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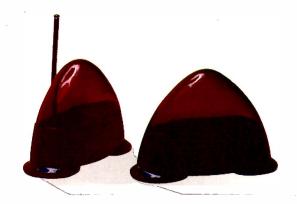
Giles **Pilbrow** lists the CTV chassis produced by Sony in the UK over the last ten years and the models in which they were used.

Servicing the Mitsubishi Euro 12 Chassis

Euro 12 Chassis 660 John Coombes on fault-finding procedures with this CTV chassis.

A Hi-8 Video Problem

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July issue on sale June 17th. Next issue, dated August, on sale July 15th.

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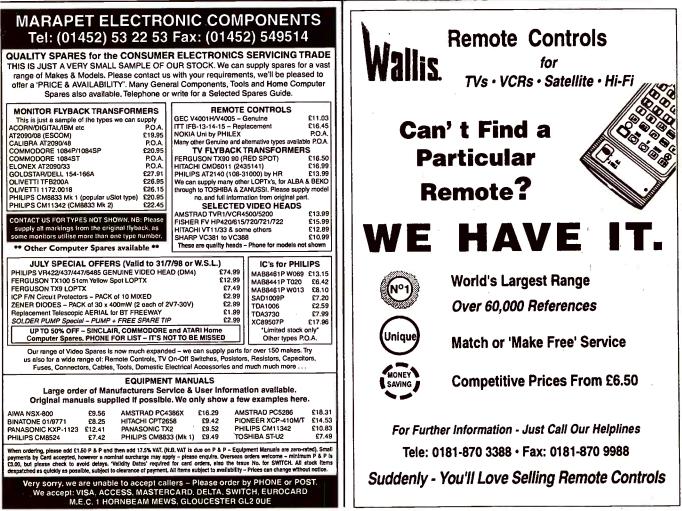
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Consumer Confusion

etail price maintenance was abolished many years ago. The government has now decided that even quoting manufacturers' recommended prices is, from September 1st, to be illegal in our industry. Whatever for? There is no way of enforcing recommended retail prices, which have become something of a joke - a quite harmless one. No one takes much notice of them. But they have served a purpose. They provide an indication of the value a manufacturer sees in a particular product and its market position. That, surely, is of some help, if not a very great one, to the customer. At least he is given an idea as to whether he is being offered a quality product, an average workaday one or a rock-bottom cut-price item. We are no longer to be allowed this bit of guidance.

Was it useful? Well, the customer can hardly take a piece of equipment to pieces before he buys it. And, nowadays, most TV sets, VCRs, PCs and whatever look much of a muchness – tube size and features apart in the case of a TV set. In this situation, to be given an indication of perceived value is surely better than nothing at all.

It is one thing to encourage free, competitive trading, quite another to leave consumers in the dark with little idea of the value of what they are being offered. They can of course carry out detailed market research, but who has the time – or inclination? They can also wade through one of those interminable *Which*? reports that state the obvious at great length and come to totally anodyne conclusions.

The fact is that doctrinaire free-marke-

teers have had it all their own way for rather too long. It is of course possible to go too far in the opposite direction, towards control and restrictions. But we need laws to enforce decent behaviour, and have had trade regulations to ensure fair practice. The move to regulation started in the Victorian era, when it was common practice to sell adulterated goods. Surely we don't want to go back to that sort of thing?

Going too far in the direction of uncontrolled trading has very real dangers. An obvious example was the misselling of personal pension schemes a few years back. When it comes to what are nowadays known as "financial products" rather than insurance, banking, pensions and so on, total confusion can reign, making it easy for the less than scrupulous to operate. Insurance, mortgages and so on have been fertile ground for those interested in only a quick, profitable deal. It's all too easy to muddly the water, get the punter confused then come up with what looks like a brilliant offer.

It's strange that governments of both colours have advocated this totally unrestricted approach to business. Right now, as Mike Peters put it recently in *ERT*, the only thing that seems to be regarded as important is different prices! It is not helpful to remove all guidelines such as suggested/recommended prices etc., which do provide a rough if very imperfect yardstick.

Right now things are getting worse and worse. Telephone salespeople are offering all sorts of confusing deals and special offers. And the rot is spreading to such simple things as the supply of gas and electricity. There have already been complaints about reduced-price offers that turn out to be something different in practice. The free-for-all is in danger of becoming a heaven-sent opportunity for the unscrupulous. You would have thought that we had learnt the lesson about unsupervised marketing.

A great deal of effort is being put into concocting various special services, deals and so on. The public is confused and, by and large, benefits little. Suggested prices represented a little bit of much-needed help. You can blame a lot of this on the Monopolies and Mergers Commission, whose remit has been extended far beyond that originally envisaged. The Commission seems to think it malevolent that anyone should set a value on anything and provide clear terms of trade.

One day the pendulum will swing back – not too far, one hopes. One also hopes that not too much damage will have been done while we were in the anything-goes era. But it will be of little help to those who have been sold a pup because of a lack of standards and guidelines. And it will have been of no help at all to honest traders who have seen their businesses ruined by slick operators.

We need some degree of regulation, in the same way that we need laws. And those recommended prices did provide a little bit of help in an otherwise very confusing marketplace. The president of the Board of Trade has not done the consumer a favour in deciding on this unnecessarily draconian prohibition.

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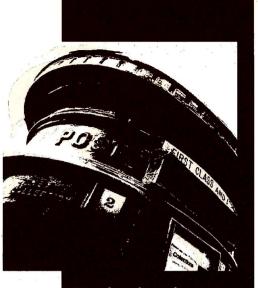


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We welcome letters from our readers and try to publish as many as we can. You can send them typed, handwritten, or on disc. Address them to the Letters Editor, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

End is Nigh?

For some years I've made a living from buying faulty TV sets and VCRs from members of the public, doing them up then selling them. I get the stock by placing wanted ads in local papers. To take VCRs as an example, most people have been delighted to accept say £20 for a faulty Ferguson 3V29 or 3V35. A good clean up, a service kit and perhaps pattern-part video heads and the machine is ready for selling at say £90. In the past this represented a third to a half of the cost of a new machine, and provided me with a fair profit for my efforts. Alas, no more. With new VCRs available at £100 or so, who in their right mind is going to pay more that £30-£40 for a secondhand machine? And don't forget that they will be all too aware of their rights and expect some sort of guarantee. With the cost of repairing some of the newer stuff, not to mention the difficulty, it just ain't on

Regrettably TV sets are going the same way. In a supermarket recently I saw a 28in. Nicam and teletext set for £249 and a 14in. portable with remote control for £89. No wonder that four TV shops in our area have closed down in recent months.

Where, I wonder, are people going to take this cheap new stuff for repair when it does go wrong? Thank heavens I've only ten years left to retirement! Meanwhile, does

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anyone need a van driver, sweeperup or suchlike? I don't mind, anything considered! *Mike Haywood, MHTV, Falmouth, Cornwall.*

The Neutral Screw

David Smith (Letters; May) observes that the "negative" screw in a UK 13A plug tends to come loose. He means the neutral screw of course, but let's not get sidetracked. Here are two possible explanations.

First, some manufacturers dip the stranded wire ends of the mains cable in solder. This contains lead, which 'creeps' under pressure. The lead exhibits the phenomenon of 'cold flow' until the pressure is relieved. Hence a loose wire. The live wire is less likely to have solder on it because most people trim it back to fit inside the plug.

Secondly, the neutral retaining screw goes into the pin directly, while the live screw goes into the fuseholder. The neutral screw is therefore subjected to shock and vibration each time the plug is inserted or removed from a socket. The effect is exacerbated by the lack of a locking washer for the screw.

Martin T. Pickering, B.Eng., Sandbach, Cheshire.

With reference to David Smith's letter (May, page 482), I would like to offer the following suggestion as to why a loose neutral mains plug screw can cause a destructive fault when a loose live side screw won't.

When the neutral side of the mains supply goes open-circuit, a current flows from the chassis circuitry to earth. For example, if the live side is at 350V with respect to earth and the neutral side is opencircuit, in 100nsec a current of 35mA flows to earth via the stray capacitance (say 10pF). This could turn on power devices unexpectedly. Inductive effects and arcing could alter this simple analysis of course. If the foregoing is valid, failures may occur in wrongly-wired houses that have single-pole neutral switches at ring-main outlets. Is there any evidence to suggest that this is a cause of destructive failures? Ray Porter, M.Sc., C.Eng., M.1.E.E., Stourbridge, W. Midlands.

Daewoo Spares

The phone number given in the *Television* TV/VCR Spares Guide 1998 for ordering spares from Daewoo is the old main switchboard number. The correct phone number, for account holders only, is

01189 252 606.

The address details are correct. Non-account holders can order spares through our distributor SEME:

Manoj Aggarwal, National Service Manager,

Daewoo Electronics Sales UK Ltd., Wokingham, Berks.

Try Zambia

In the May issue (page 483) you printed my letter on being able to supply semiconductor devices and VCR drive components that are difficult to obtain. Readers can now use our e-mail address, which is

kalibu@zamnet.zm

Our fax number is 00 260 2 221055, telephone number 00 260 2 226871. As much information as possible should be provided to help us identify the required item. *M.P. Nalletambly, Box 23186, Kitwe, Zambia.*

Mel's Mod

I've been carrying out a similar modification to that described by Mel Davies (letters, April, page 427) for some time. The current demand seems to be rather close to the limit for a 7812 regulator however. I therefore use two in parallel, with an 0.47Ω resistor in series with each output for current sharing (instead of a single resistor on the input side) – this is necessary to allow for manufacturing tolerances that affect the exact output voltage of each individual regulator.

If you examine the manufacturers' data sheets for the 78XX family of three-terminal regulators you will find that decoupling capacitors are required at the input and output to ensure stability. The values should be between 0.47μ F and 2.2μ F. These capacitors should be mounted as close to the regulator as physically possible. *I. Field.*

Letchworth, Herts.

Through-PCB Rivets

A few years ago manufacturers started to use through-PCB rivets for some connections in TV sets, particularly the line output transformer and transistor and high-wattage resistors. As a result, a fault that is potentially dangerous can occur in some sets: the solder between the rivet and the print land becomes dry-jointed, followed by arcing and eventually a burn up on the board.

Within the space of a week I had a number of JVC sets and three Philips G110 chassis that had this fault. In each case the joint was at the line output transformer connection to the collector of the line output transistor. There was a large hole in the board in one of the Philips sets.

My advice is to resolder these joints whenever a set comes in for service.

David Belmont, Wembley, Middx.

What's Cooking?

My thanks to those who, in the June issue, commented on my article on microwave oven servicing (April, page 404). Sorry for my mistake about ionising radiation. It was a genuine slip, after I'd been looking into the possibility of X-ray radiation from some types of magnetron. I abandoned this search as it led nowhere. It is my practice to check for leakage before and after servicing an oven, which is a wise precaution. There's a lot of RF power in that little box, fed by lots of volts with a deadly current-provision capability.

The design of a meter for voltage checks in the magnetron circuit was going to be done with safety in mind. Several checkers are available in the USA, but I suspect that they are made for profit rather than to perform any really useful function in magnetron circuit fault diagnosis. I favour the probe idea, and have been experimenting along these lines, so far without any danger to life and limb!

Finally, I would like to stress again the need for extreme caution when dealing with microwave ovens. There must be an intact earth wire from chassis to the mains plug's earth pin, and the oven must be earthed when installed in its operating position. Follow the manufacturer's instructions for measuring leakage and power output. Get your leakage tester checked regularly, and observe all the safety precautions. If you worked in a service department in the days of valves, or on high-power valved equipment as I did, you will know the folly of taking chances or becoming careless. A 2.1kV AC supply at up to 500mA is definitely a killer - it's the voltage used for the electric chair. J. LeJeune, Ravenshead, Notts.

Ravensneau, Nons.

Digital Picture Quality

I am intrigued by the idea that digital television will bring the viewer improved picture quality (as if the viewer could tell the difference anyway!). I wonder where this idea came from?

The system may be capable of providing a better image, but that's a very different thing from what it will be asked to do. It's a long time since even the existing PAL system was strained by anything outside the vertical interval, and I can't see that changing.

When I worked in ITV, many of us thought that the ITN news studio was the standard for picture quality, with BBC news close behind and nearly all other programme content being much inferior. This is how it should be of course: if a company cannot produce a decent quality fixed studio shot, what can it do?

But ITN's standards fell years ago. For a long time now its pictures have been all nasty edges with no real sharpness – rather like a somewhat upmarket VHS picture in fact.

It is only recently that the BBC has started to slip – but, oddly enough, not so much with its studio pictures as with the inserts, which have become very noticeably noisy.

Most of the rest aren't worth a mention, and images via satellites are a joke (except for QVC). I would like to see a good-quality picture via a digital service – or even an analogue one come to that – but I think I will be waiting for a long time. A. Jaques,

Stretford, Manchester

Health

I'm a 38-year old TV engineer who joined the trade after leaving school at sixteen. When I was 27 I was struck down by leukaemia. Thanks to good treatment, followed by a bone-marrow transplant from my sister, I recovered from the illness.

I know two TV engineers in my area, of roughly my age, who have had cancer. Several older engineers have, sadly, died of the disease. This leads me to think that our type of work could involve a health risk.

I would like to hear from any other trade readers who have had leukaemia or some other form of cancer, or who know/knew anyone in the trade who developed this illness.

Brian Milne, 3 Chapelhall Cottages, Undy, Ellon, Aberdeen.



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Digital TV Update

BDB claims to be "on track" to launch its digital terrestrial TV services in the last quarter of the year. A basic package of "at least twelve channels" will be available to subscribers at under £10 a month. At its first city presentation the company claimed that it would break even with just under two million subscribers: with three million it would make an annual profit of over £100m, rising to more that £250m with five million subscribers.

BDB is to use the Mediahighway interactive system developed by the French pay-TV giant Canal Plus: in February BDB announced that it would use the MediaGuard conditional access system developed by Seca, which is jointly owned by Canal Plus and Bertelsmann. BDB has appointed BT to set up its customer management centre, which will be staffed by BDB employees but run by BT. The contract is for the whole of BDB's twelve-year licence period. More than a hundred people will be employed at the centre initially, rising to over 1,000 by the end of the licence period.

A new digital TV group, S4C

Digital Network, is likely to be awarded the remaining DTT multiplex by the ITC. It will include S4C and Channel 5 programming. Members of the group include United News and Media, S4C and NTL.

British Interactive Broadcasting (BIB), which is owned by BT, BSkyB, Matsushita and HSBC, looks set to get the go ahead from the European Commission's competition authorities following BT's announcement that it will dispose of its cable TV operations in Westminster and Milton Keynes. BIB plans to offer interactive TV services, such as home shopping and banking, via BSkyB's digital satellite TV services.

Research carried out by NOP found that 27 per cent of adults are aware of digital TV: the figure rose to 41 per cent in homes with a PC and/or internet access. A smaller survey carried out by Radio Rentals found that 28 per cent of the population had not heard of digital TV and nearly 60 per cent didn't know what a set-top box was.

Eutelsat, BT Broadcast Services and internet service provider Easynet are piloting a system called Convergence-1. It's a high-speed DVB internet and TV service and could be launched by the end of the year. More on this in our report next month on the Cable and Satellite '98 Show.

Danish company ITE has developed WebChoice TV, which provides a TV set-PC link. Connection is via an audio lead, a series of audio cues being used to trigger special software stored on the PC's hard disc. This software turns on the PC's modem, giving access to a web site with content related to the TV programme.

The European Commission has blocked a proposed German digital pay-TV venture between media groups Kirch and Bertelsmann. It would have involved merging DF-1, Kirch's loss-making digital pay-TV service, with Premiere, an analogue subscription TV service controlled by Kirch and CLT-Ufa, which is partowned by Bertelsmann. DF-1 is now to be closed. The EC's decision could delay the introduction of multi-channel, interactive digital subscription TV in Germany.



A PIP display with a set that uses Acorn Group's new acTiVe advanced digital TV system. This software-based technology enables many features to be built into a set and, since the software can be updated remotely, the set is made 'future-proof'. Interactive services such as web surfing, e-mail, home shopping and on-line games are some of the possibilities.

VHS-ET

JVC has developed a new VHS format called VHS-ET (the ET stands for Extended or Enhanced Technology). As with S-VHS, there is considerably improved resolution: VHS-ET is understood to be capable of close to 500 lines. The format uses standard VHS tape, relying on improved heads and signal amplifiers to provide the higher performance.

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Unfortunately ET recordings cannot be played back via a standard VHS machine unless it has 'quasi S-VHS playback', which is rare. They can be played back with an S-VHS machine. The format is to be launched in Japan this summer and in the USA this autumn. There are no plans for a European launch to date.

Sega's Dreamcast

Sega has announced its next-generation games machine, called Dreamcast. It uses 128-bit technology, is internet-ready, and will run a version of Microsoft's Windows CE operating system. Dreamcast will be Sega's flagship product and is expected to help restore the company's position in the highly-competitive global video games market.

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Business News

Matsushita Electric Europe recorded a double-digit increase in sales last year and plans to increase the proportion of goods made in Europe. This will reduce transport costs and increase its ability to meet local consumer requirements. Europe accounts for about ten per cent of Matsushita's total turnover.

Lite-On Technology, the Taiwanese electronics company, is to reduce output of computer monitors sharply at its Mossend plant in Lanarkshire. Two of the three production lines will be closed down and two thirds of the 350strong workforce made redundant. Intense competition from Asian companies following recent devaluations is blamed. The company expects an upturn in the global market within the next twelve months. The plant is close to that of Chung Hwa Picture Tubes, whose current output is for TV sets only.

The South Korean LG group has taken full control of Zenith, the last indigenous US TV setmaker. LG acquired a majority shareholding in 1995. There is to be a debt-for-equity swap and new capital under a bankruptcy reorganisation plan. In future LG will supply the TV sets and other products sold under the Zenith brand name.

The Betamax Website The Betamax website is now a year old, providing plenty of evidence that

The Betamax website is now a year old, providing plenty of evidence that these sophisticated VCRs are still in wide use on both sides of the Atlantic. But spare parts are becoming more difficult to obtain and most service personnel no longer have the expertise to be able to carry out repairs. To help with this, the website includes a list of suppliers and engineers in the UK and USA. There are in fact over 240 pages at the website, which is essential surfing for anyone interested in these machines. The address is

www.elektratec.co.uk

The site was started by enthusiasts Alan Barnett and Martin Evans in London. It's known as the PALsite because it concentrates on European models. For further details you can contact the PALsite on 07050 612 290, Alan Barnett on 0181 241 1140 or Martin Evans on 07050 612 063.

Digital TV Technology

Computer company Acorn has demonstrated a set-top box technology based on software rather than dedicated hardware. The advantage of using software in conjunction with a powerful processor, in this case an Intel StrongArm 1500, is a considerable increase in operating flexibility, overcoming many interoperability problems. Signals from different sources and using different interactive standards can be handled. As new requirements arise, extra software can be downloaded. The StrongArm 1500 runs at 300MHz, enabling the system to decode two MPEG-2 data streams simultaneously: thus one channel can be watched while another is being recorded.

Matsushita believes that the next leap forward is likely to occur in 2003, when processors that operate at 10bn operations/sec become available at a reasonable price. They will be sufficiently powerful to enable multimedia tasks to be performed using software, bringing about a dramatic reduction in cost.

Matsushita is already working along these lines. It has developed a media core processor (MCP) that uses 0.35µm silicon and operates at 3.3bn operations/sec with a clock speed of 54MHz. The MCP is a powerful, programmable device capable of performing a number of multimedia tasks such as DVD and TV set-top box decoding. It combines a signal processor with a very long instruction word core. The processor handles sequential tasks such as MPEG stream analysis or the calculation of graphics coefficients while the core unit carries out more intensive tasks such as MPEG video decompression. The microcode routines required for processing are downloaded.

Matsushita is now working on an $0.25\mu m$ MCP rated at 5bn operations/sec with a clock speed of 81MHz.

Microsoft is working on voice-controlled set-top boxes for digital TV, using techniques developed by the Belgian linguistics software company Lernout and Hauspie and Creator. The chip set under development will enable the user to select channels, call up web pages and download information and video from the internet by talking into a microphone. Spoken commands are converted into a digital signal that's sent to the settop box in RF form. The Windows CE operating system will be used – it can already handle the speech technology. The system could be ready for production before the year 2000.

VLSI Technology has announced new chips for digital set-top boxes and full receivers. The latest introduction is the VES9600, which demodulates digital terrestrial TV transmissions using the DVB-T

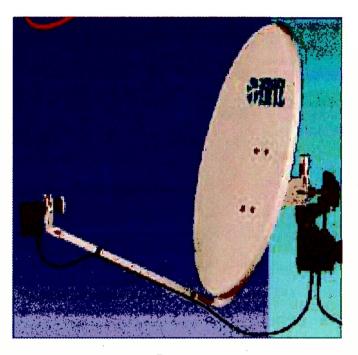
standard. It provides a three-chip receiver in conjunction with the VES2700 for MPEG-2 transport control and the VES6100 for MPEG-2 decoding. VLSI has the VES1893 for satellite digital TV demodulation and the VES1820/VES1900 for cable digital TV receivers. Another new chip, the VES1848, is a return-channel modem for interactive TV with cable systems.

VLSI subsidiary Comatlas has developed the CAS2043 plug-in board to enable a PC to receive digital satellite TV and data transmissions. The board is intended primarily for professional use, but similar products at consumer prices are expected to be available "before too long".

Texas Instruments and Philips Semiconductors have entered an interoperability agreement on physical layer IEEE 1394 (FireWire) chips running at 400Mbits/sec. An article on the FireWire digital interconnection system appears on a later page. As part of the agreement, TI and Philips will share specification information for their next generation of two-, three-, fourand six-port 400Mbits/sec physical layer devices. The individual companies can provide product differentiation by incorporating additional features and capabilities while conforming to a common pin-out, packaging and signalling specification.



Polar Instruments has launched a unique flying probe PCB test system which has been designed for manufacturers and for service organisations that deal with particular equipment in quantity. The FT100 test system provides completely automated PCB probing and is particularly helpful with fine-pitch boards. It operates with any Polar PFL series PCB fault locator for component-level fault diagnosis. Five tests per second can be carried out, employing Polar's analogue signature analysis (ASA) technique: the board being tested does not need to be powered. For further information contact Polar Instruments Ltd., Garenne Park, St. Sampson, Guernsey, Channel Islands GY2 4AF. 0148 153 081, fax 0148 152 476.



Factors that determine the performance of an LNB with digital satellite transmissions

LNBs for Digital Systems

hen a satellite uses digital transmission it can deliver more information in the same bandwidth than with analogue transmission. In addition, there's an improvement in the quality of the signal. To take full advantage of this, the receiving LNB must suit the digital signal characteristics.

Technically, there are over fifty factors that should be considered, including RF leakage, in-band spurious performance, out-of-band spurious performance, long-term ageing effects, vibration effects, corrosion resistance, intermodulation performance, dynamic range, reliability, tolerance of electrostatic discharge and many others. There are however a few key specifications that we will consider here – noise figure, gain, LO frequency stability, phase-noise performance, susceptability to microphonics and input VSWR.

Noise Figure

This is a measure of how much noise the LNB adds to the received signal. The lower the noise figure the better the reception, of weak signals in particular. With Cband (3.4-4.2GHz) LNBs the noise figure is usually expressed in Kelvin, a unit that relates to absolute zero or the level of molecular activity. It is technically incorrect to refer to degrees Kelvin. Zero Kelvin represents no noise. A very good figure for a C-band LNB is 15Kelvin: 30Kelvin is more typical.

With a Ku-band (10.7-12.7GHz) LNB the figure is expressed in dB. A very good noise figure for a Ku-band LNB is 0.6dB: 0.8dB is more tyical. As a point of reference, 35Kelvin = 0.5dB.

Gain

Gain is also expressed in dB. With a digital system it is important that the LNB's gain does not vary significantly with temperature over the received bandwidth – digital systems are much more sensitive in this respect than analogue ones. With a digital system a gain of 55-65dB under all conditions is typically required. Gain flatness across a 500-800MHz band should be better than \pm 5dB, and less than \pm 1dB over 27MHz. Greater variations can introduce gain distortion with reduced receiver performance as a result.

LO Stability

Three main types of local oscillator are used in LNBs.

(1) The dielectric resonant oscillator (DRO). Frequency conversion is determined by a free-running oscillator whose operation is stabilised by a piece of ferroceramic material.

(2) The phase-locked loop (PLL) type. An internal temperature-compensated crystal oscillator is incorporated within a digital phase-locking circuit.

(3) The PLL type with external reference. A reference oscillator outside the LNB, usually in the receiver, is used to control the frequency of the internal LO. In most cases the reference frequency is 10MHz. Connection is via the coaxial downlead.

Different digital signal types and bandwidths call for different degrees of frequency stability for optimum receiver performance. With a wideband signal such as MPEG-2 TV, frequency stability is not so important as the receiver tuning can be wider. With an SCPC radio broadcast the bandwidth is very narrow, calling for a high-stability PLL system to enable the receiver to track the signal.

The frequency stability with a DRO oscillator is ± 250 kHz-1MHz. This type is suitable for TV and wideband data broadcasts. With an internal reference PLL the frequency stability is ± 5 -100kHz, making it suitable for SCPC audio, news gathering and VSAT. The frequency stability with an external reference PLL is 0- ± 1 kHz: applications include satellite paging and narrow-band data.

Phase-noise Performance

The phase-noise specification indicates the level of noise introduced at various frequencies away from the converted carrier frequency. This noise is generated by the LO and is an indication of the oscillator's quality. In the specification, the frequency separations from the carrier are 100Hz, 1kHz, 10kHz, 100kHz and 1MHz – Table 1 shows typical Ku-band LNB phase-noise specifications.

With a digital system the bit error rate (BER) at the receiver is affected by the phase noise in the signal fed to it: the higher the noise level, the greater the number of errors.

Microphony

An installed LNB is subject to the elements – wind, rain etc. Rain or hail hitting it will produce small disturbances in the LNB's electrical performance. Wind will move or vibrate the dish with similar effect. These disturbances are superimposed on the incoming modulation. It's possible for the distortion introduced by such disturbances to be so great that the incoming signal cannot be resolved. The LO is the circuit most likely to be affected. Great care with the mechanical and electrical design of an LNB is required to minimise microphony.

There are no standards or units of measurement for LNB microphony. Simulated rain drops or other means are used for evaluation.

Input VSWR

The voltage standing-wave ratio at the input is sometimes referred to as the return loss. It's the ratio of the incident voltage/primary voltage wave present in a transmission line or waveguide to any reflected voltage present as a result of mismatching. Under optimum conditions, where there is a perfect match between the feed and its load (the LNB), the VSWR is 1:1. In practice, because of electrical and physical variations this is not possible. The reflected energy is lost and, in addition, interferes with the incoming wave, producing further loss.

A good match between the feed and the LNB is most important for maximum signal transfer to the LNB. Table 2 shows the approximate effect of VSWR on the noise performance of a Ku-band LNB with a noise figure of 0.8dB. It highlights the considerable effect that the input SVWR can have on an LNB's noise figure.

In Conclusion

With some applications selection of the correct LNB makes the difference between a system operating at full potential or one that gives far less than satisfactory performance. A high-stability or even an external reference PLL LO is required with a satellite digital paging system. Examples in the Norsat range are the 1000 and 3000 series. With an MPEG-2 digital TV signal a high-stability DRO LNB is suitable, such as the Norsat 4000 series. SNG trucks use PLL LNBs such as the Norsat 1000 series for the most reliable performance in the worst conditions.

Most operators appreciate the importance of an LNB's noise figure, gain and LO stability, but other factors such as microphony, input VSWR and phase noise also require attention. It is important to check all these parameters in a manufacturer's specification.

Aknowledgement

The above paper by Don Filmer, V.P. Engineering of Norsat, was presented during a seminar at Cable and Satellite '98, which was held at Earls Court 2 in May.

Table 1: Typical Ku-band phase-noise specifications.

Offset	Analoge	Digital	Int. ref.	Ext. ref.		
	DRO	DRO	PLL	PLL		
100Hz	NS	NS	–70dBc/Hz	–65dBc/Hz		
1kHz	–55dBc/Hz	–65dBc/Hz	–75dBc/Hz	–75dBc/Hz		
10kHz	–70dBc/Hz	–80dBc/Hz	–80dBc/Hz	–85dBc/Hz		
100kHz	–85dBc/Hz	–100dBc/Hz	–85dBc/Hz	–95dBc/Hz		
1MHz	–95dBc/Hz	–100dBc/Hz	–95dBc/Hz	–105dBc/Hz		
NS = No	NS = Not specified.					

