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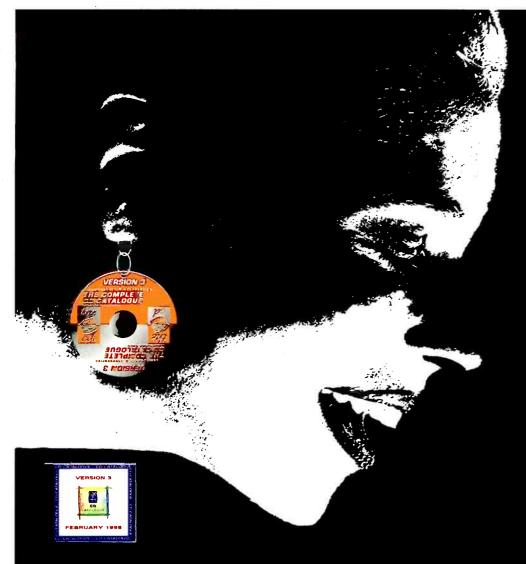
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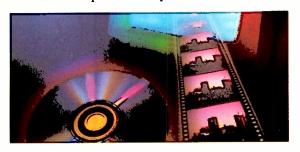
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Let battle commence

ne wonders which, if any, of the broadcasters will benefit from the start of digital services. The amount of viewing is unlikely to increase: most people watch as much TV as they want to already. Neither is the amount of advertising likely to increase very much. Will people be falling over each other to pay more for TV? Experience suggests that this is unlikely: people already complain about the cost of pay-TV, whether cable or satellite.

The present ITV channels will see diminishing revenues. Cable should do rather better, if more people can be persuaded to get connected and pay more: there are the additional and useful benefits of telecommunications and internet connection. This brings us to those who are really in the front line, BDB or ONdigital as we now have to call it, and Sky Digital.

ONdigital has presented a neat, well thought-out plan. It will offer viewers an easy to receive, affordable way of getting an increased choice of channels with better picture quality. Easy to receive since a conventional TV aerial can be used and you just need either a set-top decoder box, which will come at a subsidised price of about £200, or an integrated digital receiver-decoder. Affordable since the subscription cost will be less than £10 a month.

The aerial will present a problem for many prospective subscribers, since the channels in some areas do not correspond with the present groupings. In these areas wideband aerials will be required. These tend to be expensive, since wider bandwidth means more aerial elements. There is no suggestion that such aerials will be subsidised. It has been estimated that some £100m might have to be spent on new aerials. That said, in most areas the present aerial arrangements should suffice.

The only real disadvantage of Sky TV, apart from the cost, is the fact that a dish is required. Many people simply don't like dishes. This is strange, since there isn't nearly as much prejudice against conventional aerials, which can be just as obtrusive. And, as LNB performance has improved over the years, dishes have become smaller. In mesh form they are reasonably unobtrusive. The problem for Sky Digital is that its services will come from 28.2°E instead of 19.2°E. So you will either need to change the dish or install a second one.

Sky Digital was quick off the mark in dealing with this problem. Within a couple of days of ONdigital's public presentation of its service details and intentions, Sky Digital announced that it will provide and install digital dishes free of charge. New subscribers will pay an inclusive charge of about £200 for a subsidised set-top box and the installation of this and a dish. Existing subscribers will get the package for about £160. An effective answer to ONdigital's proposition.

The cost to Sky could be considerable. At £80-£100 per subscriber for the installation and dish, some £320m would be required simply to upgrade all current subscribers. This has, understandably, worried BSkyB's shareholders. But while the short-term costs will be high, the long-term looks a sound bet.

Things still look fairly even. Simply by installing a subsidised box, most viewers will be able to get digital TV from ONdigital. But there will be a maximum of thirty channels, including the present five, and the important movie and sports channels will be BSkyB ones. Enough channels, probably, but it doesn't look too generous compared with the 200 that satellite and cable intend to offer. ONdigital starts with the advantage that there are 18m households that use conventional receivers and appear to want neither cable nor satellite. But will they want ONdigital either? A lot of selling effort will be required, with no guarantee of success. Cable looks safer. It can simply expand on its present base. So who will be the winner? I have a feeling that Sky has done it once again.

In the short run there is going to be a lot of confusion amongst viewers. The huge amount of advertising promised by ONdigital and Sky Digital probably won't help the average viewer much. It is quite likely that viewers will simply put off their decisions about what, if anything, to do. This could mean a slow market at the start, with little benefit to setmakers and the retail trade. But if some 40m analogue receivers will have to be replaced eventually, someone is going to benefit. In the short run those subsidies will not help the retail trade, since there will be little if any profit mar-

If ONdigital were to fail because it was unable to sell enough subscriptions to become profitable - it will require two million subscribers to break even - where would this leave terrestrial TV in the long term? Would the analogue transmitters be switched off in the absence of a digital alternative? An interesting question.

COVER PRICE

We regret to announce that the cover price of Television will be £2.70 from our next issue, dated October. Increased production costs have made this necessary, but we will continue to make every effort to ensure that Television remains good value.

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Indexes for Vols. 38 to 47 are available at £3.50 each from SoftCopy Ltd., who can also supply an eight-year consolidated index on computer disc. For further details see page 826.

Binders that hold twelve issues of *Television* are available for £6.50 each from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques payable to "Television Binders".

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Digital TV: the Semiconductor Contribution

How developments in microprocessor technology have contributed to reduced set-top box cost with enhanced performance. Noel Hurley of ARM Ltd explains

ost is probably the main factor that determines the viability of a digital TV service. In particular, without reasonably priced set-top boxes the public wouldn't be interested. The semiconductor industry has, in this respect, made a major contribution – by designing chips that can carry out the signal processing required, then by integrating and shrinking them to produce small chip sets that cost a fraction of earlier multi-chip solutions. In so doing new opportunities for further cost reduction have arisen – by rethinking the hardware/software design mix used in the set-top box.

Shrinking the Chips

The semiconductor industry is ruled by the laws of geometry. Small changes is semiconductor geometry result in large changes in die area. The cost of the chip is thus reduced. Table 1 illustrates this, showing how the Advanced RISC Machines Ltd. (ARM) solution for a digital TV set-top box chip set has evolved and will continue to do so. Initially three chips were required for post-demodulation signal processing in the set-top box. They were produced using a 1μ semiconductor process. Theoretically it should be possible to shrink this vastly by using a single chip based on 0.18μ semiconductor fabrication. In so doing the silicon cost would be reduced to only three hundredths of the initial three-chip, 1μ solution.

Along with the die area reduction, the speed at which the chip operates is increased – a real win-win situation! This technology relies on the use of microprocessors

that are deeply embedded within VLSI chips rather than a stand-alone processor such as the Intel Pentium. Deeply embedded processors are smaller but not necessarily less powerful. The advantage is that they can be integrated with many other circuit requirements to create single-chip solutions.

By applying the geometric rules to embedded microprocessor technology, the performance level that could be achieved in the near future can be predicted with a degree of confidence.

The speed of the ARM ARM7TDMI processor has increased from 33MHz with 0.6μ fabrication to 77MHz with 0.35μ fabrication. The company predicts that 85MHz will be achieved with 0.25μ fabrication and over 90MHz with a further reduction to 0.18μ . This is achieved without making any change to the actual design of the chip (its 'architecture').

When design changes are made as well, the speed can be further increased. ARM has recently announced the ARM9 series of microprocessors, which can use the same software and make use of the same development tools as the current ARM7 series. Design improvements enable the ARM9 series to run at approximately twice the speed of an ARM7 device when the same type of fabrication is used. The first ARM9 devices, using 0.35µ fabrication, operate at 130MHz: with a move to 0.25 or 0.18µ, speeds in excess of 200MHz will be achieved.

Set-top Box Design

What can the set-top box designer do with this increased processing power? It could be used for product differentiation, for example to provide faster, whizzier graphics than other boxes or advanced search and display mechanisms for the electronic programme guide. The problem with doing only this is the customer's likely response to the value added to the product – will he pay more for the whizzier features? Probably not.

An alternative way of using the extra processing power is to reduce the cost of the box. The faster microprocessor can be used to replace other silicon hardware. ARM hopes to be able to replace the modem with a processor-run software routine. A V22 modem can be implemented by using a 14MHz ARM processor with software, a V34 or 56k modem by using a 50MHz ARM processor. This would enable the designer of a box to reduce its cost by removing the need for a modem chip.

Other areas that might lend themselves to microprocessor plus software implementation are the audio decoder

Table 1: Digital TV chip evolution.								
Fabrication, µ	1	0.6	0.5	0.35	0.25	0⋅18		
No. of chips	3	1	. 1	1	1	1		
Silicon area, mm²	200	72	50	24.5	12.5	6∙5		
ARM7TDMI, mm²	-	4.8	-	2.1	~1	~0.6		
Speed, MHz	-	33	40	~70	~85	?		
Volume production	1990	1992	1995	1998	1999	2001		
Relative cost	1	0.35	0.25	0.12	0.06	0.03		

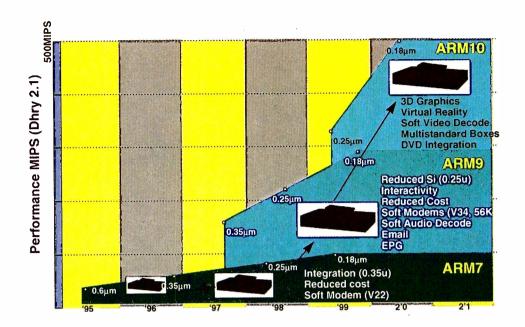


Fig. 1: ARM's digital settop box "roadmap".

and, eventually, the MPEG video decoder. Once this becomes possible, it will be far easier for a set-top box manufacturer to produce a design that can be sold worldwide, further reducing costs.

When ARM10 series processors in 0.18µ form become available, in about 2000, it should be possible to integrate other digital entertainment systems, such as DVD and home theatre, in the set-top box. At last there would be only one remote control!

Fig. 1 illustrates the way in which ARM sees the processor technology developing.

The Future

At some point in the future the ability of a company to produce ever more complex single-chip processing solutions will no longer be determined by semiconductor technology. Increasingly, the tools used and the management and technical abilities available in a company will set the limits.

In the past, semiconductor companies have had to increase the expertise of their designers as more and more technology has been incorporated on a single piece of silicon, whether the design has been based on hardware or software. It has also been necessary to increase the size of design teams. This has imposed extra demands on the skills of project managers – all this at a time when there has been much pressure to reduce design cycles.

This has given rise to a new type of company that can trade its expertise with semiconductor manufacturers. Companies such as ARM have been involved in the design and licensing of microprocessor technology since 1990. Thus semiconductor manufacturers can concentrate on developing their own expertise, outsourcing design in areas where they have limited know-how.

As ARM sees it, the computing capability of set-top boxes will continue to increase in the near future. Single-chip solutions will incorporate 200MHz processors before 2000, and 300-400MHz processors will be be used shortly afterwards. There will be a trend for hardware modules to be replaced by software routines run by these faster processors.

ARM Ltd. can be contacted on 01628 427 751, or you can visit the ARM web site at:

http://www.arm.com

Acknowledgement

The above article is an edited version of a paper presented at a Cable & Satellite '98 seminar by Noel Hurley, business development manager, digital entertainment, Advanced RISC Machines Ltd.



TELETOPICS

Interactive TV

The World Wide Web Consortium (W3C) has released specifications for a Synchronised Multimedia Integration Language (SMIL). Use of the standard will make it easier to develop TV-like content for the internet by synchronising images, text and animation.

The BBC is to join trials of Web TV's internet-based interactive TV system. Access to the internet is provided by British Telecom, while Pace Micro Technology is supplying WebTV set-top boxes. The BBC is to provide broadcasting facilities and will produce information to complement its programmes. This will be made available as pages on the internet. A technology called TV crossover links, with data transmitted during the vertical blanking interval, will provide a link between these pages and the programmes. Viewers will see an on-screen icon and, by using a remote control unit, will be

able to call up and display the relevant web pages. Although the trial will be nationwide, only some two hundred households will be involved. WebTV is owned by Microsoft.

Microsoft has already been carrying out trials in conjunction with BT and Pace, but these were linked to WebTV's US service. As a further development later this year, the BBC will supply material from its digital TV services.

ONdigital (previously BDB – see elsewhere) is to offer interactive services about six months after its autumn launch. These will include information services such as weather and travel, interactive advertising and programme-based TV information. Transactional interactive services such as home shopping will be introduced later, also possibly full internet

Cable and Wireless Communications (CWC) is to invest £13m in

the interactive TV company Two Way TV, giving it a 50·1 per cent stake. As part of the deal CWC will add Two Way TV's range of services to its forthcoming 200-channel digital cable TV package: it will also act as a distributor of Two Way TV services to other cable and DTT operators.

Two Way TV specialises in interactive entertainment, enabling viewers to compete in real-time during game shows and live sporting events, also to take part in TWTV's own channel, The Games Lounge. Viewers can compete against others in their own home or, via a cable or modem link, with others around the country. The service can be provided on a subscription basis, as part of a service package or be self-funded, with viewers 'buying' credits. TWTV has spent three years developing the system, and has already conducted extensive trials in the Midlands.



Thomson Multimedia has launched what it claims to be the thinnest, lightest wall-mounted TV, the Wysius. The flat display screen, which is 106cm diagonally, 9-6cm thick and weighs 42kg, uses plasma technology. A process developed by NEC, Capsulated Colours Filters, prevents phosphor imputities reducing picture sharpness. The suggested price is £11,500, or £13,500 as part of a complete home cinema system.

Satellite News

The Radio Regulations Board of the International Telecommunications Union has ruled against Eutelsat's claim to the 29°E orbital slot. Eutelsat had planned to use this position for its Europsat-1 craft, which could have interfered with the Astra 2A and 2B digital TV satellites at 28·2°E. The RRB said that Eutelsat had not made use of the 29°E slot originally allocated to it within the allotted time period. The Board has instructed the Radiocommunications Bureau no longer to take Europsat-1 into account when considering changes to the Broadcast Satellite Service Plan. Europsat is contesting the decision, which it claims does not comply with ITU regulations, via the French Administration. Astra 2A is due for almost imminent launch. Currently Astra 1D is being used for digital TV transmissions at 28·2°E.

The Nordic Satellite Company NSAB has leased its Sirius-3 satellite to SES (Astra) for up to twelve months. It will be sited at 28·2°E for use as a back-up for 2A. By October 1st 1999 it will be transferred to NASB's orbital slot at 5°E, where it will replace Sirius-1.

Power Saving

According to US government research, standby operation wastes at least eleven per cent of the power consumed by domestic electronic equipment such as TV sets, VCRs and PC monitors. VCRs are the worst offenders: almost ninety per cent of their power consumption is used in the standby mode, waiting for someone to issue a command.

To minimise the problem Philips Semiconductors has come up with a chopper power supply chip, called the GreenChip, that reduces the consumption of a piece of equipment in the standby mode from 5-10W to only 1-2W. A second GreenChip can reduce the power consumption to between 0·1-0·5W. The chips will be available with power ratings up to 200W.

VHS Formats

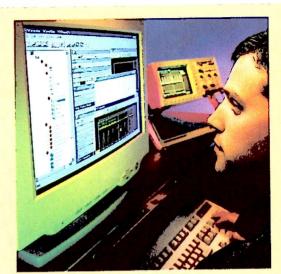
JVC has finalised the specification for its Data VHS (D-VHS) format, with technical advice from Hitachi, Matsushita and Philips. D-VHS uses a bit-stream system to record digital signals directly on tape, without compression, decompression or decoding. The basic technical format was standardised in April 1996. It includes three recording modes. A D-VHS recorder that conforms to the standard mode was launched in the States in December 1997.

The standard mode has a data input rate of 14·1Mbits/sec, giving up to seven hours' recording time with newly-developed DF420 tape. The tape speed is 16·67mm/sec. The high-speed mode (33·35mm/sec) has a data rate of 28·2Mbits/sec. It can be used for recording high-definition images (resolution up to 1,000 horizontal lines) or for multi-

channel recording. The low-speed mode has four selectable data rates: LS7 at 2Mbits/sec offers up to 49 hours of VHS-quality recording at a tape speed of 2.38mm/sec; LS5 at 2.8Mbits/sec offers 35 hours' recording time at a tape speed of 3.33mm/sec; LS3 at 4.7Mbits/sec offers 21 hours' recording time at a tape speed of 5.56mm/sec; while LS2 at 7Mbits/sec offers 14 hours' recording time at a tape speed of 8.34mm/sec. JVC points out that this range of options assures D-VHS compatibility with a wide range of future applications.

JVC, the French pay-TV company Canal Plus and a French technology company are working on the development of a D-VHS recorder with a built-in, DVB-compliant digital receiver. JVC's first European D-VHS model is expected to be

released next year.



For a short period, until December 31st 1998, Tektronix will be supplying with its TDS300 oscilloscope a connectivity interface option and WaveStar software at no extra cost. The WaveStar software is designed for use with the Windows 95/NT PC operating system. It provides easy control of scope functions and automatic data capture without the need for programming. The all-inone interface caters for popular peripherals. Tektronix UK Ltd can be reached on 1628 403 453 (fax 1628 403 458). The www site is http://www.tek.com

CAI '99 Trade Fair

The dates for the Confederation of Aerial Industries' 1999 Trade Fair have been announced: 15-17th June, at The Heathrow Park Hotel, Bath Road, Longford, West Drayton, Middx. For further information phone Ann Little on 0181 902 8998 (fax 0181 903 8719).

Digital TV

British Digital Broadcasting has adopted the name ONdigital for its terrestrial digital TV service, which is expected to start in November with fifteen channels initially, later to be expanded to about thirty. There's to be a £40m launch advertising campaign, with as much again invested in marketing and subsidies. The company has collaborated with major TV manufacturers in developing an open-standard for integrated digital TV sets (idTVs) - Sony, Hitachi, Panasonic and Philips plan to launch idTV models by the end of the year. There will also be set-top boxes for reception. The first idTVs are expected to retail at about £1,000, but sets costing £500-£600 should become available in mid-1999 as production levels increase. Pace, Sony Toshiba, Grundig, Nokia and Philips will be supplying STBs. ONdigital says its STBs will be able to receive all the BSkyB digital channels by early summer next year ONdigital and BSkyB are discussing a Simulcrypt agreement. The STBs won't be able to receive BSkyB's interactive services or Electronic Programme Guide however.

Some parts of the UK may not be able to receive all three ONdigital multiplexes (B, C and D). Those in areas where reception of multiplex D is reduced or not possible may pay less than those who can

receive all three. Information on programming and charges is expected next month

About 70 per cent of UK homes should be able to receive some sort of DTT service. Only about 55 per cent will be able to receive all the digital multiplexes however. In many areas a wideband aerial will be required to pull in extra signals. It's estimated that up to 3.5m homes will need to install a new aerial – the cost could amount to some £100m.

BSkyB's digital satellite TV launch in June was a low-key affair that received little public notice. This is not surprising, as there were no digital set-top boxes in the high-street stores and, during the initial period used to test the system, no advertising. Those who have managed to tune into the test transmissions report several problems, including poor picture quality and non-functioning electronic programme guides.

BSkyB has added more channels to its digital TV line-up. So far seventeen new channels have been added, following deals with Discovery, Flextech and UKTV, the joint venture between the BBC and Flextech. Flextech is providing four channels, UKTV six and Discovery seven. The latter's channels include Discovery Channel, Discovery Home and Leasure (these will have expanded hours), Animal Planet, a time-shifted version of Discovry

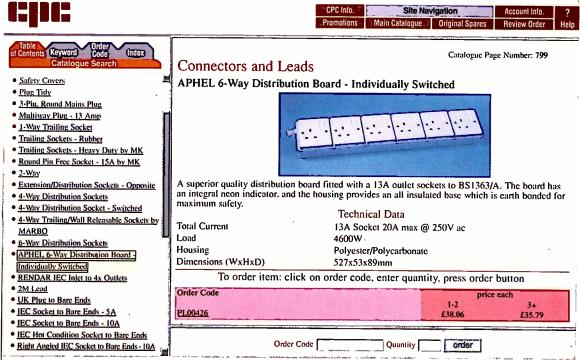
Channel and three special-interest channels under the Discovery Showcase banner.

According to a report by Continental Reasearch, by the year 2003 2-8m UK homes will be paying for digital terrestrial TV, there will be 2-6m digital cable TV subscribers and 2m digital satellite TV subscribers. In contrast the government's green paper on broadcasting and communications concludes that it is "very difficult to predict with accuracy the speed and direction of change". A refreshing bit of honesty.

The BBC spent £96m last year on developing digital TV services, including News 24 and the BBC Online web site. The Corporation plans to spend £200m a year over the next five years on digital broadcasting.

The Independent Television Commission has suggested that BSkyB could use the spare digital terrestrial TV channels allocated to Channel 5. Because of the investment cost, Channel 5 is unlikely to use two of the three DTT channels allocated to it.

Screen Subtitling Systems of Ipswich has launched a new range of DVB-compliant subtitling equipment designed for DTT services. DVB subtitling is transmitted in bitmap form rather than the code-based method used for conventional teletext subtitling.



CPC goes On-line

CPC's new on-line catalogue provides faster ordering and up-to-theminute information on product prices and availability

Specialist spares distributor CPC of Preston has launched a fully-integrated, searchable on-line electronic catalogue which provides details of over 60,000 main products and 900,000 original manufacturers' spares that are available from the company.

Features

Features of the system include online ordering and password-protected access to account details. This significantly reduces the paperwork required and speeds order processing. The information on product prices and availability, and the technical specifications, are kept up-todate as the system's server database is directly linked to CPC's central computer system.

The catalogue has been designed to ensure that customers can find a specific part or product quickly and easily, via several search methods. These include a comprehensive index, a key-word search and a CPC order code facility. Users can also identify original spares from leading manufacturers, including Aiwa, Amstrad, Grundig, Philips, Sony and Toshiba.

For ease of use the catalogue has clutter-free pages, high functionality levels and a full on-line help system. Access to the pages is from CPC's webb site, at

http://www.cpc.co.uk

which also provides company information and news announcements.

The on-line catalogue incorporates an index of equivalent related products, and cross-reference data. This enables a component or spare part to be identified from the make and model of the equipment concerned. If an item is not available, a suitable equivalent is suggested. Where the same item is available from a number of manufacturers, the user is offered a full choice.

Further features of the catalogue include technical graphics, access to special promotional offers, and a facility that enables account holders to check estimated delivery times for items on back order.

For security reasons account holders are issued with a unique password, which is sent by e-mail. Use of this password enables a customer to log on to the catalogue and then check his/her account details and status.

Non-account holders have access to the catalogue by logging on as a guest. To place an order, they have to set up an account and apply for a personalised password. The account application form can be obtained from CPC, filled in on-line or downloaded from the CPC internet site

As with the paper catalogue, all orders that arrive before 7 p.m. receive same-day despatch.

Technical queries can be dealt with by e-mail. This enables CPC's technical support team to provide a personalised and thorough response.

Operation

Chris Haworth, CPC's managing director, comments that "in view of the ever increasing number of world wide web users and the growing popularity of internet-based services, the on-line catalogue and its facilities are seen as a good opportunity for CPC to improve further its service to customers. There have been many electronic product growth predictions. It is CPC's intention to be at the forefront of this technology in the distribution industry."

The internet server system used by CPC consists of several high-performance Windows NT workstations that hold the catalogue database and have an elaborate security firewall. The server has a wide bandwidth connection to the internet and a permanent, real-time kilostream connection to CPC's IBM AS/400 computer. The data connection to the AS/400 is via a multifunction firewall, 100Mbits/sec ethernet technology: this supplies new prices and inventory informtaion to the internet server in real time.

Internet catalogue organisation and the addition of new products are carried out by CPC using a unique internet-based administration tool. The use of this software enables CPC to make both trivial

and complex changes to the internet catalogue's database in real time.

Conclusion

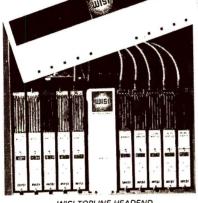
CPC has spent over a year reasearching and experimenting with this technology, with the aim of developing the most effective solution. The site is to be monitored, and what is discovered about users' habits and trends will be analysed to ensure that the catalogue continues to meet customers' needs.

CPC is one of the UK's leading specialist spares distributors to the consumer electronics, computer, education, industrial and office equipment markets. The company operates from a modern 80,000 sq ft distribution complex in Preston, Lancashire. Its full-colour catalogue, which lists details of more than 62,000 products in 2,124 pages, is mailed to almost 45,000 trade customers free of charge. There is a trade counter at the company's Preston location.

CPC can be reached by phone on 01772 654 455. The fax no. is 01772 654 466.

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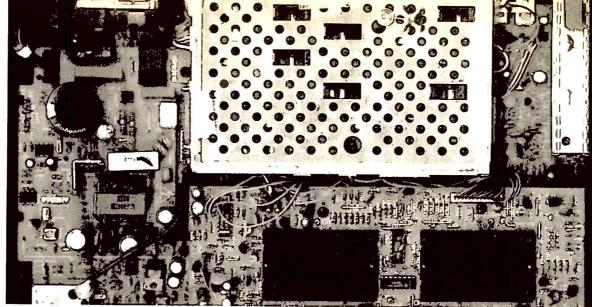


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Satellite Notebook

Grundig GIRD2000/Pace SS9000

There were no signals, just hiss on the sound and snow on the screen. It was not possible to check the tuning and LNB settings as the menus were broken up into lines. There was an LNB supply, but the satellite tuning voltage was stuck at 29V – measure it at the positive end of C134. The voltage didn't alter, as it should, when channels were changed.

Checks around the LM7001 tuning chip U20 showed that the reference signal from the tuner was missing. You can normally measure 1V peak-to-peak with a scope at pin 11, using a x10 probe. A new satellite tuner kit was required to update the original Hitachi type. **P.B.**

Pace MSS1000

Distorted sound was the complaint with this satellite receiver. The cause was C10 (100µF, 35V) in the power supply. It's the reservoir capacitor for the -21V line. The -8V supply used on the sound board is derived from the -21V line. C.J.G.

Grundig GRD150

The owner of this receiver complained that the local Band III signals that passed through the modulator were attenuated. He also wanted the modulator to be retuned to the local 5-5MHz intercarrier sound frequency (system B/G) instead of the UK 6MHz (system I). We don't see many of these receivers here, and those that we do see are usually connected via a scart lead. This one was used to feed several sets around the house however.

I found a modulator with the

same pin connections in a scrap Far Eastern receiver. It worked well, passing the Band III signals, and was already tuned to the 5.5MHz sound frequency.

Fortunately the Grundig receiver doesn't radiate much interference in Band III. Some VideoCrypt receivers produce a considerable amount of interference. The result is patterning on off-air signals. Normally the cure is to ensure that all coaxial connections are of good quality. Pay particular attention to the bonding of the braid to the body of the coaxial plugs on the lead to the TV set. H.C.

Pace DVR500

According to the customer his Dutch digital receiver produced a "flickering picture". When I visited the house I found that this was quite a good description. A basic black-and-white image was present, with flickering, displaced colours overlaid. It was the same on all channels. The receiver responded normally to menu commands.

The remedy was to disconnect the mains power for a minute then reconnect it. I told the customer to repeat this procedure if the fault recurred. So far it hasn't.

There were no obvious power point sparking problems. I wonder whether similar effects will be seen shortly with BSkyB digital receivers in the UK? H.C.

A Cable Problem

The owner of a Pace MSS100 receiver said that it was displaying the 'pink screen' LNB short-circuit warning, which had appeared suddenly in the middle of a programme. During the phone call I

was able to establish that the blue 'no signal' message appeared when the coaxial IF downlead was disconnected.

On the only previous occasion when I've come across the pink message with an MSS100 the fault was in the receiver itself. However there was no such message when I connected the receiver to a standard LNB via a short length of coaxial cable. Only the 'no signal' message was displayed: pressing the F then store buttons removed the message and produced a normal amount of snow on the screen. This almost disappeared when the LNB was disconnected. Time to head for the dish! When the LNB's output was disconnected at the roof end, and the old cable was reconnected to the receiver, the shortcircuit message returned. The coaxial cable run to the roof was thus the cause of the fault.

It went to the roof space via a plastic tube that was burried in the wall, with an exit point very close to the fireplace. Although it didn't seem to be a tight fit, no amount of pulling would remove the old cable from the tube. The householder had had some very hot fires during the winter months, so the cable and tube must have melted where it ran cose to the fireplace. The replacement cable run was installed well away from this area. H.C.

LNB Problems with Digital

A French digital receiver was being used for reception of the Canal Plus service via Astra. There was a problem with some channels. They would sometimes be all right, mainly in the evenings, but at other times they would appear "partly" –

Reports from

AMIIE(elec)

C.J. Guy and

Hugh Cocks

Philip Blundell,

as broken up square sections on the screen. This is the effect produced by a weak digital signal. It's something we're all going to become familiar with in the near future!

The receiver's installation signal strength indicator read between 4 and 5, i.e. nearly maximum. Consistent pictures can normally be seen on all channels even with a reading below 4. The branch of a tree in the garden possibly obscured part of the 1m dish. It had been trimmed back, but this hadn't cured the problem. The dish was correctly aligned.

I decided to have a look at the analogue signal output from the LNB. The cause of the problem was evident as soon as a receiver had been connected – there were lots of sparklies on all channels, right across the band.

The cure was similar to that with a problem I'd had a few weeks previously. Remove the Cambridge LNB's outer cover and tighten up the inner one. This produced clear analogue channels and consistent digital ones. On the digital receiver's display the signal

strength was a touch higher at just below maximum.

The effect is caused by feedback within the low-noise amplifier section of the LNB. If the cover is not tightened down well, intermittent 'howl round' (to use audio terminology) can occur. The problem partially cleared at night because the LNB's case would, with the colder air, have contracted slightly. H.C.

Pace PRD800 Decoding Problem

This receiver wouldn't decode VideoCrypt channels – reception of uncoded channels was OK. When you are presented with a fault of this type it's essential to find out what the VideoCrypt circuitry is doing. Connect test point TST2 to chassis – it's in the middle of the PCB, adjacent to U19. This will force all the video signals to pass via the VideoCrypt circuitry, whether encoded or not. The decoder circuitry is normally bypassed when the signal is clear.

When I did this there were whitewashed, over-contrasted pictures with unencoded signals. At this point I dug out the service manual. The power supply section is well thumbed, but the Video-Crypt section had hardly been touched!

The incoming video signal is DC coupled to pin 11 of the analogue-to-digital converter chip U20. It should sit at a DC level of 1V, which is critical. The voltage reading was about 3V however. So I replaced U20, and for good measure the zener diodes D43 (4.3V) and D44 (2.4V) which are connected to pins 12 and 7. VideoCrypt reception was now OK. The receiver was left on soak test for a long time with TST2 still shorted to chassis, so that even if there was no need for decoding the Video-Crypt section would still be in circuit. Everything continued to be work correctly

U20 normally runs quite warm, which may have contributed to its demise. With the fault present its temperature rose. I found, by experiment, that the chip overheats violently when D43 and D44 are not connected – even for a brief period! H.C.

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John Edwards'

Casebook

Grundig CUC3800 Chassis

The tripler had failed. In view of the set's size I decided to quote a price, obtain a replacement then return to fit it. Bad move. When I returned and fitted the tripler next day I found that there was EW bowing. R571 (4· Ω) had burnt out. Back to the workshop for the resistor and, just in case, a replacement EW chip (IC555). Two types are used in this chassis, depending on tube size. Guess which one I had in stock?! Later that day I returned and fitted the resistor, which smoked when I switched the set on. The customer was not impressed, and accused me of ruining the tube! Two days later I fitted the chip. The set and its owner then returned to normal behaviour. Home jobs are a hiding to nothing.

Sony KV1401U

The customer said that his set went bang when he switched it on. The mains fuse F601 was OK, and there was no short-circuit reading across the mains bridge rectifier's reservoir capacitor C604. When I switched the set on AC was present at the output from the mains filter coil but not at the input to the bridge rectifier.

Then I noticed a black burn mark across the print that led to the surge-limiter resistor R601. When I scraped this clean I saw that there was a thin crack across its width. I bridged the gap with a wire, then measured the resistance across the AC input to the bridge rectifier. A reading of just a few ohms was obtained. So I removed the degaussing posistor, which didn't rattle when I shook it. This cleared the short-circuit and the set worked when it was switched on. A new 180M type posistor completed the repair.

Samsung Cl6837AN (Z68 Chassis)

I hadn't seen this symptom before, but the cure was simple. The raster had five evenly-spaced diagonal flyback lines across the lower half of the picture. I decided to replace the TDA8350Q field/EW correction output chip IC301 before worrying about capacitors and voltage readings. Fortunately this cured the fault.

Olivetti CDU1448

The line output transistor (Q406) in this monitor was short-circuit, no doubt because of the dry-joints at every pin of the line output transformer. It had obviously been worked on before, as the transistor's heatsink had been modified. A hole had been drilled to suit a BU2508AF transistor and a mica kit. Not having the manual, I didn't know what the original transistor type was. So I fitted a new BU2508AF. It ran cool enough, and the monitor worked. So I'll have to wait and see.

To cover myself I told the customer what I'd found. He then told me that the set had been repaired by a local TV shop two months earlier. A further repair under guarantee had been refused on the grounds that the fault was a different one. I wish I knew the secret of how to avoid under-guarantee jobs! If anything goes wrong with something I've repaired they are back on the phone laying down the law. I've had demands to do a freeby on a set three years after the repair!

Goodmans 2875

This set appeared to be dead. But when the supply to the line output stage was disconnected and a bulb was used as a dummy load the power supply proved to be OK. Closer inspection led to the discovery of a crack around the case of C134 (0.01 μ F, 1.6kV) in the line output stage. To complete the repair, the short-circuit S2055AF line output transistor also had to be replaced.

Ferguson 36K2 (TX89 Chassis)

A slight tap anywhere would produce field collapse. When I removed the back I was in no way surprised. The PCB is so thin and flimsy that great care is required when sliding it out of the cabinet for inspection. Supported at only the edges, by the cabinet channel mouldings, it was bowed downwards at the middle. Numerous dry-joints were evident over the entire board. A thorough blanket resolder cured the trouble.

Mag DX15F Monitor

The customer complained that the colours were "all up the creek". He continued, with a superior tone of voice, "I know it's not the PC, because I've had it checked by two computer engineers — one even tried to charge me just to check it". I should have been warned, but I just wondered why he had gone to the bother — most people would get the monitor checked first, wouldn't they?

Anyway, after connecting it to my trusty old 286, which I use for basic tests such as this, I found that the symptom was actually no red in the display. When I tapped the top of the cabinet the red immediately returned. I was about to regret this move. "Charming" he pronounced, "call that a repair job?" I now decided that I didn't like this man and tapped the cabinet again, but a perfect, rock-steady picture remained. I knew that it wouldn't last, but it would be no good telling him.

So I breathed in deeply, looked him straight in the eye and, summoning up my most authoritative manner, declared "you've got two choices, sir: put a cross on the cabinet so you know where to tap it, or pay me thirty quid and leave here with a repaired monitor". He returned my gaze and I could sense that at this stage he didn't like me either. "What you got to do to it then?" he asked.

A voice in my head told me "tell him estimates are fif-

teen pounds". But, ignoring this, I said "resolder the tube base board". I knew immediately that I'd made the most basic mistake of all. "Right" he said, "I'll get some quotes and let you know." With that he picked up his monitor and departed, no doubt pleased with himself for having got a quotation, fault diagnosis and repair information free. I hope the other engineers on his list are not as stupid as me.

Toshiba V312 (R2000 Chassis)

The E-E picture would either drift off tune, blank out or appear overloaded, while the sound would either diminish in volume, become distorted or remain unaffected. When a different channel was selected the sound and picture would return to normal. If the original channel was selected again the fault symptom would be displayed. If the machine was switched off and left for an hour or so, then switched on again, the previously faulty channel would probably be OK and a different one would be affected.

Voltage readings and scope checks around the IF section while the fault was present and, for comparison, during normal operation (obtained by changing channel) suggested that it was OK. So it seemed logical to obtain and fit a replacement tuner/modulator block — until I discovered that the trade price with VAT is over £70! The customer might be persuaded to spend that much, but it wouldn't leave anything for my trouble — and what if my diagnosis was wrong? MCES couldn't, on this occasion, help.

I discussed the matter with the customer, who confirmed that a repair approaching £100 was out of the question. We then agreed that I would dismantle the unit and hopefully repair it. If I wasn't successful, a token payment of £20 would be made to go towards the cost of my time etc. I hoped to spot a dry-joint or something obvious

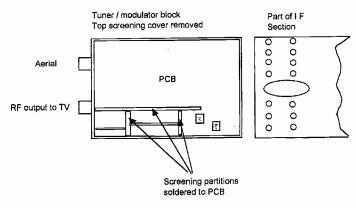
I removed the module's screening cover, swung my powerful illuminated magnifying glass into position, powered up and began my inspection. While checking I discovered that the fault symptom would immediately appear when the screening walls within the module (see Fig. 1) were gently tapped with the handle of a screwdriver. The solder that bonds the screening to the PCB looked a little crusty, so I unplugged the machine and resoldered all the metal-to-PCB connections. After that the picture remained stable during further tapping tests – and I was able to charge a little over £20.

The repair was carried out several months ago and I've heard nothing since. So presumably everything is OK – though it's possible that the customer, knowing the cost of the module, wouldn't bother had the problem returned.

The chassis is used in many Toshiba and Ferguson models, and apparently the drum assembly is supplied only complete, with the lower section, at a cost of some £140. So beware if you make an estimate when there are drum or tuner problems. Incidentally another item that costs far more than it should is the small, plastic capstan pulley in Mitsubishi and JVC machines. It splits and costs about £8 to buy, though I doubt whether it costs more than 10p to produce.

Ferguson 3V42

This machine arrived in the workshop for a routine job – renewal of the broken carriage assembly. It was quickly completed. The monitor was then connected, a tape was inserted and play was selected. My heart sank when I watched the displayed picture, which was nothing short of a mess. There were two very wide horizontal



dark bands that resembled hum bars: in between the bars there was a colourless, spotty picture without a straight vertical line anywhere. The picture was so ragged I had to look at the tape's label to find out what I was supposed to be watching.

"Don't panic" I told myself, "go for the power supply." As the E-E display was normal, a scope check on the playback switched 6V rail, at test point TP2 on the regulator board, seemed to be a good idea. I found a 2V squarewave riding on 4V DC. The likely culprit was the reservoir capacitor C23 (2,200µF, 16V), which measured open-circuit. When it had been replaced I had normal playback. Naturally as far as the customer was concerned everything was OK before the carriage broke!

Grundig CUC4400 Chassis

The fault description was interesting. "There was a twangy sound, then a rattle. The set went off then came back on, with a normal picture but no sound." When I'd removed the back cover I realised that this was quite a good description. A large spring sat alongside the TDA7245 audio output chip. Its job is to hold the tube's Aquadag earthing wire tight against the body of the tube. Fortunately, although suspended away from the tube, the bare wire hadn't fallen on to the PCB below.

I refitted the spring to the cabinet moulding at the top of the tube and hooked the wire on to its end, securing it tightly with pliers to ensure that we didn't get a repeat performance.

I suspected audio IC failure, but there were no voltages at any of its pins. So a supply rail problem was more likely. As I didn't have the circuit diagram, I reached for my copy of Television IC Data Files. This told me that pin 3 is the basic supply point. Armed with this information, I turned the board upside down and followed the print from pin 3. This brought me to R376 (8.2Ω) , which had a dark burn ring around its body. It's in series with rectifier diode D671, which is connected to pin 8 of the line output transformer. Once R376 had been replaced the sound chip had its 16V supply and everything was back to normal.

Sharp C3720H (14A Chassis)

At switch on the red standby light appeared, turned green briefly then returned to red again. The set produced no other sign of life. Checks showed that there was 122V at the collector of the line output transistor Q602 but no line drive – obviously, because the set was in the standby mode. A fault in the field timebase would produce standby operation, so this seemed a good place to start. Sure enough the 3-9 Ω fusible resistor R521 in the output stage's 24V supply was open-circuit. There was no short-circuit from the cathode of the rectifier diode D502 to chassis, so a replacement resistor was fitted. This cured the fault.

Fig. 1: Screening partitions within the tuner/modulator module in the Toshiba Model V312 (R2000 chassis).

Earlier this year Panasonic and Technics held a series of technical seminars in Italy. They covered a number of video and audio developments, including DVD, digital video and TV technology.

George Cole was there to report



Panasonic and Technics Latest Technology

anasonic's seminars were held at Stressa in Northern Italy, the first covering developments in TV technology. Panasonic has 27 TV factories worldwide, two in Europe (South Wales and the Czech Republic). Quintrix picture tubes are made in Germany. Each year Panasonic sells around ten million TV sets worldwide, with Europe accounting for 15 per cent. Panasonic has five per cent of the European market, and hopes to increase this to ten per cent by the year 2000.

Tube Technology

Panasonic has introduced several improvements to its Quintrix tubes, including the use of Super Pigment Technology. This involves adding middle gold pigment to the green phosphor. According to Panasonic this enhances the green colour reproduction. Use of a slightly tinted front glass reduces the ambient light reflection,

SVM Coll

Current SVM Coll

New SVM Coll

achieved. The contrast level improvement is, in comparison with previous tubes, 15 per cent.

A new configuration results in an oval electronic lens whose calibre is 1.7 times larger than that of a conven-

enabling higher brightness and contrast levels to be

whose calibre is 1.7 times larger than that of a conventional lens system. This gives better edge focusing and sharper centre focusing. A new scan-velocity modulation coil varies the horizontal deflection field, again to improve the picture sharpness. The new coil has been integrated with the deflection yoke (see Fig. 1), giving more precise control of the horizontal deflection field.

With a wider and flatter screen the electron beams suffer much distortion as they pass through the deflection fields. This effect can be reduced by making the vertical diameter of the electron beams smaller. A quadruple lens system and a new, rectangular control grid are used for this purpose. The reduced spot size gives a 20 per cent increase in sharpness compared with previous tube technology.

The comma-free yoke has special comma correctors to compensate for the barrel-shaped magnetic field. As a result the RGB spots are more precise.

Finally a new shadowmask has greater curvature, deflecting much of the electron beam energy.

Q-Link

Panasonic has developed Q-link, which is a communication protocol between a TV set and a VCR using a scart connection. It enables data to be downloaded from the TV set to the VCR. Its key features include a WYSI-WYR (What You See Is What You Record) feature. When the VCR handset's record button is pressed the VCR changes to the channel being watched and record-

scan-velocity modulation coil is integrated with the deflection yoke.

Fig. 1: In the latest Quintrex tubes the

ing begins.

TV Auto Power On makes the TV set switch on from standby when the VCR begins to play. VCR Auto Standby switches the VCR to standby when the TV set is switched to standby – fortunately this feature doesn't work when the VCR is playing, recording or in the timer record mode!

These features sound similar to those offered by the NexTView standard and Sony's new Smart Engine technology. I asked Panasonic whether these systems are compatible. Sadly they aren't – I'll return to the subject of standards when we come to VCR Tape Library systems.

Widescreen Digital Plus

Panasonic's New Wide Digital Plus system offers a number of features. These include extended picture noise reduction, which uses both temporal and spatial processing to produce a 3-D noise system that's claimed to be better than frame-based only noise-reduction systems. The 3-D system is said to be very effective when the picture information contains a large amount of movement. The system also improves 100Hz reproduction, which can suffer from colour smearing – known as the "dirty window effect".

One of the first models to feature much of this new technology is the TX-W32D5DP, a 32in. 16:9 aspect ratio set with 100Hz signal processing and Dolby ProLogic sound. It's fitted with the new Euro-5L chassis, which has a lower component count than the Euro-3H.

Digital TV and other Future Developments

Panasonic is involved in digital broadcasting, and Nigel Thomas from Panasonic's Welsh factory demonstrated a prototype terrestrial digital TV receiver (it was not to the same specification as BDB's digital decoder). The receiver has two PC card slots (previously known as PCMCIA) that could be used for common interface modules.

Asked about the use of a 'side-car' for the reception of satellite digital TV programming, Nigel Thomas said that although it was feasible the side car would be at least a quarter of the size of a set-top box, would probably require its own power supply and would thus be expensive.

Panasonic also showed a 42in. plasma flat-screen TV set, a large projection screen set, a prototype TV set with a built-in DVD drive and a 28in. widescreen TV set that incorporates internet capability. According to Panasonic it is too early to launch the latter, while the other sets are currently expensive to manufacture.

Panasonic was asked why none of its new sets offered progressive scan (as opposed to interlaced) technology or Dolby Digital surround sound. There were strong hints that these features would appear in next year's TV range.

Digital Video Technology

If you thought that the limits camcorder compactness had been reached you were wrong. Panasonic unveiled the NV-DS77, said to be the world's smallest digital camcorder. It weighs just 590g without battery and tape, 50g less than its predecessor the NV-DS5. The NV-DS77 has an overall volume of just 620 cubic centimetres, despite incorporating a 3-8in. LCD monitor.

Size reduction has been made possible by high-density packing – the space between many of the 1,700 components is just 0.3mm – and a new eight-layer PCB, also a new super-compact mechanism that's just 59mm in

length (compared with the NV-DS5's 80mm). The upper part of the drum has been cut to reduce its height. The cassette almost touches the drum when inserted.

The NV-DS77 includes variable-speed search, edit effects such as digital wipe and mix (which can be added after the recording), and a 10x optical zoom. An optional PC kit enables images to be downloaded to a computer for manipulation and editing. The NV-DS77 will be launched this autumn – no price details are available so far.

Panasonic is also to launch its first digital VCR, Model NV-DV10000. Its features include a wireless editing controller, LP recording (up to three hours with a 120-minute cassette) and a built-in TV tuner.

The DVC format has been given a boost by the development of longer-running cassettes. There are two new DVC tapes, a 180-minute full-size cassette for DVC recorders and a two-hour mini DV tape for camcorders.

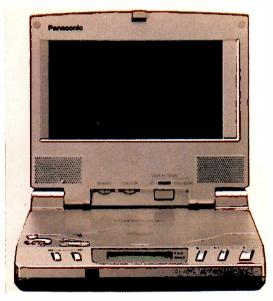
The DVC format relies on metal-evaporated (ME) tape, which is tricky and expensive to make. The new, thinner tape is 5.5 microns thick. It uses a new type of base, a poly-ethylene-naphthalate (PEN) film that's just 4.8 microns thick.

