dull. The cause turned out to be CP25 $(100\mu F)$. B.L.

Akai VS66

The capstan motor was stalling. I held the spindle, with a dummy cassette inserted, and found that it quivered all the time. Not very technical this, but I deduced that there was a power supply fault. In fact the outputs from the power supply were all unstable, with ripple on them. The culprit was C15 (220µF). B.L.

Panasonic NVL28

The customer had somehow discovered that intermittent loss of video and sound while recording could be cured by tweaking the input selector switch. Needless to say this switch now had to be replaced. Once this had been done the original fault was apparent when the same PCB was flexed. The cause was dry-joints at the jumper ribbon-cable connections between the front sub-PCBs. What did concern me was that without the customer's hint I certainly wouldn't have started looking for the cause of the trouble in this section of the VCR! B.L.

Thorn VR172L

There was no display and no deck functions worked. But the modulator was obviously powered. The customer also mentioned that prior to the present situation recordings played back in monochrome. It was very helpful to find that the power module's output connector was marked with the supply voltages that should be present. The 6V output was low at 2V, but increased to 6V when disconnected from the main PCB. As the 6V regulator wasn't running hot, I decided to connect an external 6V supply to the machine. It then worked normally. A replacement KIA78006A regulator, obtained from Chas Hyde & Son, cured the trouble. B.L.

Matsui VP9405

This machine was dead with the mains fuse intact. I had an Orion D1096 circuit, which is almost identical. It didn't take long to discover that the $470k\Omega$ start-up resistor R519 was open-circuit, and I was thankful there hadn't been a power supply blow up as there had with the Orion VCR. After a deck service everything was fine. **B.L.**

Akai VSG745

There was no E-E sound but playback was OK. Checks showed that there was no audio input to the sound processing PCB and no output from the Nicam PCB. The sound would come and go when the Nicam PCB was tapped. Crystal X1 was so dry-jointed that it was hanging out of the PCB. Resoldering this item restored normal sound. G.S.

Sharp VCM27

There were heavy interference lines on E-E via the scart output and virtually no E-E picture or playback at RF. A new RF modulator restored normal pictures. G.S.

Toshiba V404B

The tape speed was incorrect and the back-tension lever was vibrating. The fault gave the impression that the capstan motor speed was varying, with wow on the sound. In fact the cause of the trouble was incorrect seating of the cam slider, giving incorrect operation of the tension-drive lever. When you get this problem, replace all these components, including the hook levers. J.C.

Hitachi VTF450

The complaint with this machine was no results. I soon found that the N5 (250mA) circuit protector QF901 was open-circuit. It protects the supplies to the mode switch (A5·4V), the EPROM (A5V) and the IC902 reset (B5V). J.C.

Toshiba V705B

A problem we've had with these machines is intermittent failure to accept a cassette – the fault can be very intermittent. The cause is a faulty cam switch (B432), part number 70031401. J.C.

Sony SLV625U

If the RVS arm assembly is creased or jammed because the grease has hardened around the spindle, the tape can loop and jam up on the guide poles, preventing tape ejection. To overcome this problem clean the spindle, lightly oil it and reset the height to restore normal operation.

Other causes of failure to eject the tape are a faulty mode switch or a faulty BA6238A loading motor drive chip (IC204). J.C.

Panasonic NVSD400

There were lines on the playback picture and sound variations. A check on the FM waveform showed that it seemed to be distorted. The cause of the trouble was arm unit P5 (part number VXL2306), which was bent. It should be replaced, but as a tempo-

rary measure it can be bent back to the correct position. J.C.

Toshiba V212B

The E-E picture was snowy. Reception via the aerial booster was also snowy. We found that the 12V supply to the booster was missing because the BCP53-16 14V regulator transistor TP91 was short-circuit emitter-to-collector. J.C.

Samsung VIK326

A faulty right-hand side plate is the usual cause of failure to accept a tape. The plastic mount which holds the cog that drives the lift mechanism in and out becomes cracked. It may break off completely. J.C.

Ferguson FV61LV

Although this machine was supposed to be dead there was a shuffle from the deck when I plugged it in. A quick check showed that RP86 (27Ω) was open-circuit. The replacement got very hot, and an audible whistling came from the power supply. Further checks showed that the supply line voltages were all high. Instead of 14V at TP86E there was 18V. The cause was TP01 (BC858) which was leaky. **C.J.G.**

Panasonic NVSD40

A tape was stuck in this machine and the display read H02, which means failure to retract the tape into the cassette. Inspection showed that this was the case, though the loading arms had retracted. At power up there was no movement from any of the motors, but I could wind the tape back into the cassette by turning the capstan with my fingers, so there was no jamming here.

To get to the electronics you have to remove the deck. The clever designer of these machines put a deck fixing screw under the tape carriage: it's inaccessible when there is a tape in the machine. The trick I use is to ease outwards the loading arms at each side of the cassette holder. It's then possible to lift the holder and remove the tape without breaking anything.

The cause of the fault turned out to be dry-joints at the BA6887 loading-motor driver chip IC1, which is right at the front of the PCB. Why the result was failure of the capstan motor to rotate I don't know, but it rotated once IC1 had been resoldered. C.J.G.

VCR Soak Tester

Fed up with intermittent-fault VCRs that bounce? Ian Rees provides the solution: an automated active soak test system

he number of times that a service engineer can check a VCR through its functions before releasing it after repair is limited. When a VCR with an intermittent fault came back to me for the third time, I decided that what was required was a means of automatic, active soak testing. The test equipment that was developed to meet this need is described in the following article. It has proved itself many times over in reducing the number of VCRs that might otherwise have been sent back to the customer with an intermittent fault condition still present.

Design

I felt that the job could be done by using a PC to control a remote-control handset which in turn controlled a VCR's functions. A basic universal remote control unit from CPC was selected for the purpose. It's inexpensive, easy to program and can control a wide range of TV, VCR and satellite receiver brands with all the required functions. To use it to provide active soak testing I had to trace the tracks from its button pads back to the pins of its Zilog 1666 control chip (see Table 1). Only seven lines are needed for the range of six functions required. Several of the functions share control lines: this greatly simplified the interfacing.

The remote-control handset is connected to a control box by a short length of nine-way ribbon cable. This cable is hardwired to the IC pins at one end. At the other

Table 1: Test sequence, timing periods and connections to the remote-control handset IC.

| Step | Function | Time | 1666 pin connections |
|------|---|---------|-------------------------|
| 1 | Reset Power Record Stop Rewind Play Fast forward Stop | 1sec | - |
| 2 | | 1sec | 9-4 |
| 3 | | 120secs | 9-2 |
| 4 | | 1sec | 13-2 |
| 5 | | 30secs | 12-2 |
| 6 | | 120secs | 9-3 |
| 7 | | 30secs | 11-2 |
| 8 | | 1sec | 13-2 |
| 9 | Rewind | 30secs | 12-2 |
| 10 | Power | 1sec | 9-4 |

end it's terminated by an IDC plug which is connected to the control box. It is best to power the handset from its own batteries: this enables the memory to be retained when the control box is switched off.

The first prototype used ten reed relays. I designed a special sound-controlled, tone-operated interface for my PC. This switched the reed test sequence from the 'line out' of a sound card, enabling a software program to control the relays directly. The problem was that this tied down my PC while a soak test was in progress, which could be all day for several days.

The second version, described here, uses a dedicated programmer arrangement and is a stand-alone device. I didn't feel it appropriate to use reed relays, and decided instead to use a couple of CD4066 quad bilateral switch ICs. They proved to be a bit troublesome at first in this application, but worked faultlessly once the bugs had been ironed out.

Although the original PC version could call up any combination of test sequences, I found that I tended to use the same sequence most of the time. So this was hardwired into the new unit.

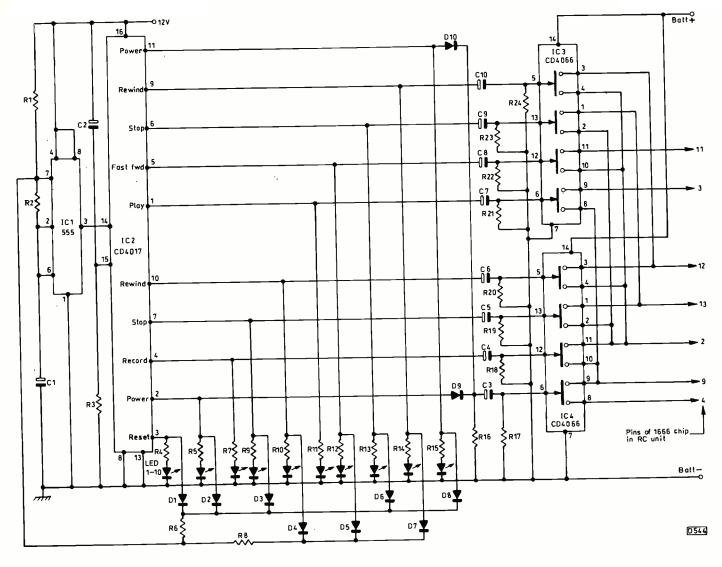
Circuit Description

Fig. 1 shows the circuit diagram of the finished unit. The output (pin 3) of a 555 timer chip (IC1) feeds clock pulses to pin 14 of a CD4017 decade counter/divider chip (IC2). This useful, inexpensive device has ten outputs, only one of which goes high and stays high until the next clock pulse arrives.

At switch-on C2 charges from the 12V supply, via R3, and resets the counter chip. Pin 3 of IC2 goes high first: the associated indicator LED1 then lights to show that it has reset. The voltage at pin 3 is fed back to pin 7 of the 555 chip via D1 and R6 to shorten its timing period to one second

The next clock pulse steps IC2 on: pin 3 goes low and pin 2 goes high. The voltage at pin 2 lights LED2 and is applied to switching pin 6 of IC4 via D9 and C3. As a result, pins 8 and 9 of IC3 are shorted. These pins activate the remote control unit's 'power' function: this signal is sent to the VCR on test. The voltage at pin 2 of IC2 is also linked via D2 and R6 to IC1's one-second delay network.

When the next clock pulse arrives from IC1, pin 4 of IC2 goes high. LED 3 (record) lights, and C4 activates pin 12 of IC4. Pins 10 and 11 of IC4 are shorted and a record command is sent to the VCR via the remote-con-



trol handset. With the record test there is no feedback to the timer chip IC1, so a full two minutes of recording time is allowed.

The next clock pulse from IC1 stops the VCR, and so on through the test program. Once the cycle has been completed it's repeated from the beginning.

The timing periods for the two rewinds and for fast forward (search) are set at thirty seconds by feedback via D4, D5 and D7 then R8 to IC1 (pin 7).

Note that all the commands to the remote-control handset are momentary. This is important to conserve battery power.

The sequence of commands and the timing periods programmed into the unit are listed in Table I. The Zilog 1666 IC pins listed are those that have to be connected together to obtain particular functions.

The timing arrangement provides a complete test cycle every 5.6 minutes, i.e. nearly eleven full test cycles an hour.

Construction

No problems should be experienced in building this unit. Nothing is critical, all parts being cheap and easy to obtain from suppliers such as CPC, Maplin, RS etc.

Although the CPC handset may not be available outside the UK, or may become unobtainable or change, with care it would be very easy to repeat the process of tracing the button pads back to the control IC and modifying the connections accordingly.

I used an IDC connector for the ribbon cable at the

control box end. This was primarily because I was too short of cash to use more than one handset. So I plug and unplug the same one, using it between various test beds. Use of hardwiring at both ends of the ribbon would simplify construction.

Fig. 1: Circuit diagram of the control unit, which drives the remote-control handset. CMOS switch version.

| Parts | list | | |
|---|---|-----------------------------------|---|
| R1 R2-3 R4-5 R6 R7 | 1ΜΩ 1kΩ 680Ω 2-7kΩ 680Ω | C1 C2-10 C11 C12-13 | 330μF, 40V 1μF, 60V 470μF, 25V 0-1μF, 100V ceramic |
| R8 R9-15 R16 R17-24 All 0-25V | 10kΩ 2⋅2kΩ | D1-10 D11-14 LED1 LED2-9 | 1N4148 BY127 (1A) 5mm green 5mm red |
| IC1 IC2 IC3-4 IC5 | 555 timer CD4017 decade CD4066 quad b 7812 12V, 1A v | ilateral swi | tch |
| F1 S1 T1 CPC UR3 HSUR3 | 100mA fuse an DPST, 1A main 0-15V AC, 100n 3 universal progr | s switch nA mains ti | ransformer emote control unit, order code |

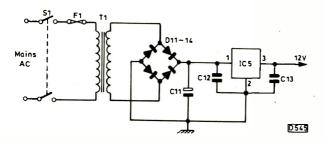
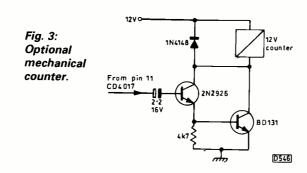


Fig. 2: The mains power supply circuit.



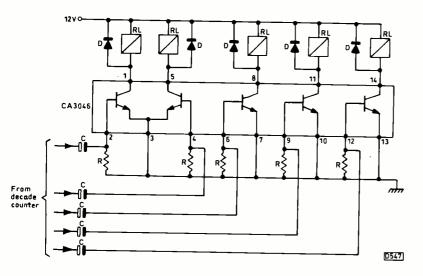


Fig. 4: Alternative reed relay circuit. Two CA3046 chips etc. are required. $C=22\mu F$, 16V, $R=2\cdot 2k\Omega$, D=1N4148, RL=12V reed relay.

The length of the ribbon cable between the control box and the handset is about 12in. This is more than enough to set up and position the unit.

A slot was filed out at the bottom end of the remote-control handset to enable the ribbon cable to be brought into it. Splay out the leads and solder them directly to the IC pins as specified in Fig. 1. The ribbon cable was glued inside the plastic handset case using Bostic, a Tyewrap being used to anchor it in place. There's a small pillar that needs to be cut back to enable the top of the handset to be refitted without springing upwards on the ribbon cable.

The unit has undergone several metamorphoses since its inception, but still lives in its original sloped-top case. It has a stop/run switch and a reset button. As these are little used I have omitted them here.

The power supply (Fig. 2) is mounted in the control box on the same matrix board as the rest of the circuitry. The 12V stabiliser IC5 doesn't need a heatsink. The

two $0.1\mu\text{F}$ ceramic capacitors C12 and C13 must be mounted as close to the input and output pins 1 and 3 of IC5 as possible, to prevent instability.

Fig. 3 shows how a small electromechanical counter can be added to provide a tally of the number of soaktest cycles completed. I put the reading on the bill: it impresses the customer!

The step timings (Table 1) are approximate – there is no need for accuracy. I've used a higher working voltage capacitor in position C1 than is theoretically necessary: this was done deliberately, to keep the leakage low. The $1\mu F$ capacitors C3-10 must not leak, otherwise the remote control unit will operate continuously during the relevant step in the cycle.

The two steering diodes D9 and D10 enable one quad switch section to operate during two of IC2's outputs. This was done because otherwise I would have had to use another quad IC to complete step 10, leaving three unused IC switches. The reset position does nothing, because I found that I got spurious starts at switch on if I triggered the first step from here. This caused handset lock-up – with both the reed and quad-switch versions.

It's important that the supply for the two quad switch ICs comes from the batteries in the remote-control handset. The first mistake I made was to use the main power supply for this purpose. The quad IC outputs go low or unstable when the supply is removed, with the result that the handset either flashes continuously or locks up whenever the control unit is switched off. Being CMOS devices the quad ICs draw little current. They can be left connected to the remote-control unit's batteries with minimal current being drawn.

If you are unlucky and close more than one contact on the CPC unit and the result is a total lock-up of all functions, there's a simple solution. Disconnect the battery supply by removing one cell, then put it back again. This will restore operation. Phew!

Relay Version

If you feel more at home with 12V reed relays, Fig. 4 shows the circuit used in the first prototype. The driver transistors are contained within a couple of CA3046 14-pin DIL npn transistor arrays. Two arrays provide ten driver transistors, so the component count is small. Note that pin 3 of the IC has two of the transistors connected to it.

Use

In use, the VCR has to be in line-of-sight of the remotecontrol handset. This is obvious, but make sure that you don't put it where you can walk between the handset and the VCR on test and obscure the link.

The handset must be programmed for use with the VCR being tested while the control box is switched off. The functions can be confirmed by using the handset buttons to make sure that every step in the test cycle works.

The VCR has to be in standby at the start of the tests, and a fully rewound tape must be inserted. The control unit resets at switch-on: one second later, VCR power-up starts. Each step in the cycle is indicated by the LEDs, one of which will always be lit.

Ideally the VCR should be connected to a TV set and an aerial, so that you can observe the results of the record and playback tests. This is a good indication that all is well.

Resetting is just a matter of turning off the control unit for a few seconds then turning it back on again. The VCR will have to be put back in step with the first test before restarting.