 Table 2: Effect of input VSWR on the noise performance of a Ku-band LNB.

LNB	Feed	VSWR	Effective
VSWR	VSWR	loss	LNB NF
3·5:1	1:1	1.6dB	0·8 + 1·6 = 2·4dB
3:1	1:1	1.2dB	0·8 + 1·2 = 2dB
2·5:1	1:1	0.8dB	0·8 + 0·8 = 1·6dB
2:1	1:1	0.5dB	0·8 + 0·5 = 1·3dB

Codes for Passive SMDs

The following code marking systems are widely used for surface-mounted resistors and capacitors. They give the resistor value in ohms and the capacitor value in picofarads.

With the three-symbol code the first two digits are the base figures and the third the multiplier (number of zeros to add). Thus $270 = 27\Omega$ or 27pF, $331 = 330\Omega$ or 330pF, $472 = 4.7k\Omega$ or 4.7nF etc. $2R2 = 2.2\Omega$ and 2P2 = 2.2pF. This code is also used for some wire-ended components, e.g. small disc ceramic capacitors.

The two-symbol code uses a letter to indicate the base figure, again in Ω or pF, followed by a multiplier number. The code is as follows:

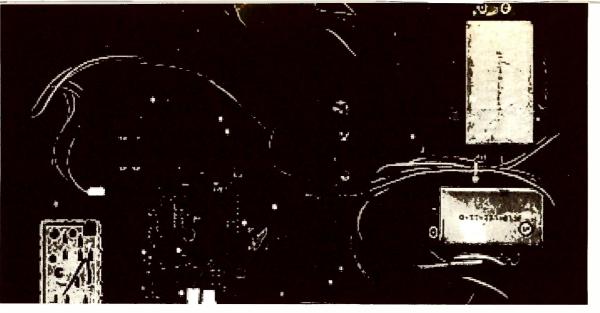
A = 1	M = 3	Y = 8·2	0 = x1
B = 1·1	N = 3·3	Z = 9·1	1 = x10
C = 1·2	P = 3·6	a = 2·5	2 = x100
D = 1·3	Q = 3·9	b = 3·5	$3 = x10^{3}$
E = 1⋅5	R'= 4·3	d = 4	4 = ×10⁴
F = 1.6	S = 4·7	e = 4·5	5 = x10⁵
G = 1·8	T = 5·1	f = 5	$6 = x10^{6}$
H = 2	U = 5·6	m = 6	7 = x10 ⁷
J = 2·2	V = 6·2	n = 7	$8 = x10^{8}$
K = 2·4	W – 6·8	t = 8	9 = ÷10
L = 2·7	X = 7.5	y = 9	

Aluminium electrolytics may have a three-symbol code with numbers to indicate capacitance in μ F and a letter to indicate the voltage rating. The letter code is as follows:

C = 6.3V, D = 10V, E = 16V, F = 25V, G = 40V, H = 63V

The position of the letter indicates the decimal point position in the capacitance value. Thus F47 = 0.47 μ F 25V, 3E3 = 3.3 μ F, 16V and 22C = 22 μ F 6.3V.

This information is intended to supplement the surface-mounted device (transistors/diodes) listing contained in the supplement to our May 1998 issue.



Satellite Notebook

BT SVS300

We've had several power supply faults with these receivers. If the power supply is dead, check R802 (100k Ω). It's best to use two 47k Ω , 1W high-stability resistors as the replacement. Also check C805 (220 μ F, 25V).

If the power supply is trying to start up or takes five minutes to do so, replace C810 and/or C825 (both 1 μ F, 63V). The resistance across R811/814 should read 1.5 Ω . If it's higher the power supply may begin to trip.

Here's a point to note. If you remove the VideoCrypt decoder PCB, beware of the rear support pillars. They are not secured to the cabinet, and can crack the bottom PCB if too much pressure is exerted! G.R.

Pace MSS100

If the power supply is dead, check D9 (RGP10K) on the secondary side. You will usually find that it's short-circuit. **M.Dr.**

Pace MSS1000

This receiver wouldn't decode VideoCrypt transmissions and there were no on-screen displays. The contrast level had been set to maximum on the menu – the field engineer had tried this as a setting below three will cause the problem. It was noticeable that with clear channels the contrast, i.e. video level, was low.

Scope checks showed that there was the normal 2V peak-to-peak output from the Nicky chip, and that the signal level remained OK through stages Q53 and Q57. It dropped to a maximum of 800mV p-p at the output from Q58 (BC856B). This surface-mounted pnp transistor had gone high-resistance. A replacement restored normal operation. **N.B.**

A Cable Problem

The problem with a six-year old installation (Pace SS9200 receiver) was sparklies on the higher-frequency channels such as UK Gold, Sky Sports 3 and CNN. Lower-frequency signals continued to produce good results.

The dish was checked and found to be correctly aligned. A new LNB produced a marginal improvement, no doubt because it had a lower noise figure and produced a few more dBs of IF output than the original one, but reception of the higher-frequency channels still wasn't as it should be. Time to investigate the cable run.

A temporary substitute cable from the LNB to the receiver in the living room produced good signals on all channels, even with the old LNB. The original cable disappeared into the loft, where a length of it was found attached to a hotwater pipe with some cable ties - a practice not to be recommended! When I removed the cable I found that the section which had run alongside the pipe was very rigid in comparison with the rest of it. The new cable was installed well away from the offending pipe! H.C.

Eclipsed . . .

Reg is retired and looks after some houses for friends who are often away for several weeks. He rang one Monday morning recently to say that the satellite picture at one of the houses in his care was full of snow. Could we call to have a look, as the owner was expected home the following thursday?

When I called later that day I

found that a large spider had made a home in the scalar feed tube at the 1.2m dish. After removing the spider and fitting a small piece of polystyrene at the entrance to the tube to prevent a repeat performance, I carried out a slight dish alignment peaking to wrap up the job. Spring is always the worst time for insects making themselves at home in prime-focus dish feeds. Some of them get right down the end of the tube. Don't use your finger as a test probe you can never be quite sure what's there!

On Thursday Reg rang on our mobile phone in great panic. "It's the same as before, all snow, and they've arrived!" This seemed rather strange, unless the polystyrene had worked loose and the spider had returned. It doesn't usually come out however, and I always ensure that it's a tight fit. Visions of polystyrene eating spiders came to me!

Reg was waiting when I arrived. He switched the TV set on and a perfect picture appeared. The polystyrene was firmly in place, and the dish was firmly locked in position.

Then it dawned on me. Reg had checked the signal at about 10.20 in the morning and it was early March, right at the time when the sun has an eclipsing effect on Astra. The sun is a much stronger source of radio energy than Astra: while it is within the dish's beam width there will be picture degradation or disappearance. Exactly the same symptoms produced by a large spider! Had Reg left the TV set switched on, he would have seen the pictures start to reappear fairly quickly. The moral could be: don't watch TV in the morning! H.C.

The Chinese Digital Channel

I was recently asked to install a digital receiver for the Chinese channel via Astra. This is now available as a vertical transmission (we're outside the horizontal digital Astra footprint here) at 11.778GHz, as part of the Canal Plus package. The receiver was a Canal Plus digital type with built-in MediaGuard conditional access – fortunately the menus are in English. It's actually the **Philips** Model DRD-DSI175B/05G. The Canal Plus version is referred to as the Philips 96514D.

The photocopied instruction manual is also in English, and is well-written by someone with experience of digital installations and the causes of any problems that might arise. It gives the symptoms, for example the picture breaking up into squares when the signal is weak.

There's no UHF modulator, but the receiver comes with a good-quality scart lead and has video and TV scart sockets. Nor does this version have an internal modem – there is provision for an external one to be connected. There are two card slots, one for the subscription card and the other for a smart bank card to enable payments to be made for pay-per-view programmes. The instruction book said that the latter slot has no function with this version of the receiver. In operation the box runs quite cool, which was a pleasant surprise.

An on-screen menu assists with dish installation. The receiver already knew what signal to head for (11.778GHz vertical), though a different one can be entered manually. A signal-strength bar display, reading 1-5, helpfully turns green at 3 – anything above this level is acceptable. The receiver is then left to scan the band. It lists the names of all channels found, whether scrambled or not. Prior to the scan you can ask the receiver to place the Chinese Channel (TVB Superchannel) as first on the list of channels found, or it can be picked from the scanned list (in this case it's channel 247) and placed in the favourite list.

The free-to-air digital channels via Astra are available, including CNN, TNT, Fashion TV, RAI-1, TV5, Moroccan TV, Egyptian TV and a mass of German stations. Scrambled ones produce an identification, after which the screen remains solidly blank. The scanning process takes up to twenty minutes, during which an on-screen bar display indicates how many stations have been found and the percentage of the scan completed. The symbol rates and forward error correction values don't have to be entered, but signals with a symbol rate of less than 15,000 are not catered for.

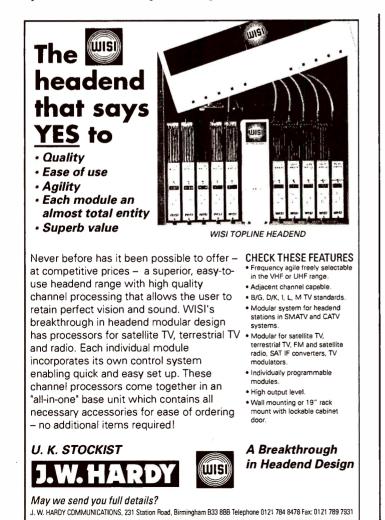
Amongst other oddities after the scan, Pace receiver information was listed just as a 'station name' – I suspect that this is for the Dutch receiver software upgrade. One problem is that although the receiver remembers the main scanned channel list, in the event of even a brief power cut the favourite channel list is immediately forgotten.

The favourite channels are picked from the main list: then, in the 'favourite mode', you can skip the unwanted ones. If you force the receiver to place TVB Superchannel on 1 during the initial scan, after a power cut all you have to do is to enter 1 via the remote control unit – otherwise 247 has to be entered, then the entire favourite procedure has to be repeated. I briefed the customer on the procedure and haven't had a call for help so far.

The receiver reinserts conventional teletext data on a normal PAL signal, so that the TV set's text decoder functions in the usual way. With the digital receivers I've come across previously, teletext is at best available via the set's own remote control or there are no teletext facilities at all.

I feel that, certainly as far as the digital receiver enthusiast market is concerned, a tuner should be linked to a PC for band scans and channel organising. The data can then be uploaded to a digital receiver -a sort of digital PaceLink system. I hope that the Sky digital receiver box will have user-friendly favourite menu structures.

For those with internet access, more information on the Chinese Channel can be found at http://www.chinese-channel.co.uk **H.C.**



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What a Life!

Donald Bullock makes a Very Cruel Device that produces shocks – and gets his comeuppance. Then there are sets and customers. And a puzzle about where the voices come from

Poor Daddy B does his scribbling all by himself in his wooden shack in the garden, away from everybody's noises and distractions. Greeneyes' dogs recently discovered it, and have on occasion done their business there.

This annoyed Daddy B very much. He doesn't particularly like dogs, especially pampered ones that do unspeakable things in his shack. So he decided to adopt a Very Wicked Wheeze: he sorted out some odds and ends from his junkbox and built himself a Very Cruel Device – a pulsing shock machine. He connected this to a pair sprung wires which he strung across the shack's doorway, just above floor level.

Then he pretended to go out. But, instead, he sat behind a bush with a whiskey and watched. Presently Greeneyes' dogs trotted up to the door and touched their noses against the wires. Then they made lots of yelping noises and did double somersaults all over the garden. Daddy B laughed happily and rubbed his hands together. But Greeneys said he was wicked, cruel, drunk and she didn't love him any more.

Daddy B didn't care. He connected an extra capacitor across the output of his Very Cruel Device to make it even Crueller, and made sure it was switched on all the time. Though he left his shack door wide open, the dogs never darkened its doorstep again.

The time came for Daddy B to write his column. He stepped over the Very Cruel Wires carefully and started to clear his desk. This disturbed some nasty mosquitoes, which Daddy B sprayed with his Cruel Mosquito Spray. They coughed and fell down dead. Except one, which flew about laughing. This made Daddy B Very Vicious. He spun around, spraying it. When it flew out of the door, Daddy B went after it.

Unfortunately he forgot about his Very Cruel Wires, and tangled his legs in them. They gave him lots of Very Cruel Shocks that made him shout and jump about Very Much. He hoped that no one had seen him dancing or heard him shouting some Very Naughty Words.

Greeneyes had of course. She said it served him right for perpetrating Cruel Things on innocent little dogs, and that he was to tell everyone in his column how Cruel and Wicked he really was.

But Daddy B mocked and told her she was getting like her mother. He hobbled off to his shack to write about his Nastiness – and to mend and refit his Cruel Wires . . .

Sins

Some days later I was back in the shop when this cove with bright eyes and a shiny red face came in. He was carrying a sign on a small pole. "Be sure your sins will find you out" it read.

"I don't suppose I can help you?" I asked.

"It's my Mitsubishi" he said. "It has faded and died – Matthew 16, verse 6 (or something)."

I eyed him up and down.

"It's in my old pram outside" he continued, "there's a picture but

there isn't a picture."

"Right, I'll get it" I said. When he'd pushed off, with his sign, I put his set on the bench. It was a CT2553STX (Euro 4Z chassis). There was sound, and the screen displayed some dull chunks of colour. Nothing else. When I increased the brightness I saw a faint raster as well.

"Strange fault" said Paul. "No luminance" I replied. "You're looking at a raster plus the transmission's colour content but not its monochrome content, which provides the detail. They do it that way to save bandwidth."

When I opened the set up I saw that there were three upright panels at the rear of the chassis, secured by a plastic bracket. The one on the right is the chroma/luminance panel. I waggled it and the luminance flashed on and off.

When I examined the panel I found that during manufacture a dab of securing adhesive had been put between its print side and the bracket. This had dried and corroded the print beneath it. So I cleaned it off and bridged the gap. When I switched on again a good, complete colour picture appeared.

Mrs Tubbs' VCR

Meanwhile Mrs Tubbs had brought in a Samsung VI710 VCR. It was virtually dead, with just bits of the display visible. "One for you" I said, "I'm off to make the tea."

When I returned Paul was replacing the STK5333 regulator chip IC101. "I checked the outputs from the power panel, at the 12-pin plug CN101" he said. "Instead of 15V at pin 1 there was only 1.3V. At pin 4 there was 0.2V instead of 5V. These two supplies are both decoupled by 47μ F electrolytics, which are OK. So I think a new chip will cure the problem."

He finished fitting it and checked the voltages. This time they were right. The VCR had a full display and worked well.

The End

Later the shiny-faced cove returned with his sign.

"Your Mitsubishi's ready" I said. "Twenty quid to you."

He pulled out his wallet and smiled. "Ah, safely delivered from its woes" he said, "Mark 22, verse 4 (or something)."

I carried the set out to his pram for him. As he pushed it away I noticed that the sign was doublesided. "The End of the World is Nigh" it announced on the other side.

Egbert Craddock

Our next customer was Egbert Craddock, who always looks as though he's riding a bike against the wind. He struggled in with a B&O 7180.

"I switches him on, right?" he bawled.

"If you say so" I replied.

"He clicks four times then goes off, right? That's no good to anyone, right?"

"You've cracked it man" I said, "give it here."

He left the set and made off. Steven took the back off and found the cause of the trouble immediately. This sort of thing narks me.

"It's just the blue focus unit" he said, "hand me a new one will you?"

I did and it did the job. "Too clever by half" I muttered.

Flighty's Visit

Mr Flighty came in, frowned at me, bought a flylead and winked at Greeneyes.

"What's worse than a giraffe with a sore throat dear?" he asked.

"Dunno" said Greeneyes, brightening up.

"A centipede with corns of course" he blurted out. "Har, har, har!!" Then off he minced, leaving Greeneyes laughing happily.

She caught my eye. "Coppades, arnohyeh, da?" she said as she laughed.

"Just a minute" I said, "you're not gibbering with Flighty now. Let's have it in English."

She looked at me coldly.

"Merely asked whether you'd like a cup of tea, or not yet. You really will have to do something about your increasing deafness."

Later she came in with the tea. "Careful, it's hot" she said.

"Cartful of what?" I asked, frowing and looking about as though puzzled.

"Don't be funny" she replied. "Toast and honey?" I asked.

A Philips K40

Major Haggerty, the bristling military no-nonsense blimp, brought in a Philips Model 22CS5751 – the old K40 chassis.

"It needs a spell in the guardhouse" he barked. "Only works in the sunshine. Otherwise whines instead. Had a coolie like that once, in the Himalayas. Yanked his head of in the finish and kicked him to the tigers . . ."

He was right. About the set I mean. At switch on it whined loudly and refused to start up until we heated the power supply with our hairdryer. Then it was OK. So we cooled the power supply down and then directed the hairdryer's heat via a funnel at various components in this section. The culprit turned out to be C2128. A replacement put an end to the nonsense.

We've had this fault before. Be careful about identifying the capacitor: there's another C2128, in the EW modulator circuit.

Little Men

When I was a small boy I was fascinated by the voices and music that came from our wind-up HMV cabinet gramophone and our huge Ekco wireless set. I knew that Henry Hall's orchestra consisted of dozens of dinner-suited musicians and their instruments, because I'd seen a picture of them. How could they get into our wireless? Obviously they would have to be shrunk. Assuming this to be possible - the early Thirties was a time of mechanical and electrical miracles – how, I wondered, did they sneak in and out?

Whilst they were in there, what did they do about eating and sleeping and other things. The answers evaded me.

And our gramophone. When father played an Al Bowlley record Al sang immediately. When the tone arm was moved across the record he would cut in with different bits of the song. How did he know which bits to sing? Did he slip along the tone arm and look through the hole beside the needle?



Unfortunately Daddy B forgot about his Very Cruel Wires.

Then there were Bix Beiderbecke's magic cornet sounds. He had died before I was born, yet he played for us from inside our gramophone. In the Thirties nobody scoffed much at the idea of ghosts. Had Bix slipped to some secret graveyard in the bowels of our gramophone?

My confusion increased when the wireless set when wrong and had to be opened. There were no little men or orchestras. Only a row of rosy-coloured valves, bits of wire and Bakelite.

Then the spring in our gramophone broke. Inside there was just a dowdy box full of greasy metal cogs. Nobody could live in there, especially in their nice clean clothes! "Where do the voices come

from, Dad?" I asked.

"Out of the air" he replied. "Who put them in the air?"

"Never mind about that" he said brusquely. "Here's tuppence ha'penny. Slip over to Thomas's and get me a packet of Woodbines."



Things that go bang in the night: the causes of mains supply problems. Pete Roberts investigates

More Power

We have what is arguably the most reliable electricity generation and distribution network in the world, with both the voltage and the frequency accurately controlled. But with thousands of miles of wire and thousands of transformers, along with numerous circuit breakers and other control gear, most of which are exposed to whatever the elements care to throw at them, breakdowns are inevitable.

Most supply faults are trivial, causing only local inconvenience. But there is always the possibility of a real humdinger of a fault, such as a Grid transformer exploding, the result being total mayhem over a wide area. In addition to complete power failures, which don't usually constitute a risk to domestic electronic equipment, there can be spikes and surges, dropouts (loss of a few cycles) and brownouts (low voltage). These can all cause problems – especially with those nasty little chopper power supplies that crop up everywhere nowadays.

Thunderstorms

Spikes and surges probably cause most damage, and are the most common types of disturbance. Thunderstorms are a common cause. These can occur when unusually large cumulo-nimbus shower clouds form in unstable air, typically found in the cold sector of a depression, often along or just behind the cold front. You can get this type of storm at any time of the year. Summer thunderstorms are frequently produced by sudden convective updraughts of hot, moist air during a heatwave. Cumulo-nimbus clouds can build to a height of several miles, sometimes extending into the lower stratosphere, topped by the distinctive anvil formation that's a trademark of a mature thundercell. Thunderstorms can sometimes hide amongst other innocuous clouds, waiting to pounce without warning.

The exact mechanism that produces the cloud's electrostatic charge is not known. It's thought to be the result of water drops and ice crystals breaking up in fierce upand down-draughts in the heart of the cloud. These fragments carry a static charge, and their motion inside the cloud is analogous to the way in which charges are carried on the belt in a Van de Graff generator.

The end result is a huge, delinquent electrostatic machine that rumbles around, looking for something to lob multi-gigavolts at. This something is all too often part of the electricity distribution system. An enormous amount of energy is stored in a mature thundercell. Fortunately most of it is dissipated by inter-cloud strokes. Earth to cloud strokes start with corona discharge from the ground, forming an ionised conductive channel to the cloud. The initial pilot stroke travels up this channel. The main stroke returns from cloud to earth, and may involve several discharges.

Because of the expense of running high-voltage cables underground, the National Grid is mostly carried overhead by pylons – frequently across some of the most exposed, inhospitable country that graces the OS maps. The pylons are often the highest things around, and have lovely pointed tops. What better target for a thunderstorm? Most strikes are to the pylons themselves, or to the neutral/earth conductor that joins their tops.

Sometimes the strike is to one or more conductors, and this is where the fun starts. Grid sections can be tens of miles long, and the transmission lines behave as, well, transmission lines. The pulse induced by a strike can

bounce back and forth between Grid substations until its energy has been dissipated. A lot of the energy flashes over the arcing horns fitted across the insulator stacks that support the cables, and the similar horns that adorn switchgear and transformers (see the accompanying photos). Electrical engineers also have at their disposal suppression devices that are more familiar to us – varistors, capacitors and chokes. They are just somewhat larger.

Despite all these measures, it's possible for a lightning strike to put a section out of action. The Grid network has a fair amount of built-in redundancy to ensure network integrity should individual sections suffer sufficient damage to prevent normal working. When a Grid line is struck, the section concerned is disconnected by high-speed, airblast-quenched breakers. Once the excess energy has been dissipated, the affected circuit is reconnected. The effect on local electricity supplies is those half-second or so blackouts that can crash a computer and make a fluorescent light restrike.

Lightning strikes become more dangerous the lower down the distribution hierarchy they occur. While the Grid and your local electrical supplier's primary highvoltage system can dissipate most of the energy in a strike, this may not be the case with a local 33kV/11kV network. Rural distribution networks with their cables and pole transformers in the open are at particular risk. Urban systems with their underground cables aren't very much better off. A ground strike can produce a massive instantaneous current pulse with a potential drop of several kV per metre, easily able to induce similar potentials in nearby burried cables. A local distribution network may not have any built-in redundancy, so lightning damage can black out a large area until repairs are carried out.

Magnetic Storms

At least there's one form of electromagnetic mayhem from which we don't generally suffer in the UK: magnetic storms. Our planet is continually bombarded by the solar wind, a stream of charged particles that are emitted by the Sun. The terrestrial magnetic field (the magnetosphere) traps most of these particles in the Van Allen belts. Thus all but a tiny percentage is prevented from reaching the Earth's surface. What little does get through forms a large proportion of terrestrial cosmic radiation. Strictly speaking, particles from the Sun and other extra-terrestrial sources, known as primary cosmic radiation, don't reach the surface: collision between primary radiation and the atoms of gas in the upper ionosphere generates showers of lower-energy particles, the so-called secondary cosmic radiation, which is what we are exposed to on the ground.

Every so often, especially during sunspot maxima, the Sun's surface becomes even more disturbed than usual and the solar wind can turn into a gale. When the vastly increased number of high-energy particles strike the Earth's upper atmosphere they often produce an intense auroral display, visible even at our latitude, seriously disturbing the ionosphere and disrupting long-distance radiocommunications.

By distorting the magnetosphere, solar storms also cause disturbances in the terrestrial magnetic field, which is strongest near the magnetic poles. While the South magnetic pole is safely out of the way in the Southern Ocean, the North magnetic pole lurks in Northern Canada. In both Canada and the USA there are large power grids with sections hundreds or even thousands of miles long. Substantial changes in the terrestrial field can induce heavy fault currents. A magnetic storm was responsible for the city-wide blackout of New York City.

Ice Storms

Ice storms are the only meteorological phenomenon that pose a major threat to both the Grid and local networks in the UK. Water doesn't necessarily freeze at 0°C. Under certain conditions it can remain liquid at temperatures considerably below the normal freezing point. Water in this state is described as being supercooled. Ice storms occur when supercooled rain hits a stationary object then flash freezes.

Ice storms occur in unusually cold conditions and are relatively rare in the UK. Severe ice storms attacked the USA's eastern seaboard last winter, causing extensive damage to electricity distribution systems.

With an ice storm you get a build-up of solid ice on conductors, which are brought down by sheer weight. System redundancy is rapidly used up, large parts of the network becoming isolated. Loss of power because of ice damage can have serious consequences, as the weather that gives rise to the problem prevents repairs. My own recollections of notable ice storms in the UK are of those that occurred during the winters of '62-63 and '81-82.

Wind

High winds can bring trees down on to 11kV and 240/415V local networks, causing extensive blackouts. Grid cables and electricity companies' primary high-voltage circuits are carried well above tree height, and those flimsy-looking pylons are designed to withstand winds that are considerably stronger than anything ever experienced in the UK.

Interesting factoid one. High winds in 1984 brought down one of the eight cooling towers at Fiddlers Ferry power station, Widnes. At the time my home overlooked the power station, and it took a few minutes to realise that something was different. It was a freak incident: a strong gust from a particular direction, deflected just so by the other towers, did the trick. Bear in mind that cooling towers are hollow: the concrete shell surrounds a structure of wooden lathes, down which the cooling water from the station's steam condensers trickles, its heat being removed by natural convection. The trend now is to use a large number of very small cooling 'towers', relying on forced draught rather than natural convection.

Heavy Industry

Lightning isn't the only cause of spikes and surges. In urban areas a regular supply of lower-grade but still potentially damaging spikes and glitches is produced by heavy industry. Prime suspects are high-power, variable-speed drives, as chopping up 415V at perhaps 1kA or more can cause serious EMC (ElectroMagnetic Compatibility, i.e. interference etc.) problems.

I remember seeing 2kV spikes on the mains supply in Chester city centre some twenty five years ago. At the time I built light dimmers for a small company there. We first noticed the spikes when using a scope to watch the mains waveform to see what effect our dimmers had on it. As the spikes occurred on only a couple of days each week, it was a dead cert that the culprit was the local paper's printing press. If I remember correctly, it was driven by three 75hp DC motors: the thyristor-drive system that controlled them was considered to be stateof-the-art at the time.

Nowadays large thyristor drives are fitted with line reactors, a sort of three-phase version of the suppression chokes found in the input to a chopper power supply. A line reactor's main job is di/dt limiting, i.e. to slow down the initial current build-up when the thryistors are fired. It also helps to reduce the amount of hash that finds its way back into the supply. There's nowadays a tendency to feed each large drive directly from a dedicated 11kV transformer to reduce pollution of the local 415/230V supplies.

Inverters

The availability of cheap, reliable, high-voltage MOSFETs has brought down the cost of variable-speed drives, which are becoming increasingly popular. Known as inverters, these devices first rectify the incoming mains supply, usually 415V three-phase, producing 630V DC. A six-transistor bridge arrangement then converts this DC back to a three-phase AC supply. The point of this is that the voltage and the frequency of the output are both variable.

Bear in mind that the almost universal squirrel-cage induction motor is semi-synchronous: thus the ability to run at a frequency higher (usually up to 75Hz or so) than the standard mains frequency enables the motor to run faster than normal without overload. Unlike a DC motor, an AC induction motor can be fully sealed. This makes AC drives suitable for use in wet, dusty, dirty or otherwise inhospitable environments.

Rectification of the incoming supply is the main source of noise with an AC drive, because the current that flows consists of high-amplitude pulses at the tips of the mains waveform. We are talking about full-wave rectification of a three-phase supply, so the fundamental frequency of any resultant noise is 300Hz. High-frequency PWM drive techniques are used to control the transistor bridge to produce the output waveform. Conventional armoured cable is, or should be, used to connect the inverter to the motor, with the armouring earthed to prevent radiation of the HF components of the switching waveform. Any HF components reflected back to the inverter's internal DC supply will be absorbed by the reservoir capacitors which, in a large inverter, may add up to 10,000µF or more. If, because of a fault, the drive signal did become impressed on the incoming supply, it would sound like a slightly wavering, fairly high-pitched raucous whine.

You have to be careful when working on these beasts: the reservoir capacitors are charged to 630V. The consequences of accidentally dropping a screwdriver across the capacitor bank's terminals would be, shall we say, interesting.