ME tape is produced in a vacuum chamber. The base film is held on a large spool that feeds a second, collection spool. Its magnetic layer consists of column-shaped cobalt crystals. The cobalt is placed in a crucible and heated to 2,000°C by a laser beam. As a result the cobalt vapourises and is deposited on the base tape that runs past it. The film then moves around a cooling drum to protect it from excessive heat. The 0.2 microns thick cobalt layer is covered by a protective diamond-like carbon layer and a fluorine-type lubricant. Panasonic calls this process Tribology Technology.

VHS Developments

The world may be moving towards digital technology but there's still a lot of life in the VHS format. Panasonic's new Model NV-HD680 incorporates some interesting technology. First, it can record teletext data on the tape during the vertical blanking interval. Furthermore subtitle captions can be switched on or off at will – with older teletext-recording VCRs subtitles are 'burnt' into the picture.

The NV-HD680 has a Tape Library system to help the user find programmes on tape. It can store programme data for up to 200 cassettes (an average of three entries



The Panasonic DVD-L10 portable DVD player which has a 5.8in. LCD screen, virtual surround sound and built-in Dolby Digital/ MPEG-2 decoders.



The Panasonic DVD-A350 is equipped with a 5.1-channel surround sound decoder for both Dolby Digital and MPEG-2 sound.

per tape). The system assigns a unique ID number to each tape, and automatically stores the data in a SRAM chip within the machine, including programme title, name of broadcaster or channel number, recording time and date, whether any subtitles are recorded and on which tape the programme can be found. The data is collected from the teletext service. Some programme titles are not broadcast, but the user can add a title (of up to 22 characters) using an on-screen menu and the remote control handset.

The user can call up his tape contents on the TV set's screen and scroll through the information pages to find the required programme and tape. When a tape has been inserted, the VCR can be instructed to find the programme from the on-screen menu. The VHS Index Search System (VISS) is used to go to the programme.

The VCR also downloads all the Tape Library data on to the last-used tape, so that if the SRAM chip is damaged the data can still be recovered.

The Tape Library system is very impressive, but there are several competing formats. Sony for example has SmartFile, which stores programme data on a super-thin memory chip that fits inside the cassette label. Hitachi's tape library system is almost identical to Panasonic's, but the two are not compatible. This means that when a user switches VCR brands or exchanges tapes with friends or relatives the benefits of the tape library system are lost.

Prior to the arrival of the VISS format in 1987 there were several incompatible tape index systems. With the introduction of the VISS standard any VISS-encoded tape can be used with any VISS-equipped VCR.

It would be nice if JVC, which handles VHS licensing,

could bring some order into the chaotic tape library market.

DVD Video

Panasonic launched its first DVD Video player in Japan in November 1996, its first US player in the following spring and its first European player last February. At the end of April this year there were 1,435 DVD Video titles in the USA (76 per cent of them films) and 901 titles in Japan (298 films, 187 Karaoke and other titles such as music). Matsushita, Panasonic's parent company, is one of the largest DVD disc manufacturers in the world. It has two plants. The one in Japan produces 600,000 discs a month while the one in California increased its production rate to 2m a month this summer. At the time of writing Matsushita is the only company capable of producing dual-layer DVD discs – which is why they are so scarce.

There are at present four Panasonic DVD players on the market, two table-top models (DVD-A350 and DVD-A150) and two portables (DVD-L10 and DVD-P10). They can all play audio CDs, Video CDs and offer NTSC playback with PAL TV sets. The DVD-A350 incorporates a Dolby Digital/MPEG-2 audio decoder. The DVD-L10 weighs just 910g and has a built-in 5.8in. TFT active-matrix LCD screen in 16:9 format

The DVD-P10 uses a second-generation LSI chip set and a new optical pickup. These are crammed into a 160mm square chassis. There is no LCD screen: it has composite video and S video outputs for connection to a TV set. Panasonic says that thanks to developments in LSI chip technology we can expect even smaller DVD portables.

Fig. 2 shows in block diagram form the first-generation LSI DVD chip arrangement, Fig. 3 the second-generation one. Panasonic is developing a third-generation "super one-chip" arrangement that should be available in 2000: everything except for the pickup preamplifier and driver, the audio DAC and the front panel processor and display/key system will be in one "super chip".

An interesting point is that the regional coding system, which prevents discs intended for one DVD region being used in another one, is not imbedded in the chip set. It will be in the form of software and firmware.

Technics - DVD Audio

The DVD family of discs includes audio, video and

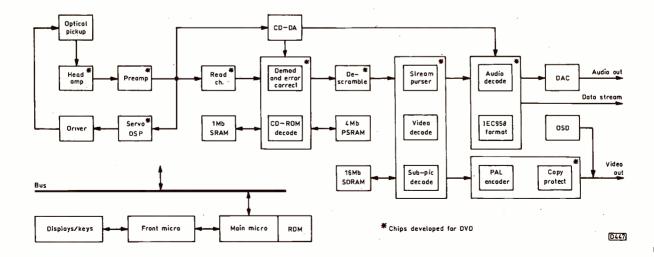
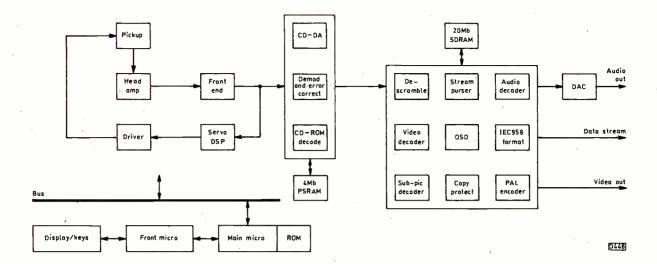


Fig. 2: First-generation DVD player chip arrangement.



linear PCM audio (usually 96kHz/20-bit or 96kHz/24recordable ones. The full specification consists of five bit). The latter is part of the DVD Video standard, not the DVD Audio standard, which is much broader. WG4 includes 39 companies from the consumer electronics and computer industries - Matsushita, Hitachi, Sony, Philips, Intel and IBM are all members. It has held thirty meetings, and version 1.0 of the DVD Audio standard should, according to Technics, be completed by the end of September.

The basic DVD Audio specification provides a range of sampling rates, from 44-1 to 192kHz, with 16- to 24bit samples, the 'standard' specification being 96kHz/24 bits. The audio can be mono, stereo or six-channel. DVD Audio discs are of the same size and thickness as CD discs (12cm in diameter, 1.2mm thick), and only one side is used. An optional dual-layer format, which could be used for a CD audio layer or additional playing time, is available. Multimedia material, such as still pictures, video and text, can be added, with display on a TV set of PC monitor.

DVD Audio discs will play on new DVD Audio decks and a new generation of so-called Universal Players that will play DVD Video and DVD Audio discs. If a DVD Audio disc contains a video clip, this could be played on a DVD Video machine.

The first DVD Audio players and discs are expected to be released in Japan next spring, but there's a fly in the ointment. Sony and Philips have developed another "Super CD" called Super Audio CD (SACD). It offers similar features to DVD Audio but is not compatible (though the audio coding method adopted by SACD could become an optional part of the DVD Audio specification). SADC is due for release in Japan early next year. One can only hope that the two parties will collaborate to produce a single standard.

books, A for read-only discs, B for video discs, C for audio discs, D for write-once discs and E for rewritable discs. Each book is in three parts, physical, file system and application. The file system used is UDF, which stands for Universal Disc Format. This is a common-file format for all applications, including audio and video. Thus the same file format can be used for different types of DVDs, making it easier to record discs and achieve compatibility. In comparison the CD format uses different file formats for each type of disc - for example CD-ROM uses the ISO 9660 standard. Technics, whose seminars were held in Genoa, devoted much time to the DVD Audio format.

Why do we need another audio format? The CD audio format launched in late 1982 samples an analogue input at a rate of 44·1kHz, producing 16-bit samples. It's far superior to an analogue LP in terms of frequency response, dynamic range, signal-to-noise ratio, harmonic distortion and other factors. But the CD specification was limited by the digital technology then available. It's now possible to have an audio format with a much improved specification.

This is not the only reason however. Although the CD format has been one of the most successful consumer products ever (around 600m CD players and over 10bn discs have been sold), sales are flattening out and the margins on mass-market CD hardware are thin. So enter super CD, which will provide better sound and additional features.

In the mid-Nineties several music industry organisations formed the International Standards Committee (ISC) which drew up a "wish list" of features that should be provided by any new audio format. They included sound quality, multi-channel sound, copyright protection, disc size and packaging. The ISC wanted compatibility with existing CD players and discs, in other words the new discs should also be playable by today's CD decks. This latter feature has proved to be problematical however, and the DVD Audio standard makes it optional rather than mandatory. Incidentally the music industry is not interested in a Regional Coding system that prevents discs being bought and used anywhere.

The DVD Audio Standard

The DVD Forum set up Working Group 4 (WG4) to develop a DVD Audio standard. Current DVD Video players use Dolby Digital and/or MPEG-2 5.1 audio and

Solid-state Audio

Looking farther ahead Technics showed us a solid-state audio player that can record up to ten minutes of MPEG audio on a 10Mbyte SRAM card. But from a practical point of view Technics says that a capacity of 100Mbytes is required. Even with the falling price of memory chips, Technics doesn't expect its microchip player to reach the market until well into the next centurv.

Acknowledgement

My thanks to the various Matsushita groups for their help with this feature.

Fig. 3: Secondgeneration DVD player chip arrangement.



Robert Blair describes faultfinding procedures and repair techniques for microwave ovens, the aim being costeffective servicing

Microwave Servicing: Hints and Tips

everal articles on microwave oven servicing have appeared in *Television* recently. So it's likely that many readers will be thinking about adding microwave ovens to the range of products they service. The purpose of this article is to help you get started. It's based on my own repair experience over several years. The main theme is time- and money-saving tips that will help you make the work cost-effective.

Health Warning!

Before you carry out any work on the internal circuitry of a microwave oven, ensure that the unit is disconnected from the mains supply and that the high-voltage capacitor has been discharged. With respect to capacitor discharging, the procedure recommended by Panasonic is as follows: wait for thirty seconds after switching the oven off, then use an insulated jumper lead to short the diode lead connector to earth. Hitachi advises that you wait for two minutes before attempting to discharge the capacitor.

A microwave oven's outer covers can be difficult to remove. To prevent injury from the sharp metal edges, always wear a pair of stout industrial gloves. They will also provide protection against the grease that can accumulate in a heavily-used oven.

Fuse Blowing

A blown internal fuse is one of the most common faults encountered. The fuse may be rated at anything from 5A to 13A. Causes of failure are many and varied, but it is usually a fairly straightforward task, with a little logical diagnosis, to decide where the cause of the trouble lies. Don't replace the fuse without making some checks – it

will invariably blow again immediately. There is always a cause for the failure, though it may not be immediately apparent.

The first item to check is the oven lamp. If this blows, it frequently takes the internal fuse with it, in which case the customer will usually say that there was a loud crack before the oven went dead. Unfortunately this fault can sometimes result in damage to components on the digital control panel.

Once you have ascertained that all is well in this department, take a look at the high-voltage rectifier. It's best to check this with one end disconnected. If you use a digital meter with a range of $2M\Omega$ or less, the diode will normally appear to be open-circuit. Using the high range of an analogue meter you will get a diode reading. If it reads the same both ways, replace it.

Some ovens have two diodes, one of which is a back-to-back protection device that's connected in parallel with the high-voltage capacitor. Check this diode as well – you will frequently find that it's short-circuit.

Next move to the high-voltage capacitor. Disconnect all leads from the two sets of terminals. When a test meter's leads are connected to the capacitor's terminals you should see a momentary kick, after which the meter should read infinity. There should be no reading between the terminals and the outer casing, except possibly where an internal diode is used – you occasionally come across a capacitor with an integral diode: if either the capacitor or the diode is faulty, the whole thing has to be replaced.

If the above checks have failed to reveal anything amiss, take a look at the magnetron. A meter connected across its terminals should produce a reading of approximately 0.4Ω . There should be no reading between the terminals and the magnetron's casing. If there is, fit a replacement. In a few models the high-voltage transformer may have to be removed to enable this to be done. Do not neglect to replace all the surrounding bits and pieces, however insignificant they may appear to be.

If all is well with the magnetron, move on to the highvoltage transformer. When this item is faulty you will often find that the windings have a burnt appearance and there's a pungent smell. Again replace it if faulty.

The door and monitor interlock switches can become faulty, the result being a blown fuse. It is recommended that they are both replaced should either of them fail. When you check these switches, remove the spade connectors from the terminals to avoid misleading results.

Repeated Fuse Blowing

More than one component can fail. The result will be repeated fuse blowing, which can be costly. To avoid this, you can use the simple but extremely useful arrangement shown in Fig. 1. It will indicate the presence of a short-circuit switch or other device without the risk of destroying your replacement fuse. In the interests of neatness and safety, use a small case to house the circuit, with a window for viewing the bulb.

Connect the unit to the mains supply then plug the oven into its 13A mains socket. Switch on. If there's no short-circuit present the bulb will glow dully. It will glow at full power if there's a short-circuit. Whatever the result, the new fuse will remain intact. With an oven that has a mechanical timer, select the 'cook' mode. If all is well the bulb will glow with moderate brightness. If there's a fault in the high-voltage section the bulb will glow fully. Unfortunately it is usually not possible to carry out this last test with a digital touch-pad oven.

Random Fuse Blowing

One of the most irritating problems is random destruction of the internal fuse. In my experience the two major causes of this are faulty door switches and, particularly with Sharp ovens, a damaged waveguide cover. The cover will usually be discoloured and show signs of having been burnt. The magnetron probe may also be damaged. Replacement is the only remedy.

Instead of buying individual waveguide covers you may find it more cost-effective to purchase roof-lining material in sheets. New covers can be cut out quite easily using a pair of good scissors, with the old cover as a template

When fitting a new waveguide cover it's frequently easier to turn the oven upside-down or on to its end. This way you have the help of gravity when replacing the screws. Before fitting the cover, ensure that the waveguide port is free of debris.

Heating Problems

It can sometimes be difficult to determine just where the fault lies when the complaint is that the oven works in every respect except that it doesn't heat up. This is where a Voltstick, available from B&Q stores for about £10, can be handy. It will glow when placed within two-three inches of the magnetron's leads. This proves that the high-voltage section of the oven works. If this section is OK but the oven doesn't heat, the cause is usually poor contacts at the terminals of the magnetron or the high-voltage capacitor. Discharge the capacitor before attempting to clean any of these contacts.

Use a fibre pen or fine file, and tighten the connectors if necessary. Check that there's no corrosion, causing

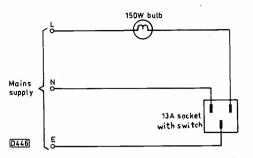


Fig. 1: Simple ovenfuse protector arrangement. Build it in a case with a window to view the bulb

poor contact, in the connection between the wire and the spade terminal. If the oven still fails to heat, suspect the magnetron or a leaky high-voltage diode or capacitor, particularly if loud buzzing accompanies the fault.

Some manufacturers fit an in-line fuse between the capacitor and the magnetron. Failure of this fuse generally means that the magnetron is faulty.

If the Voltstick fails to glow in the vicinity of the magnetron, start looking for a problem in the AC supply to the transformer, including relays and thermal cutouts, or possibly the transformer itself.

Partial Cooking

Occasionally the complaint with an oven is that it cooks the food only in parts. This can be extremely hazardous from the food poisoning point of view of course. The cause of the problem is failure of the turntable or the distribution fan to rotate. The fan is normally located in the roof of the cavity, behind the waveguide cover. In a few models it's under the cavity floor. It may be belt driven or activated by air pressure from the cooling fan.

If the oven uses a turntable, check for wear on the drive shaft that sits on top of the motor spindle. If this is OK, the motor may have seized. With a fan, the drive belt may have snapped or be slipping. A fan can also foul the waveguide cover, preventing rotation.

Faulty Grill

The grill element can fail in an oven that has this facility. Before you go ahead with the repair it's advisable to contact the customer: replacement elements can be quite expensive.

Control Panel Repairs

As there are few stock faults with digitally-operated control panels, repairs down to component level can be very time consuming. In such cases it may be more expedient to use the services of a company, such as QER (address below), that specialises in trade panel repairs.

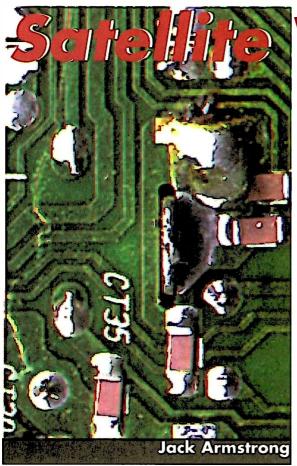
In Conclusion

Most microwave oven repairs are fairly straightforward and, with the exception of some control panel faults, can be carried out in a cost-effective manner. As ovens are being sold at ever-lower prices however, it is advisable to charge a non-returnable 'investigation fee' (deductible from the cost of the repair when completed) in order to cover lost time should the customer decide that the repair is not worthwhile.

Useful Addresses

AWI Ltd., 29 Manners View, Dodnor Industrial Estate, Newport, Isle of Wight PO30 5AF. Telephone 01983 520 121. A good source of spares.

QER, Quality House, Reedlands Road, Clay Flatts Industrial Estate, Workington CA14 3YF. Telephone 0190 067 913. Panel repairs.



Amstrad SRD510

This one came by post, very carefully packed – I was pleased that someone had taken note of my suggestions about packaging. All too often I receive parcels that rattle and have to be returned to sender unopened.

The fault report was brief but adequate. "One or two hours after a cold start a squealing noise comes from the left-hand side, the red and green LEDs flash together, the picture changes to a blank screen, then everything goes off. The receiver sometimes comes back on by itself."

I recognised these symptoms. The cause is a poor connection

Satellite Scene

If you're interested in digital satellite systems you might find it useful to take a look at a new web site:

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

It's run by Mike Hancox, who has been very helpful in the past when I've had installation problems. Mike also offers an e-mail helpline for installation, as I do for repair problems. You can contact him at:

satscene@ontv.co.uk

WORKSHOP

between the power supply and the main PCB: the connector is not very well designed, and oxidation occurs. The most common problem is a high-resistance chassis connection. You can usually carry out an effective repair by soldering in a wire to bypass the chassis connection then cleaning the connector – I use WD40, but any proprietory switch cleaner will do. The problem can also prevent response to remote-control commands, which is a disaster since there are no front panel controls!

This model has been around for several years. The electrolytics tire. So, as a precaution, I installed the parts in Relkit 3 (for details check with SatCure on 01270 753 311). In addition I replaced R9 (470 Ω) – it was hidden by glue that had turned black. My experience has been that this type of petrolium-based glue becomes both conductive and corrosive. R9 is just in front of the decoder video connector.

SRD400 Sillies

Like many other receivers, the Amstrad SRD400 is prone to microcontroller lock-out. Unplug the receiver from the mains supply, plug it back in and the chip will reset itself. Everything will then work. If the complaint is "stuck in standby", the receiver could be in the parental lock mode, caused by kids' fingers or a mains surge Press h/v, h/v, audio and it will be OK. When you get four horizontal lines on the LED display, the receiver is waiting for the lock code. If you don't have this, plug the receiver into the mains supply and leave it for two days without touching any buttons. When it has been unplugged then plugged back in again, it begins a count-down that lasts for 48 hours. Provided no buttons have been pressed, it comes out of standby - this is actually explained in the User Instructions, but we know what happens to them, don't we!

If you supply an SRD400 with a new LNB and it doesn't work, though it does with an old blue cap type, what's up? With fifty per cent of SRD400s a small modification is required to make them work with a new LNB. Remove the cover and

lift up the decoder board. Underneath you'll see a brown disc capacitor that's labelled either CP527 or C527 or it may be soldered across a diode labelled DP505. Simply cut it out. Then reassemble and you'll get pictures.

Pace Apollo 120

There was what looked like a decoder fault. But it wasn't, because German channels were also affected. The symptoms are difficult to describe. First, the picture lines appeared to be spaced too far apart, or every other line was missing. Secondly there was cogging at the edges of the picture, which would roll or jump depending on the contrast setting. And finally the decoder wouldn't decode. After some time I traced the cause to Q97. It's a BC846B buffer transistor that comes before the clamp circuit in the signal path. I've no idea why it failed.

Pace MSS1000

I had two MSS1000 receivers to repair last week. They had both been in an oven at a moderate heat for a couple of years! Not surprisingly, they had both ceased to work. The electrolytics were so black that I couldn't even read the markings on them. I had to replace the lot – fortunately I keep Relkit 10 (phone 01270 753 311 for details) in stock.

The first MSS1000 had come from Mrs Fu at the Chinese Chippy. When I'd replaced the capacitors and the power supply was working properly it still wouldn't work. It worked perfectly when I plugged in a new front panel assembly. So I replaced the microcontroller chip on the original front panel and reinstalled it. The receiver now worked but the front display didn't light up. I scraped off the chip fat, replaced the vacuum fluorescent tube, capacitor C2 and the transistors on the display board but it still wouldn't light up. Eventually I gave up and quoted a silly price for a new display assembly. She decided that she could manage without it.

The second MSS1000 was the D2-MAC version (MSS1061). I got it running but D2-MAC decoding was very intermittent. It seemed

sensible to replace all the electrolytic capacitors on the D2-MAC board - note that one of them is non-polarised. When I refitted the board I found that it wouldn't work at all! Thinking that I must have shorted something out, I put the receiver to one side until I was in the mood. Three days later I looked at it and saw that I'd plugged the D2-MAC board in slightly too far to the left. Thus each of the connector pins was displaced and in the wrong hole! Fortunately this hadn't caused any damage: the receiver worked perfectly once the board had been correctly installed.

This week two more MSS1000 series receivers arrived. An MSS1001 had been treated to a drink of coffee. This had washed over the power supply without, luckily, touching anything else. I flushed the board with soapy water, followed by Isopropanol and a blast from the hairdryer. It worked perfectly once the contents of Relkit 10 had been fitted.

The other one was an MSS501IP which, the customer said, kept displaying the message "Motor Error" and lines on the picture. These are both typical capacitor failure symptoms. So I simply fitted the complete Relkit, which did the trick.

Thorens TSR205

A large number of Polish immigants stayed in the UK after the Second World War. The ones I know are all really nice people, and Edward is no exception. So, when he told me that the receiver he'd just brought back from Germany didn't work, I had no hesitation about agreeing to look at it — despite having no service information.

Inside, this 205-channel Thorens receiver is pure Samsung. It's very nicely put together, with a mains transformer and no surface-mounted components. The problem with Edward's box was that he had shorted across the LNB connection, with the result that no LNB voltage came from the tuner.

Fortunately the LNB supply circuit was recognisable, as it's very much like that in the old Amstrad SRD400 – but with a 22kHz tone-inserter board added. There's a protection device, in the form of a posistor, but this item was intact. Instead, the 7812 12V regulator U601 had died. There was 30V at its input, 1·1V at the centre reference pin but nothing at its output. Unfortunately my test probe slipped and shorted 30V to the centre pin, after which this pin also read 0V!

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:

jack@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.

I traced the damage I'd caused to a 2SA733 pnp transistor, Q303, on the 22kHz tone board. When a BC557B transistor had been fitted in this position, and a plastic 7812 regulator rescued from a scrap SRD400 chassis had been installed, the repair was almost complete. To improve the protection, I replaced the posistor with a 1Ω fusible resistor which would simply go opencircuit in the event of a short — much easier to replace than a regulator!

Edward was delighted. "Now I can watch de Polsat channel again" he declared, "Czesc!"

Correction:

The e-mail address given for Satellite Scene last month contained an error -- "onto" should have read "ontv". See box on facing page.

Test Case 429

We know what Workshop Sage doesn't like: mid-mount VCRs and badged models made by others. So what does he like? Sony VCRs certainly: they are predictable and well-made, and there is good service back-up. Once you get to know their habits and failings, it's not hard to make a profit from servicing them. So why was Sage, a top video technician, getting so exasperated by this SLV353 on his bench? Let's see.

Shortly after a cassette was inserted, it would pop out again, accompanied by a some clicking amd whirring from the tapeloading mechanism. But this occurred only when the tape had been fully rewound. If the tape was at any other point, the machine worked perfectly – in the record, play, cue, review and fast-transport modes. Except that if the tape was rewound from one of these modes, or from the stop mode, the machine would auto-stop when the start sensor (right-hand side of the cradle) told it to do so and after this it was seldom possible to select any function. If play was selected for example the two green play arrows on the front panel would light but there would be no action from the cam (threading) motor: it didn't get a go command from the syscon chip, and after a second or two the machine would give up the attempt. The same would happen when fast forward was requested.

The problem was obviously to do with the operation of the start sensor. But Sage could find nothing wrong with it. At tape start pulses of light from the cassette LED fell on the sensor, and a good, strong pulse train appeared at pin 56 (T-sense) of the CXP80116 microcontroller chip. But pin 57 (S-sense) remained at zero volts unless and until the tape was ejected – or rewound

fully to its end. The machine's T sensor is the tape-start one at the right, the S sensor being the tape-end one at the left. All this seemed to be normal enough, but why wouldn't the microcontroller play ball? If Sage slipped a piece of card in front of the start sensor the machine worked well enough.

Sage checked the supplies to the microcontroller and the sensor-pulse amplifier chips IC503 and IC505 carefully. They were correct at 5V and free of hash. He also checked the supply and the pulse feed to the cassette LED (the 'lighthouse') and found that they were OK. But the microcontroller chip wouldn't do its stuff. After much careful thought, taking into account the fact that the play instruction brought light from the front-panel symbols but no tape start, Sage condemned the microcontroller chip and blew £26 odd on a replacement. On its arrival Sage fitted the 80-pin flat-pack chip carefully then tested the machine. The fault was still present, with exactly the same symptoms. Exasperated, Sage put the machine to one side.

When he returned to it some time later, in a better and more constructive mood, Sage went through all the checks again. With the results exactly the same, he came to the same conclusion as before – that the CXP80116 chip was faulty. But it was a new one – and the fault was a very unusual one. Certainly the cause of the problem was centred on the operation of the start sensor at the right of the cassette.

At this point an idea occurred to Sage, one that might have occurred earlier had he studied the operation of a working deck of the same type, and from this he came to a correct diagnosis. What was it? For the solution, turn to page 826.

Servicing the

Panasonic NVJ40/42/45/47/F55

Brian Storm describes the innovations that were introduced with this range of VCRs, and their subsequent fault history

hese machines all use the final version of the G mechanism. Their main feature is improved mechanism response time in comparison with previous models. The play and record mode response times were improved by using a new full-loading system. When a cassette is inserted, the video tape is quickly loaded and wrapped around the drum, awaiting the play command. Previously the loading arms stayed at the stop position until a key was pressed. For rewind and fast forward the tape is unloaded to the stop position: both functions also have faster spooling times.

Another update is the head cleaning mechanism which is fitted to the right of the drum. It's activated by the drum's exit guide and gives the heads a brief clean every time a cassette is inserted – and every time the mechanism returns from the rewind or fast forward position.

Remote Control

The combined remote control/bar scanners were redesigned, with more features added. The VCR control panels have brightly-coloured buttons that are colour co-ordinated with the relevant buttons on the remote control units.

Table 1: Luminance/chrominance processor module variations.									
Model	Board	Module							
NVJ42	VEP03928H	VEFH14D							
NVJ42	VEP03928X	VEFH14G							
NVJ47	VEP03928M	VEFH14D							
NVJ47	VEP03928AB	VEFH14G							
NVF55	VEP03857T	VEFH14D							
NVF55	VEP03928AF	VEFH14G							
NVF77	VEP03928B	VEFH14D							
NVF77	VEP03928R	VEFH14G							

NTSC Playback

Another feature that most of these models have is NTSC tape playback facilities. Although this was available with previous models such as the NVL28 and NVJ35, it had never been made a major feature before.

The system works by altering the NTSC chrominance and burst signals to provide compatibility with the PAL system. The 60Hz field, 525-line format remains the same: this means that the TV set must be able to switch its line and field rate automatically between the two standards. Of the models covered in this article, only the NVJ40 does not have an NTSC playback facility.

NTSC Dub

In addition the NVJ45, NVJ47 and NVF55, also the older NVF77 editing deck, have an NTSC dub facility. This can cause some problems for the unwary. It enables NTSC tapes to be copied by allowing the record servo circuitry to lock to the NTSC 60Hz field rate.

The problem is that most users discover this feature only when they try to record a normal PAL broadcast with the machine switched to NTSC dub (probably activated by an over-zealous duster!). The result is an unstable monochrome recording and a panic-stricken phone call for service. Obviously most people are not toohappy when asked to pay a service engineer to flick a small switch over to the correct position.

Servicing

A new service feature, designed to help the hard-pressed engineer, is a built-in error code memory. If the machine has an intermittent fault you can press eject, rewind and fast forward together (eject and shuttle forward with a jog/shuttle machine). The VCR will then display any fault code that's been stored. You can activate this feature permanently by linking together test points TPSERV and TPGND (ground).

The last two digits of the timer display show the fault code. If the machine has been unplugged from the mains supply since the fault occurred the data will unfortunately be lost. This service aid can be very useful when dealing with intermittent faults.

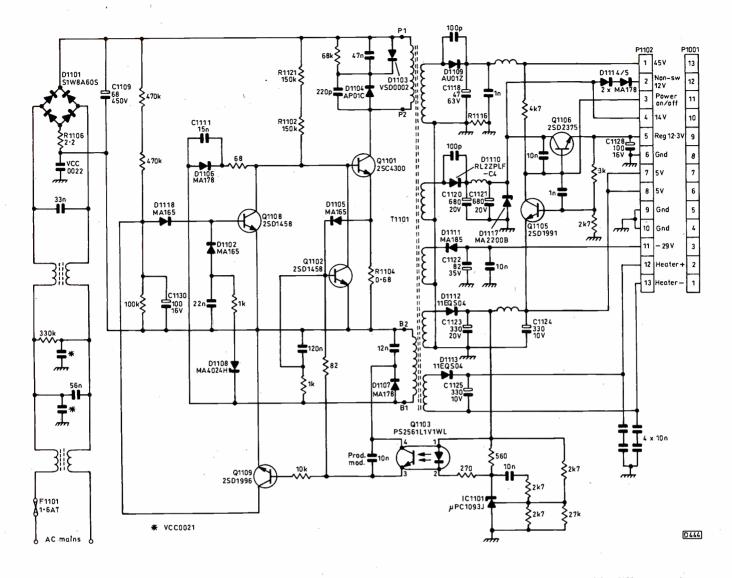


Fig. 1: Circuit diagram of the power supply used in Models NVJ42 and NVJ47. There are considerable differences in the other models.

The fault codes are as follows:

- E0 No fault condition.
- E1 Drum motor stopped.
- **E2** Reel rotation stopped.
- E4 Mechanism jammed while unloading.
- E5 Mechanism jammed while moving between fast forward and rewind.
- E9 No serial data communication between the front panel microcontroller chip IC7501 and the system control/servo microcontroller IC6001.

Another service feature is the addition of plug-in connectors between the main PCB and all the sub-panels. The RF amplifier/tuner units have a plug added at the side for mating with the adjacent RF converter. The connecting looms were all changed to push-in card connectors. This makes it easier to disconnect and reconnect sub-panels for test purposes.

The disadvantage of these machines from the servicing point of view is the increased use of surface-mounted components, including the system control/servo chip IC6001. As this particular IC is not wholly reliable, a lot of service departments had to consider an investment in modern desoldering equipment or risk damaging main boards.

Mechanism Faults

The G mechanism was by this stage at its most reliable, though there were some problems with the metal sector gear that drives the drum loading guides. These could ride up and slip off the top of the nylon gears. The result is disastrous gear teeth stripping as the mechanism struggles to unload.

The cause of intermittent mechanism faults, especially from cold, is usually dry-joints at the mechanism solenoid's lead-out wires.

Intermittent stopping (E2 fault code) usually means that the output from one or both of the reel-rotation sensors is low, sometimes because of dust and fluff build-up under the spool. The part number for the optosensors is ON2170

Intermittent powering off when a cassette is inserted often means that there's too much play around the cas-

sette housing mode switch. The best way of dealing with this is to replace the cassette housing right side, which comes as a complete unit. The part number is VXA4480.

The Power Supply

The redesigned power supply (see Fig. 1) gives less trouble than the previous types, though you can get problems with Model NVF55 when the earthing track goes opencircuit at a soldered joint to the screening can and anode of Q1103. The result is that the output voltages rise drastically. The power supply then cuts out, going dead.

The NVJ42 and NVJ47 can suffer from high-pitched whistling should the mains voltage be slightly higher than normal. This is easy to cure: add an $0.01\mu F$ capacitor across pins 3 and 4 of O1103.

C1127 (330µF) in the earlier power supply can be the cause of patterning on playback when it goes low in value, or no playback with a distorted E-E picture when it goes open-circuit.

Video Problems

Callers Welcome 9am-5.30pm Monday to Friday (other times by arrangement)

The new luminance and chrominance sub-boards use a ceramic module on stilts to carry out most of the processing. Unfortunately the electrolytic capacitors on the module can leak and corrode adjacent components. This causes numerous symptoms that are cured by replacement of the module. The symptoms include no or poor playback colour; no or poor playback luminance; no E-E luminance; no record colour; no record luminance; and any intermittent version of these faults.

The module part number is VEFH14D or VEFH14G, depending on the luminance/chrominance sub-board type. Although the boards are interchangeable, the modules aren't! The variations are listed in Table 1.

For dark bars on the E-E picture check C318. For sound-on-vision on the E-E picture check C313. These 22µF electrolytics go open-circuit.

Faults List

Fairly common faults, especially with the NVF55, are:

Capstan motor speed excessive: L2001 open-circuit. so no 12V supply to the stator.

No VU display and a blank raster: IC7001 faulty.

Failure to lock on station with cable channels: Add a 1μF capacitor across C7680

Failure to lock on station when search tuning: D7601 (MA151K) faulty.

Low E-E gain: Tuner unit and RF amplifier faulty. Part no. ENV87837H3Y.

Low feedthrough gain: Tuner unit and RF amplifier faulty. Part no. ENV87837H3Y.

Common faults with Models NVJ40/42/45/47 are:

No E-E sound: IC7651 (AN5451N) faulty.

Rolling E-E picture: C315 (22µF, non-polarised electrolytic) open-circuit.



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: Cowl and graticule with filter for the Telequipment S51A or S51B scope. Phone P. Guarini on 01709 371

Wanted: Teletext panels for the Philips Models 28CE5594 and 21PT522A/05. Must be in good working order. Service TV, 18 Benfleet Road, Hadleigh, Essex. 01702 558 444. Wanted: Urgently require red tube for Pye studio video projector (circa 1981) or information on a possible source. Richard Gifford, 4 Gipsy Lane, Needham Market, Suffolk IP6 8DY. 01449 723 009.

For disposal: Bundle of 405-line TV service sheets and other articles from Electrical and Radio Trading from mid-50s. Also Viewmaster construction details. All free to a good home. Require any copies of Television from about 1980 to 1992 inclusive. Nicholas Arnold, c/o 17 Fairway, Merrow, Guildford, Surrey GU1 2XQ. 01483 573 491.

Wanted: Circuit diagrams/service manuals for the Contec Model KT8135 and Bush Model 2515T (?Indiana 100). Photocopies OK. B. Ecclestone, 10 Stone Road, Norton Bridge, Stone, Staffs ST15 0NS. 01785 760 315. Wanted: Circuit diagram for the Beamack tube tester which was made in the Sixties. John Haylett, 160 Hookfield, Harlow. 01279 863 789 Wanted/for disposal: Require the following copies of Television: Apr, Sep, Dec 1989; Feb, Jun, Sep 1990; anything from Dec 1972 to May 1976 and June 1950 to Oct 1957 (these latter Practical Television). Have for disposal about 90 copies of Television between Nov 1977 and April 1996. Vic Smith, VAST Electronics, Unit 47, James Street, Carlisle, Cumbria CA2 5BB. 01228 625 700 ext. 247 afternoons. Wanted: S4097 vidicon camera tube. Peter Martin, 29 Rosemary Gardens, Hampton Dene, Hereford HR1 1UW.

Canon PC12 photocopier. James Burch, 9 Groveland Road, Beckenham, Kent BR3 3PU. 0181 402 2488. Wanted: CRT base for a Grundig 22in. Supersound set fitted with the CUC740 chassis - A56-540X 110° tube. Part no. is 29304-042-02. Derek Castle, 99 Buckingham Road, Brighton, E. Sussex BN1 3RB. 01273 326 194.

For disposal: Radio and Television Servicing 1969-1980, twelve books in perfect condition. Offers please. John Pawson, 20 Nerissa Close, Waterlooville, Hants PO7 8LP. 01705

422 292 evenings.

Wanted: DPU2553S IC, also a mode switch for the Hitachi Model VTM630M. B. Marsden, 25 St. George's Road, Newquay, Cornwall TR7 TRE. 01637 876 298.

Wanted: Instruction book for the GoldStar GHV1240I VCR, to buy or copy. E.J. Caines, 13 Bate's Close, Easton, Bristol BS5 0UZ. 0117 939

Wanted: UHF-VHF tuning module or complete working board for the Finlux Model 3029(v) text. D. Brown, 3 Copse Hill, Filey, N. Yorks. 01723 514 283. Wanted: Service information and dismantling instructions for the Ferguson FC04 video camera. Does anyone have a non-working camera for sale? E.W. Townsend, 13 Dorrit House, Henry Dickens Court, London W11 4DR. 0171 727 2013.

Wanted/for disposal: Require good A66-540X 26in. tube and focus unit for a Ferguson TX10. Have for disposal a Philips N1702/15 VCR with tapes including some that have series 1 Star Trek. Bob Harrison, Badgers Oak, Redbrook Street, Woodchurch, Ashford, Kent TN26 3QU. 01233 860 453. Or e-mail

bobharri@globalnet.co.uk

For disposal: Radio and Television Servicing 1970-1980; Television Oct 1976-April 1988 (complete set); approximately 200 service sheets and manuals from the 1960s-80s. All at bargain prices. Peter Sinclair, The

Gables, Glebe Road, Newent, Glos GL18 1BS. 01452 503 662 daytime. Wanted: Circuit diagram for the Olivetti SVGA monitor Model CDU1448G/L001. Also advice on why the 3842 power supply chip is shutting down though the line output stage seems to be OK. Peter Antcliffe, 63 Chester Road, Stevenage, Herts SG1 4JY. 01438 359 414.

Wanted: Mains/standby relay for Goodmans portable TV Model 1405R (5V DC/250V AC/10A, labelled OST-S-105DM). Also a standby transformer to suit the Hinari portable TV Model HIT14R. Tony Woods, 76 Leafiel Avenue, Bradford BD2 3RU. 01274

For sale: Audio service manuals for most popular makes. Average price £4 inc. postage. Mike Orr, 21 Venus Street, Congresbury, Bristol BS49 5HA. 01934 838 496.

Wanted: Spares for the JVC HRD750 VCR or a complete machine to break for parts. In particular need a capstan motor and power supply. Graham Seward, 2 Orchard Close, Severn Stoke, Worcester WR8 9JJ. 01905 371 504. Or e-mail

grahamsew@lineone.net

Wanted: 7415 op-amp IC, also a circuit diagram/service manual for the Sony TV110UWE. R.E. Bailey, 22 Grebe Close, Waterlooville, Hants PO8 9UT. 01705 783 811.

Wanted: Circuit diagram for the IBM SVGA monitor type 6322-002. Peter Antcliffe, 63 Chester Road, Stevenage, Herts SG1 4JY. 01438 359 414.

For sale: Tektronix 5115 storage oscilloscope with 5A18N dual-trace amplifier and 5B10N timebase modules fitted, Polaroid freeze-frame camera, probes, on Model 3 Tek Lab Chart £300. Laptop and notebook spares and accessories: PCMCIA, batteries, PSUs, AC adaptors, boards, screens, keyboards - Zenith, Twinhead, Mitac, AST, Ambra, Compaq. For list send 55p stamp. Julian Bohan, 30 Stanley Street, Lincoln LN5 8NG. 01522 871 926 or 0958 771 319 (mobile).

01432 277 032 after 6 p.m.

Wanted: Remote control units for the

7702. Also service information for the

B&O Beovision Models 3912 and

What a Life!

Mainly difficulties with TV sets this month. Donald Bullock on servicing and people problems – and that wordprocessor of his

omputers leave me cold. Son James has knocked himself up a beauty entirely out of units from CPC, but I haven't even mustered up enough interest to try to work it. Everybody tells me to throw away the Amstrad PCW8512 I use for writing. Now it seems that I might have to.

Because the heat in Spain dries out the exposed part of the Amstrad machine's printer ribbon, I keep producing articles full of white patches. I thought I'd found a remedy, but it hasn't worked out. It happened like this.

In Spain we put our refuse into a big communal bin. It's common practice for people to place anything they think might be useful to someone else by the side of it. That's where I found a mint Commodore MPS1270 monochrome inkjet printer, in its factory packing, but minus the instruction booklet and computer-to-printer lead. James tried it on his computer and pronounced it perfect. All I needed was a simple lead to connect it to the PCW8512. That was some months ago. I've tried here, there and everywhere, but haven't managed to get one.

Now I find that when I boot up the PCW8512 the little red light on the shift-lock key sometimes comes on and the machine won't respond to the keyboard at all. I have to switch off and boot up again. Dunno why. Do you? I does it with various start-of-the-day discs.

On the Cheap

Mr Whiner brought in his ancient Hitachi VCR the other day.

"Can you get this going for tonight?" he asked. "Only the relatives are visiting. Got to have the video working, haven't I?"

"It's essential" I said.
"Not worth spending much on it

of course" he continued, "it's so old. Say perhaps a fiver."

As I cringed away James took it to the workshop. He found that the heat had congealed the mechanism's grease. A clean up made it work all right. So we charged him a tenner.

"Hope it'll last a good while" said Mr Whiner.

It reminded me of Walt, with whom I worked many years ago. He was an excellent engineer who had been in the trade a long time, and the customers had long since got to him. Now and again, after a particularly bad experience, he would cry out "immediately isn't soon enough, free isn't cheap enough and perfection isn't good enough!"

He eventually threw in the towel and got a job repairing bicycles.

Problem with a Mitsubishi

Steven's problems with a Mitsubishi TV set began when Mr Bullneck pushed through the door and interrupted his conversation with the vicar.

"Can you pull me Mitsubishi outa the car, oney I've a bad back, see."

Steven stepped out and followed him to his car. It was about a hundred yards away, on the other side of the busy road, and it was raining. He staggered back carrying a black box about the size of a tea chest. It was a Mitsubishi CT2146TX (Euro 6 chassis).

Once I'd got Bullneck out I gave Steven a drink of water and before long he was able to stagger to the bench and try the set. It worked all right and continued to do so for the rest of the day. So he phoned Mr Bullneck. "Your set's all right" he said.

"Ill-ent" Bullneck rasped. "He goes dead every three days."

Steven opened the set and found a multitude of dry-joints where conductors joined the print. He spent a long time cleaning and resoldering them. Then he tried the set again. It was dead.

There are two chopper circuits in this chassis. The main one provides the HT supply and three LT supplies, at 24V, 12V and 5V. The other one provides standby operation, with 7.5V and -30V outputs. The 7.5V output feeds a 5V regulator, IC951.

As the HT was present, Steven moved over to the standby supply and found that the 5V line produced a hardly detectable reading. The smoothing capacitor C709 (10µF, 50V) was open-circuit.

Steven fitted a replacement and thought everything would be OK. "Not too tricky after all" he muttered. But when he switched the set on it was still dead. So it was back to the main chopper circuit, where the 12V output was missing because the 16A protector Z901 had gone open-circuit. He fitted a replacement and switched on again. There were still no results.

Must be loss of line drive" Steven commented. He resoldered the connections to the line driver transformer T551 and checked the line driver and output transistors, which were both all right. But there was still no line drive. Scope checks showed that everything was OK on the primary side of the line driver transformer. There were no pulses across the secondary winding however. The windings produced DC continuity readings both in and out of circuit. There was no short across the secondary winding. "I reckon I might as well give this one back and recommend Snoddies or Crubb's Foodstore" he moaned.

"Why not take the driver transformer out and check it with a magnifier?" I asked.

He found that the joints to the PCB were clean, but the pins had a tarnished look. So he removed the transformer again and cleaned the pins with fine emery paper. When they were shiny bright he replaced the transformer. This time the set worked at once and proved to be reliable.

"That transformer read OK despite its tarnished pins" Steven commented, "I don't see why the waveform couldn't get through."

"Perhaps the silver-plated pins had developed a silver oxide coating from solder-flux impurities" I suggested.

"Wish I'd shone the pins up earlier" Steven said.

Turkish Delight

Then Greeneyes came into the shop. She'd been to the market.

"I've a packet of Turkish delight for you" she cooed.

for you" she cooed.
"Good" I said, rubbing my hands. "Bring her in!"

Greeneyes made a silly noise and her expression turned cold. She placed a Bush 2114T portable on the counter. "Belongs to Molly" she snapped. "It's dead. Perhaps it heard one of your silly jokes."

The set boasted its Turkish origin and was dead all right. It clicked at switch on. While Greeneyes watched I went straight to the BU508D line output transistor Q402 and found that it was short-circuit. After replacing it I checked R811, the 1Ω resistor in the 24V supply. As expected it was open-circuit. I replaced this as well, and felt I was doing just fine. Show that girl who's clever. Then I switched the set on.

It emitted a curling whisp of smoke, made the same noise that Greeneyes had made over my Turkish delight joke, and looked at me just as coldly.

I checked the set again. Both the items I'd replaced had failed. So I did what I should have done before – I measured the HT voltage. It was high at 145V instead of 110V, and adjusting the HT preset VR801 made no difference. Time to switch off again

The chopper power supply is of the standard TDA4601 control-chip type. I found that two electrolytic capacitors associated with the chip had fallen in value. C817 was only 6 μ F instead of 10 μ F (16V), while C818 had fallen in value from 1 μ F (50V) to 0·3 μ F.

I replaced them, also the two items I'd blown up, wound VR801

down to zero, switched the set on and adjusted VR801 carefully for an HT reading of 110V. Everything worked smoothly. The preset's slider ended up dead central along its track, and the set produced an excellent picture.

Another Mitsubishi

At this point a large TV set with a pair of skimpy trousered legs trotted in. Steven saw that it was a Mitsubishi set and disappeared, with a squeaking sound. Being made of sterner stuff, I dashed out and hoisted it on to the bench. The legs stayed where they were, and I noticed that they were part of a tiny body, with a head and arms. Then an enormously amplified voice filled the shop and half the street.

"No picture at all Mr Bulbous" it said. Steven ran out, looking incredulous. But my attention was concentrated on the little fellow who had brought the set in.

"Just a blank screen" said the amplified voice. "Phone number is on the label there."

Steven ran back into hiding and I cringed. I waved the little chap out and tried the set. It was a modern one, and displayed a blank raster. I wanted to check whether there was any sound, but modern sets make me nasty, 'cos I can't work them. I called Steven out.