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|---------------------------|--|-------------------------------------|--|----------------------|----------------------------|----------------------|----------------------------------|---|---------------------------------------|--|-------------------------------------|----------------------|------------------------------|----------------------|--------------------------------|--|---------------------------------|-----------------------|
| Part | Price Part | Price | Part | Price | Part BLIV48AF | Price 325p | Part MJ4502 | Price 300p | Part 4N35 | Price 50p | Part LINEAR IC: | Price | Part AN6340 | Price 600p | Part BA335 | 55p | BA7004 BA7007 | 200p 200p |
| BC107 BC108 | 8p BD434 8p BD435 8p BD436 | 30p 31p 30p | BU126 BU128 BU133 | 65p 125p 125p | BUV48C BUV50 | 250p 425p | MJ10012 MJ11015 | 300p 250p | RECTIFIER | | AN203 AN210 | 210p 165p | AN6341 AN6342 AN6344 | 200p 325p 440p | BA338 BA340 BA343 | 80p 75p 60p | BA7021 BA7022 | 180p 350p |
| BC109 BC109C BC140 | 8p BD436 10p BD437 20p BD438 | 28p 36p | BU137 BU180 | 150p 100p | BUV61 BUV70 | 1000p 200p | MJ11016 MJ11032 MJ11033 | 300p 800p 800p | DIODES | 0 | AN211 AN214Q | 150p | AN6345 AN6346 | 400p 350p | BA336 BA401 | 175p 60p | BA7025L BA7107 BA7212S | 100p 475p 200p |
| BC142 BC143 | 20p BD439 20p BD440 | 40p 40p | BU184 BU204 | 100p 65p 70p | BUV90 BUV93 BUW11A | 175p 375p 200p | MJ15003 MJ15004 | 250p 300p | BY127 BY133 BY164 | 8p 8p 40p | AN217P AN228 AN252 | 95p 280p 150p | AN6350 AN6352 | 610p 450p 300p | BA402 BA511 BA514 | 50p 145p 160p | BA7252S BA7604N | 150p 100p |
| BC147 BC149 | 8p BD441 8p BD533 8p BD534 | 40p 50p 38p | BU205 BU206 BU207 | 100p 150p | BUW11AF BUW12 | 225p 125p | MJ15015 MJ15016 | 250p 350p | BY179 BY184 | 35p 32p | AN259 AN262 | 250p 140p | AN6356 AN6359 AN6360 | 500p 320p | BA516 BA518 | 150p 150p | BA7751LS BA7752 | 150p 250p |
| BC159 BC160 BC171 | 30p BD535 10p BD536 | 38p 38p | BU208 BU208A | 70p 75p | BUW12A BUW12F BUW13A | 150p 250p 200p | MJ15022 MJ15023 MJ15024 | 400p 400p 400p | BY206 BY207 BY227 | 11p 20p 19p | AN271 AN274 AN277B | 230p 250p 400p | AN6362 AN6363 | 400p 375p | BA521 BA524 | 100p 240p 180p | BA7755 BA7767AS BA8504 | 150p 155p 350p |
| BC172 BC177 | 10p BD537 14p BD538 | 40p 40p 50p | BU208AT BU208B BU208D | 200p 200p 130p | BUW32A BUW48 | 500p 550p | MJ15025 MJE340 | 700p 25p | BY228 BY298 | 28p 15p | AN2778 AN301 | 60p 330p | AN6367NK AN6368 AN6371 | 400p 275p 350p | BA526 BA527 BA532 | 95p 100p | BA15218 CA3140E | 60p 38p |
| BC178 BC179 BC182 | 14p BD643 14p BD645 7p BD647 | 50p 50p | BU209 BU225 | 90p 120p | BUW49 BUW50 | 550p 400p | MJE350 MJE520 | 80p 30p 65p | BY299 BY329-1200 | 18p | AN302 AN303 | 650p 250p | AN6387 AN6550 | 480p 100p | BA534 BA536 | 220p 150p | CNX62A CNX82A | 50p 60p 80p |
| BC182L BC183 | 7p BD649 7p BD675 | 50p 40p 40p | BU226 BU312 BU325 | 120p 90p 55p | BUW81A BUW84 BUW85 | 150p 75p 85p | MJE2955T MJE3055T MJE13004 | 65p 100p | BY448 BYT11 BYT13-1000 | 20p 25p 30p | AN304 AN315 AN316 | 360p 210p 350p | AN6551 AN6552 AN6554 | 50p 45p 80p | BA546 BA612 BA614 | 160p 120p 70p | CNX83A CX136 CX139A | 600p 750p |
| BC183L BC184 BC184L | 7p BD676 7p BD677 7p BD678 | 38p 40p | BU326A BU406 | 75p 60p | BUX10 BUX11 | 350p 200p | MJE13005 MJE13007 | 60p 100p 100p | BYV96E BYW96E | 25p 36p | AN337 AN360 | 600p 100p | AN6555 AN6605 | 50p 35p | BA618 BA631 | 55p 280p | CX141 CX145 | 750p 725p |
| BC212 BC212L | 7p BD679 7p BD680 | 40p 40p | BU406D BU407 BU407D | 85p 55p 75p | BUX12 BUX20 BUX21 | 150p 350p 450p | MJE13009 MJE15028 MJE15029 | 200p 200p | BYX10 BYX55/600 IN4001 | 15p 25p 3p | AN362 AN363 AN366 | 140p 150p 150p | AN6612 AN6650 AN6651 | 60p 45p 45p | BA656 BA658 BA681A | 110p 350p 350p | CX150B CX175 CX187 | 325p 325p 825p |
| BC213 EC213L EC214 | 7p BD681 7p BD682 7p BD705 | 45p 45p 50p | BU408 | 60p 75p | BUX22 BUX23 | 450p 900p | MJE15030 MJE15031 | 250p 400p | IN4002 IN4003 | 3p 3p | AN610 AN3211K | 160p 375p | AN6652 AN6671K | 45p 425p | BA682A BA683A | 300p 300p | CX804A CX867 | 775p 575p |
| BC214L BC237 | 7p BD707 7p BD709 | 50p 50p | BU412 | 85p 175p | BUX37 BUX39 BUX40 | 220p 450p 210p | MJE18004 MJF18004 MJF18204 | 125p 175p 350p | IN4004 IN4005 IN4006 | 3p 3p 3p | AN3215K AN3231K AN3236K | 350p 300p 450p | AN6676 AN6780S | 600p 80p | BA684 BA685 BA715 | 400p 400p 45p | CX868 CX877 CX7925B | 525p 300p 550p |
| BC238 BC239 | 7p BD711 7p BD736 20p BD826 | 50p 50p 50p | BU414B | 175p 250p 170p | BUX41 BUX42 | 200p 200p | OC28 OC29 | 350p 250p | IN4007 IN4148 | 4p 2p | AN3310K AN3312 | 325p 350p | AN6870 AN6875 AN6878 | 450p 150p 65p | BA718 BA728 | 45p 55p | CX20015A CX20106A | 600p 75p |
| BC300 BC301 BC302 | 20p BD828 20p BD839 | 50p 55p | BU426A BU433 | 70p 120p | BUX47A BUX48A BUX55 | 220p 150p 800p | OC36 | 350p 250p 175p | IN5400 IN5401 IN5402 | 9p 8p 8p | AN3313 AN3320K | 300p 450p 450p | AN6879 AN6880 | 225p 75p | BA806 BA843 | 220p 130p 160p | CX20109 CX20187 CXA1001AP | 140p 700p 1600p |
| BC303 BC304 | 20p BD897 25p BD899 | 50p 50p 50p | BU500D | 100p 225p 90p | BUX80 BUX81 | 180p 160p | S2000AF | 90p 175p | IN5402 IN5403 IN5404 | 8p 8p | AN3331K AN3792 AN3794 | 300p 325p | AN6882 AN6884 AN6888 | 300p 200p 150p | BA1310 BA1320 BA1330 | 75p 120p | CXA1019P CXA1019S | 150p 225p |
| BC327 BC328 BC337 | 7p BD977 7p BDX33 7p BDX37 | 60p | BU505D BU505DF | 90p 90p | BUX84 BUX85 | 50p 50p | S2055AF | 175p 100p 15p | IN5405 IN5406 | 11p 12p | AN3814K AN3821K | 450p 600p | AN6889 AN6913 | 100p 60p | BA1332 BA1350 | 60p 130p | CXA1044P CXA1044BI | 550p 475p 275p |
| BC338 BC441 | 7p BDX44 28p BDX47 | 100p | BU506D | 100p 70p 100p | BUX86 BUX87 BUX98A | 50p 50p 350p | TIP29A | 22p 25p | IN5407 IN5408 RGP10 | 12p 12p 25p | AN3822K AN3830K AN3990K | 800p 800p 300p | AN700 AN7010K AN7025K | 650p 250p 90p | BA1355 BA1356 BA1360 | 125p 100p 160p | CXA1081 CXA1081M CXA1081S | |
| BC446 BC477 BC516 | 8p BDX54C 18p BDX62C 22p BDX63C | 75p 150p 175p | BU508A BU508AF | 60p 60p | BUZ71 BUZ71AF | 75p 100p | TIP29E TIP30 | 40p 25p | RGP15 RGP30 | 25p 16p | AN3991K AN5010 | 400p 250p | AN7060 AN7062 | 175p 300p | BA1404 BA1604 | 120p 125p | CXA1082AS CXA1191M | 1000p 250p |
| BC537 BC546 | 25p BDX64C 8p BDX65 | 175¢ 80¢ | BU508APH BU508D | 75p | BUZ72AF | 100p 100p 150p | TIP31A | 25p 22p 27p | SR2M | 50p | AN2020 | 225p 80p 250p | AN7081K | 250p 200p | BA2266A BA3306 BA3308 | 250p 60p 70p | FT5754M | 400p 600p 250p |
| BC547 BC548 BC549 | 8p BDX66C 8p BDX67C 8p BDX71 | 175; 275; 70; | BU508DR | 85p 130p 110p | BUZ73AF BUZ76A | 60p | TIP32 TIP32A | 24p 21p | I.C. SOCK | ETS 4p | AN5025 AN5033 AN5034 | 400p 400p | AN7106K AN7110 | 170p 135p 75p | BA3312 BA3402 | 60p 90p | HA1124 HA1125 | 125p |
| BC556 | 8p BDX77 8p BDX87C | 175 175 | p BU526 | 100p 75p 100p | BUZ80AF | 135p 200p 200p | TIP33 | 28p 50p 60p | 14 PIN 16 PIN | 5ր 6ր 9ր | AN5071 | 125p 100p 450p | AN7112 | 100p 45p 120p | BA3406AL BA3416BL BA3422 | 120p 80p 350p | HA1151 | 150p 175p 130p |
| BC557 BC558 BC559 | 8p BDX88C 8p BDW24 8p BDW93 | 150; 55; 50; | BU546 | 125p 125p | BUZ90A BUZ91A | 180p 260p | TIP34 TIP34C | 65p 60p | 18 PIN 20 PIN 22 PIN | 10p | AN5132 | 250p | AN7115 | 110p 90p | BA3505F BA3506A | 140p | HA1199 HA1201 | 130p |
| BC560 BC637 | 8p BDW94 20p BDY29 | 50 ₁ 225 ₁ | BU606D BU608D | 225p 120p 120p | BYT11 | 20p 25p 225p | TIP36C | 65p 65p 20p | 24 PIN 28 PIN | 13p | AN5138NF AN5150 | < 350p 400p | AN7117 AN7120 | 65p | BA3520 | 120p 130p 225p | HA1319 | 125p 200p 300p |
| BC639 BC640 BCY33 | 20p BDY56 20p BDY58 200p BDY90 | 225 500 125 | BU705 BU706DF | 130p | IRF130 IRF140 | 475g | TIP41C TIP42A | 22p 20p | 40 PIN | 15p | AN5151 AN5210 AN5215 | 200p 675p 100p | AN7131 AN7133N | 75p 90p 325p | BA3704 BA3706 | 200p | HA1339A HA1367 | 350p 300p |
| BCY34 BCY70 | 200p BDY92 16p BF137 | 100 35 | BU706F BU724A | 150p 100p 70p | IRF240 | 550; 425; 375; | TIP47 | 22p 40p 40p | ZENER DI 400 mWat | ts | AN5222 AN5250 | 200p 160p 150p | AN7134 AN7140 | 300p 170p 70p | BA3812L BA3822LS | | HA 1384 | 120p 600p 320p |
| BCY71 BCY72 BD115 | 16p BF167 16p BF181 30p BF183 | 30 18 20 | BU806 BU807 | 70p | IRF330 IRF340 | 600j 325j | TIP50 TIP51 | 60p 80p | 2V7 to 39V 1.3 Watts 2V7 to 39V | 5 p | AN5260 AN5262 | 300g | AN7142 AN7145 | 80p 195p | BA3920 BA4110 | 300g 75g | HA1389 HA1392 | 210p |
| BD124P BD131 | 50p BF195 25p BF199 | 7 8 | p BU807F p BU808DF | 75; 210; 110; | 1RF450 | 750) 650) 110) | TIP54 | 80p 85p 70p | - | _ | AN5265 AN5315 | 80p 600p 600p | AN7146 AN7147 | 210g 180g 140g | BA4210 BA4220 | 85; 60; 70; | HA1396 | 170p 650p 200p |
| BD132 BD133 BD135 | 25p BF200 50p BF225 20p BF240 | 16 30 16 | p BU824 p BU826 | 60s | IRF520 IRF530 | 110 | TIP105 TIP106 | 65p | VOLTAGE REGULAT | ORS | AN5352 AN5411 AN5421 | 450 150 | AN7149 AN7154 | 160g | BA4236L BA4402 | 110j 45j | HA1398 | 175p |
| BD136 BD137 | 20p BF245 20p BF254 | 25 15 | p BU902 | 160; 110; 110; | IRF610 | 120 120 120 | p TIP110 | 65p 40p 40p | 7805 7806 7808 | 18 ₁ 18 ₁ 25 | AN5429 | 420s | AN7158 | 240; 310; 350; | BA4405 | 220 ₁ 80 ₁ 50 ₁ | p HA11211 | 350p 170p 350p |
| BD138 BD139 BD140 | 20p BF255 20p BF256 20p BF257 | 12 18 18 | p BU910 BU912 | 80j 100j | IRF620 IRF630 | 160 110 | p TIP112 p TIP112H | 35p 50p 30p | 7812 7815 | 18 25 25 | P ANDASON | 125; 160; 100; | AN7161N AN7163 | 375 175 | BA5101 BA5102 | 350 140 | HA11219 | 280p |
| BD144 BD157 | 90p BF259 38p BF262 | 18 25 | p BU922 | 100 110 130 | p IRF642 | 300 200 200 | P TIP116 | 30r 30r | 7824 7905 | 25 25 | AN5520 | 160) 550) 100 | AN7168 | 350) 200) 225) | BA5115L | 75 ₁ 75 200 | p HA11235 | 130p 100p 375p |
| BD166 BD175 BD177 | 30p BF270 30p BF273 30p BF311 | 18 15 21 | p BU932 p BU941 | 175 250 | p IRF710 p IRF720 | 150 150 | p TIP120 D TIP121 | 37g 35g | 7908 | 30 30 | P ANEGOLE | 350 750 | P AN7170 P AN7171K | 260 400 | BA5208A BA5402 | F 110 | p HA11247 p HA11251 | 375p |
| BD179 BD181 | 32p BF336 45p BF337 | 20 | p BU2508AI | 100 110 130 | p IRF740 | 125 125 110 | p TIP125 | 30; 30; 40; | 7915 7918 | 30 30 30 | AN5613 | 200 200 300 | P AN7173K | 325 450 375 | BA5408 | 180 180 225 | p HA11414 | 600p 300p 110p |
| BD182 BD184 BD187 | 60p BF338 60p BF362 30p BF367 | 20 30 13 | p BU2508DI BD BU2520AI | 120 170 | p IRF830 p IRF840 | 110 110 | P TIP127 P TIP130 | 35 ₁ | 78L05 | 30 24 | P ANSOZU | 250 275 | P AN7178 P AN7205 | 180 35 | BA6104 BA6109 | 250 110 | P HA11440 P HA11485E | 250p 3N 400p |
| BD201 BD202 | 33p BF371 38p BF421 | 17 18 | BD BU2525A | 325 | p IRF9510 | 1000 150 150 | p TIP132 | 30 ₁ 30 ₁ 40 ₁ | 78L12 | 24 24 24 | AN5630 | 400 375 | p AN7216 | 40: 175: 60 | p BA6125 | 225 75 55 | p HA11703 | 330p 400p 280p |
| BD203 BD204 BD222 | 42p BF422 42p BF423 31p BF455 | 21 25 12 | BU2527A BUF405A | 400 200 | p IRF9520 p IRF9530 | 150 200 | p TIP137 p TIP162 | 65 ₁ | 78L18 78L24 | 24 24 | | 350 330 500 | P AN7220 | 85 75 | p BA6138 p BA6146 | 130 150 | p HA11710 p HA11713 | 500p 250p |
| BD225 BD232 | 31p BF458 31p BF462 | 19 50 | p BUH315D | 200 175 200 | p IRF9540 | 200 240 200 | p TIP142 | 65 75 50 | 79L08 | 35 35 35 | P AN5701 | 90 150 | P AN7224 | 105 75 175 | p BA6154 | S 700 60 175 | p HA11716 | 250p 480p 700p |
| BD233 BD234 BD235 | 30p BF471 32p BF472 28p BF479 | 28 28 30 | 3p BUH515D 3p BUH517 | 250 275 | p IRF9610 p IRF9620 | 120 | p TIP146 p TIP147 | 70 80 | LM309K | 35 100 | P AN5/12 | 100 180 70 | p AN7254 | 150 250 | p BA6209 p BA6218 | 85 85 | p HA11724 p HA11741 | 650p NT 950p |
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| TBA820 TBA820M TBA920 TBA950 | 55p 35p 100p 100p | TDA1675 | 200p 200p 500p 200p | TDA3653 TDA3654 TDA3654 | 85p 80p | TDA7052 TDA7053 TDA7056 | 120p 200p 200p | TEA104 TEA106 TEA106 | 0 225 p 1 175 p | UPC1352 | C 200p | 2SA953 2SA954 | 30p 60p 30p 185p | 2SA1302 2SA1303 | 300 400 110 | 2SB829 2SB835 2SB857 | 200p 75p 80p | 2SC1170 2SC1172 | 100p 180p 150p 33p |
| TBA990 TC5020 TC5081AP | 60 200 80 | TDA 1870 A TDA 1872 A TDA 1904 | 200p 275p 80p | TDA3710 TDA3720 TDA3724 | 300p 175p 300p | TDA7072 TDA7077 | 225p 100p 175p 100p | TEA106 TEA106 TEA106 | 4 250p 7 150p | UPC1363 UPC1363 | 190; C 300; C 350; | 2SA958 2SA963 2SA965 | 60p 120p 30p | 2SA1306 2SA130 2SA1309 | 100 50 | p 2SB863 p 2SB865 | 110p 220p 25p 180p | 2SC1173 2SC1195 2SC1212 2SC1213 | 210p 35p 10p |
| TC5082P TC5090A TC9125BP | 170; 230; 410; | TDA1908/ | 80p 90p 160p 180p | TDA3725 TDA3730 TDA3740 TDA3750 | 300g 400g 400g 400g | TDA7220 TDA7222 | 65p 100p A 150p | TEA108 TEA108 TEA110 | 0P 170p 7 40p 1 425p | UPC1365 UPC1366 UPC1370 | 250 ₁ C 130 ₁ C 300 ₁ | 2SA968 2SA970 | 25p 55p 25p 35p | 2SA131 2SA1318 | 7 30 3 20 | p 2SB885 p 2SB891 p 2SB892 | 45p 35p 25p | 2SC1214 2SC1215 2SC1216 | 15p 25p 200p |
| TC9130P TC9134 TC9135P TC9137P | 150 ₁ 750 ₁ 125 ₁ 500 ₁ | TDA1941 TDA1950 | 300p 175p 50p | TDA3755 TDA3760 TDA3765 | 425 350 225 | TDA7231 TDA7233 TDA7240 | A 80p 60p 175p | TEA133 TEA151 TEA200 TEA201 | 1 150p | UPC1377 UPC1378 | C 200 ₁ | 2SA984 2SA985 | 25p 60p 25p | 2SA132 2SA132 2SA132 | 9 45 1 80 7 130 | p 2SB895 p 2SB908 p 2SB926 | 60p 70p 30p 60p | 2SC1226 2SC1237 | 15p 75p 250p 35p |
| TC9138AP TC9142 TC9143 | 150 320 300 | TDA2003 TDA2004 TDA2005 | 65p 150p 150p 70p | TDA3771 TDA3780 TDA3791 TDA3800 | 460 400 200 250 | TDA7245 | 250p 225p 400p 400p | TEA20 | 8A 80 0 9 600 0 5B 75 0 | UPC1382 UPC1384 UPC1387 | 110 425 C 250 | p 2SA991 p 2SA992 p 2SA993 | 30p 30p 50p 60p | 2SA134 2SA134 | 6 20 8 45 | p 2SB950 p 2SB951 | 180p 190p 90p | 2SC1252 2SC1278 2SC1279 | 850p 110p 30p |
| TC9145 TC9148 TC9149 TC9150 | 150 200 225 425 | DA2007 | 120p 100p 160p | TDA3803 TDA3810 TDA3825 | A 500 200 150 | TDA7256 TDA7262 TDA7272 | 400p 325p 170p | TEA202 TEA202 TEA202 | 28B 375 29A 650 | UPC1397 | 350 CA 650 | p 2SA999 p 2SA100 | 30p 25p | 2SA135 2SA135 2SA135 | 3 100 6 100 7 6 5 | p 2SB975 p 2SB985 p 2SB986 | 100p 30p 40p | 2SC1308K 2SC1312 2SC1318 | 350p 40p 10p 400p |
| TC9151P TC9152 TC9153 | 425 425 300 | p TDA2010 p TDA2020 p TDA2030 | 150p 120p 80p | TDA3827 TDA3840 TDA3842 TDA3843 | 110 200 200 200 | TDA7274 | | TEA20 | 31A 125 37 200 | UPC1420 UPC1421 UPC1423 | CA 450 CA 650 CA 550 | p 2SA1000 p 2SA1000 p 2SA101 | 200 | 2SA135 2SA136 | 9 45 | p 2SB1010 p 2SB1012 | 110p 25p 55p 60p | 2SC1327 2SC1328 | 20p 15p 15p |
| TC9154AF TC9156 TC9158P TC9162 | 225 300 450 275 | p TDA2040 p TDA2048 | 140p 600p | TDA3845 TDA3856 | 225 300 200 | TDA7284 TDA7302 TDA7310 | 100p 450p 800p | TEA21 TEA21 TEA21 | 30 350 64 160 | UPC1474 | HA 75 | p 2SA101 p 2SA101 | 2 85 3 100 | 2SA137 2SA137 2SA137 | 0 50 1 100 6 30 | p 2SB1016 2SB1017 p 2SB1018 | 130p 40p 130p | 2SC1343 2SC1345 2SC1346 | 200p 15p 100p 270p |
| TC9163 TC9164 TC9167P | 375 400 100 | p TDA2052 p TDA2054 | ∨ 525p M 110p | TDA3950 TDA4001 TDA4050 | 150 | p TDA7318 p TDA7330 | 550p | TEA22 | 61 185 62 275 | UPC149 | 3H 500 5C 400 | p 2SA101 p 2SA101 p 2SA102 | 6 30 8 100 0 30 | p 2SA138 p 2SA138 p 2SA138 | 11 100 32 120 | p 2SB1039 p 2SB1066 | 65p 40p | 2SC1359 2SC1360 | 15p 70p 25p |
| TC9172P TC9174P TC9176P | 300 325 500 | p TDA2151 | 375p 1300p | TDA4092 | 250 | p TDA7359 p TDA7360 | 300 700 | TEA37 TEA50 TEA50 | 18S 175 30 135 40 650 | P UPC151 P UPC151 P UPC152 | OCA 250 | p 2SA102 | 3 60 6 90 | p 2SA138 p 2SA138 | 36 40 6 | op 2SB1077 op 2SB1098 | 180g 80g 75g | 2SC1368 2SC1382 2SC1383 | 75p 40p 25p |
| TC9177P TCA9940 TCEP100 TD62308 | 225 100 100 AP 20 0 | p TDA2270 p TDA2320 p TDA2501 | 250p 80p 300p | TDA4173 | AF 325 145 180 | p TDA737 | 4√ 350 ₁ 0 140 ₁ | TEA51 | 10 175 14A 200 | p UPC153 p 2SA329 | | p 2SA103 p 2SA103 p 2SA103 | 6 60 7 50 8 40 | p 2SA139 p 2SA140 p 2SA140 | 99 2 9 00 15 9 23 3 9 | 5p 2SB1109 0p 2SB1123 0p 2SB1133 | 50 ₁ | 2SC1393 2SC1394 | 20p 20p 15p 55p |
| TD62382 TD62506 TD62705 | 200 200 250 | TDA2502 TDA2503 TDA2504 | 2 175p 3 200p 1 200p | TDA4200 TDA4210 TDA4260 | 160 | p TDA811 | 5 200 6 350 | TEA51 | 16 220 70 200 00 325 | p 2SA473 p 2SA483 p 2SA484 | 29 90 80 | p 2SA104 p 2SA105 p 2SA105 | 1 300 2 15 | p 2SA14 | 41 11 42 11 | Op 2SB1140 | 60 45 40 | 2SC1399 2SC1400 2SC1403 | 100p 50p 500p |
| TD6304A TD6306P TD6350P TD6359P | P 300 350 200 300 | Dp TDA2500 | 5 400p 7 450p | TDA4282 TDA4282 TDA4290 | 360 3T 450 3 125 | p TDA812 p TDA813 p TDA813 | 4 250 4 225 5 225 | TEA55 | 50 150 | p 2SA490 p 2SA493 | 29 | 5p 2SA106 5p 2SA106 2p 2SA107 | 300 9 150 3 375 | p 2SA14 p 2SA14 p 2SA14 | 50 3 59 4 62 2 | Op 2SB1151 Op 2SB1162 5p 2SB1163 | 75 400 370 | p 2SC1413 p 2SC1419 | 50p 150p 50p 700p |
| TDA 1001 TDA 1002 TDA 1003 | 200 200 150 | Op TDA251 Op TDA251 Op TDA251 | 0 450p 4A 500p 5 450p | TDA4420 | 120 1 300 | p TDA813 | 7 200 8 200 | TEA55 | 580 165 581 200 591 200 | p 2SA496 p 2SA505 p 2SA509 | 3(12(3) | Op 2SA10 Op 2SA10 Sp 2SA10 | 7 300 30 125 | p 2SA14 p 2SA14 | 75 9 88 15 | 5p 2SB1182 Op 2SB1185 | 40 50 | p 2SC1429 p 2SC1431 p 2SC1444 | 50p 400p 275p |
| TDA1005 TDA1010 TDA1011 | A 8 | DP TDA253 5p TDA254 | 2 100; 0 150; | TDA442 TDA443 TDA443 | 7 30 0 1 15 0 3 10 0 | p TDA813 p TDA813 p TDA814 | 8B 200 9 200 0 200 | P TEAS | 530 225 540E 750 | p 2SA539 p 2SA544 | 65 65 | 0p 2SA101 0p 2SA101 | 32 80 | p 2SA14 p 2SA14 p 2SA14 | 90 22 91 30 92 26 | 5p 2SB1203 0p 2SB1204 0p 2SB1204 | 4 45 5 40 | p 2SC1446 p 2SC1447 | 350; 55; 70; 120; |
| TDA1013 TDA1013 TDA1013 | 3A 11 | Op TDA254 5p TDA254 Op TDA254 | 2 110 ₁ 3 210 ₁ 4 200 ₁ | D TDA443 D TDA444 D TDA444 | 9 22 0 0 18 0 | Dp TDA814 | 5 120 6 200 | P TEA6 P TEA6 TEA6 | 000 400 100 350 200 22 ! | p 2SA562 p 2SA564 p 2SA571 | 3 1 65 | Op 2SA10 5p 2SA10 Op 2SA10 | 91 100 93 180 | p 2SA14 | 94 45 16 28 | Op 2SB122 Op 2SB124 Op 2SB127 Op 2SB128 | 3 40 4 40 2 300 | p 2SC1450 p 2SC1454 p 2SC1470 | 200 250 120 |
| TDA1020 TDA1020 TDA1020 TDA1020 | 2 33 3 13 | Op TDA254 Op TDA254 | 6A 200 8 200 | p TDA444 p TDA444 p TDA445 | 3 25 5 22 0 22 | Dp TDA817 Dp TDA817 5p TDA817 | 70 170 72 200 73 175 | P TEA6 | 310T 42 ! 414A 42 ! | p 2SA606 | 20 3 1 | | 95 300 96 8 0 | Op 2SA15 Op 2SA15 Op 2SA15 | 23 4 35 17 38 5 | 5p 2SB131 5p 2SB137 5p 2SB138 | 8 40 5 45 2 350 | p 2SC1473 p 2SC1474 | 40 15 45 70 |
| TDA 102 TDA 102 TDA 102 | 5 32 8 17 | Op TDA255 5p TDA255 Op TDA255 | 5 175 6 230 7 225 | p TDA445 p TDA448 | 3 27 0 28 | 5p TDA817 0p TDA81 | 75 300 78 650 | p TEA6 | 420 36 0 172 12 1 1 4 1 | 2SA628 5p 2SA638 5p 2SA638 | 3 2 1 5 5 5 | Op 2SA11 Op 2SA11 Op 2SA11 | 04 140 05 25 0 | Op 2SA15 Op 2SA15 | 98 22 | Op 2SB146 Op 2SC182 Op 2SC372 Op 2SC380 | 75 25 | 2SC1505 2SC1507 2SC1509 | 55 45 35 |
| TDA103 TDA104 TDA104 | 8 50 1E 25 | Op TDA257 Op TDA257 Op TDA257 | 4V 350 5A 100 | p TDA448 p TDA450 p TDA450 | 2 20 0 30 1 28 | Op TDA810 Op TDA810 Op TDA810 | 85 180 90 200 91 42 5 | p TLO6 | 1 44 4 8 | Op 2SA63 Op 2SA64 Op 2SA64 Bp 2SA64 | 2 5 | Op 2SA11 Op 2SA11 Op 2SA11 5p 2SA11 | 11 96 12 15 0 15 3 0 | Op 2SA16 Op 2SA16 Op 2SA16 | 501 2 0 525 4 526 9 | 10p 2SC388 10p 2SC394 2SC403 | A 25 60 25 | p 2SC1515 p 2SC1520 | |
| TDA104 TDA104 TDA104 | 4 11 7 20 8 20 | Op TDA25 | 78A 200 79A 210 32 130 | p TDA450 | 32 35A 30 | 5p TDA81 0p TDA82 | 96 120 05 1250 | p TLO7 | 4 8 3 5 | 0p 2SA67 5p 2SA67 0p 2SA67 | 3 1 7 3 8 2 | 5p 2SA11 5p 2SA11 6p 2SA11 | 20 4 6 23 4 6 24 6 6 | Op 2SA16 Op 2SA16 Op 2SA16 Op 2SA16 | 652 667 1 | 70p 2SC454 70p 2SC458 75p 2SC460 30p 2SC461 | 10 | 2SC1545 p 2SC1567 p 2SC1568 | 120 40 35 |
| TDA105 TDA105 TDA105 | 3 30 4 18 7 6 | 10p TDA259 10p TDA259 10p TDA259 10p TDA259 | 91 110 91Q 150 | p TDA450 | 05K 45 05M 100 | Op TDA82 Op TDA82 Op TDA82 | 148 229 15H 300 17 229 | p TMP4 p TPU2 p TPU2 | 7C-434N 125 2732 80 2735 50 | Op 2SA68 Op 2SA68 Op 2SA69 | 3 2 4 2 9 10 | 25p 2SA11 25p 2SA11 20p 2SA11 20p 2SA11 | 33 12 35 13 | Op 2SA1 Op 2SA1 Op 2SA1 | 571 3 673 4 : | 10p 2SC495 25p 2SC495 40p 2SC497 | 8 | 5p 2SC1569 5p 2SC1570 5p 2SC1571 | 55 40 50 |
| TDA105 TDA106 TDA106 TDA106 | 0 14 2 14 | 10p TDA25 10p TDA25 75p TDA26 | 94 450 95 200 00 400 | p TDA45 p TDA45 p TDA45 | 32 20 55 27 56 37 | Op TDA83 Op TDA83 Op TDA83 | 03 25 0 04 40 0 05 50 0 | Op UC38 | 342N 6 343 12 | Op 2SA70 5p 2SA70 Op 2SA71 | 6 14 8 5 1 28 | 10p 2SA1 30p 2SA1 30p 2SA1 | 42 10 43 1 45 4 | Op 2SA1 5p 2SB1 Op 2SB3 | 706 75 24 | 25p 2SC515 45p 2SC535 40p 2SC536 | 5 30 5 20 | Op 2SC1576 | 5 550 600 3 25 |
| TDA107 | 12 15 14 21 17 25 | Op TDA26 TDA26 TDA26 TDA26 | 11A 100 16 250 30 30 0 | Op TDA45 Op TDA45 Op TDA45 | 60 27 | Op TDA83 Op TDA83 Op TDA83 Op TDA73 | 41 25 49A 35 | Op UPC Op UPC | 20C 22 554 13 555 6 | Op 2SA71 Op 2SA71 Op 2SA72 | 5 9 0 | 50p 2SA1 50p 2SA1 20p 2SA1 | 146 20 151 3 152 15 | Op 2SB3 Op 2SB4 Op 2SB4 Op 2SB5 | 7 4 2 92 | 50p 2SC619 80p 2SC64 55p 2SC64 | 9 100 1 80 | Op 2SC1580 Op 2SC1611 Op 2SC1611 | 5 540 7 340 9 170 |
| TDA108 TDA108 TDA108 TDA108 | 32 2° 33 1° 35 1° | 75p TDA26 95p TDA26 70p TDA26 60p TDA26 | 53A 35 0 54 20 0 58 30 0 | Dp TDA45 Dp TDA45 Dp TDA45 | 68 22 70 20 80 40 | 15p TDA83 10p TDA83 10p TDA83 | 851 20 860N3 80 861N3 90 | Op UPC Op UPC | 556H 8 571 22 574 6 | Op 2SA72 Op 2SA72 Op 2SA73 Op 2SA74 | 6 3 | BOp 2SA1 2Op 2SA1 15p 2SA1 9Op 2SA1 | 154 2 156 9 162 3 | 2p 2SB5 0p 2SB5 0p 2SB5 | 25 27 1 31 4 | 65p 2SC64 30p 2SC68 00p 2SC68 | 7 300 1 250 3 3 | 0p 2SC162 0p 2SC162 5p 2SC162 | 3 50 4 60 6 55 |
| TDA109 | 92 1 6 97 4 7 51 | 75p TDA26 75p TDA26 40p TDA27 | 70 150 90 100 10-1 400 | Op TDA46 Op TDA46 Op TDA46 | 00 20 00 10 01 1 : | Op TDA83 | | Op UPC Op UPC Op UPC | 577 6 592 9 595 1 9 | 4p 2SA74 5p 2SA74 00p 2SA74 | 2 4 17A 4 18 | 50p 2SA1 25p 2SA1 60p 2SA1 | 163 1 169 50 | 2SB5 2SB5 2SB5 2SB5 3Op 2SB5 | 37 44 | 80p 2SC700 90p 2SC710 22p 2SC71 45p 2SC73 | 1 1 | 5p 2SC162 5p 2SC163 0p 2SC166 | 8 75 4 5 0 7 45 0 |
| TDA11 TDA11 TDA11 TDA11 | 70 70N | 50p TDA27 85p TDA27 85p TDA27 75p TDA27 | 30 20 | Op TDA46 | 10 3 ° | 70p TDA83 | 380 20 385 27 | 0p UPC 5p UPC | 596 1 9 1001 2 3 1004C 1 3 | 20p 2SA76 20p 2SA76 20p 2SA7 | 9 70 2 | 00p 2SA1 80p 2SA1 00p 2SA1 | 174 2 175 3 | 25p 25B5 30p 25B5 | 49 60 | 50p 2SC73 25p 2SC73 | 5 4 | Op 2SC166 Op 2SC167 | 9 10 |