Single-phase induction motors are large, difficult to start and relatively inefficient. Up to now however they have been the only option for small business or domestic premises that have a single-phase 230V supply. Small inverters that can produce a 220V three-phase supply from a standard domestic 13A socket, with speed control as a bonus, are now available, enabling tools or light machinery with a three-phase motor to be used.

Electric Induction Furnaces

It's not just variable-speed drives that play havoc with the mains supply. Many metalworks use electric induction furnaces. Rated at hundreds of kilowatts or even several megawatts, these have what could be called a stator winding that consists of a few tens of turns of very thick copper tubing, through which cooling water flows, wrapped around a refractory pot that holds the melt. It generates heat by inducing eddy currents in the metal by transformer action. The system is particularly popular for alloying, as the eddy currents also churn the molten metal, mixing the melt better than any mechanical method would.

The power of an induction furnace that operates at the supply frequency is usually controlled by employing a saturable reactor to regulate the current. The saturable reactor is connected in series with the supply from the transformer to the furnace. Some furnaces are driven at high frequency by a kind of inverter and can, unlike most supply-frequency units, melt metal from cold.

This manipulation of thousands of amps at several hundred volts can have serious effects on the local supply. An aluminium plant in my locality can draw up to 4MWh. In return for power at a very cheap rate, it's contracted to shut down during a power emergency.

The power factor (this is the multiplication factor for true power with an inductive/capacitive load) of an induction furnace isn't constant: it varies with melt volume, melt temperature, melt composition and the applied power. Parallel-connected capacitors are used for power-factor correction, by switching more or less microfarads into circuit as required. The current that flows via the PF-correction capacitors is pretty hefty – their circuit breakers have to be able to switch and carry hundreds of amps. There's plenty of potential here for some serious spikes. Interesting factoid two: as far as induction furnace power factor is concerned, charging and pouring are the most critical phases of a melt cycle.

Furnace operators used to control the power factor of their furnaces by manually switching, via their control panels, capacitors in and out of circuit in accordance with a cos-phi meter reading. Nowadays PF control is usually handled by a computer. Over correction is extremely dangerous, as an induction furnace with too much capacitance connected, i.e. a leading phase characteristic, becomes unstable. In one incident I was told about, a furnace with a particularly bad case of indigestion vomited a couple of tons of molten aluminium at 1,500°C (that's about yellow hot). The glob of molten metal was ejected with sufficient force to hit the foundry roof. Miraculously no one was hurt.

From our point of view, heavy inductive loads such as induction furnaces and their associated switching and control gear are potential sources of serious mainsborne interference.

Rectification

The electricity supply industry is getting rather concerned about the distortion of the mains waveform caused by millions of small power supplies in TV sets and VCRs. Once a reservoir capacitor has been charged, current is drawn from the supply as short, comparatively narrow pulses. The resulting mains waveform distortion lowers the power factor. The result is additional heating in the supply cables and transformers, effectively derating them. A poor power factor represents wasted energy that still has to be generated, but nobody pays for it.

The electricity supply industry is, understandably, not particularly pleased about this state of affairs. Industrial users are encouraged to keep their power factors as near unity as possible by having kVAR (kilovolt/amps reactive) meters fitted, with swingeing charges of several pounds per kW/h. I wonder how they would cope if everything still used half-wave rectification, as we did in the good old days?!

I wouldn't be surprised to see EMC requirements slowly tightened, with capacitor-only filtering eventually outlawed. You never know, we might see the return of choke-input filters. Interesting factoid three: did you know that if all the TV sets in the country were switched off rather than being left in standby, one large power station's worth of electricity-would be saved?

Tap Changing

A very common cause of surges and dropouts is tap changing. Rapid changes of load on the network cause voltage fluctuations that are compensated for by changing transformer taps. The tap-changing switches are located in the transformer tank and, to avoid shorting sections of winding, are break-before-make. Although tap changing is usually very rapid, it's still possible for several cycles to be lost.

Disconnectors

1 1kV rural networks suffer from dropouts caused by the method used to clear faults on the overhead lines. Shortcircuits are often caused by bits of tree (or, if you are particularly unfortunate, a whole tree), wet grass or large birds landing on the cables. When such a short occurs, automatic circuit-breakers (known as disconnectors) disconnect the section of line for a fraction of a second before reconnection and checking for a fault. If the by now parboiled bird or whatever is still there, another disconnection occurs.

These systems must have been designed by someone of the Bill Clinton school of thought, as they operate on a "three strikes and you're out" policy. Three attempts are made to clear the fault: if the short is still present, the section of line is permanently disconnected and it's up to the electricity company's engineers to remove the burnt offering. This repeated switching off and on again is not generally appreciated by the average chopper power supply.



Arcing horns on a 33kV isolator.

Brownouts

An odd fault is the so-called brownout, or severe voltage reduction. The supply line voltage can drop as low as 100V, the result being dim lights and motor burnouts. The usual cause is loss of a phase somewhere in the 11kV system. Three-phase transformers have a threelimbed core: each limb carries one primary and one secondary winding. The three circuits are magnetically coupled, so loss of one phase at the input to the transformer will result in reduced output from all three secondary windings.

Brownouts put fridge and freezer motors at risk, because of the means used to start them. Unlike their three-phase cousins, single-phase induction motors are finicky creatures. To start, they usually require some sort of arrangement that involves phase shifting to create a rotating magnetic field, for example shaded poles (as in old-fashioned gramophone motors) or capacitorfed auxiliary windings. In a fridge or freezer motor the relatively high-impedance run winding has many turns of wire and is rated for continuous operation. Compressors need a lot of torque to get them moving, so the starting arrangement includes a low-impedance starter winding with relatively few turns of thick wire. As the starter winding has a much lower inductance than the run winding, the current in it leads with respect to the current in the run winding, thus producing that allimportant rotating field.

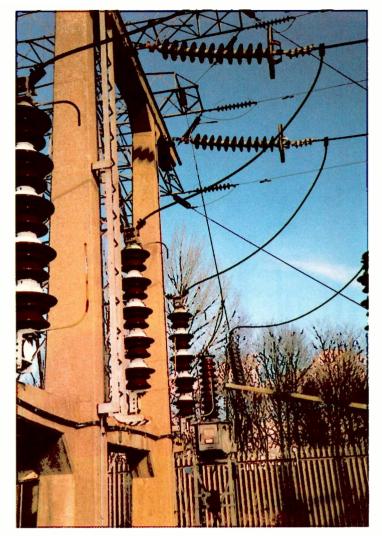
The low-impedance starter winding produces much higher torque than that needed for running, and is meant to be energised for only a second or so. Low voltage can mean that the starting relay malfunctions, leaving the starter winding connected. Although the applied voltage may be less than half of what it should be, it's still capable of driving a heavy current through the winding, which rapidly overheats and burns out. The main stator winding can also pass excessive current, as the motor remains stalled.

I can't see any reason, apart from cost or a desire to maintain a profitable market for replacement motors, why fridge and freezer manufacturers can't fit no-volt trips, which are nothing more complicated than a selflatching contactor. Should the supply voltage drop below a defined level, the contactor releases and has to be manually reset when the normal supply has been restored. All right you might end up with a freezerful of ruined food. But without a no-volt trip you could end up with a freezerful of ruined food *and* a burnt-out compresssor.

By the way, fridges and freezers that use the ingenious heat-driven ammonia absoption system are powered by a small heater cartridge and are not at risk from brownouts, though underrunning for an extended period may result in the interior temperature rising above a safe level. Caravans, motorhomes and boats are often fitted with absorption fridges, as they can come not only with both 12V DC and 230V AC heaters but can also be powered by gas!

Excessive Voltage

Things can go the other way of course. I remember, back in the Sixties, reading in the paper that a nice new substation had put more than a little sparkle into the lives of some villagers. In the previous article I described how a substation transformer is connected to provide a three-phase supply of 415V between phases and 230V between any phase and neutral. The transformer's secondary windings are connected in a star configuration, with the centre of the star forming the neutral connection which is securely earthed at the substation. The villagers got a bit of a surprise when they



A classic study of insulators and their arcing horns.

switched on their appliances one bright morning: light bulbs exploded, cooker rings glowed white hot, radio receivers went up in smoke and fridges burnt out. Someone, when wiring the substation, had made the classical error, uprating the domestic supply to 415V. Has anyone heard of this happening since?

Protection

There are ways in which customers can protect their equipment from the effects of power supply problems. Some could represent useful additional business. The best way to protect TV and video equipment from lightning damage is the simplest: pull the plug out and disconnect the aerial cable – even in an urban environment.

For dealing with mains-borne hash, a suppressor plug helps a lot. It has varistors connected between all three pins to divert to earth the energy of a spike that arrives via the live and/or neutral line. Varistors can be destroyed by really high energy surges, and more sophisticated (i.e. expensive) suppressor plugs have some kind of indicator to warn of varistor failure. Suppressor plugs also help in preventing interference generated elsewhere in the home from affecting sensitive equipment like hi-fi systems.

The UPS

Because of the possibility of hardware damage and data corruption, mains-borne spikes present a considerable hazard to computer systems. If someone has forked out over a grand for the latest Pentium II job and lives out in the sticks, it shouldn't be too difficult to persuade him to invest a couple of hundred quid in an uninterruptable power supply (UPS) – especially if the customer depends on the computer for his living. As well as providing power filtering, these units incorporate a batterydriven 240V inverter which, in the event of power failure or a particularly long dropout, will maintain a 230V supply to the computer long enough for the user to save his work and then shut down correctly.

The type of UPS intended for domestic or small business use incorporates maintenance-free, sealed leadacid batteries that are continually trickle-charged when mains power is present. On page 436 of the current CPC cataloge for example you will find listed a 250VA UPS that's capable of maintaining power for seven minutes. It incorporates EMI/RFI filtering and lightning/surge protection, all for £140.28 plus VAT. There are plenty of opportunities for extra sales here, particularly with the forecast increase in teleworking in rural communities.

Other Measures

There are other ways of cleaning up the mains supply, but they start to get expensive. One that I've not seen for years is the constant-voltage transformer. Made by Advance, it was a specially-designed transformer with a saturable core and two secondary windings, one of which was tuned by a parallel capacitor.

Other measures include filtering the mains where the supply enters the building. Prices in the current Farnell Electronic Components catalogue (EMC, Filter and Suppression, Installation Filters section) start at £92.13 for a 240V, 16A single-phase filter to \pounds 579.41 for a 220A, 415V three-phase unit, all prices plus VAT. These filters have open terminals, so they would need a suitable enclosure. Installation would probably be best carried out by an electrical contractor.

Danger

Finally I'd like to mention the very real dangers presented by the various parts of the electrical distribution system. My photographs of substation equipment were all taken from outside the railings: the only part of my body inside the fence was the hand holding the camera. High-voltage sites (high voltage being deemed to be in excess of 1kV) are exceptionally dangerous. The supply impedance is extremely low, and exposure to high voltage either by direct contact or flashover means instant death. With Grid voltages of 275kV or 400kV, any remains would probably be cremated for good measure.

Never enter any electricity company or National Grid site unless authorised to do so and accompanied by another, qualified persion. Overhead cables can also pose a threat to the unwary. You wouldn't normally regard fishing as a particularly dangerous pastime, but an angler in my vicinity was fried only recently when his carbon rod touched an 11kV cable – and I mean fried. So the same caveats that apply to the erection of aerials, or carrying long metal objects, apply to anglers using carbon rods: keep them well away from overhead power lines, including the 25kV cables that run along electrified rail routes. Remember: kilovolts mean killervolts.

Acknowledgements

I'd like to thank Manweb plc for allowing me to use some of its educational material in the preparation of these articles, and the numerous maintainers of the internet sites used for my research.

more on the

Panasonic K Deck

Adrian Williams describes some common faults experienced with this widely used VCR mechanism

The K deck has been around for several years now. It's used in a large number of Panasonic VCRs, ranging from basic mono sound models to S-VHS editing machines with hi-fi stereo and Nicam sound. There are a number of common problems. The following list of symptoms and cures may be helpful to those not familiar with the deck.

Refusal to load a tape or lace up: The loading motor, part no. VEM0427, is faulty. The shaft has a plastic collar on it: this spits, the result being loss of drive to the mechanism. Also check worm wheel gear part no. VDG0868 – remove the gear and inspect it for loose or missing teeth.

Refusal to eject tape or load (tape gets stuck in housing): Replace shaft assembly part no. VXP1339. It tends to bend outwards, away from the side plate. As a result, the housing gets stuck. You will also notice that the top plate of the carriage assembly is bent on the right-hand side.

Tape is pulled very tight in the play mode. As a result there is damage to the tape and the guide bases: Replace the take-up brake lever, part no. VXZ0313. It snaps at the end, where it's in contact with the supply brake arm, part no. VXZ0312, which it holds off during play (in the fault condition the supply brake is on).

Line at top of screen during pause or forward/rewind search: Replace the supply guide assembly, part no. VXA5245 KIT. As mentioned above, the brake lever may be faulty. The take-up guide, part no. VXA5427 KIT, may also be damaged.

Lower edge of tape is damaged, or pinch roller assembly doesn't go down fully: The P5 arm unit is distorted, part no. VXL2306. Also check the pinch roller, part no. VXL2246. Ticking noise from the mechanism during play: There are three possible cures for this one, as follows.

(1) Strip out the capstan rotor unit and regrease it (not too much).

(2) It may be necessary to replace the flywheel, part no. VXP1519. You will find that the new one has a more solid base where the rotor and capstan shaft meet.

(3) The tension roller unit, part no. VXA4799, may be worn, rubbing on its bracket.

VCR goes to standby when a tape is pushed in (no forward operation of the loading motor) or ejected (no reverse operation of the loading motor): Replace the loading motor drive chip. It's usually a BA6887, part no. BA6887-V3. Check the loading motor which may have a dead spot or a broken shaft (see above).

Capstan speed problems: The capstan drive chip is probably faulty.

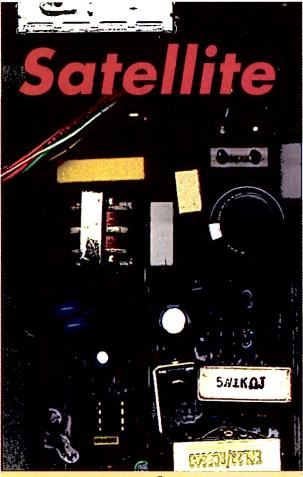
Service Notes

All new Panasonic VCRs have a service mode. No. 7 drives the loading motor forward when the play key is held on, and reverses the loading motor when the stop key is held on (the capstan is also reversed to prevent a loop of tape being formed). This is very useful, enabling most of these mechanical problems to be diagnosed very quickly without dismantling the VCR – the top must of course be removed. As far as I know older machines such as the NVHD100/NVSD44 don't have this feature.

The timing doesn't usually need to be altered.

For further information refer to John Coombe's article in the November 1996 issue.

2,



Jack Armstrong

Amstrad/Fidelity SRD950/SRD700

In previous articles I've mentioned tuner problems with these models because of failure of one or more of the 10μ F capacitors inside. This fault is becoming commonplace. I'm also getting receivers with faulty EEPROMs. In this case the symptom will be either stuck in standby with the LNB voltage tripping, or autotuning works but no channels are stored.

It seems that these EEPROMs can be damaged by voltages applied to the TV scart socket by certain TV receivers. To prevent a recurrence, disconnect R95 and R96 (both 270Ω).

Some customers have asked whether a decoder scart socket can be fitted to these models. It can, but might require an extra twenty or so components as well. A few of these receivers had these components fitted at the factory, but most didn't. A list is available.

Amstrad SRD600

I don't do many D2-MAC receiver repairs. Most get sent to the experts at Satfix in Swansea (01792 781

WORKSHOP

673). The SRD600 is an exception. It's faults are often quite simple to deal with, so I'm prepared to tackle them myself. But one particular receiver had been back to me three times, each time from a different dealer. Clearly the owner was unhappy with my diagnosis, but I had written the same report on the label each time. Without repeating the exact wording, it said that reliability couldn't be guaranteed because of something to do with the owner's cat! This time it was Wossname up Church Street who brought the receiver to me.

"Stinks" he commented. "Think the dog did something. You do it for me. I know nowt about these DeeMacTwo things."

Having pointed my dish at 1°W, I put the receiver on test. The picture would occasionally appear to lock, but most of the time I could see only a mess of black and white lines.

I repeated the procedure I'd undertaken before, but this time I scrubbed the MAC board with a toothbrush while pouring generous amounts of isopropanol across it. I dried the board with my hairdryer, and had to open the windows because the alcohol made me feel quite dizzy. Fortunately I wasn't driving that day! To chase off any remaining moisture, I finally sprayed WD40 across the board.

The unit now produced perfect PAL pictures, but there was no MAC sound and strange messages appeared when the card was inserted. Audio problems are usually caused by the AMU2481 demodulator or the DMA2281 chip. Neither of these was likely to lead to card problems however, so I guessed that the trouble was being caused by a fault in the DMA2286 chip. These square chips are mounted in sockets. There are two ways to remove them without damaging the socket:

(1) Use epoxy resin to glue a paperclip to the chip, then hook a screwdriver through the paperclip and lever it upwards, using the side panel as a fulcrum.

(2) Use of the proper tool. I've seen this item in a catalogue at £27 plus VAT. Mine came from SatCure (01270 753 311) and cost £6.95. It was worth every penny, because a new DMA2286 cured the fault.

Unfortunately this IC is rather expensive, so the repair wasn't cheap. And I still couldn't guarantee its reliability.

Pace PRD700

"What do you know about Mister Bishey?"

"Err, sorry??"

"What? I'm a bit mutton-jeff like. Age you know."

"I'm sorry, I don't understand" I shouted at the old fellow.

"No thanks. I had one afore I came out. Can you have a look at my Mister Bishey decoder?"

With that he placed a Mitsubishi ST-PB10 on the counter and hobbled out. It's actually the Pace PRD700, but was never sold under the Pace name. It was left to the likes of Mitsubishi and Granada to explain why there was no channel number display.

The fact that two screws were missing worried me. Someone had already been inside. The first thing I saw was a huge, white ceramic resistor where R1 should have been, and another in the R8 position. These are safety resistors: they are designed to go open-circuit in the event of a fault. Some prize chump had decided to prevent them doing so. Fortunately the damage had been minimised by a very black-looking 6A fuse! I fitted the correct resistors and 1AF fuse, then noticed that the chopper transistor was an underrated plastic BUT11AF which had been stood on tip-toes instead of being pushed firmly down to make a good mechanical joint before soldering. Rather than attempt to fault-find, I decided to fit the replacement kit.

"Zap, zap, zap" the receiver said when I reconnected it to the mains supply. It was the sound of R8, R14 and the fuse going open-circuit in succession. But I didn't give up. I found that the cause of the trouble was a broken track to C8. After repairing it with Teflon-coated wire I tried again.

This time the power supply ticked in time with the flashing of the standby LED. I hastily pulled the plug. Something else had been missed. I won't bore you with details of the tests carried out and the number of cups of tea it took to find the cause of the fault. Suffice it to say that C4, a 1.2nF surfacemounted capacitor, was cracked in half. But the crack was invisible until I touched the capacitor with my iron. Since C4 is the timing capacitor for the chopper control chip, it's not surprising that the circuit was ticking!

Once I'd fitted a replacement all I had to do was to find two Pace screws – black-japanned 3mm crosshead taptite sems – and reassemble the receiver before the old boy's return.

Pace PRD800

A reader has taken me to task. "My PRD800 receiver's LNB voltage is too high, so I can't get the vertical channels. In addition the picture is dreadful – and you haven't written about this fault!"

I have to confess that these symptoms have not been mentioned. The reason is that I always replace C5, C7 and C8 before applying mains power to a PRD receiver, and I assumed that all other repairers did the same. The reason is quite simple: when the value of C5 falls, all the power supply output voltages go high. The LNB voltage rises, and the 5V supply increases to about 6V and starts to destroy ICs fairly rapidly. C7 and C8 simply make the power supply go bang!

My advice to the reader was to disconnect the power supply immediately and fit all the capacitors supplied in Relkit-1 before reconnecting it. You can order this and other Relkits from SatCure (e-mail satcure@netcentral.co.uk). I think I've mentioned this before!

Pace MSS200

This receiver produced on-screen channel names and clear (not bluescreen) menus that drifted from right to left. The obvious cause of the trouble was the PTV110 chip. A replacement cured the fault, but when I inserted the Sky card I got a "card invalid" message. I checked and found that there were no clock pulses at the card, so the card's supply voltage wouldn't stay high. Since the clock pulses are supposed to come from the PTV110 chip, I fitted another one.

This time the card worked and I got pictures, but there were large black sparklies on all card channels – not Sky News, the German channels or QVC. The sparklies danced around on the left three-quarters of the picture: the right quarter was free of the dots. Yes, it was the PTV110 chip again! Since this IC is 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.

not available officially as a spare, I was taking used ones from 'unrepairable' receivers. I finally found one that resolved all the problems.

Grundig GRD300

This twin-input version of the GRD150 has a fluorescent display. The customer reported that it was "dead". But, as is often the case, it was the customer's brain that was dead. The receiver worked perfectly but its display didn't light up.

Thanks to a tip from Nigel Goodwin (www.lpilsley.demon. co.uk) I was able to fix the problem in just ten minutes by replacing the 10μ F electrolytics on the display board.

Test Case 427

"This must be the Daewoo TV" muttered Techocrat as he carried a 21in, set to his bench. It was in fact a Daewoo Model T512, which is fitted with the CP330 chassis. The fault seemed to be simple enough – according to field technician Colin Doc's label there was no vertical scanning. A doddle, done by coffee-time, thought Technocrat. The power supply and line scan circuits were working, with EHT present and correct. But nothing was happening in the field scan department.

Technocrat's first check was on the 25V supply to the TDA3653B field output chip I301. It's derived from the line output transformer and was OK – in fact there was almost 27V at pin 9 of I301. He then carried out an oscilloscope check at output pin 5. If there was a drive waveform here, the scan path was open-circuit. There was no output from the chip however. Did it have an input? No, there was no waveform at input pins 1 and 3.

The drive should come, via an *RC* network, from the fieldscan generator within the TDA8362 jungle chip 1701. It should be present at pin 43 of this chip, but wasn't. Neither was there a field ramp waveform at pin 42. So attention was concentrated on this chip and its peripheral components.

Since the chip was producing a line drive output, its supply was obviously present. So far as Technocrat could determine, its other outputs were all OK. Only three of the chip's pins are devoted to field scanning: the feedback pin 41, the ramp generator pin 42, and the output pin 43. Technocrat checked the components (R301 and C301) in the ramp-generating circuit, also its 33V supply and the associated resistors. Everything was in order. So he ordered a new TDA8362 chip and headed for the coffee department.

When the new chip had arrived and he had fitted it Technocrat was mortified to find that there was no change: the symptoms were exactly as before. He looked again at the circuit diagram. There's a capacitor (C303) between the field drive output from I701 and chassis. But it seemed to be OK, and a replacement made no difference. Nor was there a fault with any of the components connected to the TDA3653B chip's input pins. Maybe this chip was loading the drive from I701 in some way? In view of the series resistors present (R304 and R305) this was hard to believe. But as Technocrat was getting short of theories he decided to replace I301 – this one was in stock. Once again the replacement made no difference: there was still no field scan.

What next? Both chips involved with the field scanning had been replaced, and all relevant passive components seemed to have been either checked or changed. The situation was deteriorating rapidly! It was difficult to establish a chicken-and-egg prognosis, and the supplies were all OK. But the set was finally repaired and sent on its way – with the two new chips it didn't need, and with one other new component whose price was a matter of pence. As a clue, do you remember the AN5521 field driver/output chip that was so popular with Panasonic some years ago? For the solution, turn to page 671.



FireWire or IEEE 1394

The FireWire interconnection system, or IEEE 1394, is a high-speed serial data bus that's likely to become the standard way of linking digital domestic electronic equipment. Geoff Lewis, B.A., M.Sc., MIEEE, describes the system and its operation

The name FireWire belongs to Apple Computers Inc. which devised the basis of this easy-to-use, very fast, low-cost network system as long ago as 1988. Since then it has become an established IEEE standard supported by a world-wide Trade Association with over ninety members.

IEEE 1394, as FireWire is generally known, is a cross between a network and a bus extension system. It was originally intended for the distribution of digital sound via Apple Computers. Over the years however it has expanded into many other areas. In the very near future it's likely to become the main method of interconnecting digital signals between domestic communications and entertainment equipment. A clear account of its development is contained in reference (1).

Fig. I gives an indication of the wide range of devices that can be connected via IEEE 1394 links. Any device that incorporates the appropriate interface can be coupled to others via a simple cable. Currently available services that can be linked in this way include home video editing, photo-CD handling and image enhancement: at a later date video- and tele-conferencing will be added. Such is the adaptability of FireWire that it is also likely to find industrial applications.

Samsung has recently announced what it claims to be the first TV chassis to incorporate an IEEE 1394 interface. It enables the Web browser-equipped TV sets to communicate with digital audio/video equipment and PCs.

Interconnections

IEEE 1394 devices are fitted with one- or three-port interfaces that can be coupled together via special cables. An extra device can be added to a network simply by plugging it into a spare port anywhere. Devices may be linked in daisy-chain fashion or in clusters. The only restrictions are that there should be no more than sixteen hops between any two devices and that no loops should be formed.

The network is usually described in terms of a root,

tree and branch or a parent-and-child configuration, with the root or parent being the nearest to the controlling device. The serial network is currently available with bit rates of 100, 200 and 400Mbits/sec, but this is soon likely to be extended to 800Mbit/s or even 1.6Gbit/sec. FireWire will then be faster than the currently available FibreNet optical-fibre network, which runs at 1Gbit/sec.

Furthermore since IEEE 1394 is compatible with MPEG-2 video data streams, see reference (2), it will also be compatible with the ATM (Asynchronous Transfer Mode) system used for telecommunications – this has a maximum data rate of 622Mbit/s. Thus FireWire is seen as a possible way of delivering digital TV signals to homes via a cable network.

Cable and Transmission

Fig. 2 shows the construction of the special IEEE 1394 screened cable. It has three individually shielded cable pairs: two screened and twisted signal pairs (TPA and TPB) plus two power lines that are designated Vg (ground) and Vp (positive supply). There are keyed connectors. The power line pair can supply up to 1.5A at 8-40V DC. A cable without the power pair can be used for certain applications. Typical maximum cable length is 4.5m, but in the near future this could be extended to about 25m for special applications.

An extra device can be plugged into a spare port without the need to switch off the power. The system then automatically reconfigures and reprogrammes itself to the new situation. This plug-and-play arrangement is possible because the signal lines are balanced to earth by the signal format employed. In addition, the driver transceiver in an interface provides further isolation between the signal and power lines.

The high data rates are made possible by using differential non return to zero (NRZ) signalling via each shielded twisted pair (STP). These are biased with respect to earth at 2V DC maximum.

At these high data rates it is important that an accurate

clock signal is maintained. This is achieved as follows. Twisted pair TPA carries the data signal while pair TPB carries a strobe signal. As Fig. 3 shows, the strobe signal changes state whenever there is no change of state during a data signal bit period. In this way, either the data or the strobe signal changes state at every bit period

At the transmitter, exclusive-or logic is used to combine the signal data stream and the clock signal to produce the strobe signal. The strobe and data signals are combined at the receiver, again using exclusive-or logic, to generate an accurate clock signal.

The bus data streams are organised as two time-division multiplex (TDM) formats: a one-way, low bit rate asynchronous stream is used for control purposes, while a high bit rate isochronous stream carries the data being distributed (payload data). The data in an asynchronous stream is transmitted in blocks, with start and stop signals: since the data rate is constant, the local clock can be regenerated from the data stream. With an isochronous system the same master clock synchronises everything. In this case the current controlling device acts as the cycle master (CM). Both formats use variable-length data packets.

An important advantage of isochronous data transfer is that less first-in-first-out (FIFO) memory is required before and after transmission across the IEEE 1394 bus. This reduces the die size of the interface IC significantly, and thus the IC cost.

Protocols

The communication protocols used by the FireWire system are based on the International Standards Organisation (ISO) 7-layer model that was developed for open systems interconnection (OSI). Fig. 4 shows the FireWire arrangement. The two lower layers of ISO-7 are retained as the physical layer and the link layer. The system control functions are concentrated in layer 3 through to 7.