"It's only a simple fault" I said, "will you set it all up while I make the tea?"

When I returned he had an excellent picture on the screen. Then he switched the set off and back on again. A blank screen was present, as before.

"Ah" he said brightly. "The trouble will be to do with the X24C04P EEPROM chip IC702. When it fails various problems can be present. Often the one we've got now, or the teletext may be missing, there may be no Nicam sound or, with B series sets only, the rotating base. Or any combination of these faults." He was about to walk out as he spoke, and I noticed that his backside looked like a sackful of cats heading for the river.

"Rotating base?" I asked.
"Yes, permanently or intermittently" he continued. "SEME does a kit that puts matters right, at just £10.33 plus VAT. The part number is RK216G. In addition to the EEP-ROM chip it includes two 68kΩ resistors and an 0·0lμF capacitor. These are not needed in all models. It's worth ordering the kit, because it comes with a technical bulletin



He staggered back carrying a black box about the size of a tea chest.

that lists every model affected and tells you which parts each one needs for the repair. CPC does the chip on its own at £6.68 plus VAT. This set will need just the chip—others need the whole kit and detailed picture geometry adjustments."

I sauntered off. Getting clever, this boy. Not a clever as me, only I just don't bother. And anyway his tea isn't a patch on mine!

Sky TV

I've noticed that during interviews with overseas reporters in Sky TV's news broadcasts there is a noticeable delay before they seem to be able to hear and respond to the anchor man's questions.

The other day, during a conversation between the newsreader and someone in Ireland, the delays were longer – two or three seconds. The newsreader ended the interview prematurely, blaming a "slow line".

Are the delays the result of bandwidth problems I wondered? Does the transmitted picture have to be sent piecemeal and built up at the other end? At any rate the lip sync remains intact.



Reports from
Philip Blundell, AMIIEelec
John Pitt-Francis
Michael Maurice
Chris Watton
Giles Pilbrow
Graham Colebourn
Maurice Kerry
David A. Chaplin and
Glyn Dickinson

Philips D16 Chassis

"Dead set" was the complaint. When it was switched on the only response was that the standby, power on, teletext and RGB lights were flashing. The table at the back of the manual tells us that this means "protection line active". A scope check at the collector of the surface-mounted transistor Tr7657 confirmed this: the voltage was at OV instead of 5V.

As usual with Philips sets of this era, the protection line monitors the audio, field, EW and line output stages. It shuts the set down if a fault is sensed in any of them. To find out which section is faulty, check voltages as follows:

Audio stage: Collector of Tr7130.

EW circuit: Anode of diode D6502.

Line output stage: Collector of Tr7495.

Field output stage: Emitter of Tr7425

In a correctly working set there should be 0V at all these points. In fact the voltage at the emitter of Tr7425 was pulsing high, indicating that there was a field timebase fault – loss of field drive in fact.

The field drive comes from the digital video board. There's no circuit diagram for this in the manual (the board is available under an

TV Fault Finding

exchange scheme) but the circuit description book does have a circuit, so you can check for simple faults. In this case coil L5251 was open-circuit, removing the supply to the DPU2553 digital processor chip.

This was not the end of the story however: while the set was on test another fault appeared. When the set was first switched on from cold there would be no colour – the colour flickered then, after a few minutes, stayed on. A burst of freezer soon showed that the culprit was crystal X1207 on the digital video board. A new crystal cleared this final fault. **P.B.**

Samsung Cl5013T (P58SC Chassis)

This set was dead. The chopper transistor Q801 read short-circuit but this was a red herring: C816 (2·2nF, 1kV), which is in parallel with Q801, had gone short-circuit. The surge limiter resistor R801 (5·6 Ω , 7W) had failed as well. C816 is part no. 31417-901-660 (Willow Vale code 79331CA); R801 is part no. 31039-687-569 (WV code 79331RA). **P.B.**

Philips FL1.7AA Chassis

This set's picture would black out intermittently. The slightest pressure at the rear of the large signal panel would instigate the fault. A few seconds spent looking around with the magnifying glass revealed the cause: a dry-joint at jumper 4404, by plug L03. **P.B.**

Grundig CUC7301 Chassis

When this set had been on for a few minutes line drive would be lost. The TDA8362A colour decoder/timebase generator chip IC150 produces the drive waveform, which is fed to the line driver stage via a BC858B buffer transistor (CT169). Scope checks soon

revealed that this surface-mounted transistor was the cause of the trouble.

The set was actually a **Matsui** Model 20V1T. **P.B.**

JVC CS2180EK

Tuning drift was the problem, particularly during the first twenty minutes. IC921 and C925 in the 30V regulator circuit were proved innocent by substitution. I then had an expensive choice: to try replacing either the tuner or the station select module, type SBX-M904A(E). A chat with the very helpful JVC technical help team indicated that the module was the more likely cause. A replacement cured the fault, but the customer was faced with quite a large bill. Has anyone tried component-level fault-finding with this problem? It sounds like a stock fault. J.P-F.

Hitachi CPT2250 (Salora Chassis)

There was no picture and a faint smell – the sound was OK. RB589 (0.68 Ω safety) was found to be overheating because the TDA2653A field output chip had failed. Replacements restored normal operation. **J.P-F.**

Decca 165 Chassis

There was no tuning, just a snow storm. Was it the tuner? No! This was proved by unsoldering pin 4 of the tuner and feeding it from the slider of a $100k\Omega$ potentiometer connected across the 33V supply. This gave perfect tuning. Since QR07 read OK, the fault seemed to lie in the M491BB1 voltage synthesis chip IR01. A replacement restored the tuning. **J.P-F.**

Akai CT2115

Neither operation of the front control nor the remote control unit would bring this set out of standby, even to trip. The supplies all seemed to be OK and no dry-joints could be seen. It seemed that the PCA84C640P microcontroller chip could be the cause, so I debated on whether to get one and try it or buy a manual. A replacement chip proved to be a good bet, restoring correct operation. J.P-F.

Sony KVMX25TU

The picture would go off after ten minutes. Dry-joints at the line driver transformer T801 were the cause. I also resoldered some chopper transformer joints – they looked next in line to give trouble. J.P-F.

Toshiba T284T8B

The customer complained of a dead set with a bad smell of burning. The cause was the Lorlin-type mains switch, which was now a charred mess. Fortunately the customer had fitted a 3A fuse in the plug. It had blown, preventing a possible fire. Also fortunately there was no damage to the mains input PCB or the components adjacent to the switch. M.M.

Panasonic Euro 1 Chassis

When this set was switched on the standby light blinked for a fraction of a second then went out. Panic is the usual reaction when this sort of thing occurs, as the cause of the fault is generally in the digital section. Not this time however. Quite by accident I found that if the set was left on for some time the raster would be restored. The fault was in the power supply. Replacing all four electrolytics and the high-value resistors produced normal operation at switch-on. M.M.

Toshiba 2927DB

No text was the complaint with this set. When I called Toshiba's very helpful technical department I was told that memory corruption was the probable cause. I was able to clear the fault by going into the manufacturing mode and resetting the option bytes. M.M.

Nokia MP37H1

This portable produced no picture or sound, though the graphics were OK. The video signal is routed through the text board, where there was an input but no output. The cause of the fault was a BC858 surface-mounted transistor VR08. There was normal sound and vision once it had been replaced.

The way in which this set is constructed makes it difficult to work on the text board. Its print side is so close to the tuner that it is imposible to reach it with a probe. I removed the text module then refitted it at an angle of approximately 30°. After completing the repair I removed the board and refitted it correctly. M.M.

Philips GR2.2 Chassis

This set tripped when switched on. It remained dead, with no flashing LEDs. I disconnected the line output stage and checked the HT, which was OK at 148V. When the 32V rail was disconnected the set fired up. The culprit was the standby thyristor Thy6670: a replacement restored normal operation. M.M.

Philips CP90 Chassis

The width fluttered in and out, but only when it was set correctly. If the width was increased or decreased the picture was steady. The cause of the trouble was eventually traced to C2619 (1.5nF, 2kV), which is one of the tuning capacitors in the line output stage. C.W.

Hitachi C2119TZ

If one of these sets is stuck in the standby mode it's worth checking the TA8427K field output chip, which may be short-circuit. It's a common cause of this problem. C.W.

Ferguson TX80 Chassis

This set was stuck in standby. The cause was found in the line output stage, where DP12 (BA157) had failed. It's the rectifier for the 8.6V supply and is connected to pin 7 of the transformer. C.W.

Hitachi G100 Chassis

This set (Model C2564TN) was tripping. To isolate the power supply for test, disconnect plug PL702 and connect a 60W bulb between the plug's orange lead and chassis. If the bulb lights, the power supply is OK – the HT should be 140V. In this event a fault in the line output stage is likely. I found that D704 (BY228), which is one of the EW modulator diodes, was the cause of the trouble. A nasty dry-joint at L650 had probably led to its failure. C.W.

Philips 2A Chassis

There was disturbance to the line and field sync – a jumping picture and line tearing, which varied with the video content. The fault was still present when a signal was fed in at the scart socket, clearing the tuner and IF sections. Our next sus-

pect, the TDA2579/N5 sync chip, was also blameless. It's video input looked good when scoped, but I noticed that the fault was not so bad when the probe was applied. This indicated that I was in the right area. The culprit turned out to be C2550 (1 μ F), which was opencircuit. C.W.

Sony BE2A Chassis

The power supply tripped loudly. No short-circuits could be found, and the tripping stopped when the feed to the line output stage was disconnected. The cause was eventually traced to T604, which had shorted turns. This transformer is connected directly across a line output transformer winding to feed pulses to the power supply for synchronisation. The part no. is 1-424-078-11. G.P.

Ferguson TX91 Chassis

The sound was permanently at maximum. I traced the cause to the BC858B transistor TV02 which was leaky. Note that in this chassis the volume control voltage comes from the jungle chip IV01, not the microcontroller chip. G.P.

Sanyo ED1 Chassis

There was no picture, just a bright glow at the top of the screen. This indicated a field fault. The cause turned out to be the DPU2553 deflection processor chip IC508 on the digital PCB. Its part no. is 409 211 87 01. G.P.

Ferguson T10R (Thomson TX90 Chassis)

If there's no or low sound with inability to produce the tuning menu, the hotel mode needs to be released. To do this proceed as follows:

- (1) Use the remote control unit to put the set into standby.
- (2) Switch off using the mains switch. Wait thirty seconds.
- (3) Switch back on at the mains while simultaneously pressing the remote control unit's standby button.
- (4) A menu will be displayed. The hotel mode can be switched on/off by using the volume +/- keys. Press the TV button to clear the menu. G.P.

JVC MXII Chassis

There was intermittent field collapse with one of these sets. The

cause was traced to zener diode D441, type RD3.0ES(B2), which went leaky when warm. It's connected to pin 13 of the TA8859P vertical distortion compensator chip IC461. This provides the field drive at pin 8. **G.P.**

JVC C14ET1EK (Onwa Chassis)

In addition to the usual high HT problem caused by C911 and C909 in the power supply this set had no teletext. The cause was C020 (3·3µF, 50V) which was open-circuit. G.P.

Matsui 1450

This set wouldn't come out of standby from cold. I found that the 5V supply to the microcontroller chip was low because C611 (470μF, 25V) had dried up. For reliability C609 and C607 should also be replaced. **G.P.**

GoldStar CTI2190F

The complaint with one of these sets was intermittent teletext operation. The cause was traced to a dryjoint at the emitter of Q1 on the text PCB. G.P.

Sony AEIC Chassis

We've had many Sony sets that have suffered from progressive cramping at the bottom of the screen with associated width reduction. The cause of the fault is the field scan coupling capacitor, which falls in value. We recently had one of these sets with this fault and also no sound. The customer told us that the two faults had appeared on the same day, and cleared slowly as the set warmed up. He felt that there had to be a common cause.

A new scan coupling capacitor (C531, 680 μ F) corrected the field scan problem, but not the sound fault. The cause of this second problem was ripple on the 15.5V line – it activated the turn-on mute circuit. Normal sound was restored when C615 (1,000 μ F, 25V) had been replaced – it's the reservoir capacitor for the 15.5V supply. G.C.

JVC AV21F1EK (JX Chassis)

If there's no picture, just a blank screen, check for a cracked solder joint at pin 2 of the line output transformer. **G.C.**

Philips 14TVCR240

This TV-video combination could manage only a rude, blurting noise. The power supply was tripping

because the line output transformer had failed, so no surprises here. Charles Hyde can supply the transformer under stock code P81397.

The front panel buttons also needed repair. G.C.

Goodmans Compact 110

These handy 10in, sets have an Onwa-type power supply on a separate board. It generates a single 13V output at about 3A. There's no mains switch - a label on the back of the set advises the viewer to disconnect it from the mains supply when not in use. So the chopper circuit runs continuously, and eventually does its Onwa special thing and blows up. To repair it, you will need Philip Blundell's article (February issue page 236) and an Onwa kit. You may also need a new output reservoir capacitor (CP12). This is a 6,800µF, 16V type, but its ripple rating is what really matters, and it shouldn't be over 35mm tall. I fitted a low-ESR, 105°C, 3,300μF, 25V capacitor rated at 3.15A (RS 394-850).

In addition to most of the parts in the kit, RP24 (1.8k Ω) and the three small control transistors had to be replaced. RP24 had burnt out. The supply will operate when QP02 (the third small transistor) is shortcircuit emitter-to-base, but the regulation is awful - the output is 50 per cent high with normal mains input and loading. I prefer to fit higher-rated transistors in these positions, such as the 100V-rated BC639 (npn) and BC640 (pnp). They are much less likely to fail when the electrolytics wear out and the supply produces an excessive output again. G.C.

Toshiba 2500TBT

Cramping at the top of the picture gradually cleared after about an hour. The cause was C317 (2·2µF) which was low in value when cold. It's situated at the back of a heatsink near a 3,300µF capacitor, in the field circuit area. M.K.

Sony KV14M1U

At switch on the EHT could be heard to rustle up then die. The standby LED then started to flash six times on/off, pause then repeat. This is an over-voltage or excess-current indication. The line output transformer proved to be faulty. We have found that this is the usual cause of the trouble. M.K.

Panasonic TX29AD2DP

If line pairing develops at two-three inches from the bottom of the

screen when the set is hot, try replacing D508 in the field circuit. It's an MA723TA5 diode and must be this type. We've had this fault more than once. M.K.

Hitachi C1414T

This dead teletext portable had a short-circuit line output transistor (Q702) which, I was surprised to find, is not mounted on a heatsink. I thought it was type BU508DF, but a closer look showed that it was type BU2508DF. The only difference appears to be that the BU2508DF is rated at 0.4µsec while the BU508DF is rated at 0.7µsec. Anyway a new BU2508DF restored the set to life. Although the transistor seemed to run quite warm it battled on, and the owner tells me that the set is still well several months later. D.A.C.

Rediffusion Mk 4 Chassis

This teletext set produced a good picture when it was first switched on, but after a few seconds the picture turned to a very bright green raster with flyback lines. As I couldn't find any circuit fault I tried tapping the neck of the tube. There was a click and a flash and the picture returned. I explained to the owner that the tube was faulty and was liable to short again at any time. **D.A.C.**

Hitachi CPT1491 (NP84CZ Chassis)

At switch on this portable produced a whistling noise from its chopper transformer with no sound or picture. The power supply would shut down after a few seconds. When the feed to the line output stage was disconnected the power supply worked all right. As no other faults could be found, I ordered a new line output transformer. When this had been fitted the sound and picture came up, though the tube had seen better days! **D.A.C.**

Ferguson TX90 Chassis

This set did nothing though the HT-supply was present and correct. There was a 19V input at pin 1 of the MC7812CT regulator IC105, but very little emerged at pin 3. A new 12V regulator brought the set back to life. **D.A.C.**

GEC C1656H

This 16in. colour portable is fitted with the ITT CVC1100 chassis. At switch on there was only a squawking noise from the chopper transformer. Very often this is because

line output transformer has failed. I checked the line output transistor first and found that it was short-circuit all round. A secondhand BU208D restored normal operation, but why had the previous one failed?

There were no dry-joints in the chopper and line output sections, and all likely resistors, capacitors, diodes etc. checked out OK. I then opened the mains plug and found that the live and neutral terminal screws were very loose. After putting this right I replaced the second-hand line output transistor with a new one and gave the set a long soak test. D.A.C.

Ferguson 14M1 (TX86 Chassis)

Repeated failure of the TIPL791 line output transistor is common with these sets. The cause is dryioints, usually in the power supply, the line driver stage or at the pins of the 12V regulator.

In a couple of cases the set would fail when the back cover was replaced, but no amount of tapping

would reveal the whereabouts of the poor connection when it was removed again. The dry-joint was found to be at R61, which is in the extreme corner of the power supply. The plastic extension between the panel and the back cover presses on it. The easiest way of replacing this item is to fix it to the back cover with hot melt before fitting. G.D.

Mitsubishi CT2023B

The set was dead though there was HT at the line output stage. This usually means dry-joints at the line driver transformer. Not this time however. The line oscillator wasn't working because its start-up supply was low. The start-up isolation diode D501 had a slight leak. G.D.

Philips 25MN1550 (GR2.2) Mono Chassis)

This set had been elsewhere. It produced a snowy raster with the words "ERR TUNER" on the screen. There were no remote control functions. This points to a fault on the tuner's data lines. I was

about to change the tuner when I realised that this is a mono set that doesn't have data lines!

As the microcontroller chip had been replaced I decided to try a new EEPROM. This made no difference. The previous repairer had replaced the microcontroller chip IC7708 with a Nicam type (suffix 1637) instead of the standard version (suffix 1237). When the correct chip had been fitted the set could be tuned in. G.D.

Matsui 1455

This set reverted to standby very occasionally. Whenever the board was touched it came back on again! After a long battle (and a lot of solder) I found that the 2SD1426 line output transistor was intermittent. G.Ď.

Thomson TX90 Chassis

There were no signals though some variation in the snow could be seen when trying to tune. The 33V tuning supply was missing because RH04 (27k Ω) by the line output transformer was open-circuit. G.D.

/		
AN 5150 = 299 AN 5515 = 160 AN 5521 = 100 AN 7174 = 495	STR 44115	= 475
AN 5150 = 299 AN 5515 = 160	STR 90120	= 400
AN 5521 = 100	STRD 5441	= 400
AN 7174 = 495	STRD 6802	= 375
AN 7174 = 495 BA 5406 = 180 BA 7766 = 175	STRM 6545	= 775
BA 5406 = 180 BA 7766 = 175	STRM 6546	= 795
BU 27515 - 1400	STRM 6549	= 725
CNY 624 = 080	STRM 6559	= 900
CNY 82A = 060	STRS 5701	= 1700
CNX 83A = 080	STRS 5717	= 550
CNV 70 = 350	STRS 5741	= 600
HA 11277 - 250	STRS 5941	= 700
HA 11744 = 650	STRS 6307	= 450
KA 2101 = 100	STRS 6309	= 550
KIA 6299H = 200	STRS 6525	= 1350
I A 3160 = 120	STRS 6545	= 725
I LA 4120 = 270	STRS 6707	= 800
IA 4270 = 300	STRS 6708	= 550
LA 4505 = 220	STRS 6709	= 550
LA 7225 = 250	STRZ 2152	= 1000
LA 7830 = 090	STV 5180D	= 400
IR 1294 = 125	STV 2102B	= 650
I M 1881N = 375	STV 2110B	= 685
M 293R1 = 1500	STV 2118A	= 1000
BA 5406 = 180 BA 7766 = 175 BU 27515 = 1400 CNX 62A = 080 CNX 82A = 060 CNX 83A = 080 CNY 70 = 350 HA 11377 = 250 HA 11744 = 650 KA 2101 = 100 KIA 6299H = 200 LA 3160 = 120 LA 4120 = 270 LA 4270 = 300 LA 4505 = 220 LA 7225 = 250 LA 7830 = 090 LB 1294 = 125 LA 7830 = 100 M 710B1 = 610 M 523075P = 900 MB 8719 = 360 MDA 2060 = 350 MEA 2050 = 250 OM 370 = 1515 SAA 1025 = 250 SAA 1293A-31TT = 850 SAA 1293A-31TT = 850 SAA 1293A-31TT = 850	STV 2118B	= 1085
M 523075P = 900	STV 2145	= 400
MR 8719 = 360	STV 2151A	= 950
MDA 2060 = 350	STV 2160 STV 8224A	= 500
MFA 2050 = 250	STV 8224A	= 450
OM 370 = 1515	STV 9379	= 400
SAA 1025 = 250	STV 9379F TA 7280P TA 7318P	= 415
SAA 1250 = 250	TA 7280P	= 190 = 490 = 400 = 300
SAA 1293-3 = 515	TA 7318P	= 490
SAA 1293-3 = 515 SAA 1293-3 = 515 SAA 1293A-3ITT = 850 SAA 3004P = 400 SAA 7000 = 550 SAA 9057 = 475 SAF 1039P = 699 SMR 4000 = 825	TA 7698AP	= 400
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STK 441 = 980	TDA 3780	= 500
STK 463 = 850	TDA 4505M	= 1450
STK 4046/v = 1200	TDA 4944	= 175
STK 4151/2 = 850	TDA 7256	= 400
STK 4162/2 = 790	TDA 8218	= 300
SAF 1039P = 699 SMR 4000 = 825 STK 441 = 980 STK 463 = 850 STK 4046/v = 1200 STK 4151/2 = 850 STK 4162/2 = 790 STK 4843 = 2100 STK 5481 = 470 STK 5481 = 470	TDA 8740	= 600
STK 5481 = 470	TDA 9860	= 500
	TEA 2114	= 250
STK 730-060 = 645 STK 730-080 = 600	TEA 5114	= 200
	TEA 6101	= 550
STK 78603 = 850	TEA 8170	= 240
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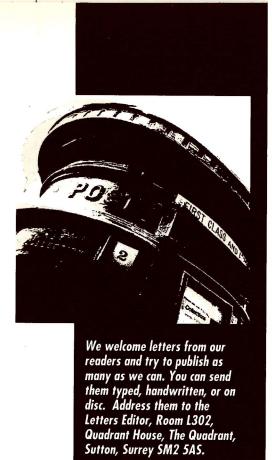
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Cancer

In a recent letter (July) Brian Milne asked about the incidence of cancer in the TV servicing trade. Several factors need to be considered.

The root of the recent scares about a connection between exposure to power-frequency EM fields and cancer was an American study that discovered a sharp increase in the incidence of leukaemia in homes situated under power cables. But further studies found that the true cause was the motor car. In the USA power lines frequently run alongside highways, and the cause of the cancer clusters was subsequently found to be exposure to benzene from car exhaust gas. Benzene is an extremely dangerous carcinogen: so dangerous that there's no safe minimum level of exposure. Its signature cancer is leukaemia. Benzene can enter the body by inhalation and through the skin.

Two factors, an initiator and a promoter, are required to cause cancer in an otherwise healthy organism. Initiators actually start the cancer, by causing genetic damage that leads to abnormal cell multiplication. Typical initiators are carcinogens like benzene, cigarette smoke and ionising radiation. Promoters speed the rate of growth of the cancer. Electromagnetic fields are known growth promoters, and as such can be used to aid bone and tissue healing after an accident or surgery. Unfortunately EM fields can also increase the rate of tumour growth. At present there is no evidence whatsoever that power-

Letters

frequency EM fields can initiate cancer.

There are several cancer risks associated with consumer electronics servicing. Many bench engineers smoke, exposing themselves and their non-smoking colleagues to significant risk. Dioxins, isocyanates and other nasties can be found in the smoke produced by burning plastics, and the colophony resin used in soldering fluxes isn't particularly good for you. British petrol contains high levels of benzene, significant amounts of which remain unburnt, to be pumped out of the exhaust pipe. Even a catalyst-equipped vehicle emits substantial amounts of benzene. Vehicle drivers are at greatest risk from benzene, and the TV trade can involve a lot of driving. Benezene's close relatives xylene and toluene are found in paints and adhesives. Living where he does, Brian Milne may face an additional risk factor: Aberdeen is based on granite, and will thus tend to have a higher level of radon gas in its atmosophere.

While working in close proximity to CRTs may expose a TV serviceman to higher levels of soft X-rays than the average viewer, it has been established that soft X-ray radiation below 30keV presents no significant risk. I have a Geiger counter that can detect X-rays, and have found no discernable increase in radiation above the background level from either my TV set or my computer monitor.

Apart from the environmental risks, cancer is one of the diseases of old age. It appears to be on the increase becasue we are all living longer. Statistically we all have a one-in-three chance of contracting some sort of cancer, although most cancers are now curable if caught in time.

A group of nutrients known as antioxidants are known to reduce your chances of developing cancer. They include vitamins C and E and beta-carotene. If, probably like most of us, your diet doesn't exactly fall into the 'healthy' class, you can buy antioxidants in capsule form. Vitamin

C is the major player, but the recommended daily allowance of 75mg is just the absolute minimum needed to prevent scurvy. Research has shown that large doses of vitamin C, typically the 1,000mg I take daily, appear to be effective in reducing the incidence of cancer. Smokers in particular need a good intake of vitamin C. I find the Asda and Superdrug own brands best value.

Pete Roberts, Runcorn, Cheshire.

Digital Problem

A couple of weeks ago a customer who had a problem with his Pace PRD800 satellite receiver called. During the course of the day the picture would disappear at random. The sound was still present, though noisy. I replaced transistor Q105 and all the usual power supply electrolytics and the unit behaved perfectly. But when I plugged it in at the customer's house the picture had disappeared! While fiddling with the connections etc. I discovered that the picture reappeared when the UHF input was disconnected. The incoming signals were found to be at about 80dBuV we're about two miles from the Black Hill transmitter. Signal attenuation only made matters worse.

My spectrum analyser showed that signal levels in about a 30dB range were present. There was nothing obvious at the same frequency and about the same level however. But when the sensitivity of the meter was increased definite noise at about 45dBµV was detected. I checked with the BBC, and was told that digital tests on several channels had been carried out during the past few weeks. The customer said that the picture would always reappear at 5.30 p.m., and never went during the weekend.

The test transmissions seem to be pretty much full-time now, and I've had about six other customers with the same problems. Our local transmitters are Black Hill (chs. 37-50) and Craigkelly (chs. 21-31 + 48). I

continued on page 807



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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
BC107 BC108	8p 8p	BD434 BD435	30p 31p	BU126 BU128	65p 125p	BUV48AF BUV48C BUV50	325p 250p 425p	MJ4502 MJ10012 MJ11015	300p 300p 250p	4N35	50p	LINEAR IO	210p	AN6340 AN6341 AN6342	600p 200p 325p	BA335 BA338 BA340	55p 80p 75p	BA7004 BA7007 BA7021	200p 200p 180p
BC109 BC109C BC140	8p 10p 20p	BD436 BD437 BD438	30p 28p 36p	BU133 BU137 BU180 BU184	125p 150p 100p 100p	BUV61 BUV70 BUV90	1000p 200p 175p	MJ11016 MJ11032 MJ11033	300p 800p 800p	RECTIFIER DIODES		AN210 AN211 AN214Q	165p 150p 170p	AN6344 AN6345 AN6346	440p 400p 350p	BA343 BA336 BA401	60p 175p 60p	BA7022 BA7025L BA7107	350p 100p 475p
BC142 BC143 BC147	20p 20p 8p	BD439 BD440 BD441	40p 40p 40p	BU204 BU205	65p 70p	BUV93 BUW11A	375p 200p	MJ15003 MJ15004	250p 300p	BY127 BY133 BY164	8p 8p 40p	AN217P AN228 AN252	95p 280p 150p	AN6350 AN6352 AN6356	610p 450p 300p	BA402 BA511 BA514	50p 145p 160p	BA7212S BA7252S BA7604N	200p 150p 100p
BC149 BC159 BC160	8p 30p	BD533 BD534 BD535	50p 38p 38p	BU206 BU207 BU208	100p 150p 70p	BUW11AF BUW12 BUW12A	225p 125p 150p 250p	MJ15015 MJ15016 MJ15022 MJ15023	250p 350p 400p 400p	BY179 BY184 BY206	35p 32p 11p	AN259 AN262 AN271	250p 140p 230p	AN6359 AN6360 AN6362	500p 320p 400p	BA516 BA518 BA521	150p 150p 100p	BA7751LS BA7752 BA7755	150p 250p 150p
BC171 BC172 BC177	10p 10p 14p	BD536 BD537 BD538	38p 40p 40p	BU208A BU208AT BU208B BU208D	75p 200p 200p 130p	BUW12F BUW13A BUW32A BUW48	200p 500p 550p	MJ 15023 MJ 15024 MJ 15025 MJ E340	400p 700p 25p	BY207 BY227 BY228	20p 19p 28p	AN274 AN277B AN278	250p 400p 60p	AN6363 AN6367NI AN6368	375p	BA524 BA526 BA527	240p 180p 95p	BA7767AS BA8504 BA15218	155p 350p 60p
BC178 BC179 BC182 BC182L	14p 14p 7p 7p	BD643 BD645 BD647 BD649	50p 50p 50p 50p	BU209 BU225 BU226	90p 120p 120p	BUW49 BUW50 BUW81A	550p 400p 150p	MJE350 MJE520 MJE2955T	80p 30p 65p	BY298 BY299 BY329-1200 BY448	15p 18p 150p 20p	AN301 AN302 AN303	330p 650p 250p	AN6371 AN6387 AN6550	350p 480p 100p	BA532 BA534 BA536	100p 220p 150p	CA3140E CNX62A CNX82A	38p 50p 60p
BC183 BC183L BC184	7p 7p 7p 7p	BD675 BD676 BD677	40p 40p 38p	BU312 BU325 BU326A	90p 55p 75p	BUW84 BUW85 BUX10	75p 85p 150p	MJE3055T MJE13004 MJE13005	65p 100p 60p	BYT11 BYT13-1000 BYV96E	25p	AN304 AN315 AN316	360p 210p 350p	AN6551 AN6552 AN6554	50p 45p 80p	BA546 BA612 BA614	160p 120p 70p	CNX83A CX136 CX139A	80p 600p 750p
BC184L BC212 BC212L	7p 7p 7p	BD678 BD679 BD680	40p 40p 40p	BU406 BU406D BU407	60p 85p 55p	BUX11 BUX12 BUX20	200p 150p 350p	MJE13007 MJE13009 MJE15028	100p 100p 200p	BYW96E BYX10 BYX55/600	36p 15p 25p	AN337 AN360 AN362 AN363	600p 100p 140p 150p	AN6555 AN6605 AN6612	50p 35p 60p	BA618 BA631 BA656	55p 280p 110p	CX141 CX145 CX150B	750p 725p 325p
BC213 BC213L BC214	7p 7p 7p	BD681 BD682 BD705	45p 45p 50p	BU407D BU408 BU408D	75p 60p 75p	BUX21 BUX22 BUX23	450p 450p 900p	MJE15029 MJE15030 MJE15031	200p 250p 400p	IN4001 IN4002 IN4003	3p 3p 3p	AN366 AN610 AN3211K	150p 160p 375p	AN6650 AN6651 AN6652	45p 45p 45p	BA658 BA681A BA682A	350p 350p 300p	CX175 CX187 CX804A	325p 825p 775p
BC214L BC237 BC238	7p 7p 7p	BD707 BD709 BD711	50p 50p 50p	BU409 BU412 BU413	85p 175p 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	AN6671K AN6676 AN6780S	425p 600p 80p 450p	BA683A BA684 BA685 BA715	300p 400p 400p 45p	CX867 CX868 CX877 CX7925B	575p 525p 300p 550p
BC239 BC300 BC301	7p 20p 20p	BD736 BD826 BD828	50p 50p 50p	BU414B BU415A BU426A	250p 170p 70p	BUX41 BUX42 BUX47A	200p 200p 220p	OC28 OC29 OC35	350p 250p 350p	IN4007 IN4148 IN5400	4p 2p 9p	AN3310K AN3312 AN3313	325p 350p 300p	AN6870 AN6875 AN6878 AN6879	150p 150p 65p 225p	BA718 BA728 BA806	45p 55p 220p	CX20015A CX20106A CX20109	600p 75p 140p
BC302 BC303 BC304	20p 20p 25p	BD839 BD897 BD899	55p 50p 50p	BU433 BU500 BU500D	120p 100p 225p	BUX48A BUX55 BUX80	150p 800p 180p	OC36 S2000A3 S2000AF S2055A	250p 175p 90p 175p	IN5401 IN5402 IN5403	8p 8p 8p	AN3320K AN3331K AN3792	450p 450p 300p	AN6880 AN6882 AN6884	75p 300p 200p	BA843 BA1310 BA1320	130p 160p 75p	CX20187 CXA1001AP CXA1019P	700p 1600p 150p
BC327 BC328 BC337	7p 7p 7p	BD977 BDX33 BDX37 BDX44	50p 60p 100p 100p	BU505 BU505D BU505DF BU506	90p 90p 90p 100p	BUX81 BUX84 BUX85 BUX86	160p 50p 50p 50p	S2055AF S2530A TIP29	175p 175p 100p 15p	IN5404 IN5405 IN5406	8p 11p 12p	AN3794 AN3814K AN3821K	325p 450p 600p	AN6888 AN6889 AN6913	150p 100p - 60p	BA 1330 BA 1332 BA 1350	120p 60p 130p	CXA1019S CXA1044P CXA1044BF	225p 550p 475p
BC338 BC441 BC446 BC477	7p 28p 8p 18p	BDX47 BDX54C BDX62C	60p 75p 150p	BU506D BU506DF BU508A	70p 100p 60p	BUX87 BUX98A BUZ71	50p 350p 75p	TIP29A TIP29C TIP29E	22p 25p 40p	IN5407 IN5408 RGP10 RGP15	12p 12p 25p	AN3822K AN3830K AN3990K	600p 800p 300p	AN700 AN7010K AN7025K	650p 250p 90p	BA1355 BA1356 BA1360	125p 100p 160p	CXA1081 CXA1081M CXA1081S	275p
BC516 BC537 BC546	22p 25p 8p	BDX63C BDX64C BDX65	175p 175p 175p 80p	BU508AF BU508APH BU508D	60p 60p 75p	BUZ71AF BUZ72A BUZ72AF	100p 100p 100p	TIP30 TIP30C TIP31A	25p 25p 22p	RGP30 SR2M	25p 16p 50p	AN3991K AN5010 AN5011	400p 250p 225p	AN7060 AN7062 AN7072	175p 300p 250p	BA1404 BA1604 BA2266A	120p 125p 250p	CXA1082AS CXA1191M CSA1209P	1000p 250p 400p
BC548 BC548 BC549	8p 8p 8p	BDX66C BDX67C BDX71	175p 275p 70p	BU508DF BU508DR BU508V	85p 130p 110p	BUZ73A BUZ73AF BUZ76A	150p 60p 110p	TIP31C TIP32 TIP32A	27p 24p 21p	I.C. SOCKE		AN2020 AN5025 AN5033	80p 250p 400p	AN7081K AN7105 AN7106K	200p 170p 135p	BA3306 BA3308 BA3312	60p 1 70p 60p	FT5754M FT5764M HA1124	600p 250p 125p
BC550 BC556 BC557	8p 8p 8p	BDX77 BDX87C BDX88C	175p 175p 150p	BU508VF BU526 BU536	100p 75p 100p	BÚZ80 BÚZ80AF BÚZ83	135p 200p 200p	TIP32C TIP33 TIP33C	28p 50p 60p	8 PIN 14 PIN 16 PIN 18 PIN	4p 5p 6p	AN5034 AN5070 AN5071	400p 125p 100p	AN7110 AN7111 AN7112	75p 100p 45p	BA3402 BA3406AL BA3416BL	90p 120p 80p	HA1125 HA1137W HA1151	120p 150p 175p
BC558 BC559 BC560	8p 8p 8p	BDW24 BDW93 BDW94	55p 50p 50p	BU546 BU603 BU606D	125p 125p 225p	BUZ90A BUZ91A BY448	180p 260p 20p	TIP34 TIP34C TIP35C	65p 60p 65p	20 PIN 22 PIN 24 PIN	9p 10p 12p 13p	AN5111 AN5132 AN5135NI AN5138NI		AN7114 AN7115 AN7116	120p 110p 90p	BA3422 BA3505F BA3506A	350p 140p 70p	HA1197 HA1199 HA1201 HA1202	130p 130p 225p 125p
BC637 BC639 BC640	20p 20p 20p	BDY29 BDY56 BDY58	225p 225p 500p	BU608D BU626 BU705	120p 120p 130p 175p	BYT11 IRF120 IRF130 IRF140	25p 225p 475p 550p	TIP36C TIP41A TIP41C TIP42A	65p 20p 22p 20p	28 PIN 40 PIN	13p 15p	AN5150 AN5151 AN5210	400p 200p 675p	AN7117 AN7120 AN7130 AN7131	65p 100p 75p 90p	BA3516 BA3520 BA3521 BA3704	120p 130p 225p 200p	HA1319 HA1338 HA1339A	200p 300p 350p
BCY33 BCY34 BCY70 BCY71	200p 200p 16p 16p	BDY90 BDY92 BF137 BF167	125p 100p 35p 30p	BU706DF BU706F BU724A BU801	150p 100p 70p	IRF230 IRF240 IRF250	550p 550p 425p 375p	TIP42C TIP47 TIP48	22p 40p 40p	ZENER DIC		AN5215 AN5222 AN5250	100p 200p 160p	AN7133N AN7134 AN7140	325p 300p 170p	BA3706 BA3812L BA3822LS	75p 80p 80p	HA1367 HA1377 HA1384	300p 120p 600p
BCY72 BD115 BD124P	16p 30p 50p	BF181 BF183 BF195	18p 20p 7p	BU806 BU807 BU807F	70p 60p 75p	IRF330 IRF340 IRF350	600p 325p 750p	TIP50 TIP51 TIP52	60p 80p 80p	2V7 to 39V 1.3 Watts 2V7 to 39V	5p 9p	AN5256 AN5260 AN5262	150p 300p 175p	AN7141 AN7142 AN7145	70p 80p 195p	BA3824LS BA3920 BA4110	75p 300p 75p	HA1388 HA1389 HA1392	320p 210p 120p
BD131 BD132 BD133	25p 25p 50p	BF199 BF200 BF225	8p 16p 30p	BU808DF BU810 BU824	210p 110p 60p	IRF450 IRF510 IRF520	650p 110p 110p	TIP54 TIP102 TIP105	85p 70p 65p	VOLTAGE REGULATO	nec .	AN5265 AN5315 AN5352 AN5411	80p 600p 600p 450p	AN7146 AN7147 AN7148	210p 180p 140p	BA4210 BA4220 BA4234L	85p 60p 70p	HA1394 HA1396 HA1397	170p 650p 200p
BD135 BD136 BD137	20p 20p 20p	BF240 BF245 BF254	16p 25p 15p	BU826 BU826A BU902	120p 160p 110p	IRF530 IRF540 IRF610	120p 120p 120p	TIP106 TIP107 TIP110	65p 65p 40p	7805 7806	18p 18p	AN5421 AN5429 AN5431	150p 420p 275p	AN7149 AN7154 AN7156	160p 180p 240p	BA4236L BA4402 BA4403	110p 45p 220p	HA1398 HA1406 HA11123 HA11211	175p 120p 350p 170p
BD138 BD139 BD140	20p 20p 20p	BF255 BF256 BF257	12p 18p 18p	BU903 BU910 BU912	110p 80p 100p	IRF611 IRF620 IRF630	120p 160p 110p	TIP111 TIP112 TIP112H TIP115	40p 35p 50p 30p	7808 7812 7815	25p 18p 25p	AN5435 AN5436N AN5512	125p 160p 100p	AN7158 AN7160 AN7161N AN7163	310p 350p 375p 175p	BA4405 BA4412 BA5101 BA5102	80p 50p 350p 140p	HA11215 HA11219 HA11221	350p 280p 180p
BD144 BD157 BD166 BD175	90p 38p 30p 30p	BF259 BF262 BF270 BF273	18p 25p 18p 15p	BU920 BU922 BU930 BU932	100p 110p 130p 175p	IRF640 IRF642 IRF650 IRF710	300p 200p 200p 150p	TIP116 TIP117 TIP120	30p 30p 30p 37p	7818 7824 7905 7906	25p 25p 25p 30p	AN5515 AN5520 AN5521	160p 550p 100p	AN7166 AN7168 AN7169	350p 200p 225p	BA5115 BA5115L BA5204	75p 75p 200p	HA11225 HA11235 HA11244	130p 100p 375p
BD177 BD179 BD181	30p 32p 45p	BF311 BF336 BF337	21p 20p 20p	BU941 BU2508A BU2508AF	250p 100p	IRF720 IRF730 IRF740	150p 125p 125p	TIP121 TIP122 TIP125	35p 30p 30p	7908 7912 7915	30p 30p 30p	AN5560 AN5601K AN5612	350p 750p 200p	AN7170 AN7171K AN7172K	260p 400p 325p	BA5208AF BA5402 BA5406	110p 180p 180p	HA11247 HA11251 HA11412	375p 120p 600p
BD182 BD184 BD187	60p 60p 30p	BF338 BF362 BF367	20p 30p 13p	BU2508D BU2508DF BU2520AF	130p 120p 170p	IRF820 IRF830 IRF840	110p 110p 110p	TIP126 TIP127 TIP130	40p 35p 30p	7918 7924 78L05	30p 30p 24p	AN5613 AN5615 AN5620	200p 300p 250p	AN7173K AN7177 AN7178	450p 375p 180p	BA5408 BA5413 BA6104	180p 225p 250p	HA11414 HA11423 HA11440	300p 110p 250p
BD201 BD202 BD203	33p 38p 42p	BF371 BF421 BF422	17p 18p 21p	BU2520DF BU2525A BU2525AF	225p 325p 220p	IRF9140 IRF9510 IRF9511	1000p 150p 150p	TIP131 TIP132 TIP136	30p 30p 40p	78L08 78L12 78L15	24p 24p 24p	AN5622 AN5625 AN5630 AN5633	275p 400p 375p 350p	AN7205 AN7213 AN7216	35p 40p 175p	BA6109 BA6110 BA6125 BA6137	110p 225p 75p	HA11485BN HA11702 HA11703 HA11706	400p 330p 400p 280p
BD204 BD222 BD225	42p 31p 31p	BF423 BF455 BF458	25p 12p 19p	BU2527AF BUF405A BUH315 BUH315D	400p 200p 200p 175p	IRF9520 IRF9530 IRF9531 IRF9540	150p 200p 200p	TIP137 TIP162 TIP141 TIP142	65p 110p 65p 75p	78L18 78L24 79L05	24p 24p 35p	AN5635N AN5640 AN5700	330p 500p 90p	AN7218 AN7220 AN7222 AN7223	60p 85p 75p 105p	BA6138 BA6146 BA6149LS	55p 130p 150p 700p	HA11710 HA11713 HA11715	500p 250p 250p
BD232 BD233 BD234 BD235	31p 30p 32p 28p	BF462 BF471 BF472 BF479	50p 28p 28p 30p	BUH515 BUH515D BUH517	200p 250p 275p	IRF9540 IRF9610 IRF9620	240p 200p 120p 110p	TIP145 TIP146 TIP147	50p 70p 80p	79L08 79L12 79L15 LM309K	35p 35p 35p	AN5701 AN5710 AN5712	150p 100p 180p	AN7224 AN7225 AN7254	75p 175p 150p	BA6154 BA6208 BA6209	60p 175p 85p	HA11716 HA11718 HA11724	480p 700p 650p
BD236 BD237 BD238	30p 21p 24p	BF494 BF495 BF595	16p 16p 16p	BUH517D BUH715 BUT11A	175p 425p 35p	IRF9622 IRF9630 IRF9640	200p 180p 280p	TIP150 TIP151 TIP2955	90p 60p 50p	LM317T LM323K 78H08KC	100p 100p 350p 800p	AN5720 AN5722 AN5730	70p 140p 160p	AN7256 AN7273 AN7310	250p 75p 60p	BA6218 BA6220 BA6222	85p 55p 130p	HA11741N1 HA11744 HA11745	330p 330p 330p
BD239 BD240 BD241A	30p 40p 40p	BF596 BF615 BF617	16p 30p 30p	BUT11AF BUT12 BUT13	35p 80p 310p	IRFD9220 IRFBC30 IRFBC40	100p 150p 250p	TIP3055 TIPL760 TIPL762A	50p 100p 200p	79H12KC 79HGKC	700p 800p	AN5732 AN5750 AN5753	120p 75p 130p	AN7311 AN7312 AN7315	90p 70p 40p	BA6227 BA6229 BA6235	50p 130p 50p	HA11749 HA11751 HA11752	350p 1500p 325p
BD243A BD244 BD245	50p 50p 50p	BF760 BF763 BF870	40p 40p 22p	BUT18 BUT18AF BUT30V	80p 65p 1700p	IRFP140 IRFP150 IRFP240	250p 300p 300p	TIPL763A TIPL791A 2N2369	200p 80p 15p	LEDs	r	AN5763 AN5790 AN5791	250p 240p 225p	AN7330 AN7362 AN7363	110p 200p 225p	BA6238A BA6239A BA6247	130p 130p 150p	HA11839N1 HA11847 HA12002	700p 220p
BD246A BD265 BD267	50p 45p 45p	BF871 BF960 BF961	22p 38p 35p	BUT56A BUT76A BUT90	65p 80p 1300p	IRFP250 IRFP350 IRFP450	280p 325p 325p	2N2646 2N2904 2N2905 2N2906	40p 20p 20p	3mm RED YELLOW GREEN	5p 8p 8p	AN5836 AN5862K AN5900 AN608P	450p 225p 130p 125p	AN7410 AN7411 AN7414 AN7415	150p 50p 275p 70p	BA6248 BA6259 BA6280AF BA6290A	140p 170p 300p 200p	HA12003 HA12005 HA12010 HA12016	150p 180p 300p 120p
BD269 BD278 BD311	45p 50p 100p	BF964 BFQ232 BFQ252A	38p 75p 60p	BUT92 BUV18 BUV20 BUV21	1200p 650p 650p	IRFP460 IRFP9140 IRFP9240	775p 1450p 350p	2N2906 2N2907 2N3019 2N3053	18p 18p 28p 18p	5mm RED YELLOW	5p 8p	AN620 AN6130 AN6135	250p 130p 120p	AN7470 AN8053 AN8275	100p 200p 250p	BA6294 BA6302A BA6304	250p 150p 120p	HA12017 HA12026 HA12038N1	100p 125p 140p
BD314 BD315 BD317 BD331	100p 150p 150p 40p	BFR90 BFR91 BR100 BR103	85p 99p 14p 37p	BUV21 BUV23 BUV24 BUV25	400p 475p 350p 110p	IRFPC50 IRFRC20 IRFZ20 IRFZ42	600p 250p 65p 275p	2N3053 2N3054 2N3055 2N3055H	40p 38p 50p	GREEN	8p	AN6209 AN6250 AN6247	350p 50p 200p	AN8370 AN8377 AN8387	1000p 400p 350p	BA6305 BA6321 BA6328	140p 250p 250p	HA12044 HA12045 HA12047	350p 280p 450p
BD331 BD332 BD361 BD362	40p 40p 60p 60p	BR303 BU105 BU108	85p 80p 100p	BUV26 BUV27 BUV28	150p 125p 110p	IRFZ44 MJ2501 MJ2955	160p 100p 55p	2N3440 2N3441 2N3442	45p 175p 85p	RECTANG LEDs	ULAR	AN6270 AN6300 AN6306	400p 600p 380p	BA222 BA225 BA314	65p 100p 40p	BA6334 BA6410 BA6411	75p 220p 250p	HA12058 HA12088 HA12116	320p 375p 130p
BD370 BD371 BD410	30p 30p 50p	BU109 BU110 BU111	80p 90p 100p	BUV37 BUV46A BUV47	175p 75p 120p	MJ3000 MJ3001 MJ4032	100p 100p 175p	2N3771 2N3772 2N3773	85p 90p 100p	5mm x 2.5 RED YELLOW	5p 8p	AN6310 AN6320 AN6326N	200p 180p 250p	BA301 BA311 BA313	55p 80p 60p	BA6418N BA6435S BA6993	100p 425p 150p	HA12411 HA12412 HA12413	175p 175p 70p
BD433	28p	BU124	60p	BUV48A	175p	MJ4035	175p	2N3819	29p	GREEN	8p	AN6332	320p	BA333	80p	BA7001	150p	HA12430	200p