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|---------------------|-----------------|--------------------|------------------------------------|----------------|--------------------|------------------------------------|--------------------|------------------|---------------------|--------------|-------------------|------------------|----------------------|-----------------------|--------------|--------------------|----------------|--------------------|----------------|--------------------|-----|
| 2SC 1678 | 80 | p 2SC2 | | 700p 90p | 2SC2719 2SC2721 | | | | p 2SC379 | 8 220 | Op 2SD25 | 7 1: | 95p 25 | D880 | Price 40p | Part 2SD132 | Pric 7 150 | | | ce Part | |
| 2SC1683 2SC1684 | 100 | p 2SC2 | | 60p 25p | 2SC2724 2SC2738 | 15 | p 2SC326 | 9 50 | p 2SC380 | 8 70 | p 2SD29 | | 50p 29 50p 29 | D882 D889 | 25p 35p | 2SD1328 2SD1330 | B 60 | p 2SD176 | 4 70 | Op 25K31 | 15 |
| 2SC1685 2SC1729 | 30 | p 2SC2 | 274 | 15p | 2SC2749 | 350 | P 2SC327 | 75 | | | | 3 : | 25p 29 | D892A D894 | 75p | 2SD1347 | 7 70 | 2SD176 | 9 110 | Op 2SK32 | |
| 2SC1730 | 10 | p 2SC2 | 278 | 50p 70p | 2SC2750 2SC2751 | 300 270 | | | | 2 135 | p 2SD32 | 5 | 30p 2S | D895 | 35p 100p | 2SD1348 2SD1350 | | | |)b SERSS | |
| 2SC1735 2SC1740 | 10 | | | 700p 800p | 2SC2752 2SC2767 | 75 ₀ | p 2SC3280 | 200 | 2SC385 | 1 100 | p 2SD34 | 8 30 | | D896 D898B | 200p 225p | 2SD1376 2SD1378 | | 2SD178 | 3 70 | 2SK35 | |
| 2SC1741 2SC1755 | | | 291 | 40p 35p | 2SC2769 2SC2773 | 400 | 2SC3284 | 600 | 2SC385 | 3 220 | | | | D900 D905 | 400p 450p | 2SD1379 2SD1380 | 100 | 2SD178 | 9 210 | p 2SK36 | 64 |
| 2SC1756 2SC1758 | 35 30 | p 2SC2 | 307 : | 300p | 2SC2774 | 700; 500; | 2SC3298 | 50 | | | | 8 4 | Op 25 | D916 | 130p | 2SD1382 | 60 | 2SD180 | 2 75 | | |
| 2SC1760 | 70 | p 2SC2 | 312 | | 2SC2785 2SC2786 | 40 ₁ 20 ₁ | | 120 | 2SC3858 | 550 | p 2SD36 | 1 10 | Op 2S | D917 D921 | 300p 320p | 2SD1384 2SD1390 | | | 6 75 | P 2SK37 | 73 |
| 2SC1775 2SC1781 | 10 ₁ | 2SC2 | | | 2SC2787 2SC2791 | 10 | 2SC3303 | 100 | 2SC3868 | 100 | p 2SD37 | | | D923 D946 | 360p 120p | 2SD1391 2SD1392 | 250 | 2SD181 | 5 50 | p 25K38 | |
| 2SC1789 2SC1809 | 100g 40g | 2SC2 | 320 | 10p | 2SC2792 | 500p 220p | 2SC3307 | 600 | | | | 65 | Op 2S | D947 D950 | 100p | 2SD1395 | 80 | 2SD182 | 7 120 | 2SK38 | 39 |
| 2SC1810 | 250 | 2SC2 | 328A | | 2SC2793 2SC2808 | 700p 40p | | 150p | 2SC3883 | 210 | p 2SD382 | 2 7 | 5p 2S | D951 | 300p 200p | 2SD1396 2SD1397 | 120g 100g | | | | |
| 2SC1815 2SC1819 | 10g 70g | | | | 2SC2810 2SC2812 | 360p | 2SC3316 | 280p | 2SC3885 | 250 | p 2SD388 | | | D957A D958 | 520p 60p | 2SD1398 2SD1399 | 120p | 2SD184 | 275 | p 2SK41 | 4 |
| 2SC1826 2SC1827 | 60p | 2SC23 | 329 4 | 80p | 2SC2814 | 40p 40p | 2SC3326 | 350ր 50ր | | | | 6 | 0p 2SI | 0965 | 35p | 2SD1400 | 280p | 2SD1850 | | | |
| SC1829 | 60p 500p | 2SC23 | 31 | | 2SC2824 2SC2825 | 75p 900p | 2SC3327 2SC3328 | 60p 50p | 2SC3890 | 150 | P 2SD401 | 5 | 0p 2St | 0970 09 7 2 | 170p 40p | 2SD1402 2SD1403 | 120p 225p | 2SD1853 2SD1856 | | 2SK427 | 7 |
| 2SC1833 2SC1834 | 27p | | | | 2SC2826 2SC2827 | 200p 130p | 2SC3330 | 20p | 2SC3893 | 225 | 2SD414 | | |)973)973A | 60p 70p | 2SD1405 2SD1406 | 80p 60p | 2SD1857 | 75 | p 25K430 | |
| SC1841 SC1844 | 12p | 2SC23 | 35 | 55p 🗀 | 2SC2832 | 300p | 2SC3333 | 25p 120p | | | | 5 | 5p 2SE | 982 | 90p | 2SD1407 | 60p | 2SD1858 2SD1863 | 35 | 2SK513 | 3 |
| SC1845 | 50ր 15ր | 2SC23 | 44 1 | 50p | 2SC2834 2SC2837 | 280p 250p | | 100p 130p | 2SC3897 2SC3907 | 400 | 2SD426 | 15 | Op 2SE | 985 986 | 120p 120p | 2SD1408 2SD1409 | 125p 170p | 2SD1864 2SD1877 | 85 | 2SK526 | |
| SC1846 SC1847 | 35p 45p | | 47 | 35p 3 | 2SC2839 2SC2853 | 40p | 2SC3352 | 200p | 2SC3927 | 250p 250p | 2SD438 | 350 | | 998 1010 | 70p 40p | 2SD1411 2SD1412 | 85p | 2SD1878 | 160 | 2SK534 | 4 |
| SC1855 SC1856 | 85p | 2SC23 | 60 1 | 20p 2 | 2SC2873 | 70p 60p | | 280p 50p | 2SC3940 2SC3943 | 40p | 2SD467 2SD468 | 19 | p 2SC | 1012 | 40p | 2SD1413 | 75p 60p | 2SD1879 2SD1880 | | | |
| SC1865 | 25p 700p | | | | 2SC2877 2SC2878 | 120p 20p | 2SC3356 2SC3358 | 120p | 2SC3944 | 80p | 2SD471 | 19 20 | | 1020 | 40p 120p | 2SD1415 2SD1417 | 190p 75p | 2SD1881 2SD1884 | 350 300 | 25KE30 | |
| SC1870 SC1871 | 700p 425p | 2SC23 2SC23 | 65 2 | BOp 2 | 2SC2879 2SC2882 | 3200p | 2SC3376 | 50р 300р | 2SC3950 2SC3953 | 120p 50p | | 100 50 | | 1022 1024 | 250p 850p | 2SD1425 | 260p | 2SD1886 | 300p | 23K544 | |
| SC1875 SC1881 | 220p | 2SC23 | 71 : | 25p 2 | 2SC2883 | 60p 60p | 2SC3377 2SC3378 | 50p 120p | 2SC3955 2SC3964 | 60p | 2SD526 | 70 | p 2SD | 1027 | 850p | 2SD1426 2SD1427 | 135p 160p | 2SD1887 2SD1894 | 225p 300p | | |
| SC1890 | 70p 15p | 2SC23 | | | 2SC2898 2SC2899 | 200p 50p | 2SC3379 2SC3381 | 1200p | 2SC3972 | 250p | 2SD549 | 120 | | 1030 1031 | 75p 70p | 2SD1428 2SD1430 | 180p 280p | 2SD1895 2SD1910 | 225p | 2SK555 | |
| SC1895 SC1904 | 500p 125p | 2SC23 | 39 4 | 5p 2 | SC2909 | 60p | 2SC3383 | 130p 80p | 2SC3973 2SC3975 | 210p 210p | | 300 225 | p 2SD p 2SD | | 600p | 2SD1431 | 200p | 2SD1911 | 300p | 2SK557 | |
| SC1906 SC1907 | 15p | 2SC24 | 08 12 | 2Op 2 | SC2910 SC2911 | 25p 80p | 2SC3393 2SC3397 | 80p 20p | 2SC3987 2SC3996 | 160p 600p | | 500 | p 2SD | 1047 | 180p | 2SD1432 2SD1433 | 400р 300р | 2SD1913 2SD1929 | 50p 50p | | |
| C1909 | 20p 250p | 2SC24 | | | SC2912 SC2921 | 120p 650p | 2SC3399 2SC3400 | 50ր 35ր | 2SC3997 | 1250p | 2SD558 | 225 200 | p 2SD | | | 2SD1438 2SD1439 | 60p 165p | 2SD1930 2SD1933 | 50p | 2SK566 | |
| SC1913 SC1914 | 90p 30p | 2SC245 | 8 1 | Op 2 | SC2922 SC2923 | 480p | 2SC3401 | 50p | 2SC3998 2SC4006 | 800p 100p | 2SD571 | 50 20 | | | 130р | 2SD1441 2SD1442 | 220p | 2SD1939 | 45p 60p | 25K606 | |
| C1921 C1922 | 15p | 2SC246 | 6 5 | 5p 2 | SC2928 | 75p 550p | 2SC3402 2SC3405 | 40p 130p | 2SC4020 2SC4023 | 150p 325p | | 530 25 | P 2SD | 1063 | q00s | 2SD1445 | 80p 200p | 2SD1941 2SD1944 | 350p 50p | 2SK612 2SK684 | |
| C1923 | 175p 10p | 2SC248 | 2 5 | | SC2929 SC2934 | 280p 75p | 2SC3409 2SC3416 | 400р 30р | 2SC4029 | 350p | 2SD596 | 25 | p 2SD | | | 2SD1446 2SD1450 | 300p 60p | 2SD1958 2SD1959 | 80p 210p | 2SK685 | |
| C1929 C1940 | 180p 110p | 2SC247 2SC248 | 0 6 | 5p 2 | SC2937 | 250p | 2SC3417 | 90p | 2SC4043 2SC4046 | 45p 40p | 2SD600 2SD601 | 30 40 | | 1069 | 150p | 2SD1451 | 200p | 2SD1978 | 50p | 2SK699 2SK719 | |
| C1941 C1942 | 27p | 2SC248 | 2 2 | Op 2 | SC2939 SC2944 | 400p 300p | 2SC3419 2SC3420 | 120p 80p | 2SC4056 2SC4059 | 200p 400p | 2SD602 2SD612 | 60 | p 2SD1 | 088 | 50p | 2SD1452 2SD1453 | 275p 140p | 2SD1984 2SD1991 | 60p 50p | 2SK724 | |
| C1944 | 350p 350p | 2SC248 2SC248 | | Op 29 | SC2958 SC2962 | 50p 800p | 2SC3421 2SC3422 | 45p 75p | 2SC4064 | 140p | 2SD613 | 50 ₁ | 2SD1 | 110 | | 2SD1455 2SD1457 | 250p 165p | 2SD1994 2SD1996 | 200p | 2SK725 2SK726 | |
| C1945 C1946 | 350p 1500p | 2SC248 2SC249 | 5 40 | Op 25 | SC2979 SC2987 | 160p | 2SC3423 | 60p | 2SC4106 2SC4107 | 150p 175p | 2SD617 2SD633 | 300 ₁ | | 111 | 20p | 2SD1458 2SD1459 | 50p | 2SD2006 | 45p 75p | 2SK727 | |
| C1947 C1953 | 450p | 2SC249 | B 5 | Op 29 | SC2988 | 250p 150p | 2SC3425 2SC3446 | 65p 150p | 2SC4123 2SC4124 | 230p 200p | 2SD636 2SD637 | 10 | 2SD1 | 128 | 00p 2 | 2SD1468 | 60р 40р | 2SD2010 2SD2011 | 250p 60p | 2SK739 2SK758 | |
| C1957 | 45p 70p | 2SC250 2SC250 | 2 14 | | SC2995 SC2999 | 60p 50p | 2SC3447 2SC3456 | 130p 200p | 2SC4125 | 275p | 2SD638 | 15 | 2SD1 | 135 | 75p 2 | 2SD1487 2SD1494 | 225p 150p | 2SD2012 2SD2018 | 50p 65p | 2SK769 | |
| C1959 C1962 | 10p 175p | 2SC250: 2SC251: | | Op 25 | | 1400p | 2SC3457 | 125p | 2SC4137 2SC4138 | 40р 200р | 2SD639 2SD640 | 20; 350; | | | 40p 2 | SD1496 SD1497 | 300p | 2SD2033 | 80p | 2SK786 2SK787 | |
| C1967 C1969 | 1300p | 2SC251 | 12 | Op 2S | C3020 | 1450p | 2SC3459 2SC3460 | 180p 130p | 2SC4157 2SC4159 | 400p 100p | 2SD655 2SD661 | 18 60 | 2SD1 | 142 3 | 50p 2 | SD1497-02 | 230p 2 350p | 2SD2061 2SD2066 | 100p 250p | 2SK791 | |
| C1970 | 160p 100p | 2SC2519 | 300 | | C3022 C3025 | 1850p 500p | 2SC3461 2SC3466 | 275p 225p | 2SC4161 2SC4169 | 125p | 2SD666 | 25 _F | 2SD1 | 148 1 | 75p 2 | SD1505 SD1506 | 90p 50p | 2SD2125 2SD2136 | 180p 85p | 2SK792 2SK793 | |
| C1971 C1972 | 400p 600p | 2SC2534 2SC2535 | | p 2S | C3026 C3030 | 450p | 2SC3468 | 70p | 2SC4199 | 60р 400р | 2SD667 2SD669 | 20p 35p | | | | SD1508 SD1509 | 60p 100p | 2SD2144 | 35p | 2SK794 | |
| C1973 C1975 | 150p 120p | 2SC2538 2SC2540 | 100 | p 2S | C3037 | 125p | 2SC3481 2SC3482 | 275p | 2SC4204 2SC4231 | 60p 250p | 2SD673 2SD676 | 350p 250p | 2SD1 | 160 1 | 50p 2 | SD1511 | 75p | 2SD2151 2SD2255 | 175p 175p | 2SK796 2SK809 | |
| C1980 | 30p | 2SC2542 | 300 | | C3038 C3039 | | 2SC3486 2SC3502 | 275p | 2SC4235 2SC4236 | 300p 450p | 2SD717 | 180p | 2SD1 | 164 | 75p 2 | SD1519 SD1521 | 70p | 2SD2331 2SD2333 | 250p 150p | 2SK812 2SK817 | |
| C1983 C1984 | | 2SC2545 2SC2546 | | | C3040 C3042 | 260p | 2SC3503 2SC3504 | 50p | 2SC4237 | 500p | 2SD718 2SD722 | 85p 240p | | | | SD1525 SD1526 | | 2SD2340 2SJ48 | 225p | 2SK851 | |
| C1985 C1986 | 100p 100p | 2SC2547 2SC2550 | 65 50 | p 25 | C3052 | 30p | 2SC3505 | | 2SC4242 2SC4278 | 120p 175p | 2SD725 2SD726 | 200p 275p | 2SD11 | 173 3 : | 50p 2 | SD1541 SD1545 | 350p | 2SJ56 | 700p | 2SK872 2SK875 | |
| 2001 2002 | 15p | 2SC2551 | 70 | p 25 | C3057 C3068 | | 2SC3506 2SC3507 | | 2SC4288A 2SC4300 | 650p 200p | 2SD731 2SD732 | 250p | 2SD11 | 86 4 | Op 2 | SD1546 | | 2SJ74 2SJ76 | 60p 220p | 2SK903 | |
| 2003 | 20p | 2SC2552 2SC2553 | 60 200 | | C3070 C3071 | 35p | 2SC3509 2SC3514 | 750p | 2SC4301 | 300p | 2SD734 | 250p 15p | 2SD11 | 91 1: | | SD1548 SD1554 | | 2SJ77 2SJ79 | 350p 225p | 2SK904 2SK951 | |
| 2004 | | 2SC2555 2SC2562 | 120 90 | p 2S | C3073 C3074 | 100p | 2SC3518 | 120p | 2SC4304 2SC4313 | 225p 600p | 2SD741 2SD743 | 120p 130p | 2SD11 2SD11 | | 0p 25 | SD1555 SD1556 | 150p | 2SJ103 | 75p | 2SK952 | |
| 2023 | 180p | 2SC2563 | 200 | p 2S | C3075 | 150p | 2SC3519 2SC3526 | | 2SC4381 2SC4382 | 150p 200p | 2SD757 2SD760 | 120p | 2SD11 | 97 19 | Op 25 | SD1565 | 75p | 2SJ109 2SJ113 | 200p 1050p | 2SK955 2SK956 | |
| 2027 | 200p | 2SC2568 2SC2570 | 120 30 | | C3077 C3086 | | 2SC3528 2SC3531 | 750p | 2SC4386 2SC4387 | 275p | 2SD762 | 70p 100p | 2SD11 2SD12 | | | SD1571 SD1572 | 170p | 2SJ114 2SJ116 | 1150p 1200p | 2SK962 | |
| 2036 | | 2SC2571 2SC2577 | 350 110 | p 2S0 | C3089 | 130p | 2SC3549 | 200p | 2SC4408 | | 2SD763 2SD768 | 140p 180p | 2SD12 2SD12 | 10 28 | Op 25 | D1575 D1576 | 200p | 2SJ117 | 550p | 2SK1023 2SK1036 | |
| 2053 | 120p | 2SC2578 | 170 | 2 SC | C3112 | 35p 2 | 2SC3552 2SC3568 | | 2SC4429 2SC4431 | | 2SD772 2SD773 | 200p 20p | 2SD12 2SD12 | 13 22 | Op 25 | D1577 | 250p | 2SJ119 2SJ162 | 700p 680p | 2SK1057 | |
| 2058 | 20p | 2SC2579 2SC2580 | 110 175 | 250 | C3114 C3116 | | 2SC3577 2SC3584 | | 2SC4466 2SC4467 | 325p | 2SD774 | 30p | 2SD12 | 23 7 | 5p 29 | D1579 D1589 | | 2SJ175 2SJ182 | | 2SK1058 2SK1081 | |
| 2060 2061 | | 2SC2581 2SC2588 | 225 ₀ | | 3117 3122 | 120p 2 | 2SC3591 2SC3595 | 200p 2 | SC4468 | 250p | 2SD777 2SD784 | 400p 650p | 2SD12: | | | D1590 D1591 | 100p 2 | SJ200 SJ307 | 625p | 2SK1082 | |
| 2068 2071 | | 2SC2590 2SC2591 | 40 ₁ 50 ₁ | 250 | 3148 | 145p 2 | SC3597 | 75p 2 | SC4517 SC4517A | | 2SD786 2SD787 | 100p 20p | 2SD12: | 29 25 | Op 2S | D1593 | 125p 2 | SK 19 | 45p | 2SK1102 2SK1117 | 2 |
| 2073 2075 | 40p | 2SC2592 | 200 _j | 2SC | 3150 | | SC3599 SC3600 | 140p 2 175p 2 | SC4531 SC4532 | 450p | 2SD788 2SD789 | 30p | 2SD123 | 30 | Op 2S | D1595 D1608 | | SK33 SK40 | 40p | 2SK1118 | - 2 |
| 2078 | 95p 2 | 2SC2603 2SC2610 | 10 ₁ 60 ₁ | | | 175p 2 | SC3606 SC3607 | 100p 2 | SC4542 | 400p | 2SD792 | 20p 400p | 2SD124 | 6 2 | | D1609 D1632 | | SK55 SK68 | 100n | 2SK1120 2SK1190 | : |
| 2085 2086 | | 2SC2611 2SC2621 | 30p 70p | 2SC | 3153 | 175p 2 | SC3608 | 65p 2 | SC4742 SC4744 | 350p | 2SD794 2SD795A | 33p 140p | 2SD124 2SD125 | | Op 2S | D1637 D1647 | 50p 2 | SK73 | 75p | 2SK1191 | 8 |
| 092 | 100p 2 | SC2625 | 190g | 2SC | 3157 | 200p 2 | SC3616 SC3636 | | SC4745 SC4747 | | 2SD798 2SD799 | 175p | 2SD125 | 4 5 | 5p 2S | D1649 | 260p 2 | SK97 SK106 | | 2SK1217 2SK1221 | 2 |
| 2097 2 | 300p 2 | SC2626 SC2630 | 600p 1800p | 2SC | 3159 2 | | | 225p 2 | SC4757 SC4762 | 200p | 2SD809 | 150p 45p | 2SD126 | 4 5 | 5p 2S | D1651 | | SK107 SK109 | 40p | 2SK1275 | 2 |
| 2118 1 | | SC2631 SC2632 | 20p 35p | 2SC | 3164 | 270p 2 | SC3659 | 600p 2 | SC4769 | 220p | 2SD811 2SD819 | 450р 300р | 2SD126 2SD126 | 5 7 9 | p 2SI | D1656 | 250p 2 | SK117 | 50p | 2SK1296 2SK1299 | 3 |
| 120 | 10p 2 | SC2634 | 10p | 2SC | 3170 3 | 300p 2 | SC3675 | 100p 2 | SC4770 SC4820 | | 2SD820 2SD821 | 250p 550p | 2SD126 | 7 59 | p 2SI | 01666 | 50p 2 | SK118 SK125 | 100p | 2SK1317 | 9 |
| 131 | 550p 2 | SC2636 SC2637 | 40p 120p | 2SC | 3175 1 | 80p 2 | SC3678 | 280p 2 | SC4826 | 70p 2 | 2SD822 | 290p | 2SD127 2SD127 | 1A 22 | p 2SI | 01668 | 120p 2 | 5K133 5K147 | 650p | 2SK1338 2SK1341 | 5 |
| 1141 153 | | SC2640 SC2653 | 1800p 100p | 2SC3 | 31 78 1 | 25p 25 | SC3680 | 380p 2 | SC4923 | 400p 2 | SD826 SD829 | 30p 375p | 2SD127 2SD127 | 2 20 0 | P 2SE | 1669 | 85p 2 | SK 152 | 40p 2 | 2SK1342 | 5 |
| 166 | 80p 2 | SC2654 SC2655 | 180p | 2SC3 | 3180 1 | 75p 29 | SC3687 | 300p 29 | SC4927 | 250p 2 | SD836 SD836A | 50p 50p | 2SD127 | 4 80 | p 2SE | 01680 | 225p 25 | 6K161 6K163 | 40p 2 | SK1350 SK1356 | 2 |
| 188 | 70p 2 | SC2656 | 50p 550p | 2SC3 | 3182 1 | 20p 29 | SC3688 | 550p 25 | SC5002 | 300p 2 | SD837 | 55p | 2SD127 | 6 60 | p 2SE |)1683)1684 | | K168 K170 | 40p 2 | SK1357 | 3 |
| 209. | 50p 2 | SC2660 SC2665 | 100p 200p | 2SC3 | 3198 | 30p 25 | C3715 | 480p 25 | SC5027 | 100p 2 | SD838 SD841 | 110p | 2SD127 2SD127 | 7 190 | P 2SE |)1706 3 | 325p 25 | K184 | 35p 2 | SK1358 SK1377 | 19 |
| 216 221 6 | 50p 29 | SC2668 | 10p | 2SC3 | 3202 | 25p 25 | GC3729 | 450p 25 | SC5048 | 300p 2 | SD844 SD850 | 200p | 2SD1288 | 175 | p 250 | 1708 3 | 375p 25 | K192 K193 | 40p 2 | SK1400 | 2 |
| 228A | 60p 25 | SC2671 SC2681 | 100p 170p | 2SC3 2SC3 | 210 5 | 20p 29 50p 29 | C3746 | 100p 25 | C5086 | 250p 2 | SD856 | 48p | 2SD1289 2SD1291 | 280 | p 2SD | 1718 2 | 200p 25 | K195 | 150p 2 | SK1404 SK1461 | 29 |
| 230 | 80p 25 | C2682 C2688 | 70p 27p | 2SC3 2SC3 | 211 2 | 20p 25 | C3748 | 100p 2S | C5148 | 300p 2 | SD858 SD863 | | 2SD1292 2SD1293 | 60 | p 2SD | 1729 2 | 30p 29 | K212 | 35p 2 | SK1462 | 42 |
| 233 1 | 00p 25 | C2690 C2694 | 60p | 2SC3 | 225 | 5 0p 2S | C3781 1 | 150p 2S | C5250 : | 300p 2 | SD864 SD866 | 200p | 2SD1297 2SD1302 | 300 | p 2SD | 1732 2 | 50p 2S | K216 ; | 200p 2 | SK1487 SK1507 | 30 |
| 236 | 20p 29 | C2705 | 3500p 40p | 2SC3: | 244 | | C3782 | 75p 2S | D188 ; | 350p 2 | SD866A | 140p | 2SD1306 | 45 | 2SD | 1740 1 | 80p 2S | K223 | 50p 25 | SK1529 | 70 |
| 238 | | C2706 C2710 | 250p 50p | 2SC3: | 246 | 50p 2S | C3787 1 | 00p 2S | D199 | 195p 29 | SD867 SD868 | | 2SD1308 2SD1309 | 80 | 2SD | 1748 | 90p 2S | K241 | 30p | SK1537 SK1544 | 90 |
| 240 | 15p 2S | C2712 C2714 | 20p | 2SC3: 2SC3: | 260 2 2 | 20p 2S | C3789 | 75p 2S | D200 1 D201 2 | | SD869 | 150p | 2SD1310 2SD1311 | 140 | 2SD | 1758 | 60p 2S | K246 K300 | 25p 25 | SK1767 | 27 |
| | | /14 | 20p | | | | | | D213 2 | | | | | | | . ABILL 1 | 80p 2S | K301 | 40p 25 | SK2038 | 29 |

| | REPLACE | EMENT VID | EO | HEADS | |
|--|---|---|-------------------------------|--|--|
| Model Price | | Model | Price M | odel Price | Model Price |
| VICUE | VHSAN3 800p | UPD250 HRD257 1 | 800p N | /FS 100 4500p /FS1 4200p | TLS1100 3100P VHR120, 130, 14, 141, 143G, 14SP, 151, 15, 16, 171, 220, 23, 244, 274, VHR310, |
| VS105, 112, 115, 116, 120, 125, 126, 201, 202, 205, 206, 240, 244, 245, 247, 248, | VHSBH1, VHSCH1 2100p | 3V32, 8942, HR7655 HRD180, 190, 230, 610, 3V59, FV12L | 800p N | E.C. | 330, 4100, 4105, 4200, 430, 4300, 4400, |
| 250, 301, 303, 304. VSP8, VSP82 850p | 0000 | FV20B, 26, 30, 32, 33, VC141L 1 HRD370, HRD430, HRD470, 3V58, F | 600p 90 √13H 90 | 16, 901A, 902A, 9033, N9034, 9040, 53, 9054, 9055, 9056, 9063, 9065, 9066, | VHR5200, 5600, 6850, 7100, 7200, 7250, 7200, 8070, 8100, 8101, 8200, VHR7800, |
| VP7200 VS9700 VS9800 900p | 4000- | 1 HRD530 HRD700, HRD840, HRD870 | BUUD 90 | 6, 9077, 2096 DX1000, 1600, PX1200 850p | 7810, 8000SP, 8801SP, VHRD4400, 4410, 4500, 4600. |
| VS2 900p | VHSFS1, VHSFS2 1300p | HRD910, FV141, FV5/H | 800p N | 911A, 914C, 915A, 916A, 917, 9110, 9120 2400p | VHRD4610, 6700, 4800 3100p 4250p |
| | VHSFB3 | BR9060, HRD330, 337, 440, 441, 63 660, 670, 720, 730, 740, 820 | P\ | /C600, 740, 744, 754, 763E, 764, /2300, 2400, 760, 794, 770, /4 1650p | VHR5300, VHR6500, VHR7400 4500p VHR3500EX 2150p |
| V\$33,35, 37, 38, 38EOG MKII, 53, 55, 66, 765, 766, 767, 768, 865, 867, | VHSVH4. VHSWH1. VHSXH1, VHSYH2 | HRD950, HRD960, HRD980, | _ N | 74 380, N381, N830, N831, N832, N833, 834, N835, N836 550p | VHR16, 235, 335E, 4150, 4160, 4350, 7250, 7260, 8250 1950p |
| VSF30, 33, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497, | 1600p | HRS5000 HRS5500, 5800, 9000. | 83 | 2611AH1 (FOR MODEL DX3000), 2400p | SHARP |
| VSG51, 54, 55, VXS450, VXS470 1600p | VS410, 415, 435, 450, 456, 460, 500, 505, | FV22L FV42 | 1400p N | 895 1800p 9052, N9530, DX2000 3400p | VC488 4200p |
| VS512, VS515, VS516 2250p VS462, 465, 467, 467EOG2, VSF12, 15EK, | 510, 520, 521, 530, 546 1600p RARCELONA, MVS5400, 440, 500, 600, | VR182LV, VR202LV EV67HV, EV68TX, EV77 | 1950p V 3800p P | CP1 1700p VC230n 2400.740.744.760, | VC789, VC790 2900p |
| 15EOH, 300, 301, 310, VSF320, 330, 340, 350, VSG30, 33, 34, 35 2300p | SE5100, 6100, 6110, 9100 TVR4500, 4510, 5510, VS400, 440, 441, | R2000 SERIES FV611 V. FV62LV, FV67HV | 1500p 7 | 54 1400p S6000 3500p | 387, 388, 471, 477, 481, 482, VC483, 460, |
| V511, VS12 1000p | 500, 505, 510, 518, 600, 610, VS5180, VS6190, 700, 900, 901, 902, | FV42L £10 VP160L, VR172L | 1950p V | 5600 3500 p H3, VH555, VH600, VH700, VH844, | 9700 850p |
| VS6, VS8, VS9 2400p VSX9 2250p VSA1100, 1110, 650, VSF500, 510, 550, | 9091, GV200, 201, 2092. SE2100, 5110 1400p MADRID, SE5140, VS540, | HRJ600EG, HRJ600EK, HRJ605EG | | H900, H1000 (ALL MODELS) 1100p H1 VH2A 700p | 571, 573, 581, 582, 583, VC5W20E, 600, |
| 550, 580, 590, 600, 650, VSG60, 64, 65, VSG70, 73, 74, 75, | VS5480 3000p MVS550, 620, VS550, 620, 630, 640, 790, | HRJ300, HRJ305, HRJ315, | 1 6 | H1, VH2A 7600p 10000, D1100 1600p 1000X, D1500X, D4500, VPCD100, | 683, 684, 402, VC500, 571, 573, 580, 584, 600, 682, 693, |
| VSX560, 580 VS155, VS165 2300p | 930, 940 2400p VS120 2300p | HRJ316EG,HRJ318E HRJ615, HRJ715, HRJ815 HRJ400, HRJ405, HRJ407MS, HRJ | 92000 - | 11000X, D1300X, D4300, V1 CD 100, D1200, D2000X, D5000 1600p (R6460, VR6520, 64VR60, | 700, 772, 7810, 782, 7822, VC/83, 8481, 8581, VCA10, 100, 102, 103, 1031, 103, |
| VS20, 22, 23, 24, 25, 26, 27, 422, 425, 426, 427, 485, VSE10, 11, 180, 190 | VS680, GV280 4600p VS160, VS740 4400p | OEK, HRJ415, HRJ416 | 4500P | R6420 725g (R6711 4 HEAD 1800g | 104, 105, 106, VCA111, 113, 116, 131, 140, 202, 203, |
| VSF200, 210, 220, 221, 222, 230, 240, 260, 261, 262, 265, 270, 275, 280, | VS170 4600p | MATSUI VX500E, 800A, 810A, 820, 80A, 77 | IR I | (R6440 2500) (R6441, VR6540, VR6541, VR6640, | 211, 234, 244, 254, 255, 30, 35, VCA40, VCB311N 320 VCD801, 802, VCM73, |
| VSF290, 510, 550, VSG20, 204, 205, 206, USG21, 211, 212, 215. | VS6690 3500p GRUNDIG | VCRL 3, VX730, VX750 | 1450p \ | /R6642 N/761 VR512 522 5229 63\$B7. | VCTS313 |
| VSG217EOG , 23, 24, 25, 405, 411, 415, | MVS710, 720, 910, SE7120, 9120, VS710, 716, 720, 800, 810, 910, 920, | VX735A VX765, VX850 | 1750p \ | /R6760, VR6761, VR6762, VR63SB/ 7172 7200 j | 3000n |
| VSP88, 88KC, 8111, VSP9, VSR100, 100FDG 100EM, 110, VSX400 1250p | VS922, 9291, GV210, 211, 220, 2292, MV2105, 2115, SE2120 1700p | VX900 | 2650n \ | /R6920 2750 ₁ 11DV2, 4SB11BVR412, 415, 6485, 6490, | VC473, VC785, VC786 1600p |
| VSR9 VS 109, VS603, VS606, VS607 2500p | HINARI VXL2, 3, 4, 20, 25, 35 1000p | MITSUBISHI HS303, HS304, HS320, HS700 HS306, HS318, HS710 | 1100p | 8880 1600) /B6048 4850 | 1700n |
| VS75 2500p | VXL5, V20H 1050p VXL6 1200p | HS307 | 1900p | 20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 21DV3, 2SB01, 02, 11, 12, 30DV2, 31DVI | VFH815 VC800, VCH851, VCH852, |
| VSF400, 410, 420, 430, 440, 441, 450, 45S, 480, 490, 497, VSX450, 470 2850p | VXL7 VXL8, 9, 10, 11, 19, 90, VCR34H, VTV 100, | H\$319 H\$330 H\$400 | 2000p | 31DV2, 31DV3, 35B02, 03, 05, 11, 12, 13, 58SB4, 71SB4, 86SBI, 91SB2, 92SB2, | VCH882 2700p VCH80 VCH81 VEH815 2800p |
| VSG20, 204, 204, 205, 206, 20, 21, 211, 212, 215, 217, 225, 23, 24, 25, 200, 200, 200, 200, 200, 200, 200, | 200 1100p HITACHI | HS349, HSE27, 31, 32, HSB27, 31, 32, HSM33, 34, 35, 37G | 1650p | DV186, 190, 291, 292, 468, 471, VR201, 202, 203, 2115, 212, 213, 223, 231, 232, | VCA33, VCA36, VCA43, VCA44, VCA46, VCA49 1500p |
| VSP100, 110, 88, VSR100, 110, VSX400 | VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, | HS411 HSE30, HSB30 | 1600p | 302, 303, 305, 311, 312, VR313, 3210, 3219, 322, 3229, 323, 501, 6180, 6182, 6185, 6290, 6291, VR6293, 6362, 6367, | VCA55, VCA63 1800p VC570 2800p |
| VSG415, VSG415EA, VSG425 2800p VS75, VSA77 2700p | VT7, V11/, V118, V119 1800p | HS338 HSE10, HSE11, HSE20, HSE21, HS | | 6467, 6468, 6470 4600 VR3260, 6349, 6442, 663, 6448, 6449, | p SONY DSR-19R FOR SL-T 9ME 3100p |
| VSF1000, VSF1010, VSF1030 5800p | VT100, 110, 111, 112, 113, 115, 118, 120, | HSB10, HSB20 HS300, HS301, HS302, HS310, | 1500p | 6542, 6643 | p DSR-21 R FOR SLC 8-C9 2600p |
| ALBA VDR3000, VCR4000, VCR5000, VCR6000 1650p | VT410, 413, 414, 415, 416, 418, 510, 515, | HS273, HS550Q HS200 | 550p | VR601 1800 49SB6, VR6548, VR6648, VR6843 2750 | SLF1E2 PIN, SLC24PS, 33E, 34, 44PS, |
| VTV10 VCR7000, 7800, 8000, 8800 1100p | VTM625, 626, 725, 210, 211, 215, 726, 727, 728, 820, 821, 825, 920, | HS337, HS347 HSB12, HSE12, HSE22, HSM16G, | 18 | SAISHO VR100, 605, 705, 805, 905, 1000, 1100, | SLT20ME, 30ME, SL100 1500p |
| AMSTRAD VCR4500, VCR5200, VCR9000, | 921 VT3000 550p | HS411EZ, HS411GZ | 2100n | 1200, 1600 1200 VR3300X, VR3600X, VR3650X, VR3800 | p SL5100, SL3000 1 PIN, SLC6E, SL36ES, 1300p |
| TVR1 900p 1000p | | HSB11, HSB21 HSB52, HSE50, 52G, HSM36, 50, | 54, 3100p | VR3200, VR3500 1400 | 10000 |
| VCR1000, 2000, 6000, 61000, 62000, 8600, 8602, 8700, 9005, DD8900, DD8904, | 8030, 8040, 8100, 8300, 8500 | 55, 57, 58, 60 HSE51 | | VR2000, VR3300, VR3600 1400 VR2500 2650 | P SLV201, SLV202 2900p |
| TVR4 1100p TVR2, TVR3, VCR4600, VCR4600 MKII, | VT8700, 9000, 9300, 9500, 9700, 9900 850p VT8, 9, 56, 57, 570, 575, 576, 580, 585, | HS410 HS412, HS421GZ HS5300, HS5424, HS5600 | 3100p 2500p | VR\$5000X, VX6000A, VXL12X 1500 | E SLV412, SLV427, SLV474 1900p |
| VCR800 VCR8804, VCR9340 2100p | 588 2500p | HSM20, HSM55 | 1900p | SALORA 6500, 6600 SV7300, SV8200, SV8300, | DSR49R, SLHF100P, SLHF100UB SLV656, SLV715, 725, 727, 757, SLV777, |
| VCR8603, VCR8604, VCR8704, VCR8714 1350p | VT130, 135, 138, 145, 250, 255, 258, 420, | HSM59, HSM68E NV300, 322, 332, 333, 340, 390, 2 | 000, | SV9200 1500 SV7400, SV8400 1600 |)p SLV815, SLV825 4100p)p SLV3531IR 2100p |
| VCR9140, VCR9142 2550r VCR9340 3650r | VT438, 535, 536, VTL30, 301, VTM630, | 1 2010, 3000, 7000, 7200,7500, NV | 0, 8620 | SV8100 1200 SV900, SV9900 3450 | P CCDE340F, CCDF500E, CCDV90E, |
| VCR9244 3450) UF020, 22, VCR3000, 3002, | VT52, VT60, VT61E, VT62E, VT63, V164, VT640 850p | NV777, NV330 | 1150p | SV601, SV611, SV6910 1500 SV800, SV810 2800 |)p SLV801, SLV802 2500p)p SLV310 SLV315, SLV325, |
| 9500 1750g | VT168, VT150, VT260, VT450, VT498 (4 HEAD) 1900p | NV8050, NV8051 NATIONAL PANASONIC | 2500p | SV6700, SV8710, SV8750 150 0 623N, SV6800, SV6900, SV8850, SV887 | OP SLV335 1200; 0, SLV210, SLV212, SLV270, SLV273, |
| FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 716, 720, | VT530 1400p VT522 VTM212, 620, 622, 720, 722, 822, | AG1000, 1050, NV250, 260, 280, | Поор | SV8970 SV88110, SV8910 265 | OP SLV285, SLV300 OP SLV125, 213, 225, 252, 255, 262, 280, |
| 908, 910, 911, 915, 916, 918, | 922, 925 VT660E 2600p | AG6010, AG6015 | 2000p 2000p | 823N, SV8920 350 923N 450 | OP SLV363, SLV416, SLVX50, |
| FVHP5000, 5001, 5005, 5050, 5075 1100 | | | 675p | \$V8600, \$V8700 155 \$V8420 240 | OP SLVX55 OP SLVX75, SLVX90, SLVX95 |
| VBS3500, 7100, 7500, 7600, 9900, VBR330 1800 VBS7000, VBS7100, VBS9000 2000 | | NVD80, NVH65 AG5150, AG5250, NVF65, NVH75 | 2600p , NVH77 2600p | \$V8620 210 \$V9300 250 \$V8830 220 | Op SLHF100P, SLHF100UB 3400 |
| VBS7000, VBS7100, VBS9000 2000 FVHP500, 711, 715, 721, 722, 730, 830, 5100, FVHD720 1100 | 748 753 754 830 831 835 838 840 | NVF51 | 4200p 2300p | SV8720 225 | Op SIVE90 5150 |
| FVHP725, FVHP830, FVHP980 2500 FVHP990 2700 | P V/TE770 774 775, 860, 861. | NV.130 NVHJ33, NVL10, 20, NV | .21. | SAMSUNG | SLVE800 3450 |
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| FVHP20 1150 FVHD230, FVHP1100, 1200, 130, 1340, | VTF180, VTF185, VTF280 8500 VTF350, VTF351 5150 | P NVM1, NVM3, NVM5 | 4200p 700p | 717, 614, 619, 629, 710, 712, 720, 730, 970, 971, 972, SV716, 717, SVX303, 30 | 5, V21, V31, V32, V33, V50, V51, V52, V53, |
| 1410, 2000, 200, 210, 300, | VTM220, VTM220E, VTM220UK 3000 | P NV430, NV431, NV433, NVSD2, P NVSD25, NVSD3 | NVSD22, 800p | 627 629 710 971 V1520, 616, 621, 62 | 6. VEE VE7 550 |
| FVHD250, 270, 370, FVHP1500, FVHP250 | THE OFFICIENT | NV730, NV730F, NV770 4 HEAD | 1150p | 900, 910, SVX319 VB770, V1710, 730, 731, 735, | V83 V841V85 V86, V87, |
| FVHP132, 1400, 1440, 320, 440, 445 5VHP470S, FVHP475HV 3550 4800 | 3660, 3750, 3860, 4100 3292, 8900, 8901, 8902, 8903, 8906, 8922 | NV366 NV21 HQ, NV 180, NVD48 | 1700p 1700p 1700p | 750, 751, 770, VB750, VK8220, VX750, VX7330, VK770, VK8225, VR1730, 173 | 7050 5, DV90, 96, 97, NM3, V108, 109, |
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| GVH51, GVH122, VCP4000, VCP4100, | 3V16, 3V233V24, 3V31, 3V35, 3V36, 3V3 | 8, NVJ47, | | SX3230, 3231, 3260, 3261, VK30, 300, | V880MS V700G V500G, V509G 250G |
| VCP4200 GHV1232, 1233, 1241, 1242, 1243, 1244, 1245, 1246, 1266, 1290, 1291 | | 2, 400, 44, 45 NVG10, 11, 12, 14, 16, 120, NV | 1200p 50, 280, | 1230, 1260, 1261, VK30R, 31R, 32R, VXK300, 301, 306, 3 321, 326, 336 19 | 20, V9680 2900 20p V300G V301, V305, V306. |
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| VCP4320, 4321, 4325, 4326 904 C211 GHV1392P, 1393P, 1900P, 1290, | 320, 321, 350, 521, 522, 525, 526. HRD527, 540, 550, 560, 590, 770, | NVG50, NVG300 NVG45 | 1600p 1100p | VTC5000, 5400, 600, 6000, 6010, 6500 | , V220, V221, V222 1100 , 21 V711, V880 2700 |
| 1291PQ, 12931Q, 1295P, GSE1295PQ GSE1296, 1297, 1891, 191 | 0, HRDX20, HRDX22, 8950, 8951, 3V64, 3V65, FV10, FVII, FV20, FV21, FV20 | NVH70 NV688 | 2400p 1650p | VTCM25, VTC2000, 5100, 5150, 5300, | VCPB1E, VCP2C2 1000 V65, V66, V6 950 |
| 120005, 2000, GSEC200, 1GSEC205, 211, 2301, GSEG2301, | HRD565 HRD566, 3V48 1800 | DD AG6800 AH6810 AG6820 | 1050p 2100p 2100p | VTC5350, 5370, VTCNX10, VTCNX15, 30, VPR5800 18 | 20, V312, V322, V412 2600 00p V91G 4600 |
| GSEQ12, 204, 20, 22, P416P, P500P QUISY22, QUISY24, RC205P, RG11P, | HRD725, HRD755, 3V43, 3V53 1800 | AG6100, AG6200, AG6300 NVG7, NVG9, NV230 | 2100p 700p 2000p | VTC5500, 5550, 9100, 9300, 9350, 935 | 5, V609, V610V610B, V610UK, V611, 00p V659F, V660, V660F 220 |
| RG20, RG2001, RQ20, RQ204HP, RQ241, VCP100P, | 3V30 8945 2406 | Dp NVG 15, NVG400 | 2600p 2600p 3800p | VHR1110, VHR1150, VHR1300, VHR15 | 700, V312, V403T, V413G 920 00p V703W, V813G 400 |
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| RC405P GSEQ121, RQ2011, RQ2031, | FV31, FV41R 1150 FV37, FV43H, HRD860 2000 | DID NVSD40 | 1050p | VHR1500, VHR2500, VHR3330 15 | GRANDATA ITD |
| G.E.C. | BR7030/40H, BR7040 2100 | NVF75, NVF77 Op NVF55 NVFS200, NVFS88, NVSF90, | 2800 | VHR7900 30 VHR5700, VHR7700E, | |
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| CR5000, VCR6000 105n | | VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, | NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 650, 730, NV770, 810, 870, 890, 970, AG | VHR2700 100 |
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| VR123, VCR4600, VCR4700, | FVHP5000, 5005, 5050, 5075, 5100, 975, 980 | V19700, 9900 75n | 400, NVH70 50p NVFV1, NVM10, 3000, 3300, 40, 7, 9000, 9900, | 1 VHK4//0.5080.5100.5200.6300.6360.6360 |
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| CR7000 80p CR1000, 2000, 6000, 6100, 6200, 8600, 8602, | G.E.C. | VT3000 120n | NVM 1, NVM3, NVM5 70e | 7800, 7810, 8000, 8100, 8200, 8250 |
| 503, 8604, | 1301 | VT100, 110, 111, 113, 115, 118, 120, 125, 120 | PHILIPS | 8500, VHR8800, 8801, VHRD4400, 4410, 4500. |
| CR8700, 8704, 8714, 8800, 8804, 9000, 9005. | V4004 100p V4007 80p | 130, 135, 138, | VR6460, VR6920 170p | 4500, VHRD4610, 4710, 4890, 6700 60p |
| 244, 9340, | GOLDSTAR | 200, 200, VIL30 60n | VR6442, VR6542 70n | VTR1000 |
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| 00 75n | 1244, 1245, GHV1246, 1247, 1248, 1250, 1266, 51, 8000, | J.V.C. | DV186, 190, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, 203, 211, 2115, 212, 213, 223, | SHARP |
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| FV100 200p FV200, RTV222, RTV224 90p | GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301 | HR7350, HR7600, HR7610, HR7650, | 21D, V3, 25BO1, 25BO2, 11, 12, 302, 303, 305, 31DVI, 31DV2, 31D, V3, 3SB11, 3SB12, 3SB13, | VC8000 110p |
| TV200, RTV222, RTV224 90p TV202, RTX200 150p | VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, | UD7700 | 1 /2588, VR30DV2, 35BO2, 35BO3, 635B7 | VC300, 387, 471, 473, 481, 482, 483, 486, 488, |
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| V315, RTV316, RTV319, RTV320, | VHSBH1, VHSCH 1 150p | HKU /U. / 180 210 21 1 217 220 200 | 92SB3 | VC700, 750, 783, VC6F3, VC6V3 70p VC208, 671, 772, 779, 780, 781, 782, 785, 786, |
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| 10 65n | VHSTJ1, VHSTJ2 150p | 910, 960, 980, HRDX20, 25, HRJ2 10 | 247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, 3329, 333, 337, 339, 3419, 342, 343, 3469, 347 | 01, 83, 865, 910, VC51000 |
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| 85, 3V36, 3V38, 3V39, 3V49, 8943, | VHSXJ3 85n | 411, 415, 416, 507, HRJ6 10, 615, 715, 97, HRS4700, 5800, SR3200, SRS368E 1250 | 442, 4229, 432, 437, 442, 44, 5, 4469, 447, 4479, 451, 452, 457, 458, 459, 512, 522, 5229, | VCC10 70p |
| 60p 2, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, | VHSYJ2 80p | HRJ600 SR3200, SRS368E 125p 40p | 63/9, 642, 647, 722, 7229, 723, 7379, 747. | SONY |
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| 5, 8947, 8948 45p | VHSFG1, VHSFG2, VHSFG3. | VR955 180p | SAISHO VR2000, VHL3 | SLC9, SL8000, SL8080, SLT50 |
| 8, 3V43, 3V44, 3V59, 3V64, 3V65, 8950, 1, FV10, FV11, FV12, FV13, FV14, FV20, | VHSFG4, VHSF63 180p | MATSUI | VR3800, 3200, 3300, 3500, 3600, 3650, | SL8000E, SL8080E, SL8200, SL8600 1750 |
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| | 1600, 2000, 2080, 2200, 2280, | MITSUBISHI 70p | VX617, VX619, X626, VX627, VX629 | V33, V31, V32, V51, V52, V53, V9600, |
| H 80n | MVS200RC 90n | HS200 300- | VX/14 75p | V61, V63, V65, V66, V67 |
| 55p | VS150 160p | MS300, 301, 302, 307, 310, 337, 338, 347, 349 | VB520, 510, 610, 616, 617, 619, 620, 626, 627, 629, V1510, 520, V1611, 616, 621, 626, VX510, | DV80B, DV80D, V71, 73, 74, 75, 77, 81, 83, 85, |
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| | LC290N, LC295SN, SVS 180, VS 170 70p VS 160, BARCELONA, FLORENZ, GV4000, | HS/00 110p | 319, 322, VB750, 770, 8220, 8226, V1770, 700 | 660, 711, 880 120p |
| 1000 1000 | 4000, 4001, | HOME TO THE PARTY OF THE PARTY | 8220, 8225, VK8220, VPX31, VX750, VX770, | V91 G, V95G 115p V212, 213, 22-2, 3i2, 322, 403, 412, 413, 610, |
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| | RTV301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 404, 414, 424, 434, 444, 478, 707 | ldler | Drder Code | | Price: 200p |
| Goldstar | GHV1221 1232 1240 1241 1242 1242 1244 1245 1242 | | Philips | DB532, VR6520, 6843, 644 | Reel Idler |
| | GHV1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247 GHV1248, 8000, 8200, 8210, 8215, GVHP51, VCP4100, 4130 | , Idler | Sharp | VC600, 651, 681, 682, 684, 685, 693, 699, 700, 783, 6FR, 6V3, | Idler Assembly |
| aronuly | 1VIV 3400, 440, V 5400 410 440V SAFO AGO | ldler | 1 . | DF3 | NPLYV0107GEZZ |
| vatronar | INV23U, 25U, 25U, 28U, 37U, 38U, NIV/42U, 421, 422, 45U, 40U, 40E | Idler Arm VVD 0521 | Order Code | | Price: 615p |
| | | | Philips | VR6843, 6943, 44SB9, VR44SB920, 44SB922, 6943 | Reel Drive Unit |
| | 2, 10, 11, 14, 14, 15, 16, 18 KH 13H 40H AG1000 AG10E0 1907 |). | Sharp | VC//2, /80, /81, 782, 785, 786, VC787, 800, 793, 799, 7910 | ldles |
| | 1500, 1810, AG2100, 2200, NVH65, 70 VR6460, VR6520, VR6920 | | | 7822, VCA100, 102, 104, VCA131, 140, 170, 202, 203, 234, 501 | |
| order Code: | IDLOS | Idler Arm 40340162 | | VCA602, 5011, VCD801, 802, VCH851, 852, VCH882, VCM73, | NPLTV0111GEZZ |
| | VCPTOOO | Price 100p | | VCT72, VC782MK11 | |
| | VC200, 381, 383, 384, 385, 386, VC388, 390, 393, 3300, 8381, | ldler 150280 | Drder Code: | : IDL90 | |
| | | III NURA ALANA | N.E.C. | N911, 915, 916, 917, 9012, 9013N9014, 9016, 9033, 9034, 9053 | Price: 700p |
| rder Code: | IDL10 | Idler NIDL0005GEZZ | | N9054, 9055, 9056, 9066, 9096, N9110, 9120, 9510, 9520, 9530 | , |
| hilips | VR6540 | Price: 100p | | N9610, DX1000, 1600, 2000, DX3000, PX1200 | |
| harp | VC3UU, 387, 4U2, 471, 473, 477 VC481 AR2 AR2 ARE ARR ARE | idler | Order Code: | IDL 245 | Idler Arm Assembly |
| | | idler | | DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, | Price: 270p |
| rder Code: I | 081.582.583.584.585.8481.6E0.6N/one | NIDL0006GFZZ | | 312 313 3210 3210 222 2220 222 52500 1/2 122 | Pressure Roller Assembly |
| | IDETT | Price: 100p | | 312, 313, 3210, 3219, 322, 3229, 323, 535BO, VR486, 471, 562, 582, 571, 761, 301, 303, VP300, 300, 300, 500, 500, 500, 500, 500, | PS403-40205 |
| | VSIU | Reel Idler | | 582, 571, 761, 201, 202, VR203, 302, 303, 305, 6180, 6182, 6185 | , |
| erguson | 3743, 3749, 3730, 3731, 37323735, 8923, 8924, 8926, 6926 | | | 6285, 6290, 6291, 6293, VR6362, 6367, 6390, 6391, 6393, 6467, | |
| | 107100 7200 7200 7000 7000 7000 | Reel Idler PU48967 | | 6468, 6470, 6561, 6570, 6581VR6670, 6676, 6710, 6760, 6761, | |
| rder Code: I | | Reel Idler PU48967 | | 6762, 6870, 6970, 6975, 86B1, 63SB7, 68SB4, 71SB4, 71SB5, | |
| | 21/20 21/20 21/21 21/22 21/22 21/22 | Price: 175p | | 72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DV1, 21DV2 | |
| | | Take Up Idler PU 51402 | | 40001, 20802, 25811, 25812, 30DV2, 31DV1, 31DV2, 31DV | |
| .V.C. | HR7200, 7600, 7650, 7655, 7300, 7350, 7610, HRD110, 111, 120, | Til Milli Brian and | _ | 335B02, 35B03, 35B05, 35B11, 35B12, 35B13 | |
| | | lake Up Idler PU 51402A | Toshiba | V91, V95 | Pressure Roller Assembly |
| rder Code: I | DL22 | Price 100p | | _ | PS403-40205 |
| | | nce roop | Order Code: | PR232 | Price: 300p |
| | REPLACEME | VIII | | | N OFFE |