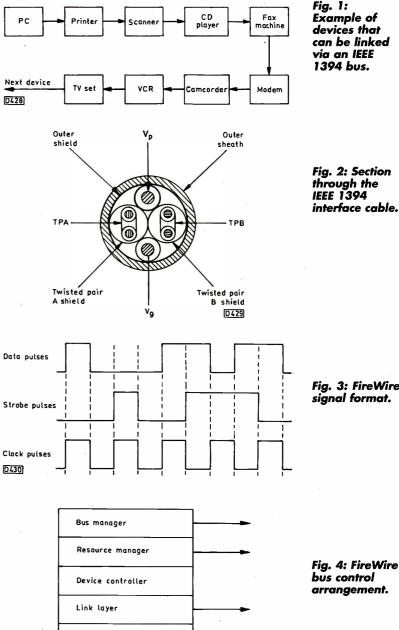
The physical layer has four main functions: to translate the symbols used by the link layer into appropriate cable signals and vice versa; to define the mechanical and electrical connections for the bus; and to provide arbitration to ensure that only one device transmits at a given time, also ensuring that all devices have fair access to the bus.

Link layer control (LLC) manages data packet assembly and disassembly for both the asynchronous control data and the isochronous payload data. The one-way asynchronous packets, which are sent to a transaction layer, contain delimiting signals whose reception must be acknowledged. The isochronous data stream is sent direct to the receiver. In addition LLC handles address and error control, data framing, and generates packet cycle timing and sync signals.

The resource manager layer acts as the transaction layer for the asynchronous data stream. Write operations send data from the source to the receiver while read operations function in the reverse direction. A lock operation is also possible: this sends data on a round trip through the processing at both ends of the chain, and can act as a test and control function.

The bus management layer is quite complex, operating in the hardware and software of an individual interface. It controls the operation of the physical, link and transaction layers. If the network includes a PC, this will most likely act as the bus manager, running its own applications program, but other arrangements are possible.

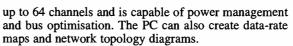
A fully-managed system includes a PC or similar smart device that controls all modes of data transfer for



1394 bus.

Fig. 2: Section through the **IEEE 1394** interface cable.

Fig. 3: FireWire signal format.



D431

Physical layer

A non-managed bus has a cycle master and is capable of only asynchronous data transfers for control functions. Examples are direct transfer of data between a scanner and a hard disk or between a hard disc and a printer, without the direct involvement of a computer processor.

A limited bus management system falls between these two extremes: it has a limited power management ability, but can handle both asynchronous and isochronous data transfers for between eight and 64 channels.

A network can include up to 63 devices, each with a 6bit ID number. Multiple networks can be interconnected via bridges, with up to 1,023 separate buses each with a 10-bit ID. This combination allows for a total system with up to $63 \times 1,023 = 64,449$ devices. Device addresses have 64 bits: 16 specify the devices and networks, while the remaining 48 bits are for memory addressing. In this way the network can identify uniquely 280Tbytes of memory.

Initialisation

At the end of the FireWire initialisation process the root/parent device will have been established and will remain in control as long as it's connected to the bus. Initialisation occurs at power up and whenever a device is added or removed. At the start of the process, all the information on network topology held in the device registers is cleared. The physical layer at each device first checks the connection status of its ports, each of which signals 1 if it is connected or 0 if disconnected. If more than one port signals 1, the device may be a branch.

As this process continues, a tree structure begins to form so that the root device can be selected and all the other physical connections referred to it. Generally the last device selected during this process is designated as the root. If one particular PC is to be designated as the root, the process time can be extended to ensure that this is the result. Once the tree has been formed, each device is allocated an ID for asynchronous traffic.

Various management roles will have been allocated during the initialisation process. Most important is that of the cycle master, which is usually the root device and has the highest priority for bus access. The cycle master provides and maintains the clock signal for isochronous data transfers. Some management roles can be allocated to devices other than the root one. The isochronous resource manager allocates time to those devices with isochronous data to transmit.

Whenever hot plugging generates a reset signal, the asynchronous resource and bus manager functions remain with the original device – assuming that it hasn't been removed.

The next stage of initialisation involves allocating channels 0 to 63, and time slots for those devices that need to communicate. Only channels that are free can be allocated: this information is held in the channel-available registers.

After a reset, the allocation of time slots may leave one device short of its previously allotted capacity. The device will then make requests periodically for an increased allocation. This continues until another device relinquishes time slots.

When configuration has been completed, the various devices connected negotiate for access to the bus. In addition, asynchronous and isochronous data compete for access to the bus. This is all controlled by the cycle master which transmits a timing signal known as cycle start, typically once every 125µs.

This very complex protocol, which appears to be so simple to the user, is usually controlled by a collection of single bits that are stored in various registers.

System Timing and Arbitration

System timing is based on the phase-locked-loop crystal oscillator in each device's interface. These oscillators run at 24.576MHz (98.304MHz clocks may also be found). The clock in the interface device chosen as the cycle master is the one that is actually used. The 24.576MHz signal is divided down to create 1Hz (one second) and 8kHz timing control signals. These control the time division multiplexing (TDM).

The cycle status and control bits are contained within bits 20-24 of the third, fourth and fifth quadlets. The basic cycle duration is 125μ sec, and is repeated at 8kHz. Of the total cycle period, at least 20 per cent is allocated to asynchronous control data with the remaining 80 per cent used for isochronous payload data. Devices negotiate for bus access at every cycle. Only one is allowed to transmit at a time. Devices with reserved isochronous channels negotiate first: when a device receives a cycle start signal it sends a request for access to the root device. This accepts the first request it receives, which is always from the device nearest to it. There follows a small isochronous gap, after which arbitration starts again and the next nearest device is granted access. The process continues until all the devices that have isochronous data to transmit have gained access.

A longer gap, called the sub-action gap, follows so that asynchronous arbitration can start. Both gaps are proportional to twice the number of connections in the network. The sub-action gaps provide time for the acknowledgement signals.

To provide fair access, each device is allowed to transmit only once during the asynchronous part of each cycle. The cycle time ends with a longer idle period gap, called the arbitration reset gap, after which the process restarts.

Data Packets

The serial data is organised as quadlets: each is four bytes long (32 bits). A data packet has at least two header bytes and two bytes of data. Quadlets are time aligned for accuracy so that they can be loaded into the FIFO registers, which are 32 bits wide and 64 quadlets deep. So that the quadlets consist of integer multiples of bytes, meaningless bits may be added as padding. Cyclic redundancy checks (CRCs) are included at the end of both the header and the payload data blocks.

These basic elements are common to both asynchronous and isochronous packets, but the headers for the two differ in length and content. Asynchronous headers include at least four quadlets to specify the destination ID, source ID and various control functions such as packet priority. Isochronous packet headers include just the channel number plus control information, and can be as short as two quadlets because the destination and source addresses are included in the channel number. Table 1 summarises the isochronous packet structure.

Operation of a Typical Interface

A typical interface consists of little more than two VLSI (very large-scale integration) ASIC (application specific IC) chips that act as the physical and link layer controllers. Suitable chips are the Texas Instruments TSB11CO1 (physical layer) and TSB12CO1 (link layer), which use low-power CMOS technology but with the inputs designed to allow for hot plugging.

The TSB11CO1 is a three-port device that includes logic to perform the arbitration and bus initialisation functions. The TSB12CO1 transmits and receives correctly-formatted isochronous data in real time. It includes reconfigurable FIFO memories for the data as well as the configuration registers required to operate the device.

Physical Layer Control

Fig. 5 shows the basic arrangement of a physical layer control chip with three identical ports. Its crystal-controlled PLL clock provides three outputs via digital dividers, $98\cdot304$ MHz, $49\cdot152$ MHz and $24\cdot576$ MHz. The $49\cdot152$ MHz output is maintained at an accuracy of ± 100 ppm ($\pm 4\cdot9152$ kHz) to control the outbound encoded strobe and data signals. This frequency is also needed by the link layer controller to resynchronise received data.

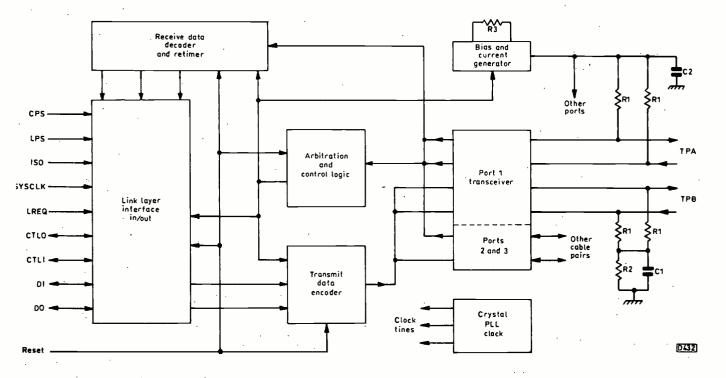


Fig. 5: Physical layer control chip arrangement (Texas Instruments). R1 is 56 Ω , R2 5k Ω , R3 6·36k Ω ±0·5%, C1 250pF and C2 1µF.

Data bits to be transmitted are received from the link layer controller chip via the relevant data lines, in synchronism with the 49.152MHz clock. After encoding, they are transmitted via the TPA pair. The encoded strobe, at 98.304MHz, is transmitted via the TPB pair.

During packet reception the transmitter sections of the TPA and TPB transceivers are disabled while the receiver ports are enabled. This is achieved by the use of a simple flip-flop control bit.

The data and strobe signals are both differentially encoded – the signal swings equally about the 1 86V nominal bias level. These signals are typically restricted to a voltage swing of 172-265mV (about 220mV \pm 40mV). The level was chosen to allow interoperability with chip sets that use either 3V or 5V CMOS technology. The resistors marked as R1 provide optimum loading (112 Ω) for the line drivers. R2, C1 act as a filter for the TPB lines. R3 sets the driver stage output current and controls the bias level. Ports 2 and 3 act in an identical way.

The chip's link layer interface directs the data between the receive and transmit modes, determined by a range of control signals. The most important of these are as follows:

Cable power status (CPS): This pin is connected to the cable power line via a 400k Ω resistor. It detects the presence of the cable power supply and also feeds this information to the link level control chip.

Link power status (LPS): When this link is not powered the system clock is disabled and the chip performs only the basic repeater functions required for network initialisation and operation.

System clock (SYSCLK): This terminal provides the 49.152MHz clock signal to which the data, control and link requests are synchronised.

Link request (LREQ): This signal from the link layer

control chip requests a particular service.

Control inputs/outputs (CTLI/CTLO): These bidirectional terminals control the exchange of information between the physical and link layer chips.

Data inputs/outputs (DI/DO): These bidirectional terminals provide the communication paths between the physical and link layer chips.

Reset input (/RESET): When this line goes low, there are bus reset operations at the active cable ports and the internal logic is reset to the start state.

Link Layer Control

The TI TSB12CO1 high-speed link layer control chip provides easy integration with an input/output subsystem. It transmits and receives correctly-formatted IEEE 1394 data packets and generates the 32-bit CRC (cyclic redundancy check) – this is used to check the header and payload data blocks. It can operate as a cycle master and can receive two isochronous channels. Fig. 6 shows the basic arrangement of this chip.

The TSB12CO1 integrates directly with physical layer chips such as the TSB11CO1 described above or the TSB21LVO3, which is used for processing an MPEG-2 data stream. It operates at 100, 200 and 400Mbit/s rates. Its 32-bit bus is compatible with most other 32-bit proprietary buses available.

The FIFO memories ATF (asynchronous transfer), ITF (isochronous transfer) and GRF (general receive) provide variable-length data transfer and are software adjustable for optimum performance. The physical layer interface I/O signals have already been described.

The transmitter retrieves data from either the ATF or the ITF FIFO and generates correctly-formatted serial data packets for transmission via the physical layer interface. When data is present at the ATF FIFO the transmitter negotiates for bus access then sends the data packet. When data is present at the ITF FIFO the arbitration results in data being transmitted on the next

TECHNOLOGY

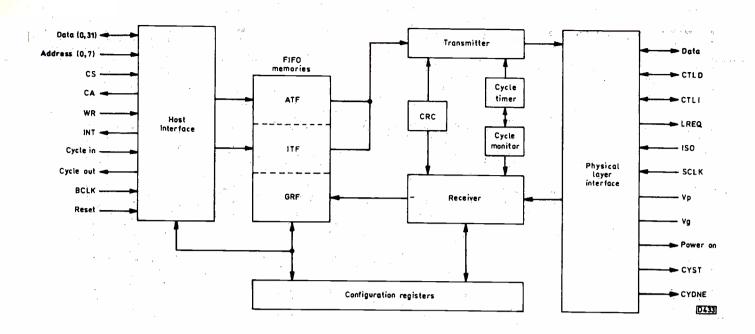


Fig. 6: Link layer control chip arrangement (Texas Instruments).

isochronous cycle. When the chip acts as cycle master its transmitter automatically sends the cycle start packet.

The receiver accepts data from the physical layer interface and checks the address. If the data is addressed to this piece of equipment and the CRC is correct, the header is confirmed in the GRF. For block and isochronous packets the rest of each one is checked on a quadlet-by-quadlet basis to the end of the packet and then confirmed in the GRF.

The error code for a packet is contained in a status quadlet which is sent as an acknowledgement. With isochronous packets, which need no acknowledgement, the error code tells the transaction layer whether the data CRC is correct or not. If the header is in error, the memory is emptied and the remainder of the packet is ignored. When a cycle start message is received, it is detected and sent to the cycle timer but not placed in the

Table 1: Isochronous packet structure.					
Field	Bit size	Notes			
Data length	16	Indicates number of bytes in current packet			
TAG	2	Data format (see footnote)			
Channel no.	6	Indicates channel number with which data is associated			
Transaction code	4	Code for current isochronous packet			
Synchronism code	4	Transaction layer specific sync code			
Header CRC	32	All isochronous packets			
Data block		All data block payload packets			
Data block CRC	32	All data block packets			

Footnote: The TAG field is used to define the data format: 00 represents data formatted for normal IEEE 1394 operation while 01 indicates that HyperLynx for MPEG-2 data is in use. The other two codes are at present not allocated.

GRF. If, at the end of an isochronous cycle, the cycle mark enable bit in the control register is set, the receiver inserts a cycle mark packet in the GRF to indicate the end of the cycle.

The transmit and receive FIFOs, both asynchronous and isochronous, are software adjustable to cater for individual applications. The maximum memory capacity is 509 quadlets, which can be shared between the ATF, ITF and GRF sections.

A cycle timer is incorporated in all devices that use isochronous data transfer: it consists of a 32-bit register. The lower twelve bits form a modulo-3072 counter that increments once every 24.576MHz clock periods (40.69nsec). The next 13, higher-order bits are used to count up to 8kHz (125µsec). The higher seven bits form a seconds count.

A cycle source bit in the configuration register can be set to indicate which device is acting as the cycle master. The cycle-in input starts cycle count incrementing: the cycle-out signal indicates that it's time to send the cycle start packet. The cycle monitor is used only by devices that provide isochronous data transfer. It monitors the chip activity and schedules the operations.

The host interface consists of a 32-bit parallel data bus and an 8-bit address bus. The BCLK signal is the bus clock, which is asynchronous to the system clock (SCLK). The CA and CS inputs denote cycle acknowledge and cycle start respectively. The WR input indicates read/write and operates in conjunction with the CS input. When these are both driven high, a read from the chip is signalled – low inputs produce a write operation.

To speed operation, this chip is interrupt driven. When the INT line goes low, this indicates that a particular service function needs to be performed.

References and Acknowledgement

(1) Ingrid J. Wickelgren, The Facts about FireWire, IEEE Journal Spectrum, pages 19-25 April 1997.

(2) Texas Instruments, IEEE 1394-1995 Link layer Controller for MPEG-2 Transport, 1997.

(3) Texas Instruments, IEEE 1394 Circuits, product information, 1997.

I would like to acknowledge the help provided by Colin Davies of Texas Instruments.

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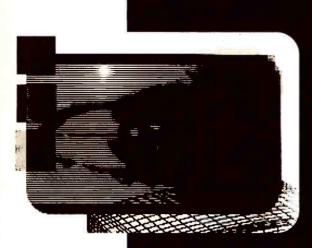
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Ferguson TX92 Chassis

If there is loss of one colour, check the tube's first anode (screen/G2) voltage as laid down in the manual. The cathode voltage for the missing colour should of course be high, and there will probably be no change as the A1 voltage is varied. The first checks should be on the tube's base panel. Lift one end of all three $82k\Omega$ RGB feedback resistors RB24/44/64. Check their values and replace any that are out of tolerance.

If this doesn't restore the missing colour, switch off and lift one end of RV17 (82Ω), RV18 and RV16 (both 120 Ω) on the main panel. Tune in a monochrome signal and scope IV01's RGB output pins 27, 28 and 29. With a monochrome signal all three waveforms should be of similar amplitude. If one is low, replace the three 100nF chip capacitors CV10/11/12. This has solved the problems I've had so far. **P.B.**

Samsung SCT11B/D Chassis

The following applies to sets, including Models CI3373 and CI5079, that are fitted with this chassis – you will find the chassis number printed on the PCB, just below the line output transformer on the solder side.

If the set is dead with DZ801 or IC801 short-circuit, inspect the

TV Fault Finding

board in the area of DZ801. If it's blackened, indicating that DZ801 has been getting hot, the power supply has probably been producing excess voltage in standby. In standby the 125V line should rise to 140V. In some sets it can rise to 180V, with the result that DZ801 fails. Replace the following parts with the latest types – this normally solves the problem:

DZ801, replace with part no. 0403-000691.

IC801, replace with part no. AA13-20004P version C.

HC801, replace with part no. AA13-20004M version C.

If the supply still produces 180V in standby, replace C852 using part no. 2301-000111. **P.B.**

Grundig M70-690/9 (CUC6851 chassis)

If there is no front display, check whether fuse Si6010 on the mains switch panel is open-circuit. **P.B.**

Samsung CI5079T (SCT11D Chassis)

This set produced a blank blue screen with no sound. The menus could be called up, but they were partly off the top of the screen. This was a clue – the EEPROM had lost its settings.

With the SAA5290ZP-026 the option byte should be set to 5D.

With the SAA5290ZP-042 the option byte should be set to CA.

Once a new EEPROM had been fitted and the option byte set up, the menus were in the correct place on the screen and snow had replaced the blank display. But no signals could be tuned in. Pin 1 of the microcontroller chip, where the PWM tuning voltage signal should be present, was short-circuit to chassis. A new microcontroller chip and a picture size and grey-scale set up completed the repair.

If you need to order a service manual for a CI5079T, quote the chassis type – you will find it on the solder side of the PCB, by the LOPT pins. **P.B.**

Hitachi C1414T

Although this set's power supply appears to be quite conventional it won't start if you connect a light bulb as a dummy load across its output. If you switch on then connect the bulb, it will light.

The basic fault was that the overvoltage zener diode ZD952 (P6KE130R) and the line output transistor Q702 (BU2508DF) had gone short-circuit. Replacing these items and the optocoupler IC901 (CNX82R) cured the fault. But before doing so I wanted to test the power supply running on its own. Hence the comments above. M.M.

Sony KV2553MT

This multi-standard set had been imported from the USA. There was no picture: the owner complained about a thin white line across the screen with a black band at the bottom. The cause of the trouble was C681 (560 μ F, 25V) which on test read under 90 μ F. A new 680 μ F, 50V capacitor rated at 105°C cured the fault. **M.M.**

Philips 2A Chassis

When this set came in it was tripping. Fortunately the engineer who brought it along mentioned that there was a width fault. I found that R3601 ($5\cdot 6\Omega$) in the EW modulator driver stage was open-circuit. A replacement stopped the tripping, but there was now excessive width with the control having no effect.

A voltage check at the emitter of the EW modulator driver transistor TR7599 produced a reading of approximately 2.2V instead of the usual 15.5V. A check at the width control itself revealed that the -26V supply was missing. R3602 (15 Ω) was open-circuit because the supply's reservoir capacitor C2602 (10 μ F, 63V) was short-circuit. When I removed it I found that its case had burst. Replacements followed by setting up restored correct operation. M.M.

Matsui 209R

The fault symptoms were field bounce and partial field collapse. The cause turned out to be dryjoints at the scan plug connector. Resoldering put matters right. **M.M.**

Philips CP110

This one came in from another dealer who thought that the cause of the blown mains fuse was the degaussing posistor, which rattled. Checks revealed that two of the mains bridge rectifier diodes were short-circuit. When these were replaced the fuse held but the set didn't come on.

The voltage at pin 9 of the TEA1039 chopper control chip was low. So I replaced the usual items the BUT11AF chopper transistor TR7665, the TEA1039 chip, the 120Ω and 100Ω resistors in TR7665's base circuit etc., but still no joy. The BYD33J HT rectifier D6664 was short-circuit. When this had been replaced the set came on and the channel numbers lit up. Time to reconnect the scan-coil plug, restoring the HT supply to the line output stage. The set then tripped. I had a working set once the line output transformer had been replaced – pity the tube was as flat as a pancake! M.M.

Samsung Cl6230

There were two faults with this set: no remote control and flyback lines at the top of the screen when the set had been on for a while. The customer mentioned that the field output chip had been replaced several times. I replaced the associated flyback boost capacitor, but the field fault persisted. The cause was the chip itself, proved by a squirt of freezer.

When I removed the chip I found that the previous engineer hadn't bothered to clean off the old heatsink compound. So the chip wasn't making proper contact with its heatsink. All was well when I'd cleaned off the old grease and fitted a new chip.

The cause of the remote control system failure was simple: the pre-

vious engineer had forgotten to refit the plug from the remote control sensor/amplifier! **M.M.**

Ferguson TX90 Chassis

Field collapse superimposed on a normal picture was the unusual symptom with this 14in. set. At first I thought that the screen had been burnt by a previous field collapse fault. But this was not the case: after about five minutes the line almost vanished.

The field output stage bias resistors were all OK. They are fed from the same 150V line that supplies the RGB output transistors. The cause of the problem was this supply's reservoir capacitor C190 (22μ F, 160V). A replacement also improved the picture. **K.F.B.**

Hitachi C2114T (G7PS Chassis)

The field output chip IC601 had failed. It failed again after a few months and was replaced, along with C605, only to fail yet again. On Hitachi's advice we fitted a 10nF, 50V capacitor across the field scan coils, on the print side of the panel, and made sure that R613 was fitted. But the set continued to destroy its field output chip.

The latest modification is to add two BZX79-33V zener diodes in series, with their cathode to pin 2 of IC601 and the anode to chassis. If this fails, it seems that a new CRT is required. **K.F.B.**

Ferguson ICC9 Chassis

If the symptom is loss of one of the primary colours, check the relevant surface-mounted buffer transistor first. Use a scope – these transistors can test OK with a multimeter. TV71 is for red, TV76 for green and TV81 for blue. **M.Dr.**

Tatung 180 Chassis

The power supply pumped at switch on. When the feed to the line output stage was disconnected the power supply fired up first time. But connecting a 60W bulb as a dummy load made it trip again. The usual cause of this fault is C806 and C807 (both 100 μ F, 25V). Not this time however. The capacitance of the mains bridge rectifier's reservoir capacitor C805 (100 μ F, 385V) had dropped to a very low value. **M.Dr.**

Sanyo EC1-B Chassis

One of these sets would shut down after three seconds. The chassis incorporates a protection circuit that's monitored by the PCA84C840/062 microcontroller chip IC701. The idea is that the protection line is held high by the 10k Ω pull-up resistor R706. Various diodes connect this line to the supply rails. When a supply is lost, the relevant diode conducts and the protection line goes low. The exception to this circuitry is the HT line (B1), which is checked for overvoltage by a potential divider/zener diode/transistor arrangement which likewise pulls the protection line low in the event of a fault.

In this particular case however IC701 had developed an internal leak of about $2k\Omega$, which made the protection line go low. I assume that the three-second delay is programmed into the chip's software to allow the supply rails to be established before checks are made.

I've now had this fault three times, with two other variants of the same chassis. **P.G.**

Hitachi CPT2508 (G7P Mk II Chassis)

This set was dead with the mains fuse blackened and the 3.9Ω , 7W surge limiter resistor R901 opencircuit. As a 300Ω reading was obtained across the mains bridge rectifier's reservoir capacitor C909 I at first suspected that the chopper transistor Q901 was leaky. The culprit was the snubber capacitor C919 (4.7nF, 1kV) however. It's one of those disc capacitors and on closer inspection I could see that it had split along its length. A replacement rated at 2kV restored normal operation. **P.G.**

Toshiba 1510TBT

This set had died during an electrical storm. Unusually the power supply worked, but the set was stuck in standby. The 5V supply for the microcontroller chip ICA01 is derived from the AC mains supply via a $3.9k\Omega$, 10W resistor (RA60) which acts as an integrator in conjunction with a 470 μ F, 16V capacitor (CA45). The 9V supply produced by these components is clamped by a couple of series-connected 4.7V zener diodes and fed to a BC547B 5V regulator transistor (QA03).

Checks showed that the 5V supply was low at 4V while the voltages at the pins of ICA01 were haywire. In particular the voltage at its reset pin hovered at 1.2V instead of being 5V. Thus ICA01 refused to initialise. The reset line is fed by QA04, which is in QA03's base circuit. QA03 was the cause of the trouble: it had slight base-emitter leakage. P.G.

GoldStar CIT2180F

This set was dead. There was plenty of voltage across the mains bridge rectifier's reservoir capacitor C808 but nothing at the collector of the chopper transistor Q801. The cause was hairline cracks around all the pins of the chopper transformer, though a magnifier was required to see them. Resoldering restored normal operation. **P.G.**

Huanya 37C3

Some quick ones on these sets. If the set fails to start, check R710 $(10k\Omega, 3W)$ which provides the line oscillator with a start-up feed.

No colour usually means that the D7193AP colour decoder chip IC501 is faulty. Replace with a TA7193.

If there's no field flyback blanking, check the two 1μ F, 50V seriesconnected electrolytics C612/3. Note that in some versions of the chassis only one of these capacitors is fitted, the other one being linked out. Non-linear field scanning usually means that C611 (2·2 μ F, 50V) is open-circuit. **P.G.**

Mitsubishi CT25M1TX

The complaint was intermittent loss of the picture. When the loss occurred it lasted for only a few seconds. The fault could not be instigated by heating/freezing or by tapping, and during a soak test put in an appearance just once in three days. When it occurred the picture blanked completely, but both text and the on-screen graphics still worked.

Eventually the fault lasted for longer than its usual brief period and I had a chance to make some checks. The signals were OK at the TDA3561 colour decoder/switching chip, including the sandcastle pulses. Data input switching is carried out at pin 9, which goes high for text/on-screen graphics. In the fault condition the voltage here was 0.9V instead of 0V. Two transistors, Q7705 (text) and Q702 (onscreen graphics), control this voltage. Q702 had 3.2V at its emitter instead of 0V, and much the same at its base. At first I suspected the microcontroller chip IC701, but breaking its connection to Q702's base still left the incorrect voltage here. A replacement transistor, type JC501QR, cured the fault - the original one had been intermittently leaky.

The JC501QR is a general-pur-

pose, low-voltage transistor. I've found that a BC182L works quite well as a substitute. **P.G.**

Saisho CT141X/Matsui 1420A

The owner of this 14in. portable complained about an extremely intermittent bright picture. When the fault finally put in an appearance I found that C431 (4.7μ F, 250V) had gone open-circuit. It's the reservoir capacitor for the 180V supply to the RGB output stages. **P.G.**

Hitachi G7P Chassis

One of these sets would intermittently fail to start. We'd had it in for the same fault about six months previously, and thought we had cured it by replacing C914 ($2 \cdot 2\mu F$, 50V) which had fallen in value. It's part of the start-up supply for the TDA4601 chopper control chip IC901. This time C914 was OK. The culprit was C916 ($33\mu F$, 25V), which takes over as the reservoir capacitor for IC901's supply once the circuit gets going. As with C914, it had fallen in value. **P.H.**

Mitsubishi CT2964ST (Euro 4 Chassis)

This monster set's reported fault was no teletext. After attending to a multitude of dry-joints in the power supply and timebase sections of the main board I turned attention to the complaint. In fact the set seemed to be switching over to the teletext mode but produced only a blank screen. The 5V teletext supply was low because C922 (100μ F, 25V) was open-circuit. Once this capacitor had been replaced the set performed as it should, which is more than can be said for me after I'd lifted it! **P.H.**

Bush 2114T

The customer said that this set had gone bang. When I opened it up I could see why. The HT reservoir capacitor C810 (220 μ F, 160V) had exploded. There was debris everywhere – it took an absolute age to clean it all up. To avoid a bounce I also replaced R808 (270k Ω) and C818 (1 μ F, 50V). When faulty these items can be responsible for a blown chopper transistor and high HT respectively. **P.H.**

Ferguson C51ND (ICC7 Chassis)

Intermittent sound was the complaint with this Nicam set. The audio was sometimes low and couldn't be changed even though the on-screen level moved when told to do so by the remote control unit. In addition the sound menu had only the volume level control present: the displays for balance, bass, treble and mono/stereo were not there. After attending to some suspect joints on the main and Nicam boards the problem was still present. Thinking it might be a microcontroller fault I replaced this item. Again to no avail.