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Part HA13001	Price		Price	Part	Price		Price		Price		Pric		Price	e Part	Price	Part	Price	Part	Price
HA13001 HA13006	650p 200p 400p	LA2800 LA3120 LA3150	350p 200p	LA7096 LA7113	200p 275p	LF353 LF355	48p 60p	MC3401	50p 45p	SAB3029 SAB3035	275) STK3106		STK5478 STK5479	380p 300p	STR16006 STR17006	500p	TA7281	200p
HA13007 HA13108	300p 280p	LA3160 LA3161	200p 120p	LA7116 LA7123	125p 1300p	LF357 LF398	70p 300p	MC3423P MC3488A	100p P 250p	SAB3036 SAB3037	725; 700;	STK3122 STK3152	III 725p	STK5481	470p 285p	STR20005 STR20012	450p 450p	TA7210	160p 200p
HA13117	175p	LA3210	40p 65p	LA7210 LA7212	60p 150p	LH2426S LM301	600p 26p	MN1220T	AP 300p	SAB3042 SAB3064	825p	STK3156		STK5483	440p 450p	STR20015	450p	TA7284P	200p 400p
HA13118 HA13119	140p 140p	LA3226 LA3246	60p 75p	LA7214 LA7220	150p 125p	LM311 LM319	35p 165p	MN1226 MN1228	450p 600p	SAB3209 SAB3210	225	I STK 4019	480p 380p	STK5487	525p 480p	STR30110 STR30115	330p 275p	TA7288 TA7291P	220p 200p
HA13127 HA13128 HA13130	350p 400p	LA3300 LA3301	140p 110p	LA7222 LA7224	110p 150p	LM324 LM335Z	30p 120p	MN1276	1300p 70p	SAB6456 SAB8048	125p 225p	STK4024	II 550p	STK5490	450p 450p	STR30120 STR30123 STR30125	400p 450p 550p	TA7292P	325p 450p
HA13135 HA13139	450p 500p 600p	LA3361 LA3365	100p 70p	LA7225 LA7292	250p 275p	LM339 LM348	35p 50p	MN3004 MN3005	600p 2000p	SAB8051 SDA2003	AP 700	STK4026	480p 550p	STK5720	400p 450p	STR30130 STR40090	250p 350p	TA7299	200p 75p
HA13150A HA13151		LA3370 LA3373 LA3375	70p 70p	LA7294 LA7295	200p 160p	LM358 LM380	45p 80p	MN3011 MN3101	4000p 110p	SDA2004 SDA2005	325p 700p	STK4032	II 1050p	STK5730	450p 300p	STR40115 STR41090	600p 330p	TA7303	70p
HA13403 HA13406V	400p	LA3376 LA3380	300p 80p 300p	LA7297 LA7305A	120p 350p	LM381 LM382	150p 130p	MN3102 MN3207	110p 375p	SDA2007 SDA2008	300p 400p	STK4036 STK4038	470p 680p	STK6324E		STR43111 STR44115	950p 475p	TA7307 TA7310	100p 100p
HA 13408 HA 13412	350p 600p	LA3390 LA3400	250p 250p	LA7308 LA7311	70р 200р	LM386 LM387	60р 100р	MN3208 MN6030B	950p 350p	SDA2112 SDA2120	450p 200p	STK4042	11 650p	STK6328A	800p 850p	STR45111 STR50020	550p 350p	TA7312 TA7313	120p 70p
HA13426 HA13432	500p 400p	LA3401 LA3410	90p 150p	LA7320 LA7323 LA7330	120p 325p	LM389N	105p 45p	MN6163A MTA001M		SDA2131 SDA2208	225p 450p	STK4046	950p 950p	STK6607	400p 725p	STR50092 STR50103/	550p	TA7314 TA7315	175p 200p
HA13441 HA17524	450p 250p	LA3430 LA3600	135p 60p	LA7331 LA7332	350p 250p 225p	LM431 LM710	50p 45p	NE555 NE556	20p 40p	SDA4212 SDA5241	775p 725p	STK4050	1280p	STK6732	1000p 900p	STR50113 STR50115	500p 500p	TA7317P TA7320P	120p 200p
KA2102 KA2130	100p 150p	LA3605 LA3607	100p 125p	LA7340 LA7376	300p 150p	LM723 LM741DIL LM741ME	40p 18p	NE558 NE565	80p 110p	SDA5243 SDA5343	1450p	STK4065	510p 650p	STK6932	1000p 525p	STR51041 STR50213	500p 500p	TA7322 TA7323	130p 80p
KA2131 KA2206	110p 150p	LA4030 LA4031	180p	LA7391 LA7520	550p 200p	LM747 LM1017	45p 55p 200p	NE567 NE571 NE592	115p 290p	SDA5640 SDA5642	200p 450p	STK4111	500p 500p	STK6972	275p 490p	STR53041 STR54041	400p 320p	TA7234 TA7325	75p 90p
KA2209 KA2210	125p 230p	LA4032 LA4051	140p 160p	LA7530 LA7535	200p 175p	LM1035N LM1040N	350p 650p	NE5532P SAA1000	85p 140p	SGSF444 SGFS465	500p 500p	STK4112 STK4121	500p 480p	STK6982	600p	STR55041 STR56041	450p 550p	TA7326 TA7328	200p 110p
KA2212 KA2213	65p 130p	LA4100 LA4101	85p 80p	LA7545 LA7550	160p 275p	LM1203 LM1203AN	225p	SAA1004 SAA1005	350p 650p 325p	SLA4031 SLA7020 STA301A	750p 4 450p 200p	STK4131	560p 480p	STK7216	420p	STR58041 STR59041	250p 300p	TA7330P TA7331P	80p 80p
KA2214 KA2224	100p 50p	LA4102 LA4110	100p 120p	LA7555 LA7620	150p 500p	LM1875T LM1881N	330p 375p	SAA1006 SAA1008	300p 450p	STA341M STA401A	180p 220p	STK4133 STK4141	750p	STK7225	400p 500p	STR60001 STR80145	525p 475p	TA7333 TA7335	100p
KA2244 KA2261	75p 100p	LA4120 LA4138	270p 105p	LA7680 LA7681	675p 650p	LM1886 LM1889	250p 300p	SAA1010 SAA1024	400p 250p	STA403A STA405A	270p 280p	STK4142 STK4147	530p	STK7251	600p 500p	STR81145 STR90120	375p 425p	TA7336	85p 180p
KA2263 KA2264	100p 100p	LA4140 LA4142	60p 65p	LA7710 LA7800	250p 90p	LM1894N LM1895N	200p 275p	SAA1025 SAA1026	250p 400p	STA431A STA432A	250p 220p	STK4151	680p 650p	STK7308 STK7309	450p 350p 400p	STRD1206 STRD1406 STRD1706	500p 600p	TA7337P TA7339P	175p 175p
KA2284 KA2309 KA2401	75p 175p	LA4145 LA4160	65p 100p	LA7801 LA7802	100р 300р	LM2901N LM2902N	35p 40p	SAA1027 SAA1029	400p 150p	STA434A STA435A	270p 270p	STK4161 STK4162	650p 550p	STK7310 STK7348	470p 400p	STRD1806 STRD1816	360p 360p 350p	TA7341 TA7342P	250p 70p
KA2412 KA2912	150p 225p 125p	LA4162 LA4178 LA4180	110p 150p	LA7806 LA7808	260p 250p	LM2903N LM3900	40p 40p	SAA1042 SAA1043P	325p 675p	STA441C STA451C	220p 280p	STK4164 STK4171	1175p 900p	STK7356 STK7358	425p 440p	STRD1906 STRD3035	550p 300p	TA7343 TA7347P	120p 120p
KA2913A KA2914A	175p 200p	LA4182 LA4190	150p 180p 300p	LA 7820 LA7823 LA7824	100p 200p	LM3909 LM3911N	100p 200p	SAA1044 SAA1056	400p 300p	STA456C STA471	240p 210p	STK4172 STK4181	680p 680p	STK7402 STK7404	560p 600p	STRD4412 STRD4420	500p 550p	TA7348P TA7349P	125p 175p
KA22427 KIA6213S	100p 60p	LA4192 LA4200	140p 130p	LA7830 LA7831	130p 90p	LM3914 LM3915	160p 160p	SAA1057 SAA1058	375p 225p	STA901M STK0025	280p 420p	STK4182 STK4191	750p 700p	STK7406 STK7408	650p 675p	STRD4512 STRD5441	400p 475p	TA7354P TA7357	65p 340p
KIA6210AH KIA6281H	400p 250p	LA4201 LA4260	120p 230p	LA7832 LA7835	85p 130p 150p	LM3916 LM8363 LM8560	270p 320p	SAA1060 SAA1061	375p 250p	STK0029 STK0039	1000p 600p	STK4192 STK4211		STK7410 STK7458	1500p 1250p	STRD5541 STRD6008	450p 575p	TA7358 TA7359P	85p 90p
KIA6283K KIA6299H	150p	LA4261 LA4265	300p 125p	LA7837 LA7838	150p 200p	LM13600 LM13700	175p 150p 125p	SAA1062 SAA1063 SAA1064	250p 250p	STK0040 STK0049	520p 510p	STK4211	1200p	STK7554 STK7561	600p 650p	STRD6009E STRD6018	450p 450p	TA7361 TA7362	125p 150p
KIA7227CP KIA7313	200p 45p	LA4270 LA4282	300p 350p	LA7850 LA7851	225p 200p	LM18293 M4918B1	500p 800p	SAA1070 SAA1073	275p 550p 325p	STK0050 STK0059 STK0060	440p 620p	STK4231	1050p	STK7562 STK7563	1000p 800p	STRD6602 STRD6601	475p 650p	TA7364P TA7366P	175p 65p
L149V L165V	300p 250p	LA4420 LA4422	140p 130p	LA7910 LA7913	150p 90p	M494B1 M5265P	700p 200p	SAA1075 SAA1086	350p 175p	STK0000 STK0070 STK0080	820p 1100p 1000p	STK4241 V STK4272 STK4273	√ 1250p 500p 550p	STK7573 STK7576 STK7703	400p 1500p	STRM6545 STRM6546	900p	TA7368P TA7373F	35p 150p
L200 L272 L272M	200p 200p	LM4425A LA4430	200p 130p	LA7930 LA7940	350p 200p	M50115P M50117P	320p 500p	SAA1089 SAA1101	325p 700p	STK011 STK015	330p 440p	STK4301 STK4311	500p 650p	STK8050 STK8250	1000p 1600p 500p	STRM6549 STRS5741 STRS5941	500p 800p 750p	TA7374 TA7376P	175p 100p
L290B L291B	110p 225p 300p	LA4440 LA4445 LA4446		LA7953 LA9200	300p 300p	M50119P M50422P	525p 750p	SAA1124 SAA1130	200p 550p	STK016 STK025	760p 650p	STK4332 STK4352	365p 500p	STK8260 STK8280	1200p 1850p	STRS6307 STRS6308	600p	TA7378P TA7401	60p 250p
L292 L293B	750p	LA4460 LA4461	170p 120p 120p	LB1205 LB1216 LB1258	170p 150p 100p	M50461 M50784	350p 300p	SAA1250 SAA1251	280p 380p	STK050 STK077	1600p 520p	STK4362 STK4372	450p 600p	STK73405 STK73410	350p	STRS6309 STRS6707	600p 1000p	TA7402P TA7403	200p 325p
L293C L293D	325p	LA4466 LA4470		LB1268 LB1274	70p 85p	M50786 M50790 M51014L	500p 600p 120p	SAA1271 SAA1274 SAA1290	400p 280p	STK078 STK080	1800p 550p	STK4392 STK4412	500p 450p	STK7340 II STK73605	500p 375p	STRS6708 TA7054	575p 190p	TA7404 TA7405P	150p 200p
L293E L294	250p 475p	LA4475 LA4476	225p	LB1290 LB1292	120p	M51143AL M51161	110p 300p	SAA1293 SAA1294	750p 550p 800p	STK082 STK084 STK085	2000p 600p 900p	STK4432 STK4773	600p 820p	STK73907 STK78617	700p 2400p	TA7061 TA7062	115p 200p	TA7411AP TA7415P	150p 350p
L295 L297	525p	LA4480 LA4485	225p	LB1405 LB1407	70p 130p	M51161P M51162P	250p 250p	SAA1300 SAA1310	200p 200p	STK086 STK0100	1000p 900p	STK4793 STK4803 STK4813	800p 1000p 800p	STR370 STR371 STR380	300p 400p	TA7066 TA7075P	120p 300p	TA7417AP TA7521P	225p 350p
L298 L465A	525p	LA4495 LA4496	250p	LB1409 LB1412	200p 300p	M51164AL M51166P	80p 300p	SAA1350 SAA1351	275p 750p	STK0100II STK420	1200p 400p	STK4833 STK4843	850p 720p	STR381 STR383	350p 390p 410p	TA7089 TA7102P TA7119	300p 500p	TA7607 TA7608	200p 360p
L482 L497B L702B	525p	LA4498 LA4500	200p	LB1415 LB1416	100p 85p	M51182L M51191L	110p 85p	SAA1900S SAA3004	475p 400p	STK430 STK433	500p 400p	STK4853 STK4863	1700p 700p	STR384 STR440	350p 800p	TA7120 TA7124	150p 55p 250p	TA7609 TA7611	170p 210p
L702N L702N L2720	325p	LA4505 LA4508	200p	LB1426 LB1450	125p 110p	M51231P M51308SP	200p 550p	SAA3006P SAA3007P	225p 130p	STK435 STK436	375p 430p	STK4873 STK4893	1100p 1000p	STR441 STR442	950p 1600p	TA7130P TA7137	85p 60p	TA7612 TA7613AP	300p
L2722 L4960	175p	LA4510 LA4520 LA4550	170p	LB1615 LB1620	270p 210p	M51310AP M51316P	900p 300p	SAA3008P SAA3010P	200p 300p	STK437 STK439	600p 500p	STK4913 STK5314	900p 475p	STR450A STR451	700p 800p	TA7140 TA7141	100p 825p	TA7614	90p 170p
L6203 L6210	600p	LA4555 LA4557	120p	LB1622 LB1630 LB1639		M51320 M51356P	200p 400p	SAA3027P SAA3049P	375p 550p	STK441 STK443	680p 700p	STK5315 STK5322	500p 500p	STR452 STR453	600p 500p	TA7150P TA7157	250p 100p	TA7616 TA7621	300p
L6221AS, L6506	300p	LA4558 LA4570	125p	LB1640 LB1641	300p 150p 75p	M51358P M51365P M51366P	150p 350p 360p	SAA4700 SAA5000 SAA5010	200p	STK457 STK459	470p 560p	STK5323 STK5324	600p 450p	STR454 STR455	1300p 550p	TA7172P TA7193	150p 320p	TA7622 TA7628	420p 110p
LA1130 LA1135	240p	LA4571 LA4581	175p	B1642 B1645		M51381P M51384AP	200p	SAA5012 SAA5020		STK460 STK461	660p 600p	STK5325 STK5326	370p 750p	STR456 STR457	470p 600p		200p 1200p	TA7629 TA7630	220p 200p
LA1145 LA1150	200p 1 150p	LA4597 LA4620	125p	B1648 B1649	200p 190p	M51387P M51392P	600p 300p	SAA5030 SAA5040A	440p 280p	STK463 STK465 STK501	900p 550p	STK5330 STK5331 STK5332	850p 300p 180p	STR470 STR1096		TA7207 TA7208	150p 125p	TA7632 TA7640	400p 90p
LA1170 LA1177	130p	LA4630 LA4700	325p	.B3500 .C4966	125p 65p	M51393AP M51395AP	350p 450p	SAA5040B SAA5041	400p	STK561 STK563	450p 415p	STK5333 STK5335	650p 350p	STR1195 STR1229 STR2005	325p	TA7210 TA7214 TA7217	200p 220p	TA7641 TA7644BP	140p 480p
LA1180 LA1185	150p	LA4705 LA5005	90p 1	.C7011 .C7060	600p	M51397AP M51436P	425p 350p	SAA5042 SAA5050	425p 650p	STK583 STK760	500p 600p	STK5336 STK5337	350p 500p	STR2005 STR2012 STR2013	400p	TA7220 TA7222	145p 220p	TA76545P TA7658	65p 100p
LA1186 LA1201 LA1205	75p l	LA5112 LA5511	200p 50p	C7120 C7130	300p	M51496P M51533	275p 300p	SAA5051 SAA5052	400p 500p	STK770 STK772	400p 650n	STK5338 STK5339	295p 400p	STR2015 STR2024	550p	TA7223 TA7225	90p 210p 300p	TA7659P TA7660P	400p 325p
LA1205 LA1207 LA1210	120p	LA5512 LA5522 LA5523	45p	.C7131 .C7132	400p	M51544 M51848 M64622B	150p 150p	CAAEDEA	EAC-	STK772B STK780	480p 575p	STK5340 STK5342	350p 245p	STR2105 STR2124	600p	TA7226 TA7227	290p 700p	TA7666P TA7668	100p 100p
LA1222 LA1230	80p (_A5524 _A5527	80p	.C7137 .C7181 .C7185	350p	M54523P M54563P M58484	200p 200p	SAA5230 SAA5231 SAA5240PA SAA5243PE SAA5244AP	170p 600p	STK795 STK1039	450p 460p	STK5343 STK5353	380p 400p	STR3105 STR3113	525p 225p	TA7230 TA7232	100p 95p	TA7672 TA7676AP	400p 450p
LA 1235 LA 1240	130p l	A5530 A5531	65p L	.C7191 .C7207	300p	M51516 M51518	500p 260p	SAA5243PE SAA5244AP	360p 950p	STK1040 STK1049	640p 700p	STK5361 STK5362	375p 400p	STR3115 STR3123	400p 400p	TA7233 TA7237	120p 300p	TA7679 TA7680AP	475p 200p
LA1245 LA1260	110p L 75p L	A5537 A5655	45p L	.C7215 .C7217	160p	M51995P M51977P	250p 300p	SAA5246AF SAA5250P	750p	STK1050 STK1060 STK1070	650p 700p	STK5372 STK5373	260p 375p	STR3125 STR3130	480p 500p	TA7238 TA7240	400p	TA7681AP TA7687AP	425p 100p
LA1261 LA1265	75p L 125p L	.A5658 .A5665	225p L 250p L	.C7218 .C7230	250p	M52307P M54646AP	900p 400p	SAA5250P SAA5351 SAA7000 SAA7020	375p	STK 1070 STK 1080 STK 2025	850p 940p 620p	STK5391 STK5392 STK5421	375p 500p	STR3135 STR3212	275p	TA7241 TA7242	165p 190p	TA7688 TA7698	150p 400p
LA1266 LA1267	130p L	.A5667 .A5700	200p L	.C7267 .C7351	550p	MB3708 MB3712	BUUD	SAA/210P	600p	STK2025 STK2028 STK2029	500p 480p	STK5421 STK5422 STK5431	450p 375p 550p	STR3214 STR3215 STR3315	275p	TA7243 TA7245	320p 225p	TA7699 TA7705	600p 300p
LA1354 LA1363	90p L	.A6339 .A6355	35p L 50p L	.C7364 .C7432	200p 425p	MB3713 MB3714	130p 225p	SAA7220PA SAA7274P	550p	STK2030 STK2038	1000p 700p	STK5434 STK5436	570p 500p	STR4090A STR4142	650p	TA7245BPO TA7248P TA7250B	200p 575p	TA7709P TA7719P	150p 200p
LA1364 LA1365 LA1368	120p L	A6510 A6515	150p L	C7522 C7535	300p 1	MB3715 MB3722	250p 200p	SAA7280P SAA9050	1450p	STK2048 STK2058IV	950p 1600p	STK5441 STK5443	400p 575p	STR4211 STR4512	315p	TA7251BP	325p 325p 225p	TA7727P TA7750	125p 200p
LA1369	200p L	.A6520 .A6531 .A7007	250p L	C7537AN C7537N	450p	MB3730 MB3731	900p 220p	SAA9057 SAB0600	475p	STK2101 STK2110	1050p 550p	STK5446 STK5451	350p 390p	STR5015 STR5100	500p	TA7259P TA7262P	225p 400p	TA7757 TA7769	200p 130p
LA1385 LA1503 LA1805	120p L	A7007 A7011 A7016	220p L	C7560 C7565	300p	MB3732 MB3735	400p	SAB0601 SAB0602	525p	STK2125 STK2129	580p 750p	STK5461 STK5462	500p 500p	STR5214 STR5315	475p	TA7263P TA7265AP	325p 300p	TA7772P TA7784	150p
LA1810 LA1851	130p L	A7018 A7019	100p L	C7582E C7800 C7815H	175p	MB3756 MB3759 MB3771	200p	SAB1009BP SAB1016	600p 3	STK2139 STK2155	675p 900p	STK5464 STK5466	300p 500p	STR5412 STR6020	280p 270p	TA7267 TA7267BP	220p 120p	TA7792P TA7796P	250p 250p
LA2000 LA2001	150p L 200p L	A7033 A7042	400p L 280p L	C7818 C7820	280p	MB3773 MB8719	110p	SAB1046P SAB2015P SAB2016P	525p 3	STK2230 STK2240	470p 740p	STK5467 STK5468	400p 300p	STR7001 STR9005	600p	TA7269 TA7270	260p 170p	TA8101N	75p 230p 140p
LA2101 LA2110	270p L	A7046 A7051	300p L 130p L	C7821N C7822N	250p 1	MC1391 MC1455	120p	SAB2016P SAB2022P SAB3012	150p 525p 675p	STK2250 STK3041 STK3042	650p 370p 375p	STK5471 STK5472 STK5473	900p 375p	STR9012 STR10006	300p	ΓΑ7271 ΓΑ7272	220p 260p	TA8105N TA8110AP	110p
LA2200 LA2205	190p L 150p L	A7053 A7054	130p L 350p L	C7881B C7881M	135p 1 325p 1	MC1488 MC1489	35p	SAB3013 SAB3017	200p 3	STK3044 STK3062	950p	STK5473 STK5474 STK5476	500p	STR11006 STR12006 STR13006	450p	ΓΑ7273 ΓΑ7274 ΓΑ7270Β	300p 210p	TA8119P TA8122AN	70p 250p
LA2211	350p L	A7060		F347		AC1496		SAB3021	450p	TK3082	550p	STK5477	450p	STR15006 STR15006	500p	TA7279P TA7280		TA8127N TA8132AN	100p 200p

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Part	Price	Part	Price	Part	Price	Part	Price			Part UPC1004C	Price		Price 90p	Part 2SA1177	Price 25p	Part 2SB561	Price 30p	Part 2SC738	Price 15p
TA8164P TA8184P TA8189P	100p 350p 130p	TDA1180 TDA1185A TDA1190	120p 190p 80p	TDA2760 TDA2780 TDA2791	400p 600p 275p	TDA4661 TDA4670 TDA4680	225p 475p 350p	TDA8395 TDA8405	360p 550p	UPC1009 UPC1018	950p 170p	2SA773 2SA777	50p 35p	2SA1179 2SA1182 2SA1184	20p 20p 120p	2SB562 2SB564 2SB566	20p 15p 90p	2SC739 2SC761 2SC762	150p 110p 150p
TA8200AH TA8201AK TA8205	325p 300p 220p	TDA 1200B TDA 1220 TDA 1235	80p 50p 300p	TDA2795 TDA2822M TDA2824	150p 60p 85p	TDA4685 TDA4700A TDA4714C	275p 750p 350p	TDA8415 TDA8416 TDA8417	650p 625p 550p	UPC1020 UPC1023 UPC1024H 2	60p 75p	2SA778 2SA781 2SA786	100p 150p 25p	2SA1185 2SA1186	200p 500p	2SB596 2SB598	50p 30p	2SC783 2SC790	85p 50p
TA8207K TA8210	175p 260p	TDA1236 TDA1251	240p 150p 150p	TDA2840 TDA3047 TDA3048	200p 100p 130p	TDA4716C TDA4718A TDA4725	450p 250p 750p	TDA8421 TDA8425 TDA8432	300p 500p 550p	UPC1025 UPC1026 UPC1028	230p 95p 90p	2SA794 2SA798 2SA812	50p 30p 15p	2SA1198 2SA1201 2SA1202	40p 40p 25p	2SB600 2SB601 2SB605	500p 60p 25p	2SC792 2SC805 2SC828	380p 225p 20p
TA8211AH TA8214K TA8215	200p 260p 300p	TDA1270 TDA1327 TDA1405	200p 50p	TDA3082 TDA3083	200p 200p	TDA4800 TDA4810 TDA4814A	300p 500p 300p	TDA8433 TDA8440 TDA8442	600p 300p 200p	UPC1031H UPC1032 UPC1035C	150p 60p 110p	2SA814 2SA816 2SA817	60p 70p 20p	2SA1204 2SA1206 2SA1207	60p 25p	2SB631 2SB632 2SB633	40p 45p 80p	2SC829 2SC839 2SC867	15p 20p 900p
TA8216H TA8217P TA8220AH	300p 120p 500p	TDA1410 TDA1412 TDA1506	220p 35p 275p	TDA3190 TDA3301B TDA3310	100p 1600p 120p	TDA4850 TDA4851 TDA4852	475p 325p 325p	TDA8443 TDA8444 TDA8451	350p 200p 325p	UPC1043C UPC1158H UPC1161	125p 70p 110p	2SA825 2SA836 2SA837	20p 20p 200p	2SA1208 2SA1209 2SA1210	100p	2SB641 2SB647 2SB648	12p 20p 45p	2SC870 2SC897 2SC900B	100p 175p 30p
TA8221AH TA8225H TA8225L	600p 475p 475p	TDA1508 TDA1510 TDA1512	175p 170p 140p	TDA3410 TDA3420 TDA3501	150p 200p 300p	TDA4860 TDA4866	200p 275p	TDA8452 TDA8453	200p 350p	UPC1167 UPC1170 UPC1173	125p 150p 200p	2SA839 2SA841 2SA844	110p 20p 20p	2SA1215 2SA1216 2SA1217	600p 550p	2SB649 2SB673 2SB676	35p 100p 85p	2SC930 2SC936 2SC941	15p 300p 15p
TA8227 TA8229K TA8400P	250p 200p 200p	TDA1514A TDA1515A TDA1516Q	325p 200p 350p	TDA3502 TDA3504 TDA3505	360p 300p 275p	TDA4881 TDA4935 TDA4940	200p 300p 200p	TDA8461 TDA8490 TDA8540	950p 225p 250p	UPC1176C UPC1178H	120p 250p 200p	2SA847 2SA854 2SA861	25p 30p 45p	2SA1220 2SA1221 2SA1222	75p 70p	2SB688 2SB703 2SB705	90p 90p 200p	2SC944 2SC945 2SC950	140p 10p 40p
TA8410K TA8410P TA8432	200p 200p 200p	TDA1517 TDA1519 TDA1519A	150p 200p 200p	TDA3506 TDA3507 TDA3510	260p 450p 200p	TDA4942 TDA4944 TDA4950	200p 175p 100p	TDA8702 TDA8703 TDA8708	275p 500p 600p	UPC1180C UPC185H2 UPC1186	400p 80p	2SA872 2SA872A	25p 50p	2SA1226 2SA1227	25p 250p	2SB707 2SB716 2SB718	200p 20p 60p	2SC959 2SC980 2SC982	225p 40p 20p
TA8605N TA8606N TA8607P	350p 350p 320p	TDA1520 TDA1521 TDA1522	275p 210p 110p	TDA3520 TDA3530 TDA3540	250p 250p 200p	TDA5030A TDA5140A TDA5330T	100p 200p 300p	TDA8730 TDA8732 TDA8735	225p 300p 175p	UPC1187 UPC1188H UPC1191	150p 350p 300p	2SA879 2SA884 2SA885	30p 100p 35p	2SA1232 2SA1237 2SA1238	25p 30p	2SB727 2SB733 2SB734	100p 75p 35p	2SC983 2SC1000 2SC1001	120p 20p 950p
TA8611AN TA8615N TA8628N	250p 480p 350p	TDA1524 TDA1526 TDA1534	200p 225p 2000p	TDA3541 TDA3560 TDA3561	175p 260p 300p	TDA5331T TDA5332T TDA5500	200p 150p 400p	TDA8740 TDA8741 TDA8808T	625p 550p 325p	UPC1197 UPC1198H UPC1210	140p 200p 150p	2SA886 2SA887 2SA893	45p 20p 15p	2SA1239 2SA1240 2SA1242	45p 80p	2SB737 2SB739	20p 22p	2SC1008 2SC1010	20p 225p
TA8631 TA8632N	500p 550p	TDA 1540 TDA 1541 TDA 1542	420p 500p 250p	TDA3561A TDA3562 TDA3562TF	300p 260p	TDA5600 TDA5660P TDA5700	450p 250p 200p	TDA8809T TDA9045 TDA9080	350p 300p 400p	UPC1215V UPC1222 UPC1225H	125p 130p 220p	2SA896 2SA899 2SA900	25p 40p 45p	2SA1244 2SA1245 2SA1246	55p 80p	2SB744 2SB750 2SB753	55p 60p 100p	2SC1012 2SC1013 2SC1014	75p 170p 140p
	425p 375p 1500p	TDA1543 TDA1552Q	200p 350p	TDA3563 TDA3564 TDA3565	350p 325p 220p	TDA5701 TDA5708 TDA5709	200p 275p 375p	TDA9102C TDA9403 TDA9500	250p 130p 750p	UPC1227V UPC1228HA UPC1230	225p	2SA904 2SA907 2SA909	20p 650p 500p	2SA1248 2SA1249 2SA1252	100p 20p	2SB754 2SB764 2SB765	80p 30p 70p	2SC1030 2SC1046 2SC1047	150p 250p 20p
TA8659AN TA8690N TA8691N	900p 700p 450p	TDA1553AC TDA1555Q TDA1557Q	375p 300p	TDA3566 TDA3567	280p 350p	TDA5800 TDA5820	850p 370p	TDA9503 TDA9513 TDA9800	550p 225p 225p	UPC1237HA UPC1238 UPC1241H	70p 120p 150p	2SA912 2SA913 2SA914	70p 100p 90p	2SA1250 2SA1250 2SA1250	3 0 p	2SB772 2SB774 2SB775	25p 50p 100p	2SC1050 2SC1051 2SC1061	280p 250p 85p
TA8701AN TA8718N TA8720	275p 550p 525p	TDA1558Q TDA1560Q TDA1571	300p 675p 300p	TDA3569 TDA3570 TDA3580	300p 375p 300p	TDA5832 TDA5850 TDA5930	125p 175p 225p	TDA9821 TEA0652	200p 150p	UPC1242H UPC1245V UPC1270H	150p 130p 250p	2SA915 2SA916 2SA921	30p 30p 40p	2SA1256 2SA126 2SA126	70p	2SB776 2SB788 2SB791	110p 35p 130p	2SC1069 2SC1070 2SC1079	175p 65p 300p
TA8739P TA8872N TAA550	450p 450p 25p	TDA1572 TDA1574 TDA1576	175p 125p 170p	TDA3586 TDA3590 TDA3591	750p 250p 360p	TDA6100Q TDA6101Q TDA6111Q	150p 120p 225p	TEA0653T TEA0655 TEA0665	80p 300p	UPC1274V UPC1277	250p 240p	2SA928A 2SA933	25p 30p 30p	2SA126 2SA126 2SA126	280p	2SB794 2SB795 2SB810	40p 45p 15p	2SC1080 2SC1096 2SC1098	225p 40p 120p
TBA120S TBA396 TBA520	40p 70p 120p	TDA1578A TDA1579 TDA1589	210p 130p 275p	TDA3592A TDA3601Q TDA3602	300p 375p 225p	TDA6200 TDA6600-2 TDA6610-2		TEA1002 TEA1007 TEA1009	650p 120p 100p	UPC1278 UPC1288V UPC1297CA		2SA934 2SA935 2SA937	40p 20p	2SA128	50p 60p	2SB816 2SB817 2SB819	160p 175p 60p	2SC1106 2SC1114 2SC1115	180p 415p 280p
TBA530 TBA540 TBA560	100p 90p 90p	TDA1591 TDA1596 TDA1598	275p 200p 160p	TDA3611 TDA3640 TDA3645	450p 350p 400p	TDA6612-2 TDA7000 TDA7010T	170p 120p	TEA1015P TEA1017 TEA1019	110p 280p 130p	UPC1298 UPC1313H / UPC1316C	70p	2SA939 2SA940 2SA942	140p 50p 60p	2SA128 2SA128 2SA129	50p	2SB822 2SB824	40p 60p	2SC1116 2SC1124 2SC1161	290p 270p 110p
TBA800 TBA810AS TBA820	40p 40p 55p	TDA1600 TDA1602A TDA1670A	200p 400p 200p	TDA3651 TDA3652 TDA3652-TX	200p 500p	TDA7020T TDA7021T TDA7050	175p 200p 100p	TEA1024 TEA1035 TEA1039	150p 200p 150p	UPC1318 UPC1330HA UPC1335V	320p	2SA949 2SA950 2SA951	70p 18p 60p	2SA129 2SA129 2SA129	4 450p 5 500p	2SB825 2SB826 2SB827	135p 75p 200p	2SC1162 2SC1164	30p 600p 750p
TBA820M TBA920	35p 100p	TDA 1675 TDA 1701	200p 500p 200p	TDA3653 TDA3654 TDA3654Q	85p 80p 85p	TDA7052 TDA7053 TDA7056	120p 200p 200p	TEA1045 TEA1060 TEA1061	300p 225p 175p	UPC1350 UPC1352C UPC1360C	115p 450p 200p	2SA952 2SA953 2SA954	30p 60p 30p	2SA130 2SA130 2SA130	2 300p 3 400p	2SB828 2SB829 2SB835	200p 200p 75p	2SC1165 2SC1166 2SC1170	100p 180p
TBA950 TBA990 TC5020	100p 60p 200p	TDA1771 TDA1870A TDA1872A	200p 275p	TDA3710 TDA3720	300p 175p	TDA7057Q TDA7072	225p 100p	TEA1062 TEA1064 TEA1067	250p 250p 150p	UPC1362C UPC1363 UPC1363C	250p 190p 300p	2SA957 2SA958 2SA963	185p 60p 120p	2SA130 2SA130 2SA130	4 110p 5 110p	2SB857 2SB861 2SB863	80p 110p 220p	2SC1172 2SC1173 2SC1195	150p 33p 210p
TC5081AP TC5082P TC5090A	80p 170p 230p	TDA1904 TDA1905 TDA1908A	80p 80p 90p	TDA3724 TDA3725 TDA3730	300p 300p 400p	TDA7077 TDA7211 TDA7220	175p 100p 65p	TEA1068 TEA1080P	350p 170p 40p	UPC1364C UPC1365 UPC1366C	350p 250p 130p	2SA965 2SA966	30p 25p 55p	2SA130 2SA131 2SA131	9 50p 5 100p	2SB865 2SB882 2SB885	25p 180p 45p	2SC1212 2SC1213 2SC1214	35p 10p 15p
TC9125BP TC9130P TC9134	410p 150p 750p	TDA1910 TDA1940 TDA1941	160p 180p 300p	TDA3740 TDA3750 TDA3755	400p 400p 425p	TDA7222 TDA7230A TDA7231A	100p 150p 80p	TEA1087 TEA1101 TEA1330	425p 65p	UPC1370C UPC1373	300p 85p	2SA970 2SA979	25p 35p 25p	2SA131 2SA131 2SA132	8 20 p 9 25 p	2SB891 2SB892	35p 25p 60p	2SC1215 2SC1216 2SC1222	25p 200p 15p
TC9135P TC9137P TC9138AP	125p 500p 150p	TDA1950 TDA2002 TDA2003	175p 50p 65p	TDA3760 TDA3765V TDA3771	350p 225p 460p	TDA7233 TDA7240 TDA7241	60p 175p 250p	TEA1511 TEA2000 TEA2014A	150p 500p 80p	UPC1377C UPC1378 UPC1379C	200p 1000p 170p	2SA985 2SA988	60p 25p	2SA132 2SA132	1 80p 7 130p	2SB908 2SB926	70p 30p 60p	2SC1226 2SC1237 2SC1247A	75p 250p 35p
TC9142 TC9143 TC9145	320p 300p 150p	TDA2004 TDA2005 TDA2006	150p 150p 70p	TDA3780 TDA3791 TDA3800	400p 200p 250p	TDA7245 TDA7250 TDA7255	225p 400p 400p	TEA2018A TEA2019 TEA2025B	80p 600p 75p	UPC1382 UPC1384 UPC1387C	110p 425p 250p	2SA992 2SA993	30p 30p 50p	2SA132 2SA134 2SA134	6 20 p 8 45 p	2SB950 2SB951	180p 190p 90p	2SC1252 2SC1278 2SC1279	850p 110p 30p
TC9148 TC9149 TC9150	200p 225p 425p	TDA2007 TDA2008 TDA2009	120p 100p 160p	TDA3803A TDA3810 TDA3825	500p 200p 150p	TDA7256 TDA7262 TDA7272	400p 325p 170p	TEA2028 TEA2028B TEA2029A	650p	UPC1394 UPC1397 UPC1403CA	120p 350p 650p	2SA999 2SA1005	60p 30p 25p	2SA135 2SA135 2SA135	3 100p 6 100p	2SB975 2SB985	100p 30p	2SC1308K 2SC1312	350p 40p 10p
TC9151P TC9152	425p 425p	TDA2010 TDA2020	150p 120p 80p	TDA3827 TDA3840 TDA3842	110p 200p 200p	TDA7273 TDA7274 TDA7275	80p 45p 75p	TEA2029C TEA2031A TEA2037	270p 125p 200p	UPC1406HA UPC1420CA UPC1421CA	450p	2SA1008	90p 125p 200p	2SA135 2SA135	8 130 p 9 45 p	2SB1009 2SB1010	40p 110p 25p	2SC1318 2SC1325 2SC1327	400p 20p
TC9153 TC9154AP TC9156	300p 225p 300p	TDA2030H TDA2040	100p 140p	TDA3843 TDA3845 TDA3856	200p 225p 300p	TDA7282 TDA7284 TDA7302	50p 100p 450p	TEA2114 TEA2117 TEA2130	200p 450p 350p	UPC1423CA UPC1470 UPC1474HA	200p	2SA1011	225p 80p 85p	2SA136	2 25p 0 50p	2SB1015 2SB1016	55p 60p 130p	2SC1328 2SC1342 2SC1343	15p 15p 200p
TC9158P TC9162 TC9163	450p 275p 375p	TDA2051V TDA2052V	525p	TDA3857 TDA3950	200p 225p	TDA7310 TDA7313	800p 650p	TEA2164 TEA2260	160p 225p	UPC1484CA UPC1488H UPC1498H	300p 115p 500p	2SA1013 2SA1015	100p 10p 30p	2SA137 2SA137	1 100p 6 30p	2SB1017 2SB1018	40p 130p 120p	2SC1345 2SC1346 2SC1358	15p 100p 270p
TC9164 TC9167P TC9172P	400p 100p 300p	TDA2054M TDA2107 TDA2148	250p 325p	TDA4001 TDA4050 TDA4052	250p 150p 500p	TDA7318 TDA7330A TDA7350	300p	TEA2262 TEA3717D	185p 275p P 160p	UPC1505C UPC1513H	400p	2SA1018 2SA1020	100p 30p 35p	2SA138	1 100p 2 120p	2SB1039 2SB1066	65p 40p 160p	2SC1359 2SC1360 2SC1364	15p 70p 25p
TC9174P TC9176P TC9177P	325p 500p 225p	I TDA2170	375p 1300p 200p	TDA4060 TDA4092 TDA4100	500p 250p 150p	TDA7359 TDA7360 TDA7361	300p 700p 175p	TEA5040	135p 650p	UPC1514CA UPC1515CA UPC1520CA	1 250p 1 250p	2SA1023 2SA1026	60p 90p	2SA138	6 400p 7 75 p	2SB1077 2SB1098	180p 80p 75p	2SC1368 2SC1382 2SC1383	75p 40p 25p
TCA9940 TCEP100 TD62308AF	100p 100p	TDA2270 TDA2320	250p 80p 300p	TDA4173A TDA4180 TDA4190	F 325p 145p 180p	TDA7370V TDA7374V TDA7770	325p 350p 140p	TEA5101A TEA5110 TEA5114A	175p 200p	UPC1521H/ UPC1536C 2SA329	550p	2SA 1036 2SA 1037	60p 60p 50p	2SA139	9 25 p 10 150 p	2SB1109 2SB1123	40p 50p 50p	2SC1384 2SC1393 2SC1394	20p 20p 15p
TD62382 TD62506 TD62705	200p 200p 250p	TDA2502 TDA2503	175p 200p 200p	TDA4200 TDA4210 TDA4260	300p 160p 250p	TDA8114 TDA8115 TDA8116	225p 200p 350p	TEA5115 TEA5116 TEA5170	220p 220p 200p	2SA467 2SA473 2SA483	40p 29p 90p	2SA1048 2SA1051	40p 25p 300p	2SA142 2SA144	18 35 p	2SB1134 2SB1135	65p 60p	2SC1398 2SC1399	55p 100p 50p
TD6304AP TD6306P TD6350P	300p 350p 200p	TDA2505 TDA2506	220p 400p 450p	TDA4280 TDA4282 TDA4283T	320p 360p	TDA8120E TDA8124 TDA8134	250p 225p	TEA5501 TEA5550	325p 225p 150p	2SA484 2SA489 2SA490	80p 50p 45p	2SA1060 2SA1061	15p 120p 300p	2SA144 2SA145	3 130p	2SB1143 2SB1151	45p 40p 75p	2SC1403 2SC1407	500p 50p 150p
TD6359P TDA1001 TDA1002	300p 200p 200p	TDA2507T	450p 450p	TDA4290 TDA4400 TDA4420	125p 175p 120p	TDA8135 TDA8136 TDA8137	225p 225p 200p	TEA5560	130p 85p 165p	2SA493 2SA495 2SA496	25; 40; 30;	2SA1073 2SA1076	150p 375p 230p	2SA146 2SA146	52 25 59 100	2SB1163 2SB1168	400p 370p 50p	2SC1419 2SC1426	50p 50p 700p 50p
TDA1003 TDA1005A TDA1010A	150p	TDA2515	450p 300p 100p	TDA4421 TDA4426 TDA4427	300p 170p 200p	TDA8138 TDA8138A TDA8138B	200p 130p	TEA5581 TEA5591	200p 200p 300p	2SA505 2SA509 2SA537	120; 35; 170;	2SA1080 2SA1081	300p 125p 80p	2SA148	38 150 1 39 300 1	2SB1185 2SB1202	40p 50p 45p	2SC1431 2SC1444	400p 275p
TDA 1011 TDA 1012 TDA 1013A	75p 120p	TDA2540 TDA2541	150p 70p 110p	TDA4431 TDA4433 TDA4437	150p 100p 125p	TDA8139 TDA8140 TDA8143	200p 200p 160p	TEA5630 TEA5640E	225p 750p 650p	2SA539 2SA544 2SA550	20 650 150	2SA1083 2SA1084	80p 20p 100p	2SA149 2SA149	1 300p	2SB1204 2SB1205	45p 45p 40p	2SC1446 2SC1447	350p 55p 70p
TDA1015 TDA1016	85p 140p	TDA2543	210p 200p 120p	TDA4439 TDA4440 TDA4442	220p 180p 240p	TDA8145 TDA8146	120p 200p 125p	TEA6000 TEA6100	400p 350p 225p	2SA562 2SA564 2SA571	30 15 650	2SA1085 2SA1091	75p 100p 180p	2SA149	94 450; 16 280 ;	2SB1243 2SB1274	60p 40p 40p	2SC1450 2SC1454	120p 200p 250p
TDA1020 TDA1022 TDA1023	110p 330p 130p	TDA2546A TDA2548	200p 200p	TDA4443 TDA4445	250p 220p 225p	TDA8170 TDA8172	170p 200p 175p	TEA6300 TEA63101	500p 425p	2SA603 2SA606	100 200 15	p 2SA1094 p 2SA1095	190p 300p 80p	2SA15	23 45	2SB1318	300p 40p 45p	2SC1472 2SC1473	120p 40p 15p
TDA 1024 TDA 1025 TDA 1028	150p 320p 175p	TDA2555 TDA2556	300p 175p 230p	TDA4450 TDA4452 TDA4453	250p 275p	TDA8174 TDA8175	200p 300p	TEA64156	525p 360p 125p	2SA614 2SA628	150 20 50	p 2SA1102 p 2SA1103	130p 130p 140p	2SA15	38 55 10 50	2SB1382 2SB1468	350p 100p 75p	2SC1501	45p 70p 55p
TDA1029 TDA1035 TDA1038	200p 160p 500p	TDA2558	225p 400p / 350p	TDA4481 TDA4482	280p 215p 200p	TDA81799 TDA8185	180p	TL431 TL494	45p	2SA636 2SA639	50 60 60	p 2SA1105 p 2SA1106	250p 160p 90p	2SA15	99 220 00 250	2SC372 2SC380	25p 10p 25p	2SC1507 2SC1509	45p 35p 35p
TDA 1041E TDA 1041P TDA 1044	250p 180p 110p	TDA2575A TDA2577A TDA2578A	4 200p 4 200p	TDA4501 TDA4502	300p 280p 400p	TDA8191 TDA8192	200p 425p 200p	TLO64	40p 80p 38p	2SA642 2SA643	50 25	p 2SA1112 p 2SA1115	150p 30p	2SA16	25 40 1 26 90 1	2SC394 2SC403	60p 25p 15p	2SC1515 2SC1520	60p 45p 110p
TDA1047 TDA1048 TDA1053	200p 200p 300p	TDA2579A TDA2582 TDA2590	210p 130p 170p	TDA4503 TDA45054 TDA45058	325p 300p 275p	TDA8196 TDA8205 TDA8213	120p 1250p 175p	TLO83	80p 55p 70p	2SA677 2SA678	15 35 26	p 2SA1123 p 2SA1124	40p 40p 60p	2SA16 2SA16	52 70 57 175	2SC458 2SC460	10p 10p 10p	2SC1545 2SC1567	120p 40p 35p
TDA1054 TDA1057 TDA10598	180g 60g 40g	TDA2591 TDA25910 TDA2593	110p 150p 80p	TDA45051 TDA45051 TDA4510	< 450р И 1000р 200р	TDA82148 TDA82158 TDA8217	1 300p	TPU2732 TPU2735	800p 500p	2SA684 2SA699	25 25 100	p 2SA1133 p 2SA1135	50p 120p 130p	2SA16	71 310 73 425	2SC495 2SC496	45p 25p 85p	2SC1569 2SC1570	55p 40p 50p
TDA1060 TDA1062 TDA1068	140 140 75	TDA2594	300p 200p 400p	TDA4532 TDA4555	200p 275p 370p	TDA8303 TDA8304 TDA8305	250p 400p 500p	UC3524 UC3842N UC3843	100p 60p 125p	2SA705 2SA706 2SA708	70 140 50	p 2SA1142 p 2SA1143	200; 100; 15;	2SA17	06 25 5 45	2SC515 2SC535	100g 30g	2SC1573 2SC1576	25p 550p 600p
TDA1072 TDA1074	150; 280;	p TDA2611A p TDA2616	4 100p	TDA4557	200p 270p 150p	TDA8340 TDA8341	150p 250p	UC3844 UPC20C	70p 220p 130p	2SA711 2SA715	280 50 50	p 2SA1145 p 2SA1146 p 2SA1151	40; 200; 30;	2SB33 2SB47	7 150 4 250	2SC605 2SC619	20p 100p 100p	2SC1583 2SC1586	25p 540p
TDA1077 TDA1082 TDA1083	250; 275; 95;	DA2640 DA26534	350p	TDA4566 TDA4568	250p 225p 225p 200p	TDA7350	275p	UPC555 UPC556H	60p 80p 220p	2SA720 2SA725 2SA726	20 80 20	p 2SA1152 p 2SA1153 p 2SA1154	150; 30; 22;	2SB49 2SB51 2SB52	2 80 1 55 5 65	2SC641 p 2SC644 p 2SC647	80; 10; 300;	2SC1619 2SC1623	340p 170p 50p
TDA1085 TDA1087 TDA1092	170; 60; 100;	p TDA2658 p TDA2670	300p 150p	TDA4580	400g 200g	TDA83611 TDA8362A	V3 900 p N 1200 p	DPC574 DPC575C	60p	2SA733 2SA740	15 90 450	p 2SA1156 p 2SA1162	90; 30; 15;	2SB52 2SB53	7 130 1 400	2SC681 2SC683 2SC708	250 35 100	2SC1626 2SC1627	60p 55p 15p
TDA1097 TDA1151 TDA1154	475 40 50	p TDA2710- p TDA2721	200p	TDA4601 TDA4605	120; 190;	TDA8366N	2 . 15 00 ;	UPC592 UPC595	95; 190; 190;	2SA747A 2SA748	425 60 200	p 2SA1169 p 2SA1170	500; 500;	2SB53 2SB54	7 90 4 22 6 45	2SC710 2SC711 2SC730	15; 15; 350;	2SC1628 2SC1634 2SC1667	75 p 50 p 450 p
TDA1170 TDA1170N TDA1175	85 N 85 175	p TDA2740	200p 300p 200p	TDA4650	370; 300; 200;	TDA8385	275	UPC1001	220	2SA769	80 200	p 2SA1174	25	2SB54	9 50	p 2SC732	40 40	2SC1669	100p 15p