VXP0433 VXP0463 VXP0521 VXP0581 1430662T15620 NIDL0005GEZZ NIDL0006GEZZ NPLY0107GEZZ

IT15 IT16 IT17 IT18 IT19 IT20 IT21 IT21

Price: 20p each 16p each pack of 5 13p each pack of 10

Packs are for each model



JVC

Akai

Goldstar Hitachi M32773 MZ366960J2 VXP0521 6861471 6861482 6886971 PU48697B

IT01 IT02 IT17 IT03 IT04 IT05 IT06 Ferguson

National Panasonic PU51380 PU51402A PU55373 PU55374 VXP0329 VXP0343 VXP0344 VXP0401

IT07 IT08 IT09 IT10 IT11 IT12 IT13 IT14

Sanyo Sharp

| | | | CH ROLLE | <u>uk</u> | | |
|--|--|----------------------------|---|---------------|---|--|
| | ice Model p | rice Mod | | | Model Price | e Model |
| AKAI VS10, VS9300, VS9500, VS9700, VS9800, | FVHP615, 618, 620, 622, 710, 711, 715, 71 720, 721, 722, 725, 730, | | 00, 605, 747, 777, 920, 925 | Op N | IS7000 140 | |
| | Op FVHP810 830 840 | 40p BP500 | 0, HRD110, 111, 120, 220, 225. | | ORION | VC699, 700, 772, 750, 779, 780, 781, 781 |
| VS12, VS15 | FVHP905, 906, 907, 908, 910, 911, 915, 91 918, 970, 975, 980, 990, FVHP 5000, 5005, | 6, 455 | 1100 | Юр∣∨ | (H1, VH2 140 (C150, 180, VH3, 33, 200, 201, 205, 212, 250, | |
| VS105, 112, 115, 116, 120, 125 | 1 5050, 5075, 5100 1 | 40n HPD1/ | ROLLER ASSEMBLY 10, 141, 142, 143, 150, 152, 157, 158, | 1 2: | 04, 200, 300, 303, 312, | VC6F2 VC6V2 VCA 100 102 104 124 |
| 126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516, | VBR330, VBS3500, 7000, 7100, 7500, 7600 |), 160, 56 | 55, 566, 725, 755, | J 10 | H404, 555, 700, 704, 712, 770, 780, 844, 900 000, 2948, 3030, 3312 | 1 170, 202, 203, 211, 234, 303, 501, 502 |
| VSX9 | Op FVHD230, 250, 270, 370, 2000D, FVHP3, 2 | 40p HRP50 10. PINCH | ROLLER ASSEMBLY 1350 | OD A | HF2A, VP2948 140 | VCA602, 5011, VCD801, 802, 851, 852, 8 882, VCM73, VCT73, VCT72, |
| VS201, 301, 303, 304, 603, 606, 607, VSP8, VSP82, VP58, VP82 | 250, 300, 310, 1100, | HRD15 | 20, 510, 520, 521, 522, 525, 527, 560. | C | OMB 15000, 16000, HV03, LVH50, NEVH, EVHM, NEVHML | VCB361 |
| VS125, VS155, VS165, VS220, VS240, VS2 | Op FVHP1200, 1250, 130, 132, 1340, 1340, 140 0, 1410, 1440, 1500, 200, | JU, 600, 61 | 10, 620, 637, 641, i0, 720, 830, 840, 910, HRJ205, | T | VP230RC, VCP, VH04, 30, 103, 300, 358, 360, | VC220 |
| VS512 VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 42 | Op FVHP320410, 420, 430, 440, 445, 470, 475, | HRS58 | 00 350 | _ 36 | 62, 400, 416, 512. | VCATU, 30G, 60, 103, 105, 106, 111, 113, |
| 426, 427, 462, 465, 467. | EVHDIAD EVHDAD EVHDER EVUDA CUUR | 40p PINCH | ROLLER ASSEMBLY | | H530, 532, 535, 536, 600, 630, 635, 640, 666, 30, 735, 744, 774, 790 | VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 50 |
| VS485, 765, 766, 767, 768, 865, 867, 965, 9 VSA77, VSA650, | /, FVHP20 1/ | 40p 210, 21 | 0, BRS600, HRD160, 170, 171, 180, 190 11, 217, 227, | 7U, VI | H800, 820, 850, 888, 893, 900, 930, 940, 942 | 52, 53, 54, 55, 57, 58, 505, |
| VSF10, 11, 12, 15, 180, 190, 200, 210, 220 | FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 40 FVHS10, 30 | 100, HRD23 | 0, 271, 300, 310, 320, 321, 330, 337, | VH | 74, 1012, 1040, 1050, H1060, 1070, VH1100, 1120, 1204, 1440, | VCA60, 605, 615, 62, 63, 67, 68, 1031, 11 VCB311, 320, VCBS97, VCD805, 806, 810 |
| 221, 222, 230, 240, 30, 33 | PINCH ROLLER ASSEMBLY | | 0, 430, 440, 441, 0, 500, 530, 700, 750, 950, HRS5000, | 15 | 500, 1660, 1800, 2004 | VCH80, 81, 865, 910, VCS 1000, VCT310 |
| VSF330, 4, 500, 550, VSP88, VSR100, VSX4 450, 470 | 00, GOLDSTAR 0p GHV51, 1221, 1232, 1233, 1240, 1241, 1242 | 5500, 9 | 000 875 | 5p VH | H2151, 2308, 22042400, 2500, 2600, 2700, H2960, 2970, 3050, | VCT410, 610, VCT 1314, 5313, VC790 |
| VSF260, 261, 262, 265, 270, 274, 275, 280 | 1243, 1244, 1245, 1246,140n | HRD54 | ROLLER ASSEMBLY 0, HRD550, HRD580, HRD660, HRD860 | VH | 13060, 4000, 4008, 4010, 4012, 4015, 4015. | VC780, 790, VCA10, 103, 1031, 105, 106, 244, 254, 255, 30, 35, |
| 290, 340, 350, 410, 420, 43C VSF441, 440, 450, 455, 480, 490, 497, 510, | GHV1247, 1248, 1250, 1266, 1290, 1291, 12 | 295, HRD969 | 700 | 40 | 120, 4300, 5020, | VCA340, 43, 47, 50, 60, 605, 615, VCD806 |
| 560, 580, 590, 599, 600, | 1296, 1392, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 44 | PINCH | ROLLER ASSEMBLY | | P 10, 200, 220, 225, 245, VR821, 925, 1032, 49, 2959, 2957, 2966, 2979, 2980, VTV300, | 815, VCH80, 81, 83, 85, |
| /SG20, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54 | 51, 8000, 8200, GHV8210, 8215, 8430 | HRS920 |), HRJ605, HRJ815, | _ <u>VX</u> | (L20, 25, 30 140p | VCH865, 87, 910, VCS 1000, VCT212, 310 510, 610, VCTI314, |
| 55, 60, 64, 65, 70, 73, 74, 75, /SP110, VSX560, VSX580 14 | GHVP1240, 1241, 1247, 1248, 1290, 1291 | BRATOL | | | HILIPS | VCTS212 |
| /S17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 5 | PP GHVP1295, 1296, VCP4000, 4100, 4130, 420, 4300, 4301, 4305, VCP4306, 4310, 4311, 43 | 00, VX6000 |), 730, 735, 750, 755, 765, 800, 850, | / VR | R6460 VR6920 140p R2020, VR2021, VR2022, VR2023, | PINCH ROLLER ASSEMBLY |
| 5, VSA77 77 | P 4316, 4320, 4321, 4325, 4326, 4350, GSF12 | 15, VS888 | , VX2000, VX2500, VX3000, | P VR | 32024 14 On | |
| PINCH ROLLER ASSEMBLY /S422, 425, 426, 427, 462, 465, 467, 485, 49 | 1291, 1295, 1296, 1297, 1891, 1910, 20005. | VY6000 | , VX2000, VX2500, VX3000, A 140 _F | | 140p | VHL3, VR1000, 2000, 2500, 3200, 3300, 33 |
| 65, 766, 767, 768, 865. | INTAGUE | Op MITSU | BISHI | DV | 140p (856, 586, VR702, 703, 6485, 6585, 6589, | 3600, 3650, 3800, VR\$4400, VR\$5000 1 |
| 67, 965, 967, VSA650, VSF10, 11, 12, 14, 19 80, 190, 200, 210, 220, | VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 3 | HS12, 5 | 300, 5424, 5600, HSB11, 12, 16, 21, 27 | 7, 678 | 85, 6880, 6948 140n | VR3400 |
| 21, 222, 230, 240, 30, 300, 301, 310, 32n, 31 | 39, 88, 330, 680, 4200. | UCCAO | 41, 51, 52, 82, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, | VR | 445, VR6442, VR6542, VR6643, VR6843, | SAMSUNG |
| 30, 4, 500, 510, 600, | 8300 8500 8700 930 VT9500 9700 9000 | , 82, HSN | 11000, 110, 120, 15 | DV. | 6943, 44SB9 140p 464, 662, VR2220, 2300, 2324, 2330, 2334, | SV716, 717, VB510, 520, 610, 616, 617, 61 620, 626, 627, 629, 900, |
| SR110, VSX100, 400, 450, 470 800 INCH ROLLER ASSEMBLY | P VM600 14 | On 0, 16, 17 | 70, 190, 210, 23, 25, 250, 27, 33, 34, 35, 870, 380, 45, 450, 5 | 5, 234 | 40, 2350, 2414, VR2480, 2485, 2486, 2489 | V910, V1510, 520, 611, 616, 621, 626, 900 |
| SS99 140 | VT8 52 57 61 62 62 64 65 05 06 00 40 | 30, 37, 3 | 570, 380, 45, 450, 5 55, 57, 58, 59, 68, HSMS2, 9, HSS11, | 249 VR6 | 90, 2498, 2840, 6462, 6463, 6464, 6560, 6660, 6860, 6861, 6862, 6863 140n | 910, VX510, 520, 616, |
| LBA | VT120, 122, 125, 128, 130, 135, 138, 145, 15 | 14, 15, 1 | 7, 19, 25, 5600, HV | N-1 | 1700, VR2870 140p | VX617, 619, 626, 627, 629 |
| CR3000X, VCR4000 140 CR5000, VCR6000 146 | P 168, 170, 175, 220, 225 | DINCHE | 0, 303, 85, SV8900, 8930 750p ROLLER ASSEMBLY PART NO: | | 2025, VR6580, VR6581 140p | SVX301, 303, 305, 307, 319, 322, VB710, 7750, 770, 971, 8220, VB8225, V1710, 730, |
| CR161, VCR222 140 | | 4, 948D020 | 0010 | 664 | SB6, VR3260, 6349, 6448, 6449, 6548, 18 140p | 770, 790, 8220, 8225, 970, VX710, 712, |
| CR7000, VCR7800, VCR8000, | VT426, 428, 430, 431, 435, 438, 450, 498, 51 | HSE11, | 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, | PRE | ESSURE ROLLER ASSEMBLY PS403-40205 | VX720, 730, 750, 770, 790, 825, 8225, 970 |
| CR8800 140 TV10 146 | P 575, 517, 518, 520, 525. | 21 00 4 | , 5424, 5600, HSB11, 12, 16, 21, 27, 1, 51, 52, 82, HSM1000, 110, 120, 150, | DV1 | 186, 190, VR211, 2115, 212, 213, 223, 286 | 971, 972, 8220, PX980, 981, 982, SE9000, 9001, SX7120, 7121, 7220, 7221, 7230, |
| TV10 140 MSTRAD | VT526, 530, 535, 536, 540, 545, 546, 548, 576, 576, 580, 585, 588 | U, HSM16. | 170, 18, 190, 210, 23, 25, 250, 27, 30 | | , 292, 311, 312, 313, 3210, 3219, 322, 3229, 323, 535BO, 486, | SX7301, VK8220, |
| CR1000, 2000, 4500, 4600, 4700, 5200, 6000 | VT640, 830, VTF660, 665, 70, 770, 774, 775 | 33, 34, 3 | 5, 36, 37, 370, 38, HSM380, 40, 45 | 471 | , 562, 582, 571, 761, | VPX31 1. |
| 100, 6200, 8600, | 780, 785, 860, 861, 865, | HSMS2, | 54, 55, 555, 57, 58, 59, 60, 68, 9, HSMX1, 18, 19, 2, HSS11, 12, 14, | VR2 | 201, 202, VR203, 302, 303, 305, 6180, 6182, 5, 6285, 6290. | VX9880 1 |
| CR8602, 8603, 8604, 8700, 8704, 8714, 8800 804, 9000, 9005, | VTL30, 1000, 2000, VTLC50, VTM598, 620, 622, 625, 626, 630, 635 | 15, 17, 1 | 9, 21, 25, 5600, HVF125, HVF150, 303. | VR6 | 5291, 6293, 6362, 6367, 6390, 6391, 6393, | PX31 R, 32R, PXR30, SV80, SX3230, 3231, 3260, 3261, VS390, VX30, 31, 32, 3560, 35 |
| CR9244, 9340, DD8900, 8904 | VTM636, 640, 645, 646, 720, 722, 725, 726. | 85, SV89 | 00, 8930 140p IS300, HS301, HS302, HS303, HS304, | 646 | 7, 6468, 6470, 6561 | 370, 375, 380, VXK300, 301, 306, 307, 320 |
| VR1, 2, 3, 4 140 CR7000 140 | 727, 728, 730, 731, 735, | H5310, F | 15320, H5330, H5302, H5303, H5304, | | 5570, 6581VR6670, 6676, 6710, 6760, 6761, 2, 6870, 6970 | VXK321, 326, 330, 331, 336, 337, 350, 351, |
| D8900, DD8904, VCR6000, 6100, 6200, 8600 | VTM736, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, | HS700 | 140n | VR6 | 975, 86BI, 63SB7, 68SB4, 71SB4, 71SB5 | PX990, 991, 992, S11230, 1240, SVX4000, |
| 502, 8603, 8604, | VTM835, 838, 840, 841, 845, 920, 921, 922, | HS347 H | IS307, HS318, HS319, HS337, HS338, IS349, HS400, HS410, HS411, HS412, | , 72SI | B8, 72SB8, 92SB31, 20DV1, 20DV2 | 504, 600, SX1230, |
| CR8700, 8800, 900>9, 9140, 9244, 140 700 | 925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200 | HS421, H | IS480, HS710, HSB 10, HSB20, 30. | | W7, 21DVI, 21DV2, 2SB01, 2SB02, 2SB11, 112, 30DV2, 31DVI, 31DV2, 31DV33SB02, | SX1231, 1260, 1261, 1566, V11560, VPK43, |
| NCH ROLLER ASSEMBLY PART NO: 15314 | E 1.3280 500 VMS7200 446 | | | 32R | 03, | VX1230, 1260, 1261, VX1560, 1561, 1850 |
| (3650, UF20, VCR3000, VCR3002, VCR4000 CR9500 300 | VT3000 14.0 | n | AL PANASONIC | | 05 3SB11 3SB12 3SB13 280p | SONY 14 |
| NCH ROLLER ASSEMBLY PART NO: | VT410, 420, 428, 430, 450, 498, 518, 520, 522 530, VTF770, 780, | NV100, 1 | 80, 300, 330PX, 332, 333, 340, 366, | 7229 | 31, 232, 332, 422, 4229, 512, 5229, 722, 9, 723 | SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ |
| 54966 | VTM598, 622, 722, 740, 748, 753 650 | 600, 688, | 777, 788, 3321. | VR50 | 01 PR38 140p | SLT6ME, SLT7ME 14 |
| 09900, 9904, TX3650, UF20, 22, 24, CR3000, 3002, 9500 140 | PINCH ROLLER ASSEMBLY | AG0010, | 6015, 6100, 6200, 6400, 6800, 140p | SAN | | SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11 |
| 31004 VS1104 140 | 285, 350, 351, 355. | 147230, 2 | 50, 260, 280, 370, 380, 430, 431, 433 | 2300 | .1100, 1110, 1150, 1200, 1300, 1500, 2100, 0, 2370, 2500, | 20, 25, 30, 35, 60, 100, SLE200 SLEGGE SLEGGE SLEGGE |
| RGUSON | VTF360, 365, VTM140, 141, 145, 145, 210, 21 | 450, 460, | 465, 470, 480 | VHR; | 2700, 3330, MVR220 140n | SLF200, SLF60PS, SLF90E, SLFH150, 850, SLK88, 95, SLT20ME, SLT30ME, |
| 00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, | 212, 215, 220, 221, | 890, 2000 | 50, 730, 770, 780, 810, 830, 850, 870, , 2010, 3000, | VTC5 | 5000, 5150, 5300, 5350, 5400, 5500, 6000, 0, 6500, 9100, | SLT50ME 14 |
| 00, 8901, 8902, 8903, 8904, 8906, 8909, 12, 8922, 8923, 8924, 8925, 8929 14 0 | | P NV7000, 7 | 7200, 7800, 8050, 8150, 8170, 8200. | VTCS | 9300, VTCM10, 20, 11, 21, 30, 31, 40, 50, | BMC 100, BMC200, BMC500 14 |
| 29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, | V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90 | NV8610 8 | 0, 8500, 8600 3620, NVG11, 14, 16, NVG7, 10, 12, | VPR | 5800 140n | SLV201, 202, 301, 302, 401, 402, 801, |
| 33, 8940, 8941, 8942 140 35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, | H13V, VTV100, 200 | P 15, 18, 30 | , 130, 400, | VHR | 3100.3300, 3310, 3400, 3500, 3700, 3800, D500, 700 140p | 802 14 SLV210, 270, 273, 275, 300, 353, 373, 410, 4 |
| 15, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56. | VXL4, VXL20, VXL35 140 | P AG 1000, P 6810, 7500 | 1050, 1200, 1500, 2100, 2200, 6500, | VTC3 | 3000 140p | 474, 656, 715 30 |
| 7, 3V5E, 3V59, 3V65, FV10, FVII, FV12, | VTV100, VXL10, VXL11, VLX9, | NVH70 | 140n | VHR1 | 120, 130, 14, 141, 143, 14, 150, 151, 153, 15, 16, 171, 194, 22 | SLV757, 777 14 |
| i2 140n | VXL90 700 | NVG9, NV | G120 140p | 0VHR | R23, 235, 240, 244, 250, 251, 274, 27, 297. | SLV255 14 |
| 0, 8951, FV10B, 11R, 13H, 14T, 20B, 21B | V20H, VXL5, VXL6 MOD KIT 275 | 7355. 7650 | 3720, 7150, 7330, 7350, D. NVH65, 75, NVJ30, NVL20, 23, 25, | 310, 3 | 330, 335, 350, 390, VHR4100, 4105, 4150. | SLV275, 282, 315, 325, 353, 363, 373, 410, 4 416, 474, 625, 656, SLV715, 725, 727, 757, 7 |
| , 26D, 31R, 32L,FV33H, 39S, 41R, 42L, 50B , 52L, VC141L 140n | J.V.C. | 28, NVG30 | 00, NVF65, NVF70, NVFS1 NVFS | VHR5 | | 815, 825, SLVX30, 50, 55 14 |
| 7H, FV44L, FV46T, FV43H, | HR2200, 3300, 3330, 3360, 3660, 4100, 7700 | 100, NVG | 19, 20, 25, 33, 40, 50, | /100, | , 7200, 7250, VHR7260, 7300, 7400, 7440 | SLV125, 213, 225, 252, 255, 262, SLVXI, |
| 7H 140n | HR2650, 7200, 7300, 7350, 7600, 7610, 7650. | NVV8000 NVD48, N | VD80, NVG21 NVG45 140p | 7500, | . 7520, 7530, 7540, 7700, 774, 780, | 20, 3 |
| 5, 3V36, 3V38, 3V39, 3V49, 8943, | 7655 140n | NVJ700PX | 140n | 8500, | . 8800, VHRD4400, 4410, 4500, 4600 | SLV215, 216EE, 275, 282, 315, 325, 353, 363EE, 373, 393, 410, 415, |
| CH ROLLER ASSEMBLY | HRD110, 111, 120, 121, 140, 141, 142, 143, 150, 152, 156, 157, 158. | NVHD100, NVSD40 | NVHD101, NCHD90, NVSD30, | 4610, | 4710, 4890, 6700, VHRS700 140p | SLV416EE, 474, 494EE, 555UC, 559, 575UC |
| 2, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 5, 3V56, 3V57, 8945, 8947, 8948 1350p | HRD160, 220, 225, 250, 257, 445, 455, 565 | PINCH RO | LLER ASSEMBLY | VCR1 | 00 140p | 579, 585HF, 595HF, SLV60W, 615, 625, 656 |
| 5, 3V56, 3V57, 8945, 8947, 8948 1350p CH ROLLER ASSEMBLY | 566, 725, 755, HRP50, BP5000, BR7000, | AG5150, 5 | 250, 5700, 6024, NVD38, 48, 80, | 5200, | 5240, 5350, 7200, 7250, 7260, 7700 | 676UC, 686HF, 696HF, 715, 725, 727, 757, SLV767B, 777, 815, 825, SLVE7, 8, |
| 7, FV57, FV58 350p | BRS611, 811 140p HRD520, 540, 550, 560, 580, 600, 610, 620, | NVF55, 65, NVFS1, 10 | , /0, /5, //, | VHRD | 24410, 4610, 4710, 4890, 5450, | 9SLVX30AS, |
| CH ROLLER ASSEMBLY 1R 140p | 1 637, 640, 641, 650, 660 | 25, 28, 300 | , 33, 40, 45, 46, | | HROLLED ACCEMBLY | SLVX35AF, SLVX50AS, SLVX55DH, |
| 1L, FV42L 925p | HRD670, 720, 730, 740, 770, 820, 830, 840, 860, 870, 880, 910, 960, | NVG50, NV 42, 45, 47, | /H65, 75, 77, NVJ30, 33, 35, 37, 40, | VHR3 | 100, 3200, 3300, 3310, 3400, 3700, 3800, | SLVX65BR, SVO140, 160 1250 PINCH ROLLER ASSEMBLY PART NO: |
| CH ROLLER ASSEMBLY | HRD980, HRDX20, 22, 25, HRJ200, 205, 210 | NVL20, 23. | 25 22 1021 | VHRD | 1500 7000 total | X37277701 |
| 8, 3V59, 3V64, 3V65, FV10, 11, 12, 13, 14, 21, 22, 26, 30, 32, 33 | 215, 300, 315, 316, 318 | PINCH ROL | LEB ACCEMBLY | SHAR | RP : | SLV210, 212, 270, 273, 275, 285, 300, 310, 33 |
| 9, VC141L 875n | HRJ400, 405, 407, 410, 411, 415, 416, 507, 600, 605, 610, 615, 715, 815 | N,E.C. | 000 000 00- | VC200 | 0, 381, 383, 384, 385, 386, 388, 390, 393, | ¹²⁵ , 427 3 50 |
| CH ROLLER ASSEMBLY | HRJ97, HRS4700, 5800, 5900, 6800, 6900. | PVC2300 2 | 032, 033, 895 140p | 800, 23 | 300, 3300, 6000. | PINCH ROLLER ASSEMBLY |
| CH ROLLER ASSEMBLY | SR3200, 330, 368 | /00 | 140n | 838.9 | 00, 6300, 7300, 7700, 7750, 7800, 8300, 100, 9300, 9400, | SV6700.8750, 9700, VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 1350 |
| 1, FV62, FV67, FV68, FV70, FV71, FV72, | HRD170, 171, 180, 210, 211, 217, 230, 300, 320, 321, 330, 337, 350, | DX1000, 16 | 500, 1800, 2000, 3000, N9012, 9013, | VC950 | 00, 9600, 9700, 9800 140p F | PINCH ROLLER ASSEMBLY |
| 4, FV77 775p CH ROLLER ASSEMBLY | HRD370, 400, 430, 440, 441, 470, 500, 530. | 9014, 9016, N9034, 905 | 9033 | VC300 |), 387, 402, 471, 473, 477, 481, 482, 483, | SL100, 200, SLC20, 30, 33, 34, 40, 44, 80, 88, |
| HER | 700, 750, 950, | 9110, 9120, | 9510, 9520, | 573. 58 | 88, 496, 500, 5/1, |), SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90, SLHF100, 150, 950, SLK85, 95, SLO1700, |
| P420, 520, 530 140 p | HRS5000, 5500, 8000, 9000, BR7030, 7040, 9060, | N9530, 961 | U, PA 1200 140p | VC5W2 | 20E, VCA1031 140p S | SLS550, SLT0, 30, 50 300 |
| | | | 0X4000, N9077 | | | INCH ROLLER ASSEMBLY |

| | 1010 |
|-----------|------|
| VIDEO LAM | PS |

| | | | | | " | TATIVIT () | | | | | |
|--|----------|-------|---|------------|-------|--|------------|-------|------------------------------------|--------------------|---|
| | der Code | Price | Models & Description | Order Code | Price | Models & Description 0 | Order Code | Price | Madala 8 Danish | | |
| UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES) | VL01 | 25p | | VI 05 | | AKAI, GRANADA (VHSTJ2), HITACHI (VT3000), ITT (VR3912, | VL01 | - | | Order Code VL07 | _ |
| PANASONIC VIDEO LAMPS | VL02 | 30p | | 1. | | VRP3833), JVC (HR2200, 3300, | | | (VR8300), GRANADA (VHSTJ3, | | |
| SHARP VIDEO LAMPS HITACHI 5381682 (VT63, VT64) | VL02 | 30p | HINARI, HITACHI, ITT, JVC (HRD | | | 3330, 3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, 519, 610). | | | WJ1, WJ3), ITT (VR3913, 3914, | | |
| VIDEO LAMPS | VL04 | 135p | SERIES), MATSUI, MITSUBISHI, NEC, ORION, NATIONAL, | | | THOMSON (VK300, 305, 306, 3301 FERGUSON (3V00, 16, 22, 24, 329) | 1), | | 3963) JVC (HT7200, 7300, 7350, | | |
| AKAI IVS10), GRANADA | VL06 | 40p | PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP | | | 8900, 8901, 8902, 8903, 8909, 5912 8922, 8925) | 2, | | 7700) TELEFUNKEN (VR450, 520, | , | 1 |
| (VHSXJ3), TT (VR3993,3994), JVC (HR2650, 7600, 7610, 7650, 7655), | | | SIEMEN, SONY, TELEFUNKEN, THOMSON, TOSHIBA | | | BLAUPUNKT, ORION (VH1, 2A), | 1/1.00 | | 529, 540, 549, 620, 640, 920, 1920 | 0), | |
| TELEFUNKEN (VR530, 535, 539, 550 630, 650), THOMSON (V309, 316, 35 | , 7. | - 1 | GRANADA (VHSAY3),SHARP | 1// 00 | _ | NATIONAL (NV200,2010, 3000. | VL02 | 30p | THOMSON (V4100, VK308, 309, 3 | 312, | |
| VK309, 411,TX8000), FERGUSON (3V31, 8941, 8942) | ., | - 1 | (VC200, 381, 384, 385, 386, 388, | VL08 | 45p | 7000, 8150, 8200, 8400, 8600, 8610 8620), SHARP (VC2300, 6000, 6200 |),). | | 410), FERGUSON (3V23, 29, 30, | | |
| (3431, 6341, 6342) | _ | | 390, 393, 9300, 9500, 9700) | | | 6300, 7300, 7700, 8300) | -, | | 8923, 8924, 8929, 8930, 8931, 894 | IO) | |