Ferguson Technical was very helpful and suggested that I resolder pins 24, 25 and 26 of the TDA6200 chip IS04 on the Nicam board. These pins handle the clock and data traffic. As I'd already done this, the next suggestion was to resolder all the links on this double-sided board. Doing this cured the fault. Note that IS04 can be the cause of the fault.

I also found that the on-screen graphics were a bit too far to the right. This was corrected by adjusting LB03 in the on-screen display oscillator circuit. **P.H.**

Philips CP90 Chassis

I thought this was going to be an easy one – the set had lost its memory. A new nicad battery fixed that. I then found that the tuning would not stop at a signal. As the transmission tuned through, I briefly saw a picture that was shifted to the left.

So it appeared that there was a problem with the line oscillator, which is in the IF unit. This module is not covered in the manual, and Philips seems to regard it as unrepairable. A replacement module is expensive, so an attempt at repair seemed preferable to a declined estimate. In fact replacing the TDA2579 chip cured the problem. **P.H.**

Salora J Chassis

This set took a long time to come on and the mains switch wouldn't latch. When the electrolytics on the primary side of the Ipsalo circuit were checked with a bridge CB712 and CB726 (both 4.7μ F, 35V) were found to be low in value. They were replaced, along with the switch, but this wasn't the end of the matter.

There was pronounced ripple on the screen when the set was still cold. CB514 (1,000 μ F, 25V), the 15V supply reservoir capacitor on the secondary side of the Ipsalo circuit, was low in value. In addition field lock was not too good. This was cured by replacing the field scan coupling capacitor CB410 (2,200 μ F, 25V) which had also fallen in value. **P.H.**

Philips KT4 Chassis

The complaint with this set was intermittent loss of the picture, sound OK. Fortunately the fault became permanent after a few days. When the picture went off, the line frequency whistle changed pitch. But there was still EHT.

The chassis has an unusual power supply/line timebase arrangement. Drive for the line output transistor is obtained from a secondary winding on the chopper transformer. A TDA3576B chip, IC7200, is used for line sync purposes. It controls an oscillator in the power supply. The TDA3576B chip was faulty. So was the screen printing on the PCB – at first we fitted the replacement chip the wrong way round. Fortunately it suffered no damage. M.Dr.

Hitachi C2114T (G7PS Chassis)

This set had died because of the usual failure of R901. When it had been revived there was a hum bar, yet no ripple could be detected on any of the supply lines. It was eventually removed by a slight tweak to the AGC preset. All channels, both strong and weak, had been affected. C.J.G.

GoldStar CIT2168

This set bounced following a power supply repair, the complaint being no teletext. There were dry-joints at connector P102 on the text board. Why are we always expected to do two repairs for the price of one? My local garage doesn't! **C.J.G.**

JVC C1480

Tuning drift was the complaint with one of these sets. For tuning control they have an unnecessarily complicated and ridiculously expensive thick-film module. Oh dear. We were able to trace the cause of the trouble to a surfacemounted electrolytic capacitor on the module however – C016, 0.47μ F. It's the same type that gives trouble with certain JVC capstan motors. **C.J.G.**

Sony KVX2952 (AEIC Chassis)

The chopper transistor was shortcircuit and a replacement got very hot and threatened to go the same way. C611 (47μ F) in its base circuit

was the cause, and the 100Ω surface-mounted resistor R651 was open-circuit.

It's always worth checking the waveform carefully where an electrolytic capacitor is used to couple the drive to a chopper or line output transistor. C.J.G.

Datsura CDR9009 (Sanyo A1-14 Chassis)

For a rolling, non-linear field scan, check the value of R548. It varies with the model. This one was fitted with a $180k\Omega$ resistor that had risen in value to several M Ω . C.J.G.

Fidelity CTV1405R

These portables are getting a bit long in the tooth now but can still produce excellent pictures. This one suffered from erratic tuning, sound buzz etc. A replacement AFT coil cured all these faults. C.J.G.

GoldStar CIT2168 (PC04A Chassis)

The cause of intermittent failure to start was traced to D401 (1N4003). It provides a start-up supply for the line driver stage. **C.J.G.**

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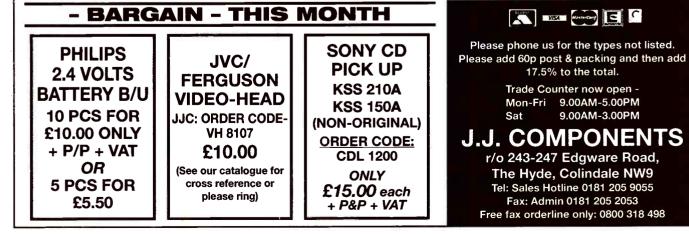
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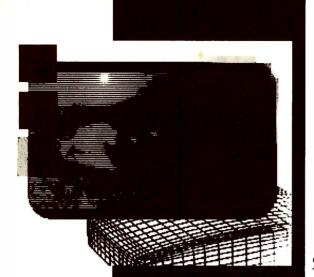
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Reports from Alan Bonhomme Adrian Spriddell and Ian Field

Elkay EM14 SVGA

There was a red screen. Replacing C22 on the tube base PCB restored the missing green. All was well for several hours, after which there was a green screen with flyback lines. This time coil L10 had gone open-circuit. It's value is 22μ H, and it looks like a resistor. **A.B.**

AOC CMLB346

The symptom was very fine line tearing on verticals. Checks revealed that C232 (1μ F) was open-circuit. Its position is near the centre at the front edge of the main PCB. **A.S.**

Viglen CA1428LE

The customer was an electronics engineer and had already tried to deal with the fault – no green. I expected a difficult job and got one! Most of the checks that should have been carried out had been, so I decided to deflux the CRT panel and start again. I repeated some of the checks and thought of a few more.

By now the fresh flux on the PCB was beginning to look a mess again. I decided, while it was still obvious which soldering had been reworked in the course of removing components for test, to unsolder and remake all the others – including the many wire links. Once I'd completed this process and again defluxed the PCB it worked correctly.

During the solder reworking I noticed that many of the wire links

Monitors

only just made it through the PCB. The customer had obviously been aware of this, as most of the wire links had been 'levered' to check their strength. This is a valid test method. I think that if slightly more force had been applied the faulty link would have been found before I got a job out of it! **I.F.**

Digital PCX-BC

When this monitor was powered it produced only a 'warm, damp smell' which reminded me of the Fidelity ZX2000/3000 chassis. Looking at the cabinet design I expected to find an AST inside, but the innards more closely resembled a Philips 7CM5279.

Occasionally a shower of sparks was seen within the LOPT cage at switch on! The spring clip that holds the IRF730 boost regulator MOSFET protrudes through slots in the heatsink/LOPT cage and had cut into the windings of coil 5613. When this coil had been replaced fortunately the MOSFET had not been damaged - the monitor worked, though the scan was too wide. The MUR460 diode that was the cause of this hides under the heatsink clips on the line output transistor and efficiency diode. The PCB print was blurred – the diode could have been 6624 or 8824. I.F.

Taxan EV420-4R

The original complaint was intermittent operation. During fault assessment it became so intermittent the monitor didn't come on at all! Some poor soldering around the TDA8172 field output chip I301 was dealt with while carrying out a visual examination, but the fault was still present at power-up. The power supply was working, and was driving the CRT's heaters, but there were no scan-derived supplies.

Line drive was present, but the HT supply was missing at the line output transformer. When tracing

back to the source I came to O802 (IRFS630), an all-plastic version of the IRF630. It acts as a chopper-type EW/width modulator, driven by I804. This is a second UC3842 chip, the first one being in the power supply. I804 was providing pulses at the gate of Q802, but this device's drain voltage was missing. So back to the power supply, specifically D813, which is mounted on a folded-metal standup heatsink. The solder fillet had torn away from the rest of the track. Once the solder and detached piece of pad had been removed and a brace link had been soldered in to provide connection and mechanical strength all was well. I.F.

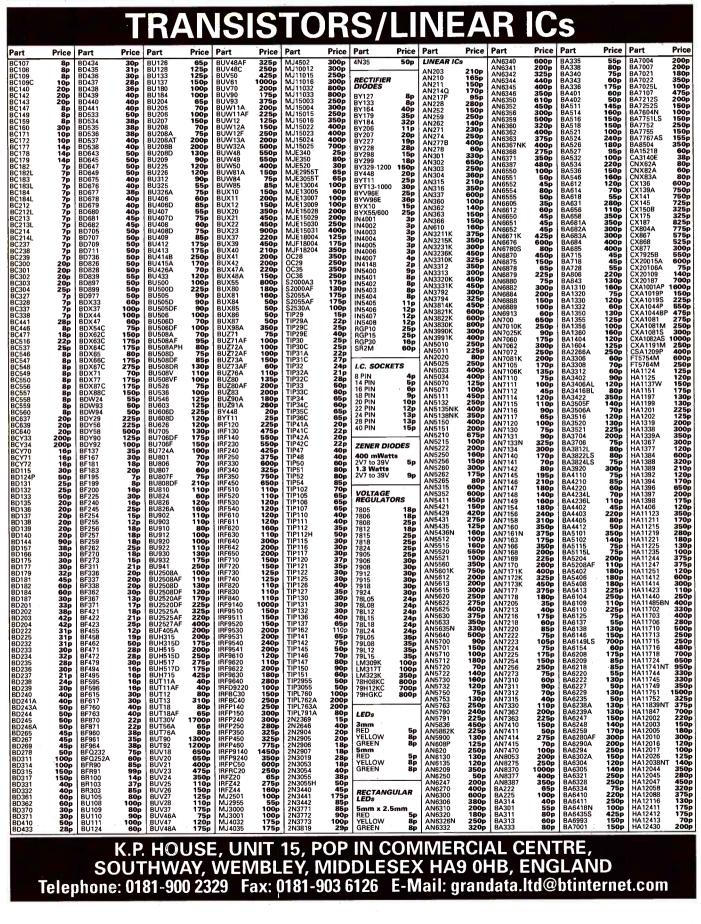
RML RM1439

There was a blank screen, though power supply activity was evident at switch on. A scan-derived 12V supply is provided by the rectifier circuit D532, R545 (2.2Ω) and C533 (100µF, 25V), followed by IC501 (7812) for regulation. It was missing because R545 was opencircuit. This item had recently been replaced by someone else, and had been soldered on the print side of the PCB. The markings on D532 had been partly rubbed off and were unidentifiable. I decided that IC501 was unlikely to be the culprit, so I replaced C533 and R545 and fitted a UF5404 diode in position D532 - I had a strong suspicion that the original diode had been breaking down at running temperature. As I was unable to check the diode's specification, I had to select a replacement with an undisputable safety margin. Anyway the monitor then produced a normal raster.

These monitors were made by Mitsubishi and also turn up wearing **Dell** badges. A similar chassis was custom-built for RML for its educational machines. But don't assume that parts will be interchangeable. **I.F.**