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2SC1675 2SC1678	90p	2SC2261	700p	2SC2719	25p	2SC3263	280p	2SC3798	220p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A		2SK312	750p
2SC1683	80p 100p	2SC2267 2SC2270	90p 60p	2SC2721 2SC2724	120p 15p	2SC3264 2SC3269	390p 50p	2SC3807 2SC3808	120p 70p	2SD287 2SD291	250p 250p	2SD882 2SD889	25p 35p	2SD1328 2SD1330	60p 50p	2SD1764 2SD1765	70p 70p	2SK315 2SK320	70p 120p
2SC1684 2SC1685	30p 30p	2SC2271 2SC2274	25p 15p	2SC2738 2SC2749	200p 350p	2SC3270 2SC3271	50p 75p	2SC3811 2SC3831	80p 250p	2SD313 2SD315	25p 75p	2SD892A 2SD894	75p 35p	2SD1347 2SD1348	70р 65р	2SD1769 2SD1773	110p 100p	2SK323	130p
2SC1729 2SC1730	900p 10p	2SC2275 2SC2278	50p 70p	2SC2750 2SC2751	300p 270p	2SC3277 2SC3279	280p 30p	2SC3832 2SC3833	135p 250p	2SD325 2SD330	30p 65p	2SD895 2SD896	100p 200p	2SD1350 2SD1376	150p 60p	2SD1776 2SD1783	70p 70p	2SK332 2SK359	175p 40p
2SC1735 2SC1740	70p 10p	2SC2283 2SC2290	700p 1800p	2SC2752 2SC2767	75p 300p	2SC3280 2SC3281	200p 200p	2SC3851 2SC3852	100p 80p	2SD348 2SD350	300p 320p	2SD898B 2SD900	225p 400p	2SD1378 2SD1379	60p 100p	2SD1785 2SD1789	160p 210p	2SK363 2SK364	50p 40p
2SC1741 2SC1755	35p 90p	2SC2291 2SC2298	40p 35p	2SC2769 2SC2773	400p 700p	2SC3284 2SC3293	600p 85p	2SC3853 2SC3855	220p 220p	2SD357 2SD358	40p 40p	2SD905 2SD916	450p 130p	2SD1380 2SD1382	100p 60p	2SD1796 2SD1802	120p 75p	2SK367 2SK369	40p 30p
2SC1756 2SC1758	35p 30p	2SC2307 2SC2308	300p 10p	2SC2774 2SC2785	500p 40p	2SC3298 2SC3299	50p 120p	2SC3857 2SC3858	500p 550p	2SD359 2SD361	50p 100p	2SD917 2SD921	300p 320p	2SD1384 2SD1390	50p 350p	2SD1806 2SD1812	75p 45p	2SK373	40p
2SC1760 2SC1775	70p 10p	2SC2312 2SC2314	300p 70p	2SC2786 2SC2787	20p 10p	2SC3300 2SC3303	400p 100p	2SC3866 2SC3868	275p 100p	2SD362 2SD371	100p 240p	2SD923 2SD946	360p 120p	2SD1391 2SD1392	250p	2SD1815	50p	2SK374 2SK386	45p 600p
2SC1781 2SC1789	20p 100p	2SC2316 2SC2320	150p 10p	2SC2791 2SC2792	500p 220p	2SC3306 2SC3307	130p 600p	2SC3870 2SC388A	200p 25p	2SD380 2SD381	650p	2SD947	100p	2SD1395	85p 80p	2SD1825 2SD1827	60p 120p	2SK389 2SK400	115p 700p
2SC1809 2SC1810	40p 250p	2SC2324 2SC2328A	120p	2SC2793 2SC2808	700p 40p	2SC3309	150p	2SC3883	210p	2SD382	50p 75p	2SD950 2SD951	300p 200p	2SD1396 2SD1397	120p 100p	2SD1843 2SD1846	70p 350p	2SK405	450p
2SC1815 2SC1819	10p 70p	2SC2310	25p	2SC2810	360p	2SC3310 2SC3316	125p 280p	2SC3884A 2SC3885	200p 250p	2SD386 2SD388	70p 150p	2SD957A 2SD958	520p 60p	2SD1398 2SD1399	120p 300p	2SD1847 2SD1849	275p 280p	2SK414 2SK415	550p 500p
2SC1826	60p	2SC2315 2SC2329	175p 480p	2SC2812 2SC2814	40p 40p	2SC3317 2SC3326	350p 50p	2SC3885A 2SC3886A	290p 275p	2SD389 2SD400	60p 14p	2SD965 2SD970	35p 170p	2SD1400 2SD1402	280p 120p	2SD1850 2SD1853	325p 40p	2SK423 2SK427	75p 50p
2SC1827 2SC1829	60p 500p	2SC2230 2SC2331	300p 50p	2SC2824 2SC2825	75p 900p	2SC3327 2SC3328	60p 50p	2SC3890 2SC3892A	150p 250p	2SD401 2SD402	50p 120p	2SD972 2SD973	40p 60p	2SD1403 2SD1405	225p 80p	2SD1856 2SD1857	40p 75p	2SK430	200p
2SC1833 2SC1834	27p 50p	2SC2333 2SC2334	200p 80p	2SC2826 2SC2827	200p 130p	2SC3330 2SC3331	20p 25p	2SC3893 2SC3895	225p 325p	2SD414 2SD415	45p 55p	2SD973A 2SD982	70p 90p	2SD1406 2SD1407	60p 60p	2SD1858 2SD1863	40p 35p	2SK511 2SK513	450p 325p
2SC1841 2SC1844	12p 50p	2SC2335 2SC23364	55p \ 125p	2SC2832 2SC2834	300p 280p	2SC3333 2SC3345	120p 100p	2SC3896 2SC3897	400p 400p	2SD424 2SD426	350p 150p	2SD985 2SD986	120p 120p	2SD1408 2SD1409	125p 170p	2SD1864 2SD1877	85p 175p	2SK526 2SK531	160p 350p
2SC1845 2SC1846	15p 35p	2SC2344 2SC2347	150p 35p	2SC2837 2SC2839	250p 40p	2SC3346 2SC3352	130p 200p	2SC3907 2SC3927	250p 250p	2SD427 2SD438	350p 35p	2SD998 2SD1010	70p 40p	2SD1411 2SD1412	85p 75p	2SD1878 2SD1879	160p	2SK534	700p
2SC1847 2SC1855	45p 85p	2SC2353 2SC2360	120p 120p	2SC2853 2SC2873	70p 60p	2SC3353 2SC3355	280p 50p	2SC3940 2SC3943	40p 75p	2SD467 2SD468	15p 15p	2SD1010 2SD1020	40p 40p	2SD1413	60p	2SD1880	275p 360p	2SK537 2SK538	900p 350p
2SC1856 2SC1865	25p 700p	2SC2361 2SC2362	150p 50p	2SC2877 2SC2878	120p 20p	2SC3356	120p	2SC3944	80p	2SD471	20p	2SD1021	120p	2SD1415 2SD1417	190p 75p	2SD1881 2SD1884	350p 300p	2SK539 2SK544	1100p 30p
2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3358 2SC3376	50p 300p	2SC3950 2SC3953	120p 50p	2SD476 2SD525	100p 50p	2SD1022 2SD1024	250p 850p	2SD1425 2SD1426	260p 135p	2SD1886 2SD1887	300p 225p	2SK552	250p
2SC1871 2SC1875	425p 220p	2SC2369 2SC2371	100p 25p	2SC2882 2SC2883	60p 60p	2SC3377 2SC3378	50p 120p	2SC3955 2SC3964	60p 100p	2SD526 2SD545	70р 18р	2SD1027 2SD1030	850p 75p	2SD1427 2SD1428	160p 180p	2SD1894 2SD1895	300p 225p	2SK553 2SK555	225p 320p
2SC1881 2SC1890	70p 15p	2SC2373 2SC2383	210p 50p	2SC2898 2SC2899	200p 50p	2SC3379 2SC3381	1200p 130p	2SC3972 2SC3973	250p 210p	2SD549 2SD551	120p 300p	2SD1031 2SD1036	70p 600p	2SD1430 2SD1431	280p 200p	2SD1910 2SD1911	175p 300p	2SK556 2SK557	500p 400p
2SC1895 2SC1904	500p 125p	2SC2389 2SC2407	45p 110p	2SC2909 2SC2910	60p 25p	2SC3383 2SC3393	80p 80p	2SC3975 2SC3987	210p 160p	2SD554 2SD555	225p 500p	2SD1046 2SD1047	200p 180p	2SD1432 2SD1433	400p 300p	2SD1913 2SD1929	50p 50p	2SK559	600p
2SC1906 2SC1907	15p 20p	2SC2408 2SC2412K	120p 50p	2SC2911 2SC2912	80p 120p	2SC3397 2SC3399	20p 50p	2SC3996 2SC3997	600p 1250p	2SD556 2SD558	225p 200p	2SD1051 2SD1055	130p 60p	2SD1438 2SD1439	60p 165p	2SD1930 2SD1933	50p 45p	2SK560 2SK566	580p 475p
2SC1909 2SC1913	250p 90p	2SC2440 2SC2458	200p 10p	2SC2921 2SC2922	650p 480p	2SC3400 2SC3401	35p 50p	2SC3998 2SC4006	800p 100p	2SD560 2SD571	50p 20p	2SD1060 2SD1062	130p 150p	2SD1441 2SD1442	220p	2SD1939	60p	2SK606 2SK612	70p 80p
2SC1914 2SC1921	30p 15p	2SC2459 2SC2466	50p 55p	2SC2923 2SC2928	75p 550p	2SC3402 2SC3405	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	80p 200p	2SD1941 2SD1944	350p 50p	2SK684	950p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	130p 400p	2SC4023 2SC4029	325p 350p	2SD592 2SD596	25p 25p	2SD1064 2SD1065	250p 160p	2SD1446 2SD1450	300p 60p	2SD1958 2SD1959	80p 210p	2SK685 2SK699	1150p 100p
2SC1923 2SC1929	10p 180p	2SC2492 2SC2470	50p 65p	2SC2934 2SC2937	75p 250p	2SC3416 2SC3417	30p 90p	2SC4043 2SC4046	45p 40p	2SD600 2SD601	30p 40p	2SD1069 2SD1073	150p 350p	2SD1451 2SD1452	200p 275p	2SD1978 2SD1984	50p 60p	2SK719 2SK724	300p 500p
2SC1940 2SC1941	110p 27p	2SC2481 2SC2482	120p 20p	2SC2939 2SC2944	400p 300p	2SC3419 2SC3420	120p 80p	2SC4056 2SC4059	200p 400p	2SD602 2SD612	60p 50p	2SD1088 2SD1094	150p 375p	2SD1453 2SD1455	140p 250p	2SD1991 2SD1994	50p 200p	2SK725	550p
2SC1942 2SC1944	350p 350p	2SC2483 2SC2484	120p 185p	2SC2958 2SC2962	50p 800p	2SC3421 2SC3422	45p 75p	2SC4064 2SC4106	140p 150p	2SD613 2SD617	70p 300p	2SD1110 2SD1111	225p 20p	2SD1457 2SD1458	165p 50p	2SD1996 2SD2006	45p 75p	2SK726 2SK727	425p 475p
2SC1945 2SC1946	350p 1500p	2SC2485 2SC2491	400p 200p	2SC2979 2SC2987	160p 250p	2SC3423 2SC3425	60p 65p	2SC4107 2SC4123	175p 230p	2SD633 2SD636	70p 10p	2SD1113 2SD1128	225p 200p	2SD1459 2SD1468	60р 40р	2SD2010 2SD2011	250p 60p	2SK739 2SK758	400p 300p
2SC1947 2SC1953	450p 45p	2SC2498 2SC2500	50p 25p	2SC2988 2SC2995	150p 60p	2SC3446 2SC3447	150p 130p	2SC4124 2SC4125	200p 275p	2SD637 2SD638	15p 15p	2SD1133 2SD1135	65p 75p	2SD1487 2SD1494	225p 150p	2SD2012 2SD2018	50p 65p	2SK769	500p
2SC1957 2SC1959	70p 10p	2SC2502 2SC2503	140p 600p	2SC2999 2SC3001	50p 1400p	2SC3456 2SC3457	200p 125p	2SC4137 2SC4138	40p 200p	2SD639 2SD640	20p 350p	2SD1138 2SD1140	40p	2SD1496 2SD1497	300p	2SD2033	80p	2SK786 2SK787	200p 800p
2SC1962 2SC1967	175p 1300p	2SC2512 2SC2517	20p 120p	2SC3019 2SC3020	320p 1450p	2SC3459 2SC3460	180p 130p	2SC4157 2SC4159	400p 100p	2SD655 2SD661	18p	2SD1142 2SD1145	40p 350p	2SD1497-0		2SD2061 2SD2066	100p 250p	2SK791 2SK792	225p 300p
2SC1969 2SC1970	160p 100p	2SC2519 2SC2527	60p 300p	2SC3022 2SC3025	1850p	2SC3461	275p	2SC4161	125p	2SD666	60p 25p	2SD1148	25p 175p	2SD1505 2SD1506	90p 50p	2SD2125 2SD2136	180p 85p	2SK793 2SK794	300p 315p
2SC1971	400p	2SC2534	150p	2SC3026	500p 450p	2SC3466 2SC3468	225p 70p	2SC4169 2SC4199	60p 400p	2SD667 2SD669	20p 35p	2SD1153 2SD1159	30p 65p	2SD1508 2SD1509	60p 100p	2SD2144 2SD2151	35p 175p	2SK796	600p
2SC1972 2SC1973	600p 150p	2SC2535 2SC2538	300p 100p	2SC3030 2SC3037	300p 125p	2SC3481 2SC3482	300p 275p	2SC4204 2SC4231	60p 250p	2SD673 2SD676	350p 250p	2SD1160 2SD1163A	150p 220p	2SD1511 2SD1519	75p 250p	2SD2255 2SD2331	175p 250p	2SK809 2SK812	850p 150p
2SC1975 2SC1980	120p 30p	2SC2540 2SC2542	1900p 300p	2SC3038 2SC3039	125p 80p	2SC3486 2SC3502	275p 50p	2SC4235 2SC4236	300p 450p	2SD717 2SD718	180p 85p	2SD1164 2SD1168	75p 270p	2SD1521 2SD1525	70p 450p	2SD2333 2SD2340	150p 225p	2SK817 2SK851	325p 550p
2SC1983 2SC1984	75p 150p	2SC2545 2SC2546	55p 25p	2SC3040 2SC3042	260p 300p	2SC3503 2SC3504	50p 120p	2SC4237 2SC4242	500p 120p	2SD722 2SD725	240p 200p	2SD1169 2SD1173	280p 350p	2SD1526 2SD1541	100p 350p	2SJ48 2SJ56	425p 700p	2SK872	650p
2SC1985 2SC1986	100p 100p	2SC2547 2SC2550	65p 50p	2SC3052 2SC3057	30p 150p	2SC3505 2SC3506	240p 250p	2SC4278 2SC4288A	175p 650p	2SD726 2SD731	275p 250p	2SD1185 2SD1186	280p 400p	2SD1545 2SD1546	275p 350p	2SJ74 2SJ76	60p 220p	2SK875 2SK903	475p 500p
2SC2001 2SC2002	15p 15p	2SC2551 2SC2552	70p 60p	2SC3068 2SC3070	60p 35p	2SC3507 2SC3509	650p	2SC4300 2SC4301	200p 300p	2SD732 2SD734	250p 15p	2SD1189 2SD1191	55p 120p	2SD1548 2SD1554	400p 170p	2SJ77 2SJ79	350p 225p	2SK904 2SK951	500p 275p
2SC2003 2SC2004	20p 20p	2SC2553 2SC2555	200p 120p	2SC3071 2SC3073	25p 100p	2SC3514 2SC3518	170p	2SC4304 2SC4313	225p 600p	2SD741 2SD743	120p 130p	2SD1192 2SD1196	90p 150p	2SD1555 2SD1556	150p 225p	2SJ103 2SJ109	75p 200p	2SK952	275p
2SC2022 2SC2023	110p 180p	2SC2562 2SC2563	90p 200p	2SC3074 2SC3075	200p 150p	2SC3519 2SC3526	250p	2SC4381 2SC4382	150p 200p	2SD757 2SD760	120p 70p	2SD1197 2SD1198	150p 60p	2SD1565	75p	2SJ113	1050p	2SK955 2SK956	450p 400p
2SC2026 2SC2027	30p 200p	2SC2568 2SC2570	120p 30p	2SC3077 2SC3086	120p 150p	2SC3528 2SC3531	750p	2SC4386 2SC4387	275p	2SD762	100p	2SD1198 2SD1207 2SD1210	40p	2SD1571 2SD1572	170p 100p	2SJ114 2SJ116	1150p 1200p	2SK962 2SK1023	700p 550p
2SC2036	50p	2SC2571	350p	2SC3089	130p	2SC3549	200p	2SC4408	425p 50p	2SD763 2SD768	140p 180p	2SD1211	280p 120p	2SD1575 2SD1576	200p 150p	2SJ117 2SJ119	550p 700p	2SK1036	450p
2SC2037 2SC2053 2SC2055	50p 120p	2SC2577 2SC2578	110p 170p	2SC3101 2SC3112	750p 35p	2SC3552 2SC3568	200p	2SC4429 2SC4431	275p 90p	2SD772 2SD773	200p 20p	2SD1213 2SD1218	220p 75p	2SD1577 2SD1579	250p 80p	2SJ162 2SJ175	680p 200p	2SK1057 2SK1058	600p 800p
2SC2055 2SC2058		2SC2579 2SC2580	110p 175p	2SC3114 2SC3116	40p 75p	2SC3577 2SC3584	200p	2SC4466 2SC4467	325p 175p	2SD774 2SD777	30p 400p	2SD1223 2SD1225	75p 70p	2SD1589 2SD1590	60р 100р	2SJ182 2SJ200	150p 625p	2SK1081 2SK1082	700p 450p
2SC2060 2SC2061	75p	2SC2588	225p 600p	2SC3117 2SC3122	120p 50p	2SC3591 2SC3595		2SC4468 2SC4517	250p 200p	2SD784 2SD786	650p 100p	2SD1227 2SD1229	40p 250p	2SD1591 2SD1593	310p 125p	2SJ307 2SK19	175p 45p	2SK1102 2SK1117	375p 250p
2SC2068 2SC2071	140p	2SC2590 2SC2591	40p 50p	2SC3148 2SC3149	145p 180p	2SC3597 2SC3599	140p	2SC4517A 2SC4531	225p 450p	2SD787 2SD788	20p 30p	2SD1237 2SD1238	300p 300p	2SD1595 2SD1608	70p 210p	2SK33 2SK40	40p 50p	2SK1118	225p
2SC2073 2SC2075	60p	2SC2592 2SC2603	200p 10p	2SC3150 2SC3151	100р 175р	2SC3600 2SC3606	175p 100p	2SC4532 2SC4542	1000p 400p	2SD789 2SD792	20p 400p	2SD1244 2SD1246	25p 20p	2SD1609 2SD1632	45p 320p	2SK55 2SK68	100p	2SK1120 2SK1190	550p 350p
2SC2078 2SC2085	100p	2SC2610 2SC2611	60p 30p	2SC3152 2SC3153	130p 175p	2SC3607 2SC3608	150p	2SC4742 2SC4744	275p 350p	2SD794 2SD795A	33p 140p	2SD1247 2SD1251	40p 180p	2SD1637 2SD1647	50p 40p	2SK73 2SK97	75p 200p	2SK1191 2SK1217	800p 700p
2SC2086 2SC2092	60p	2SC2621 2SC2625	70p 190p	2SC3156 2SC3157	350p 200p	2SC3616 2SC3636	45p	2SC4745 2SC4747	550p 375p	2SD798 2SD799	175p 150p	2SD1254 2SD1263	55p 90p	2SD1649 2SD1650	260p 150p	2SK106	40p	2SK1221	200p
2SC2094	1200p	2SC2626 2SC2630	600p 1800p	2SC3158 2SC3159	260p 200p	2SC3642 2SC3657	225p	2SC4757 2SC4762	200p	2SD809 2SD811	45p 450p	2SD1264 2SD1265	55p 75p	2SD1650 2SD1651 2SD1656	150p	2SK107 2SK109	40p 150p	2SK1275 2SK1296	275p 350p
2SC2099 :	2500p	2SC2631 2SC2632	20p 35p	2SC3164 2SC3169	270p 150p	2SC3659 2SC3668	600p	2SC4769 2SC4770	220p	2SD819	300p	2SD1266	180p	2SD1663	250p 350p	2SK117 2SK118	50p 50p	2SK1299 2SK1317	450p 900p
2SC2118 2SC2120 2SC2122A	10p	2SC2634	10p	2SC3170	300p	2SC3675	100p	2SC4820	225p	2SD820 2SD821	250p 550p	2SD1267 2SD1271	55p 55p	2SD1666 2SD1667	50p 120p	2SK125 2SK133	100p 650p	2SK1338	250p
2SC2131	550p	2SC2636 2SC2637	40p 120p	2SC3173 2SC3175	180p 150p	2SC3678 2SC3679	140p	2SC4826 2SC4891	800p	2SD822 2SD826	290p 30p	2SD1271A 2SD1272	200p	2SD1668 2SD1669	90p 85p	2SK147 2SK152	160p 40p	2SK1341 2SK1342	500p 500p
2SC2141 2SC2153	40p	2SC2640 2SC2653		2SC3178 2SC3179	125p 70p	2SC3680 2SC3685	450p	2SC4923 2SC4924	250p	2SD829 2SD836	375p 50p	2SD1273 2SD1274	50p 80p	2SD1677 2SD1680	200p 225p	2SK161 2SK163	30p 40p	2SK1350 2SK1356	200p 225p
2SC2166 2SC2168	120p	2SC2654 2SC2655	50p	2SC3180 2SC3181	175p 200p	2SC3687 2SC3688	550p	2SC4927 2SC5002	300p	2SD836A 2SD837	50p 55p	2SD1275 2SD1276	50p 60p	2SD1683 2SD1684	45p 70p	2SK168 2SK170	40p 50p	2SK1357	350p
2SC2188 2SC2200	70p 250p	2SC2656 2SC2660	550p 100p	2SC3182 2SC3198	120p 30p	2SC3692 2SC3715	150p	2SC5003 2SC5027	350p 100p	2SD838 2SD841	500p 110p	2SD1277 2SD1279	190p 600p	2SD1706 2SD1707	325p 400p	2SK184 2SK192	35p 45p	2SK1358 2SK1377	400p 150p
2SC2209 2SC2216	50p	2SC2665 2SC2668	200p 10p	2SC3199 2SC3202	40p 25p	2SC3717 2SC3729	120p	2SC5048 2SC5044	300p	2SD844 2SD850	200p 170p	2SD1288 2SD1289	175p 250p	2SD1708 2SD1710	375p	2SK193	40p	2SK1400 2SK1404	250p 290p
2SC2221 2SC2228A	650p	2SC2671 2SC2681	100p	2SC3209 2SC3210	120p 550p	2SC3746 2SC3747	100p	2SC5044 2SC5086 2SC5129	250p	2SD856 2SD858	48p	2SD1291	280p	2SD1718	275p	2SK195 2SK197	150p 140p	2SK1461	220p
2SC2229	15p	2SC2682	70p	2SC3211	220p	2SC3748	100p	2SC5148	300p	2SD863	250p 23p	2SD1292 2SD1293	60p 70p	2SD1729 2SD1730	275p	2SK212 2SK214	35p 170p	2SK1462 2SK1487	425p 250p
2SC2230 2SC2233	100p	2SC2688 2SC2690	60p	2SC3212 2SC3225	260p 50p	2SC3752 2SC3781	150p	2SC5149 2SC5250	300p	2SD864 2SD866	200p 120p	2SD1297 2SD1302	300p 20p	2SD1732 2SD1739	180p	2SK216 2SK223	200p 50p	2SK1507 2SK1529	300p 700p
2SC2235 2SC2236	20p	2SC2694 2SC2705	40p	2SC3242 2SC3244	30p 45p	2SC3782 2SC3783	300p	2SD188 2SD198	140p	2SD866A 2SD867	140p 350p	2SD1306 2SD1308	45p 80p	2SD1740 2SD1748	125p 90p	2SK240 2SK241	140p 30p	2SK1537	400p
2SC2237 2SC2238		2SC2706 2SC2710	250p 50p	2SC3246 2SC3259	50p 350p	2SC3787 2SC3788	100p	2SD199 2SD200	195p	2SD868 2SD869	260p 150p	2SD1309 2SD1310	140p 140p	2SD1756 2SD1758	275p 60p	2SK246 2SK300	30p 25p	2SK1544 2SK1767	900p 275p
2SC2240 2SC2258	15p 30p	2SC2712 2SC2714	20p	2SC3260 2SC3261	220p	2SC3789 2SC3790	75p	2SD201 2SD213	260p	2SD870 2SD871	140p	2SD1311 2SD1313	65p	2SD1760 2SD1761	80p	2SK301 2SK303	40p	2SK2038 2SK2039	295p 750p
2SC2259		2SC2716		2SC3262		2SC3795		2SD234		2SD879		2SD1326		2SD1762		2SK304		2SK2134	225p

	REPLACI	EMENT VIDE	O HEADS	
Model Price	Model Price	Model Price	Model Price	Model Price
AKAI VS105, 112, 115, 116, 120, 125, 126, 201,	VHSAN3 800p VHSAY3 1200p VHSBH1, VHSCH1 2100p	HRD750, HRD830, HRD860 1900p HRD250, HRD257 1800p 3V32, 8942, HR7655 1800p	NVFS 100 4500p NVFS1 4200p	VHR120, 130, 14, 141, 143G, 14SP, 151, 15, 16, 171, 220, 23, 244, 274, VHR310,
202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82 850p	VHSBH1, VHSCH1 2100p VHSBP1 850p VHSBY3 2600p	HRD180, 190, 230, 610, 3V59, FV12L, FV20R, 26, 30, 32, 33, VC141L 1600p	N.E.C. N9011, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, N9034, 9040,	330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100,
VP7100, VS9300, VS9500 650p VP7200, VS9700, VS9800 900p	VHSD52 1600p VHSEH2, VHSDH2 1600p	HRD370, HRD430, HRD470, 3V58, FV13H 1800p HRD530, HRD700, HRD840, HRD870,	9053, 9054, 9055, 9056, 9063, 9065, 9066, 906	VHR\$200, \$600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 7810, 8000SP, 8801SP, VHRD4400, 4410,
VS1 900p VS2 900p VS3 900p	VHSEY1, VHSEY2 1400p VHSFS1, VHSFS2 1300p VHSFG2, VHSFG4, VHSF63,	HRD910, FV14T, FV57H 2300p GRC1, GRC2, 3 V41 2800p	N9096, DX1000, 1600, PX1200 850p N911A, 914C, 915A, 916A, 917, 9110, 9120 2400p	4500, 4600, VHRD4610, 6700, 4800 3100p
VS10 1350p VSP1 900p	VHSFB3 1300p VHSTJ1, VHSTJ2, VHSTJ3, VHSWJ3,	BR9060, HRD330, 337, 440, 441, 637, 641, 660, 670, 720, 730, 740, 820	PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770.	TLS2000 4250p VHR5300, VHR6500, VHR7400 4500p VHR3500EX 2150p
VS33,35, 37, 38, 38EOG MKII, 53, 55, 66, 765, 766, 767, 768, 865, 867, VSF30, 33, 4, 400, 410, 420, 430, 440, 441,	VHSYJ2 700p VHSVH4, VHSWH1, VHSXH1, VHSYH2 1600p	HRD950, HRD960, HRD980, FV46 4500p	774 1650p N380, N381, N830, N831, N832, N833, N834, N835, N836 550p	VHR16, 235, 335E, 4150, 4160, 4350, 7250, 7260, 8250 1950p
450, 455, 480, 490, 497, VSG51, 54, 55, VXS450,	VHSWJI VHSXJ3 700p	HRS5000, HRS5500, 5800, 9000, FV395.BRS600, SRS368E 5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000 2400p	VTC3000 1400p SHARP VC390, VC393, VC496 2750p
VXS470 1600p VS512, VS515, VS516 2250p VS462, 465, 467, 467EOG2, VSF12, 15EK,	VS410, 415, 435, 450, 456, 460, 500, 505, 510, 520, 521, 530, 546	FV22L 1400p FV42 2600p VR182LV, VR202LV 1950p	N895 1800p N9052, N9530, DX2000 3400p VCP1 1700p	VC488 4200p VC779 1800p
15EOH, 300, 301, 310, VSF320, 330, 340, 350, VSG30,	BARCELONA, MVS5400, 440, 500, 600, SE5100, 6100, 6110, 9100 TVR4500, 4510, 5510, VS400, 440, 441.	FV67HV, FV68TX, FV77 3800p R2000 SERIES 4500p	PVC2300, 2400, 740, 744, 760, 764 1400p	VC789, VC790 2900p VC200, 220, 300, 381, 383, 384, 385, 386,
33, 34, 35 2300p VS11, VS12 1000p	500, 505, 510, 518, 600, 610, VS5180, VS6190, 700, 900, 901, 902,	FV61LV, FV62LV, FV67HV FV42L VP160L, VR172L 4000p £101.00p 1950p	DS6000 3500p D5600 3500p VH3, VH555, VH600, VH700, VH844,	387, 388, 471, 477, 481, 482, VC483, 486, 3300, 8381, 9100, 9300, 9400, 9500, 9600, 9700 850p
VS6, VS8, VS9 VSX9 VSA1100, 1110, 650, VSF500, 510, 550,	9091, GV200, 201, 2092, SE2100, 5110 1400p MADRID, SE5140, VS540,	HRJ200, HRJ205 3300p HRJ600EG, HRJ600EK, HRJ605EG,	VH900, VH1000 (ALL MODELS) 1100p	VC108, 208, 382, 402, 405, 408, 500, 550, 571, 573, 581, 582, 583, VC5W20E, 600,
560, 580, 590, 600, 650, VSG60, 64, 65, VSG70, 73, 74, 75,	VS5480 3000p MVS550, 620, VS550, 620, 630, 640, 790,	HRJ605UK, HRJ610EK 7100p HRJ300, HRJ305, HRJ315, HRJ316EG,HRJ318E 3750p	VH1, VH2A 700p D1000, D1100 1600p	651, 674, 681, 684, 6V3, 750, 780, 781, 683, 684, 402, VC500, 571, 573, 580, 584, 600, 682, 693,
VSX560, 580 3600p VS155, VS165 2300p VS20, 22, 23, 24, 25, 26, 27, 422, 425, 426,	930, 940 2400p VS120 2300p VS680, GV280 4600p	HRJ615, HRJ715, HRJ815 9200p HRJ400, HRJ405, HRJ407MS, HRJ41	D1000X, D1500X, D4500, VPCD100, D1200, D2000X, D5000 1600p VR6460, VR6520, 64VR60,	700, 772, 7810, 782, 7822, VC783, 8481, 8581, VCA10, 100, 102, 103, 1031, 103,
427, 485, VSF10, 11, 180, 190 VSF200, 210, 220, 221, 222, 230, 240, 260,	VS160, VS740 4400p VS170 4600p	OEK, HRJ415, HRJ416 4500p MATSUI	VR6420 725p VR6711 4 HEAD 1800p	104, 105, 106, VCA111, 113, 116, 131, 140, 202, 203, 211, 234, 244, 254, 255, 30, 35, VCA40,
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VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSX400 1250p VSR9 1300p	VS922, 9291, GV210, 211, 220, 2292, MV2105, 2115, SE2120 1700p	VX600 1100p VX900 2650p	VR6920 2750p 41DV2, 4SB11BVR412, 415, 6485, 6490,	VC793 3000p VC473, VC785, VC786 1600p
VS 109, VS603, VS606, VS607 2500p VS75 2500p	HINARI VXL2, 3, 4, 20, 25, 35 1000p	MITSUBISHI HS303, HS304, HS320, HS700 HS306, HS318, HS710 1100p	6880 1600p	VC699, VCA501, VCA602 2400p VC585, VC685 1700p VC90ET 3900p
VS965, VC967 3450p VSF400, 410, 420, 430, 440, 441, 450, 45S, 480, 490, 497, VSX450,	VXL6 1200p VXL7 1300p	HS307	20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 21DV3, 2SB01, 02, 11, 12, 30DV2, 31DVI, 31DV2, 31DV3, 3SB02, 03, 05, 11, 12, 13,	VFH815 2800p VC800, VCH851, VCH852,
470 2850p VSG20, 204, 204, 205, 206, 20, 21, 211,		HS400 2800p HS349, HSE27, 31, 32, HSB27,	68SB4, 71SB4, 86SBI, 91SB2, 92SB2, DV186, 190, 291, 292, 468, 471, VR201,	VCH882 2700p VCH80, VCH81, VFH815 2800p VCA33, VCA36, VCA43, VCA44, VCA46,
212, 215, 217, 225, 23, 24, 25, VSP100, 110, 88, VSR100, 110, VSX400 1300p	HITACHI VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30 850p	31, 32, HSM33, 34, 35, 37G 1650p HS411 2400p	202, 203, 2115, 212, 213, 223, 231, 232, 302, 303, 305, 311, 312, VR313, 3210, 3219, 322, 3229, 323, 501, 6180, 6182,	VCA49 1500p VCA55, VCA63 1800p
VSG415, VSG415EA, VSG425 2800 p VS75, VSA77 2700 p	VT7, VT17, VT18, VT19 1600p VT35, VT350, VT38, VT39 1800p	HSE30, HSB30 1600p HS338 1600p HSE10, HSE11, HSE20, HSE21, HSE41,	6185, 6290, 6291, VR6293, 6362, 6367, 6467, 6468, 6470, 4600p	VC570 2800p SONY
VSF1000, VSF1010, VSF1030 5800p	VT100, 110, 111, 112, 113, 115, 118, 120, 125, 128, 220, 225, 400, 405,	HSB10, HSB20 1500p HS300, HS301, HS302, HS310,	VR3260, 6349, 6442, 663, 6448, 6449, 6542, 6643 1250p VR601 1800p	DSR-19R FOR SL-T 9ME 3100p DSR-21 R FOR SLC 8-C9 2600p DSR-35R FORC20, C30, C40, SLF1UB,
VDR3000, VCR4000, VCR5000, VCR6000 1650p VTV10 1000p		HS273, HS550Q 1000p HS200 550p HS337, HS347 1000p	49SB6, VR6548, VR6648, VR6843 2750p	SLF1E2 PIN, SLC24PS, 33E, 34, 44PS, SLF11, 30PF, 35, 60PS, SLK85,
VCR7000, 7800, 8000, 8800 1100p	727, 728, 820, 821, 825, 920, 921 1100p	HSB12, HSE12, HSE22, HSM16G, 18, 23, 25, 30, MX1 1700p	SAISHO VR100, 605, 705, 805, 905, 1000, 1100,	SLT20ME, 30ME, SL100 1500p DSR-43R FOR SLC7 RANGE, SL5000, SL5100, SL3000 1 PIN, SLC6E, SL36ES,
VCR4500, VCR5200, VCR9000, TVR1 900p		HS411EZ, HS411GZ 2100p HSB11, HSB21 1600p HSB52, HSE50, 52G, HSM36, 50, 54,	1200, 1600 1200p VR3300X, VR3600X, VR3650X, VR3800 1400p	SL37E 1300p SL3000, SL8000, SL8080, SLC5E, SLT7ME
VCR7000 1000p VCR1000, 2000, 6000, 61000, 62000, 8600, 8602, 8700, 9005, DD8900, DD8904,	VT77, 680, 6500, 6700, 6800, 7000, 8000, 8030, 8040, 8100, 8300, 8500	55, 57, 58, 60 3100p HSE51 2600p	VR3200, VR3500 1400p VR2000, VR3300, VR3600 1400p	SLV201, SLV202 1500p
TVR4 1100p	9900	HS410 3000p HS412, HS421GZ 3100p HS5300, HS5424, HS5600 2500p	VR2500 2650p VRS5000X, VX6000A, VXL12X 1500p	CULTOTE CLUCTOVE CLUVATO
VCR400 1100p VCR8800, VCR8804, VCR9340 2100p VCR8603, VCR8604, VCR8704, VCR8714	588 2500p VT65 1800p	HS5300, HS5424, HS5600 2500p HSM20, HSM55 1900p HSM40 2350p	SALORA 6500, 6600 SV7300, SV8200, SV8300,	DSR49R, SLHF100P, SLHF100UB 3000p
VCR9140, VCR9142 2550p	425, 426, 428, 430, 431, 435	HSM59, HSM68E 6050p NV300, 322, 332, 333, 340, 390, 2000, 2010, 3000, 7000, 7200.7500, NV7800,	SV9200 1500p SV7400, SV8400 1600p	SIV25318 2100p
VCR9340 3650 p VCR9244 3450 p	635, 636 VT52, VT60, VT61E, VT62E, VT63, VT64,	7850, 8170, 8200, 8400, 8600, 8610, 8620 625p	SV8100 1200p SV900, SV9900 3450p SV601, SV611, SV6910 1500p	CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E 4800p
UF020, 22, VCR3000, 3002, 9500 1750p FISHER	VT640 850p VT168, VT150, VT260, VT450, VT498	NV777, NV330 1150p NV8050, NV8051 2500p	SV800, SV810 2800p SV6700 SV8710 SV8750 1500p	SLV310, SLV315, SLV325, SLV335 1200p
FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 716, 720,	(4 HEAD) 1900p VT530 1400p VT522, VTM212, 620, 622, 720, 722, 822,	NATIONAL PANASONIC AG1000, 1050, NV250, 260, 280, 450, 460, 465, 470, 480, 650 1100p	623N, SV6800, SV6900, SV8850, SV8870, SV8970 1750p	SLV210, SLV212, SLV270, SLV273, SLV285, SLV300 950p
FVHP721, 722, 730, 830, 905, 906, 907, 908, 910, 911, 915, 916, 918, FVHP5000, 5001, 5005, 5050,	922, 925 1300p VT660E 2600p	AG6010, AG6015 2000p AG6840 2000p	923N 4500p	CIVIDED CIVIATE CIVIVED
5075 V8S3500, 7100, 7500, 7600, 9900, VBR330	V/TEAU 545 546 548 VTD660 665	NV100, NV200, NV370, NV380, NV630 675p NVD80, NVH65 2600p	\$V8600, \$V8700 1550p \$V8420 2400p	SLVX55 2000p SLVX75, SLVX90, SLVX95 3000p
VBS7000, VBS7100, VBS9000 2000 FVHP500, 711, 715, 721, 722, 730, 830,	TM598, 640, 645, 646, TM730, 731, 735, 736, 740, 745, 746,	NVD80, NVH65 2600p AG5150, AG5250, NVF65, NVH75, NVH75 NVF51 4200p	SV9300 2500p SV8830 2200p	SLHF100P, SLHF100UB 3400p
FVHP725, FVHP830, FVHP980 2500	VTE770 774 775 860 861	NVF51 4200p NVGI9 2300p NVJ30, NVHJ33, NVL10, 20, NVL21,	SV8520 1900p	SLVE90 5150p SLV615, SLV625, SLVE600, SLVE700,
FVHP990 2700 FVHP975 2400 FVHD407, FVHD140, FVHP1, FVHP10,	9 865 4100p 9 VT85, VT86, VT88 2000p	NVG30, 31, 40, 130, NVJ37, 40, 42, NVSD30, 10EE, 11, 2, 30, 35	SAMSUNG SV8500 1500p SVX301, VB900, 910, VVT510, VT320,	SLVE800 3450p TOSHIBA
FVHD407, FVHD140, FVHF1, FVHF10, FVHP20 1150 ₁ FVHD230, FVHP1100, 1200, 130, 1340,	VTF780, VTF785 VTF180, VTF185, VTF280 VTF350, VTF351 4800p 8500p 5150p	NVJ35, NVG46	5600, VX510, 511, 520.616, VX626, 627	V63 1500p V9680 3400p V8600, V8650, V8700 3000p
1410, 2000, 200, 210, 300, FVHP310, 410, 420 1800 ; FVHD250, 270, 370, FVHP1500, FVHP250	VTM220, VTM220E, VTM220UK 3000p VTS390E 5150p	AG2100, AG2200 700p NV430, NV431, NV433, NVSD2, NVSD22, NVSD25, NVSD3 800p	9/0, 9/1, 9/2, 5V/16, /1/, 5VA3U3, 3U3,	V21, V31, V32, V33, V50, V51, V52, V53, V9600 1100p
EVHP132 1400 1440 320	HR2200, 3300, 3320, 3330, 3350, 3360,	NV730, NV730F, NV770	900, 910, 1200p	V83, V841V85, V86, V87,
440, 445 3550 FVHP470S, FVHP475HV 4800 FVHP1250, FVHP430S 1950	3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V06, 3V22 550 p	NV366 1700 NV21 HQ, NV 180, NVD48 1700 NV7881 1700	750, 751, 770, V8750, VK8220, VX750, VX7330, VK770, VK8225, VR1730, 1735,	V88 1050p DV90, 96, 97, NM3, V108, 109,
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2051 1900 GVH51, GVH122, VCP4000, VCP4100,	3V16, 3V233V24, 3V31, 3V35, 3V36, 3V38	AG6024, NVG33, 46, NVL23, 25, 28, NVJ47,	PL30LR, PX3031, 31R, 32R, 990, 992, 991, PXP30, PXR30, VX 1260, SVX503, SX3230, 3231, 3260, 3261, VK30, 300,	V600 2350p V880MS 2600p
VCP4200 1100; GHV1232, 1233, 1241, 1242, 1243, 1244, 1245, 1246, 1266, 1290, 1291	P 3V39, 3V49 550p BR1600, HRD140, 141, 142, 143, 150, 152,	49, 700PX, NVSD20EE, 400, 44, 45 NVG10, 11, 12, 14, 16, 120, NV250, 280,	1230, 1260, 1261, VK30R, 31R, 32R, VXK300, 301, 306, 320,	V500G, V509G 2500p V9680 2900p
GHV1295, 1296, 1891, 8210, 8215, 1221, 1240, 1241, 1247, 1248, 2145	156, 157, 158, 160, 5101 HRS10, 8947, 8948, 3V42, 3V44, 3V45, 3V46, 3V47, 3V52, 3V54,	450, 465 1100 ₀ NVG18 1400 ₀	321, 326, 336 S11230, 1240, SVX600, SX1230, 1231,	V300G, V301, V305, V306, V309G 2550p
VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, VCP4320, 4321, 4325, 4326	3V55, 3V56, 3V57 HRD154, 170, 171, 210, 211, 217, 310,	NVG20, 21, 22, 25, 28, 200, NVD48 1200	7230, 7301 1900p	V110, V120, V130, V140, V210, V211,
C211, GHV1392P, 1393P, 19OOP, 1290, 1291PQ, 12931Q, 1295P,	HRD527, 540, 550, 560, 590, 770, HRD520, HRDX22, 8950, 8951	NVG45 1100 NVH70 2400	VTC5000, 5400, 600, 6000, 6010, 6500, VPR5000, VTC 1500, VTCM 10, 11, 20, 21	V220, V221, V222 1100p V711, V880 2700p
GSE1295PQ, GSE1296, 1297, 1891, 1910 20005, 2000, GSEC200, GSEC205, 211, 2301, GSEG2301,	' 3V64, 3V65, FV10, FVII, FV20, FV21, FV26	NV688 1650 NV600 1050	5 VTCM25, VTC2000, 5100, 5150, 5300, 5150, 5400,	VCPB1E, VCP2C2 1300p V65, V66, V6 950p V312, V322, V412 2600p
GSEQ12, 204, 20, 22, P416P, P500P QUISY22, QUISY24, RC205P, RG11P,	HRD565, HRD566, 3V48 HRD725, HRD755, 3V43, 3V53 8930, 8931, 8933, 8940, 3V29,	AG6100, AG6200, AG6300 2100	30, VPR5800 1800; VTC5500, 5550, 9100, 9300, 9350, 9355,	V91G 4600p V609, V610V610B, V610UK, V611,
RG20, RG2001, RQ20, RQ204HP, RQ241, VCP100P,	3V30 550 ₁ 8945 2400 ₁	NV780 2000 NVG 15, NVG400 2600	p 9455, 9500 1700; p VHR1110, VHR1150, VHR1300, VHR1700.	V312, V403T, V413G 9200p
GSEG10 1300 GHV4400, 4400, GSE-Q404P, QUISY40, RC405P 2350	P 3V00, 8902, 8903, 8909, 8912,	NVM7, NVMC20 3800 NVF70 5200 NVJ45, NVJ47 1200	VHR3200, 3270, 3100, 3110, 3150, 3300, 3400, 3310, VHRD500 1100	V95G 8000p
GSEQ121, RQ2011, RQ2031, RQ2051 1950	P FV37, FV43H, HRD860 2000 BR7000E, BR7000S, BR7030,	NVSD40 1050 NVF75, NVF77 4300	p VHR1500, VHR2500, VHR3330 1500p p VHR2700 2450p	CPANDATA ITD
G.E.C. 4000H, 4001H, 4002H V4001H, V4004, V4100 1200	BR7030/40H, BR7040 2100 P HR7200, 7300, 7350, 2650,	NVF55 2800 NVFS200, NVFS88, NVSF90,	VHR5700, VHR7700E, VHRD4710 2700	TFI: 0181-900 2329
V4005H 1500 GRANADA	HRD455 1600 HRD520 1400	NVHD90, NVHD 100, NV HD 101, NVHF 100 2300	VHR150E, 153, 154, 1501R, 240, 250, 251	FAX: 0181-903 6126
CSI, DS2 1600 VHSAH1 1100	p HRD300, 400, 580, 600, 620, p 640, 650 1500	NVSD1 1000 AG7330, AG7350, AG7355,	6550 1800	
VHŠAH3 2400	P NATION 1000			NE DA DEC