VIDEO SERVICE KITS NV600/NV688 AMSTRAD Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER PLAY IDLER, FF/REW IDLER, TENSION BAND PLAY IDLER TYRE, FF/REW IDLER TYRE Contents BELT SET. PINCH ROLLER, REEL IDLER, VIDEO LAMP BELT SET. PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08 £5.50 £6.00 £12.00 Order Code: SK26 Order Code: SK41 Order Code: SK25 VT11/VT33 FERGUSON & JVC CONTENTS BELT SET. T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. FF/REW IDLER. CLUTCH PLATE. TENSION BAND Order Code: SK45 £: Economy Kit Contents BELT SET. PINCH ROLLER. NV730/NV770 3V42/43 HRD455/HRD725 Economy Kit Contents Contents SLOT IN BELT. LOADING BELT PINCH ROLLER. IDLER UNIT. FE/REW IDLER TYRE, T/UP REEL SLOT IN BELT. LOADING BELT. PINCH ROLLER. IDLER TYRE TABLE TYRE. SUPPLY REEL Franchier Kit Contents Contents BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BELT SET, PINCH RDLLER SUPPLY CLUTCH, TAKE UP TENSION BAND £3.00 Order Code: SK19 £5.50 Order Code: SK20 £3.75 BAND £16.00 Order Code: SK38 NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK Order Code: SK37 VT 52/61/62/63/64/65/85/86/640 Economy Kit Contents BELT SET, PINCH ROLLER IDLER TYRE Contents BELT SET, PINCH ROLLER, Economy Kit Contents BELT SET, PINCH RDLLER FF/REW IDLER Contents BELT SET, PINCH ROLLER, HRD170/180/210/230/300/320/370/400/430/530/700/750 IDLER TENSION BAND FF/REW ARM, CLUTCH PLATE. £5.00 Order Code: SK22 £2.75 HRS5000 Order Code: SK21 TENSION BAND Order Code: SK49 £14.00 Order Code: SK50 BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND NV777/NV788 Order Code: SK44 Economy Kit Contents BELT SET, PINCH ROLLER VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/ 510/520/25/26/530/35/36/540/545/46/48/570/75/576/580/85/88 Contents BELT SET, PINCH ROLLER, 3V29/3V30 IDLER UNIT, TENSION BAND **IDLER TYRE** Contents TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE. £4.00 Order Code: SK17 SHARP £6.00 Order Code: SK18 HR7200/7300/7350 TENSION BAND Order Code: SK52 BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES €9.75 VC381 Contents BELT SET, PINCH ROLLER REEL IDLER TYRE VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/ BELT SET, PINCH ROLLER 3V35/36, 38/39/49 REEL IDLER. TENSION BAND. VIDED LAMP Order Code: SK47 175/220/225/250/255/258/260/VTL30 HRD110/111/120/225 BELT SET PINCH BOLLER, FF/REW ARM, CLUTCH PLATE. £8.00 Order Code: SK48 £3.25 BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES VC500/VC571/VC581/VC582/VC583/VC584/VC5F3 Economy Kit Contents BELT SET. PINCH ROLLER PANASONIC NV2000/NV2010NV7000/NV7200/NV7800 Contents BELT SET, PINCH ROLLER. REEL IDLER, TENSION BAND Order Code: SK60 3V31/3V42 HR7600/7610/7650/7655 HR7800/7610/robw.roc. Contents BELT SET, T/U REEL TABLE TYRE. PINCH ROLLER. REEL TICHER. T/U LUTCH. T/U IDLER. TENSION BAND. VIDEO LAMP Order Code: SK33 £11.00 Crear Code: SK33 Economy Kit Contents BELT SET. PINCH ROLLER. ES TENSION BAND. IDLER TYRES £5.00 Order Code: SK02 REEL LOLER Contents BELT SET. PINCH ROLLER. £9.50 Order Code: SK61 £5.00 TENSION BAND, IDLER TYRES VC781/VC7810/VC7822/VC785/VC786/VC793/VC800 Order Code: SK03 VCA100/VCA102/VCA104/VCA202 Economy Kit Contents NV300/NV330/NV333/NV340/NV366 Contents BELT SET, PINCH ROLLER. REEL DRIVE UNIT. TENSION BELT SET PINCH BOLLER Contents REIT SET, PINCH ROLLER, TENSION BAND, IOLER TYRE REEL DRIVE UNIT TYRE 3V35/36/38/39/49 HRD110/111/120/121/225 BAND £3.75 £13.50 Drder Code: SK65 Order Code: SK64 Economy Kit Content Contents BELT SET. T/U REEL TABLE BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. T/U CLUTCH. T/U IDLER TYRE. REEL NV2000/NV2010 VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 Economy Kit Contents BELT SET, PINCH ROLLER. Contents BELT SET. PINCH ROLLER. FF IDLER. PLAY IDLER. TENSION BAND. VIDEO LAMP Order Code: SK13 Economy Kit Contents BELT SET. PINCH RDLLER REEL DRIVE UNIT TYRE TYRE, SUPPLY REEL TABLE Contents BELT SET, PINCH ROLLER. TYRE, PINCH ROLLER, T/U IDLER TYRE. PULLEY TYRE CLUTCH TALIDLER REEL REEL DRIVE UNIT, TENSION £6.00 Order Code: SK14 IDLER, TENSION BAND IDLER TYRE £3.50 £10.00 Order Code: SK36 Order Code: SK35 F5.00 £13,50 Order Code: SK6: Order Code: SK62 NV7000/NV7200/NV7800 Economy Kit Contents BELT SET, PINCH ROLLER IDLER TYRE. CLUTCH TYRE 3V29/3V30 HRD7200/7300/7350 Contents BELT SET, PINCH ROLLER, IDLER UNIT. PLAY IDLER. **FOR MORE DETAILS OF OVER 500** Economy Kit Contents BELT SET. T/U REEL IDLER TYRE. SUPPLY REEL TABLE BELT SET. T/U REEL TABLE TENSION BAND TYPES OF SERVICE KITS ... £3.25 TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL IDLER. T/U CLUTCH. T/U IDLER. TENSION BAND. VIDED LAMP Order Code: SK11 PLEASE RING US! TYRE, PINCH ROLLER, REEL IDLE TYRE, T/U IDLER TYRE NV300/NV330/NV333/NV340/NV366 Economy Kit Contents BELT SET, PINCH ROLLER IDLER TYRE. PLAY IDLER AP T/U CLUTCH £10.00 Order Code: SK32 SERVICE KIT & UPGRADE FOR ONWA TV CHASSIS Contents BELT SET, PINCH RDLLER, Order Code: SK31 IDLER LINIT PLAY IDLER TENSION BAND 3V44/45/48/53/54/55/57 Order Code: SK15 £7.00 Drder Code: SK16 FAILURE OF ZD401 (ZD401 ON THE 20/21 CHASSIS) IS NOT HRP50/HRD140/150/158/160 HRD250/257/565/566/755 NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/ UNCOMMON Economy Kit Contents BELT SET. PINCH ROLLER Contents BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSIDN NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/ AG1810 (P/K) THIS KIT HAS BEEN ASSEMBLED AS A REPAIR KIT FOR COMPONENT FAILURES AND AS AN UPGRADE FOR THE Economy Kit Contents LDADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER. TYRE Contents LDADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER BAND POWER SUPPLY. Order Code: SK39 £15.00 Order Code: SK40 THE KIT CONSISTS OF ALL THE REQUIRED COMPONENTS TENSION BAND Order Code: SK27 £6.00 Order Code: SK28 FISHER FVHP905/906/907/908/910/911/916/918 £3.00 AND COMES COMPLETE WITH FULL INSTRUCTIONS AND CIRCUIT DIAGRAM. Economy Kit Contents BELT SET. PINCH ROLLER. IDLER TYRE Contents BELT SET. PINCH ROLLER. NV332 THE KIT IS DESIGNED TO FIT THE FOLLOWING MAKES AND Economy Kit Contents BELT SET, PINCH RDLLER PLAY IDLER TYRE. FF/REW IDLER TYRE Contents BELT SET, PINCH ROLLER, IDLER GEAR IDLER UNIT MODELS TENSION BAND PLAY IDLER. FF/REW IDLER TENSION BAND. FF/REW TYRE * AKAI * ALBA / BUSH Drder Code: SK57 £13.00 Drder Code: SK58 £12.00 Order Code: SK30 £5.10 Order Code: SK29 * HINARI * GOODMANS FVHP615/618/620/622/710/711/715/716/720/721/722/725/ 730/830/840 Contents Economy Kit Contents NV230/250/260/280/430/450/460/470/650/810/890/ * IVC * MATSUI AG1200PK/AG1500PK Contents Economy Kit BELT SET, PINCH ROLLER. Contents BELT SET, PINCH RDLLER, IDLER, TENSIDN BAND Order Code: SK23 ORDER CODE: ONWAKIT PH Economy Kit Contents BELT SET, PINCH ROLLER BELT SET, PINCH ROLLER PRICE: 1200p IDLER GEAR IDLER UNIT IDLER TYRE IDLER TYRE TENSIDN BAND Drder Code: SK68 £3.25 £6.00 Order Code: SK24 £11.00 Order Code: SK69

VIDEO CASSETTE HOUSINGS **CEMENT**

| | | Codo | Price | Name | Models | Code | Price | Name | Models | Code | Price |
|-------------------|--|-------|----------------|--------------------|-----------------------------------|------|-------|---------------------|--------------------------------------|-------|-------|
| Name | Models | Code | rnce | Ivallic | FV31R | CH19 | 4300p | | VCA103, 103GV, 106, 106GVM, | | |
| AKAI | VS35, VS53, VS55, | | | | HRD515, 520, 527, 540, 550, 580, | | | | 254GVM | CH23 | 2500 |
| | VS56, VS75 | CH18 | 3200p | | 600, 610, 620, 660, 670, HRD830, | | | | VCS211, 244, 5055, 605, VCB230, | | |
| GRANADA | VHSDP1 | CH05 | 1100p | | 840, 850, 860, 4050, 6600, FV37H | CH20 | 2200p | | VCD806G, 810G, VCT212, 310, | | |
| | VHSYJ2 | CH01 | 2800p | | HRD540, 580, 830, 860, 910, 960, | | | | 410G, 610 | CH24 | 2500 |
| GOLDSTAR | GHV1290P, 1291P, 1295P, 9400, | | | | HRD970, HRDX20, | | | TELEFUNKEN | VR2970 | CH02 | 2800 |
| | 73401, GSE1295P, GSE1891P, | | | FERGUSON | FV57H | CH27 | 2400p | THOMSON | V320, 321, 323, 326, 4200, 4300 | CH01 | 2800 |
| | 20001Q, 20051Q, VCP4200, 4300, | | | I.T.T. | VR3605, VR3905 | CH01 | 2800p | | V342, 343, 352, 353, 360, 364, 368, | | |
| | 4301, 4305, VCP4306, 4311, 4315, | | | 1,1,1. | VR3916, 3926, 3946, 3948, 3976, | | | | 4210, 4230, 4260, 4400, V5500, | | |
| | 4316, 4320, 4321, 4325 | CH25 | 2000p | | 3986, 3995, 3997, 6948 | CH02 | 2800p | | 6000, 8540 | CH02 | 2800 |
| | GHV51, 1221, 1232, 1240, 1241, | | | | VR3916, 3926, 3946, 3948, 3976, | | | TOSHIBA | V55, V57 | CH01 | 2800 |
| I | 1242, 1244, 1246, 1248, GHV8000, | 81100 | 2900p | Ť. | 3986, 3995, 3997, 6948 | CH02 | 2800p | | V65, V66 | CH02 | 2800 |
| | 8200 | CH26 | 29000 | NATIONAL PANASONIC | NV730 | CH06 | 4300p | | | | |
| FERGUSDN & J.V.C. | 3V38, 3V39, 8943, 8944, 8951. | | | N.E.C. | N830EG, N831EG, N831EG, N832, | | | the sto sto sto sto | , 华华华华华. | ++. | * |
| | 3V35, 3V36, 3V49, HRD 110, 111, | 01101 | 2800p | N.E.C. | N833EG | CH01 | 2800p | MMMMM | MMMM | ~ ~ | ~ ~ |
| | 120, 121, 225 | CH01 | 2800p | | N895 | CH02 | 2800p | AMS | TRAD MOD | KIT | 次 |
| | 3V42, 3V43, 3V44, 3V45, 3V48, | | | PHILIPS | CASSETTE LIFT ASSEMBLY (691203 | (66) | | AIVIO | I KAD MOD | 77.7 | |
| | 3V53, 3V54, 3V55, 3V57, 8945, | | | FILLES | DV186, 190, 286, 471, 562, 761, | | | * | | | * |
| | .8947, 8948, HRD 140, | | | | VR6180, 6182, 6185, 6285, VR6290, | | | | | | A |
| | 141, 150, 157, 158, 160, 250, | 01102 | 2800p | | 6291 6293 6362 6367 6393 6467 | | | FITS: | | | X |
| | HRD257, 455, 565, 566, 725, 755 | CH02 | 280Up | | 6468, 6470, VR6561, 6670, 6760, | | | VCR 4500, 4 | 500,4700,5200,TVR | 1,2,3 | A |
| | 8948, 8950, FV10B, 12L, 13H, 14T, | | | | 6761, 6870, 6970 | CH05 | 1100p | 太 | | | 太 |
| | 20B, 21R, 22L, 26, 395, HRO230, | 21100 | 2000- | | VR6443 | CH22 | 2900p | A DOLG | C 03.35 MAT . | a a b | .A |
| | 430, 530 | CH03 | 2800p | | VR6448 | CH23 | 2500p | | $E: £2.25 + VAT \epsilon$ | each | N |
| | 3V58, 3V59, 3V64, 3V65, FV11R, | | | | 49SB6 | CH24 | 2500p | | والمحاديث والمراجع والمراجع والمراجع | de de | 4-4 |
| | 8950, 8951, HRD 170, HRD 180, HRD 370 | CH04 | 280 0 p | SHARP | VCA100, VCH851, VCH852 | CH22 | 2900p | XXXXX | ANNANA | AA | MM |

MODESWI

NV2000, 2010, 7000, 7200, 7800 (VS50048)

NV230, 260, 430, 810, 870, 2300, 4300 £3.50

(VSS0110)

NV830 (VSS0091)

NV300, 333, 340, 366, 688, 777, 778

(VSS0060

NVG21, 25, NVH65, NVD80 (VSS0175A)

AUDIO CONTROL HE AMSTRAD ORIGINAL NO: 150751

Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000

Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER,
TOWADA, UNIVERSUM ORDER CODE: AH01 PRICE: 1350p

£2.25

£2.10

£3.75

AMSTRAD ORIGINAL NO: 153134 Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD-HAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEI-

DER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA UNIVERSUM ORDER CODE: AH02 PRICE: 1450p Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER MODELS PRICE VBR 009 NVG7 etc 875p VBR0050 NV300, NV340 etc 875p VBR0061 NV777 etc 875p VBR0103A NV250, NV450 etc 625p VBR0125 6250

SET OF 8 ALLEN KEYS

0.90mm

1.50mm

2.00mm

3.00mm

0.77mm

1.27mm

1.60mm

2.40mm

VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs 13p each pack of 25pcs Order Code: SP14

VIDEO MAINTENANCE TOOLS

Set of 8 Allen keys packed in a plastic wallet Order code: TOOL 9, Price 125p
Specifically designed for video maintenance

UNIVERSAL HEAD EXTRACTOR

Hand tool designed for extracting hard to remove heads without damage to either the head or the mounting assembly. Adjustable so as to suit various heads. Order code: TOOL 8, Price 600p

VCR ALIGNMENT KIT

CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS

- RCA TYPE AUDIO & CONTROL HEAD POSITIONING TOOL
- RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS
- RCA TYPE BACK TENSION TOOL
- TENSION ADJUSTMENT TOOL FOR VARIOUS USES
- VCR ADJUSTMENT TOOL

3 REVERSIBLE SCREWDRIVERS **SPRING HOOK**

CIRCLIP PLIERS MICRO SCREWDRIVER

VCR HEAD EXTRACTOR Order code: TOOL 10, Price 2900p

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

This transparent videocassette replaces a normal videotape during measurements, adjustments and inspection. The mechanical parts come into sight and become accessible Order code: TOOL 23, Price 500p

UP BATTERIES

PHILIPS

Part Nos: 138 - 101138, 138 - 10313 1.2v 90mAH

Order Code: BB01

Part Nos: 138 - 10229, 2.4v 100mAH

Order Code: BB02

Price: 70p

Price: 135p

FERGUSON

Part No: 00E6 - 067 - 001 1.2V 100mAH Order Code: BB03

Part Nos: 00E6 - 606 - 8001 2.4V 100mAH

Order Code: BB04

Price: 90p

Price: 150p

LITE PSU REPAIR

| MAKE & MODEL | CODE | PRICE |
|-------------------------------------|---------|-------|
| PACE PRD800, PRD900 | SATPSU1 | 600p |
| PACE SS9000, 9200, 9010, 9210, 9220 | SATPSU2 | 550p |
| AMSTRAD SRD510, SRD520 | SATPSU3 | 600p |
| AMSTRAD SRD500 | SATPSU4 | 600p |
| AMSTRAD SRX340, SRX345, SRX350 | SATPSU5 | 600p |
| PACE D100/150 | SATPSU6 | 650p |
| CHURCHILL D2MAC | SATPSU7 | 650p |
| PACE MSS100 | SATPSU8 | 1100p |
| | 1 1 | |
| | | |

SATELLITE TUNERS

PACE PRD800/MSS200 2Ghz (221-2077062) ORDER CODE: TUNER01 PRICE: 1400p + VAT

PACE PRD900/MSS1000 2Ghz (221-21770112) ORDER CODE: TUNER02 PRICE: 1400p + VAT

SWITCH MODE TRANSFORMERS

PACE 9000

ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900

ORDER CODE: PRD800 PRICE: 550p

| MAKE & MODEL | CODE | PRICE |
|--|----------|-------|
| PACE MSS200/300 APPOLL | SATPSU9 | 900p |
| PACE MSS500/1000 | SATPSU10 | 1230p |
| FERGUSON SRD4 | SATPSU11 | 650p |
| ECHOSTAR SR5500 | SATPSU12 | 1600p |
| ECHOSTAR 6500/7700/8700 | SATPSU13 | 2750p |
| AMSTRAD SRD600 | SATPSU14 | 2600p |
| MIMTEC (Surensen) | SATPSU15 | 700p |
| AMSTRAD SRD700, SR950, SRX100, 301, 501, 502, 1002, 2001, SRD2000 SAT250 | SATPSU16 | 1250p |

SATMETER

The Satmeter is a professional portable satellite strength meter designed for the installation and maintenance of satellite TV systems. The Satmeter can be used as stand alone with powering the LNB as well as in loop.

Through operation with satellite RX powering the LNB.

- * Acoustical signal: On signal strength *LED indicator: Vert/Hori
- * Frequency Range: 900 to 2050 Mhz *Input impedence: 70 Ohm * Power amplifier: 18db

*Detection Range: -60 to -10 DBM

* Max. input signal: -10 DBM ORDER CODE: TOOL22

PRICE: 8500p

REPLACEMENT

GRUNDIG

PART No: 29703, 29102

USED ON:

C7500, C8500. C8502, C8712 . . .ETC Order Code: SW1 Price: 100p

PHILIPS

USED ON: K30, K35, K40, KT3, KT4 Order Code: SW13

Price: 95p

SONY

USED ON: KV1612, KB1612, KV1614, KV2052, V2056 KV2062, KV2067, KV2212 . . . ETC Order Code: SW5 Price: 130p

USED ON: KV1400, KV1440, KV2040, KV2060 (POWER SWITCH 26mm) Order Code: SW12

Price: 110p

SONY

USED ON: KV2020

(POWER SWITCH 21mm +Remote)

Order Code: SW6 Price: 130p

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9

Price: 35p

| AND IN SE | | FUSES | | |
|--|-----------------|-------|-------------------|-------|
| A STREET, STRE | TIME LAG (20mm) | | QUICK BLOW (20mm) | PRICE |
| CURRENT RATING | ORDER CODE | PRICE | ORDER CODE | 60p |
| | FUSE36 | 75p | FUSE37 | 60p |
| 100mA | FUSE01 | 75p | FUSE17 | |
| 160mA | | 75p | FUSE18 | 60p |
| 250mA | FUSE02 | 75p | FUSE19 | 60p |
| 315mA | FUSE03 | 75p | FUSE20 | 60p |
| 400mA | FUSE04 | | FUSE21 | 60p |
| 500mA | FUSE05 | 75p | FUSE22 | 60p |
| 630mA | FUSE06 | 75p | FUSE23 | 60p |
| 800mA | FUSE07 | 60p | FUSE24 | 60p |
| 1A | FUSE08 | 60p | | 60p |
| | FUSE09 | 60p | FUSE25 | 60p |
| 1.25A | FUSE10 | 60p | FUSE26 | 60p |
| 1.6A | FUSE11 | 50p | FUSE27 | |
| 2A | | 50p | FUSE28 | 60p |
| 2.5A | FUSE12 | 55p | FUSE29 | 50p |
| 3.15A | FUSE13 | 55p | FUSE30 | 50p |
| -1A | FUSE14 | | FUSE31 | 50p |
| 5A | FUSE15 | 60p | FUSE32 | 50p |
| 6.3A | FUSE16 | 60p | FU3E32 | |

| CERAMIC PLUG TOP | | | | | |
|------------------|------------|-------|--|--|--|
| CURRENT RATING | ORDER CODE | PRICE | | | |
| ZA ZA | FUSE33 | 100p | | | |
| 5A | FUSE34 | 100p | | | |
| 13A | FUSE35 | 100p | | | |

| 32 mm CERAMIC SLOW BLOW | | | | | | | |
|-------------------------|------------|-------|--|--|--|--|--|
| CURRENT RATING | ORDER CODE | PRICE | | | | | |
| RA | FUSE44 | 185p | | | | | |
| 10A | FUSE45 | 185p | | | | | |
| 15A | FUSE46 | 185p | | | | | |
| 20A | FUSE47 | 210p | | | | | |

NB. All fuses are made in the UK and fully meet BS4265 & BS1362 safety standards and should not be compared with cheap imported types

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Euroslot

ORDER CODE: TOOL11

PRICE: 220p

TELEVISION Edition 7

This new A5 size guide lists more than 9600 faults and to approx. 474 pages in size.

Price: 1650p only – no VAT (+ £2 Postage) Order Code: BOOK02

Satellite Repair Manual Edition 5

346 pages of receiver faults plus notes and general information such as many useful button sequences for resetting parental lock codes, resetting installation choice to factory defaults.

Price £16.00 – No VAT plus Postage £1 Order Code: BOOK03

20mm CERAMIC TIME LAG

| ZUIIIIII CERAIVIIC TAVIE 2120 | | | | | |
|-------------------------------|------------|-------|--|--|--|
| CURRENT RATING | ORDER CODE | PRICE | | | |
| 6.3A | FUSE38 | 100p | | | |
| 8A | FUSE39 | 100p | | | |
| 10A | FUSE40 | 100p | | | |
| 3 15A | FUSE41 | 85p | | | |
| 4A | FUSE42 | 85p | | | |
| 5A | FUSE43 | 85p | | | |
| | 1000 | | | | |

38mm CERAMIC TIME LAG CURRENT RATING ORDER CODE PRICE 10A FUSE48 825p ** ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES **

SPRING HOOK

Spring Hook, to unlock springs in audio tape recorders & VCRs

ORDER CODE: TOOL20 PRICE: 265p

AULT FINDING / COMPARISON BOOKS

Video Recorders Edition 5 1997

Satellite Fault Finding Guide Issue 1.

Listing about 1,000 faults for over a

range of 24 different brands.

Order Code: BOOK05.

Price £8.50 - No VAT.

Over 300 pages packed with more than 5500 faults for different brands

Price £15.00 - No VAT. Order Code: BOOK01

SEMICONDUCTOR COMPARISONS 1999

With over 650 pages listing more than 34,200 Semiconductors with suitable alternatives complete with descriptions and base information. Price: 1900p only – No VAT (+£2 Postage).

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SEMICONDUCTOR COMPARISONS 1999

The new 1998 Jaeger Semiconductor comparison with 1100 pages packed with information on over 95,000 semiconductors in much greater detail plus marketing data on SMD devices and a separate generic table of all the type designations.

Price: £47.00 only – No VAT (+ £5 Postage). Order Code: BOOK06

SERVICE AIDS

| DESCRIPTION | VOLUME | CODE | PRICE |
|----------------------------|------------|------|--------------|
| VIDEO HEAD CLEANER | 75ML | SP01 | 145p |
| SWITCH CLEANER | 176ML | SP02 | 155p |
| SILICONE GREASE | 200ML | SP03 | 180p |
| FREEZE IT | 170ML | SP04 | 295 p |
| FREEZE IT | 400ML | SP16 | 580p |
| FOAM CLEANER | 400ML | SP05 | 180p |
| ANTI-STATIC | 200ML | SP06 | 180p |
| AEROKLEANE | 200ML | SP07 | 200p |
| AERO DUSTER | 200ML | SP08 | 340p |
| AERO DUSTER | 400ML | SP17 | 580p |
| PLASTIC SEAL | 200ML | SP09 | 250p |
| GLASS CLEANER | 200ML | SP10 | 160p |
| COLDKLENE | 200ML | SP13 | 220p |
| EXCEL POLISH 80 | 200ML | SP18 | 160p |
| ADHESIVE 120 | 500ML | SP19 | 250p |
| LABEL REMOVER 130 | 200ML | SP20 | 260p |
| REFURB 140 | 400ML | SP21 | 260p |
| TUBE SILICON GREASE | 50 GRAMMES | SP11 | 225p |
| TUBE SILICON SEALANT WHITE | 75ML | SP22 | 250p |
| TUBE SILICON SEALANT CLEAR | 75ML | SP23 | 250p |
| TUBE HEAT SINK COMPOUND | 25 GRAMMES | SP12 | 150p |
| DRIVE CLEANER | 200ML | SP24 | 150p |
| SCREEN CLEANER | 200ML | SP25 | 145 |
| COMPUTER CARE KIT | - | SP26 | 2100p |
| Outra Gran di Michini | | | |

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| SOLDERING STAND & SPONGES SOLDERING STAND (MADE BY ANTEX) SPARE SPONGE | \$108 \$109 | 350p 55p |
| SOLDER 18 SWG 500 GRAMMES 20 SWG 500 GRAMMES 22 SWG 500 GRAMMES | \$110 \$111 \$112 | 500p 650p 700p |
| DESOLDERING AIDS SDLDER MOP STANDARD GAUGE 1.2MM X 1.5M SOLDER MOP 1.2MM X 10M DESOLDERING PUMP SPARE NOZZLE | \$107 \$113 \$105 \$106 | 100p 420p 320p 60p |
| | | _ |