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HA13007 HA13108	300p 260p	LA3160 LA3161	120p 40p	LA7123 LA7210	1300p 60p	LF398 LH2426S	300p 600p	MC3488AP MC34063AP	250p 300p	SAB3037 SAB3042	700p 825p	STK3152 II S STK3156 E	900p 900p	STK5482 STK5483	285p 440p	STR20012 STR20015	450p 450p	TA7283 TA7284P	200p 200p 400p
HA13117 HA13118 HA13119	175p 140p 140p	LA3210 LA3226 LA3246	65p 60p 75p	LA7212 LA7214 LA7220	150p 150p 125p	LM301 LM311 LM319	26p 35p 165p	MN1220T MN1226 MN1228	600p 450p 600p	SAB3064 SAB3209 SAB3210	130p 225p 250p	STK4019 4 STK4021 3	100p 180p 380p	STK5486 STK5487 STK5488	450p 525p 480p	STR30110 STR30115 STR30120	330p 275p 400p	TA7288 TA7291P	220p 200p
HA13127 HA13128 HA13130	350p 400p 450p	LA3300 LA3301 LA3361	140p 110p 100p	LA7222 LA7224 LA7225	110p 150p 250p	LM324 LM335Z LM339	30p 120p 35p	MN1276 MN1280 MN3004	1300p 70p 600p	SAB6456 SAB8048 SAB8051AP	125p 225p 700p	STK4025 E	550p 530p 180p	STK5490 STK5632 STK5720	450p 450p 400p	STR30123 STR30125 STR30130	450p 550p 250p	TA7292P TA7294P TA7299	325p 450p 200p
HA13135 HA13139	600p 600p	LA3365 LA3370	70p 70p	LA7292 LA7294	275p 200p	LM348 LM358	50p 45p	MN3005 MN3011	2000p 4000p	SDA2003 SDA2004	450p 325p	STK4028 5 STK4032 # 10	550p 550p	STK5725 STK5730	450p 450p	STR40090 STR40115	350p 600p	TA7302P TA7303	75p 70p
HA13150A HA13151 HA13403	1150p 875p 400p	LA3373 LA3375 LA3376	70p 300p 80p	LA7295 LA7297 LA7305A	160p 120p 350p	LM380 LM381 LM382	80p 150p 130p	MN3101 MN3102 MN3207	110p 110p 375p	SDA2005 SDA2007 SDA2008	700p 300p 400p	STK4036 4 STK4038 6	925p 170p 180p	STK6316 STK63248 STK6327	300p 500p 1200p	STR41090 STR43111 STR44115	330p 950p 475p	TA7307 TA7310 TA7312	100p 100p 120p
HA13406W HA13408 HA13412	400p 350p 600p	LA3380 LA3390 LA3400	300p 250p 250p	LA7308 LA7311 LA7320	70p 200p 120p	LM386 LM387 LM389N	60p 100p 105p	MN3208 MN6030B MN6163A	950p 350p 700p	SDA2112 SDA2120 SDA2131	450p 200p 225p	STK4042 II 8	350p 300p 350p	STK6328A STK6431 STK6607	800p 850p 400p	STR45111 STR50020 STR50092	550p 350p 550p	TA7313 TA7314	70p 175p
HA13426 HA13432 HA13441	500p 400p 450p	LA3401 LA3410 LA3430	90p 160p 135p	LA7323 LA7330 LA7331	325p 350p 250p	LM393 LM431 LM710	45p 60p 45p	MTA001M NE555 NE556	600p 20p 40p	SDA2208 SDA4212 SDA5241	450p 775p 725p	STK4046 STK4048 12	50p 80p 300p	STK6722 STK6732 STK6822	725p 1000p 900p	STR50103A STR50113 STR50115	260p 500p 500p	TA7315 TA7317P TA7320P	200p 120p 200p
HA17524 KA2102	250p 100p	LA3600 LA3605	60p 100p	LA7332 LA7340	225p 300p	LM723 LM741DIL	40p 18p	NE558 NE565	80p 110p	SDA5243-2 SDA5343	450p 1460p	STK4060 5 STK4065 6	510p 350p	STK6922 STK6932	500p 525p	STR51041 STR50213	500p 500p	TA7322 TA7323	130p 80p
KA2130 KA2131 KA2206	150p 110p 150p	LA3607 LA4030 LA4031	125p 180p 140p	LA7376 LA7391 LA7520	150p 550p 200p	LM741MET LM747 LM1017	45p 55p 200p	NE567 NE571 NE592	115p 290p 85p	SDA5640 SDA5642 SGSF444	200p 450p 500p	STK4111 E STK4112 E	500p 500p 500p	STK6962 STK6972 STK6981B	275p 490p 600p	STR53041 STR54041 STR55041	400p 320p 450p	TA7234 TA7325 TA7326	75p 90p 200p
KA2209 KA2210 KA2212	125p 230p 65p	LA 4032 LA 4051 LA 4100	140p 160p 85p	LA7530 LA7535 LA7545	200p 175p 160p	LM1035N LM1040N LM1203	350p 650p 225p	NE5532P SAA1000 SAA1004	140p 350p 650p	SGFS465 SLA4031 SLA7020M	500p 750p 450p	STK4122 E	180p 160p 180p	STK6982 STK6982H STK7216	600p 600p 420p	STR56041 STR58041 STR59041	550p 250p 300p	TA7328 TA7330P	110p 80p
KA2213 KA2214 KA2224	130p 100p	LA4101 LA4102 LA4110	80p 100p 120p	LA7550 LA7555 LA7620	275p 150p 500p	LM1203AN LM1875T LM1881N	225p 330p 375p	SAA1005 SAA1006 SAA1008	325p 300p	STA301A STA341M STA401A	200p 180p 220p	STK4132 II 6 STK4133 II 7	300p 750p	STK7217 STK7225 STK7226	400p 500p 600p	STR60001 STR80145 STR81145	525p 475p 375p	TA7331P TA7333 TA7335	80p 100p 85p
KA2244 KA2261	50p 75p 100p	LA4120 LA4138	270p 105p	LA7680 LA7681	675p 650p	LM1886 LM1889	250p 300p	SAA1010 SAA1024	450p 400p 250p	STA403A STA405A	270p 280p	STK4142 E STK4147 II 14	120p 130p 150p	STK7251 STK7253	500p 450p	STR90120 STRD1206	425p 500p	TA7336 TA7337P	180p 175p
KA2263 KA2264 KA2284	100p 100p 75p	LA4140 LA4142 LA4145	60p 65p 65p	LA7710 LA7800 LA7801	250p 90p 100p	LM1894N LM1895N LM2901N	200p 275p 35p	SAA1025 SAA1026 SAA1027	250p 400p 400p	STA431A STA432A STA434A	250p 220p 270p	STK4152 6 STK4161 6	180p 150p 150p	STK7308 STK7309 STK7310	350p 400p 470p	STRD1406 STRD1706 STRD1806	600p 360p 360p	TA7339P TA7341 TA7342P	175p 250p 70p
KA2309 KA2401 KA2412	175p 160p 225p	LA4160 LA4162 LA4178	100p 110p 150p	LA7802 LA7806 LA7808	300p 260p 250p	LM2902N LM2903N LM3900	40p 40p 40p	SAA1029 SAA1042 SAA1043P	150p 325p 675p	STA435A STA441C STA451C	270p 220p 280p	STK4162 E STK4164 II 11	i50p 176p 100p	STK7348 STK7356 STK7358	400p 425p 440p	STRD1816 STRD1906 STRD3035	350p 550p 300p	TA7343 TA7347P	120p 120p
KA2912 KA2913A	125p 175p	LA4180 LA4182	150p 180p	LA 7820 LA7823	100p 200p	LM3909 LM3911N	100p 200p	SAA1044 SAA1056	400p 300p	STA456C STA471	240p 210p	STK4172 II 6 STK4181 6	80p 80p	STK7402 STK7404 STK7406	560p 600p	STRD4412 STRD4420	500p 550p	TA7348P TA7349P TA7354P	125p 175p 65p
KA2914A KA22427 KIA6213S	200p 100p 60p	LA4190 LA4192 LA4200	300p 140p 130p	LA7824 LA7830 LA7831	130p 90p 85p	LM3914 LM3915 LM3916	150p 160p 270p	SAA1057 SAA1058 SAA1060	375p 225p 375p		280p 420p 1000p	STK4191 7 STK4192 7	750p 700p 700p	STK7408 STK7410	650p 675p 1500p	STRD4512 STRD5441 STRD5541	400p 475p 450p	TA7357 TA7358	340p 85p
KIA6210AH KIA6281H KIA6283K	400p 250p 150p	LA4201 LA4260 LA4261	120p 230p 300p	LA7832 LA7835 LA7837	130p 150p 150p	LM8363 LM8560 LM13600	320p 175p 150p	SAA1061 SAA1062 SAA1063	250p 250p 250p	STK0039 STK0040 STK0049	600p 520p 510p	STK4211 10 STK4211 V 8 STK4221 12	000p 000p	STK7458 STK7554 STK7561	1250p 600p 650p	STRD6008 STRD6009E STRD6018	575p 450p 450p	TA7359P TA7361 TA7362	90p 125p 150p
KIA6299H KIA7227CP KIA7313	210p 200p 45p	LA4265 LA4270 LA4282	125p 300p 350p	LA7838 LA7850 LA7851	200p 225p 200p	LM13700 LM18293 M491881	125p 500p 800p	SAA1064 SAA1070 SAA1073	275p 550p 325p	STK0050 STK0059 STK0060	440p 620p 820p	STK4231 II 10 STK4241 10)50p)50p 160p	STK7562 STK7563 STK7573	1000p 800p 400p	STRD6602 STRD6601 STRM6545	475p 650p 900p	TA7364P TA7366P	176p 65p
L149V L165V	300p 250p	LA4420 LA4422	140p 130p	LA7910 LA7913	150p 90p	M49481 M5265P	700p 200p	SAA1075 SAA1086	350p 175p	STK0070 STK0080	1100p 1000p	STK4272 5 STK4273 6	i00p i50p	STK7576 STK7703	1500p	STRM6546 STRM6549	900p 500p	TA7368P TA7373F TA7374	35p 150p 175p
L200 L272 L272M	200p 200p 110p	LM4425A LA4430 LA4440	200p 130p 200p	LA7930 LA7940 LA7953	350p 200p 300p	M50115P M50117P M50119P	320p 500p 525p	SAA1089 SAA1101 SAA1124	325p 700p 200p	STK011 STK015 STK016	330p 440p 760p	STK4311 E STK4332 3	600p 850p 865p	STK8050 STK8250 STK8260	1600p 500p 1200p	STRS5741 STRS5941 STRS6307	800p 750p 600p	TA7376P TA7378P	100p 60p
L2908 L2918 L292	225p 300p 750p	LA4445 LA4446 LA4460	200p 170p 120p	LA9200 LB1205 LB1216	300p 170p 150p	M50422P M50461 M50784	750p 350p 300p	SAA1130 SAA1250 SAA1251	550p 280p 380p	STK025 STK050 STK077	650p 1600p 520p	STK4362 4	i00p 150p 100p	STK8280 STK73405 II STK73410	1850p 550p 350p	STRS6308 STRS6309 STRS6707	600p 600p 1000p	TA7401 TA7402P TA7403	250p 200p 325p
L2938 L293C L293D	225p 325p 226p	LA4461 LA4466 LA4470	120p 225p 300p	LB1258 LB1268 LB1274	100p 70p 85p	M50786 M50790 M51014L	500p 600p 120p	SAA1271 SAA1274 SAA1290	400p 280p 750p	STK078 STK080	1800p 550p 2000p	STK4392 5 STK4412 4	:00p 50p 00p	STK7340 II STK73605 STK73907	500p 375p 700p	STRS6708 TA7054 TA7061	575p 190p 115p	TA7404 TA7405P	150p 200p
L293E L294	260p 475p	LA4475 LA4476	225p 225p	LB1290 LB1292	120p 110p	M51143AL M51161	110p 300p	SAA1293 SAA1294	550p 800p	STK084 STK085	600p 900p	STK4773 8 STK4793 8	120p 100p	STK78617 STR370	2400p 300p	TA7062 TA7066	200p 120p	TA7411AP TA7415P TA7417AP	150p 350p 225p
L295 L297 L298	450p 525p 400p	LA4480 LA4485 LA4495	226p 300p 250p	LB1405 LB1407 LB1409	70p 130p 200p	M51161P M51162P M51164AL	250p 250p 80p	SAA1300 SAA1310 SAA1350	200p 200p 275p	STK0100 STK0100II	1000p 900p 1200p	STK4813 8 STK4833 8	00p 300p 350p	STR371 STR380 STR381	400p 350p 390p	TA7075P TA7089 TA7102P	300p 300p 500p	TA7521P TA7607 TA7608	350p 200p 360p
L465A L482 L497B	625p 400p 525p	LA4496 LA4498 LA4500	250p 275p 200p	LB1412 LB1415 LB1416	300p 100p 85p	M51166P M51182L M51191L	300p 110p 85p	SAA1351 SAA1900S SAA3004	750p 475p 400p	STK420 STK430 STK433	400p 500p 400p	STK4853 17	20p 700p 700p	STR383 STR384 STR440	410p 350p 800p	TA7119 TA7120 TA7124	150p 55p 250p	TA7609 TA7611	170p 210p
L702B L702N L2720	400p 325p 150p	LA4505 LA4508 LA4510	220p 200p 100p	LB1426 LB1450 LB1615	125p 110p 270p	M51231P M51308SP M51310AP	200p 550p 900p	SAA3006P SAA3007P SAA3008P	225p 130p 200p	STK435 STK436 STK437	375p 430p 600p	STK4873 11 STK4893 10	00p 100p 100p	STR441 STR442 STR450A	950p 1600p 700p	TA7130P TA7137 TA7140	85p 60p 100p	TA7612 TA7613AP TA7614	300p 90p 170p
L2722 L4960 L6203	175p 325p 600p	LA4520 LA4550 LA4555	170p 200p 120p	LB1620 LB1622 LB1630	210p 220p 80p	M51316P M51320 M51356P	300p 200p 400p	SAA3010P SAA3027P SAA3049P	300p 375p 550p	STK439 STK441 STK443	500p 680p 700p	STK5314 4 STK5315 5	75p 00p	STR451 STR452 STR453	800p 600p 500p	TA7141 TA7150P TA7157	825p 250p 100p	TA7616 TA7621	300p 300p
L6210 L6221AS	250p 300p	LA4557 LA4558	150p 125p	LB1639 LB1640	300p 150p	M51358P M51365P	150p 350p	SAA4700 SAA5000	425p 200p	STK457 STK459	470p 560p	STK5323 6 STK5324 4	100p 150p	STR454 STR455	1300p 550p	TA7172P TA7193	150p 320p	TA7622 TA7628 TA7629	420p 110p 220p
L6506 LA1130 LA1135	300p 240p 120p	LA4570 LA4571 LA4581	130p 175p 175p	LB1641 LB1642 LB1645	75p 150p 100p	M51366P M51381P M51384AP	360p 200p 750p	SAA5010 SAA5012 SAA5020	220p 400p 350p	STK460 STK461 STK463	660p 600p 950p	STK5326 7 STK5330 8	170p 150p 150p	STR456 STR457 STR470	470p 600p 400p	TA7207	200p 1200p 150p	TA7630 TA7632	200p 400p
LA1145 LA1150 LA1170	200p 150p 90p	LA4597 LA4620 LA4630	126p 400p 325p	LB1648 LB1649 LB3500	200p 190p 125p	M51387P M51392P M51393AP	600p 300p 350p	SAA5030 SAA5040A SAA5040B	440p 280p 400p	STK465 STK501 STK561	900p 550p 450p	STK5332 1	80p	STR1096 STR1195 STR1229	275p 350p 325p	TA7208 TA7210 TA7214	125p 200p 220p	TA7640 TA7641 TA7644BP	90p 140p 480p
LA1177 LA1180 LA1185 LA1186	130p 75p	LA4700 LA4705	350p 400p	LC4966 LC7011	65p 500p	M51395AP M51397AP	450p 425p	SAA5041 SAA5042	550p 425p	STK563 STK583	415p 500p	STK5335 3 STK5336 3	150p 150p	STR2005 STR2012	400p	TA7217 TA7220	145p 220p	TA76545P TA7658	65p 100p
LA1186 LA1201	A1201 75p LA5511 500p LC7130 3000p M51533 3000p SA45052 5000p S1K7/2 6500p S1K5339 4000p S1R2024 575p LA522 3000p TA7866P 100 A1205 75p LA5512 50p LC7131 260p M51544 150p SA4505 500p S1K7280 480p S1K534 350p S1R2105 600p TA726 290p TA78668 100 A1207 120p LA5522 45p LC7132 400p M51848 150p SA45230 850p S1K780 675p S1K534 245p S1R2124 675p TA7227 700p TA7678 400															400p 325p 100p			
LA1207 LA1210	120p 140p	LA5522 LA5523	45p 150p	LC7132 LC7137	400p 450p	M51848 M54523P	150p 200p	SAA5230 SAA5231	850p	STK780	675p	STK5343 2	45p 180p	STR2124	675p 525p	TA7226 TA7227 TA7230	100p	TA7668 TA7672	100p 400p
LA1222	130p 130p	LA5527 LA5530	150p 65p	LC7185 LC7191	350p 300p	M58484 M51516	500p 260p	SAA5243PE SAA5244AP	360p 950p	STK1039 STK1040 STK1049	460p 640p 700p	STK5361 3 STK5362 4	175p	STR3115	400p	LIA/233	1200	TA7679 TA7680AP	475p 200p
LA1230 LA1235 LA1240 LA1245 LA1260 LA1261 LA1265 LA1266 LA1267 LA1254	80p 110p 75p	LA5531 LA5537 LA5655	65p 45p 175p	LC7207 LC7215 LC7217	275p 160p 350p	M51518 M51995P M51977P	200p 250p 300p	SAA5246AP SAA5246P SAA5250P	380p 750p 750p	STK1050 STK1060 STK1070	650p 700p 850p	STK5372 2 STK5373 3	60p 175p 175p	STR3123 STR3125 STR3130 STR3135 STR3212	480p 500p 250p	TA7237 TA7238 TA7240 TA7241 TA7242	300p 400p 160p 165p	TA7681AP TA7687AP TA7688	425p 100p
LA1261 LA1265	75p 125p 130p	LA5658 LA5665 LA5667	225p 250p 200p	LC7218 LC7230 LC7267	250p 700p 550p	M52307P M54646AP MB3708	900p 400p 275p	SAA5351 SAA7000	375p 550p 600p	STK 1080 STK 2025 STK 2028	940p 620p 500p	SIK5421 4	i00p 150p 175p	STR3214	275p 275p 275p	TA7242 TA7243 TA7245 TA7245BPO	165p 190p 320p 225p	TA7698 TA7699	150p 400p 600p
LA1267 LA1354	150p 225p	LA5700 LA6339	300p 35p	LC7351 LC7364	200p 200p	MB3712 MB3713	600p 130p	SAA7020 SAA7210P SAA7220PA	1300p 550p	STK2029 STK2030	480p 1000p	STK5431 5 STK5434 5	50p	STR3215 STR3315 STR4090A	275p 650p		225p 200p 575p	TA7705 TA7709P TA7719P	300p 150p 200p
LA1354 LA1363 LA1364 LA1365	90p 200p 120p 220p	LA6355 LA6510 LA6515	50p 150p 150p	LC7432 LC7522 LC7535	425p 350p 300p	MB3714 MB3715 MB3722	225p 260p 200p	SAA7220PA SAA7274P SAA7280P SAA9050	600p 1450p 450p	STK2038 STK2048 STK2058IV	700p 950p 1600p	STK5443 5	00p 00p 75p	STR4142 STR4211 STR4512	450p 315p 400p	TA7250B TA7251BP TA7256P	575p 325p 325p 225p	TA7727P TA7750	125p 200p
LA1365 LA1368 LA1369 LA1385	220p 200p 170p	LA6520 LA6531 LA7007	175p 250p 400p	LC7537AN LC7537N LC7560	400p 450p 750p	MB3730 MB3731 MB3732	900p 220p	SAR0600	475p 600p 625p	STK2101 STK2110 STK2125	1050p 550p 580p	STK5446 3 STK5451 3 STK5461 6	50p 190p	STR5015 STR5100	500p 550p 475p	TA7256P TA7259P TA7262P TA7263P	225p 225p 400p 325p	TA7757 TA7769 TA7772P	200p 130p 150p
LA1385 LA1503 LA1805	120p 175p 130p	LA7011 LA7016 LA7018	220p 45p 100p	LC7565 LC7582E LC7800	300p 300p 175p	MB3735 MB3756 MB3759	240p 400p 160p 200p	SAB0601 SAB0602 SAB1009BP SAB1016	625p 225p 600p	STK2129 STK2139	750p 675p 900p	STK5462 5 STK5464 3	00p 00p 00p	STR5214 STR5315 STR5412 STR6020	575p 280p 270p	TA7263P TA7265AP TA7267 TA7267 TA7267BP	325p 300p 220p	TA7784 TA7792P	260p 250p
LA1851 LA2000	300p 150p	LA7019 LA7033	130p 400p	LC7815H LC7818	175p 280p	MB3771 MB3773	110p 110p	SAB1046P SAB2015P	350p 525p	STK2155 STK2230 STK2240	470p 740p	STK5467 4	00p	STR7001 STR9005	600p 400p	TA7269	120p 260p 170p	TA7796P TA8101N TA8105N	75p 230p 140p
LA1810 LA1851 LA2000 LA2001 LA2101 LA2101	200p 270p 150p	LA7042 LA7046 LA7051	280p 300p 130p	LC7820 LC7821N LC7822N	325p 250p 160p	MB8719 MC1391 MC1455	360p 120p 45p	SAB2016P SAB2022P SAB3012	150p 525p 875p	STK2250 STK3041 STK3042	650p 370p 375p	STK5471 9 STK5472 3 STK5473 4	100p 175p 180p	STR9012 STR10006 STR11006	300p 450p 325p	TA7271 TA7272 TA7273	220p 260p 300p	TA8110AP TA8119P	110p 70p
LA2200 LA2205 LA2211	AZ200 1940 LA7053 1300 LC7881M 325p MC1488 35p SA5013 200p S1K3044 950p S1K344 5000 S1K1200 4500p LA7214 210p MC1489 35p SA5013 200p S1K3044 950p S1K1200 4500p LA7219 210p MC1489 35p SA83013 200p S1K3044 9500 S1K3446 500p TA7219 210p MC1489 35p SA83013 200p S1K3044 9500 S1K3446 500p TA7219 210p MC1489 35p SA83013 200p S1K3446 500p S1K3446 500p TA7219 210p MC1489 35p SA83013 200p S1K3044 9500 S1K3446 500p S1K3446 500p TA7219 210p MC1489 35p SA83013 200p S1K3044 9500 S1K3446 500p S1K3474 500p S1K3446 500p S1K346 500p S1																		
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TA8164P TA8184P TA8189P	100p 350p 130p	TDA1180 TDA1185A TDA1190	120p 190p 80p	TDA2760 TDA2780 TDA2791	400p 600p 276p	TDA4661 TDA4670 TDA4680	225p 475p 350p	TDA8391 TDA8395 TDA8405	675p 360p 560p	UPC1004C UPC1009 UPC1018	130p 950p 170p	2SA771 2SA773 2SA777	90p 60p 35p	2SA1177 2SA1179 2SA1182	25p 20p 20p	2S8561 2S8562 2S8564	30p 20p 16p	2SC738 2SC739 2SC761	16p 160p 110p
TA8200AH TA8201AK TA8205	325p 300p 220p	TDA12008 TDA1220 TDA1235	80p 50p 300p	TDA2795 TDA2822M TDA2824	150p 60p 85p	TDA4685 TDA4700A TDA4714C	275p 760p 350p	TDA8415 TDA8416 TDA8417	650p 625p 550p	UPC1020 UPC1023 UPC1024H 2	200p 60p 75p	2SA778 2SA781 2SA786	100p 150p 25p	2SA1184 2SA1185 2SA1186	120p 200p 600p	2S8566 2S8596 2S8598	90p 50p 30p	2SC762 2SC783 2SC790	150p 85p 50p 380p
TA8207K TA8210 TA8211AH	175p 260p 200p 260p	TDA1236 TDA1251 TDA1270 TDA1327	240p 150p 150p 200p	TDA2840 TDA3047 TDA3048 TDA3082	200p 100p 130p 200p	TDA4716C TDA4718A TDA4725 TDA4800	450p 250p 750p 300p	TDA8421 TDA8425 TDA8432 TDA8433	300p 500p 550p 600p	UPC1025 UPC1026 UPC1028 UPC1031H	230p 95p 90p 160p	2SA794 2SA798 2SA812 2SA814	50p 30p 15p 60p	2SA1198 2SA1201 2SA1202 2SA1204	40p 40p 25p 225p	2S8600 2S8801 2S8605 2S8631	600p 60p 26p 40p	2SC792 2SC805 2SC828 2SC829	225p 20p 15p
TA8214K TA8215 TA8216H TA8217P	300p 300p 120p	TDA1405 TDA1410 TDA1412	50p 220p 35p	TDA3083 TDA3190 TDA33018	200p 100p 1600p	TDA4810 TDA4814A TDA4850	500p 300p 475p	TDA8440 TDA8442 TDA8443	300p 200p 350p	UPC1032 UPC1035C UPC1043C	60p 110p 125p	2SA816 2SA817 2SA825	70p 20p 20p	2SA1206 2SA1207 2SA1208	60p 25p 70p	258632 258633 258641	46p 80p 12p	2SC839 2SC867 2SC870	20p 900p 100p
TA8220AH TA8221AH TA8225H	500p 600p 475p	TDA1506 TDA1508 TDA1510	276p 175p 170p	TDA3310 TDA3410 TDA3420	120p 160p 200p	TDA4851 TDA4852 TDA4860	325p 325p 200p	TDA8444 TDA8451 TDA8452	200p 325p 200p	UPC1158H UPC1161 UPC1167	70p 110p 125p	2SA836 2SA837 2SA839	20p 200p 110p	2SA1209 2SA1210 2SA1215	100p 120p 600p	2S8647 2S8648 2S8649	20p 45p 35p	2SC897 2SC9008 2SC930	175p 30p 15p
TA8225L TA8227 TA8229K	475p 250p 200p	TDA1512 TDA1514A TDA1515A	140p 326p 200p	TDA3501 TDA3502 TDA3504	300p 360p 300p	TDA4886 TDA4881 TDA4935	275p 200p 300p	TDA8453 TDA8461 TDA8490	350p 950p 225p	UPC1170 UPC1173 UPC1176C	160p 200p 120p	2SA841 2SA844 2SA847	20p 20p 25p	2SA1216 2SA1217 2SA1220	550p 100p 76p	2S8673 2S8676 2S8688	100p 85p 90p	2SC936 2SC941 2SC944	300p 15p 140p
TA8400P TA8410K TA8410P	200p 200p 200p	TDA1516Q TDA1517 TDA1519	350p 150p 200p	TDA3505 TDA3506 TDA3507	275p 260p 450p 200p	TDA4940 TDA4942 TDA4944 TDA4950	200p 200p 175p 100p	TDA8540 TDA8702 TDA8703 TDA8708	250p 275p 500p 600p	UPC1178H UPC1180C UPC185H2 UPC1186	250p 200p 400p 80p	2SA854 2SA861 2SA872 2SA872A	30p 46p 26p 60p	2SA1221 2SA1222 2SA1226 2SA1227	70p 60p 25p 250p	2S8703 2S8705 2S8707 2S8716	90p 200p 200p 200p	2SC945 2SC950 2SC959 2SC980	10p 40p 225p 40p
TA8432 TA8605N TA8606N TA8607P	200p 350p 350p 320p	TDA1519A TDA1520 TDA1521 TDA1522	200p 276p 210p 110p	TDA3510 TDA3520 TDA3530 TDA3540	250p 250p 250p 200p	TDA5030A TDA5140A TDA5330T	100p 200p 300p	TDA8730 TDA8732 TDA8735	226p 300p 175p	UPC1187 UPC1188H UPC1191	150p 350p 300p	2SA879 2SA884 2SA885	30p 100p 35p	2SA1232 2SA1237 2SA1238	180p 25p 30p	2S8718 2S8727 2S8733	60p 100p 75p	2SC982 2SC983 2SC1000	20p 120p 20p
TA8611AN TA8615N TA8628N	260p 480p 350p	TDA1524 TDA1526 TDA1534	200p 225p 2000p	TDA3541 TDA3560 TDA3561	176p 260p 300p	TDA5331T TDA5332T TDA5500	200p 160p 400p	TDA8740 TDA8741 TDA8808T	625p 650p 325p	UPC1197 UPC1198H UPC1210	140p 200p 150p	2SA885 2SA887 2SA893	45p 20p 15p	2SA1239 2SA1240 2SA1242	30p 45p - 80p	258734 258737 258739	35p 20p 22p	2SC1001 2SC1008 2SC1010	950p 20p 226p
TA8631 TA8632N TA8644N	600p 650p 426p	TDA1540 TDA1541 TDA1542	420p 600p 250p	TDA3561A TDA3562 TDA3562TF		TDA5600 TDA5660P TDA5700	450p 260p 200p	TDA8809T TDA9045 TDA9080	360p 300p 400p	UPC1215V UPC1222 UPC1225H	125p 130p 220p	2SA896 2SA899 2SA900	25p 40p 45p	2SA1244 2SA1245 2SA1246	120p 65p 80p 35p	2SB744 2S8750 2S8753 2SB754	66p 60p 100p 80p	2SC1012 2SC1013 2SC1014 2SC1030	75p 170p 140p 150p
TA8646 TA8653N TA8659AN TA8690N	375p 1500p 900p 700p	TDA1543 TDA1552Q TDA1553A0 TDA1555Q	200p 350p 325p 375p	TDA3563 TDA3564 TDA3565 TDA3566	350p 325p 220p 280p	TDA5701 TDA5708 TDA5709 TDA5800	200p 275p 375p 850p	TDA9102C TDA9403 TDA9500 TDA9503	250p 130p 750p 650p	UPC1227V UPC1228HA UPC1230 UPC1237HA	225p 45p 200p 70p	2SA904 2SA907 2SA909 2SA912	20p 650p 500p 70p	2SA1248 2SA1249 2SA1252 2SA1253	100p 20p 30p	2SB764 2SB765 2SB772	30p 70p 26p	2SC1046 2SC1047 2SC1050	250p 20p 280p
TA8691N TA8701AN TA8718N	460p 275p 550p	TDA 15570 TDA 15580 TDA 15600	300p 300p 675p	TDA3567 TDA3569 TDA3570	350p 300p 376p	TDA5820 TDA5832 TDA5850	370p 125p 175p	TDA9513 TDA9800 TDA9821	225p 225p 200p	UPC1238 UPC1241H UPC1242H	120p 150p 150p	2SA913 2SA914 2SA915	100p 90p 30p	2SA1256 2SA1257 2SA1258	30p 30p 70p	2SB774 2SB775 2SB776	50p 100p 110p	2SC1051 2SC1061 2SC1069	260p 86p 176p
TA8720 TA8739P TA8872N	525p 460p 450p	TDA1571 TDA1572 TDA1574	300p 175p 126p	TDA3580 TDA3586 TDA3590	300p 760p 250p	TDA5930 TDA6100Q TDA6101Q	225p 150p 120p	TEA0652 TEA0653T TEA0855	150p 80p 300p	UPC1245V UPC1270H UPC1274V	130p 250p 260p	2SA916 2SA921 2SA928A	30p 40p 25p	2SA1261 2SA1262 2SA1263 2SA1264	150p 110p 280p	2SB788 2SB791 2SB794	35p 130p 40p	2SC1070 2SC1079 2SC1080	65p 300p 225p 40p
TAA550 T8A120S T8A396	25p 40p 70p	TDA 1576 TDA 1578A TDA 1579 TDA 1589	170p 210p 130p	TDA3591 TDA3592A TDA3601Q TDA3602	360p 300p 376p 226p	TDA61110 TDA6200 TDA6600-2 TDA6610-2	225p 750p 700p 1100p	TEA0665 TEA1002 TEA1007 TEA1009	300p 650p 120p 100p	UPC1277 UPC1278 UPC1288V UPC1297CA	240p 240p 230p 325p	2SA933 2SA934 2SA935 2SA937	30p 30p 40p 20p	2SA 1264 2SA 1265 2SA 1283 2SA 1284	280p 200p 50p 60p	2SB795 2SB810 2SB816 2SB817	45p 15p 160p 175p	2SC1096 2SC1098 2SC1106 2SC1114	120p 180p 415p
T8A520 T8A530 T8A540 TBA560	120p 100p 90p 90p	TDA1595 TDA1596 TDA1598	275p 275p 200p 160p	TDA3611 TDA3640 TDA3645	450p 350p 400p	TDA6612-2 TDA7000 TDA7010T	900p 170p 120p	TEA1015P TEA1017 TEA1019	110p 280p 130p	UPC1298 UPC1313H A UPC1316C	320p	2SA939 2SA940 2SA942	140p 50p 60p	2SA1288 2SA1289 2SA1290	60p 50p 150p	2SB819 2SB822 2S8824	60p 40p 60p	2SC1115 2SC1116 2SC1124	280p 290p 270p
T8A800 T8A810AS T8A820	40p 40p 55p	TDA1600 TDA1602A TDA1670A	200p 400p 200p	TDA3651 TDA3652 TDA3652-TX	200p 500p 10800p	TDA7020T TDA7021T TDA7050	175p 200p 100p	TEA1024 TEA1035 TEA1039	150p 200p 150p	UPC1318 UPC1330HA UPC1335V	300p 80p 320p	2SA949 2SA950 2SA951	70p 18p 60p	2SA1293 2SA1294 2SA1295	110p 450p 500p	2S8825 2S8826 2S8827	136p 76p 200p	2SC1161 2SC1162 2SC1164	110p 30p 800p
T8A820M T8A920 T8A950	35p 100p 100p	TDA1675 TDA1701 TDA1771	200p 500p 200p	TDA3653 TDA3654 TDA3654Q	86p 80p 85p	TDA7052 TDA7053 TDA7058 TDA70570	120p 200p 200p 225p	TEA1045 TEA1060 TEA1061 TEA1062	300p 226p 176p 280p	UPC1350 UPC1352C UPC1360C UPC1362C	115p 450p 200p 250p	2SA952 2SA953 2SA954 2SA957	30p 60p .30p 185p	2SA1301 2SA1302 2SA1303 2SA1304	260p 300p 400p 110p	2S8828 2S8829 2S8835 2S8857	200p 200p 75p 80p	2SC1165 2SC1166 2SC1170 2SC1172	750p 100p 180p 160p
T8A990 TC5020 TC5081AP TC5082P	60p 200p 80p 170p	TDA1870A TDA1872A TDA1904 TDA1905	200p 275p 80p 80p	TDA3710 TDA3720 TDA3724 TDA3725	300p 175p 300p 300p	TDA7072 TDA7077 TDA7077 TDA7211	100p 175p 100p	TEA1064 TEA1067 TEA1068	260p 150p 350p	UPC1363 UPC1363C UPC1364C	190p 300p 350p	2SA958 2SA963 2SA965	60p 120p 30p	2SA1306 2SA1307 2SA1309	110p 100p 60p	2SB861 2SB863 2SB865	110p 220p 25p	2SC1173 2SC1195 2SC1212	33p 210p 36p
TC5090A TC91258P TC9130P	230p 410p 150p	TDA1908A TDA1910 TDA1940	90p 160p 180p	TDA3730 TDA3740 TDA3750	400p 400p 400p	TDA7220 TDA7222 TDA7230A	65p 100p 150p	TEA1080P TEA1087 TEA1101	170p 40p 425p	UPC1365 UPC1366C UPC1370C	250p 130p 300p	2SA966 2SA968 2SA970	25p 55p 25p	2SA1315 2SA1317 2SA1318	100p 30p 20p	2S8882 2S8665 2S8891	180p 46p 35p	2SC1213 2SC1214 2SC1215	10p 16p 25p
TC9134 TC9135P TC9137P	760p 125p 600p	TDA1941 TDA1950 TDA2002	300p 176p 50p	TDA3755 TDA3760 TDA3765V	425p 360p 225p	TDA7231A TDA7233 TDA7240 TDA7241	80p 60p 175p	TEA1330 TEA1511 TEA2000	65p 150p 500p 80p	UPC1373 UPC1377C UPC1378 UPC1379C	86p 200p 1000p 170p	2SA979 2SA984 2SA985 2SA988	35p 25p 60p 25p	2SA1319 2SA1320 2SA1321 2SA1327	25p 45p 80p 130p	2S8892 2S8895 2S8908 2S8926	25p 60p 70p 30p	2SC1216 2SC1222 2SC1226 2SC1237	200p 15p 75p 250p
TC9138AP TC9142 TC9143 TC9145	160p 320p 300p 160p	TDA2003 TDA2004 TDA2005 TDA2006	65p 150p 160p 70p	TDA3771 TDA3780 TDA3791 TDA3800	460p 400p 200p 250p	TDA7245 TDA7250 TDA7255	250p 225p 400p 400p	TEA2014A TEA2018A TEA2019 TEA20258	110p 600p 75p	UPC1382 UPC1384 UPC1387C	110p 425p 250p	2SA991 2SA992 2SA993	30p 30p 60p	2SA1329 2SA1348 2SA1348	200p 20p 45p	2S8941 2S8950 2S8951	60p 180p 190p	2SC1247A 2SC1252 2SC1278	35p 850p 110p
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 TEA20288 TEA2029A	325p 375p 650p	UPC1394 UPC1397 UPC1403CA	120p 350p 650p	2SA995 2SA999 2SA1005	60p 30p 26p	2SA1352 2SA1353 2SA1356	100p 100p 100p	258953 258975 258985	90p 100p 30p	2SC1279 2SC1308K 2SC1312	30p 350p 40p
TC9151P TC9152 TC9153	425p 425p 300p	TDA2010 TDA2020 TDA2030	150p 120p 80p 100p	TDA3827 TDA3840 TDA3842 TDA3843	110p 200p 200p	TDA7273 TDA7274 TDA7275	80p 45p 75p 50p	TEA2029C TEA2031A TEA2037	270p 125p 200p	UPC1406HA UPC1420CA UPC1421CA UPC1423CA	460p 650p	2SA1008 2SA1008 2SA1009 2SA1010	90p 125p 200p 225p	2SA1357 2SA1358 2SA1359 2SA1360	65p 130p 46p 46p	2S8986 2S81009 2S81010 2S81012	40p 110p 25p 55p	2SC1318 2SC1325 2SC1327 2SC1328	10p 400p 20p 15p
TC9154AP TC9156 TC9158P TC9162	225p 300p 450p 275p	TDA2030H TDA2040 TDA2048 TDA2051V	140p 600p 450p	TDA3843 TDA3845 TDA3856 TDA3857	200p 225p 300p 200p	TDA7282 TDA7284 TDA7302 TDA7310	100p 450p 800p	TEA2114 TEA2117 TEA2130 TEA2164	200p 450p 350p 180p	UPC1470 UPC1474HA UPC1484CA	200p 75p	2SA1010 2SA1011 2SA1012 2SA1013	80p 85p 100p	2SA1360 2SA1362 2SA1370 2SA1371	25p 50p 100p	2581015 2581016 2581016 2581017	60p 130p 40p	2SC1342 2SC1343 2SC1345	15p 200p 15p
TC9163 TC9164 TC9167P	376p 400p 100p	TDA2052V TDA2054M TDA2107	626p 110p 250p	TDA3950 TDA4001 TDA4050	225p 260p 150p	TDA7313 TDA7318 TDA7330A	650p 650p 700p	TEA2260 TEA2261 TEA2262	226p 185p 276p	UPC1488H UPC1498H UPC1505C	115p 500p 400p	2SA1015 2SA1016 2SA1018	10p 30p 100p	2SA1376 2SA1380 2SA1381	30p 75p 100p	2581018 2581020 2581039	130p 120p 65p	2SC1348 2SC1358 2SC1359	100p 270p 15p
TC9172P TC9174P TC9176P	300p 325p 600p	TDA2148 TDA2151 TDA2170	325p 375p 1300p	TDA4052 TDA4060 TDA4092 TDA4100	500p 500p 250p	TDA7350 TDA7359 TDA7360	300p 300p 700p	TEA3717DP TEA3718S TEA5030	175p 135p	UPC1513HA UPC1514CA UPC1515CA	260p	2SA1020 2SA1021 2SA1023 2SA1026	30p 35p 60p 90p	2SA1382 2SA1385 2SA1386 2SA1387	120p 180p 400p 75p	2581066 2581088 2581077 2581098	40p 160p 180p 80p	2SC1360 2SC1364 2SC1368 2SC1382	70p 25p 75p 40p
TC9177P TCA9940 TCEP100 TD62308AP	225p 100p 100p 200p	TDA2220 TDA2270 TDA2320 TDA2501	200p 250p 80p 300p	TDA4100 TDA4173AI TDA4180 TDA4190	150p 325p 145p 180p	TDA7361 TDA7370V TDA7374V TDA7770	176p 326p 350p 140p	TEA5040 TEA5101A TEA5110 TEA5114A	650p 175p 175p 200p	UPC1520CA UPC1521HA UPC1536C 2SA329	260p 120p 660p 76p	2SA1020 2SA1029 2SA1038 2SA1037	60p 60p 50p	2SA1396 2SA1399 2SA1399 2SA1400	120p 25p 150p	2581099 2581109 2581109 2581123	76p 40p 50p	2SC1383 2SC1384 2SC1393	26p 20p 20p
TD62382 TD62506 TD62705	200p 200p 250p	TDA2502 TDA2503 TDA2504	175p 200p 200p	TDA4200 TDA4210 TDA4260	300p 160p 250p	TDA8114 TDA8115 TDA8116	226p 200p 360p	TEA5115 TEA5116 TEA5170	220p 220p 200p	2SA467 2SA473 2SA483	40p 29p 90p	2SA1038 2SA1048 2SA1051	25p 300p	2SA1423 2SA1428 2SA1441	30 p 35 p 110 p	2SB1133 2SB1134 2S81135	60p 65p 60p	2SC1394 2SC1398 2SC1399	16p 55p 100p
TD6304AP TD6306P TD6350P TD6359P	300p 350p 200p 300p	TDA2505 TDA2506 TDA2507 TDA2507T	220p 400p 450p 450p	TDA4280 TDA4282 TDA4283T TDA4283T	320p 360p 450p 125p	TDA81208 TDA8124 TDA8134 TDA8135	400p 260p 226p 226p	TEA5500 TEA5501 TEA5550 TEA5560	325p 226p 150p 130p	2SA484 2SA489 2SA490 2SA493	80p 80p 45p 25p	2SA1052 2SA1060 2SA1061 2SA1069	15p 120p 300p 150p	2SA1442 2SA1443 2SA1450 2SA1459	110p 130p 30p 40p	2S81140 2SB1143 2S81151 2S81162	45p 40p 75p 400p	2SC1400 2SC1403 2SC1407 2SC1413	50p 500p 50p 150p
TDA1001 TDA1002 TDA1003	200p 200p 160p	TDA2510 TDA2514A TDA2515	450p 600p 450p	TDA4400 TDA4420 TDA4421	176p 120p 300p	TDA8136 TDA8137 TDA8138	225p 200p 200p	TEA5570 TEA5580 TEA5581	85p 165p 200p	2SA495 2SA496 2SA505 2SA509	40p 30p 120p 35p	2SA1069 2SA1073 2SA1078 2SA1077	375p 230p 300p	2SA1462 2SA1469 2SA1475	25p 100p 95p	2SB1163 2SB1168 2S81182	370p 60p 40p	2SC1419 2SC1426 2SC1429	50p 700p 50p
TDA1005A TDA1010A TDA1011	176p 80p 76p	TDA2530 TDA2532 TDA2540 TDA2541	300p 100p 150p	TDA4426 TDA4427 TDA4431	170p 200p 150p	TDA8138A TDA8138B TDA8139	130p 200p 200p	TEA5591 TEA5620 TEA5630 TEA5640E	200p 300p 225p	2SA537 2SA539	35p 170p 20p 850p	2SA1080 2SA1081 2SA1082	125p 80p 80p 20p	2SA1488 2SA1489 2SA1490 2SA1491	150p 300p 225p 300p	2S81185 2SB1202 2SB1203 2SB1204	50p 45p 45p 45p	2SC1431 2SC1444 2SC1445 2SC1446	400p 275p 350p 55p
TDA1012 TDA1013A TDA1015 TDA1018	120p 110p 85p 140p	TDA2541 TDA2542 TDA2543 TDA2544	70p 110p 210p 200p	TDA4433 TDA4437 TDA4439 TDA4440	100p 125p 220p 180p	TDA8140 TDA8143 TDA8145 TDA8145 TDA8146	200p 160p 120p 200p	TEA5640E TEA5701 TEA6000 TEA6100	760p 650p 400p 350p	2SA544 2SA550 2SA562 2SA564	150p 30p 15p	2SA1083 2SA1084 2SA1085 2SA1091	100p 75p 100p	2SA1491 2SA1492 2SA1493 2SA1494	260p 500p 450p	2SB1205 2SB1223 2SB1223 2SB1243	40p 60p 40p	2SC1447 2SC1449 2SC1450	70p 120p 200p
TDA1020 TDA1022 TDA1023	110p 330p 130p	TDA2545 TDA2548A TDA2548	120p 200p 200p	TDA4442 TDA4443 TDA4445	240p 250p 220p	TDA8160 TDA8170 TDA8172	125p 170p 200p 175p	TEA6200 TEA6300 TEA6310T	225p 600p 425p	2SA571 2SA603 2SA606	650p 100p 200p	2SA1093 2SA1094 2SA1095	180p 190p 300p	2SA1516 2SA1519 2SA1523	260p 20p 45p	2S81274 2SB1282 2SB1318	40p 300p 40p	2SC1454 2SC1470 2SC1472	250p 120p 40p
TDA1024 TDA1025 TDA1028	150p 320p 175p	TDA2549 TDA2555 TDA2556	300p 175p 230p	TDA4450 TDA4452 TDA4453 TDA4480	225p 250p 275p 280p	TDA8173 TDA8174 TDA8175 TDA8178	200p 300p	TEA6414A TEA6415B TEA6420 TEA8172	425p 525p 360p 125p	2SA608 2SA614 2SA628 2SA628	18p 160p 20p 50p	2SA1096 2SA1102 2SA1103 2SA1104	80p 130p 130p 140p	2SA1535 2SA1538 2SA1540 2SA1540 2SA1598	175p 55p 50p 220p	2SB1375 2SB1382 2SB1468 2SC182	45p 360p 100p 75p	2SC1473 2SC1474 2SC1501 2SC1505	16p 46p 70p 56p
TDA1029 TDA1035 TDA1038 TDA1041E	200p 160p 500p 260p	TDA2557 TDA2558 TDA2574V TDA2575A	225p 400p 350p 100p	TDA4481 TDA4482 TDA4500	215p 200p 300p	TDA8179S TDA8185 TDA8190	650p 750p 180p 200p	TL431 TL494 TLO61	45p 100p 40p	2SA634 2SA636 2SA639 2SA640	50p 60p 60p	2SA1105 2SA1106 2SA1111	250p 160p 90p	2SA1599 2SA1600 2SA1601	220p 250p 200p	2SC372 2SC380 2SC388A	25p 10p 25p	2SC1507 2SC1509 2SC1514	45p 35p 35p
TDA1041P TDA1044 TDA1047	180p 110p 200p	TDA2577A TDA2578A TDA2579A TDA2579A TDA2582	200p 200p 210p	TDA4501 TDA4502 TDA4503	280p 400p 325p 300p	TDA8191 TDA8192 TDA8196	200p 425p 200p 120p	TLO64 TLO71 TLO74	60p 38p 80p	2SA642 2SA643 2SA673	60p 25p 15p	2SA1112 2SA1115 2SA1120	150p 30p 40p	2SA1625 2SA1626 2SA1640	40p 90p 100p	2SC394 2SC403 2SC454	60p 25p 15p	2SC1515 2SC1520 2SC1541	60p 45p 110p
TDA1048 TDA1053 TDA1054 TDA1057	200p 300p 180p 60p	TDA2582 TDA2590 TDA2591 TDA2591Q	130p 170p 110p 150p	TDA4505A TDA4505E TDA4505K TDA4505M	275p 450p	TDA8205 TDA8213 TDA8214B TDA8215H	1250p 175p 225p 300p	TLO83 TLO84 TMP47C-434 TPU2732	56p 70p 1250p 800p	2SA677 2SA678 2SA683 2SA684	35p 26p 25p 25p	2SA1123 2SA1124 2SA1127 2SA1133	40p 60p 50p 120p	2SA1652 2SA1667 2SA1668 2SA1671	70p 175p 180p 310p	2SC458 2SC460 2SC461 2SC495	10p 10p 15p 45p	2SC1545 2SC1567 2SC1568 2SC1569	120p 40p 35p 55p
TDA1057 TDA1059B TDA1060 TDA1062	40p 140p 140p	TDA2593 TDA2594 TDA2595	80p 300p 200p	TDA450510 TDA4510 TDA4532 TDA4555	200p 200p 276p	TDA8217 TDA8303 TDA6304	225p 250p 400p	TPU2735 UC3524 UC3842N	500p 100p 80p	2SA699 2SA705 2SA706	100p 70p 140p	2SA1135 2SA1141 2SA1142	130p 200p 100p	2SA1673 2SA1680 2SA1708	425p 40p 25p	2SC496 2SC497 2SC515 2SC535	26p 85p 100p	2SC1570 2SC1571 2SC1573	40p 50p 25p
TDA1088 TDA1072 TDA1074	.75p 150p 280p	TDA2600 TDA2611A TDA2616	400p 100p 250p	TDA4556 TDA4557 TDA4560	370p 200p 270p	TDA8305 TDA8340 TDA8341	500p 150p 250p	UC3843 UC3844 UPC20C	125p 70p 220p	2SA708 2SA711 2SA715	50p 280p 60p	2SA1143 2SA1145 2SA1146	15p 40p 200p	2SB175 2SB324 2SB337	45p 40p 150p	2SC536 2SC605	30p 20p 100p	2SC1576 2SC1580 2SC1583	550p 600p 25p
TDA1077 TDA1082 TDA1083 TDA1085	250p 275p 95p 170p	TDA2630 TDA2640 TDA2653A TDA2654	300p 350p 350p 200p	TDA4565 TDA4566 TDA4568 TDA4568 TDA4570	150p 250p 225p 200p	TDA8349A TDA7350Q TDA8351 TDA8380N3	360p 275p 200p 800p	UPC554 UPC555 UPC556H UPC571	130p 60p 80p 220p	2SA719 2SA720 2SA725 2SA726	60p 20p 80p 20p	2SA1151 2SA1152 2SA1153 2SA1153 2SA1154	30p 150p 30p 22p	2S8474 2S8492 2S8511 2S8525	250p 80p 55p 65p	2SC619 2SC641 2SC644 2SC647	100p 80p 10p 300p	2SC1586 2SC1617 2SC1619 2SC1623	640p 340p 170p 50p
TDA1087 TDA1092 TDA1097	60p 100p 476p	TDA2658 TDA2670 TDA2690	300p	TDA4570 TDA4580 TDA4600 TDA4600II TDA4601	200p 400p 200p 160p 120p	TDA6361N3 TDA8362AN TDA8362N3	900p 1200p 1200p	UPC574 UPC575C2 UPC577	60p 90p 64p	2SA733 2SA740 2SA742	16p .90p	2SA1156 2SA1162 2SA1163	90p 30p 15p	2S8527 2S8531 2S8536	130p 400p 80p	2SC681 2SC683 2SC708	260p 36p 100p	2SC1624 2SC1626 2SC1627	60p 65p 15p
TDA1151 TDA1154 TDA1170	40p 60p 86p	TDA2710-1 TDA2721 TDA2730 TDA2740.	100p 400p 200p 200p	TDA4605 TDA4610	190p 370p	TDA8366N2 TDA8372A TDA8380	1600p 1850p 200p	UPC592 UPC595 UPC596	95p 190p 190p	2SA747A 2SA748 2SA764	425p 60p 200p 80p	2SA1169 2SA1170 2SA1173 2SA1173	500p 500p 60p 25p	-258537 258544 258546 258549	90p 22p 45p 50p	2SC710 2SC711 2SC730 2SC732	15p 15p 350p 40p	2SC1628 2SC1634 2SC1667 2SC1669	75p 60p 450p 100p
TDA1170N TDA1175	86p 175p	[TDA27,50	300p 200p	TDA4650 TDA4660	300p 200p	TDA8385 TDA8390A	276p 660p	UPC1001 UPC1004C	220p 130p	2SA769 2SA770	200p	2SA1175	30p	2\$8560	26p	2SC735	40p	2SC1674	16p
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JAPANESE TRANSISTORS