ALL TV & VIDEO PARTS SOLD ARE REPLACEMENT PARTS

		/CR BELT KIT	ΓS	
Model Price	Model Price	Model Price	Model Price	Model Price
VP7100, VS9300, VS9500, VS9700, VS9800	TX3650, VCR3000, VCR3002, VCR9500 75p	406, 407, 4092, 410, GV411, 412, 414, 415, 416, 417, 4192, 4200, 420, 430, 434, 435.	N.E.C. N830, N831, N832, N833 100p	V1710, 730, 750, 970, VX710, 712, 720, 730, 970, 971, 972
VS1, VS2, VS3, VS5, VS12, VS15, VP88 70p	FISHER	GV437, 440, 450, 4592, 460, 464, 470, 500,	N895 80p	970, 971, 972 VX9880 110
VS10 65p	VBS7000 245p VBS9000 120p	I GV5105, 511, 530, 5395, 540, 560, 5695	PVC2300, PVC2400 180p DX1000, 1600, 1800, 2000, 3000, N9012, 9013,	SX7121 95
VSX9, VS105, 112, 115, 116, 120, 125, 126,	VBS9000 120p FVHP520, FVHP530, FVHP420 60p	MV4005, 4105, SE4100, 4104, 4120, 5102.	9014 9016 N9033 9034 9053 9054 9056	SANYO VTC5000, 5150, 6000, 6500, VTCM10, 11, 20,
155, 165, 205, 220, VS24, 240, 244, 245, 247, 248, 250, 512, 515,	FVHP615, 618, 620, 622, 710, 711, 715, 720,	5104, 5106, TVR37001 70p	9056, 9066, 9096, 9110, 9120,	21, 30, 31, 50 65
516 200p	721, 722, 725, 730, FVHP830, 840 60p	VXL2 80r		VTC5300, VTC5350, VTC5400, VPR5800 80
VS22, VS23, VS25, VS35, VS37, VS38, VS53, VS55, VS66 80p	FVHP905, 906, 907, 908, 910, 911, 915, 916,	VXL7, VXL8, VXL9, VXL10, VXL11, VXL19,	NV300, NV330PX, NV332, NV333 NV340,	VTC5500 70
VS4, VS6, VS8, VS9 95p	918 76p VBR330, VBS7500, VBS7600.	200 1000	NV366 100p NV777, NV788 100p	VTC9100, VTC9300 140 VTC1100, 1300, 1500, VHR1100, 1110, 1150,
VSA77 120p	VRS9900 400m	VXL4, VXL35, VTV300 70p	NV2000, NV2010, NV3000 80p	1200, 1300,
VSS99 105p		VXL5, VXL6 100p VXL3, VXL20 90p		VHR1500, 2370, MVR220 80 VHR2100, VHR2300, VHR2500,
VCR40000 130p	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 110p	HITACHI	NV230, 250, 280, 430, 431, 433, 450, 460, 465	VHR2700 100
VCR5000, VCR6000 105p	FVHD230, 250, 270, 370, FVHP1100, 1200,	VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, 39, 88, 165, 5030	470, 650, 730, NV770, 810, 870, 890, 970, AG 1000, 1050 85p	VHR3100, 3110, 3150, 3300, 3310, 3400, 3500, 370 3800, VHRD500, 700, TLS1000, TLS1001 65
VCR161, VCR222 100p VCR3000X, VCR4000, VCR4000X 75p	1250, 130, 132, FVHP1340, 1400, 1410, 1440, 1500, 2000, 200.	VT5000, VT5500, VT18 1200	NV370, NV380, NV480, NV630, NV780,	VHR120, 130, 14, 141, 143, 14, 150, 151, 153,
VCR7000, VCR7800, VCR8000, VCR8800 110p	210, 250, 3, 300,	VT7000, VT8000, VT8030, VT8040, VT8300,	NV600 NV600 ACCOLD ACCOLD	154, 15, 16, 171, VHR194, 220, 23, 235, 240, 244, 250, 251, 274, 297, 310, 330, VHR335, 390
AMSTRAD 105p	310, 320, 2000, 410, 420, 430, 440, 445, 470, 475, FVSD2905 85p	VT680, VT6500, VT6800, VT9300, VT9500.	NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, NVH70 50p	4100, 4105, 4150, 4200, 430, 4300, 4350, 474
TVR123, VCR4600, VCR4700.	FVHP5000, 5005, 5050, 5075, 5100, 975, 980,	VT9700, 9900 75p VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 86,	NVFV1, NVM10, 3000, 3300, 40, 7, 9000, 9900	VHR4770, 5080, 5100, 5200, 5300, 5350, 5700 6850, 7100, VHR7200 7250, 7260, 7300, 7400,
VCR5200 80p	990 95p	640 60p	NVMS1, 4 70p	7500, 7520, 7530, 7530, VHR7540, 7700, 774
VCR7000 80p VCR1000, 2000, 6000, 6100, 6200, 8600, 8602,	G.E.C. 4005 150p	VT3000 120p VT100, 110, 111, 113, 115, 118, 120, 125, 128.	NVM 1, NVM3, NVM5 70p	7800, 7810, 8000, 8100, 8200, 8250, 8500, VHR8800, 8801, VHRD4400, 4410, 4500,
8603, 8604,	V4004 100p	130, 135, 138,	VR6460, VR6920 170p	4600, VHRD4610, 4710, 4890, 6700 60;
VCR8700, 8704, 8714, 8800, 8804, 9000, 9005, 9244, 9340,	V4007 80p	VT145, 150, 168, i70, 175, 220, 225, 250, 255, 258, 260, VTL30 60p	VR6540 100p VR6442, VR6542 70p	VTR1000 70r
DD8900, DD8904, TVR4 100p	GOLDSTAR GHV1221, 1232, 1233, 1240, 1241, 1242, 1243,	258, 260, VTL30 60p VM500 VM600 90p	VR2025, VR2580 100p	VTC6010 75
TX3650, UF20, 22 24, VCR3000, 3002, 4000,	1244, 1245,	J.V.C.	DV186, 190, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, 203, 211, 2115, 212, 213, 223.	SHARP VC200, 381, 384, 385, 386, 388, 390, 393, 838,
9500 75p VS1004 105p	GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215,	HR3300, HR3330, HR3360, HR3660, HR4100 1300	311, 312, 313, 3210, 3219, 322, 32, 29, 323,	9100, 9300, 9500, VC9700 80c
BLAUPUNKT	VCP4100, VCP4130 80p	HR7200, HR7300 50p	535, VR20DV1, 20DV2, 20RW7, 21DV1, 21DV2, 21D, V3, 25BO1, 25BO2, 11, 12, 302, 303, 305,	VC7300, VC7700, VC7750, VC7800, VC8000 110r
RTV100 200p	GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301.	HR7350, HR7600, HR7610, HR7650, HR7655 500	31DVI, 31DV2, 31D, V3, 3SB11, 3SB12, 3SB13,	VC8300 115c
RTV200, RTV222, RTV224 90p RTV202, RTX200 150p	VCP4305, 4306, 4310, 4311, 4315, 4320, 4321,	HR7700 50p	72SB8, VR30DV2, 35BO2, 35BO3, 635B7, 715B4, 715B5, 715B8, VR865B2, 915B2.	VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481
RTV322, RTV248 100p	4325, 4326 120p	HRD110, 111, 120, 121, 220, 225,	925B3, VR6180, 6182, 6185, 6285.	VC402, 500, 571, 573, 581, 582, 583, 584, 585.
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707	GRANADA	HRD140, 141, 143, 150, 152, 157, 158, 160	6290VR6291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561.	VCSF3, VC8581 80r VC108, 405, 408, 550, 600, 651, 674, 681, 682,
434, 444, 707 135p RTV211, RTV214 140p	VHSH1, VHSAH3 100p VHSVH4, VHSWH1, VHSXH1 60p	190, 250, 257, 310, HRD455, 565, 566, 725,	6570, 6581, 6670, VR6676, 6710, 6760, 6761.	682, 684, 685, 693
RTV324, RTV32565p	VHSYH2 50p	HRD 170, 171, 180, 210, 21 1, 217, 230, 300	6762, 6870, 6970, 6975, VR68SB4, 86SBI, 92SB3 75p	VC700, 750, 783, VC6F3, VC6V3 70p VC208, 671, 772, 779, 780, 781, 782, 785, 786,
RTV315, RTV316, RTV319, RTV320, RTV317 50p	VHSBH1, VHSCH 1 150p VHSBP1 135p	320, 321, 330, 337, HRD350, 370, 400, 430,	VR445B9, VR445B920, VR445B922, VR6443,	787, 793, 800.VC7810, 7822, VCA100, 102
RTV301, RTV333, RTV338, RTV404,	VHSAN3 110p	440, 44 1, 500, 530, 700, 750,950, HRS5000, 5500, 8000, 9000, BR9060, BRS600.	VR3260, 6349, 6448, 6449, 6548, 6648.	103, 104, 131, 140, 170, 202, 03, VCA234, 501, 502, 602, 5011, VCB311, 361, VCD801, 802,
RTV424 85p	VHSDS2 125p VHSAY3 125p	605, 920, 925 45p	49SB620, 644869S, 49SB6 110p	VCH851, 852, 882, VCM73, VCT72 65n
FERGUSON 3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901,	VHSBY3 100p	HRD227, 520, 52 1, 522, 527, 600, 610, 620, 637, 641, 650, 830,	VKR6850, VKR6855 70p VR501 110n	VCA10, 103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA36, 37, 40, 43, 454,
8902, 8903, 8904,	VHSEY1, VHSEY2 70p VHSCC1 100n	HRD840, HRDX20, 22, HRJ200, 205, 300, 305,	VKR6800, VKR6810, VKR6820 70p	48, 50, 505, 51, 52, 53, 54, 55, 56, 57, 58,
8906, 8909, 8912, 8922 3V23, 8923, 8924, 8929 50p	GRANADA	SR330, HRS10 125p HRD840, 550, 560, 580, 590, 640, 660, 670,	SE4104, VR231, 2310, 2319, 231, 232, 2329, 237, 23, 241, 2410, 2419, 242, 243, 245, 2469,	VCA60, 605, 615, 67, 68, 1031, VCB320, VCBS97, VCD805, VCD806, 810, 815, VCH80,
3V23, 8923, 8924, 8929 5 0p 3V29, 3V30, 8930, 8931, 8933,	VHSDP1, VHSFV2 80p	720, 730, 740, 770, HRD820, 860, 870, 880,	247, 2479, 251, 252, 256, 257, 258, 33, 19, 332,	81, 85, 865, 910, VC51000,
8940 65p	VHSTJ3 65p	910, 960, 980, HRDX20, 25, HRJ2 10, HRJ215, 315, 316, 318, 400, 405, 407, 410,	3329, 333, 337, 339, 3419, 342, 343, 3469, 347, 3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437	VCT212, 310, 410, 610, VCT1314, VCTS312, 313, VC790ET 80p
3V31, 3V32, 8941, 8942 3V35, 3V36, 3V38, 3V39, 3V49, 8943,	VHSWJ1, VHSWJ2 120p VHSXJ3 85n	411, 415, 416, 507, HRJ6 10, 615, 715, 97,	442, 4229, 432, 437, 442, 44, 5, 4469, 447, 4479, 451, 452, 457, 458, 459, 512, 522, 5229,	VCC10 70p
8944 60p	VHSYJ2 80p	HRS4700, 5800, SR3200, SRS368E 60p HRJ600 40p	6379, 642, 647, 722, 7229, 723, 7379, 747.	SONY SLC6, SLJ10, SLT6ME 140p
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57.	VHSFJ2 140p VHSFS1, VHSFS2 130p	LOGIK	8389, 948, 9489 70p SAISHO	SLC5, SLC7, SLJ7, SLJ9, SLT7ME 140p
8945, 8947, 8948 45p	VHSFG1, VHSFG2, VHSFG3,	VR955 180p MATSUI	VR2000, VHL3 90p	SLC9, SL8000, SL8080, SLT50 165p SL8000E, SL8080E, SL8200, SL8600 175p
3V58, 3V43, 3V44, 3V59, 3V64, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20,	VHSFG4, VHSF63 180p GRUNDIG	VX600, 730, 735, 750, 755, 765, 850, 6000.	VR3800, 3200, 3300, 3500, 3600, 3650, VRS4400, 5000 75n	SLV255, 125, 213, 225, 262, SLVX1,
FV21, FV22, FV26, FV32, FV39, VC141L 45p	MVS400, 440, VS400, 410, 415, 435, 440, 441.	VS888 75p	1/20400	20, 3 95p TOSHIBA
FV31R 110p	450, 456, 460 55p VS180, 200, 220, 226, 262, 265, 267, 2X40800,	VX1000, VX2000, VX2500, VX3000, VX6000 80p	SAMSUNG	V55, V57 85n
FV61L, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77 50p	0850, 0880,	VX800 70p	SV716, 717, V1616, V~621, V1626, VX616, VX617, VX619, X626, VX627, VX629,	V33, V31, V32, V51, V52, V53, V9600,
V43H, FV44L, FV46T, FV57H 125p	1600, 2000, 2080, 2200, 2280, MVS200RC 90p	MITSUBISHI HS200 200p	VX714 75p	V61, V63, V65, V66, V67
FV37H 80p BV52 55p	VS150 160p	HS300, 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, 86
V41R, FV42L 100p	VS310, 311, 315, 320, 326, 340, 345, 380, 385,	411, 412, 421, 480, HSB10, 20, 30, HSE10, 20, 30, 70	511, 520, VT320, 5600 80p	V108, 109, 110, 120, 130, 140, i99, 209, 210
FIDELITY HQS200, VCR1000, 2000, 600, 6000.	VS150 75p	HS303, HS304, HS306, HS307, HS330, HS400.	VB900, VB910, V1900, V1910	211, 220, 221, 411, V421, 609, 610, 611, 659,
100 180p	LC290N, LC295SN, SVS 180, VS 170 70p VS 160, BARCELONA, FLORENZ, GV4000,	HS700 110p	319, 322, VB750, 770, 8220, 8225, V1770, 790,	V91 G, V95G 115p
7CN 100 160p	4000, 4001,	HS318, HS319, HS410 110p HSM1000, 16, HSM23, 25, 33, 34, 35, 37, 54,	8220, 8225, VK8220, VPX31, VX750, VX770, 790, 8220, 8225, SE9000, 9001 90p	V212, 213, 22-2, 3i2, 322, 403, 412, 413, 610,
/TR1000, VTR1001 100p	GV4002, 400, 401, 4010, 402, 403, 404, 405,	55, 57, 58, 59, 68 65p		703, 813 50p VCPB1E 110p
	REPLACEM	ENT IDLERS	& PULLEYS	

Make	Models	Description	Make	RS & PULLEYS	Description
Hitachi	VT11, 14, 17, 19, 33, 34, 35, 38, 39, 52, 57, 61, 62, 63, 64, 65, 85,		Ferguson	3V39, 3V30, 3V31, 3V32, 3V353V36, 3V38, 3V39, 3V49,	
Order Code	86, 330, 350, 640, 16S, 5030	FF Rew Idler 6886792		8931, 8933, 8940, 8941, 8942, 8943, 8944	osso, Take up clutch FU 51360
Hitachi	VT680, 6500, 6800, 9300, 9500VT9700, 9900	Price 100p	J.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610	Take Up Clutch
Order Code	: IDL02	Play Idler 6861482 6861481 Price: 180p	ļ		PU 53462A PU 51380
Blaupunkt	RTV301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 404,	Idler	Order Code		Price: 200p
	414, 424, 434, 444, 478, 707		Philips	DB532, VR6520, 6843, 644	Reel Idler
Goldstar	GHV1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247	, Idler	Sharp	VC600, 651, 681, 682, 684, 685, 693, 699, 700, 783, 6FR,	6V3, Idler Assembly
Grundig	GHV1248, 8000, 8200, 8210, 8215, GVHP51, VCP4100, 4130 MVS400, 440, VS400, 410, 440VS450, 460		_	6F3	NPLYV0107GEZZ
National	NV230, 250, 260, 280, 370, 380, NV430, 431, 433, 450, 460, 465,	Idler	Order Code		Price: 615p
	4/0, 480, 630, 650, /30, /80, NV810, 830, 850, 870, 890, NVG7		Philips	VR6843, 6943, 44SB9, VR44SB920, 44SB922, 6943	Reel Drive Unit
	9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, AG1000, AG1050, 1200),	Sharp	VC772, 780, 781, 782, 785, 786, VC787, 800, 793, 799, 78	310, Idler
Philips	1500, 1810, AG2100, 2200, NVH65, 70 VR6460, VR6520, VR6920			7822, VCA100, 102, 104, VCA131, 140, 170, 202, 203, 23	4, 501, NPLTV0111GEZZ
Order Code:	* IDL08	Idler Arm 40340162 Price 100p	1	VCA602, 5011, VCD801, 802, VCH851, 852, VCH882, VC	M73,
	VCR7000	Idler 150280	Order Code:	VCT72, VC782MK11	
Sharp	VC200, 381, 383, 384, 385, 386, VC388, 390, 393, 3300, 8381	luler 150260	N.E.C.		Price: 700p
	9100, 9300, 9500, 9700	Idler NIDL0005GEZZ	W.L.C.	N911, 915, 916, 917, 9012, 9013N9014, 9016, 9033, 9034 N9054, 9055, 9056, 9066, 9096, N9110, 9120, 9510, 9520	1, 9053,
Order Code:		Price: 100p	ļ	N9610, DX1000, 1600, 2000, DX3000, PX1200	
Philips Sharp	VR6540	ldler	Order Code:	IDI 245	Idler Arm Assembly Price: 270p
and p	VC300, 387, 402, 471, 473, 477, VC481, 482, 483, 486, 488, 496, 500, 571, 573.	ldler -		DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 3	B11, Pressure Roller Assemble
	581, 582, 583, 584, 585, 8481, 5F3, 5W20E	NIDL0006GEZZ		312, 313, 3210, 3219, 322, 3229, 323, 535BO, VR486, 471	1, 562. PS403-40205
Order Code:	IDL11	Price: 100p		582, 571, 761, 201, 202, VR203, 302, 303, 305, 6180, 6183	
Akai	VS10	Reel Idler		6285, 6290, 6291, 6293, VR6362, 6367, 6390, 6391, 6393,	6467
erguson	3V23, 3V29, 3V30, 3V31, 3V323V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942			6468, 6470, 6561, 6570, 6581VR6670, 6676, 6710, 6760, 6	6761.
	HR7200, 7300, 7350, 7600, 7610, 7650, 7655, 7700	Reel Idler PU48967 Reel Idler PU48967		6762, 6870, 6970, 6975, 86B1, 63SB7, 68SB4, 71SB4, 71	
Order Code:	IDL20	Price: 175p		72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DV1,	21DV2.
		Take Up Idler PU 51402		2SB01, 2SB02, 2SB11, 2SB12, 30DV2, 31DV1, 31DV2, 31	IDV,
	8931, 8933, 8940, 8941, 8942, 8943, 8944	· ·		33SB02, 3SB03, 3SB05, 3SB11, 3SB12, 3SB13	•
I.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610, HRD110, 111, 120,	Take Up idler PU 51402A	Toshiba	V91, V95	Pressure Roller Assembly
order Code:	121, 225 IDI 22	D-1 400-			PS403-40205
	IVAL	Price 100p	Order Code:	PR232	Price: 300p

							LER TY		<u> </u>
Akai	M32773	IT01	Ferguson	PU51380	IT07		VXP0433	IT15	
	MZ366960J2	IT02		PU51402A	1T08		VXP0463	IT16	Price:
oldstar	VXP0521	IT17		· PU55373	IT09		VXP0521	IT17	20p each
litachi	6861471	IT03		PU55374	IT10		VXP0581	IT18	16p each pack of 5
	6861482	IT04	National	VXP0329	IT11	Sanyo	1430662T15620	IT19	13p each pack of 10
	6886971	IT05	Panasonic	VXP0343	IT12	Sharp	NIDL0005GEZZ	IT20	1-p -1-011 paon 01 10
VC	PU48697B	IT06		VXP0344	IT13	•	NIDL0006GEZZ	IT21	مين مياها
				VXP0401	IT14		NPLY0107GEZZ	IT22	Packs are for each mode



	Di	NCH DOLLE	DC	
		NCH ROLLE		
Model Price	FVHP615, 618, 620, 622, 710, 711, 715, 716,	Model Price BRS600, 605, 747, 777, 920, 925 140p		Model Price 681, 682, 684, 685, 693,
V\$10, V\$9300, V\$9500, V\$9700, V\$9800, VP7100, VP77 140p	720, 721, 722, 725, 730,	HRS10 140p	ORION	VC699, 700, 772, 750, 779, 780, 781, 7810,
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9,	FVHP905, 906, 907, 908, 910, 911, 915, 916,	BP5000, HRD110, 111, 120, 220, 225, 455 1100p	VH1, VH2 140p VC150, 180, VH3, 33, 200, 201, 205, 212, 250,	782, 782MK2, 7822, 783, VC785, 786, 787, 793, 800, 7810, 7822, VCT72,
VS12, VS15 140p VS105, 112, 115, 116, 120, 125,	918, 970, 975, 980, 990, FVHP 5000, 5005, 5050, 5075, 5100 140p	PINCH ROLLER ASSEMBLY HRD140, 141, 142, 143, 150, 152, 157, 158,	254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900,	VC6F3, VC6V3, VCA 100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502,
126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516,	VBR330, VBS3500, 7000, 7100, 7500, 7600, 9000, 9900 140p	160, 565, 566, 725, 755, HRP50 1350p	1000, 2948, 3030, 3312 VHF2A, VP2948 140p	VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72,
VSX9 VS201, 301, 303, 304, 603, 606, 607, VSP8,	FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100,	PINCH ROLLER ASSEMBLY HRD1520, 510, 520, 521, 522, 525, 527, 560,	COMB 15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML,	VCB361 140p
VSP82, VP58, VP82 140p VS125, VS155, VS165, VS220, VS240, VS250,	FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200,	600, 610, 620, 637, 641, HRD650, 720, 830, 840, 910, HRJ205,	TVP230RC, VCP, VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512,	VC220 140p VCA10, 30G, 60, 103, 105, 106, 111, 113, 131,
VS512 140p VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425,	FVHP320410, 420, 430, 440, 445, 470, 475, FVSP290S, 495, 2905 140p	HRS5800 350p PINCH ROLLER ASSEMBLY	VH530, 532, 535, 536, 600, 630, 635, 640, 666,	211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51,
426, 427, 462, 465, 467, VS485, 765, 766, 767, 768, 865, 867, 965, 967,	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 140p	BR7030, BRS600, HRD160, 170, 171, 180, 190, 210, 211, 217, 227,	730, 735, 744, 774, 790 VH800, 820, 850, 888, 893, 900, 930, 940, 942,	52, 53, 54, 55, 57, 58, 505,
VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220,	FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 4000,	HRD230, 271, 300, 310, 320, 321, 330, 337,	974, 1012, 1040, 1050, VH1060, 1070, VH1100, 1120, 1204, 1440,	VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCBS97, VCD805, 806, 810, 815,
221, 222, 230, 240, 30, 33	PINCH ROLLER ASSEMBLY	350, 400, 430, 440, 441, HRD470, 500, 530, 700, 750, 950, HRS5000,	1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700,	VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VC790 140p
VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470 140p	GOLDSTAR GHV51, 1221, 1232, 1233, 1240, 1241, 1242,	5500, 9000 875p PINCH ROLLER ASSEMBLY	VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015,	VC780, 790, VCA10, 103, 1031, 105, 106, 211, 244, 254, 255, 30, 35,
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VCR161, VCR222 VCR7000, VCR7800, VCR8000,	415, 416, 418, 420, 425 VT426, 428, 430, 431, 435, 438, 450, 498, 510,	HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27,	PRESSURE ROLLER ASSEMBLY PS403-40205 DV186, 190, VR211, 2115, 212, 213, 223, 286,	971, 972, 8220, PX980, 981, 982, SE9000,
VCR8800 140p VTV10 140p	515, 517, 518, 520, 525, VT526, 530, 535, 536, 540, 545, 546, 548, 570,	31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30,	291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 535BO, 486,	9001, SX7120, 7121, 7220, 7221, 7230, SX7301, VK8220,
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6100, 6200, 8600,	780, 785, 860, 861, 865, VTL30, 1000, 2000, VTLC50, VTM598, 620,	450, 50, 54, 55, 555, 57, 58, 59, 60, 68, HSMS2, 9, HSMX1, 18, 19, 2, HSS11, 12, 14,	VR201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290,	PX31 R. 32R. PXR30. SV80. SX3230. 3231.
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3V35, 3V36, 3V38, 3V39, 3V49, 8943,	HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655	NVD48, NVD80, NVG21 NVG45 140p NVJ700PX 140p	0VHR7810, 8000, 8070, 8100, 8200, 8250, 8500, 8800, VHRD4400, 4410, 4500, 4600,	SLV215, 216EE, 275, 282, 315, 325, 353, 363EE, 373, 393, 410, 415,
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PINCH ROLLER ASSEMBLY FV31R 140p	637, 640, 641, 650, 660,	25, 28, 300, 33, 40, 45, 46, NVG50, NVH65, 75, 77, NVJ30, 33, 35, 37, 40,	PINCH ROLLER ASSEMBLY VHR3100, 3200, 3300, 3310, 3400, 3700, 3800,	SLVX65BR, SVO140, 160 1250p
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FV39, VC141L 875p PINCH ROLLER ASSEMBLY	HRJ400, 405, 407, 410, 411, 415, 416, 507, 600, 605, 610, 615, 715, 815	N.E.C. N830, 831, 832, 833, 895 140p	VC200, 381, 383, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000,	PINCH ROLLER ASSEMBLY SV6700.8750, 9700, VHR3100, 3200, 3300,
FV43H, FV44L, FV45X, FV46T 700p	HRJ97, HRS4700, 5800, 5900, 6800, 6900, SR3200, 330, 368 140p	PVC2300, 2400, 740, 744, 746, 760, 764, 766 140p	VC6200, 6300, 7300, 7700, 7750, 7800, 8300, 838, 9100, 9300, 9400.	3310, 3400, 3700, 3800, VHRD500, 700 1350p
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FV74, FV77 775p PINCH ROLLER ASSEMBLY	HRD370, 400, 430, 440, 441, 470, 500, 530, 700, 750, 950,	N9034, 9053, 9054, 9055, 9056, 9066, 9096, 9110, 9120, 9510, 9520,	486, 488, 496, 500, 571, 573, 581, 582, 583, 584, 585, 8481, VC5F3,	9, SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90, SLHF100, 150, 950, SLK85, 95, SLO1700,
FISHER FVHP420, 520, 530 140p	HRS5000, 5500, 8000, 9000, BR7030, 7040, 9060,	N9530, 9610, PX 1200 140p DS6000G, DX4000, N9077	VC5W20E, VCA1031 140p VC108, 208, 405, 408, 550, 600, 651, 671, 674,	SLS550, SLT0, 30, 50 300p PINCH ROLLER ASSEMBLY
1406				,
		VIDEO LAMPS		

Models & Description O	rder Code	Price	Models & Description	Order Code	Price	Models & Description	Order Code	Price	Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V	VL01	25p			100p	AKAI, GRANADA (VHSTJ2),	VL01	25p	AUTHENTIC (N850), DECCA	VL07	40p
80mV (310mm WIRES)			BLAUPUNKT, FERGUSON, FII			HITACHI (VT3000), ITT (VR3912,			(VR8300), GRANADA (VHSTJ3,		1
PANASONIC VIDEO LAMPS	VL02	30p	FISHER, FUJITSU, FUNAI, G.E			VRP3833), JVC (HR2200, 3300,			(VN0300), GNANADA (VNS 133,		
SHARP VIDEO LAMPS	VL02	30p	GOLDSTAR, GRANADA, GRU HINARI, HITACHI, ITT, JVC (HI			3330, 3660), MITSUBISHI (HS20 TELEFUNKEN (VR510, 519, 610)			WJ1, WJ3), ITT (VR3913, 3914,		
HITACHI 5381682 (VT63, VT64)	VL04	135p	SERIES), MATSUI, MITSUBIS			THOMSON (VK300, 305, 306, 33			3963) JVC (HT7200, 7300, 7350,		
VIDEO LAMPS			NEC, ORION, NATIONAL,	,		FERGUSON (3V00, 16, 22, 24, 3)			3303/346 (111/200, 7300, 7330)		
AKAI IVS10),GRANADA	ÝL06	40p	PHILIPS, SAISHO, SALORA,			8900, 8901, 8902, 8903, 8909, 59	12,		7700) TELEFUNKEN (VR450, 52	0,	
(VHSXJ3), TT (VR3993,3994), JVC		40p	SAMSUNG, SANYO, SHARP,			8922, 8925)			529, 540, 549, 620, 640, 920, 19	20)	
(HR2650, 7600, 7610, 7650, 7655),			SIEMEN, SONY, TELEFUNKEI THOMSON.TOSHIBA	N,		BLAUPUNKT, ORION (VH1, 2A),	VL02	30p			I
TELEFUNKEN (VR530, 535, 539, 58			THOMSON, TOSHIBA			NATIONAL (NV200,2010, 3000,		ООР	THOMSON (V4100, VK308, 309	, 312,	1
630, 650), THOMSON (V309, 316, 3	357,		GRANADA (VHSAY3),SHARP		45p	7000, 8150, 8200, 8400, 8600, 86	310,		410), FERGUSON (3V23, 29, 30,		
VK309, 411,TX8000), FERGUSON			(VC200, 381, 384, 385, 386, 38	18,		8620), SHARP (VC2300, 6000, 62	200,				
(3V31, 8941, 8942)			390, 393, 9300, 9500, 9700)			6300, 7300, 7700, 8300)			8923, 8924, 8929, 8930, 8931, 8	940)	

AMSTRAD VCR700 Contents BELT SET, PINCH ROLLER. REEL IDLER. VIDEO LAMP Order Code: SK41 FERGUSON & JVC 3V42/43 FERGUSON & JVC SV42/43 FERGUSON & JVC SV42/43 FERGUSON & JVC Contents BELT SET, PINCH ROLLER. TENSION BAND. IDLER TYRES BELT SET, PINCH ROLLER. TENSION BAND. IDLER TYRES BELT SET, PINCH ROLLER. TENSION BAND. IDLER TYRES Contents BELT SET, PINCH ROLLER. TENSION BAND. IDLER TYRE CONTENTS Contents BELT SET, PINCH ROLLER. TUP REEL TYRE. SUPPLY REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. SUPPLY REEL TYRE. PINCH ROLLER. TYRE SUPPLY REEL TYRE. SUPPLY REEL TYRE. SUPPLY REEL TOTHER COLUTCH, TAKE UP CULTCH MECHANISM, TENSION BAND CULTCH DOTHER CODE: SK43 SLOT IN BELT. LOADING BELT. SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK45 E3.75 Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK46 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK45 SLOT IN BELT. LOADING BELT. TENSION BAND Order Code: SK45 SLOT IN BELT. LOADING	£3.00
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	£2.75
Order Code: SK44 £7.00 NV777/NV788 NV777/NV788 3 V29/3V30 510/520/255/25/530/35/36/540/545/46/48/750/75/576/580/85/88 BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER HR7200/7300/7350 Contents IDLER UNIT. TENSION BAND IDLER TYRE Contents TIMING BELT. PINCH ROLLER, FF/REW ARM. CLUTCH BASE. Drder Code: SK17 £6.00 Drder Code: SK18	£4.00
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TENSION BAND TENS	13.23
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THE FINCH NOLER. TO THE FINCH NOLER. THE LOWER	£5.00
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FISHER FVHP905/906/907/908/910/911/915/918 TENSION BAND TYRE FVHP905/906/907/908/910/911/915/918 TONGET Code: SK27 F6.00 Order Code: SK28 F3.00 THE KIT CONSISTS OF ALL THE REQUIRED COMPONI AND COMES COMPLETE WITH FULL INSTRUCTIONS CIRCUIT DIAGRAM. FUNDER: GEAR IOLER UNIT. FOR COMENTS FOR THE KIT IS DESIGNED TO FIT THE FOLLOWING MAKES FIT SET PINCH BOLLER FIT SET	AND
TENSION BAND Order Code: SK57	
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Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, VS55,				FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM,		
	VS56, V\$75	CH18	3200p		HRD515, 520, 527, 540, 550, 580,				254GVM	CH23	2500p
GRANADA	VHSDP1	CH05	1100p		600, 610, 620, 660, 670, HRD830,				VCS211, 244, 5055, 605, VCB230,		
	VHSYJ2	CH01	2800p		840, 850, 860, 4050, 6600, FV37H	CH20	2200p		VCD806G, 810G, VCT212, 310,		
GDLDSTAR	GHV1290P, 1291P, 1295P, 9400,				HRD540, 580, 830, 860, 910, 960,				410G, 610	CH24	2500p
	73401, GSE1295P, GSE1891P,				HRD970, HRDX20,		-	TELEFUNKEN	VR2970	CH02	2800p
	200010, 200510, VCP4200, 4300,			FERGUSON	FV57H	CH27	2400p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800р
	4301, 4305, VCP4306, 4311, 4315,			LT.T.	VR3605, VR3905	CH01	2800p		V342, 343, 352, 353, 360, 364, 368,		
	4316, 4320, 4321, 4325	CH25	2000p		VR3916, 3926, 3946, 3948, 3976,				4210, 4230, 4260, 4400, V5500,		
	GHV51, 1221, 1232, 1240, 1241,				3986, 3995, 3997, 6948	CH02	2800p		6000, 8540	CH02	2800p
	1242, 1244, 1246, 1248, GHV8000,				VR3916, 3926, 3946, 3948, 3976,			TOSHIBA	V55, V57	CH01	2800p
	8200	CH26	2900p		3986, 3995, 3997, 6948	CH02	2800p		V65, V66	CH02	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951,			NATIONAL PANASONIC	NV730	CH06	4300p				
	3V35, 3V36, 3V49, HRD 110, 111,			N.E.C.	N830EG, N831EG, N831EG, N832,			de de de de de	***	A	*
	120, 121, 225	CH01	2800p		N833EG	CH01	2800p	1			~ ~
	3V42, 3V43, 3V44, 3V45, 3V48,				N895	CH02	2800p	AMS	TRAD MOD I	ZIT	*
	3V53, 3V54, 3V55, 3V57, 8945,			PHILIPS	CASSETTE LIFT ASSEMBLY (6912036	i6)		Α	I KAD MOD I	711	
	8947, 8948, HRD 140,				DV186, 190, 286, 471, 562, 761,			汝			*
	141, 150, 157, 158, 160, 250,				VR6180, 6182, 6185, 6285, VR6290,						
	HRD257, 455, 565, 566, 725, 755	CH02	2800p		6291, 6293, 6362, 6367, 6393, 6467,			FITS:	4500 5000 TVD	2.2	公
	8948, 8950, FV10B, 12L, 13H, 14T,				6468, 6470, VR6561, 6670, 6760,			🔭 VCR 4500 , 46	500, 4700, 5200, TVR	,2,3	
	20B, 21R, 22L, 26, 395, HRD230,				6761, 6870, 6970	CH05	1100p	*			*
	430, 530	CH03	2800p		VR6443	CH22	2900p	A DDICI	E: £2.25 + VAT e	aah	
	3V58, 3V59, 3V64, 3V65, FV11R,				VR6448	CH23	2500p	☆ PRICI	2: £2.23 + VAI e	acii	*
	8950, 8951, HRD170, HRD180.				49SB6	CH24	2500p	at at at at at		L-4-	1.1
	HRD370	CH04	2800p	SHARP	VCA100, VCH851, VCH852	CH22	2900p	西西西西西	TO TO TO TO TO TO	W W	WW

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

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

NV830 (VSS0091)

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

(VSS0060

(VSS0110)

NVG21 25 NVH65 NVD80 (VSS0175A)

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, ORDER CODE: AH01

£2.25

£2.10

£3.75

£2 00

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, ORDER CODE: AH02 PRICE: 1450p

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875р
VBR0103A	NV250, NV450 etc	625р
VBR0125		625p

SET OF 8 ALLEN KEYS

0.90mm

1.50mm

2.00mm

3.00mm

0.77mm

1.27mm

1.60mm

2.40mm

VIDEO TOOLS

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

UDIO CONTROL HEADS

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

BACK UP BAT INDIRIDS

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

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

Order Code: BB03

FERGUSON

Part Nos: 00E6 - 606 - 8001 2.4V 100mAH Order Code: BB04

Price: 150p

Price: 90p

SATEI

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

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	SATPSU16	650p

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

1002, 2001, SRD2000 SAT250

ORDER CODE: TOOL22 PRICE: 8500p

ACEMIENT

GRUNDIG

PART No: 29703, 29102

USED ON:

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

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:

Order Code: SW12

KV1400, KV1440, KV2040, KV2060 (POWER SWITCH 26mm) Price: 110p

KV2020

USED ON:

(POWER SWITCH 21mm +Remote)

Order Code: SW6

Price: 130p

SONY 2 PIN FUNCTION SWITCH

SONY

Order Code: SW9

Price: 35p

	TIME LAG (20mm)		OUICK BLOW (20mm)	
CURRENT RATING	ORDER CODE	PRICE	ORDER CODE	PRICE
100mA	FUSE36	75p	FUSE37	60p
J60mA	FUSE01	75p	FUSE17	60p
250mA	FUSE02	75p	FUSE18	60p
315mA	FUSE03	75p	FUSE19	60p
400mA	FUSE04	75p	FUSE20	60p
500mA	FUSE05	75p	FUSE21	60p
630mA	FUSE06	75p	FUSE22	60p
800mA	FUSE07	60p	FUSE23	60p
IA	FUSE08	60p	FUSE24	60p
1,25A	FUSE09	60p	FUSE25	60p
1.6A	FUSE10	60p	FUSE26	60p
2A	FUSE11	50p	FUŞE27	60p
2.5A	FUSE12	50p	FUSE28	60p
3.15A	FUSE13	55p	FUŞE29	50p
4A	FUSE14	55p	FUSE30	50p
5A	FUSE15	60p	FUSE31	50p
6.3A	FUSE16	60p	FUSE32	50p

CERAMIC PLUG TOP								
CURRENT RATING	ORDER CODE	PRICE						
3A	FUSE33	100p						
5A	FUSE34	100p						
13A	FUSE35	100p						

32 mm CERAMIC SLOW BLOW 10A FUSE45 185p

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

FUSE47

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
an OFF	A DATE OF THE AT	TAC

20mm CERAMIC TIME LAG

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

TAGE TESTER

20A

A terminal screwdriver incorporating continuity & voltage with Euroslot PRICE: 220p

ORDER CODE: TOOL11

SPRING HOOK

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

ORDER CODE: TOOL20 PRICE: 265p

OMPARISON BOOKS

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.

Video Recorders Edition 5 1997

Over 300 pages packed with more than

5500 faults for different brands

Price £15.00 - No VAT. Order Code: BOOK01

TELEVISION Edition 6

210p

Lists more than 8,450 faults with 460 pages covering 58 different brands Price: 1600p only - no VAT. Order Code: BOOK02

Satellite Repair Manual Edition 4

A comprehensive guide to receiver reviewing, featuring stock faults and installation tips.