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|---|---------------------|----------------|
| Models & Description | Order Code | Price |
| AIWA XC007 | | |
| DX-990A, DX-DIA | KSSS151A | 1900p |
| CXL60, CXL66G, CXL80, CXN3100, CXN320, CXN3300, CXN360, CXN420, CXN420 | KSS152A | 1600p |
| CXN550, CXN990, CXN999, CXNV20, CXSL70, DX29100M, FDN636, FDN6508, FDN939, LCX60, LCX666, LCX70M, LCX60, M7400, M75, NSX320, NSX360, NSX400, NSX430, NSX430, NSX400, NSX430, NSX400, NSX430, NSX900, NSX929, NSX950, SXSA05638, NSX9399, NSXV20, SXFN550, SXFN520, XC300, XC550, XC750, XC950, XC | | |
| CXAP1, CXL7, CXL8G, CXLC50P, CX258, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX8G, LCXAP1, XC002, XC004, XC005, XC777 | KSS152A | 1600p |
| XP31, XP33, XP55, XP80G | KSS210B | 2000p |
| XP6.XP7 | KS220A KSS331A | 2500p 3400p |
| AKAI | 100331A | 3400p |
| CD73, DC93 | KSS151A | 1900p |
| CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79, CDM480, CDM600, CDM670, CDEM770, CDM959, MX550, MX570, MX650, MX670, MX750, MX950 | | |
| DENON | KSS210A | 1300p |
| DCD1500II, DCD1520, DCDE3520 | VCC1E1A | |
| DCD1400, DCD600, DCD800 | K\$S151A K\$152A | 1900p 1600p |
| DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920 | KSS210A | 1300p |
| DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715, DCD825, DCD895, DN2000F | | |
| GOLDSTAR | KSS240A | 2000p |
| CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222A/L, FFH272L, | | |
| FFR333L, FFR373K, FJ606, FR606L | KSS210A | 1300p |
| CD320A/L, CD630S/L, FFH212A/L.FFH212E | KSS210B | 2000p |
| GRUNDIG CD260 CD255 | | |
| CD360, CD435 CCD300, CD101MCD904, MC10, NEW ORLEANS CD | HOPM3 | 2150p |
| KRCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD | KSS210A | 1300p |
| CDP60, CDP90 | KSS210B KSS220A | 2000p |
| CDP65 | KSS331A | 2500p 3400p |
| CD905 | OPTIMA5 | 1600p |
| HITACHI DAW560 | | |
| FX-10 | HOPM3 | 2150p |
| AXC10 | KSS210A KSS210B | 1300p |
| J.V.C. | KJJZ IUB | 2000p |
| 1990-1992, LATE 1987-1988 – XLE300BK, XLE31BK, XLE51BK, XLE900BK, XLME91BK, XLV101BK, XLV21BK, XLV22BK, XLV311BK, XLV333BK, X-Z1010TN, XLZ411BK, XLZ444BK, XLZ555BK, XLZ611BK | OPTHAN | |
| CONADIO CASSETTE, MINI SYSTEMS - MODELS 1990-1992 | OPTIMA3 OPTIMA4S | 4000p 5000p |
| CA-C33, CA-MX30BK, CA-MX33BK, UX-A5, UX-A6, XL-M309, XL-M403BK, XL-M408, XL-M409, | 0.1111740 | эосор |
| KL-M504BK, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V31BK, XL-V51BK, XL-X552BK, XL-X55 | | |
| | OPTIMA5 | 1600p |
| | | |
| | | |
| KLMC100/M, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK, KLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XTSG | | |
| KENWOOD | OPTIMA6S | 1600p |
| P47, DP660SG, DP8020, DP87, L1000D | V0045-4 | |
| P1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP403, DP5030, DP5030 | KSS152A | 1600p |
| 75040, DF320, DF7030, DF7040, DF7050, DF730, DF930, DF930, DF950, DF4650, DF4650 | | |
| PM7730, DPM850, DPM991, DX6620, M225, M25, M450, M850, PD3030, PDM991, RDX25, XDC3, RXDC3L, UD202, UD302 | | |
| PC42, DPC72, DPC77, DPC80, DPC92 | KSS210A | 1300p |
| P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DP85, DP89, M774, PD3060 | KSS220A | 2500p |
| 0502, 0070, 0D701, 0D90, XE5 | KSS240A | 2000p |
| PC321, DPC521, DPC531, DPC631K, DPC721, DPC731 | KSS331A | 3400p |
| P1060, DP2060, PART No: RCTRH8136AFZZ | RH8136A | 4500p |
| ANASONIC 19177A SI 9207A SI 9217A SI 9227A SI 92 | | |
| LP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A, LPG100A, SLPG200A, SLPG400A, SLPG500AK, SLPG500AS, SLPJ24A, SLPJ26A, | | |
| LPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A | 601 20200 | |
| 7 | 691-30209 | 5500p |

| CK UPS | | | |
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| Models & Description | | Order Code | |
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| SLP370G, SLP400C, SLP555, SLP777, SLP999, SLP, | A10, SLPC20, SLPC25, SLPJ25, | | |
| SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK25, SLPK26, PHILIPS | SLPS50, SLPS70, SLPS700, SLPS840, SLPS900 | SOAAD70A | |
| AZ8304, CD070, CD080, 690, 910, 920. PART NO. 48 | 222 224 2232 | | |
| CD100, CD130, CD1380, CD1482 CD200 CD204 C | D210 CD200 CD202 CD204 CD200 | 4822-691 | |
| CD460, CD482, CD500, CD502, CD582, CD583, CD58 | 34, CD610, CD620, CD630, CD780 | | |
| CD761, CD762, CD840, CD883, CD960, CDF104, CD | M4/19 ECD185 | 691-30209 | |
| AS440, AS445, AS540, AS640, AZ8048, AZ8640, CD | 070, CD080, CD091, CD163, CD165 | 031-30203 | - |
| CD690, CD710, CD720, CD732, CD740, CD750, CD9 | 10 CD920 CD935 EW17 EW21 | | |
| FW26, FW330, FW36, FW360, FW380I, FW40, FW4 CD1210/40 | 1, FW46, FW56, FW66, FW68 | CDM12.1 | _ |
| AZ8006 | | CDM12.4 | _ |
| FW11 | | OPTIMA6S | _ |
| PIONEER | | OFTIMADS | - |
| PDM400, PDM410, PDM500, PDM510, PDM600, PD | M610, PDM700, PDM710, PDM730 | | |
| PD1303, PD1403, PD1503, PDX940M, PDX950M, PD | Z560T, PDZ72T, PDZ73T, PDZ81M. | | |
| PUZ82M, PUZ83M, PDZ960M, XDZ53T, XDZ54T | | KSS151A | |
| N32, N90M, PD101, PD201, PD32, PD41, PD4500, PD47 | 00, PD52PD5700, PD65,I PD6500, PD6700, | | _ |
| PD7700, PD8700, PD970, PDCP420, PDCP520M, PDCP5 PDM430, PDM450, PDM550, PDM630, PDM650, PDM75 | 201, PDJ 4001, PDJ500T, PDJ800M, PDJ900M, | | |
| FDF920M, FDS001, FDS001, PDS701, PDS701G, P[)S90 | 11 PDT310 PDT510 PD7 PD7570T PD774T | | |
| DE04M, FDZ370M, FAA1349, S125CD1, S135CD1, S30 | GCDM S303CDT S505DM S605DT S707DM | | |
| | | PEA1030 | |
| 10M400, FDM410, FDM500, PDM510, PDM600, PDM | 4610 PDM700 PDM710 PDM720 | | - |
| PDT303, PDT403, PDT503, PDX940M, PDX950M, PD PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XD | Z560T, PDZ72T, PDZ73T, PDZ81M, | | |
| SAMSUNG | 2551, XU262, XU262M, XU2630, XR282 | PWY1009 | _ |
| CD20 | | 1100110 | |
| CD1200, CD1310, SCM-6000, SCM6900 | | HDPM3 | _ |
| RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, I | RCD990, RCD995, SCM6900 | KSS210A SOH90T4N | - |
| SANYO | | 5011007414 | - |
| DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, | DCX891, DCX891N, MCDZ10. | | |
| PART No. 6142186855 DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6 | 1 10005000 | 614218 | |
| DCX1000MD, DCX1003, DCX900MD, DCX903, DCX9 | 15 | 614220 | _ |
| DCD10, DCD11U, DCD20, DCD30, DCD30AT, DCD6, D | CD8U DCMS1 DCY110 DCY120 | KSS210A | _ |
| DCX210, DCX220, DCX993, DCX994, MCDMS40L, M | CDMS50L, MCDMS660L, MCDZ1L. | | |
| MCDZZL, MCDZ3L. PART No. 6142391303 | | 614239 | |
| DCD12. PART No. 6450055966 MCDZ31L, MCDZ41L, MCOZ61L, MCDZ71L | | 645005 | Ξ |
| SHARP | | KSS210B | _ |
| CD-111, CD-301, CD-302, CD-304, CD-310, CD-C3, CD | 1700 CD-1900 CD 111 CD 1110 CD 1110 | | |
| CD-X12, CD-X15, CD-X16, CD-X17, CD-X20, CD-X4, | KIRED CHICGECO DV 150 DV 100 DV 150 | | |
| DA 400, DA-401, DA-650, DX-660, UX-999, DX-A3, D) | C-N45 DX-R554 DX-R7 DY-R76 DV R76A | | |
| UN-11/1, UN-11/10, UN-1820, UX-R840 UX-/100 DX- | /1000 DY-71500 GECDEE OT 20CD OT 22CD | | |
| QT-350CD, QT-37CD, QT-38CD, QT-CD20, QT-CD33, R SG-W1CD, SG-W2CD, SYS302, ZCD7CD. PART No. R | S95 SC-7700 SC-9900 SC-9906 SC-A1 | | |
| UT-50CD, QT-60CD, QT80CD, PART No. RCTRHR124A | F77 | RH8122A | _ |
| DXR-8408, PART No. RCTTRH8130AF27 | | RH8124AF | |
| CDS360E, 360H, 370, 450H/E, CMS150CDH, CMSR40 | OCDH, CP150, CPR400, CPS360, 370. | RH8130AF | _ |
| FART NO. RCTRH8136AFZZ | | RH8136AF | |
| SONY | | | _ |
| KSS240A KSS121A | | KSS240A | |
| KSS151A | | KSS121A | |
| KSS210A | | KSS151A | |
| KSS210B | | KSS210A | _ |
| KSS220A | | KSS210B KSS220A | - |
| KSS331A | | K\$\$331A | |
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| KSS360A TECHNICS | | KSS360A | 7 |

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|--|----------------|--------------|----------------------|----------------|--------------|------------------------------|----------------|--------------|--------------------------|------------------|--------|
| Description | Code | Price | Description | Code | Price | Description | | D-f- | I D ist | | |
| AKAI | | | A512120/230 | RC900 | 650p | PANASONIC | Code | Price | Description | Code | Price |
| RC-V10A | RC876 | 650p | A514790 | RC901 | 650p | EUR51200 | RC200 | 050- | SONY | | |
| RCV 37 B | RC891 | 650p | A5088470 | RC902 | 650p | TC2200 | RC204 | 650p 650p | RM604, RM605, RM606 | RC140 | 650p |
| V25A | RC896 | 650p | A518612 | RC903 | 650p | VSQ0357/NV730 | RC202 | 650p | 32 CHANNEL | RC140 | 650p |
| DECCA | | | SCL002 | RC904 | 650p | TNQ1621 | RC203 | 650p | RM613 | RC141 | 650p |
| RC70 | RC894 | 650p | C2096 A511940 | RC905 | 650p | PHILIPS | | | RM632, RM636 | RC160 | 600p |
| FISHER | | | 655602H | RC906 | 650p | RC5002,5154 | RC134 | 650p | TATUNG FXA | | |
| RC905B | RC879 | 650p | | RC1920 | 650p | KT3 NON TEXT | RC135 | 650p | RC70 | RC877 | 650p |
| GRANADA | | | ITT IFB13, 14, 15 | 00440 | | 69117032 69117194 | RC178 | 650p | FX70 FASTTEXT | RC883 | 650p |
| UNIVERSAL TEXT | RC309 | 650p | FS4 | RC143 RC148 | 650p | RC5991-UNIV | RC180 RC300 | 650p | TELEFUNKEN | RC894 | 650p |
| MK4 TEXT, 70155G, 70115G, 70133G 95288E | RC880 | 650p | RG305 | RC305 | 650p 650p | RC38 | RC301 | 550p 650p | FB632 | DCcoac. | T 000- |
| 94490D | RC882 | 650p | RG306 | RC306 | 650p | KT3 TEXT | RC5301 | 650p | FB639 | RC632S1 RC639 | 650p |
| GRUNDIG | RC884 | 650p | FS9/1-10/1 | RC307 | 650p | RC5352 | RC5352 | 650p | THORN/FERGUSON | 110033 | doco |
| TP160E | 00407 | | VS5 RUK | RC308 | 650p | RC5375 | RC5375 | | 3V35-42 | RC342 | d00a |
| TP200, TP300 | RC107 | 650p | VS4-1 | RC308 | 650p | RC5 STANDARD RC5903 | RC300 | 550p | 3V31-32 | RC344 | 650p |
| TP400 | RC380 RC401 | 650p 600p | MULTICONTROL (17C20) | RC311 | 650p | SALORA | RC5903 | 650p | 3V57-58 | RC628 | 650p |
| TP590-600 | RC600 | 650p | LOEWE | | | SERIES L | DC100 | 05.0 | TX10 TEXT | RC732 | 575p |
| TP390, TP610 | RC610 | 650p | DC11 | RC146 | 650p | 86173 | RC190 RC882 | 650p 650p | TX10 STEREO TEXT | RC738 | 575p |
| TP621 | RC612 | 650p | MATSUI | | | SANYO | 110002 | doco | TC9-90-100 | RC740 | 600p |
| TP630, TP650 | RC650 | 650p | 010270601 | RC889 | 650p | RC218, RC222, RC228, RC238 | RC140 | 650p | 3V55, FV11 | RC783 | 650p |
| TP666 TP661 | RC660 | 650p | VX770 | RC892 | 650p | JXGE | RC878 | 650p | TX100 FASTTEXT | RC789 | 650p |
| | RC661 | 650p | NOKIA | | | JXDE VHR2300 | RC884 | 650p | TX100 ST, FASTTEXT | RC789 | 650p |
| HITACHI | | | SATELLITE | RC550 | 650p | RC628 | RC890 | 650p | PROFESSIONAL | RC790 | 650p |
| CLE800-CLE830 A617402/655602 | RC140 | 650p | ORION | | - 1 | SHARP | RC865 | 650p | T OSHIBA CT937 | 00000 | |
| A01740Z/00000Z | RC1920 | 650p | RC53 | RC892 | 650p | G0121CESA, 123CESA, 204, 251 | RC140 | 650p | CT9117 | RC950 | 650p |
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LOT193 1550; LOT207 1650; LOT266 1650; LOT27 1450; LOT200 1400; LOT201 1550; LOT196 1650; LOT201 1550; LOT201 1550; LOT201 1450; 1450t LOT234 2433455 RTRNF 2023 BMZZ LOT310 1500p RTRNF 2023 8 SONY 3753100 1-439-243-00 1-439-243-11 1-439-243-31 1-439-243-32 1-439-244-01 1-439-244-11 1-439-244-11 1-439-244-21 LOT38 4822 140 10151 4822 140 10161 LOT38 LOT182 LOT82 LOT82 LOT23 LOT23 LOT23 LOT84 LOT204 2433521 2433581 LOT85 LOT22 LOT275 1500c 4822 140 10171 4822 140 10176 2433721 2433751 2433752 2433752 2433891 2433893 2433893 2433893 2434002 2434141 2434141 2434274 LOT83 LOT91 LOT01 1300 4822 140 10194 4822 140 10198 06 D-3-084-001 LOT01 OT91 1-439-416-5 1350p 06 D-3-087-00° LOT250 #822 140 10390 #822 140 10230 #822 140 10246 #822 140 10246 #822 140 10246 #822 140 10254 #822 140 10263 #822 140 10263 #822 140 10271 #822 140 10271 #822 140 10283 #822 140 10283 #822 140 10386 #822 140 10336 #822 140 10336 #822 140 10336 #822 140 10336 1-439-430-2 1400p 1650p 1550p 1650p 1550p 1450p 1450p 1650p 1250p 4822 140 10201 06 D-3-088-00 LOT23 LOT84 1400p 1450p 4515 03 40 4515 03 41 LOT229 LOT229 LOT48 LOT48 LOT48 LOT48 LOT45 LOT45 LOT45 LOT45 154125A 06 D-3-093-001 154125A TOSHIBA 37010 37011 37012 37013 37014 37015 06 D-3-095-001 LOT87 LOT87 1400 4515 03 43 4515 03 44 LOT131 1450p LOT131 1450p LOT105 LOT107 06 D-3-095-002 06 D-3-095-002 06 D-333-512-001 FETX 100 90 DEG FETX 90 WHITE FETX 100 DEG GRUNDIG 1450p 4515 03 46 1450p 1450p 1450p 1450p LOT117 LOT210 LOT208 LOT123 LOT122 LOT104 LOT125 LOT110 LOT132 LOT122 LOT124 LOT124 LOT1284 1-439-244-21 1-439-244-31 LOT131 LOT131 LOT27 LOT27 LOT04 4515 03 50 4515 03 51 LOT131 LOT131 LOT131 LOT131 LOT131 LOT131 1-439-256-00 4515 03 75 LOT56 LOT22 LOT131 1450p LOT131 1450p LOT131 1450p LOT131 1450p LOT131 1450p LOT55 1400p LOT01 1300p LOT250 1350p LOT281 1300p 4516 16 01 1-439--256-2 LOT153 LOT140 LOT149 LOT60 LOT163 1750p 1500p 1400p 1250p MITSUBISH 37016 MITSUBISHI 731003 276-16399 334 B 07803 334 B 08104 334 B 08104 334 P 18506 334 P 18506 75908-05008A 2434453 1550p 1500p 1-439-256-22 LOT51 29201.014.0 1-439-276-21 29201.015.0 2434593 1-439-280-00 LOT50 1450p 1450p 37019 29201.017.01 2435062 1-439-280-13 1-439-280-13 1-439-286-00 1-439-286-11 1-439-286-12 1-439-286-21 1-439-288-00 1-439-288-02 1-439-289-01 1-439-289-21 1-439-289-21 I OT50 LOT87 29201.018.01 2435121 LOT46 LOT74 LOT295 16000 243375 29201.018.02 LOT61 2435131 LOT251 1600p 1600p 1550p 1500p 1500p 1500p 1700p 1300p 1550p 1500p LOT46 1300p 2433751 2433752 23236023 23236052 23236098 23236198 LOT62 1250p 243514 LOT282 1300p LOT88 1450p LOT295 LOT51 LOT75 LOT70 LOT49 LOT273 LOT272 LOT279 LOT78 LOT46 LOT46 1300 LOT62 1250p LOT88 LOT89 LOT281 1300p LOT131 1450p LOT288 1400p LOT288 1400p LOT289 1500p 2435301 2435671 2436201 2436202 2432101-2 2433451H 2433453H 2433891H 2433892G 4822 140 10353 LOT63 17000 1600p LOT46 LOT63 1700p LOT166 1600p LOT165 1350p LOT165 1350p LOT165 1350p LOT65 1500p LOT164 1400p 4822 140 10356 LOT284 LOT109 LOT228 LOT228 LOT47 LOT47 LOT47 LOT47 LOT93 LOT93 LOT269 LOT94 1750c 4822 140 10367 4822 140 10369 4822 140 10381 4822 140 10384 4822 140 10395 4822 140 10406 4822 140 10421 4822 140 17078 **SANYO** 094-00020/0.9 094-00035/0.2 4822 140 1036 LOT286 OT109 12000 D 108/37 DCF1577 1750g 29201.022.03 LOT109 LOT128 1600 1400p 1400p 1400p 1400p 1450p 1450p 1550p 1300p 1300p 23236255 29201.022.04 LOTRI 1350p 1250p 23236424 29201.022.04A LOT127 LOT82 KFS 60226E 23236425 29201.024.01 LOT116 1600p -439-289-22 MSH-1FBW08 23236428 LOT289 29201.024.04 LOT73 LOT109 11500 NIKKAI 3122113837011 LOT131 HINARI -439-294-00 LOT67 1450p BABY10 LOT131 1500p 1500p 1500p LOT24 1.T.T. 4515 01 08 4515 01 15 LOT103 1250p LOT113 LOT136 LOT139 LOT139 ORION TER 4039 AD 51 13914 1 51 14184 1 LOT24 LOT02 1500p LOT24 PANASONIC 1-439-303-11 1500p LOT162 1350p LOT39 1850p HM51-1411834-1

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- Audible Continuity and Diode test



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 Side Attachable test leads

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DM551

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- Auto Power Off

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 High reliability
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Pocket Analogue Multimeter

- Mirrored Scale reduces errors13 Versatile Ranges
- 2k Ω/V DC/AC Sensitivity
 Recessed Input Terminals for safe use
- Fuse and diode Protection



AM518

General Purpose Analogue Multimeter

- 20 Versatile Ranges for general purpose testing
- Large Mirrored Scale of 80mm length
 Audible Continuity Test
- DCA 10A measurement
 20kΩ/V DC 9kΩ



AM519

- AMD 19
 General Purpose Analogue Multimeter
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 24 Versatile Ranges with battery check
 Continuity check (LED indicator)
 Series Capacitor Output to detect AC signal

Fuse and diode Protection



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Digital Clamp Multimeter

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 Rubber Holster
 Clip On Test Lead Lamp
 Backlit LCD

High reliabilityCapacitance Measurement

Auto Power Off
 Full Ranges Protection

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 Plug-in Clamp for AC current measurement
- Datahold for easy readingAudible continuity
- Auto Power Off



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Current Transducer

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- ACA 0-50A, ±3% 50-300 A ±2%
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- High Safety Design



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HELP WANTED

The help wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department - do not write to or phone the advertisement department about this feature.

Wanted: LOPT for the Matsui Model 2080, part no. 3220012. D. Mehta, 133 Booth Road, Colindale, London NW9 5JU. 0181 200 0987.

Wanted: Amstrad/Fidelity VMC100 camcorder spares or scrap camera. Particularly require lens and front video section. S. Wardill, 1 Wentworth Road, Southend-on-Sea, Essex SS2 5LF. 01702

Wanted: Set of radio valves, UCH42, UF41, UL41 and UY41. M.M. Rigg, Four Ways, 139 Broad Lane, Rochdale OL16 4PP. 01706 640 409.

Wanted: Information on the Escom computer system with Intel 80486 processor. Also on upgrading from 486 to a Pentium overdrive. Greg Strange, phone/fax 0151 327 5971.

Wanted: Circuit diagram for the Hitachi HV62K CCTV camera. D.J. Rockliffe, 3 Hewell Lane, Barnt Green, Nr Birmingahm B45 8NZ. 0121 445 5360. Wanted: Circuit diagram (photocopy OK) for PCB type 145N(N) used in the Sharp TV Model 3705. P.T. McKeever, 4 Castleview Park, Derry, N. Ireland BT48 8DL. 01504 353 613.

Wanted: Circuit diagram or layout for plug-in transistor Y amplifier unit 1Y2 for the Dynamco D7100 scope. Jim Littler, 363 Atherton Road, Hindley Green, Wigan, Lancs WN2 3XD.

Wanted: STK183BC colour output chip for the Amstrad PC14 HRCD R computer monitor, or does anyone know of a replacement? Richard S. Barnard, 105 Portland Road, Worthing, W. Sussex BN11 1QA.

Wanted: LOPT for the Plustron 5in. TV/radio/cassette Model TVRC5C. It has 11 pins and is marked TMF-205L UKCT. Or does anyone know how to fixed shorted turns? Graham Seward, 2 Orchard Close, Severn Stoke, Worcester WR8 9JJ. 01905 371 504. E-mail grahamsew@tesco.net

Wanted: MN15151GBC chip (IC701) or complete panel for the Goodmans C series Model 2050R. Please phone Peter on 01642 650 027.

Wanted: 16MB memory module for the Mitac 4028G series notebook computer. Phone John Rider on 01384 825 512. Wanted: 0.12Ω safety resistor circuit ref. R1101 for the Panasonic NV370 VCR. Chris Lusardi, 154 Western Road,

Tingley WF3 1QA. 0113 253 0432. Wanted: Chopper transformer for the Nikkai Model TLG1409. Numbers on the transformer are 5903 06002A-AA-L SE. Also require CB radio and radio scanner. M. Payne, 66 Nevinson Avenue, South Shields, Tyne and Wear NE34 8NP. 0191 537 2062.

Wanted: Cabinet front for the Akai VS485EK VCR and a working or repairable main chassis panel for the Grundig TVR5504 (CUC3500), plug-in boards not needed. T.J. Steel, 185 Charter Road, Chippenham, Wilts SN15 2RF. 01249 464 427.

Wanted: Heads, in reasonable condition. for the Philips VCR Model VR2020. Steve Rowe, 20 Woodside Close, Knaphill, Woking, Surrey GU21 2DD. 01483 480 027.

Wanted: Power supply for the Sharp VC2300H VCR plus circuit diagram or manual. Gerald Dethick, 35 Bideford Road, Offerton, Stockport, Cheshire SK2 5AX. 0161 480 7537.

Wanted: Service manual or circuit diagram for the Sharp VLC780H camcorder good photocopy OK. G. Thomas, 31 The Parade, Merthyr Tudful CF47 0ET. 01685 722 575.

Wanted: Philips Matchline 36ML8906/05B power board with LOPT and power amplifiers. Vince Stanley. Phone 01954 253 649, fax 01954 253 601 or e-mail

vince.stanley@pigroup.co.uk Wanted: Repair data for the Amstrad type 83-4933-9-001 and type 9975414801 14in. SVGA monitors and also the Mega PC base unit. David Benyon, Marshland View, St. Annes Hill, Bude, Cornwall EX23 0LT. 01288 353 373

Wanted: Betamax tape rewinder; SL1432 IC; GoldStar 12401 and Tashiko VVE992 VCRs, working or not. Ron Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP. 01708 558 792. Wanted: Manual for the Taylor 45D valve tester. G. Edwards, 17 Watson-Watt Gardens, Mundesley, Norfolk NR11 8DR. Wanted: Technicolor portable VCR/monitor. Condition immaterial as long as the power supply and monitor sections are complete. Also any information on, or a source of spares for, or a scrap Varitronic Express labelling

machine. Mine doesn't print the characters correctly. Andie Wilkes, 01926 404 935 (day), 0121 605 0720 (evening) or e-mail andie@wilkes123.freeserve.co.uk For sale: Video Jackfield, musa, two-row with 20 musa per row with test points. Brand new boxed. Also BNC patchpanel 2U-19in. rackmount, two rows of 16 double-sided BNCs. Brand new never used. Phone Fran Ott on 01359 240 745. Wanted/for sale: Require 10 x 7in. 3- 5Ω speaker, Truvox radio jack circa 1953 and a teletext board for the Grundig CUC220 chassis. Have for sale Sony TA100 15W PC amplifier £30, sixvolume set of Radio and Television Servicing pre-1956-1962 £30, two Canon NP50 and one NP5500 copiers plus some chemicals for breaking £80 - very heavy, buyer collects. W. Milne, 20 Graham Road, Wimbledon, London SW19 3SR. 0181 543 9542. Contact: Would like to keep in touch

with service technicians in the UK and Ireland for exchange of advice and ideas about our job. Write to Stefano Tonelli, Via Antica Luni 2, 54011 AULLA (MS), Italy or e-mail vidserv@tin.it

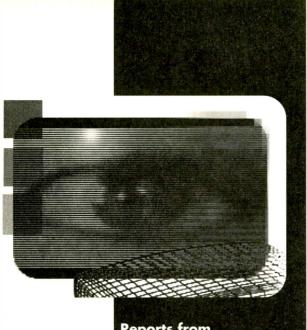
Wanted/for sale: Require valves, parts, manuals, knobs etc., in fact anything to do with 405-line TV and valve radio sets, also old test gear (especially 405line pattern generator), anything considered. Can supply photocopies of many early Trader service sheets at £1 each. Steve Taylor, 11 Charnborough Road, Coalville LE67 4SF. 01530 832 695 or 07977 805 308.

Wanted: Service manuals for the Technics SLP7 CD player, Sanyo VTC5000 VCR, Panasonic AG6800 VCR, Akai DT200 timer unit, Trio KX710 cassette deck and Hitachi D5500M cassette deck. Terry Martini, 122B Cannon Street Road, London E1 2LH. Phone 0171 702 8774, fax 0171 702 8216 or e-mail

terrym@callnetuk.com

For sale: Manuals for the Ferguson FV10, FV11, FV13, FV21, FV26, FV30, 3V24, 3V44 and 3V59 VCRs at £3 each plus postage. Also Avo 9 Mk 4 meter in excellent condition with EverReady case (needs new leads), £50 plus carriage. Phone David Forfar on 01695 735 132 for further details and list of other manuals.

TELEVISION August 1999 709



Reports from
Philip Blundell, AMIIEelec
David Smith
Bob Longhurst
Chris Watton
Paul Hardy
Michael Dranfield
Tony Matthews and
Derek, Telecare

Toshiba 3357DB (C5SS chassis)

Another dealer had replaced the STRS6709 chopper chip Q801 because it had gone short-circuit between pins 1, 2 and 3. The replacement failed next day. When Q801 has failed, D809 (MTZJ5-6B, part no. 23316672) must always be checked. If it's short-circuit Q801 will fail when the set is brought out of standby. **P.B.**

Hitachi CPT1454

"Just snow" it said on the job card. Voltage checks around the tuner unit (helpful to have the pin functions printed on the PCB) showed that the 12V supply was missing. When I traced back along the track I found a crack in the copper, by the AGC control. The track was broken at one end of R222. A small wire link restored normal operation. P.B.

Philips 29PT9113/05 (MD2.22 AA chassis)

This set was dead – well almost. At switch on the front LED went green for 15 seconds then turned steady red. There was no EHT or sound of any kind during this time. It's unusual for the LED to be a constant red during a fault condition: in most situations it flashes red. The trusty dealer service tool couldn't

TV Fault Finding

pick up any error codes, so I was on my own with this fault!

The standby microcontroller chip (the chassis has two chips of this type) appeared to be OK, as the front LED and the remote-control receiver sections were working. But the main microcontroller chip, which wakes up the set and sends error codes to the infra-red transmitting LED, wasn't working.

Checks around this IC showed that the clock oscillator (1200) was running, the reset pulse was OK, and the +5S standby, +5V2 and +8S supplies were present and correct. Even the Main-Is-Alive signal, which indicates that the main microcontroller chip is operational, was as per the manual. The I²C bus was active during the 15 seconds when the front LED was green.

Could there be a software fault – either a faulty ROM or EAROM? Fortunately I was able to borrow a working text/control PCB from a neighbouring dealer (thanks Kevin!). This enabled me to prove that microprocessor 7200 was faulty.

Philips operates a repair service for this PCB, at a fixed price. Remember to keep the orignal EAROM chip (or copy it) to save having to set up the option codes, picture geometry, grey scale and tuning afterwards! P.B.

Samsung CI5944 (SCT12B chassis)

The TDA8350 field/EW output chip in this chassis seems to fail quite often. Samsung has issued a modification sheet, which is rather too involved to explain here. The value of one component has to be changed and five others added. Ask me in 18 months if it does the trick!

If you replace the chip and the scanning is restored but there are flyback lines at the top of the screen, check R307 (10Ω) which

tends to go high in value. Its part no. is 2008-000179. **P.B.**

Grundig G1000 Chassis

If the set is dead but the standby LED is glowing, check whether the efficiency diode D304 (BY133) is short-circuit and R314 (6·8kΩ, 4W) in the feed to the line driver stage is open-circuit. **P.B.**

GoldStar CI20C22F (PC42 chassis)

There was no sound or vision, just a blank raster with the on-screen display showing when the remote control unit was used. A check on the supply lines seemed to be a good idea, especially as there are several 78 series three-terminal regulators on the signals board. IC831 (7812) had 16V at its input but only 9V instead of 12V at its output. A replacement restored normal operation. **P.B.**

Panasonic TX29AD1DP

Tripping with field collapse was the complaint with one of these sets. There are two switch-mode power supplies and a conventional transformer supply. Look no farther than R7000 (180k Ω) and R7005 (150k Ω) which are connected in series and provide a start-up supply for the STR chip. They are on the side panel, where the audio output stage lives. R7000 had in this case gone high in value. As a result the power supply couldn't get going.

A word of advice. There are two identical plugs near the top of the panel. If they are wrongly connected you will get the same results. Better to mark them than be led a merry dance! D.S.

Osaki CI5013T

This set was stuck in standby. Safety resistor R826 (1Ω , 0.5W) was open-circuit and the line output transistor was short-circuit – which

was not surprising as R826 had 250V at one side! The cause of the excessive voltage was C852 (470 μ F, 16V) in the power supply. It had gone low in value. Once it had been replaced and the HT had been set at 125V the receiver produced a super picture. Odd that the 160V capacitors were intact and hadn't blown their tops! **D.S.**

Crown CTZ9009R

The width varied, with severe EW bowing. After all the main components had been checked and proved to be OK I removed the scan coils and found severe burn marks in one spot. Fortunately I had a spare yoke, which restored normal scanning. **D.S.**

Mitsubishi CT15M2X

There was just a squealing noise when this set was switched on. The cause turned out to be the 2SD1877 line output transistor Q552, which was short-circuit. After checking for possible causes I fitted a replacement and switched on. The set then worked perfectly but, still suspicious, I kept a wary eye on it. After about ten minutes my suspicions were confirmed when the HT rose. Fortunately there was no further damage. The cause of this power supply fault was the STR54041 chip IC901. B.L.

Ssangyong CTV0014

There was sound but no picture, because of field collapse. The surge limiter R122 (3.3Ω) in the supply to the field output chip was open-circuit, and a resistance check showed that there was a dead short across the supply. C108 (1,000 μ F, 25V) rather than the IC had gone short-circuit. I used a 35V replacement, unhappy at the thought of a 25V electrolytic decoupling a 25V supply. The HT was correct at 120V. A two-day soak test proved that the set was now OK. **B.L.**

Ferguson ICC8 Chassis

I was told that this set went dead intermittently. It failed to do so during five days on test. So I carried out a tap test, followed by a flex-and-twist test. It was still OK. Blanket resoldering of all likely causes of the trouble was then undertaken. It failed during the first evening the customer had it back!

After another five days of fruitless testing a frustrated thump on the side of the cabinet did the trick: off it went. A quick attack inside revealed great sensitivity around the plastic power supply cage. The cause of the fault turned out to be dry-joints on the chopper transistor's metal heatsink plate – its soldered lugs are used to complete the chassis line. Had it been a Sony set I would have looked for dodgy lugs first! B.L.

Tatung A Chassis

There was no remote-control operation. The handset was OK, but an oscilloscope check showed that there was no output from the stand-up IR receiver unit. Its 5V supply was present, and the external circuitry was OK. A new receiver unit from Wizard Distributors, order code TAT117, solved the problem. **B.L.**

Goodmans 2185T

There was a green picture. The usual suspects were all OK, so further testing was required. This brought me to R618 which was open-circuit. According to the circuit daigram it should have been $470k\Omega$, but $330k\Omega$ was fitted. It was covered with the dreaded dried glue.