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	Part	Price	Part	Price	Part	Price	Part 👘	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
	2SC1675																			
	2SC1683	100p	2SC2270	60p	2SC2724	16p	2SC3269		2SC3808	70p	2SD291	250p	2SD889	35p	2SD1330	60p	2SD1765	70p		
	2SC1684																		2 <mark>5K3</mark> 23	130p
	2SC1729	900p	2SC2275	50p	2SC2750	300p	2SC3277	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p		
	2SC1740	10p	2SC2290	1800p	2SC2767	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p		
		35p 90p		40p 35p		400p 700p		600p 85p	2SC3853 2SC3855											
	2SC1756	36p	2SC2307	300p	2SC2774	500p	2SC3298	50p	2SC3857	500p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK373	40p
	2SC1758 2SC1760																			
	2SC1775																			
	2SC1789																			
	2SC1809																			
	2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1849	280p		
	2SC1819																			
	2SC1827	60p	2SC2230	300p	2SC2824	76p	2SC3327	60p	2SC3890	160p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p		
	2SC1834		2SC2334	80p	2SC2827			25p	2SC3895											
	2SC1844																	175p		
	2SC1845																			
	2SC1847	46p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	16p	2SD1012	40p	2SD1413	60p	2SD1880	360p		
	2SC1855 2SC1856															190p 76p			2SK539	1100p
	2SC1865	700p	2SC2362	60p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p		
	2SC1870 2SC1871							300p 60p				50p 70p	2SD1024 2SD1027			135p 160p		226p 300p	2SK553	225p
	2SC1875	220p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3964	100p	2SD545	18p	2SD1030	76p	2SD1428	180p	2SD1895	225p		
	2SC1881 2SC1890																			
	2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	226p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK559	600p
	2SC1906	16p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p		
Schult Map Schult Map <t< td=""><td>2SC1907 2SC1909</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2SK606</td><td>70p</td></t<>	2SC1907 2SC1909																		2SK606	70p
Scile Tip Scile Tip <th< td=""><td>2SC1913</td><td>90p</td><td>2SC2458</td><td>10p</td><td>2SC2922</td><td>480p</td><td>2SC3401</td><td>50p</td><td>2SC4006</td><td>100p</td><td>2SD571</td><td>20p</td><td>2SD1062</td><td>150p</td><td>2SD1442</td><td>80p</td><td>2SD1941</td><td>350p</td><td></td><td></td></th<>	2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p		
Schler The Schler Schler Schler Schler	2SC1914 2SC1921			55p				40p 130p	2SC4020 2SC4023			26p								1150p
Schler Indy Schler Map <	2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	350p	2SD596	26p	2SD1065	160p	2SD1450	60p		210p		100p
Schule Top Schule Schule Schule Schule	2SC1923																			
Sciell Baby Sciell Baby <th< td=""><td>2SC1940</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2SK725</td><td>660p</td></th<>	2SC1940																		2SK725	660p
Schwart Schwart <t< td=""><td>2SC1941</td><td></td><td></td><td>120p</td><td></td><td></td><td>2SC3421</td><td></td><td>2SC4064</td><td>140p</td><td>2SD613</td><td></td><td>2SD1110</td><td></td><td>2SD1457</td><td>165p</td><td>2SD1996</td><td>45p</td><td></td><td>425p</td></t<>	2SC1941			120p			2SC3421		2SC4064	140p	2SD613		2SD1110		2SD1457	165p	2SD1996	45p		425p
Scient Indo Scient Scient <td>2SC1944 2SC1945</td> <td></td>	2SC1944 2SC1945																			
Science Science <t< td=""><td>2SC1946</td><td>1500p</td><td>2SC2491</td><td>200p</td><td>2SC2987</td><td>250p</td><td>2SC3425</td><td>65p</td><td>2SC4123</td><td>230p</td><td>2SD636</td><td>10p</td><td>2SD1128</td><td>200p</td><td>2SD1468</td><td>40p</td><td>2SD2011</td><td>60p</td><td></td><td></td></t<>	2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	10p	2SD1128	200p	2SD1468	40p	2SD2011	60p		
Science Too Science Sc																				
Science Trip Science S	2SC1957	70p	2SC2502	140p															2SK787	800p
Schling Soc. 100	2SC1959 2SC1962																			
Scierro 100p ZCC237 300p ZCC238 100p ZCC388 200p ZCC388 200p <t< td=""><td>2SC1967</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2SK793</td><td></td></t<>	2SC1967																		2SK793	
Szc:197 GOOD ZC:208 TOP ZC:208 <thz:208< th=""> TOP ZC:208</thz:208<>	2SC1970	100p	2SC2527	300p	2SC3025	500p	2SC3466	226p	2SC4169	60p	2SD667	20p	2SD1153	30p	2SD1508	60p	2SD2144	36p		
S2C1973 1360p 25C2331 1360p 25C2432 270p 25C4231 280p7	2SC1971 2SC1972											36p 350p						175p		
3261:88 30p 25C:380 30p 25C:380 40p 25C:481 460p 25C:184 460p 25D:186 470p 25D:155 460p 25D:125 450p 25D:155 450p 25D:155 450p 25D:155 450p 25D:155 25D:155 </td <td>2SC1973</td> <td>150p</td> <td>2SC2538</td> <td>100p</td> <td>2SC3037</td> <td>125p</td> <td>2SC3482</td> <td>275p</td> <td>2SC4231</td> <td>250p</td> <td>2SD676</td> <td>250p</td> <td></td> <td>220p</td> <td></td> <td></td> <td>2SD2331</td> <td>260p</td> <td></td> <td>150p</td>	2SC1973	150p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250p	2SD676	250p		220p			2SD2331	260p		150p
Science Tep Science Tep Science Scienc	2SC1980	30p	2SC2542		2SC3039	80p	2SC3502	50p	2SC4236	450p	2SD718	85p	2SD1168	270p	2SD1525	450p	2SD2340	225p		
3251 1000 25C338 1000 25C335 25C435 2500 250114 2501147 1000 2501175 1000 2501175 1000 2501175 1000 2501175 1000 2501175 2000 2501175 2000 2501175 2000 250117	2SC1983																		2SK872	650p
252:200 100 252:300 100 252:300 250:32 <td>2SC1985</td> <td>100p</td> <td>2SC2547</td> <td>65p</td> <td>2SC3052</td> <td>30p</td> <td>2SC3505</td> <td>240p</td> <td>2SC4278</td> <td>176p</td> <td>2SD726</td> <td>275p</td> <td>2SD1185</td> <td>280p</td> <td>2SD1545</td> <td>275p</td> <td>2SJ74</td> <td>60p</td> <td></td> <td></td>	2SC1985	100p	2SC2547	65p	2SC3052	30p	2SC3505	240p	2SC4278	176p	2SD726	275p	2SD1185	280p	2SD1545	275p	2SJ74	60p		
156 25C202 169 25C307 359 25C308 760 25C311 1709 25D141 1709 25D155 160 25U103 7109 25U103 7109 25U103 7109 25U103 7109 25U103 7109 25U114 7109 25U117 7209																			1	500p
282:204 200 28:2037 100 28:2037 1000 28:2037 1000 28:308 4000 28:0137 1200 28:01100	2SC2002	16p	2SC2552	60p	2SC3070	35p	2SC3509	760p	2SC4301	300p	2SD734	16p	2SD1191	120p	2SD1554	170p		225p		276p
1800 252C283 2000 25C387 1700 25C388 2000 25C381 2200 25C381 2000 25C381 2000 25C381 2000 25C448 2000 25D173 2000 25D175 2000 25L182 2001 25L182 <t< td=""><td>2SC2004</td><td></td><td>2SC2555</td><td></td><td>2SC3073</td><td>100p</td><td>2SC3518</td><td>120p</td><td>2SC4313</td><td>600p</td><td>2SD743</td><td>130p</td><td>2SD1196</td><td>150p</td><td>2SD1556</td><td>225p</td><td>2SJ109</td><td>200p</td><td></td><td>450p</td></t<>	2SC2004		2SC2555		2SC3073	100p	2SC3518	120p	2SC4313	600p	2SD743	130p	2SD1196	150p	2SD1556	225p	2SJ109	200p		450p
352 353 352 353 352 353 352 353 352 353 352 353 352 353 352 353 352 353 352 <td>2SC2022</td> <td></td>	2SC2022																			
Schuld, 2009 Zolumba Top Zolumba Zolumba Top Zolumba Top Zolumba Zolumba <thzolumba< th=""> Zolumba Zolumb</thzolumba<>	2SC2026	30p	2SC2568	120p	2SC3077	120p	2SC3528	750p	2SC4386	275p	2SD762	100p	2SD1207	40p	2SD1572	100p	2SJ116	1200p		
B2C2037 G0p B2C2171 110p B2C3181 380p B2C383 200p 250173 200p <	2SC2027 2SC2036							200p		60p								660p 700p	2SK1036	460p
SEC2055 1100 SEC2175 1107 SEC2175 125 SEC2575 126 <	2SC2037	50p	2SC2577	110p	2SC3101	750p	2SC3552	270p	2SC4429	276p	2SD772	200p	2SD1213	220p	2SD1577	250p	2SJ162	680p		800p 800p
252/208 200 25/208 200 25/208 2000	2SC2055	150p	2SC2579	110p	2SC3114	40p	2SC3577	276p	2SC4466	326p	2SD774	30p	2SD1223	76p	2SD1589	60p	2SJ182	160p	2SK1081	700p
252/2061 76p 252/288 600p 25/238 600p 25/238 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2500 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2500 2501/23 2501/23 2500 2501/23 2501/23 2500 2501/23 2501/23 2500 2501/23 2501/23 2500 2501/23 2501/23 2500 2501/23 25001/23 2500/23 2500/23 <	2SC2058	20p	2SC2580	176p	2SC3116			200p												450p
SEC208 60p SEC2590 40p SEC3148 140p SEC4571 420p ZSD1237 300p ZSD168 20p ZSL1237 300p ZSD168 20p ZSL1243 300p ZSD168 300p ZSD161 TSD ZSD178 300p ZSD161 TSD ZSD178 30p ZSD161 TSD ZSD177 TSD ZSD178 TSD ZSD178 TSD ZSD177 TSD <thzsd177< th=""> TSD ZSD177</thzsd177<>	2SC2061	76p	2SC2588	600p	2SC3122	50p	2SC3595	220p	2SC4517	200p	2SD786	100p	2SD1229	260p	2SD1593	126p	2SK19	46p		376p 250p
25C2073 40p 25C2552 200p 25C3151 170p 25C4352 100p 25C4352 100p 25C3151 170p 25C4351 170p 25C4351 170p 25C3151 170p 25C	2SC2068 2SC2071															210p			2SK1118	225p
Saccors Gip Saccors Sa	2SC2073	40p	2SC2592	200p	2SC3150	100p	2SC3600	176p	2SC4532	1000p	2SD789	20p	2SD1244	25p	2SD1609	46p	2SK55	100p		
252:208 100p 252:281 30p 253:38 175p 250:361 410p 251:251 180p 250:164 40p 255:271 200p 255:172 250:176 750p 255:171 50p 255:171 60p 255:173 100p 255:173 100p 255:171 100p 255:171 100p 255:171 100p 255:171 100p 255:171 90p 255:171 90p 255:171 90p 255:171 90p 255:171 90p <td>2SC2078</td> <td>95p</td> <td>2SC2610</td> <td>60p</td> <td>2SC3152</td> <td>130p</td> <td>2SC3607</td> <td>160p</td> <td>2SC4742</td> <td>276p</td> <td>2SD794</td> <td>33p</td> <td>2SD1247</td> <td>40p</td> <td>2SD1637</td> <td>60p</td> <td>2SK73</td> <td>76p</td> <td>2SK1191</td> <td>800p</td>	2SC2078	95p	2SC2610	60p	2SC3152	130p	2SC3607	160p	2SC4742	276p	2SD794	33p	2SD1247	40p	2SD1637	60p	2SK73	76p	2SK1191	800p
22c2002 100p 2SC2825 190p 2SC3836 280p 2SC4747 375p 2SC799 160p 2SD1263 90p SSD1650 160p 2SK107 40p SK1275 275p 2SC2084 1200p 2SC3664 280p 2SC3657 400p 2SC4757 200p 2SD1656 150p 2SK117 60p 2SK129 450p 2SC155 75p 2SD1656 250p 2SK118 60p 2SK129 460p 2SK129 450p 2SC2637 100p 2SC3657 40p 2SC478 220p 2SD1616 150p 2SK137 900p 2SK137 900p 2SK137 900p 2SC477 2S0p 2SD262 250p 2SD1266 150p 2SK137 100p 2SC477 2S0p 2SD1271 65p 2SD1667 120p 2SK137 160p 2SC3677 100p 2SC482 250p 2SD1271 65p 2SD1669 85p 2SK162 40p 2SK135 20p 2SC487 30p 2SD167	2SC2085	100p	2SC2611	30p	2SC3153	175p	2SC3608	65p	2SC4744	350p	2SD795A	140p	2SD1251	180p		40p	2SK97	200p		700p 200n
252C094 1200p 25C2626 600p 25C3184 200p 25C367 200p 25C368 300p 25C176 55p 25D166 50p 25C175 50p 25C176 50p 25C176 50p 25D166 50p 25C175 100p 25C387 100p 25C377 300p 25C478 20p 25D1267 55p 25D166 50p 25K173 60p 25K133 60p 25K134 60p 25K135 60p 25K138 60p<	2SC2092	100p	2SC2625	190p	2SC3157	200p	2SC3636	280p	2SC4747	376p	2SD799	160p	2SD1263	90p	2SD1650	160p	2SK107	40p		276p
25C2099 25C009 25C2081 2000 25C2180 3000 25D1266 1800 25D163 3500 25K118 600 25K1137 900 25C2118 1000 25C2832 350 25C3168 1600 25C367 1000 25C3173 3000 25C367 1000 25C367 1200 25K133 6500 25K1137 1600 25K133 6500 25K1137 1600 25K133 6500 25K1137 1600 25K133 6500 25K113 6500 25K1137 1600 25K133 6500 25K1137 1600 25K137 1600 25K137 1600 25K137 1600 25K137 1600 25K135 200	2SC2094											45p 450p							2SK1296	350p
Shi Citilia Tituting Sch Citilia Sch	2SC2099	2500p	2SC2631	20p	2SC3164	270p	2SC3659	600p	2SC4769	220p	2SD819	300p	2SD1266	180p	2SD1663	350p	2SK118	50p		
25C2122A 3000 25C387 200 25C317 1000 25C387 200 25C317 2200 25D171A 2250 25D168 900 25K1137 1600 25K1347 1600 25K1357 3600 25D175 500 25D1884 460 25K1357 3600 25C1175 500 25D1848 460 25K1357 3600 25C1175 500 25D184 700 25K144 300 25K1357 3600 25D177 600 25D184 700 25K144 300 25K137 3600 25D177 900 25D184 700 25K147 400 25K147 40						300p						260p 660p		65p 56p					2SK1338	260p
22c2141 00p 22c2240 1800p 22c2340 1800p 25c2450 1800p 25c2450 1800p 25c423 400p 25c842 400p 25c842 400p 25c842 400p 25c842 25c165 50p 25c1677 200p 25k163 40p 25k135 40p 25c166 40p 25c465 40p 25c388 45p 25c166 50p 25c168 45p 25c168 45p 25c175 50p 25b184 70p 25c188 40p 25k1356 40p 25k1356 40p 25k136 40p 25k137 16p <t< td=""><td>2SC2122A</td><td>300p</td><td>2SC2636</td><td>40p</td><td>2SC3173</td><td>180p</td><td>2SC3678</td><td>280p</td><td>2SC4826</td><td>70p</td><td>2SD822</td><td>290p</td><td>2SD1271A</td><td>226p</td><td>2SD1668</td><td>90p</td><td>2SK147</td><td>160p</td><td></td><td></td></t<>	2SC2122A	300p	2SC2636	40p	2SC3173	180p	2SC3678	280p	2SC4826	70p	2SD822	290p	2SD1271A	226p	2SD1668	90p	2SK147	160p		
25C2153 40p 25C2165 100p 25C2166 100p 25C180 100p 25C181 100p <td>2SC2141</td> <td>60p</td> <td>2SC2640</td> <td>1800p</td> <td>2SC3178</td> <td>125p</td> <td>2SC3680</td> <td>380p</td> <td>2SC4923</td> <td>400p</td> <td>2SD829</td> <td>375p</td> <td>2SD1273</td> <td>50p</td> <td>2SD1677</td> <td>200p</td> <td>2SK161</td> <td>30p</td> <td>2SK1350</td> <td>200p</td>	2SC2141	60p	2SC2640	1800p	2SC3178	125p	2SC3680	380p	2SC4923	400p	2SD829	375p	2SD1273	50p	2SD1677	200p	2SK161	30p	2SK1350	200p
25c2168 120p 25c2656 60p 25c3181 200p 25c308 60p 25c802 300p 25b83 65p 25c1176 60p 25c1164 70p 25c1164 70p 25c1176 60p 25c1183 40p 25c2188 70p 25c2686 100p 25c3181 10p 25c302 350p 25b838 600p 25b177 400p 25k1184 345p 25k137 160p 25c2208 50p 25c2665 100p 25c319 40p 25c3717 120p 25c5027 100p 25b124 20p 25b128 120p 25b1108 376p 25k114 240p 25k144 240p 25k144 240p 25k144 240p 25b1108 25b118 25b	2SC2153																			225p
25C2188 70p 25C2666 660p 25C3182 120p 25C3082 160p 25C803 350p 25D83 600p 25D177 190p 25D1706 326p 25K144 35p 25K147 160p 25C2200 50p 25C3660 100p 25C3182 30p 25C5048 100p 25D841 110p 25D177 600p 25K192 40p 25K140 260p 25C2208 60p 25C2661 10p 25C3202 25p 25C372 450p 25C5048 300p 25D841 110p 25D1288 175p 25D170 25K193 40p 25K140 290p 25C2216 660p 25C2671 100p 25C372 450p 25C5048 250p 25D1718 276p 25K144 290p 25C2228 60p 25C671 100p 25C374 100p 25C189 300p 25D856 250p 25D179 250p 25K144 26K144 250p 25C2236 60p 25C3742 100p 25C149 300p 25D866 23p 25D130 <t< td=""><td>2SC2168</td><td>120p</td><td>2SC2655</td><td>60p</td><td>2SC3181</td><td>200p</td><td>2SC3688</td><td>650p</td><td>2SC5002</td><td>300p</td><td>2SD837</td><td>66p</td><td>2SD1276</td><td>60p</td><td>2SD1684</td><td>70p</td><td>2SK170</td><td>50p</td><td>2SK1358</td><td>400p</td></t<>	2SC2168	120p	2SC2655	60p	2SC3181	200p	2SC3688	650p	2SC5002	300p	2SD837	66p	2SD1276	60p	2SD1684	70p	2SK170	50p	2SK1358	400p
25C2209 50p 25C2685 200p 25C3199 40p 25C3171 120p 25C5048 300p 25D850 175p 25D1788 375p 25K193 40p 25K140 290p 25C2216 60p 25C2671 100p 25C372 450p 25C5048 250p 25D129 250p 25D1718 276p 25K195 150p 25K140 290p 25D1718 276p 25K195 150p 25K140 290p 25D1718 276p 25K195 150p 25K140 290p 25C171 200p 25C171 200p 25C171 200p 25C171 200p 25C171 200p 25C174 100p 25C179 300p 25D129 40p 25K141 220p 25K141 170p 25K146 240p 25C2223 16p 25C348 100p 25C149 300p 25D866 20p 25D173 250p 25K141 170p 25K140 140p 25K145 200p 25K145 300p 2	2SC2188 2SC2200					30p		150p 480p				110p							2SK1377	150p
3252221 660p 25C2671 100p 25C374 100p 25C517 200p 25C171 200p 25K145 200p 25K1461 220p 25C2221 660p 25C2671 100p 25C374 100p 25C5179 300p 25D1291 260p 25D179 276p 25K147 100p 25C5179 300p 25D1291 260p 25D179 276p 25K147 100p 25C5179 300p 25D183 25p 25D179 230p 25K147 10p 25K146 25p 25C2228 60p 25C381 100p 25C5189 300p 25D183 23p 25D173 276p 25K141 10p 25K146 25p 25C2230 80p 25C384 70p 25C378 26p 25C149 300p 25D186 20p 25D173 26p 25K141 20p 25K147 70p 25K147 70p 25K157 300p 25D18 400p 25D130 40p 25K173 300p	2SC2209	60p	2SC2665	200p	2SC3199	400	2SC3717	120p	2SC5048	300p	2SD844	200p	2SD1288	176p	2SD1708	376p	2SK193	40p		
25C2228A 00p 25C2681 170p 25C3210 66p 25C374 120p 25C129 300p 25D858 260p 25D1292 60p 25D1799 230p 25K121 35p 25K1462 426p 25C2239 16p 25C2680 70p 25C3211 220p 25C3748 100p 25C149 300p 25D863 23p 25D1297 30p 25K212 35p 25K1462 426p 25C2233 100p 25C386 27p 25C325 50p 25C378 150p 25C580 300p 25D866 120p 25D1397 30p 25K214 10p 25K157 300p 25C2236 60p 25C3242 30p 25C378 75p 25D188 350p 25D1306 45p 25D174 125p 25K249 400p 25K1529 700p 25K140 140p 25K157 400p 25K157 400p 25K157 400p 25K146 40p 25K154 400p 25K154 400p	2SC2216 2SC2221	650p				26p 120p	2SC3746	100p	2SC5086	250p	2SD856	48p	2SD1291	280p	2SD1718	276p	2SK197	140p	2SK1461	220p
25C2230 60p 25C2688 27p 25C321 260p 25C378 27p 25C149 300p 25D864 200p 25D132 260p 25K132 260p 25K157 300p 25C2233 100p 25C2680 60p 25C3242 30p 25C534 300p 25D866 120p 25D1302 20p 25D1732 260p 25K153 700p 25C2236 60p 25C2694 360p 25C344 30p 25C3783 70p 25D198 140p 25D866 140p 25D1306 45p 25D174 12p 25K154 30p 25K154 30p 25K154 30p 25K154 400p 25K154 40p 25K154 40p 25K154 40p 25K154 40p 25K154 40p 25K154 40p 25K154	2SC2228A	60p	2SC2681	170p	2SC3210	660p	2SC3747	120p	2SC5129	300p	2SD858	250p	2SD1292	60p	2SD1729	230p	2SK212	35p		426p
25C2233 1000p 25C289 3600p 25C322.5 50p 25C323.5 50p 25C324.5 50p 25C324.4 50p 25C324.5 50p 25C378.7 10p 25D198 10p 25D130.5 10p 25D17.6 50p 25K24.6 30p 25K176.7 25K176.7 25D17.8 60p 25D17.6 60p 25K176.7 25K176.7 25K176.7 25K176.7 25K176.7 25K176.7 25K176.7 25K176.7	2SC2230	80p	2SC2688	27p	2SC3212	260p	2SC3752	250p	2SC5149	300p	2SD864	200p	2SD1297	300p	2SD1732	250p	2SK216	200p		250p 300p
25c2236 20p 25c2706 40p 25c324 45p 25c378 300p 25b198 140p 25b88 260p 25b1748 90p 25k243 30p 25k174 90p 25c2236 40p 25c206 250p 25c378 100p 25b198 140p 25b88 260p 25b130 40p 25k144 30p 25k154 90p 25k1767 275p 25k248 30p 25k1767 275p 25k1767 275p 25k1767 25p 25k1714 20p <td>2SC2233</td> <td></td> <td>20p 45p</td> <td></td> <td></td> <td></td> <td></td> <td>2SK1529</td> <td>700p</td>	2SC2233													20p 45p					2SK1529	700p
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HSJ, HSMBBE GUSUP SV22 00, 322, 332, 340, 380, 2000, 327, 332, 340, 380, 2000, 327, 332, 340, 380, 2000, 374, 340, 350, 341, 350, 344, 345, 347, 446, 450, 345, 347, 446, 450, 450, 344, 346, 346, 347, 446, 450, 450, 450, 450, 450, 450, 450, 450	51 10			30	50p	VR20 VR25
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19 2300p Sys8 30, NVHJ33, NVL10, 20, NV221, SAM 330, NVHJ33, NV10, 20, NV221, SAM 330, NV, 11, 2, 30, 35 1450p 130, 102, 11, 2, 30, 35 1450p 130, NV30, NVM5 700p 335, NVG46 1700p 11, NVM3, NVM5 4200p 130, NV411, NV433, NVSD2, NVSD2, VESD2, 130, NV31, NV433, NVSD2, NVSD2, VESD2, 130, NV31, NV433, NVSD2, 1860p 30, NV700F, NV770 1860p 166 1860p 150, NV950 2760p 750, NV950 2760p 160, NV950 2760p 170, NV890, NV970 3200p 170, NV890, NV970 3200p 170, NV890, NV970 3200p 170, NV8020EE, 1450p 130, 11, 12, 14, 16, 120, NV250, 280, 321, 130, 11, 12, 14, 16, 120, NV250, 280, 321, 130, 11, 12, 14, 16, 120, NV250, 280, 321, 130, AG6200, AG6300 2600p YT20 350, NVG300 2600p YT20 <td></td> <td>, AG5250,</td> <td>NVF65, NVH75,</td> <td>- 32</td> <td>200p</td> <td>SV88</td>		, AG5250,	NVF65, NVH75,	- 32	200p	SV88
330, 31, 40, 130, NVJ37, 40, 42, 130, NVS17, 40, 42, 145, 12, 23, 03, 5 SV85, SV		NIV/LI 199	N/1 10 20 N//	23	tinn .	0.000
1100, AG2200 700p 770p 7720 720p 770p 7720p 7720p 7720 720p 720p 720p 720p 7210 720p 7210 7210 7210 7210 7210 7210 7210 7210 72100p 72100p 72100p<	30, 330,	31, 40, 13			50n	SAM SV85
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THQ, NV 180, NVD48 2000 750, 801 2600 VX73 981 2600 VX73 10, NV8301 2400 VX73 10, NV8301 2400 VX73 10, NV8301 2260 VX15 10, NV890, NV970 3200 VX15 10, NV890, NV970 3200 VX15 1024, NV832, 46, NVL23, 25, 28, NV570 X33 X43 10, 11, 12, 14, 16, 120, NV250, 280, VX33 S112 S112 310, 11, 12, 14, 16, 120, NV250, 280, VX63 S112 1260 310, 11, 12, 14, 16, 120, NV250, 280, VX63 S112 1260 320, 21, 22, 25, 28, 200, J66300 26000 S41 S000 350, NVG300 20000 S40 VTCC 350, NVG300 26000 VTCC S100, AG6200, AG6300 26000 VTCC 3100, AG6200, AG6300 26000 VH7C YTCC S200 VH7C 315, NVG400 26000 VHR VHR VHR VHR 75, NVG77 47500 VHR <td>100</td> <td>, AG2200 NV431, N</td> <td></td> <td>7 1VS1</td> <td>00p</td> <td>970,</td>	100	, AG2200 NV431, N		7 1VS1	00p	970,
THQ, NV 180, NVD48 2000 750, 801 2600 VX73 981 2600 VX73 10, NV8301 2400 VX73 10, NV8301 2400 VX73 10, NV8301 2260 VX15 10, NV890, NV970 3200 VX15 10, NV890, NV970 3200 VX15 1024, NV832, 46, NVL23, 25, 28, NV570 X33 X43 10, 11, 12, 14, 16, 120, NV250, 280, VX33 S112 S112 310, 11, 12, 14, 16, 120, NV250, 280, VX63 S112 1260 310, 11, 12, 14, 16, 120, NV250, 280, VX63 S112 1260 320, 21, 22, 25, 28, 200, J66300 26000 S41 S000 350, NVG300 20000 S40 VTCC 350, NVG300 26000 VTCC S100, AG6200, AG6300 26000 VTCC 3100, AG6200, AG6300 26000 VH7C YTCC S200 VH7C 315, NVG400 26000 VHR VHR VHR VHR 75, NVG77 47500 VHR <td>D25</td> <td>5, NVSD3 NV730F, N</td> <td>IV770</td> <td>10</td> <td>100p</td> <td>627,</td>	D25	5, NVSD3 NV730F, N	IV770	10	100p	627,
NUSDE PXP2 7047 NUSDE 1450 7067X NUSD20EE 1450 7067X 1450 1450 7067 120 321 7067X 120 320 706 120 320 706 120 320 706 120 320 700 120 320 700 120 320 700 14500 7230 700 36000 7230 700 36000 700 700 26000 905 800 AH6810 AG6820 26000 900 10600 700 70 70 26000 700 700 70 26000 945 700 70 20000 945 700 220000 9400 700 220000 9400 701 20000 94000 75 <t< th=""><td></td><td></td><td></td><td>14</td><td>50p 150p</td><td>SVX3</td></t<>				14	50p 150p	SVX3
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310 111 12, 14, 16, 120, NV250, 280, 7 VK33 465 1800p 321, 5 318 1800p 321, 280, 21, 280, 200, 280, 7 318 1260 1260 320, 21, 22, 25, 28, 200, 200, 200, 200, 200, 200, 200,	6024	, NVG33,	46, NVL23, 25, 3	28,	oop	PL30 PXP3
310 111 12, 14, 16, 120, NV250, 280, 7 VK33 465 1800p 321, 5 318 1800p 321, 280, 21, 280, 200, 280, 7 318 1260 1260 320, 21, 22, 25, 28, 200, 200, 200, 200, 200, 200, 200,	7005	X, NVSD	20EE,	14	50n	SX32 1230
18 1800 1260 220, 21, 22, 25, 28, 200, 7230 236, NVG300 2000 345 1350 345 1350 345 1350 345 1350 346 1050 347 2400 3600, AH6810, AG6820 2600 370, NG9, NV230 1050 315, NVG400 26000 315, NVG400 26000 315, NVG400 26000 315, NVG400 26000 77, NVMC20 38000 78 20000 315, NV577 47500 75 40000 945 4000 950 4000 950, NVF77 47500 950, NVHD 100, NV HD 101, NVH7 27.3 310, M37550, AG7355, 467355 40000	510, 46	11, 12, 14	, 16, 120, NV25	0, 2 1 B	80, 6 00 p	1 VK30
170 36800 product VPRE 388 24000 product VTCI 300 10650 product VTCI 300 A46810, AG6820 2600 product 3100, AG6200, AG68300 2600 product VTCI 37, NVG3, NV230 10650 product VTCI 76 2400 product VTCI 70 2400 product VHR 70 2400 product VHR 70 2400 product VHR 70 5200 product VHR 70 5200 product VHR 75, NVF77 4750 product VHR 75, NVF77 4750 product VHR 750 4000 product VHR 750, NVF588, NVSF90 4000 product VHR 8000 4600 product VHR 9001 11, NVHF 27.3 31400 product 300, AG7350, AG7355, 6550 6550 6550	518 520	21, 22, 25	. 28, 200.		loob	1260
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5800, AH8810, AG8820 2800 p 90 5100, AG8200, AG8300 2800 p 90, V 57, NVG9, NV230 105 0p 9455 780 315, NVG400 2800 p 9455 315, NVG400 2800 p VHR VHR 77, NVMC20 3800 p VHR VHR 76, NVJ47 2000 p 9455 VHR 75, NVF77 4750 p VHR VHR 5010 2800 v VHR VHR VHR 5020 7540 v 7540 v 7540 v 501 3100 p 7540 v 7540 v 302 p 36750 p 7540 v 7540 v				14 36	50p	VTCS
3800, AH8810, AG6820 2600p V1C5 3100, AG6300, AG6300 2600p 30, V 37, NVG9, NV230 106 0p VTC5 800 2400p V4R5 315, NVG400 2400p VHR3 700 5200p VHR1 145, NVJ47 2000p VHR1 145, NVJ47 2000p VHR1 750 5200p VHR1 755 4000p VHR1 755 4000p VHR1 900 4600p VHR1 1090, NVHD 100, NV HD 101, NVHF 3100p Z7.3 301, AG7350, AG7355, AG7355, 4000p Z7.3	588 500					VTCI 5400
780 2400p 9455 3 15, NVG400 2600p VHR 3 15, NVG400 3800p VHR 3 70, NVMC20 3800p VHR 70 5200p VHR 145, NVJ47 2000p 3400p 5040 22550p VHR 75, NVF77 4750p VHR 55 4000p VHR 8000 4600p VHR 1090, NVHD 100, NV HD 101, NVHF 3100p 27.3 501 1400p 75.4000p	5800 5100	, AH6810, , AG6200	AG6820 AG6300	- 26	600p	30, V
NY, NVMC20 3800p VHR: 70 5200p VHR: 145, NVJ47 2000p VHR: 5040 22550p VHR: 75, NVF77 4750p VHR: 55 4000p VHR: 750, NVF588, NVSF90. VHR VHR 8000 4600p VHR: 1090, NVHD 100, NV HD 101, NVHF 2100p Z 501 1400p Z 300, AG7350, AG7355, 6550 6550	780		230	10	160p	9455
145, NVJ47 2000p 3400 S040 2250p VHR 775, NVF77 4750p VHR *55 4000p VHR *500, NVFS88, NVSF90, 4600p VHR 8000 4600p VHR 1090, NVHD 100, NV HD 101, NVHF 910p 21.03 SD1 3100p 7540 330, AG7350, AG7355, 6550 6550	3 15 V17, I	, NVG400 NVMC20		26	100p 100p	I VHR:
55 3000 p VHR 8200, NVFS88, NVSF90, 4600 p VHR 8000 4600 p VHR 4600 p 27,3 3100 p 320, AG7350, AG7355, 1400 p 7540	70 145,	NVJ47		- 20)00p	3400
*\$200, NVF\$88, NVSF90, VHR /8000 4600p VHR /8000, NVHD 100, NV HD 101, NVHF VHR VHR 0501, NVHD 100, NV HD 101, NVHF 27, 3 3100p 27, 3 7510, AG7350, AG7355, 1400p 554 6550				47	750o	VHR
SD1 1400p 7540 7330, AG7350, AG7355, 6550	-55	NVES8	8, NVSF90,			I VHR
7330, AG7350, AG7355, 6550	iD9	0, NVHD 1	00, NV HD 101,			VHR 27.3
7450 5000p TLS1	7330	, AG7350	, AG7355,	14	100p	6550
	7450)		50)00p	TLS