Price £15.00 Only No VAT Postage 100p Order Code: BOOK03

SEMICONDUCTOR COMPARISONS 1997/8 Listing more than 31,600 Semiconductors with suitable alternative complete with descriptions

and hase information. Price: £15.50 - No VAT. Order Code: BOOK04

SEMICONDUCTOR COMPARISONS 1997

The new 1997 Jaeger Semiconductor with 952 pages packed with information on over 80,000 semiconductors in much greater detail plus marketing data on SMD devices and a separate generic table of all type designations. Price: £40.00 only - No VAT (+ £5 Postage). Order Code: BOOK06

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DESCRIPTION	VOLUME	CODE	PRICE
VIDED HEAD CLEANER	75ML	SP01	145p
SWITCH CLEANER	176ML	SP02	155p
SILICONE GREASE	200ML	SP03	180p
FREEZE IT	170ML	SP04	295p
FREEZE IT	400ML	SP16	580p
FOAM CLEANER	400ML	SP05	180p
ANTI-STATIC	200ML	SP06	180p
AEROKLEANE	200ML	SP07	200p
AERD DUSTER	200ML	SP08	340p
AERO DUSTER	400ML	SP17	580p
PLASTIC SEAL	200ML	SP09	250p
GLASS CLEANER	250ML	SP10	170p
CDLDKLENE	250ML	SP13	235p
EXCEL POLISH 80	250ML	SP18	180p
ADHESIVE 120	400ML	SP19	225p
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	145p
COMPUTER CARE KIT		SP26	2100p

All the above items are manufactured by Servisol If you purchase more than one Servisol Product, postage & package will be charged as follows:

300p for 2-5 cans 500p for more than 5 cans

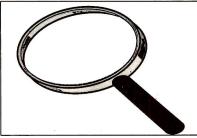
SOLDERING

DESCRIPTION	CODE	PRICE
ANTEX SOLDERING IRONS 25 WATT 240 VAC (XS25W 240V) 15 WATT 240 VAC (XS15W 240V) 25 WATT SPARE ELEMENT 15 WATT SPARE ELEMENT	S101 S102 S103 S104	900p 900p 450p 450p
SOLDERING STAND & SPONGES SOLDERING STAND (MADE BY ANTEX) SPARE SPONGE	S108 S109	350p 55p
SOLDER 18 SWG 500 GRAMMES 20 SWG 500 GRAMMES 22 SWG 500 GRAMMES	\$110 \$111 \$112	500p 650p 700p
DESOLDERING AIDS SOLDER 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

I.C. PROTECTORS

ICPF10, ICPF15, ICPF20, ICPF25, ICPF38, ICPF50, ICPF75 ICPN5, ICPN10, ICPN15, ICPN20, ICPN25, ICPN 38, ICPN50, ICPN75

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90p

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CASSETTE DC MOTORS

6V MOTOR 9V MOTOR 12V CW MOTOR 12V CCW MOTOR 13.2V MOTOR

170p 170p 170p 170p

290p

CASSETTE TAPE HEADS

MONO HEAD STEREO HEAD MINI HEAD **AUTO REVERSE HEAD**

	CD	
Models & Description	Order Code	Price
XC007	KSSS151A	1900p
DX-990A, DX-DIA	KSS152A	1600p
CXL69, CXL66G, CXL80, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN540, CXN5540, CXN556G, CXN590, CXN999, CXNV20, CXSL70, DX29100M, FDM536, FDM636, FDM639, LCX60, LCX60, LCX66G, LCX70M, LCX60, M7400, M75, NSX320, NSX320, NSX400, NSX430, NSX430, NSX430, NSX430, NSX430, NSX636, NSX656, NSX656, NSX656, NSX656, NSX656, NSX656, N	NODIGEA	ТОООР
XC550, XC750, XC900, XC950, XCN992, XG320, XG360, XG400, XG990, ZD3000M, ZD3100M CXAP1, CXL7, CXL8G, CXLC50P, CXZ68, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7.	KSS152A	1600p
LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XP31, XP33, XP55, XP80G XP6.XP7	KS220A	2500p
AKAI	KSS331A	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
DCD1500H, DCD1520, DCDE3520	KSS151A	1900p
DCD1400, DCD600, DCD800	KS152A	1600p
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KSS210A	1300p
DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715,		
DCD825, DCD890, DCD895, DN2000F GOLDSTAR	KSS240A	2000р
CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222A/L, FFH272L,		
FH333L, FFH373K, FJ606, FR606L	KSS210A	1300p
CD320A/L, CD630S/L, FFH212A/L.FFH212E	KSS210B	2000p
GRUNDIG		
CD360, CD435	НОРМ3	2150p
CCD300, CD101MCD904, MC10, NEW ORLEANS CD	KSS210A	1300p
(RCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS2108	2000p
CDP60, CDP90 CDP65	KSS220A	2500p
D905	KSS331A OPTIMA5	3400p 1600p
HITACHI	OFTIMAS	тооор
DAW560	нормз	2150p
X-10	KSS210A	1300p
XC10	KSS210B	2000p
I.V.C. 1900-1992, LATE 1987-1988 – XLE300BK, XLE31BK, XLE51BK, XLE900BK, XLME91BK, XLV101BK, LLV211BK, XLV222BK, XLV311BK, XLV333BK, XZ1010TN, XLZ411BK, XLZ44BK, XLZ555BK, XLZ611BK	OPTIMA3	4000p
CDRADIO CASSETTE, MINI SYSTEMS - MODELS 1990-1992	OPTIMAS OPTIMAS	5000p
A-C33, CA-MX30BK, CA-MX33BK, UX-A5, UX-A6, XL-M309, XL-M403BK, XL-M408, XL-M409.	OI HIMAG	эооор
(L-M504BK, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V131BK, XL-V151TN, XL-V221BK,		
(L-V241TN, XL-242BK, XL-V251TN, XL-V252BK, XL-Z1050TN, XL-Z551TN, XL-Z552BK	OPTIMA5	1600p
994 ONWARDS - CAE4BBK, CAMCG7, CAMXG9, CAS20BK, CAS30BK, VAS50, CAS60RBK, MXS20, MXS30, MXS60, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620, CX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF115, XLF215, XLF216,		
(LMC190/M, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK,		
(LV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XTS60	OPTIMA6S	1600p
(ENWOOD P47, DP660SG, DP8020, DP87, L1000D	VCC 1E1A	4600
P1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030.	KSS152A	1600p
P5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650, DPM6630, PM7730, DPM850, DPM991, DX6620, M225, M25, M450, M850, PD3030, PDM991, RDX25,		
XDC3, RXDC3L, UD202, UD302	KSS210A	1300p
	KSS220A	2500p
PC42, DPC72, DPC77, DPC80, DPC92	V005164	
P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DP89, M77A, PD3060,	KSS240A	2000p
P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DP89, M77A, PD3060, DD502, UD70, UD701, UD90, XE5		
P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DP89, M77A, PD3060,	KSS331A	3400p
P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DPB9, M77A, PD3060, ID502, UD70, UD701, UD90, XE5 IPC321, DPC531, DPC531, DPC631K, DPC721, DPC731		3400p 4500p
P1050, DP2060, DP3060, DP501, DP5060, DP722, DP76, DPB5, DPB9, M77A, PD3060, ID502, UD70, UD701, UD09, XE5 PC321, DPC521, DPC531, DPC631K, DPC721, DPC731 P1060, DP2060, PART No: RCTRIHB136AFZZ	KSS331A	

Models & Description	Order Code	
SAD30, SLCH9, SLP150, SLP170, SLP200, SLP202, SLP222, SLP230, SLP250, SLP333,	Order Cour	
SLP370G, SLP400C, SLP555, SLP777, SLP999, SLPA10, SLPC20, SLPC25, SLPJ25,		
SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK25, SLPK26, SLPS50, SLPS70, SLPS700, SLPS840, SLPS900	SOAAD70A	
PHILIPS		
AZ8304, CD070, CD080, 690, 910, 920. PART NO. 4822-691-20768 CD100, CD130, CD1380, CD1482, CD200, CD204, CD210, CD300, CD303, CD304, CD380,	4822-691	
CD480, CD482, CD500, CD502, CD582, CD583, CD584, CD610, CD620, CD630, CD780,		
CD781, CD782, CD840, CD883, CD960, CDF 104, CDM4/19, FCD185	691-30209	
AS440, AS445, AS540, AS640, AZ8048, AZ8640, CD070, CD080, CD091, CD163, CD165,		
CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD935, FW17, FW21, FW26, FW360, FW360, FW360, FW360, FW40, FW41, FW46, FW56, FW66, FW68	CDM12.1	
CD1210/40	CDM12.4	
AZ8006	KSS210B	
FW11	OPTIMA6S	
PIONEER PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730,		
PDT303, PDT403, PDT503, PDM930, PDM950, PDM910, PDM970, PDM970, PDM930,		
PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T	KSS151A	
N32, N90M, ,PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65,I PD6500, PD6700,		
PD7700, PD8700, PD970, PDCP420, PDCP520M, PDCP520T, PDJ400T, PDJ500T, PDJ800M, PDJ900M, PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP710T, PDP720T, PDP910M.		
PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDT310, PDT510, PDZ, PDZ570T, PDZ74T,		
PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S505DM, S505DT, S707DM,		
S707DTM, S909DM, S990DT, XCP410M, XCP410T, XDZ54T, XDZ55T, XDZ64M, XDZ64T, XRP310, XRP320	PEA 1030	_
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M.		
PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	
SAMSUNG	7 77 11003	_
CD20	НОРМ3	
CD1200, CD1310, SCM-6000, SCM6900	KSS210A	
RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SOH90T4N	
SANYO		
DCF S3, DCTS5, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142186855	614218	
DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6142205006	614220	_
DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915	KSS210A	
DCD10, DCD11U, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCMS1, DCX110, DCX120,		
DCX210, DCX220, DCX993, DCX994, MCDMS40L, MCDMS50L, MCDMS660L, MCDZ1L, MCDZ2L, MCDZ3L. PART No. 6142391303	614239	
DCD12. PART No. 6450055966	645005	_
MCDZ31L, MCDZ41L, MCDZ61L, MCDZ71L	KSS210B	
SHARP		
CD-111, CD-301, CD-302, CD-304, CD-310, CD-C3, CD-L700, CD-L800, CD-U1, CD-U10, CD-X10,		
CD-X12, CD-X15, CD-X16, CD-X17, CD-X20, CD-X9, CKL650, CMS95CD, DX-150, DX-160, DX-450, DX-460, DX-461, DX-650, DX-660, DX-999, DX-A3, DX-N45, DX-R554, DX-R7, DX-R75, DX-R750,		
DX-R77, DX-R770, DX-R820, DX-R840, DX-Z100, DX-Z1000, DX-Z1500, GFCD55, QT-30CD, QT-33CD,		
QT-350CD, QT-37CD, QT-38CD, QT-CD20, QT-CD33, RS95, SC-77CD, SC-99CD, SC-RS95, SG-A1.		
SG-W1CD, SG-W2CD, SYS302, ZCD7CD. PART No. RCTRH8122AFZZ	RH8122A	
QT-50CD, QT-60CD, QT80CD. PART No. RCTRH8124AFZZ DXR-840B. PART No. RCTTRH8130AFZZ	RH8124AF	
CDS360E, 360H, 370, 450H/E, CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370.	RH8130AF	
PART No. RCTRH8136AFZZ	RH8136AF	
SONY		
KSS240A	KSS240A	_
KSS121A KSS151A	KSS121A	
KSS210A	KSS 151A KSS 210A	
KSS210B	KSS210A KSS210B	-
KSS 220A	KSS220A	7
KSS331A	KSS331A	_
KSS360A	KSS360A	

			REN	TOI	Έ (CONTROLS					
Description	Code	Price	Description	Code	Price	Description	Code	Price	Description	Code	Price
AKAI			A512120/230	RC900	650p	PANASONIC			SONY		
RC-V10A	RC876	650p	A514790	RC901	650p	EUR51200	RC200	650p	RM604, RM605, RM606	RC140	650p
RCV 37 B	RC891	650p	A5088470	RC902	650p	TC2200	RC204	650p	32 CHANNEL	RC140	650p
V25A	RC896	650p	A518612	RC903	650p	VSQ0357/NV730	RC202	650p	RM613	RC140	650p
DECCA			SCL002	RC904	650p	TNQ1621	RC203	650p	RM632, RM636	RC160	600p
RC70	RC894	650p	C2096	RC905	650p	PHILIPS			TATUNG	110100	очир
FISHER			A511940	RC906	650p	RC5002,5154	RC134	650p	FXA	RC877	650p
RC905B	RC879	650p	655602H	RC1920	650p	KT3 NON TEXT	RC135	650p	RC70	RC883	650p
GRANADA			<u>ΙΠ</u>			69117032 69117194	RC178	650p	FX70 FASTTEXT	RC894	650p
UNIVERSAL TEXT	RC309	650p	IFB13, 14, 15	RC143	650p	RC5991-UNIV	RC180 RC300	650p 550p	TELEFUNKEN		осор
MK4 TEXT, 70155G, 70115G, 70133G	RC880	650p	FS4 RG305	RC148	650p	RC38	RC301	650p	FB632	RC632S	T 650n
95288E	RC882	650p	RG306	RC305 RC306	650p 650p	KT3 TEXT	RC5301	650p	FB639	RC639	650p
94490D	RC884	650p	FS9/1-10/1	RC307	650p	RC5352	RC5352	650p	THORN/FERGUSON		000
GRUNDIG			VS5 RUK	RC308	650p	RC5375	RC5375		3V35-42	RC342	600p
TP160E	RC107	650p	VS4-1	RC308	650p	RC5 STANDARD	RC300	550p	3V31-32	RC344	650p
TP200, TP300	RC380	650p	MULTICDNTROL (17C20)	RC311	650p	RC5903	RC5903	650p	3V57-58	RC628	650p
TP400	RC401	600p	LOEWE			SALORA			TX10 TEXT	RC732	575p
TP590-600	RC600	650p	DC11	RC146	650p	SERIES L	RC190	650p	TX10 STEREO TEXT	RC738	575p
TP390, TP610	RC610	650p	MATSUI	110110	ОЗОР	86173 SANYO	RC882	650p	TC9-90-100	RC740	600p
TP621	RC612	650p	010270601	RC889	650p	RC218, RC222, RC228, RC238	RC140	650p	3V55, FV11	RC783	650p
TP630, TP650 TP666	RC650	650p	VX770	RC892	650p	JXGE	RC878	650p	TX100 FASTTEXT	RC789	650p
TP661	RC660 RC661	650p 650p	NOKIA		Joop	JXDE	RC884	650p	TX100 ST, FASTTEXT	RC789	650p
	110001	озор	SATELLITE	RC550	650p	VHR2300	RC890	650p	PROFESSIONAL	RC790	650p
HITACHI CLE800-CLE830	00440	050	,	nc550	ooup	RC628	RC865	650p	TOSHIBA		
A617402/655602	RC140 RC1920	650p 650p	ORION RC53	0.000		SHARP			CT937_	RC950	650p
70177020300Z	NO 1320	goop	i uras	RC892	650p	G0121CESA, 123CESA, 204, 251	RC140	650p	CT9117	RC951	650p

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LOT202 1800; D 069/37 LOT274 ECM 2015 AL LOT78 RTRNF 1783 CEZZ LOT202 FERGUSON 00 D-3-508-001 HIRNE 1786 BMZZ LOT211 RTRNE 1786 CEZZ LOT211 RTRNE 1786 CEZZ LOT211 RTRNE 2000 BMZZ LOT307 RTRNE 2002 BMZZ LOT307 RTRNE 2002 BMZZ LOT307 RTRNE 2003 BMZZ LOT308 RTRNE 2004 BMZZ LOT308 RTRNE 2006 BMZZ LOT308 RTRNE 2006 BMZZ LOT308 RTRNE 2007 BMZZ LOT308 RTRNE 2002 BMZZ LOT307 RTRNE 2023 BMZZ LOT307 SONY 3753100 LOT275 1-439-243-00 LOT275 RTRNF 1786 BM77 LOT211 LOTES 1250 00 D-3-508-00 1-439-332-52 1-439-333-00 LOT188 LOT191 1-439-333-11 1-439-333-12 LOT270 1550g LOT268 1400a 00 D-4-235-002 00 D-4-235-002 HTI 00 D-4-235-00201G 00 D-4-260-004 HTI 1-439-363-21 LOT268 1400r LOT81 LOT311 1450: LOT81 1-439-387-11 1-439-316-12 1-439-416-11 1-439-416-21 1-439-416-23 1-439-416-41 1-439-416-51 1-439-430-21 154125A 2433455 LOT234 4515 03 28 LOT311 1450p LOT311 LOT255 LOT255 LOT255 LOT255 2433521 LOT85 LOT22 00 H-0-701-2400 24335R 4515 03 30 LOT179 4822 140 10161 LOT103 LOT104 06 D-3-083-001 LOT82 1250p 243372 LOT83 4515 03 31 LOT207 4822 140 10171 1500p 06 D-3-083-002 LOT82 06 D-3-083-002 06 D-3-084-001 06 D-3-087-001 06 D-3-098-001 06 D-3-093-001 06 D-3-095-002 06 D-333-512-001 FETX 100 90 DEG 1-439-243-00 1-439-243-11 1-439-243-12 1-439-243-31 LOT91 LOT91 LOT91 LOT114 LOT23 LOT23 LOT84 LOT204 LOT87 LOT87 243375 LOTOI 1300 4515 03 34 LOT56 LOT193 4822 140 10176 1400 2433752 2433752 2433891 2433892 2433893 2433952 2434002 2434141 2434274 2434274 2434274 2434453 2434455 LOTOS 4515 03 35 4822 140 10194 LOT105 1500p LOT116 1600p 1400 LOT250 4515 03 38 4515 03 40 4515 03 41 4515 03 43 4515 03 44 4515 03 46 4515 03 50 4515 03 51 4515 03 75 4516 16 01 MITSUBISHI 731003 4515 03 38 LOT27 1450; LOT200 1400; LOT56 1650; LOT56 1650; LOT201 1550; LOT27 1450; LOT27 1450; LOT22 1250; LOT27 4822 140 10198 4822 140 10320 4822 140 10236 4822 140 10246 4822 140 10246 4822 140 10256 4822 140 10263 4822 140 10263 4822 140 10274 4822 140 10274 4822 140 10274 4822 140 10283 4822 140 10283 4822 140 10384 4822 140 10348 4822 140 10348 4822 140 10348 4822 140 10348 LOT23 LOT84 4822 140 10201 LOT104 1500x LOT229 LOT118 1550 1-439-243-32 1-439-243-41 LOT229 LOT275 1500m LOT111 LOT229 TOSHIBA LOT105 1-439-244-00 LOT48 37010 LOT131 1450n LOT204 LOT04 LOT48 LOT48 LOT45 LOT45 LOT45 LOT45 LOT230 LOT92 LOT92 LOT92 LOT46 LOT46 LOT46 LOT46 LOT46 LOT107 37011 LOT131 1450p 1450p 1450p 1450p 1450p 1450p 1450p 1450p 1450p 1400p 1300p 1-439-244-21 1-439-244-31 1-439-256-00 LOT117 LOT117 LOT210 LOT208 LOT123 LOT122 LOT104 LOT125 LOT110 LOT132 LOT122 LOT131 FETX 90 WHITE FETX 100 100 DEG LOT06 LOT34 1-439-256-00 1-439-256-11 1-439-256-21 1-439-256-22 1-439-280-00 1-439-280-10 1-439-286-11 1-439-286-12 1-439-286-13 1-439-286-13 1-439-286-13 GRUNDIG 29201 008 01 LOT153 1750 LOT51 LOT49 LOT50 LOT50 LOT74 LOT295 1550p 1500p 1450p 1450p 1600p 1600p 1550p LOT140 1500p LOT149 1400p LOT60 1250p LOT163 1300p LOT61 1700p LOT62 1250p LOT62 1250p 731003 276-16399 29201.014.01 29201.015.01 29201.017.01 29201.018.01 29201.018.02 2434593 LOT44 LOT296 37018 334 B 07803 334 B 078030 334 B 08104 37019 2435121 LOT87 LOT251 1810951 LOT55 LOT01 2435131 2433751 2435141 LOT282 334 B 08108 334 P 18506 2433752 LOT250 LOT250 1350p LOT281 1300p LOT281 1450p LOT288 1400p LOT289 1500p LOT289 1400p LOT289 1500p LOT289 1500p LOT289 1500p LOT281 1450p 29201.019.02 2435301 LOT88 LOT89 LOT51 23236023 334 P 18507 29201.022.01 LQT63 2435671 LOT75 LOT70 4822 140 10353 4822 140 10356 LOT284 29201.022.02 2436201 LOT109 1200 5908-05008A-AA 1500 23236052 23236098 23236198 23236255 23236424 23236425 LOT 109 LOT 109 LOT 79 LOT 81 LOT 82 LOT 23 LOT 84 29201.022.03 LOT165 1350r D 108/37 LOT49 1500 4822 140 10367 4822 140 10369 1-439-288-00 LOT228 LOT228 2436202 2432101-2 2433451H 2433453H 2433891H 2433892G LOT273 29201.022.04 LOT165 1350p LOT165 1350p DCF1577 1700 LOT109 DCF2077A KFS 60226B MSH-1FBW08 1400p 1400p 1400p 29201 022 044 LOT272 LOT279 1300p 4822 140 10381 4822 140 10384 1-439-289-00 LOT47 LOT47 LOT165 1500; LOT164 1400; LOT127 1550: 29201 024 01 1-439-289-21 29201.024.01 29201.024.04 HINARI 154 138 K 51 13914 1 51 14184 1 CF 44 A HM51-1411834-1 LOT116 1600p LOT73 1150p LOT109 1200p LOT103 1250p LOT78 4822 140 10395 1-439-289-22 LOT47 NIKKAI BABY10 ORION 3714002 4822 140 10395 4822 140 10406 4822 140 10421 4822 140 17078 1-439-289-31 LOT47 1400x 23236428 1500p 1500p 1500p 1500p 1500p LOT24 LOT24 LOT24 LOT24 LOT24 1450p 1450p 1550p LOT67 1450p 1-439-294-00 LOT93 LOT93 3122113837011 LOT131 1-439-294-11 150F6D TFB 4039 AD LOT02 1500p SANYO 1-439-294-21 LOT269 LOT293 LOT113 1400p LOT162 1350p LOT94 TFB 4048 AD TER 4048 BD LOT39 1850r 094-00035/0.2 1-439-303-11 I OT281 130 On



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feel that we'll be getting a lot more calls.

The BBC didn't believe that its transmissions would cause any problems of this nature. There seems to be no obligation, as Ch. 5 had, to sort out viewers' problems. Has anyone else had this difficulty?

Niel Jorgensen, Easter Satellites, Eastersat@zetnet.co.uk

The Internet

In his article on the internet in the August issue Peter Marlow failed to mention newsgroups. Basically these are enormous bulletin boards, covering everything you might ever want to know/talk about/exchange information on – also, it has to be said, some you wouldn't! Most are in text format, though some are for binaries.

Readers may in particular like to be aware of a newsgroup sci.electronics.repair. Although the input to it is largely North American, there is an increasing number of UK contributions. The scope of this newsgroup is very wide, but TV sets, VCRs and computer monitors form the staple diet, and many technicians/repairmen share their information/experience here. I have repaired several monitors quickly after posting a question, the information often coming back within hours. As with all newsgroups, you have to tolerate a certain amount of nonsense, but this is a minor irrita-

Anyone who posts to this newsgroup will sooner or later be aware of the ESR and low-ohms meter kit available by mail order from Dick Smith Co. in Australia. Orders can be faxed. This high-quality kit costs about £24 including postage and arrives in about ten days. I have one and it's quite simply fantastic value. Incidentally the chap who designed the meter, Bob Parker, often posts to this forum himself. Anyone wanting more information can get it by aiming their browser at either http://www.flippers.com/esrktmtr.htm http://www.nlc.net.au/~bobp/ or go to

http://www.nlc.net.au/~bobp/ or go to http://www.dejanews.com and do a search for "esr meter". Chris Laudan, Horsford, Norwich.

Mains Plug Screws

My thanks to Martin Pickering and Ray Porter for their replies (July issue) to my earlier letter on loose neutral mains plug screws.

In my early days we had a bedroom light switch that dangled from the ceiling just above the headboard. The thing would start to buzz when I turned out the light. Tightening its terminals cured this.

It would be interesting to see what would happen if the screw threads were in the opposite direction. Would using a tighter thread and a finer pitch improve retention?

In many applications the earth terminal is not used: I've come across plugs in which the earth screw has fallen out and been left to rattle about inside the plug.

Although the live wire is held by a screw, it isn't buffered against mechanical shock by the spring clips. This suggests that vibration may have a part to play. David Smith, Leigh, Lancs.

Drive Belts

Our thanks to several readers who provided detailed calculations for working out the diameter of a drive belt (Letters, June). The correct figure for the example given by David Martin in June is 59-36mm, which is not greatly different from the figure (58-6mm) produced by his simplified calculation.

With regard to the reduction factor to provide the necessary grip and prevent slipping on the pulleys, R.C. Oaksford points out that the harder the flexing properties the smaller the reduction factor, which approaches zero with say leather or similar nonstretch materials.

P.J. Ratcliffe says that the stiffness of a new rubber belt being deformed around the pulleys should be adequate to provide slip-free drive for light-duty applications: to avoid damage to the drive bearings, no additional tensioning is required. He goes on to say that the drive belt dimensions have to be fairly precise in the absence of a third pulley adjustment to take up the slack. For heavy duty examples (e.g. a car alternator/fan belt) it's necessary to calculate the maximum loading torque before slippage occurs for a given tensioning force. Refer to standard texts (A-level physics). In practice if the drive belt slips it produces a characteristic squeal. The tensioning criterion should be set out in the owner's manual.

Ray Porter mentions that the "belt shortness" required depends on its stiffness, which in turn depends on the rubber, its width and its thickness. The torque required to transmit from a drive pulley depends on the application: for example loading motors have to deliver more torque than a tape-counter mechanism, so the

amount of pre-load will differ and the "shortness" will be different given the same belt cross-section. Ray suspects that a practical rule of thumb could be applied, and wonders whether a survey of say three examples of each of the common applications might produce the information sought. Do any other readers have such data?

John Hopkins wonders why it should be necessary to work out the diameter, since suppliers can provide belts for almost anything for about £1

Many thanks to all those who contributed information on this subject. *Editor*.

How to stay in business

Here's a comment or two from a TV dealer – with the emphasis on *dealer*. (1) I agree with the abolition of all manufacturers' recommended prices. We know that they are a con, so that the impression of a bargain can be given by cutting £50-£100 off an inflated price.

(2) There's a lot of moaning in the telly business at the moment about £99 portables, videos etc. The trade will not collapse as a result of this. Deal a bit harder. Get a better price on what you buy. You will be surprised by what can be saved.
(3) The freeby merchants. This is one field in which I've failed. In the post recently I had bills for the rates, electricity, the phone, spares, £800 for a recent car repair – nowhere did the word free appear in any of them. What's this all about I hear you say?

Well, in recent TV ads (not mine) I've noticed free call out to any area, free estimates, no VAT and discounts for OAPs. Think about this. A fifteen mile trip to pick up say a 29in. Sony set, then back to the workshop, then bench time (say two hours) while checking the set and preparing an estimate. Estimate refused. Take TV set back to customer. No charge. How do you envisage paying the above bills when engaged in this type of farce?

I would never have been able to get into the TV game if the established TV dealers in my area had been on their toes. I knew nothing about electronics – could hardly change a fuse. At the time I worked in a scrap yard. But I knew how to sell. Not bragging either. If I can still manage it at 71 years, anyone can.

Life will certainly be interesting in the near future. Rex Webb, Proprietor, KTV Warehouse Sales/Service Centre, Camborne, Cornwall.



Reports from
Nick Beer
Terry Lamoon
Michael Dranfield
Philip Blundell, AMIIE
Chris Watton
Ronnie Boag and
Christopher D. Nunn

JVC HRJ225

Drive for the front loading mechanism was not present because the lever (part no. PQ4635A-2) behind the reels was not being countersprung into position: the lever's lug, to which the counter spring is attached, had broken off. A new lever cured the fault. But, looking at the size of the lug and considering the tension on the spring, I feel that it's likely to break again. **N.B.**

Philips VR6547

This machine did nothing. The dealer who sent it to me had discovered that the ICP for the 5V supply was open-circuit. A replacement made no difference, but at least it didn't fail. When the power supply was run without load the outputs seemed to be OK, though the voltages across the 12V, 6V and -30V rails were slightly low. On load, every output fell to about half the correct level.

The biasing of the optocoupler PC1 was excessive because the 2SC1740S error detector transistor Q31 was leaky. **N.B.**

Panasonic NVL28B

This machine was dead. No, it was not C9 this time! Tests on the secondary side of the power supply revealed that the 20V over-voltage protection zener diode D1113 was short-circuit. It had clearly been replaced before, apparently quite recently. When I removed it and ran the power supply without load I dis-

VCR Clinic

covered why – the 20V line was at 35V. All the other voltages on the secondary side of the circuit were proportionately high. The cause of the trouble was C1114 (47 μ F, 16V) in the feedback network on the primary side of the circuit. **N.B.**

Matsui VP9601

Intermittent tape chewing was the complaint. So I took the top off the machine and put it on test. It worked happily all day. What to do? I decided to make it work harder by putting it into rewind then stopping it half way through. As the brakes didn't act immediately, the tape looped. The cure was a new mode switch – it's a common cause of problems with this model. T.L.

Philips Turbo Deck

If the problem with a machine fitted with this deck is failure to load or intrmittent failure to do so, check whether the loading motor's pulley shaft is damaged or split. If it is, order the kit from Philips – part no. 4822 310 10657. T.L.

Sony SLVE7

Tape damage is a common problem with these machines. Always check that the load arm moves freely. If it doesn't, take it off, clean it thoroughly, lubricate the contact points and replace it in the correct position. The machine should then be OK. T.L.

Matsui VP9405

The complaints were that this machine didn't always eject, loaded badly or the tape jammed. I went straight for the mode switch, but it had already been changed. Time to put the machine through its paces. Loading was very slow, but manual load with no cassette was perfectly free. When I inserted another cassette for loading I put the slightest

pressure on the loading belt, which stopped. It started again when gently pushed. The laoding motor was faulty and was unable to take much resistance. A replacement cured the problems. T.L.

Toshiba V254

Looping on rewind was the problem, because the capstan didn't stop quickly enough. I spoke to the Toshiba boffins about this. They suggested adding a 100μF, 6·3V capacitor across the Cap +5V supply, positive lead to the cathode of DT107 and the negative lead to jumper wire JT035. It worked. T.L.

Sanyo VHR390

This machine played all right but shut off in rewind. Fast forward was OK. I was suspicious of the reel sensor which, when I checked it, was full of dirt and hair. This was removed and the area was thoroughly cleaned. The machine then worked perfectly. T.L.

Matsui VXA1100

This relatively new machine was dead. The cause was simply that R534 (470k Ω) in the primary side of the power supply had gone opencircuit. **M.Dr.**

Akai VSF410

This machine had gone off after a power surge during an electrical storm. The clock lit up and, when the power button was pressed, the machine powered up. But it immediately powered down again. The 13V zener diode D13 had gone short-circuit, leaving Tr1 without base bias. **M.Dr.**

Tatung TVR912

There were several symptoms with this Sharp clone. Play stopped after about one second; the counter read six minutes when an E180 tape had been fully rewound; and if the ACE head was unplugged during a rewind the tape counter continued to count. Very strange! The cause of these symptoms was about 0.8V of ripple at pin 22 of the microcontroller chip.

A check in the power supply showed that there was about 4V peak-to-peak of 50Hz ripple on the UR 6.5V line. The 0.27Ω safety resistor R904 in the feed to the bridge rectifier was open-circuit, hence the 50Hz ripple. A replacement failed at switch on: D907 (1N4003) in the bridge was short-circuit. Replacing these two items restored normal operation. **M.Dr.**

Grundig VS520/540

We've had a number of these machines with a dead power supply: once the mains feed has been disconnected the power supply won't restart. If the mains fuse is intact, replacing C407 (220 μ F, 25V), C420 (100 μ F, 25V) and C443 (100 μ F, 10V) usually solves the problem. **P.B.**

Philips VR258/05

If there's no front keyboard or remote control operation (the machine will accept a tape but won't eject or play it), check whether the Wickman fuse F1403 (315mA) is open-circuit. **P.B.**

Ferguson FV62 (R2000 Cat 1 Chassis)

This machine was dead with a blown mains fuse and a short-circuit chopper transistor (TP08). After fitting a Thomson repair kit I found that the power supply worked but the output voltage was high – check for 14-2V across test points BP04 and BP05, with a 220V AC mains input. The correct voltage was obtained when CP10 (10µF) had been replaced.

One component that's not included in the kit is the ZPD3.9V zener diode DP15 – it's not shown on the circuit diagram, but is connected in parallel with RP33 (1.5Ω) . It can go short-circuit when TP08 fails. The result is low output voltages. **P.B.**

Baird 8945

The customer said that this twospeed machine kept jumping to LP. After testing it for several days we returned it as the fault hadn't put in an appearance. It came back a few days later with a post-it note that pointed to the LP LED and the comment that this would light when the fault occurred. We plugged it in and left it. After a while we heard a faint relay ticking sound every thirty seconds or so. Sure enough the LP LED was coming on. This was in the E-E mode, with no tape inserted. A check at the active pin of the switch produced a DC reading that wavered between 2·5-5·5V. The reading should be 0V for LP and 8·5V for SP. Dismantling and cleaning out the switch cured the fault.

This Model was also sold as the **Ferguson** 3V42 and the **JVC** HRD455EK. **C.W.**

Saisho VR2500/Matsui VX990

There was a warble on the sound and poor playback chroma lock. The cause was traced to C08 in the power supply. It's near the STK5332 multi-voltage regulator chip. C.W.

Ferguson FV22L

There's a modification to deal with various timer faults such as ignoring the stop time or stopping prematurely in the OTR mode: fit an 0.047µF capacitor between pins 3 and 8 of connector CN603, on the print side of the PCB. A kit is available, part no. 01P1-500-001 – or Willow Vale 20122MT. C.W.

GoldStar RQ5041

The customer complained that this machine sometimes failed to start. The buttons worked and the display symbols lit, but the machine didn't respond. On test we found that the drum didn't rotate because its supply was missing. There was a 12V output at the power supply, but it didn't reach the motor because L202 (100µH) was open-circuit. C.W.

Daewoo V435

The symptoms were cutting out in play and record, and noisy in play, fast forward and record. The solution was to replace the reel gear total assembly, part no. 97SB382410. **R.B.**

Samsung P130R

IC702 (KA8301) had blown in half because the outputs from the power supply were twice what they should be! The culprit was C104 (33μF, 35V), whose value had decreased by about a half. Obvious enough, but don't leave the power supply connected for any length of time while testing or C017 will be sent into orbit (yes, it happened!). It's rated at 25V and, under the fault

condition, receives some 50V.

As there are only a few electrolytics in the power supply I replaced them all. The machine then worked very well. C.D.N.

Amstrad DD8900

This monster's lower deck had a fault: intermittent eject. I decided to remove the bottom plate rather than the top deck. After about a million attempts to get the deck to refuse to eject, the fault suddenly appeared. The cassette housing drive spindle was being overdriven, and thus jamming, because the down switch was dirty. C.D.N.

Toshiba V703B

This VCR's display had become dim. The machine then died completely. Heating the power supply brought it back to life, and with the aid of a can of freezer I found that C813 (47µF, 16V) in the power control circuit was the cause of the trouble. C.D.N.

Sanyo VHR3100

When a cassette was inserted the carriage would move backwards and forwards then the machine would switch off. If a tape was loaded manually, fast forward and rewind were OK but in the play mode the capstan motor ran very fast while the drum motor sometimes wouldn't rotate at all. The cure was to replace IC4001 (LC7412-8017). Shop around, because the price tends to vary quite a lot. C.D.N.

Aiwa HVG75K

The playback sound disappeared when this machine had been working for one to two hours. It came back when IC701 (BA7767AS) was frozen, but a replacement failed to cure the fault. After more heating and freezing I found that C732 (0·1µF) was the culprit. It sits just under IC701. C.D.N.

Ferguson 3V32/JVC HR7655EK

This machine sometimes failed to unload and eject, though the stop light flashed – as if it was waiting for the mechanism to unwind.

The loading belt and timing were OK. When I disconnected the motor I found that 12V was present in the unload mode. The voltage dropped to 3-6V when the loading motor was reconnected. But a new loading motor made no difference! Q5 was OK but D19 produced a high reading. Thankfully a replacement cured the fault. C.D.N.

The S-VHS ET Specification

The latest VHS system development is S-VHS ET. Peter Brough describes the evolution of the system and the characteristics of the new version

During the twenty or so years since the basic VHS VCR format was first introduced, a number of other versions have appeared. These include VHS HQ, VHS Hi-Fi, S-VHS, W-VHS and D-VHS. A new system, S-VHS ET (for Expanded Technology), has just been released in Japan. It's main feature is that it enables S-VHS recordings to be made using standard VHS tape, the main penalty being a lower signal-to-noise ratio than with S-VHS tape.

Background

Earlier versions of the VHS system have been covered by articles in previous issues of *Television*. Here's a brief background to S-VHS.

S-VHS was launched in 1987. Prior to that a number of small improvements had been made to VHS picture quality, most notably with VHS HQ which arrived in 1985. This used several techniques to improve the picture, including an increase in the white-clip level from 160 to 180 per cent and filtering to reduce noise. Subsequent improvements in video tape technology and VCR circuitry increased the VHS horizontal resolution from about 240 lines to some 260.

JVC, which licenses VHS, had always been keen to ensure that any VHS development was compatible with older VHS machines. Thus Hi-Fi and HQ tapes can be played by machines that don't have these features. But

in 1987 JVC launched Super VHS (S-VHS), which uses a variety of techniques to greatly improve picture quality. The FM bandwidth was extended from about 3MHz to around 5MHz, increasing the horizontal resolution to about 400 lines. The white-clip level is 210 per cent (dark clip 70 per cent). There is no overlap between the luminance (Y) and colour (C) sidebands and, by using separate Y/C outputs instead of RF or composite video, cross-colour and other artefacts are avoided.

S-VHS picture quality is a great improvement on VHS, but a price has to be paid for it. High-coercivity video tape, composed of super-fine ferric oxide particles, has to be used (at least this was the case before the arrival of ET technology). The tape typically costs about three times that of standard VHS tape. And S-VHS equipment is only partly compatible with VHS: S-VHS equipment can play and record in the VHS mode, but the vast majority of VHS machines cannot play S-VHS recordings (see below).

S-VHS ET

JVC is keen to stress that S-VHS ET is not a new format. It's more a new technology that extends the S-VHS system. Unfortunately JVC has not released full technical details of how ET works. What we do know is that the combination of a high-performance video head and an improved preamplifier enables the system to record a 160 per cent wider signal bandwidth on VHS tape – JVC recommends the use of high-grade VHS tape for ET recordings.

Table 1 summarises the basic NTSC specification for S-VHS ET. Apart from a slightly lower white-clip level, the S-VHS ET and S-VHS specifications are almost identical. JVC adds that the ET technology also involves a new signal-emphasis system.

S-VHS ET Compatibility

S-VHS ET recordings can be played back using an S-VHS machine, with 400-line horizontal resolution, or a standard VHS deck that's equipped with S-VHS Quasi-Playback (SQPB). With the latter option the horizontal resolution is 280 lines. The SQPB system enables a VHS recorder to play S-VHS tapes, though with VHS quality. It was originally intended for owners of S-VHS camcorders, so that recordings could be played back by an existing VHS machine.

Table 1: Basic S-VHS ET Specification (NTSC).

Peak white FM Sync tip FM

7MHz 5·4MHz 1·6MHz

Sync tip FN Deviation White clip

Dark clip

About 190% About 70%

Colour-under phase-shift recording is used for the chrominance signal.

Audio is standard VHS linear and FM.

With the exception of the white-clip level this specification also applies to the S-VHS format.

What ET does is to enable VHS tape to be used to make both VHS and S-VHS recordings. It would be interesting to compare an S-VHS recording with an ET one using an S-VHS machine.

Future Plans

Asked why S-VHS ET had been developed, JVC pointed out that the advent of digital broadcasting will produce a demand for higher-resolution recordings. There is little doubt that JVC is keen to increase the market for S-VHS, hence the intention to launch S-VHS models in the UK later this year at under £350. JVC is also considering the use of ET technology in camcorders. It expects other manufacturers to introduce S-VHS ET equipment.

JVC introduced two S-VHS ET models in Japan in early June, the HR-S100 and the HR-V100. The latter has a built-in satellite receiver. Prices work out at the equivalent of about £221 and £265 respectively. Production of the HR-V100 is to start at a rate of 10,000 a month: production of the HR-S100 will be at half this rate initially.

S-VHS ET is to be launched in the USA later this year. A European launch will follow next year.

Incidentally JVC says that the cassette ID hole system designed to be used by an S-VHS machine to check whether a standard or an S-VHS tape is loaded fell into disuse soon after the launch of S-VHS! All machines use the signal waveform to determine the type of recording, ignoring the presence or absence of an ID hole.

Acknowledgement

My thanks to Mr Masayuki Murakami of the Victor Company of Japan for his help with this article.

Book Review

The Professional "Screwdriver Experts" Guide – Satellite Receiver Repairs and Modifications, by Martin Pickering. Over 350 pages. Available from SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA by mail order at £19.95 plus £2.50 post and packing, also from most suppliers of satellite accessories.

This is the fifth edition of the Satellite Repair Manual, which has become a virtual bible for satellite receiver servicing. I just wonder whether, if one had to start from scratch, it would be possible put together such a vast store of technical data and know-how. But Martin has been at it since the start of satellite TV, and has gradually built up this fantastic storehouse of knowledge. The fifth edition has once again been significantly extended, so even if you have an earlier one it's as well to buy and benefit from this latest version.

The great advantage of the book is its essentially practical nature. It tells you exactly what to look for and do, and how to go about it. There is a very helpful faults index at the end, listing the more common faults with the more common receivers, but it's only a sampling of the fault information contained in the book. If you don't find what you need to know via this index, simply go to the relevant section for the receiver concerned. A model cross-reference and page index at the beginning is a further help.

You'll want to know a bit about digital satellite TV of course, so a good, readily comprehensible section of over twenty pages has been added on this subject. Other general sections inform us about LNBs, sparklies, interference and so on. But the heart of the book is its detailed information on particular models.

I would say that it's an essential reference source for anyone involved in satellite receiver servicing – until the sixth edition comes along, as it inevitably will! It's very good value too.

J.A.R.

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Servicing the JVC C14/C21ET1

These models use a version of the Onwa chassis and as a result are more troublesome than those fitted with a standard JVC chassis. Cliff Martin provides a fault guide based on service experience with many hundreds of the sets

hese JVC sets were fitted with the well-known Onwa chassis that has appeared in several brand ranges, for example Goodmans and Bush. The component reference numbers in the following article relate mainly to the 21in. version. The two sets are very similar in design, but the circuit reference numbers vary between the two models. There are also differences in the chassis layout.

Power Supply

It's by now well known that the power supply in these chassis can cause big problems, because when faulty the HT output can rise from 112/115V to over 200V. You can always tell when this has happened, because the 12V regulator zener diode ZD401 will be short-circuit and its feed resistor R419 will be burnt out. In severe cases the top of the HT reservoir capacitor will have split open.

An upgrade kit, part number TPCA0068B (14in. model) or TPCA0068C (21in. model), is available from JVC and can be used to repair the power supply. But it doesn't contain zener diodes ZD901 (8·2V) and ZD902 (9·1V). It's essential to replace them, as they almost certainly contributed to the fault. If the set has one of those cheap, open-type skeleton presets for HT adjustment, replace it with a better-quality one – intermittent wiper

Fig. 1: The overvoltage protection circuit used Model C14ET1. For more reliable operation short out R663 and change the value of to R401 to $47k\Omega$.

contact causes a dramatic rise in the HT voltage.

To improve reliability, the upgrade kit components should be fitted to any set that comes in for service.

The kit also modifies the overvoltage protection circuit to ensure that the set goes into the safety mode should the fault occur again. This is achieved by switching off the 5V supply to the microcontroller chip. As a result the HT relay drops out.

If the set seems to be dead, i.e. the standby LED is not alight, don't assume that the power supply is not working. It may be that R404/R918 (0.68 Ω) is open-circuit. This removes the LT supplies and can be confusing because, in the 14in. model, the HT reservoir capacitor is connected to the output from the relay. So there are no outputs from the power supply.

If there are no pulses at the collector of the chopper transistor Q904, check whether its base drive coupling capacitor is open-circuit. It may read OK when checked with a capacitance meter, but won't work in circuit.

If Q904 is short-circuit it will have taken out R902 as well and maybe R914. Ensure that these items are replaced with original parts, as they are safety components. C909 and C911 should be replaced if this has happened – these two capacitors are included in the power supply kit.

If the HT rectifier diode is leaky or short-circuit, the relay will drop in then straight back out again. The diode supplied with the upgrade kit is an improved version. Remember to check that its series safety resistor hasn't suffered.

Although it's best to use the upgrade kit, if the set is required in a hurry replacing both zener diodes with standard types and the two 47µF capacitors with 105°C types should be OK and ensure reasonable reliability.

The modification to the cutout is as follows: in Model C21ET1 short out R677 and remove R678; in Model C14ET1 short out R663 and change the value of R401 from $10k\Omega$ to $47k\Omega$ (see Fig.1).

A 5V supply is fed to pin 10 of the colour decoder/timebase generator chip IC301, regulated by ZD301. This zener diode is suspect in the event of faults such as high brightness.

It saves a lot of time and money if supply voltages are carefully checked before you start replacing ICs etc.

Line Timebase

The line output stage is quite reliable. It provides the 24V and 12V supplies. Sometimes the 0.68Ω surge limiter resistors here go high in value. The voltage on the 12V line will fall, causing strange faults, notably field cramp at the bottom of the screen.

Failure of the line oscillator to start usually means that R317 (21in. model) or R323 (14in. model) has gone open-circuit, removing the start-up supply to IC301.

Sync Faults

Sync faults are rare, but poor field sync can be caused by C308 going almost open-circuit. It couples the video signal to the base of Q302. This fault doesn't affect the contrast or the picture in any other way. For no sync with 14in. sets, check whether R340 is open-circuit.

The IF Strip

In most chassis the IF strip is probably the most reliable section. Not so in this one! Any capacitor is likely to fail, especially if it's of the ceramic type. These capacitors always go leaky: $2-3k\Omega$ is a common reading. They can cause the following faults:

No sound: Check C110.

No sound with a slight whistle: Check C106.

Severe sync crushing with a soot-and-whitewash picture: Check C113.

No AFC action: Check C119 (21in. model) or C129 (14in. model).

If there's no picture, check whether the test points in the IF section are pushed over so that they touch the metal coil screening cans. This fault may clear if the set is tapped

CF101 can go open-circuit. This will add a 6MHz carrier to the video. The result is patterning and no colour.

Control System

The control system is fairly reliable. The microcontroller chip doesn't fail very often, though it frequently gets accused of having done so.

The most common fault is intermittent reverting to standby. This is caused by leakage in the tack switches. If the set shuts down when switch AV is pressed I've found that it's best to replace all the switches.

Another problem is failure of the set to stop when search tuning. It's caused by a fault in the ident circuit, around transistors Q614/615. Any component in this area is suspect. The capacitors and 1N4148 diodes D609 and D610 are favourites. Failure of this circuit also mutes the sound.

In Conclusion

In conclusion, I wish other engineers the best of luck with these (and other!) sets. Although the chassis used in these models is troublesome, it doesn't reflect on the quality of JVC's own current and past TV chassis. These are so reliable that it would be difficult to prepare a fault-finding article on them such as this one.

The basic Onwa power supply circuit was shown on page 237 of the February issue, but the component reference numbers vary greatly from model to model and mostly don't match with these JVC sets.





Reports from
David C. Woodnott
and
Eugene Trundle

Sony CCDF150E

The complaint was that previously recorded tapes played back all right but new recordings wouldn't play back correctly. The cause was traced to failure of C206 and C216 on board CV9. Replacement of these two surface-mounted capacitors and a service restored the unit to good health. **D.C.W.**

Sony CCDTR305E

This small handycam didn't produce any E-E pictures – playback was OK. An internal inspection revealed that L852 had become detached from its normal position. As a result there was no HT supply to the camera section. Refitting L852 restored normal operation – the customer denied any knowledge of possible impact! D.C.W.

Canon UC2000E

The note that came with this camcorder said that it wouldn't accept a tape but would close the housing if a tape wasn't fitted. When we checked it we heard the capstan motor rotating at high speed. Further checks proved that the FG sensor was faulty. A new motor restored the unit to normal working order.

This model is very similar to a **Samsung** one that uses the same or a very similar mechanism! **D.C.W.**

Sony CCDTR810E

The complaint was "no operation" but in fact the unit was dead – there was no power-up. The cause was

Camcorner

easy to spot: PS1502, a surface-mounted protector, was open-circuit. Despite various checks and a long soak test no reason for its failure could be established. **D.C.W.**

Sony CCDTR75E

This camcorder's mechanism wouldn't accept a tape but closed satisfactorily without one. A common cause of this is failure of the drum to rotate, possibly because of a ribbon-cable connection problem. But the drum could be seen to start, at which point the mechanism ejected the tape.

A check on the cassette brakerelease mechanism showed that it was working correctly. When the take-up and supply reel spools were rotated manually however the supply reel was almost completely jammed. Further examination revealed the cause: the spindle was bent.

All was well once the spindle had been straightened and the reel had been refitted. No other damage had been sustained. It's an uncommon fault with this mechanism. You more often get it with the Canon UC mechanism (Models UC10 etc.). Someone must have been a bit heavy-handed I suppose. D.C.W.

Chinnon VC1500 etc

This and similar **Orion** models now often damage the tape when used in the play revue mode. The usual cause is a worn capstan drive belt. If a Chinnon replacement isn't available, a JVC type for a similar mechanism will work all right – Willow Vale part no. 20406NA. **D.C.W.**

Canon E600E

The report with this camcorder listed a couple of seemingly unrelated symptoms. First there was intermittent zoom operation with the W/T buttons. Then the fade button worked only occasionally, with the fade sometimes staying on after the button was released. This model

has a direct-acting fade: hold the button in to fade, release it to restore the picture.