Another fault was apparent, field cramping. The cause of this turned out to be C333 (4.7μ F). **B.L.**

Ferguson TX99 Chassis

Although the power supply was working the set appeared to be dead. Checks showed that the 18.5V supply was missing. The usual cause of this is the 1A circuit protector ICP1 going open-circuit, but in this case there was an open-circuit at pin 7 of the chopper transformer. When the transformer was removed most of the leadouts were found to be very poorly soldered. Remaking them restored normal operation. C.W.

Roadstar TVM70034

These 6in. monochrome sets are popular with lorry drivers. One problem you get is loss of tuning or tuner drift. The usual cause is C107 $(0.01\mu\text{F})$, a disc capacitor that tends to become leaky. **C.W.**

Daewoo T514 (CP365 chassis)

Intermittent loss of the signal is a complaint you can get with these sets. If a button is pressed, you find that the on-screen displays are there. But only switching off and on will restore the signal. Then, after a while, the fault returns. The cause is poor connections to the chopper transformer. Don't be surprised if no amount of thrashing will instigate the fault. C.W.

Matsui 20T1

No sound is a quite common fault with this set. The cause is usually safety resistor R550 (4.7Ω) which goes open-circuit. It's mounted next to the speaker plug. C.W.

Sony KVX2532 (AE1B chassis)

If the picture is cramped at the bottom and stretched at the top, check the field scan coupling capacitor C531 (680µF, 25V). It's quite a common fault with these sets. This one had a rather unusual fault, incorrect purity and convergence because the scan coils were incorrectly positioned. C.W.

Hitachi C2166TN

For an apparently dead set with a dim standby LED, check the connections to IC902. C.W.

Tatung 140 Series Chassis

It took over a year to establish the cause of an extremely intermittent fault, low gain, with one of these sets. Fortunately the customer was quite understanding. On initial test the fault put in a brief appearance then refused to make another. Some suspect joints were remade. On subsequent visits the tuner was replaced, as the best guess as to the cause, then the SAW filter and the IF chip. During one visit the fault remained long enough for voltage checks to be carried out. I found that the base-emitter junction of Q101 (BF959), which drives the SAW filter, was going open-circuit. A BF141 proved to be a suitable replacement, and the set has not been back for many months now. P.H.

Philips G90AE Chassis

The customer's complaints were that the picture was ragged, the display went dim and teletext was poor. The first two faults were cured by replacement of C2640 $(680\mu F)$ and C2580 $(470\mu F)$, the reservoir capacitors for the 22V and 12V supplies respectively. The teletext fault was a bit more obscure: it looked rather like poor purity Resoldering the joints where the teletext panel is joined to the main PCB didn't fix it. The cure was to resolder a lot of the long links on the main PCB near the teletext panel. P.H.

Sony KVM2140U (BE2A chassis)

We've had a number of these sets in which the Aquadag earth lead retaining clip has broken away from the cabinet. The only way to repair this is to use a couple of tie wraps and anchor the lead to the tube mount. In most cases there is no other damage. With one set there was no picture after reattaching the lead. The customer had complained that it was dead. In fact there was field collapse because R819 (0.47Ω , 0.25W safety) had failed, **P.H.**

Sharp CV2131 (8PSR chassis)

This set had intermittently failed to work and was now dead. Quite a number of poor joints were attended to, but the real culprit was C723. It's a 3·3µF non-polarised electrolytic capacitor in the power supply. I didn't have one in stock, but two 6·8µF electrolytics connected back-to-back restored normal operation. P.H.

Philips G90AE Chassis

We've seen a number of these sets that have displayed F4 or F7. Usually the signals are missing, the LED changes colour from green to orange and there is no response to the remote control unit. These error codes point to the EEPROM or the teletext chip. In each case however the microcontroller chip has been faulty.

The error codes seem to occur only when the chip is quite warm. Freezer spray and a hairdryer are useful diagnostic aids to prove whether it's faulty. I usually warm the chip until I can just touch it with the back of a finger for a few seconds. If the fault is present at this temperature, a power reset usually makes no difference. If you then cool the chip slightly with freezer, a power reset will normally restore correct operation. **P.H.**

Ferguson ICC5 Chassis

At switch on the EHT blipped up but the set otherwise remained dead. The cause was traced to a dried out electrolytic capacitor, CP26 (470μF), on the primary side of the chopper power supply. It's the reservoir capacitor for the 7.5V supply. M.Dr.

NEI E28G1TFXN (E5 chassis)

This set would trip out at switch on. The supply to the line output stage was disconnected and a bulb was used as a dummy load. This proved that the cause of the fault was in the power supply. Cold checks revealed that D652, which provides the supply for pin 6 of the

TDA4605-2 chopper control chip, had a high forward resistance. Once it had been resoldered it seemed to be OK and the set worked. So the set was put on soak test.

A couple of hours later the set was again dead. This time the power supply was OK but there was no supply to the line driver stage. Another diode, D705, was found to be dropping more than 0.7V. A replacement restored normal operation then, ten minutes later, there was field collapse. The boost diode D301 in the field output stage was faulty.

It was by now clear that there was a batch of bad 1N4003 diodes in the set. I removed another one, from a different part of the circuit, placed it across my ohmmeter probes and pulled at the leadout wires. The forward resistance varied as different stress was applied to the wires. As the offending diodes were all silver in colour they were very easy to spot. It was apparent that unless they were all replaced the set would be coming back time and time again. I decided to replace the lot with 1N4007s. After that the set worked perfectly

Intermittent problems with Samsung S13240/3269 VCRs are caused by the same thing, high forward-resistance diodes. Again it's best to replace the lot – in this case there are only about six. M.Dr.

Bush 2052T/A

For no sound check Q616 (2SC1815). It's in the ident feed to the microcontroller chip IC601. When it fails IC601 mutes the sound because it thinks there's no incoming signal. M.Dr.

JVC CVT21EK

This set would switch on then drop back to standby as the relay removed the HT supply. Suspecting field collapse, I shorted the relay's contacts. The set then came on with a blank raster and no on-screen displays.

Checks around the microcontroller chip IC601 showed that the voltage at the reset pin (2) was low. This pin is connected to chassis via Q602, whose base is labelled "X ray". It's part of a trip circuit that operates in the event of a fault, forcing the reset pin low to switch the set back to standby. When I traced the path from the base of Q602 I came to Q805, which monitors the line output stage's HT current as it flows via R808. This 0.68Ω, 1W safety resistor was the

cause of the trouble: it had increased in value to 1.2Ω . M.Dr.

Toshiba 175T9B/215T8B

For field linearity problems check the electrolytic feedback capacitor C317 ($4.7\mu F$, 50V). **M.Dr.**

Ferguson ICC9 Chassis

"Intermittent picture and sound" it said on the job card. As tapping the rear of the PCB seemed to provoke the fault I spent some time resoldering suspect joints. This failed to cure the fault. I then decided to scope the line drive waveform and found that it disappeared when the fault was present. It was not being produced by the STV2160 chip IV01. Voltage checks around this chip showed that the supply at pin 13 dropped sharply in the fault condition. The cause was traced to DV01 (1N4001), which was intermittent. T.M.

Matsui 20T1 (Grundig G1000 chassis)

Off-air reception was OK but the picture was unstable when a prerecorded tape was being viewed. The customer was using a scart lead, and the video option had been selected. A replacement microcontroller chip cured the fault. T.M.

Energy-saving Lamps

The customer complained about random channel changing, going into the text mode and sometimes switching off. None of these things happened in the workshop. The customer then told me that the trouble occurred in the evening, when the lights were on. Energy-saving fluorescent lamps had recently been installed in the centre light, and were eventually found to be the cause of the trouble: they were putting out a lot of infra-red radiation which was interfering with the remote control circuitry. T.M.

Ferguson ICC8 Chassis

One of these sets would trip out immediately after starting up. Checks in the line output stage showed that the BY397 13V supply rectifier DL13 was short-circuit. Make sure that you use a fast diode in this position – I use a <50µsec device. **D.T.**

Osaki P140

There was no tuning or on-screen tuning indication because the microcontroller chip had become corrupted. Resetting cures the fault: select channel 38 then press 'store' and 'control up'. **D.T.**

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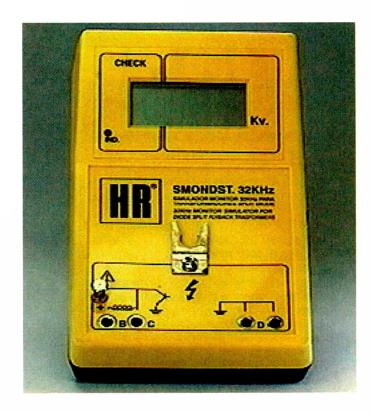
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Alan Willcox checks out a unit that's been specifically designed to test 32kHz diode-split LOPTs used in monitors



The HR monitor LOPT tester

y first impression of HR's tester type SMONDST.32kHz, for monitor line output transformers, was "here's a box with nothing in it"! The unit weighs a mere 6.5oz. It has a standard 4-digit LCD panel to present its findings: there's also a small red LED that provides a 'faulty' indication.

Description

On closer inspection I found that the circuitry inside is quite sophisticated. There are two fibreglass PCBs, and the construction is of good quality. The LCD and the LED, along with the bulk of the circuitry, are on the smaller PCB. There are six surface-mounted ICs on this board, four of which drive the LCD directly. The board is held by sealed nuts and is mounted at a good angle for viewing when the tester is on the bench. Both boards are double-sided, but I was not inclined to remove them for closer examination. In the absence of a circuit diagram, I can't provide an explanation of how the circuitry on the smaller PCB interprets the test results it receives from the larger one.

The test terminals and the test signal generator are on this larger PCB. The LOPT driver IC is a plug-in device and is crystal controlled. An attenuator network, from the EHT (final anode) test point, is kept well clear of the other circuitry.

There has been no scrimping over the quality of the test leads, and the miniature crocodile clips are of supperb quality.

There's no battery-power option and no on/off switch. These omissions are sensible. The mains adaptor runs quite hot, and for long life it's best switched off at source when not in use. Power consumption was found

to be just 17mA at 15V AC. The heat generated in the mains adaptor is the result of the losses you get with a small transformer. Rectification is carried out in the meter itself. With such a low current consumption, this section should be very reliable.

Use

When the tester is first powered, with no connections made to a transformer under test, it appears to indicate that 200-0kV is present at the EHT test point. In fact the first digit is a fault code number that indicates the way in which the transformer has failed – if in fact it has. For economic reasons this indication cannot be separated from the rest of the display – to do so would require a dedicated display device. Markings on the case distinguish between the fault code and the EHT reading. This is an acceptable compromise. When the transformer being tested is OK, the fault code digit is not present and the LED is off.

Tests normally involve four connections: to the HT supply pin for the transformer's primary winding, to the output transistor's collector, to chassis and to the EHT cap. When a test is made in situ, the only requirement is that the connection between the primary winding and the line output transistor's collector circuit is desoldered. A test point is provided to enable the flyback pulses to be displayed on an oscilloscope.

One of the tester's strongest points is that it provides an indication of the EHT that would be generated in the line output stage. In my opinion this is the most meaningful assessment of whether all is well. In effect it tests not only the primary and secondary windings but also the split-diode EHT sections, and is thus an indication of the condition of the transformer as a whole.

Tests with a few transformers known to be faulty produced fault code readings of 3 or 4 and little by way of an EHT value. These codes may seem to be rather academic – the section of the transformer that has failed is, after all, usually of little interest. But once you have some experience in using the meter the codes could be helpful in a marginal case.

When tests were made on working monitors the fault code disappeared and the LED remained out.

The Test Signal

The signal used to drive the primary winding of the transformer being tested is 12V DC with a rather unusual waveform superimposed on it. This is mainly a squarewave, with a period of precisely 35µsec (about 28kHz) in the case of the tester I had for evaluation. But it's a squarewave with a difference. Its amplitude is only 400mV, with rise and fall times so fast that I couldn't measure them. Where it differs however is that a spike with an 0.02µsec period is present at the trailing edge. The presence of this pulse may be the reason why the tester simulates the operation of the line output stage so well. It doesn't work in the way that many other LOPT testers do, by ringing the line output transformer.

LOPT Testing

With a good transformer the observed flyback pulse was clean. In this respect normal operating conditions are simulated. With a faulty transformer the pulses were about a third later on in the cycle. The fault code indicator analyses the pulses either by amplitude or repetition — without them there is no indication. This is a clever circuit indeed.

The meter is very sensitive to inductive reactance. When I tested a LOPT in a working TV set I obtained a faulty indication. When I introduced a shorted turn the tester showed the transformer to be good. The tester is thus suitable for checking only monitor LOPTs.

The flyback pulse amplitude and the magnitude of the resulting EHT voltage is about ten per cent of the normal operating level. Some types of transformer failure, such as breaking down (arcing) at high voltages, occur only under normal working conditions. My estimate of the occurrence of this type of failure would be about twenty per cent.

There is no claim to 100 per cent success in testing. As always, much depends on the experience of the user. I can provide a tip here. If the tester gives a faulty indication and you are not quite sure, introduce a shorted turn around the limb of the transformer (this is not always possible of course) while observing the tester. If there is a significant change in the reading, you can be faily sure that the transformer is OK. But bear in mind the proviso about breakdown under the high-voltage conditions in normal use.

Under the test conditions the actual EHT at the tube's final anode is about 2kV. This takes a few seconds to discharge after power has been removed. At this level, semiconductor devices connected to the transformer's secondary windings will turn on. The only supply of concern is that to the field output stage. When I introduced a short across this supply, insufficient energy was diverted to affect the readings.

The package contains a complete reference guide to all HR transformers with a template which, when aligned with the relevant HR number, gives the transformer's pin numbers and the connection points for the tester. Also given is the EHT value to be expected. The required position of the high/low resolution switch, the

only one on the tester, is shown. This switch doesn't alter the test signal: it adjusts the scale of the EHT indicator so that the reading corresponds with the information given. A lot of work has gone into the construction of these tables.

Verdict

The English translation in the multilingual instruction manual is poor, which is irritating and confusing. I feel that for the cost of the meter specific instructions for the country of sale, checked by an engineer who speaks the relevant language, would be justified. For example at one point the instructions read "The instrument should be checked outside the monitor..." I could go on about this!

A similar instrument, type STVDST.01, is required for testing TV receiver LOPTs. It's a pity that the two testers, which use the same technology, couldn't have been incorporated in a single unit. A serious omission is a cross-reference guide to HR type numbers and monitor model numbers. This exists in book form, and if provided with the tester would be a great help. A CD is also in preparation.

These criticisms apart, the tester itself works very well and does all that is claimed of it.

The tester is available from SEME Ltd., Hudson Road, Melton Mowbray, Leics LE13 1BS. Sales hotline 01664 484 000, fax 01664 563 976. The order code is EQU488 and the current price £73.45 plus VAT.

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Reports from David C. Woodnott

Sony CCD-TR760E

The camera/VTR power switch was extremely stiff. As with other similar models, this switch also operates the internal lens cover mechanism. These parts can often be dismantled then cleaned and lubricated, using a suitable plastic lubricant, before reassembly. With some models they are available as replacements; with other models a complete front case has to be obtained, which makes an expensive repair out of what must seem to the customer to be a rather minor problem.

With this particular unit the dismantling and cleaning procedure worked and all was then well. I did however warn the customer that any further similar trouble would be more expensive to rectify.

Nikon VN9000

This Sony clone (similar to the CCD-V88) produced a green camera picture. I found that the problem was intermittent, and that the unit would revert to a no-picture condition. Playback was acceptable, but required some 'tidying up'. The camera picture symptom varied between a greenish shade and complete loss of picture into a mass of lines. The sync and burst signals remained constant at all times.

I decided to check the camera head PCBs for signs of leaked electrolyte – widespread capacitor failure on the video and syscon boards is becoming common with these units. Any severe problems here could mean the end of the camcorder, as not being worth repair. In

Camcorner

this case however both these boards were OK. So on to the camera section.

I removed and inspected all the boards. Board VC32P (process and SSG) was found to be in trouble. Several capacitors had leaked, and some minor print repair was required. After washing, drying and repairing the PCB, and fitting new capacitors, I reassembled the unit for testing – minus, at this stage, the many screening cans/screws etc. that make these camcorders a joy to work on!

At power up the green picture had disappeared. But only the lines were present, as previously! I next investigated the SSG section, and found that the VSUB driver transistor Q629 was faulty. Once this item had been replaced a correctly coloured E-E picture appeared on the monitor's screen.

The VSUB voltage was then reset as laid down in the manual. Having restored the camera head to health, I gave the deck a service and reassembled the units. With a camcorder of this age and known propensity to capacitor failure, I always warn the customer about the risks involved in undertaking a repair.

Sony CCD-FX500E

The note attached to this unit said it was dead. It certainly was – there was no power up in either the camera or the playback mode.

When the cam/VTR switch fails it usually does so for one or other mode, rarely for both. I released the switch from the case to check it, then saw the cause of the problem. The cam/VTR button had fractured internally: it appeared to move correctly from side to side, but didn't operate the switch. A new button assembly was all that was required.

Sony CCD-TR780E

When I checked this dead camcorder I found that PS501 had failed. As the usual checks for short-circuits etc. failed to reveal anything amiss, I fitted a replacement and put the unit on soak test. It worked for several days without giving any trouble. PS501 supplies an unregulated input to IC502 on the servo/syscon PCB VS125. This IC is labelled "reg.battery detect" and, amongst other things, provides separate 5V and 3·7V supplies for the mode control master chip IC503. It was difficult to see how PS501 could have failed without any tell-tale signs in this area, but there weren't any. The unit continued to work during several more days of soak testing, and was then returned to the customer.

A few months later the unit reappeared with exactly the same symptom. PS501 had again failed, and as before no reason for its failure could be found. As electrolytic capacitors are always suspect, though they are usually OK in such a new unit, I replaced C503 and C506 which decouple the two supply lines. They looked and tested OK in all respects – value and ESR. Six months later the unit has not returned, and we know it has been well used.

Samsung VPK70

This camcorder arrived with a note to say that there was a tracking fault and that it had been checked, unsuccessfully, elsewhere. Their looseness made it fairly obvious that the tape guides had been adjusted in an attempt to achieve stable pictures. During playback the tracking was 'almost OK', with occasional vertical picture jumping, especially after rewind search. Careful realignment of the tape path with a Sony test tape failed to improve matters, and I couldn't see any obvious damage to the deck, guides etc. Everything seemed to be all right, but the machine wouldn't set up properly.

As a last resort I checked the deck against another one that was in the workshop. This almost immediately revealed what was wrong: a slant pole was missing on the take-up guide coaster! This deck has two slant poles on the take-up coaster, and one had sheared off. The break was not detectable unless you knew that the pole should be there. A replacement assembly cured the problem.

Some experimentation led to acceptable reception of the first RSL station in the UK under very unfavourable conditions. It also revealed a curious polarisation condition. Keith Cummins describes his attempts to receive TV12

Polarisation Puzzle

his short article describes my efforts to receive transmissions from TV12, the Isle of Wight RSL-TV station. When I started off I didn't realise that I was embarking on what would end up as DX-TV reception – at a distance of 4.5 miles!

Having discovered that TV12's transmissions are on ch. 54, I first tried tuning in via my existing group A aerial. There was not the slightest hint of a signal. I next hung a set-top loop aerial out of the window. This produced a faint impression of a signal. Bearing in mind that the Rowridge transmitter is just 4.5 miles away, and that when I walk a few hundred yards I can see the mast, I was surprised at the lack of signal. The next step was to add a preamplifier with a gain of 12dB. This enabled me to receive something, but the signal was so poor that even large captions were illegible.

Polarsisation Peculiarities

At this point I squashed the loop aerial and discovered that the received signal was vertically polarised. I didn't realise that the transmissions are actually horizontally polarised until later, when I read about them in Roger Bunney's DX-TV column. To cut a long story short I ended up discussing the matter with Roger, who assured me that the transmissions are horizontally polarised. So what was happening at my reception site?

I obtained a group C/D aerial with a gain of 14dB and proved beyond doubt that the polarisation as received was vertical. The signal was still very noisy, but at least I could now read the captions. Roger Bunney had suggested that because transmission to the south of Rowridge, where I live, is restricted to prevent interference to French transmitters, reflection from

the support mast could affect the polarisation.

Since the signal strength was so low, I now knew that a good mastead preamplifier would be essential to achieve anything that approached reasonable reception. David Martin of Aerial Techniques recommended the Triax TA34, which has a gain of 34dB and a noise figure of 1.8dB. When one had been installed it was possible to read the smallest captions. Definition was good, but noise was still noticeable - along with co-channel interference from Ch. 4 Mendip. The Mendip transmissions are horizontally polarised, but are still received at a consistently perceptible level via the vertically-polarised aerial.

Theories

Subsequently, at an IIE meeting, I met two members who are broadcast engineers and discussed the polarisation puzzle with them. Although not involved with the TV12 equipment, they were able to confirm that the transmission ERP is 1kW, obtained by feeding 200W into a directional aerial array with a 7dB power gain. Their theory suggested that since the power was very low spurious transmission artefacts at the rear of the aerial were of no consequence – unlike the situation where hundreds of kW are involved.

I later received a phone call from one of these engineers to say that he had checked the polarisation in a due easterly direction. It was horizontal. But the vertical component was only 3dB down, compared with the normal broadcast specification of better than -15dB. My site is a further 30° round the back of the mast. I guess that, since I receive no horizontally polarised signal component, the ratio of the hori-

zontal to the vertical component of the signal changes with direction until, where I am, the horizontal component has disappeared. Futhermore the gain of the aerial may well be negative in my direction. For example a 10dB power loss would imply an ERP of 20W. This may not be far adrift, judging by the difficulties I have encountered.

Another theory put forward involved ground reflection, which can apparently cause a polarisation twist. But reflection of this type would in all probability degrade the definition, and this isn't happening. Reflection from surrounding objects can, I think, be ruled out because maximum signal is obtained by aiming the aerial directly at the transmitting mast. Also the received polarisation is absolutely vertical, not skewed: this supports the "don't care, it's the back of the aerial" theory.

To sum up, I appear to be receiving an undefined rear-lobe transmission that has somehow become vertically polarised.

In Conclusion

As more RSL stations come on air, the problems I have described here may become more widespread. The moral is: don't trust the specified polarisation in difficult reception conditions that involve directional transmitting aerials and low power.

Several people subsequently told me that reception is impossible in my situation, but persistence has yielded results which, though not brilliant, are watchable. The irony is that if I'd been aware from the start that the transmissions are horizontally polarised I might not have experimented in the way that led to my discovery of the polarisation puzzle.

TELEVISION August 1999



DX and Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and about satellite developments. The PLT problem. New aerial designs. Roger Bunney reports

TVE E3; RAI IA, B;

SVT1 (Sweden) E2;

19/5/99

■he 1999 Sporadic E season is now with us. It started rather late, and to date has been more of a fizzler than a bang. For many DX enthusiasts the prime channels E2 and R1 have been lost because of strong local 49MHz interference from baby alarms etc. For my own sightings I've had to rely more on the higher channels: the number of openings, their intensity and duration left much to be desired. A similar story of infrequent SpE propagation is revealed by logs from Peter Schubert (Rainham) and Cyril Willis (Norfolk). Reception has generally been from the south, i.e. signals from Spain, Italy, etc. Here's a collated SpE log for the month:

 10/5/99
 Unidentified ch. E3 signal.

 14/5/99
 RTP (Portugal) E3.

 16/5/99
 Canal+ L2; TVE (Spain) E2, 3, 4; RAI (Italy) IA; TVA (Italy) IA; LTV (Lithuania) R2; unidentified logos in ch. R2.

 17/5/99
 TVA IA; RAI IA; unidentified ch. R1

signal.

Fox News with a Balkans' package westbound from Europe.



YLE (Finland) E3; unidentified signals in chs. R1 and R2. 20/5/99 TVE E2-4; RTP E3. 21/5/99 RAI IA. 22/5/99 TVE E2; unidentified signals in chs. R1 and 23/5/99 RAI IA, B; TVA IA; unidentified ch. R1 signal. 24/5/99 RAI IA, B; TVA IA; RTP E3; TVE E2-4; MTV (Hungary) R1; unidentified signals in chs. R1 and E4. 25/5/99 TVE E3. TVA IA, RAI IA, B; 26/5/99 Video (Italy) E2. 28/5/99 RAI IA. Unidentified signals in chs. R1, R2 and 29/5/99 TVE E3; RTP E2-4; system M signal in ch. E2 (see below). 30/5/99 TVE E2-4; RTP E3.

There was a tropospheric lift in early May, with mainly UHF signals from France and the Benelux countries received in the south/south east. By May 4th things were back to normal.

George Gaskin (Gibraltar) had more widespread reception from the 10th, with SpE signals in Band I from Belgium, Sweden, Switzerland and the Czech Republic. On the 27th a tall cruise liner had to dock in a manner that broke the microwave link between the GBC-TV studio and the 30ft ch. E6 TV tower. Result: loss of TV reception until the ship sailed off twelve hours later.

A mystery system M (US standard) ch. E2 signal from the SE has

put in an appearance from time to time in recent years. Cyril Willis saw the weak signal on May 29th from 1200 BST. Video was clearly audible using a scanner. Cyril wonders whether it comes from a US base in Germany or Turkey.

Nice to hear again from Ian Roberts, who is now in Randpark Ridge, South Africa – some 20km NW of Johannesburg. He too suffers from interference in chs. E2/R1 from baby minders, cordless phones and other devices that produce strong carriers. But he still monitors ch. E2 via TEP (transequatorial skip), using a scanner, and comments on the large number of transmitters that still use this channel. He feels that the present solar cycle might not be too good – little has been monitored above 56MHz.

Robert Copeman in Melbourne, Australia reports on the transition to digital TV there. Single station per channel operation is to be used, running at much higher powers than in the UK. End-December 2005 is the proposed analogue switch-off date. Chs. 6, 8, 10, 11 and 12 will be used for digital TV in Melbourne. This suggests that Band I will be reallocated to other uses.

Satellite Sightings

There have been fewer news feeds from the Balkans in recent weeks. Much of the output has again been via Eutelsat II F3 at 36°E, in digital form, though W2 at 16°E has also been used – at frequencies up to 12·550GHz, with horizontal polarisation and the familiar 5,632 SR and 3/4 FEC. Intelsat 705 (18°W) is also worth checking. It has traditionally been used for Italian OB links: feeds below 11GHz have been seen, with vertical polarisation, SR 6,399 and

FEC 3/4. Roy Carmen (Dorking) even saw "DSNG7 UKI-433 Montenegro" via Telecom 2D at 5°W. The signal was at 11·493GHz with vertical polarisation, SR 27,500 and FEC 3/4. These are unusual SR values for SNG working. Eutelsat II F2 at 10°E has carried occasional traffic for CNN. It shows that news feeds can pop up anywhere.

Fortunately there's more than war reporting via the Clarke belt. The famed Indianapolis 500 motor race was to be seen on May 30th at 1800 BST via New Skies/K at 21·5°W. An analogue feed at 11·529GHz H was used for the ABC network: the same programming less opt-out network stings was carried in digital form (SR 5,632, FEC 3/4) at 11·550GHz H, one of BTI's leases. Interesting that the digital commentary and pictures were delayed by about two seconds in comparison with the analogue programming.

The 30th was a sporty day, with Gillingham v. Manchester City full time during the evening via Eutelsat II F3 at 36°E. The link was provided by OB/SNG UKI-95 SIS-17 in clear analogue form at 11.634GHz H.

Football enthusiasts had a ball on the 26th, with Manchester United v. Bayern Munchen as a clear PAL ITV feed via Intelsat 705 (18°W) at 11.664GHz H. The Spanish uplinker Retevision E-19 fed live BBC Breakfast TV footage back to the UK on the 25th and 26th via Eutelsat at 36°E. This was digital material at 11.580GHz H (SR 5,632, FEC 3/4).

The Round Italy Cycle Race '99 was carried by Intelsat 705 on the 26th at 11·136GHz V. It was remarkable, with camera shots from a helicopter and motor cycles with hardly any video dropouts as the cyclists sped round mountain roads and steep slopes. Telecom 2C at 3°E also carried analogue coverage of the race.

It was unusual to see an analogue news feed (clear PAL) for Sky London via New Skies/K (21·5°) at 1545 BST on the 31st. The London News Network (LNN) signal used the 11·531GHz H transponder. Another curious sighting via the same satellite late that evening consisted of a test pattern with "Alice Productions Bruxelles" and a phone number. This digital signal (SR 5,632, FEC 3/4) was at 11·525GHz H and lasted till 2300 BST.

Dean Rogers (London SE2) uses a Humax FTA receiver quite effectively despite its lack of auto SR/FEC locking. His interest is mostly in sports however, which usually means an SR or 5,632, 6,111 or 7,028 and FEC always 3/4. May 9th was a good

day for him, with the Motor Cycle Grand Prix, Spain as an analogue signal at 10°E and the FIA World Rally Championships from France as a digital signal via 2C (3°E). The latter feed, at 12.507GHz (SR 5,632, FEC 3/4), was for both Canal Plus and Eurosport. Dean has a problem with the RTL digital package via Hot Bird at 13°E (11.054GHz H, SR 27,500, FEC 5/6). The Humax gives the signal level as 90 per cent, data up to 100 per cent, yet the picture suffers from freeze frames and lockup. No other broadcast package via Hot Bird does this. Can anyone offer an answer?

Terrestrial News

DTT: The close down of analogue TV in Italy has been brought forward: the latest proposal is end 2006. Here are further proposals: UK 2012-15; France 2010-15; Sweden 2008-12; Ireland 2009-15; the Netherlands 2010; Spain 2012; Germany 2010.

DTT is to be launched in France during autumn 2001/spring 2002. Test transmissions should start after 2000, once a transmitter allocation plan has been agreed. RAI (Italy) is currently testing UHF DTT, with coverage expected to extend from 30 to 60 per cent of the population by 2003.

The US DTT standard differs from that adopted in the UK, with much higher powers. Aerial company Andrews has just installed its Trasdar digital transmitting aerial system atop the 1,454ft Sears Tower in Chicago for WFLT-TV (ch. 31). The 30ft long aerial is mounted on an 80ft mast on the roof of the building. The FCC gave the four main networks till May 1st for them to have DTT on-air in parallel with analogue services.

TVB and Asia Television have started DTT tests in Hong Kong.

London area Band III DAB (Digital Audio Broadcasting) franchises have been advertised. To date bids have come from CE Digital, Switch Digital and MXR London. CE Digital was awarded the Birmingham area franchise and plans to start in early summer 2000. France: The daytime educational La Cinquieme and evening ARTE cultural channels are to be merged to provide a fifth national service. Malaysia: Broadcasting is to be privatised. The government has asked for proposals - no privatisation date has been decided.

RSL-TV: The ITC has issued a list of broadcasters that have recently been given an RSL-TV licence, see Table 1. TV12 (Isle of Wight) ch. E54 is already on air, with relays



planned. Lanarkshire Television ch. E67H is about to go on air. MATV (Leicester) was launched on May 27th with programming aimed at the Asian community.

Satellite News

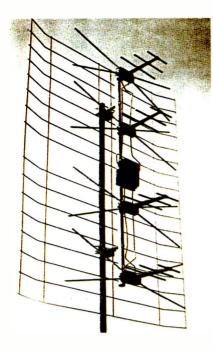
Rupert Murdoch has at long last managed to buy into Italian pay-TV, by taking a 35 per cent stake in the Stream digital service. It's to be relaunched with new programming and exclusive access to major football team TV rights. Stream has been An early-morning digital feed from KFOR-TV provided dramatic footage of the tornados that swept Texas and the Midwest in late April.



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A stacked bowtie/panel array from the Lithuanian firm Intrada. This model covers Band III and the UHF channels. Note the small UHF director chain at the front of each bowtie dipole. making heavy losses: it is in competition with Telepiu, which is controlled by Canal Plus.

A new TV channel, Bulgarian SAT-TV, has appeared as a digital signal (SR 27,500, FEC 3/4) via Hot Bird at 13°E. It's present between about 1400-0200 local time. Check at 11.095GHz H.

The Chinese government has changed its mind and decided to ban domestic reception of satellite TV.

There was concern about possible mass

defection of viewers from the dull national Chinese network programming.

Alcatel/Loral Europe*Star 1 will provide enthusiasts with added interest when it's launched next summer. It will be in orbit at 45°E, providing broadcast and general communications services between SE Asia and Europe – and points in between down to South Africa. The all Ku-band satellite will be joined by the similar Europe*Star 2 in summer 2002.

The Indian government has delayed legislation on digital pay-TV. There is debate over licence fees to 'allow' channels to 'land' in India. The latest Indian satellite, INSAT-2E, is now in orbit at 83°E. It carries 17 C-band transponders plus several meteorological and experimental payloads. AsiaSat-3S is now in orbit at 105.5°E, providing broadcast and general communications services for Asia, Australasia and the Middle East. It has 28 C-band and 16 Ku-band transponders.

Table 1: Recently-approved RSL-TV stations.

| Station | Channel/power | Transmitter |
|--|--|--|
| Ch. 6 Aberdeen Ch. 6 Dundee Ch. 6 Edinburgh Ch. 6 Glasgow Ch. 6 Perth Ch. 6 Stirling City TV, Bristol Manchester Student TV Midland Broadcasting Corporation (Leicester) | E48H/50kW E49V/0.5kW E52H/3.2kW E59H/10kW E47H/1kW E56H/0.2kW E66H/0.5kW E39H/0.5kW | Durris Tay Bridge Craigkelly Black Hill Perth Chartershall Ilchester Crescent Salford University Ratcliffe College |
| The Oxford Channel TVC9 Derry | E47H/10kW E21V/0·5kW | Oxford Sheriff's Mountain |

Concern has been expressed over the lack of any Ku-band operation at 47°W. The Columbian TDRS-6 satellite at this position has only Cband transponders. There have been calls for reallocation of the licence.

There are rumours that PanAmSat might adopt an FEC rate of 7/8 for its digital services. This is worrying cable operators. The equivalent of an analogue signal at threshold with an optimum signal-noise ratio of 46dB is a digital signal that just locks without pixelation. In C band a 3m dish provides good quality with the FEC at 1/2. If this is changed to 7/8 the received signal is 4dB below threshold, calling for a 5.2m dish to restore the previous quality. Bad news at the reception site but good news for the satellite operator, since more signals can be compressed into a given bandwidth. For a technical discussion on this subject refer to SatFACTS April 1999, pages 6-8, The BER Confusion by Bob Cooper.

PLT Interference

In a previous column I mentioned PLT (Power Line Telecommunication), which uses the mains supply for data communication over wide areas and is being pushed by power concerns such as NOR.WEB, Nortel etc. The June issue of the RSB's magazine *Radcom* carries an update on the subject by Dave Lauder (EMC, page 78). Things don't look good for radio amateurs and weak-signal enthusiasts who operate at HF and up to the low VHF spectrum.

A graph of field strength/frequency proposed by the power industry illustrates what we could expect at a distance of about 10m from the cables. The graph includes indication of noise levels within 'rural' and 'quiet rural' environments, along with other indications of man-made interference. Typically, at 30MHz the proposed PLT system would create potential background noise (interference) levels of 16dB above the 'rural' and 30dB above the 'quiet rural' levels. PLT noise would be slightly less at the low end of Band I, but most of us are in residential areas where the background noise is already high. It would thus mean a further addition to the RF pollution.

New Aerials

Each year I visit the Cable and Satellite Show, now called Cable and Satellite Mediacast. Although the event has moved towards the internet, computer access and so on there are still items of interest to the enthusiast. Advanced Satellite International of London NW10 for example had

many unusual smaller components, such as a range of C-band feeds and the rare PTFE shaped polarising slabs for use with a horn to provide left- or right-hand circular polarisation. More importantly, several companies displayed terrestrial TV aerials. These included Televes, Triax and two companies I'd not come across before, CB Vicky of Italy and Intrada of Kaunas, Lithuania.

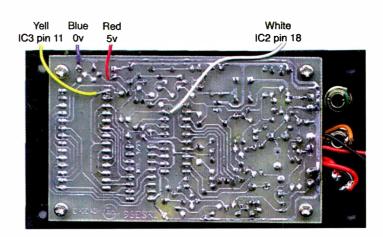
In addition to the usual multiple X-director Yagi arrays for UHF use, CB Vicky had a log-periodic aerial with Band III and UHF sections mounted in-line on a common split boom. The highest-gain version, with 24 elements, provided a gain of 7.5dBd over chs. E5-12 and 9dBd over chs. 21-69. Its length is 1.61m.

Several bowtie/panel UHF arrays were on display at the Intrada stand. They had something extra to offer. For example a twin-bay panel array had a mass of X-type directors ahead of each dipole, lifting the gain across the UHF band from a low of 14dBd at 470MHz to a peak of 16dBd at 850MHz then falling slightly to 15·8dBd at 870MHz.

Of greater interest to me was the ZAT range of export bowtie/panel aerials. Three of these, Models ZAT18, ZAT22 and ZAT24, cover Band III (chs. R6-12, i.e. 175-230MHz) and UHF (chs. 21-69), with gains as high as 6.5-9dB in Band III and 11-15dB at UHF. The UHF gain is increased above the usual 11-13dB by including a small half-wave director chain in front of each of the four full-wave dipoles. Models ZAT23 and ZAT25 differ in covering Band I (chs. 2-4), the VHF-FM band, Band III and UHF. The gain claimed for the ZAT25 is a remarkable 4.5-6dB in Band I, 6.5dB in Band II. 6.5-9dB in Band III and 11-15dB at UHF. In view of the fact that the width of the ZAT25's reflector screen is 820mm, well below a half wave in Band I, and that the only Band I element in the stack of four dipoles is a single extended bowtie with central inductive loading, I feel that the quoted VHF performance figures are probably rather optimistic. If any trade/aerial rigger has experience of these aerials I'd be interested to hear about the results obtained in practice.

It was good to find new aerial designs in a market that's seen minimal change in recent years. The use of high-performance wideband aerials with a flat response will undoubtedly increase as reception of the digital multiplexes becomes more widespread. Perhaps we'll find Lithuanian aerials adorning our rooftops!

Beeper for the Genie



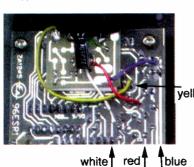
The addition of an audible test-result indication speeds PCB checks when using the Genie ESR meter. Martin Pickering, B.Eng. has devised this modification to provide beeps

he Genie ESR meter (an electrolytic capacitor tester) was designed by Bob Parker. Details were originally published in the magazine *Electronics Australia*: a test report appeared in the January 1999 issue of *Television*. There have been no modifications to the Genie since it was originally introduced, which is a testament to its excellent design.

If you compare it with more expensive units such as the Capacitor Wizard however, one notable feature is missing: there's no audible tone to indicate the range of measurement. This omission is easy to remedy. The simple, low-cost addition described in this article gives very acceptable results.

Circuit Details

Fig. 1 shows the modification circuit details. Two general-purpose npn transistors (e.g. BC548) are used to detect the on state of the Genie's range LEDs. As the LEDs are multiplexed, the voltages fed to them are continuously switched on and off. Because of this the transistors (Q1/2) are connected in a rather unusual way.



Heading photograph: connections to the Genie PCB. Photograph above: the SatCure beeper subpanel connected to a Genie PCB. Pin 11 of IC3 in the Genie sends 5V pulses to both decimal LEDs. Transistor Q2 is on when either of these LEDs is lit (ESR between zero and 9.9Ω). The piezoelectric beeper P1 then receives current via Q2 and R3, whose value is chosen to set the beep volume.

If the least-significant LED is activated (ESR 0.99Ω or lower), Q1 is

pulsed on by pin 18 of IC2. R3 is then bypassed, increasing the beep volume.

If neither LED is lit (ESR 10Ω or higher) there is no sound from the beeper.

The value of C1 (22µF) was chosen to smooth the volt-

age applied to the beeper without causing a significant delay before sound is produced.

Effect

The effect of this modification is that the Genie beeps loudly for ESR values of 0-0- 99Ω , softly for ESR values of 1-9- 9Ω and remains silent for ESR values of 10Ω and above. This audible indication aids 'eyes-free' operation, enabling you to check several electrolytic capacitors quickly without removing your attention from the probes.

Although the beep threshold is fixed, it has proved to be just as useful as the variable-threshold, fixed-volume beep provided by the Capacitor Wizard.

Genie Kit Problems

There have been a few component problems with some Genie kits. In particular the gain of the BC238 transistors has sometimes been so low that either the meter has refused to turn on, spurious faults have occurred, or the LED display has been dim.

Even when this fault has been rectified the display can be difficult to see in bright sunlight. The solution is to fit a pair of Ultra-bright LED displays.

Availability

Genie ESR meters can be obtained from SatCure in either kit form (£61.63 inclusive), ready-built (£73.38) or upgraded as described above (£82.19). The latter is known

as the Genie-Plus version. An Ultrabright LED display pair and the piezoelectric beeper (just the beeper or a modification kit of parts) are also available from SatCure.

SatCure can be reached on 01270 753 311. The

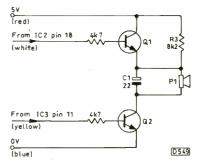


Fig. 1: Beeper circuit for the Genie ESR meter.

address is PO Box 12, Sandbach, Cheshire CW11 1XA. You can visit the SatCure web site at

http://www.netcentral.co.uk/satcure/

We welcome letters from our readers

DTT Reception

Surrey SM2 5AS.

There have been several letters on the subject of variable digital terrestrial TV reception. The following information should be of interest.

and try to publish as many as we can.

You can send them typed, handwritten

or on disc. Address them to the Letters

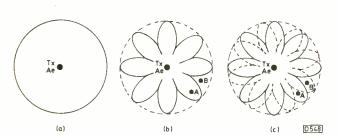
Quadrant House, The Quadrant, Sutton,

Editor, Television, Room L302,

An ONdigital representative gave a short talk at a recent local RETRA branch meeting here. Although he was not technical, he did touch on the transmission problems with a digital signal.

Analogue signals are usually transmitted omnidirectionally from the aerial, as shown in Fig. 1(a). The distribution of a digital signal is not the same: it can be likened to the petals of a flower, as shown in Fig. 1(b). If the receiving site is at A, within one of the lobes, reception is fine. If it's at B, the same distance from the transmitter, there is zero signal and thus no reception. Fig. 1(b) shows the distribution for just one multiplex: the lobes for the other multiplexes do not coincide with this or any other one. Fig. 1(c) illustrates this. At A both signals would be received, but at B only one signal would be received. For simplicity the diagram shows just two multiplexes. Thus getting full coverage from a transmitter without

Fig 1: Transmitting aerial polar responses. (a) Omnidirectional analogue; (b) omnidirectional digital, one multiplex; (c) omnidirectional digital, two multiplexes.



Letters

any dead spots is a virtually unsolvable problem.

There are areas where no signals at all can be received, because interaction between adjacent transmitters causes cancellation. This creates what ONdigital calls a "white hole". There are complete towns sitting in these zero-signal white holes: Basingstoke, Hampshire was quoted as an example. ONdigital technicians are working on the problem, but it seems that the use of many fill-in transmitters offers the only long-term solution.

There are none of these problems with SkyDigital. The picture doesn't break up, freeze or pixilate at all. ONdigital should maybe think about installing a satellite at 28·2°E and forget about terrestrial transmitters, which are thirsty in terms of energy that has to be generated by burning fossil fuel. Peter C. Murchison, Salisbury, Wilts.

Free STBs

There are likely to be unanticipated problems with the free set-top boxes being offered by ONdigital and SkyDigital. ONdigital is offering a free STB to all subscribers. This is not a gift however: it's a free rental, which means that if the box goes wrong ONdigital will exchange it free of charge. We've seen offers like this in the past. They are not 'set in stone' and may change at any time in the future. This is where I see problems.

Normally when a new product is launched and repairs are subsequently needed the service industry can cope: experience is gained, and the product's shortcomings are noted. Over a period of time we acquire any specialised test equipment required and stock up on service data and spare parts. In the present case however it will not be viable to do this until the offers have stopped and we feel confident that they will not start again.

What will happen with the ONdigital/Bush 21in. analogue/dig-

ital TV sets? Will they be distributed on a free exchange basis, or will customers have only the standard one-year guarantee that applies with an analogue TV set? If the latter is the case, customers would be ill advised to pay for something that may be 'beyond economic repair' because a free STB with unlimited replacement is available.

The final problem we have here is that although our local branch of Currys is supplying free ONdigital boxes to those who sign up there will be no reception in this area until October. In answer to the question "will standing orders start in October?" the reply was "no they start immediately, because you could use the box in an area where reception is possible". This seems a certain way for ONdigital to encourage greater sales of SkyDigital subscriptions.

My advice is to think it through before you get too involved, whether you are a potential viewer or, like me, a service centre. John Hopkins, The TV Workshop, Felixstowe.

Channel 5: the Aftermath

When transmission details for Channel 5 were announced in the early Nineties many of us in this trade were appalled that the fourchannel transmission plan which had served us so well was to be seriously compromised. The fourchannel system had been well thought out and carefully engineered. At the vast majority of locations, it provided good reception of four TV services using one small aerial. That has now changed. It wouldn't be so bad if the only problem was poor Channel 5 reception. What annoys me is that the presence of Channel 5 often spoils reception of the other channels. This might seem surprising, but it often happens.

Before Channel 5 came along, almost every TV transmitter site in the country radiated four signals that could be received using an aerial designed for one group of channels. A 'grouped' aerial has a relatively narrow bandwidth, and thus good gain and directivity. Despite attempts at obfuscation by those who sell wideband aerials, the relationship between gain/directivity and bandwidth is set by the laws of nature and thus can't be altered. A wideband aerial will always have inferior performance to a grouped 'equivalent'. After all, that's why the four-channel plan was devised – to have all four signals from each transmitter on fairly closely-spaced channels.

The pressure is now on installers to supply wideband aerials, against their better judgement, for the sake of Channel 5 reception. In fringe areas, or where ghosting is a problem, the likely result is unnecessarily poor reception of the other channels.

To take the Crosspool transmitter at Sheffield as an example, the channels used are 21, 24, 27, 31 and, would you believe it, 67! Four in group A and one, Channel 5 of course, near the top end for group C/D – and on permanent half power at that. I was incredulous when this channel allocation was announced, and still am. Can anyone explain why ch. 34 couldn't have been used?

Even the better-quality, properly-designed wideband aerials don't perform nearly as well as their grouped equivalent. Wideband arrays based on the traditional Yagi configuration are available from the larger manufacturers, who often quote performance figures next to those for their grouped versions. These tell their own story. Logperiodic aerials are again becoming fashionable, all these years after Antiference had a brief fling with them in the Seventies. These aerials are genuinely wideband, and have good directional characteristics, but the gain is very poor. The stacked bow-tie, or 'fireguard', has its adherents, but I'm not one of them. I've always found that their directional characteristics leave something to be desired, especially with horizontally-polarised signals.

Local riggers who always use the cheapest possible 'contract' aerials are not suddenly going to start using good-quality wideband aerials. They are going to use the cheapest possible wideband arrays. The reaction of one manufacturer to the Crosspool channel allocation has been to produce what is possibly the worst UHF aerial I have ever encountered. It's a contract 18-element array with the folded

dipole correct for group A and the director chain about right for group C/D. To make matters worse, the flat plate reflector is not long enough to function below channel 25. There's no attempt at impedance matching or efficient signal transfer from the director chain to the dipole. The grouped aerials from this firm aren't exactly brilliant, but they perform much better than this wideband effort which is, well, staggeringly bad. One that I played about with before replacing it had no useful directional abilities whatsoever for ch. 21 reception. The ch. 67 gain was about 3dB, rather than the 13dB of a half-decent grouped aerial. The sad thing is that these aerials are selling like hotcakes, because for a lot of riggers in Sheffield they 'solve' the Channel 5 problem.

Another problem arises with choice of transmitter. This is best explained by considering an example. The coverage areas of the Emley Moor and Belmont transmitters have a very large overlap. Before Channel 5 came along, we would use whichever transmitter provided the best reception. But at many locations we now have a dilemma. The Channel 5 transmissions from Belmont are so lowpowered that in most parts of my area we can't use them. In places where we would automatically have used Belmont we now have to consider Emley Moor - for the sake of Channel 5. A ridiculous situation frequently arises: we have to provide indifferent Emley Moor signals despite the presence of four good signals from Belmont. This must be a common problem, and I'd be interested to hear the views of aerial installers in other parts of the country. The low-powered relays and the south coast main stations don't carry Channel 5, so this situation must frequently arise.

We've paid a high price for Channel 5. A nonsense has been made of the four-channel transmission plan, and this has resulted in a general reduction in the quality of TV reception. What are the benefits of Channel 5? Has there been a wealth of brilliant, innovative programming? Has viewing choice increased in any real sense? I don't need to answer these questions, do I? Whatever the reasons for starting Channel 5, the interests of ordinary viewers were not given much consideration.

We now have digital terrestrial and digital satellite TV. Both these developments were in the pipeline when Channel 5 started. They show what an anachronism the terrestrial analogue Channel 5 transmissions are. In years to come it will seem incredible that a brand new analogue network was set up, at such cost, at the dawn of the digital era. Bill Wright, Wright's Aerials, Rotherham, S. Yorkshire.

Multimeter Batteries

Many older analogue multimeters use a small BLR154 15V battery to provide power on the higher-resistance ranges. These are still readily available from most wholesalers, but their cost (currently about £5) has increased so much recently that I was prompted to look for an economical alternative. The GPI, GP23A or Duracell MN21 caralarm transmitter battery has proved to be ideal. It has a similar capacity to the original, and can be bought for well under £1 if you shop around.

Its obvious shortcoming is the lower terminal voltage of just 12V. In practice however this seems to be of little consequence. All the meters I've come across have been able to achieve full-scale deflection with the zero-adjustment control not too far from its normal setting. Accuracy is not affected.

The size also differs: 28mm long by 10mm wide compared to the original battery's 35mm by 14mm. As far as I know there is no dedicated holder, but one designed for a 1.5V N cell fits rather well – very little adjustment is required. Alternatively, if modifying the meter sounds too much like hard work, careful bending of the battery holder terminals and a suitably-positioned lump of BluTac will often suffice. *Nicholas Arnold*,

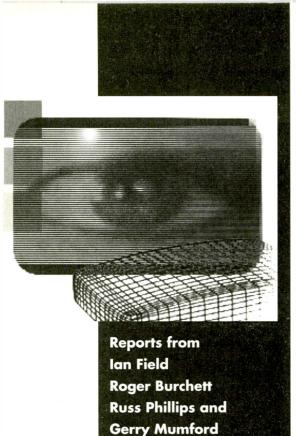
Nicholas Arnold, Rye, East Sussex.

Chip Availability

In the April Monitors section Ian Field mentioned that the TC4010BP chip is now difficult to obtain. It may be helpful to readers to know that the CD4010CN is still available from Farnell Electronic Components under order code 384 549. It should be OK. Farnell's sales number is 0113 263 6311, fax 0113 263 3411. Technical support is available on 0113 279 9123, fax 0113 279 4279.

I have found the company to be very helpful. It doesn't require a minimum order, and credit cards are welcome.

Ian Johnson, St. Albans, Herts.



Taxan MV789LR

Several of these monitors arrived as a batch with the instruction "get as many as possible going". At least half had a duff line output transformer. The remainder had a cracked main board or other fault. These monitors have a good specification and are worth repair if a LOPT can be obtained at a reasonable cost. If the root cause of its failure is not corrected however you can destroy the replacement LOPT.

The first and most important thing to check is that the value of R820 is correct (150k Ω , 1%) and that it is of the right type. You can find it by following the tracks from the 4N35 optocoupler I802 to the TL431 adjustable zener I803 and the set-HT control. One end goes to chassis via R824 (910 Ω). Follow the other track to R819 (12k Ω) with R820 alongside. Both rectifiers on the secondary side of the power supply should be checked.

If R820 is an ordinary 5% resistor, replace it anyway. Use a good-quality 1% resistor (four colour bands for the value code plus brown for 1%) rated at 0.5W or more. A 2% resistor can be used provided it is of high quality/stability and has been checked for accuracy.

Q808 (2SK526) always dies when R820 fails. It's a chopper-type device used for EW control. The input to it is about 210V, while the smoothing electrolytics on its output side are rated at 200V. So it's obvious that this FET should reduce the HT fed to the LOPT. It won't when it goes short-circuit!

Monitors

The 2SK526 has a drain-source voltage rating of 250V and a drain current rating of 10A. The drain-source resistance rating when on is 0.4Ω (0.6Ω maximum).

The 2SC4747 line output transistor Q403 rarely fails. But I found one that broke down at working voltage though it tested OK when cold. This gave the impression that the LOPT was faulty! Its failure hadn't damaged Q808, but this item should always be checked. I.F.

Fujitsu/ICL Value Plus 17"/ KDS KD1700V

This monitor came in with a blackened mains fuse. The auxiliary chopper power supply MOSFET was obviously not the original one, as at some time past its predecessor had vented soot on the side of an adjacent snubber resistor. There was evidence that dampness had been a problem, and I assume that someone had repaired the auxiliary power supply only to have the main power supply blow up next time power was applied. The main power supply chopper MOSFET Q801 had blown apart, removing most of the casing and the type number. Gate protection zener diode ZD801 (Z12C) had blown open-circuit, and R811 (22 Ω) had vapourised. In view of all this, IC801 (SG3824M) was added to the list of items to

The rebuilt power supply struggled for a few seconds, then blew up as before. This suggested that something else was wrong in the monitor and that the power supply current sensing was faulty as well. R805, part of the *RC* network connected to pin 3 (current sensing) of the 3824 chip, read almost exactly $24k\Omega$. But the third band looked more red than orange, indicating that it should have read $2\cdot4k\Omega$.

Once the power supply had been restored to working order I carried out some checks in the line output stage. Q414 (MJW16212) was short-circuit, so was the EHT PWM control transistor Q416 (2SK2341).

As it was not possible to identify

Q801 from its remains, several types were tried until one that ran at a reasonable temperature was found. Eventually a 2SK727 was left in circuit and given a full fiveday continuous soak test to make sure that it was up to the task. ZD801 was upgraded to 18V, as normally used in power supplies that employ a 2SK727. I.F.

Gateway 2000 CS1024 N12

Several of these monitors were brought in because they were dead. It's my opinion that this chassis is dangerous and is on the whole best avoided! The main weakness seems to be the resistors that sample the HT output from the chopper power supply for regulation purposes. Since an over-voltage condition had persisted for some time before the power supplies blew up completely, most of these monitors were writeoffs. The output from the power supply continues to rise until almost every power stage is damaged. I regularly leave monitors on overnight to soak test: I won't do so with any that use this chassis!

The worst case of overheating was due to a different cause however and was repairable – despite the fact that the pedestal had fused to the cabinet cover so badly that the two couldn't be separated! One lead of L101 (scan coupling or EW decoupling coil) had been dry-jointed to the large rectangular copper pad that forms the junction between C116 and C117 (both 0.33µF). There's an aperture in the PCB between these two capacitors: the amount of carbonised PCB that had to be removed left a new, larger aperture next to it.

With all the other monitors R325 and/or R335 (33·2k Ω , 1%, 3W) was either high-resistance or open-circuit, several of the electrolytics on the secondary side of the power supply had vented, and most of the recifiers had broken in two!

The TDA1170N frame timebase chip IC201 is probably the first power device to suffer, but because

its supply rectifier breaks in two the power supply continues to run amok until something else stops it. It's probably a matter of luck whether the chopper MOSFET fails before something gets well alight! **I.F.**

Elonex MN009/1

The complaint with this colour SVGA monitor was that it powered down after a while. I found that the cause was dry-joints at the 7808CT regulator chip IC7108, which is mounted on the rear metal bracket next to the VGA cable entry.

There are numerous versions of this chassis, many of which have separate PWM regulators for the scan and EHT. Most of these have a MOSFET approximately where the regulator is in this one: the dryjoints cause considerably more damage! **I.F.**

Dell Ultrascan P1428E

The ticket said "line on screen" but the symptoms looked nothing like this. The picture was collapsing in all directions, with the sides bowing in and up to 100 per cent loss of contrast. In fact the power supply regulation was erratic.

Inspection revealed that C631 ($100\mu F$, 200V) was slightly bulged. To be on the safe side the HT sensing resistors R627 ($1.5k\Omega$) and R628 ($100k\Omega$) were checked: they were OK. The small electrolytics in the power supply were then checked: C622 ($10\mu F$, 50V), C618 ($100\mu F$, 35V) and C651 ($10\mu F$, 50V) seemed to have some effect on the symptom when frozen. The problem was solved by replacing all these suspect capacitors. The cost is less than the time taken to check out each one individually.

This fault stirred memories of a similar case, where the symptom had been failure to start: the small electrolytics on the primary side of many 3842-based power supplies are suspect. **I.F.**

JD144

Another anonymous JD144! This one bore the Model name 29J44J and the model numbers JD144J and FCC ID:AMPJD144J. It was dead. The cabinet design was the same as the last one seen, but the chassis was quite different! The cause of the fault was the same however: the Nicholas 140M271 degaussing posistor had failed. Don't bother shaking it to see if it rattles – break it open and inspect the thermistor pellets.

The plastic pushbutton assembly used in some of these models seems

to be poorly moulded. If it's not too bad, a quick squirt with Electrolube DFL200D PTFE spray will cure the problem. Smoother action can be obtained by unclipping the pushbutton and applying Finish Line Teflon-fortified bicycle grease to the sliding surfaces. **I.F.**

Anbonn AM14S

This monochrome monitor had been taking an increasingly long time to start up. C100 (68 μ F, 25V) in the start-up supply to the chopper control chip had fallen in value. **R.B.**

Taxan EV410LR

Every one of these monitors I've come across has been fitted with a Samsung M34KUK35X13-K tube. All have suffered from low emission within eighteen months. Only one responded to tube rejuvenation. From my experiences of CTX monitors with Samsung tubes, the extra life probably won't be very long. R.B.

Peacock PM14P48LR

The usual cause when one of these comes in dead is that the $27k\Omega$ start-up resistor R603 has gone high in value or open-circuit. There are two series-connected resistors of the same value in the start-up circuit, the other one being R604. A word of warning: with this fault the mains bridge rectifier's reservoir capacitor will be fully charged. **R.B.**

Viglen 145

There was no EHT because of loss of line output transistor drive. The cause of the trouble was eventually traced to a dry-joint at R877 (0.22 Ω fusible) in the 9V supply. Although the joint looked sound, the resistor measured open-circuit when checked in circuit. When I removed the resistor to replace it I discovered that one leg had not been soldered. Once the resistor had been correctly soldered in place the monitor worked perfectly. **R.P.**

AOC CM335

If the HT voltage (85V) is set too high the picture width will be excessive with lack of height. For correct operation the HT should be set at no more than 90V. R.P.

KME 26510A32HX/H

Two of these monitors were brought in from a local mechanical engineering plant. They are industrial units that are used in the operator panel displays of large machinery. The first unit was dead, though the power supply appeared to be OK.

There was no HT supply at the line output stage however, because power choke L3 was open-circuit. In fact one leg had corroded off. Fortunately the choke is open-wound and has few turns, so repair was easy.

The second monitor powered up but arced badly. On inspection, sparks could be seen jumping across the burnt ends of R47 ($27k\Omega$, 3W) on the tube base PCB. The neighbouring MPSA93 transistor VT11 was short-circuit. These two components were replaced, but at power up the unit again arced, this time from the line output transformer (1242.0148). VT11 had once more died. After replacing these items we finally had a display. **G.M.**

XGA CK3148L

There was no blue in this monitor's display. A check on the CRT base panel showed that R531 (47 Ω , 0·125W) had burnt up. As a result, R553 (1k Ω , 5W fusible) had increased in value. Once these two resistors had been replaced there was a correctly coloured display. G.M.

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John Edwards' Casebook

Mitsubishi CT21M2TX (Euro 14 chassis)

When this set was switched on the standby LED glowed red. Then, when the standby button on the remote control unit was operated, the set came to life and the LED turned green. But the screen remained blank and there was no sound. This situation continued as I changed channels, except for the display of an occasional burst of snow. The EEPROM chip IC702 is not all that reliable so, after checking that the 5V supply was present at pin 8 and that there was data activity at pins 5 and 6, I fitted a replacement. But I couldn't figure out how to tune and store channels using the remote control unit. The only relevant button was the preset one: all the others were normal customer preference ones.

I phoned the customer to ask for the user's booklet. This never goes down well – it suggests that I don't know what I'm up to. The lady of the house said she hadn't seen it for years, but would ask her husband to phone when he got back from work to tell me how to work the set. That was too much. I told her not to bother, it wouldn't take me long to figure it out.

Well, I did figure it out — eventually. So if you want to know, this is it. Select the channel you want to tune in, then press the preset button (I got that straight away!). You will see the tuning display appear, coloured blue. The next step is to change its colour to yellow by pressing the channel down button. Then press the volume + or — button to start the search tuning. When it has stopped on a channel, press volume + until the channel you selected is displayed. Press the preset button to store it, then repeat for all the other channels you require. I don't know if my method is the same as that in the user's booklet, but it works.

I was not all that surprised when the husband phoned me that evening. Apparently his wife had suggested he got in touch. I was happy to tell him that the set was now OK. "Yeah, I guessed she'd got it wrong" he said, "after all, one tele's the same as any other."

I decided not to get involved in a discussion about the thousands of models and the numerous circuit arrangements and different control systems in use. I agreed with him and arranged a delivery time.

GoldStar GSEQ121

This centre-mount machine erased the previous sound track but wouldn't record over it. The E-E and recorded pictures were fine. I decided to carry out checks at the pins of the BA7790LS audio playback/record chip IC401. The 9V supply was present at pin 7, and audio from the IF strip was present at pin 18. But there was no output to the record head at pin 21. So either the chip

was faulty or it wasn't being told to record.

Pin 24 is used for record/playback switching. There should be 5V here in the record mode and 1V in playback. In fact 0.5V was present here whichever mode was selected. Thinking that the chip might be faulty, I disconnected pin 24. The voltage on the print leading to it remained at 0.5V. So the chip was permanently switched to playback.

The control voltage comes from pin 31 of a surface-mounted microcontroller chip. I decided to check the continuity between the two pins with my multimeter's buzzer facility: there was no response with one prod at the audio chip and the other at the microcontroller chip, but when the 'audio' prod was placed on the track about 2mm from pin 31 of the micro a buzz was heard. Although I couldn't see it, there was an open-circuit just short of this pin. I solved the problem by carefully soldering one end of a single strand of wire directly to the micro's pin and the other end to a good area of track, with a small piece of insulation tape beneath. After that there was continuity between the two pins and correct record/playback operation.

Compaq 491 (171FS)

This 17in. monitor was dead. There was HT at the drain of the chopper FET Q920, but no supply at pin 7 of the UC3842 chopper control chip. R902 (30k Ω) was open-circuit.

Matsui 1496R/T and 2096R/T

Here's a bit of information that could well be useful. The following situation can arise with these sets: the customer has entered a 'pass' code number and has forgotten it, or has accidentally entered a random code number. In either event the set will remain in the pass mode and won't allow access to some or all channels. The instruction book doesn't mention this.

To remove the pass code: (1) take the PCB out of the remote control unit and connect a tact switch between pins 4 and 17 of IC1; (2) switch on the set via the remote control unit and select the channel or channels that have a pass code number; (3) press the tact switch and hold it down for about a second. The 'pass channel' will clear and the picture will return.

To remove the pass mode permanently, press the tact switch again. The message "pass clear" will appear on the screen and the set will be back to normal operation. Return the remote control unit to its original condition and write out your invoice! My thanks to Dave at Charles Hyde for this one. I had a customer two days after he'd told me!

Answer to Test Case 440 - see page 681 -

Aren't these intermittent faults horrible? Especially when they result in component destruction, when they lie dormant for a long time then strike in an instant, and when they rear their evil heads after a new repair that's just been paid for. All three of these factors were present in this case – and at the end of it all there wasn't an extra bean by way of payment.

Considering the many possibilities, Television Ted felt that the most likely causes were: a flashover or other failure within the line output transformer; the same situation with some other component in the line output stage, such as the tuning capacitor C559; a sudden rise in the HT voltage because of a power supply fault; or a marked change in Q552's drive waveform (the driver transformer T551 faulty?) or its load conditions (maybe a rectifier or scan coil fault). He carefully chose the points to be monitored, using a couple of old dual-beam oscilloscopes for the purpose with a continuous watch and recording provided by means of a camera/recorder itg.

When the fault next occurred, the tape was rewound and the waveforms at the crucial moment were studied. The 112V supply had suddenly shot up, and with it the flyback voltage in the line output stage. The cause of the trouble was the STR54041 chopper chip IC901. It had perhaps lost its internal feedback, reference voltage or whatever.

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Digital TV receivers: the front end

Time to get to grips with the channel decoder section of a digital TV STB/IDTV receiver, whether for terrestrial off-air, satellite or cable reception. K.F. Ibrahim starts a new series that gives detailed insight.

Servicing the Aiwa HVFX1500 VCR

John Coombes provides servicing guidance on the deck and the electronics used in this model.

Test report: the Global Remote Eye

The Global Remote Eye can be used to insert control signals into a wired link between a Sky digibox and a TV set, giving two-way remote control operation.

The Super Audio CD format

George Cole explains the techniques used in this recent audio disc format, which was launched last May.

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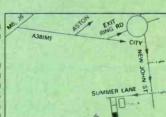
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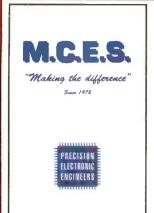


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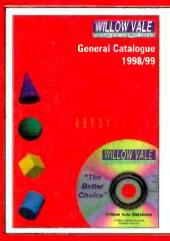
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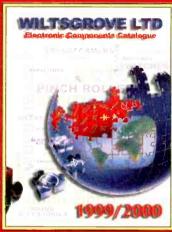
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