They are not common faults with this model. In fact during initial tests it was difficult to get the unit to misbehave for long enough to be able to carry out any meaningful checks. As the various connectors on the camera head are sometimes damaged by side-case impact I decided to check them. They looked to be OK, but I resoldered them as a precaution. All to no avail: although the unit worked for long periods with its case removed, as soon as the case was refitted the faults reappeared - intermittently of course!

Further internal inspection revealed that the short ribbon cable (EF20) between the camera head and the main VTR PCBs was slightly fractured. A replacement cured the problems. Doubtless refitting the case had moved the cable sufficiently to cause the fracture to become intermittent. **D.C.W.**

Sharp VLE30H

Intermittent operation was the complaint with this early Viewcam. It would shut down, sometimes after being moved or the camera section being tilted. An internal inspection revealed that one of the two ribbon cables which connect the camera unit to the main recorder section was fractured. It's best to replace them as a pair - they are identical. The cables allow independent movement of the two sections of the unit, and are generally reliable. A replacement cable pair (Tilt FPC) restored the unit to good health. D.C.W.

JVC AA-V35

This dual-battery charger appeared to be quite dead, with no LEDs alight and no output voltages. It did draw current from the mains supply however. We found that the double-wound toroidal choke L23 was short-circuit between windings. **E.T.**

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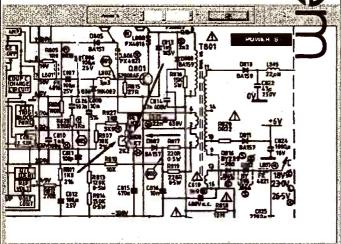
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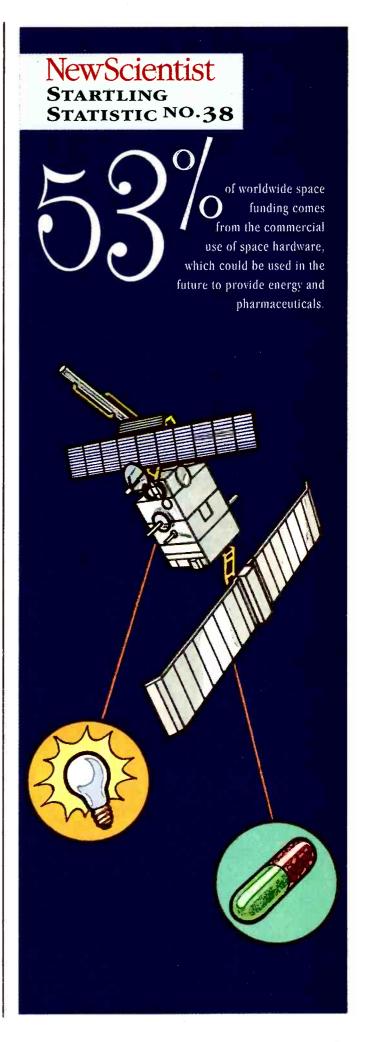
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RETRA president Brian McPherson addressing the conference.

The second RETRA Service Conference presented an opportunity to consider the problems of servicing in the digital age. Eugene Trundle reports on the proceedings

Service '98

ollowing last year's very successful first service conference, dealer association RETRA held a second one in late June. It was again very well organised and attended, with much of interest for dealers, service managers and technicians.

The proceedings were opened by RETRA president Brian McPherson. He emphasised in particular the need to provide the public with an excellent service – this point was driven home by an hilarious Wallace and Gromit 'industrial-training' film – and the desirability of having mandatory codes of practice in servicing, backed up by a compulsory licensing and registration system similar to the gas industry's CORGI one. He felt that the most likely solution to the problem of providing future technical training for technicians would be by means of 'distance-learning' courses – we'll return to this later.

MPEG and Multiplexing

Granada's training manager Peter Herd was the first guest speaker. He began by pointing out that digital TV became possible only with the advent of low-cost digital signal processors and memory banks and the development of sophisticated data-compression techniques. He then explained the MPEG-2 compression system, which is based on removing the redundant information in ordinary pictures, describing how each frame is broken down into macroblocks for DCT (discrete cosine transform) processing and quantisation. This was followed by details of run-length coding, 'packetisation' and streaming (PES), packet identifiers (PIDs) and mul-

tiplexing for transmission, all supported by clear diagrams presented on a large viewing screen.

Aerials for DTV-T

In the next presentation Tim Jenks, technical executive of the CAI (Confederation of Aerial Industries), explained why good a aerial installation would be required for reception of the new digital terrestrial TV transmissions and exploded some of the myths of signal distribution via cables. He stressed the importance of using good-quality feeder cable and accessories and of avoiding impedance mismatches.

Using the local Sutton Coldfield transmitter as an example, he explained how aerial response and spurious responses (side lobes) affect the reception of Channel 5 (analogue) and the new digital multiplexes, and why wideband aerials will become more common in the future. Well-known on the Continent, and likely to be used more widely in the UK, are group K (UHF channels 21-48) and group E (channels 35-68) aerials.

Dishes for Digital TV

Bill Collins, Technical Services manager of Astra, examined some aspects of dish installation for satellite DTV reception. The alternatives are a dual-feed (analogue and digital) system or a dedicated digital system with a smaller dish. While an existing analogue-type signal-strength/peaking meter might, at a pinch, do for DTV work – you also need a 22kHz tone generator – a new purpose-designed meter is much better. The ideal type has a bit error-rate (BER) readout.

The FEC (forward error correction) applied to the signals is greater for the UK than for other European countries. Nevertheless correct polarisation setting for minimum cross-polar interference between digital carriers, an LNB with low phase-noise, and the avoidance of signal reflections in feeder cables are all vitally important.

Surface-mounted Chip Tips

Steve and Darren Beeching of Grove Farm Publications gave a demonstration of how to deal with surface-mounted LSI chips: they removed and refitted one there and then, watched by the audience via two close-up TV cameras and a large screen. Several types of equipment were used – Leister, Pace and Chemtronics Chemask. The latter is a peel-off, heat-dissipating compound.

Several techniques and many different tools and accessories are available for surface-mount work. No single system is suitable for all applications. When removing S-M devices, the main dangers are print damage and the dispersal of small, adjacent components.

The next step with S-M technology will be ball-gate arrays, in which a matrix of surface connectors covers the underside of an IC.

A 'technical information module' on soldering and desoldering is available from Grove Farm Publications. For more details phone 01636 626 895.

Quality vs Quantity

The DTV group of broadcasters was represented by Jim Slater, whose talk covered many aspects of terrestrial digital TV. He began by comparing transmitter powers and signal-to-noise ratios for analogue and digital TV, leading on to a description of the various DTV multiplexes, their operators and contents. We also learnt that BDB is to get a new and better name – not then known, but see Teletopics.

Attention was next turned to the trade-off in DTV broadcasting between bit rate and image quality. Multiplex operators will want to broadcast as many programmes as possible simultaneously, within the constraints of acceptable quality. It's likely, in Jim Slater's view, that within five years it will be possible to transmit twice as many programmes within a given bit rate, using techniques such as Statmux – statistical multiplexing. This would, for example, enable sixteen programmes to occupy a 32Mbits/sec data stream, each with a variable bit rate to suit its picture content from moment to moment, but averaging 2Mbits/sec across the board. Thanks to the flexibility of the MPEG-2 system, the receiver could handle this without the need for any hardware changes!

The ITC has demanded a minimum standard for DTV-T sound transmission: in its 256kbit form it can carry Dolby Pro-Logic Surround sound, which is considered adequate for home cinema purposes. None of the broadcasters in the DTV group have plans for five-channel sound, nor is this in the specification for first-generation set-top boxes. Five-channel sound is expensive to produce, has limited take-up and would be justified only for a dedicated movie channel.

There were more details of the widescreen Test Card M, which was shown in prototype form on page 541 of our June issue. It will have a moving clock, a rotating colour cube, and Carol will write on the blackboard – to check for dropped frames. A sound/vision synchronisation check will also be provided. Even so, what's seen on the screen will be just the "tip of the iceberg": there will also be comprehensive digital test sequences, basically MPEG-2 transport streams stored on CD-ROM, to 'stress' different aspects of the overall system to the

limit. Test card transmission may become rare as precious air time is sold off – as happened with terrestrial analogue TV in the Seventies!

Euras

Antje Brandt of Euras International explained the workings of the Euras fault database, which now serves 20,000 customers Europe-wide. She described the "caring and sharing" philosophy of Euras, particularly of those individuals and companies who contribute to it. The system currently has some 500,000 fault tips: we will be reviewing it in a forthcoming issue.

From a reply to Chris Avis we learnt that tips are gratefully received but not paid for, though there are prize draws and the like!

NVQs for Technicians

Bob Douglas, a member of the EESLB (Electrical and Electronics Servicing Lead Body), explained the current situation with National Vocational Qualifications (NVQs) in our industry. He pointed out that they demonstrate actual competence in a way that the traditional qualifications and standards can't. Expressing his disappointment at the bad press that NVQs have had in the past, he explained the concept, purpose and structure of the NVQ system. Full information on the subject is available from the EESLB c/o EEB, Savoy Hill House, Savoy Hill, London WC2R 0BS (0171 836 3357).

City and Guilds courses and qualifications will continue to be available as long as they are required, and new technology courses along the lines of C&G 2240 are being developed. Their use depends on funding however, and the constraints described last year haven't gone away!

Distance Learning

Terry Tudor is the Project Manager for Bolton College Consultancy Services. In addition to conventional C&G and BTEC courses, the College is to offer a new form of 'distance learning'. It's called the ADAPT project, and will be focused on the new NVQs for brown- and whitegoods servicing. Many varied methods of communication will be used: papers, videotapes, CD-ROMs, the internet, ISDN and videoconferencing.

Several partners have teamed up to help make ADAPT a success – primarily Bolton College, the CAI, Circuit Tech, the EESLB, IBM, LJ Technical Systems, RETRA and Satvision plc. Each has been involved in different

Multi-pin surfacemounted chips like this are making the engineer's life more difficult.





Use of a fine-tip soldering iron with a surface mounted chip during the Beeching demonstration. aspects of the learning process and its delivery to students.

The ADAPT project will be able to serve 130 candidates, with thirty assessor/mentors, starting next January. It will cover NVQ Level II: Level III coverage is scheduled to start a year later. Recruitment for the initial Level II project begins this autumn – 24 computer workstations are on free loan offer to selected dealers to support Assessor and NVQ training. For more details phone 01204 388 122 or fax 01204 528 032.

Philips Service

The only equipment manufacturer present this year was Philips Consumer Electronics, whose SE England Technical Support Manager Bob Green reviewed the company's current technology in consumer TV/video gear. He mentioned the ever-falling prices and customers' ever-increasing expectations.

Philips CE's response to the servicing challenge into the next millennium comes in three main forms, the first of which is CSM – Customer Service Mode. When called up by the user's remote-control handset, this provides up to 22 lines of on-screen information on software settings, error modes etc., typically for relaying to a service technician over the phone.

Complementary to CSM is Compair - Computer Aided Repair - in which an ordinary (e.g. 486) PC forms the central element of a fault-diagnosis system. It's Windows-based and has diagnostic software on a floppy disc. The software can be easily updated via the internet (Philips operates a closed intranet site for dealers and service agents) or a CD-ROM. A single interface box is used for communication with a DST (Dealer Service Tool) remote-control handset, or IR signals provided by suitably-equipped TV sets and VCRs, or via a hardwire hook-up with forthcoming products. The link from the interface box to the PC is in RS232 form. Compair automates the process of fault-finding, and could be developed to provide remote fault-finding via a modem. Given compatibility, it would work with other makes of equipment.

The third factor in the service plan is Searchman, an electronic service manual system, again based on a simple, inexpensive PC and easily updated. We saw a screen demonstration of this. It was very impressive: the circuits, equivalent to many square feet of diagram that can be zoomed in, are taken directly from the design software and are thus crystal clear.

Compair and Searchman are due to be released this

month (September), which is exiting news. Bob Green's parting shot was, not surprisingly, a call for every workshop – every bench even – to get kitted up with a PC.

Q and A Session

The final questions and answers session was very interesting. Brian McPherson was of the opinion that registered, licenced repairers would have to form a 'closed shop' to be effective. Jim Slater suggested that five-channel surround sound has appeal to only a tiny minority of people. Bob Green said that Compair specifications have been made available to other manufacturers, and that the system would be accessible to those without Philips Service accounts. Bill Collins mentioned that the Astra 19.2°E slot is too full to be able to provide DTV, and that BSkyB is involved in litigation with ITV over the latter's wish not to "go satellite".

Trade Stands

Some of the cost of the conference was met by a group of exhibitors who had trade stands alongside the meeting hall. Alban Electronics displayed a wide range of test equipment; CHS concentrated this year on its computerised communications systems CHESS and CHAOS; Euras demonstrated its fault database; Konig displayed spares, accessories and test equipment as both a manufacturer and supplier; SEME concentrated on soldering equipment and rework stations. Willow Vale was there as a well-known distributor of spares, tools and service equipment.

Full Marks

In conclusion I found it a good conference of great interest to anyone who lives in the rapidly-changing world of consumer electronics servicing.

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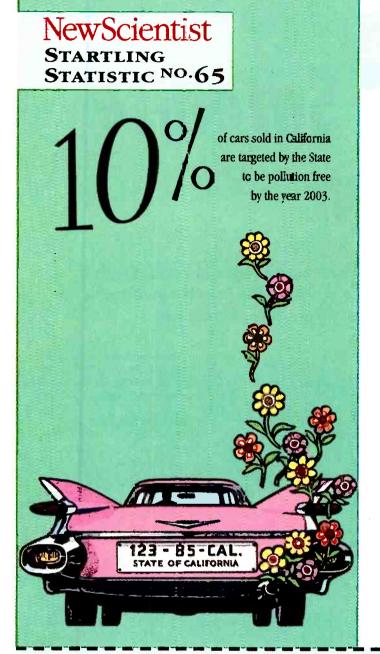
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34N

DX and Satellite Reception

DX and satellite TV reception and news from abroad. Further thoughts on the use of phaser systems for interference reduction, with a test of the MFJ system. Roger Bunney reports

5/6/98: TVE E2, 3, 4; RAI IA, B;

RTP E3; C+ (France) L2.

ood news at last: June was an excellent month for Sporadic E reception. There were high-level signals on most days, and some exotic ones for those willing to search. Syria ch. E3 was seen on several occasions, also an unidentified Arabic ch. E3 station likely to be in Jordan. The favoured direction of propagation seems to have been from the south/south east – there have, so far, been no reports of reception from Finland or Iceland. The composite SpE log for the month is as follows:

3/6/98: TVE (Spain) chs. E2, 3, 4; RTP (Portugal) ch. E3; RAI (Italy) chs. IA, B; Video (Italy) ch. E2 (47-86MHz); TVR (Romania) ch. R3; NRK (Norway) E2; Syria E2; unidentified Arabic E3 signal; ARD (Germany) E3; HRT (Croatia) E4; RTS (Serbia) E3. 4/6/98: TVE E2, 3, 4; RAI IB; Video E2.

7/6/98: RAI IA, B; Video E2; TVE E2; Syria E2 9/6/98: RTLKL (RTL Klub, Hungary) R2; Arabic E3; YT-1 (Ukraine) R1. 10/6/98: RTS E3 11/6/98: TVE E2, 3, 4; RTP E3 12/6/98: RAI IA; Video E2; RTS E3; unidentified Italian IA signal with M logo at bottom RH side. 14/6/98: RTP E2, 3 15/6/98: RAI IA; RTP E2; TVE E2; RTS E4; NRK E2, 3. **16/6/98:** RAI IB; TVE E2, 3, 4; HRT E3; Video E2; RTP E2, 3. 17/6/98: RTP E3; TVE E2 18/6/98: RAI IA, B; RTS E4; HRT E3; TVE E2, 3, 4; RTP E3. 21/6/98: TVE E4; RAI IA, B; SVT (Sweden) E2, 3, 4; NRK E2, 3; ARD E3; LTV (Lithuania) R1. 22/6/98: RAI IA. 23/6/98: TVE E3, 4; RAI IA, B; Video E2; ARD E2; LTV R2; ORT (Russia) R1, 2; LTV R2; ETV

It may help with the identification of Arabic ch. E2 signals to bear in mind that the Syrian network doesn't use VITS (data signals in the field blanking interval) while Dubai does.

(Estonia) R2; MTV (Hungary) R1.

26/6/98: RTLKL R2; RAI IA, B;

RTS E3; TVR R1; Syria E2; RTP

E3; TVE E2, 3, 4; Video E2.

28/6/98: Video E2.

30/6/98: NRK E4.

27/6/98: SVT E2, 3; LTV R2.

Garry Smith (Derby) mentions a ch. E3 signal with an 'elipse' type logo. He thinks it may be from a Turkish TV6 station. Also a "stripy

1" signal seen in chs. R1 and R2, thought to be from the Ukraine. Can anyone provide any information on this possibility?

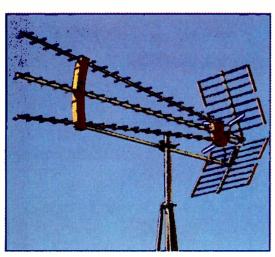
Satellite Sightings

There was a mass of World Cup feeds from France from the second week of June onwards. ITV made extensive use of Intelsat at 31.5°W, with ITV-MCR WC98 at 10-968GHz vertical and a couple of 'floating' uplinks, from hotel venus etc. The main ITV-MCR feed was often carried by the 11.026GHz vertical transponder as well. The BBC mainly used the French Telecom satellites at 5°W and 3°E. Live two-way interviews were often carried by the 11.607 and 11 643GHz transponders at 5°W, the latter with "BBC PARIS ST" on the test pattern. Many of these analogue feeds were duplicated in digital form.

For me the most significant event was my first reception from the new Nilesat craft at 7°W. Libyan TV video was present on the 7th at 11.867 and 11.905GHz (no audio, just subcarriers at 6.6, 7.2 and 7.8MHz). Reception was difficult with mega-volt signals from Telecom 2A at 8°W. My thanks to Alan Davidson (Scotland) who alerted me to signals from this satellite.

The first concert in the Rolling Stones' Bridges to Babylon European tour, on June 13th, created interest. Much of the pre-concert rehearsal, rigging etc. from the Zeppelin Field, Nuremburg, Germany was seen live via Intelsat K (21.5°W) at 11.531GHz horizon-

This triplestacked, wideband, highgain UHF array covers 470-900MHz. At 470MHz the gain is 15dB, rising to about 20dB at 860MHz. For further details check with Televes UK on 01633 875 821.



tal from 1830 onwards. The extensive tour build-up included a poorly-linked, part-prerecorded halfhour plus item, with live inserts from the first concert, via Eutelsat II F2 (10°E) at 11.633GHz horizontal. The list of tour dates included the UK venues that were cancelled and moved to Helsinki for tax reasons. It provided a fascinating view of the world of pop business.

VOA-TV had problems on the evening of the 26th. Its Worldnet feeds via Eutelsat at 10°E (11-153GHz horizontal) for Serbia (2100) and Bosnia (2130) were of appaling quality. When the intermittent vision carrier was present it provided overloaded, burnt-out pictures - with no audio.

On the 29th the regular UKI-149 GMTV SNG feed via Intelsat K for the breakfast-time show revealed the presenter, in wellies, standing in a sea of thick mud with swamped tents. The venue was Glastonbury, washed out for the second year running.

Sports enthusiast Dean Rogers (London SE2) was obviously delighted with the mass of football feeds. He found other items of interest however. An unusual one for TV was live mountain biking via Eutelsat II F4 (7°E) for Eurosport (still with SIS). The Le Mans 24-hour race was seen via Intelsat K, with live coverage up to midnight. Odd to see cars racing in darkness! The action in the pits, with quick tyre changes and servicing, was dramatic.

I recently mentioned horse racing via Sirius (5°E) as being digital but clear. John Womersley (Bradford, Yorkshire) points out that two days after the magazine appeared conditional access was imposed. The Sainsburys feed for its stores via Eutelsat II F3 (16°E) is no good either: the MPEG offering on the Open Broadcast Network is now conditional access at 11-128GHz horizontal. More digital excitement, via Telecom 2C at 3°E: the Globocast, Brazil World Cup reverse programme feed to Europe carried all the commercials, programmes, soaps etc. To help our digital zappers, PID (picture identification) entry is required for APTV-1 - 12.549GHz hor/5632/(3/4)/(v512/a650/f8190).

John Locker (Wirral) comments on the mass of BBC and ITV feeds via Intelsat at 31.5°W and the Telecom satellites. Interesting that the Eurosport feed was also seen in C band at 18°W. The STS91 MIR docking mission ran into communications problems, so no Ku-band downlinks were seen: the 16.83GHz downlink at 16°W was very weak and was cross-strapped to C band at 18°W for transmission to NASA. John spotted the newlylaunched THOR-3 when it came over the horizon to 36°W for tests. Signals were seen at 11.8 and 11.727GHz vertical. By now the satellite should have taken up residence at 1°W.

Terrestrial News

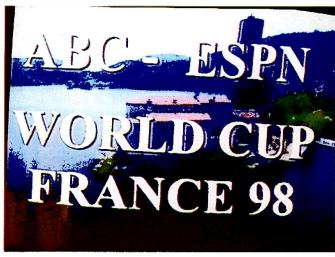
Ireland: The TV3 commercial channel has announced an opening date: September 21st. Initially the programmes will consist of mainly imported material - until the Canadian-backed operation can build up its own production. Italy: The ABS company is to replace the transmitters at Udine, Monte Penice, Monte Cammarata and Punta Badde Urbara. This will involve a move to UHF. Numerous RAI VHF-FM transmitters are also to be replaced.

UK: The Radiocommunications Agency has confirmed that the 380-400MHz band has been allocated to the emergency service and public safety radio. It's been a NATO allocation. Police, fire and ambulance services will probably move to this band. Public utilities and road services, e.g. the AA, will not have access to it.

Eastern Europe: There is to be TV expansion in Romania, with the government seeking bids for 21 terrestrial broadcast licences. Bulgaria is preparing legislation that will lead to the first nationwide commercial TV network being opened. Malaysia: The government has put a stop to further terrestrial TV stations being opened. Its nationwide network Radio Televisyen Malaysia has been refused permission to open a third terrestrial network. Sweden: The commercial network TV4, the national broadcaster SVT. Canal Plus, TV3 and Kunskaps TV are the successful applicants for terrestrial digital TV franchises. Kunskaps TV will share time with the business news channel TV8. TV4 and SVT will both have regional programming channels allocated to their services. Norway: There are to be no more NRK or TV2 analogue transmitters. The present analogue system will

continue until terrestrial digital TV is in operation. Bands I and III will then be closed for TV, with digital transmission at UHF (including NRK-1).

Denmark: For Danish local TV,



check the following channels during tropospheric lifts: E23V Naestved*, Esbjerg and Kolding*; E23H Kobenhavn and Arhus*; E28V Vejle*; E35H Aberna; E40V Holeby; E43H Svendborg; E49H Odense; E51V Alborg*; E57V Herning*; E60H Kobenhavn* and Slagelse*; E60V Fredericia*. Asterisked transmitters relay TV Danmark either all or part time. Internet DX: Those linked to the internet can access a couple of

Football time: a States-bound feed via Intelsat K at 21.5°W.



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	Video Input : 1 S-Video Input : 2 Video Output : 1 S-Video Output : 2
Picture resolution	500 lines for both dynamic and static picture
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and a Drake R8 in North Carolina, USA at

http://www.chilton.com/scripts/radio/R8-receiver

Is this the first website DXing?

Satellite News

This might be bad news for sat-zappers. Sony has developed a data speed-up package, type DSM-T1, that doubles the data rate at an SNG uplink site. A matching DSM-R1 demodulator is required for reception. The system provides a degree of security and reduces transponder rental time.

AsiaSat-3R is still on course for launch at 105.5°E, but the launch of the proposed AsiaSat-4 at 122°E has been put back to 2000. Canal Plus is to arrive in asia in the autumn of 1999; it will run the Taiwanese digital DTH TV service Carnival Star, with about fifty TV channels plus radio and various multimedia services. Mediaguard encryption is to be used, and fifteen manufacturers have been licensed to make decoder boxes. DirectTV Japan has signed up 110,000 subscribers in six months for its digital service which promises 130 channels by September. But rival SkyPerfectTV has signed up 672,000 subscribers with an offer of 107 channels to increase to 170 by the middle of the year. The Indonesian Indovision service is suffering from a high subscriber churn rate: 1,000 new subscribers

sign up each month but 400 terminate. The target of 750,000 subscribers is unlikely to be reached in the foreseeable future – the highest total reached to date is 37,000. Indovision's B-MAC services have ended with a move to digital transmission.

World Television News, London, has been bought by Associated Press TV (APTV) for nearly £40m. There's talk that this might involve redundancies.

Intelsat 704 has fed HDTV signals to NHK Tokyo while 801 has fed HDTV to Brazil, the first ever HDTV programming seen in Latin America.

Signal Phasers

The subject of signal phasing units has come up several times in this column over the past year. There is continuing interest since Band I is still active for DX-TV, though local but legal interference is an increasing problem. Analogue TV is likely to be around in Band I for at least another ten years, so any means of interference reduction is worth trying.

The main problems arise from computer radiation and the high-level noise around 49MHz. The former is usually wideband, so notch filtering doesn't help much. It can help with the 49MHz problem however.

Todd Emslie's simple yet effective wideband nulling system was described in the July issue. It can be used across the VHF spectrum, the only additional electronics required being an attenuator and a couple of wideband preamplifiers. A simple preamplifier can be made from a BFY90 transistor and a few other components, at a total cost that should be less than £2. A more expensive alternative is the C.M. Howes ultra-wideband scanner preamplifier kit, which costs £15.95. It's based on a small MSA0685 microwave device with appropriately designed PCB. The claimed gain is 15dB from 4-1,300MHz with a noise figure of under 3dB at HF/low VHF rising to 3.2dB at 1,300MHz. There is usable gain outside this bandwidth.

This could be an interesting preamplifier for general use in the TV bands. I'm building a couple of samples and will report back on their performance. The exceptionally wide bandwidth and quoted gain could result in overloading and non-linearity problems, and in particular breakthrough of the outputs from nearby HF transmitters/taxi

base stations/police UHF repeaters etc. So I feel that it would be wise to add bandpass coupling. The preamplifier is intended for masthead mounting with a scanner aerial, and a power interface board (for coaxial cable powering) with a switchable 10dB attenuator is part of the kit. It's available from C.M. Howes Communications, Eydon, Daventry, Northants NN11 3PT (tel. 01327 260 178).

The MFJ Noise Cancelling Signal Enhancer Model 1026 is currently available from short-wave specialists/dealers. It's a phasing system with a built-in whip interference pickup aerial/preamplifier. Model 1025, to special order, uses on an external input from an interference pickup aerial - it incorporates an interference preamplifier. The input from the DX aerial is combined with the adjusted antiphase interference input to reduce, or possibly cancel, the interference. It's priced at the £125 plus level. There are lots of knobs and switches and a red LED - it looks good!

The system can also be used to provide gain (in the absence of interference) with the inputs from two aerials. A directional aerial system can be created using a couple of vertical dipoles. The circuitry differs from designs previously shown in these pages, though it appears to be a fairly basic affair. There's a push-button locking switch for use below or above 7-12MHz. The unit can, with additional controls for this purpose, be used in an amateur transmitting station.

I obtained a Model 1025, powered it at 12V from an external 13A block PSU, and switched on. A discone aerial was used for the interference input and a two-element wideband Band I aerial for the DX input. I tuned to chs. E2/R1, which are continuously jammed by signals from the 300 plus homes on my estate, but the results were disappointing. The phaser refused to provide anything more than a few dBs of interference reduction, despite prolonged adjustment of the phase switches and the on-board preamplifier gain controls.

Before I start to alter the circuitry I'm going to check with MFJ in Starkville, USA, on the phaser's performance at low VHF, and see whether there might be any modifications for use in this part of the spectrum. I'll report back. In the meantime I suggest that the Todd Emslie approach be considered: it's cheap, cheerful – and it works!

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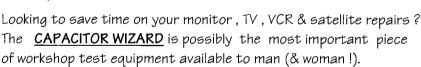


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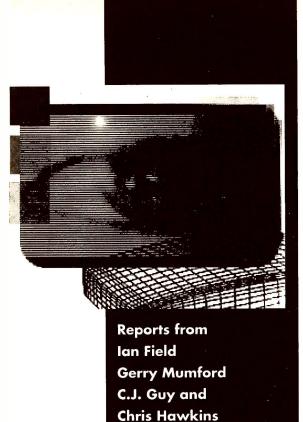


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Viglen CA1426LT

The power supply was running and the heaters were glowing. When the PC was fired up and connected a vertical line flashed on the screen, accompanied by a scrunch sound. This had me worried: I thought that the LOPT was arcing internally. I decided to dismantle the monitor and look for other causes however.

With these monitors the base section of the case has to be separated from the CRT/escutcheon assembly before the PCB can be removed. I use masking tape on the monitor's front surround and reinforce the middle, top and bottom with DIY tape (fabric tape with PVC top layer). Put the monitor face down and check that the anode cap is discharged. I find that a charge can build up while you are working on the unit. A quick squirt of water-based cleaning spray to bridge the anode cavity to the Aquadag will prevent this. But make sure that the anode is discharged first: most cleaners contain alcohol and will burst into flames if a spark occurs. Hook the anode lead on to the line output stage heatsink. The cleaning spray leakage trick ensures that I don't forget to clean the grime from around the anode connection!

Lift the CRT base away, disconnecting the earthing braids as you do so. This leaves only the scan plug and degaussing lead. With a logical approach, these monitors are not as difficult to strip down as they look.

Once the many screws (some

Monitors

partly hidden) had been removed I was able to see that the solder had been applied very sparingly. The connection at one end of L301 had arced away. Cleaning and resoldering this completed the repair. I.F.

Hyundai HCM421E

This monitor came in because of an intermittent frame fault. It took a considerable time to appear. Much time was wasted on the soldering, which was quite good overall apart from solder whiskers.

The user height control (V size preset) at the rear of the case felt loose, but no amount of wiggling it would produce the fault until the monitor had fully warmed up. As I didn't have a replacement in stock I decided to strip, clean and retension the old one. It looked as if the wiper's slip-ring metalisation had worn, so as well as retensioning the spring contact I offset it. A quick rub with a graphite pencil completed the renovation. When the control had been reassembled the problem had been completely cured. **I.F.**

Daewoo CMC1427S

There was a bright raster with flyback lines. The chassis looked difficult to get at, so I decided to pick on the CRT base assembly which is awkward to get at! It's fixed to the tube's neck with hot-melt glue, and there's a knack to removing the shield, most of which is the heatsink for the video output chip and remains attached to the CRT panel. Lever out the tab and unsolder that end. Ease the PCB out of the shielding box while keeping the solder melted at the other end. It's obvious when you study it carefully, but looks a right puzzle to begin

Once in I found that the 80V HT supply was low at only about 13V. So back to the main board which, despite appearances, is easy to get at. Unclip the plastic 'floor' from the front assembly to gain access to two screws, one in the LOPT cage and one enclosed by the field out-

put heatsink. The PCB then unclips, slides back and lifts out.

The 80V supply comes from the chopper circuit via the 2SC2073 emitter-follower Q111, whose base is driven by Q112 (2SA910) via R112 (10 Ω). The base of Q111 is decoupled by C113 (100 μ F, 100V), whose charging current is too much for the very tiny 10Ω resistor which goes open-circuit. Q111 is then cut off. **I.F.**

CTX 1451LR

This monitor was dead. The line output transformer had failed, taking with it the BU2520DF line output transistor. The customer refused the estimate, so the monitor was returned unrepaired. But some observations may help others.

The diodes at each end of the row along the secondary side of the chopper transformer were both cooking. The BYV96E HT rectifier had almost certainly been damaged by the line output stage shorts. Although it doesn't look like one, the data book says it's a 3A rectifier. No cause could be found for the distress suffered by the BYD33G (1·3A) LT rectifier. I suspect that it partially fails, the result being line drive pulses with a slow edge followed by failure of the LOPT.

If you service one of these monitors it would be a good idea to replace these two diodes before trouble with the LOPT develops. Most of the CTX monitors of later manufacture I've seen use 3A rectifiers for every rail. UF540X series rectifiers are a good choice, the UF5404 as a replacement for the BYD33G and the UF5408 as a replacement for the BYV96E. The Trr specification for UF540X series rectifiers is in the range 50-75µsec. **I.F.**

Compaq 444

The complaints were "intermittently dead or faulty line lock". The monitor was very touchy, and occasionally blew the line output transistor. PCB defluxing was the

answer. Almost invisible cracks tend to develop around the nylon support pillars. Don't miss the earth pins on the LOPT focus block when going over the soldering. Dry-joints here can do odd things! I.F.

EM144CE

This monitor was dead. On inspection I found that a large crack had spread in three directions from the focus unit's earth pin. When this had been repaired I checked the soldering around all the other heavy components – some displayed signs of mechanical stress.

While resoldering around the chopper transformer I noticed that the connections to the 115V rectifier D109 were heat fatigued: when I resoldered it one pad lifted on the tip of the iron. If this had happened to the rectifier that supplies the regulation optocoupler the power supply would probably have blown up. So I checked the condition of the PCB around all the chopper power supply rectifiers very carefully. Once all this had been attended to the monitor worked well. **I.F.**

CTX 15695

If one of these monitors switches on and the LED lights for about a second, followed by switch-off, suspect dry-joints at Q106 on the secondary side of the power supply circuit. It's surprising how common this fault is! G.M.

Dell D1428HS

When faulty these monitors are usually totally dead. They can play a particularly nasty trick however, as they use a soft-start on/off switch that's connected to a surface-mount OEM microcontroller panel. If a video signal is connected when you are probing around this panel, the 5V supply appears to be present but a bit low. So you think the monitor is stuck in standby (a microcontroller error) and that this is the reason why the main supply rails are down.

In fact the measured voltage is a "ghost" derived from the sync signals: all the supplies are down. The cause of the problem is always R5 $(0.33\Omega, 0.5W)$ being open-circuit. It's in the primary side of the power supply.

In this model the supply lines remain up even in standby. **G.M.**

Compaq 476

There was a white screen with flyback lines – an image was present but was very faint. The cause of the fault was in the supply to the brightness network. Rectifier diode D803 (1N4937) had gone short-circuit. As a result its feed resistor R806 (0.22Ω , 0.5W) was open-circuit. **G.M.**

Dell D1528LS

There was EW bowing and excessive width that culdn't be controlled. A pair of transistors in the line output stage, Q438 (2SC2236) and Q439 (2SA966), had gone short-circuit whille R478 (1Ω , 0.5W) had burnt up. Replacing these items cured the problem, but the transistors ran very hot.

Further investigation revealed that their feed coil L403 (611204130/1) was short-circuit. When a cold DC check is carried out on this component a reading of 1.8Ω should be obtained. We replaced the coil with one rescued from a scrap chassis. The transistors then ran cool again. **G.M.**

CTX CVP5468NI

This monitor appeared to be dead, but the supplies were all present. The line output stage wasn't in operation however, because of a huge dry-joint at the HT feed diode D412. G.M.

HM Technology CK1420

This monitor was dead with the fuse intact. A quick check revealed that there was no supply at the UC3842 chopper control chip. Start-up resistor R531 (560kΩ, 0.5W) had gone open-circuit.

When this resistor had been replaced the monitor was still dead, with only a few volts at the chip (which incorporates under-voltage lock-out). It transpired that zener diode ZD501 (36V, 500mW) was very leaky. G.M.

Sony KX27PS1

This heavy beast didn't want to start. When it did, a loud and raucous whistling sound came from the power supply, which is enclosed in a thick aluminium case. It was difficult to open this because of the hardened heatsink compound in all the joints. Once I managed to get inside I found that the power supply was full of dryjoints. A good clean and resolder cured the problem. For good measure I replaced the small electrolytics inside the case. C.J.G.

Tatung TM3401

This monitor produced a dull display. The cause was R475 (100k Ω)

in the beam-limiter circuit. Shades of the TX90 chassis! **C.J.G.**

Commodore 1084SP1

This monitor whistled while its owner waited but didn't cure itself. Diode D6517 (BY228) was short-circuit.

It's worth looking at the solder joints under the SUB D 9-pin connector before you return one of these monitors to its owner. C.H.

Aldix Soundvision 15

The power supply was pulsing and the HT voltage was at a third of its normal level. So there appeared to be a fault in the line output stage. The line output transistor and transformer checked OK, but when I traced back to the damper diode network (DP30, DP31) I found that DP31 was dead short. An RGP30 diode fitted as a replacement restored normal operation.

This monitor uses a DBL2054D chip in the field output stage. A TDA1675 is a suitable replacement. C.H.

AOC 45

The owner said he had seen smoke followed by lots of noise, after which there was nothing but a bad smell. When I ventured inside the monitor I couldn't seen any burnt components. So I switched on, which produced a squealing noise from the power supply.

Diode D904, which is connected directly to the transformer, turned out to the short-circuit. When removed it appeared to have fried. No markings remained, so a BY399 was fitted as a replacement. The monitor then worked all right, though the smell lingered on. C.H.

Compaq Presario 313

If the left and/or right channel fails to produce sound, check IC5 and IC6 (both type TDA7058) by replacement. The Philips data book says that the chip is protected against short-circuits, but the customer proved, with his 30W hi-fi speakers, that this was not so! A case of multimedia madness. C.H.

KT KTM1428

This repair was a long, drawn-out business. The width was correct, but the height stretched to infinity. To cut a long story short, to obtain a normal display I had to replace all the very small 0·125W resistors in the field output circuit – R318 (1M Ω), R319 (150k Ω), R320 (320k Ω) and R323 (180k Ω). I used 0·5W replacements. **C.H.**

Answer to Test Case 429 - see page 783 -

Rather as with the last two test case items, the cause of Sage's woes was an incomplete knowledge of exactly how the system is designed and is supposed to work! Some VCRs sit happily, with a fully-rewound tape and with light falling on the start sensor via the tape's transparent leader, ready to respond to any forward deck command – but not a backward one. Others, like this Sony model, have a little program in the system-control software: it moves forwards any fully-rewound tape to the point where the clear leader section is wound into the cassette shell and the start sensor is thus blinded by the opaque tape. If the control system in such a machine is thwarted in this respect, it objects: continued activation of either of the tape-end sensors results in shut down and/or ejection of the cassette.

Sage now knew why the control system was behaving as it did, but not why the short forward-wind movement failed to take place. Close observation of the capstan motor then revealed that it tried but failed to wind the tape forwards at the crucial moment after cassette insertion or the end of a rewind. In fact the capstan motor itself was faulty, despite the fact that the machine worked correctly in all the other modes!

Sage cleaned and lubricated the capstan motor and replaced its electrolytic capacitor C001. After this all was well. Phew!

NEXT MONTH IN TELEVISION

Servicing the Panasonic Euro 1 Chassis

This was one of the first TV chassis that uses digital signal processing to be introduced in the UK. While most faults are conventional power supply/deflection ones, the digital section sometimes calls for a different approach to fault-finding: as an aid, Panasonic has introduced the LUC1 PC interface. John Coombes on what this involves and general fault-finding.

FireWire Developments

The basic FireWire digital data interconnection system was described in our July issue. Since then further developments have been announced. Geoff Lewis, B.A., M.Sc., provides an update.

Reviews

Martin Pickering on a new consumer electronics product, the internet set-top box. Stock up and make a fortune! Plus Eugene Trundle on a video alignment test tape from SEME at under £30.

A PC-based Portable Servicing Database

Michael Maurice decided that it was time to update his servicing administration. As most of his work is undertaken in the field, a portable PC system and printer were required. The results, using the equipment and software selected, are impressive.

Satellite Polariser Test Modules

Last August we published a motorised dish tester designed by Pete Haylor. He has since designed simple magnetic and mechanical polariser modules that can be added to the original unit either singly or together.

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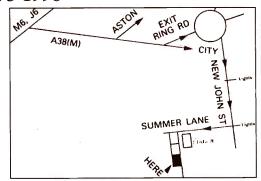


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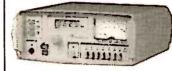
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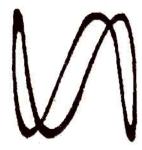
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The successful candidate should have the ability to:

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- carry out special tests and trials to ensure that our high standards in broadcasting are maintained
- interpret circuit diagrams and follow service manuals, essential
- work well with others and be able to work unsupervised, as necessary

Candidates should have a good general education and specific training on the different types of equipment involved will be provided. Whilst formal training and suitable qualifications are desirable, experience in fault finding and repairing domestic or professional electronic equipment would be much more valuable.

To apply please contact the Recruitment Office on 0800 783 9573 for an Application Form, Job Profile and Person Profile.

Application Forms should be returned to Jeanette Scott, Assistant HR Officer by Friday 25th September.

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B B C Resources

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Broadcast Engineering

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COTFACS provides a wide range of maintenance support associated with a large cable TV system and Domestic Audio Visual Equipment, at West London BBC premises.

Your tasks as a COTFACS Engineer will vary according to the day-today requirements and could include: maintenance, alignment, acceptance testing, installation and modification activities on a wide range of technical equipment used by the Department and our customers.

Although working to a coordinator, you will be expected to carry out your duties without close supervision. You will have relevant knowledge and experience of vision, sound and computer systems as they relate to a domestic A/V repair workshop. You should have the ability to work in a fast moving environment, responding to customer requirements, often to conflicting demands and changing priorities.

Good interpersonal and communication skills are essential along with an innovative approach to problem solving. You will ideally possess a relevant engineering degree, although applicants with the minimum of a City and Guilds 224 qualification will also be considered. The post requires sufficient hearing and colour vision.

For further details and an application form, please contact BBC Recruitment Services (quoting ref. 27451/TL) by September 8th on 0181-740 0005, Minicom 0181-225 9878. Alternatively, send a postcard to BBC Recruitment Services, PO Box 7000, London W12 8GJ, or e-mail recserv@bbc.co.uk quoting ref. 27451/TL and giving your full name and address. Application forms to be returned by September 11th.

You can also see this vacancy on http://www.bbc.co.uk/ jobs/e27451.shtml and apply online from our world wide web site.

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Test & Service Engineers

A leading edge manufacturer of Telecomms Comms equipment based in the South East and overseas requires a capable Customer Support Engineer. Tasks will include the support and maintenance of customer equipment, assisting the Development Team in commissioning and testing of in-house projects, site installation, and providing system training for customers. At least 2 years experience in similar environment. Hardware and data communications, Profound understanding of paging devices. Able to travel upon short notice, UK and abroad and possess a clean driving licence. Good all round electronic maintenance skills.

Ref: PFUCST

Technical Author

217-23K

A Motion Control and Simulation Systems manufacturer based in Middlesex requires a Technical
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systems, agents and distributors and internal use, Products are computer controlled hydraulic
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and Materials testingAct least I years full-time experience in generating technical manuals in
industrial/electronics/instrumentation/process control environment etc. Knowledge of Quark or
Pasemaker advantageous.

We have 2 URGENT vacancies for Electronic Buyers based in the South East. Candidates must be experienced in purchasing and stock control in a production environment, preferably electronics. PC literate, also MRP knowledge. Have a proven track record in cost reduction techniques, vendor assessment and development of supplier partnerships. CIPS part or full qualification is not essential but would aid your application. An awareness of electronic or mechanical components, MRP systems, Kanban, jiT and electronic trading.

A global Testing Standards organisation based in the Home Counties requires experienced Engineers.

Candidates will be experienced in the calibration and test of telecomms test and measurement technologies working within the barriers of ISO9002. Fault finding to discrete component level, diagnosts and rectification etc. Experienced in the Refillerowave filed, preferably upto 40GHz is desirable, experience in a NAMAS/UKAS lab would benefit your career progression. Ref: PFMHSB

Paul Fraser

RECRUITMENT
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TestLink, The Ventura Centre, Upton Industrial Estate, Poole, Dorset BH16 5SW e mail: cvs@testlink.co.uk

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WER SUPPLY-VS1000-VS1100 WER SUPPLY, LONG OR SHORT CHASSIS 991/1992 MODELS 991/1992 MODELS UNER SUPPLY - SWITCH MODE - DOUBLE DECKER OFF MIXED NOKIA FIT. LORA FINLEX SERVICE MANUAL - POS INS ADAPTOR 12V AT 500 M/A GATIVE CENTRE	£1.00	TUBE BASE – Mixed 10 for AA Batteries made by STC Group of Companies 10	- P		TAID!	Z COMPONENTS No Credit C
IWER SUPPLY-VS.1000-VS.1100 WER SUPPLY, LONG OR SHORT CHASSIS 1991/1992 MODELS 1991/1992 MO	£1.00 £1.00 BU205 BU206	75p BUT13 £1.00 BYW95C £1.00 BUT18AF £1.00 BYW562A	10p	HD6140815 £1,00 No accounts S	FND	
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WER SUPPLY-VS.1000-VS.1100	£1.00 £1.00 £1.00 BU205 BU206 BU207 BU208A BU208A BU208A BU2208A BU222BU326 BU3222 BU326BU407 BU407	AA Batteries made by STC Group of Companies 1/8 75p BUT13	10p 8p 10p 25p 10p	HES4093 20p HGAI124A 50p HM6264 ALP-15 £3.50 KTST 6391 B1 £3.00 Tel: 01	PSTE E: 702 3	IGNTON, SHOEBURYNESS, SSEX SS3 8AF. 38894 Fax: 01702 338805
DWER SUPPLY-VS10000-VS1100 WER SUPPLY, LONG OR SHORT CHASSIS 1991/1992 MODELS 1991/1992 MODELS DWER SUPPLY - SWITCH MODE - DOUBLE DECKIER OFF MIXED NOKIA FIT: ALORA FINLEX SERVICE MANUAL AINS ADAPTOR 12V AT 500 M/A EGATIVE CENTRE 105 20p 2SD1432 £1.00 F 106 20p 2SD1433 £1.00 F 109 20p 2SD1576 £1.00 F 12F 20p 2SD1577 £2.00 F 12F 20p 2SD1877 £2.00 F 12F 20p 2SD1877 £2.00 F 12F 20p 2SD1878 £1.00 F 12F 20	ET £4.00 £1.00 £1.00 BU205 BU206 BU207 BU208 BU208A BU208D BU2022 BU326 BU407 BU508AF BU508AF BU508AF	AA Batteries made by STC Group of Companies 1/8 75p BUT13	8p 10p 25p 10p 20p 10p 5p 5p	HEJ34093 205 HIGA11234 505 HM6264 ALP-15 £3.50 K7ST 6391 B1 £3.00 INS401 505 LY398N 54.00 Specific P/P chart	PSTE E: 702 3 ges are	EIGNTON, SHOEBURYNESS, SSEX SS3 8AF. 38894 Fax: 01702 338805 PER ITEM • For UK addresses add P/P
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