H.	U HEADS
	Model
00р 00р 00р	NVFS 100 NVFS1
50p	N.E.C. N9011, 9012, 9013E, 9014E, 9014G
13H 00p	9053, 9054, 9055, 9056, 9063, 9065 906, 9077.
00p 00p	N E.C. 9016, 9012, 9013E, 9014E, 9014G 9016, 901A, 902A, 9033, N9034, 9 9053, 9054, 9055, 9056, 9063, 9065 906, 9077, N9096, DX1000, 1600, PX1200 N911A, 914C, 915A, 916A, 917, 911
641,	PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770,
00p	
00p	N380, N381, N830, N831, N832, N N834, N835, N836 82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000
50p 00p 00p	N895
50p	N9052, N9530, DX2000 VCP1 PVC2300, 2400, 740, 744, 760,
00p 00p	764 OS6000
00p 50p	D5600 VH3, VH555, VH600, VH700, VH84
00p 00p	D5600 VH3, VH555, VH600, VH700, VH84 VH800, VH1000 (ALL MODELS) VH1, VH2A D1000, D1100 D1000X, D1500X, D4500, VPCD10 D1000X, D500X, 04500, VPCD10 D1200, D2000X, D5000 VR640, VR6440 VR6440 VR6440 VR6440
60p	D1000, D1100
00p	D1200, D2000X, D5000 VR6460, VR6520, 64VR60,
50p	VR6420 VR6711 4 HEAD
00p 50p	
00p	VR6441, VR543, VR543, VR544, VR644 VR6642 DV761, VR512, 522, 5229, 63SB7, VR6760, VR6761, VR6762, VR63S1
50p 00p 50p	VR6920 41DV2, 4SB11BVR412, 415, 6485,
00p	6880
00p 100p	VR6948 20DV1, 20DV2, 20RW7, 21DVI, 21I 21DV2, 25B01, 02, 11, 12, 30DV2
100p	V R6848 20DV1, 20DV2, 20RW7, 21DV1, 211 21DV3, 25B01, 02, 11, 12, 30DV2, 31DV2, 31DV3, 35B02, 03, 05, 11, 685B4, 715B4, 865B1, 915B2, 925 DV186, 190, 291, 292, 468, 471, VI 202, 203, 2015, 212, 2468, 471, VI 202, 203, 205, 311, 312, VR313, 31 302, 303, 305, 311, 312, VR313, 31 3219, 322, 3229, 323, 501, 6180, 6 6185, 6290, 6291, VR6293, 6362, 6 6467, 6468, 6470 VR3260, 6343, 6442, 663, 6448, 64 6542, 6643
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00p 1, 00p	6467, 6468, 6470
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100p	VR3200, VR3500 VR2000, VR3300, VR3600 VR2500
250p	VRS5000X, VX6000A, VXL12X
050p 150p 150p	SALORA 6500, 6600
50p	SV7300, SV8200, SV8300, SV9200 SV7400, SV8400
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150p 300p	SV8100 SV800, SV9900 SV601, SV611, SV6910 SV800, SV810 SV6700, SV8710, SV8750 623N, SV6800, SV6900, SV8850, S
	623N, SV6800, SV6900, SV8850, SV8970
300p 500p	SV88110, SV8910 823N, SV8920
100p 725p	923N SV8600, SV8700
100p H77	SV8420 SV8620 SV9300
200p 200p	SV8830
300p	SV8720 SV8520 SAMSUNG
150p 700p	
700p 200p 700p	SV8500 SVX301, VB900, 910, VVT510, VT 5600, VX510, 511, 520,616, V17, 171, 614, 619, 629, 710, 712, 720, 970, 971, 972, SV716, 717, SVX30 VP510, 520, 610, 616, 617, 619, 62 600, 910, SVX319, VB770, V1710, 730, 731, 750, 751, 770, VB750, VK8220, VX VX7330, VK770, VK8225, VR1730, XR20
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000p	750, 751, 770, VB750, VK8220, VX VX7330, VK770, VK8225, VR1730, XR20
100p 750p 200p	V11560, VN1560, VN1561, VX153 V11560, VX1561, VX1580 PL30LR, PX3031, 31R, 32R, 990, 9 PXP30, PXR30, VX 1260, SVX503 SX3230, 3231, 3260, 3261, VK30, 1300, 4260, 1361
,	PL30LR, PX3031, 31R, 32R, 990, 9 PXP30, PXR30, VX 1260, SVX503 SX3230, 3231, 3260, 3261, VK30
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500p 800p	321, 326, 336 S11230, 1240, SVX600, SX1230, 1
700p	1260, 1261, 7120, 7121, 7220, SX 7230, 7301
000p 450p 800p	SANYO VTC5000, 5400, 600, 6000, 6010, 4 VPR5000, VTC 1500, VTCM 10, 1 VTCM25, VTC2000, 5100, 5150, 5 5400
400p 050p	VTCM25, VTC2000, 5100, 5150, 5 5400,
600p	5400, VTC5350, 5370, VTCNX10, VTCN 30, VPR5800
050 p 400 p 800 p	
ROOm	VHR2300, VHR2370 VHR3200, 3270, 3100, 3110, 3150
200p 000p 250p	V1C5500, 5550, 9100, 9300, 9350, 9455, 9500 VHR1110, VHR1150, VHR1300, VI VHR2300, VHR2370 VHR3200, 3270, 3100, 3110, 3150 3400, 3310, VHRD500 VHR1500, VHR2500, VHR3330 VHR1500, VHR2500, VHR3330
750p 000p	VIII2/00
600p /HF	VHR5700, VHR7700E, VHRD4710 VHR150E, 153, 154, 1501R, 240, 2
100p 400p	27, 350, 474, 5350E, 7500, VHR75 7540, 8500SP, 8800, VHRD5350E,
000p	6550 TLS1000P. TLS1001P.

1000P, TLS1001P

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5000p 4850p	TLS1100 VHR120, 130, 14, 141, 143G, 14SP,	3100p 151,
	330 4100 4105 4200 430 4300 4	R310, 1400,
14G, 9015, 4, 9040, 1065, 9066,	4500, 5080, 5100, VHR5200, 5600, 6850, 7100, 7200,	7250,
1150p	4500, 5080, 5100, VHR5200, 5600, 6850, 7100, 7200, 7300, 8070, 8100, 8101, 8200, VHR 7810, 8000SP, 8801SP, VHRD4400, 4500, 4500	4410,
9110, 9120 2400p	VHRD4610, 6700, 4800	3100p
64,	VHR5300, VHR6500, VHR7400 VHR3500EX	4500p
1650p 2, N833, 700p	VHR5300, VHR6500, VHR7400 VHR3500EX VHR16, 235, 335E, 4150, 4160, 435 7250, 7260, 8250	i0, 1950p
3000p	SHARP	1400p
3150p 3400p	VC390, VC393, VC496 VC488	2750p 4200p
1700p	VC779 VC789, VC790	1800p 2900p
1400p 3500p	VC7/9 VC789, VC790 VC200, 220, 300, 381, 383, 384, 38 387, 388, 471, 477, 481, 482, VC48 3300, 8381, 9100, 9300, 9400, 9500 9700	5, 386, 3, 486,
3500p 1844,	9700 VC108 208 382 402 405 408 50	1100p
1100p 700p	571, 573, 581, 582, 583, VC5W20E 651, 674, 681, 684, 6V3, 750, 780,	, 600, 781.
	683, 684, 402, VC500, 571, 573, 580, 584, 600, 68	2, 693,
1600p 0100, 1600p	700, 772, 7810, 782, 7822, VC783, 8581, VCA10, 100, 102, 103, 1031,	8481, 103,
725p 1800p	104, 105, 106, VCA111, 113, 116, 131, 140, 202, 2	203,
2500p 640, 1300p 37,	VCB311N, 320, VCD801, 802, VCN	173, 171314
1300p 37, 35 87 7172	5700 VC108, 208, 382, 402, 405, 408, 50 571, 573, 581, 582, 583, VC5W20E 851, 674, 681, 684, 693, 750, 780, VC500, 571, 573, 580, 584, 600, 68 700, 772, 7810, 782, 7822, VC783, 8581, VCA10, 100, 102, 103, 1031, 104, 105, 106, VCA111, 113, 116, 131, 140, 202, 2 11, 234, 244, 254, 255, 30, 35, VC VCB311N, 320, VCD801, 802, VCN VCT212, 310, 410, VCT510, 72, VC VCT5313 VC6000, 6200, 6300, 7300, 7100, 7750, 8000, 6300	1100p
35 B7 7172 7200p 2750p	VC800, 62/0, 63/0, 73/0, YC793 VC473, VC785, VC786 VC699, VCA501, VCA602 VC595, VC855 VC90FT VFH815 VC800, VCH851 VC802, VCH851 VC802, VCH852	30000
85, 6490, 1600p	VC473, VC785, VC786 VC699, VCA501, VCA602	2200p
48500	VC585, VC685 VC90ET	2000p 3900p
21DV2, V2, 31DVI, 11, 12, 13, 92SB2,	VFH815 VC800, VCH851, VCH852, VCH882	2800p
. VH201.	VCH80, VCH81, VFH815 VCA33, VCA36, VCA43, VCA44, V	2700p 2800p CA46,
231, 232, 3, 3210, 5, 6182,	VCH892, VCH892, VCH892, VCH892, VCH892, VCH89, VCH89, VCH81, VFH815 VCH80, VCH81, VFH815 VCA33, VCA36, VCA43, VCA44, V VCA45, VCA63	1500p 2200p
2, 6367, 4600p	VC570	2800p
, 6449, 1250p	DSR-19R FOR SL-T 9ME DSR-21 R FOR SLC 8-C9 DSR-35R FORC20, C30, C40, SLF1 SLF1E2 PIN, SLC24PS, 33E, 34, 4 SLF11, 30PF, 35, 60PS, SLK85,	3100p 2600p
1800p	DSR-35R FORC20, C30, C40, SLF1 SLF1E2 PIN, SLC24PS, 33E, 34, 4	UB, 4PS,
2750p	SLF1EZ PIN, SLC24PS, 33E, 38, 4 SLF11, 30PF, 35, 60PS, SLK85, SLT20ME, 30ME, SL100 DSR-43R FOR SLC7 RANGE, SL5(SL5100, SL3000 1 PIN, SLC6E, SL SL37F	1500p
0, 1100, 1200p	SL5100, SL3000 1 PIN, SLC6E, SL SL5100, SL3000 1 PIN, SLC6E, SL SL37F	36ES, 1300m
VR3800 1400p	SL3000, SL8000, SL8080, SLC5E, S	1600p
1400p 1400p 2650p	SLV201, SLV202 SLK95, SLT50ME	2000p 2900p
1500p	SLV201, SLV202 SLK95, SLT50ME SLV275, SLV373VB, SLV410, SLV412, SLV427, SLV474 DSP408, SLVE1008	2200p
1600p	SLHF100UB	3850p
1500p 1600p		4600p 2600p
1200p 3450p 1500p	SLV383JUB SLV353UB CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E SLV801, SLV802 SLV310, SLV315, SLV325, SLV335	4800p
2800p 1500p	SLV801, SLV802 SLV310, SLV315, SLV325,	3550p
0, SV8870, 1750p	SLV335 SLV210, SLV212, SLV270, SLV273 SLV285, SLV300	1150p
2650p 3500p	SLV210, SLV212, SLV270, SLV273 SLV285, SLV300 SLV125, 213, 225, 252, 255, 262, 2 SLVX1, 20, 3	80, 1750p
4500p 1550p	SLV363, SLV416, SLVX50, SLVX55 SLVX55, SLVX90, SLVX95 SLV282, SLVX30, SLVX35 SLHF100P, SLHF100UB SLHF100D, SLHF100UB SLVE7, SLVE8, SLVE9	2750p
2400p 2100p 2500p	SLVX75, SLVX90, SLVX95 SLV282, SLVX30, SLVX35	3000p
2200p 2250p	SLHF100P, SLHF100UB SLVE7, SLVE8, SLVE9	3850p 5150p 5150p
1900p	SLVE90 SLV615, SLV625, SLVE600, SLVE7 SLVE800	3450p
1 500p VT320,	TOSHIBA V63	1500p
VX626, 627, 20, 730,	V9680	3400p
X303, 305, 620, 626,	V21, V31, V32, V33, V50, V51, V52	14500
, 621, 626, 1200p 31, 735,	V55, V57 V71, V73, V74, V75, V77, V80, V8 V83, V841V85, V86, V87, V88	700p 1, V82,
VX750, 730, 1735,	V83, V841V85, V86, V87, V88 DV90, 96, 97, NM3, V108, 109,	1200p
1900p 1530, 2200p 0, 992, 991,	V88 DV90, 96, 97, NM3, V108, 109, 199, 200, 202, 205, 207, 209, 80, 93, 94 V5470, V5480	1450p
2200p 0, 992, 991,		1300p 2350p
503, 30, 300,	V880MS V700G	2800p 3700p 2500p
1, 306, 320, 1900p	V500G, V509G V9680 V300G, V301, V305, V306,	2500p 2900p
80, 1231, SX7221,	V309G	2550p 1700p
1900p	V110, V120, V130, V140, V210, V2 V212,	211,
10, 6500, 0, 11, 20, 21	V220, V221, V222 V711, V880	1500p 3850p 1200p
0, 11, 20, 21 0, 5300,	V220, V221, V222 V711, V880 VCPB1E, VCP2C2 V65, V66, V6 V312, V322, V412 V91G	1200p 1250p 2600p
CNX15, 20, 1800p 350, 9355,	I V609, V610V610B, V610UK, V611	4600p
1900p VHR1700,	V659E V660 V660E	3200p 9200p
1200p 150, 3300,	V312, V403T, V413G V703W, V813G V95G	5200p 8000p
1500p 2100p		
2450p 3000p	GRANDATA LT	
2700p 0. 250, 251.	TEL: 0181-900 23	29
0, 250, 251, R7530, OE, 5450E,	FAX: 0181-903 61	26
3850p		

ALL TV & VIDEO PARTS SOLD ARE REPLACEMENT PARTS

		CR BELT KIT	S	
		Model Price	Model Price	Model Price
AKAI 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,
120p	FISHER	GV437, 440, 450, 4592, 460, 464, 470, 500,	N895 80p	970, 971, 972 100p VX9880 110p
VS1, VS2, VS3, VS5, VS12, VS15, VP88 70p VS10 65p	VBS7000 245p	501, 5050, 5095, GV5105, 511, 530, 5395, 540, 560, 5695,	PVC2300, PVC2400 180p DX1000, 1600, 1800, 2000, 3000, N9012, 9013,	SX7121 95p
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, 9055,	SANYO VTC5000, 5150, 6000, 6500, VTCM10, 11, 20,
155, 165, 205, 220, VS24, 240, 244, 245, 247,	FVHP615, 618, 620, 622, 710, 711, 715, 720,	5104, 5106, TVR37001 70p	9056, 9066, 9096, 9110, 9120,	21, 30, 31, 50 65p
248, 250, 512, 515, 516 200p	721, 722, 725, 730,	HINARI VXL2 80p	N9510, 9520, 9530, 9610 80p NATIONAL PANASONIC	VTC5300, VTC5350, VTC5400,
VS22, VS23, VS25, VS35, VS37, VS38, VS53,	FVHP830, 840 80p FVHP905, 906, 907, 908, 910, 911, 915, 916,	VXL7, VXL8, VXL9, VXL10, VXL11, VXL19,	NV300, NV330PX, NV332, NV333 NV340,	VPR5800 80p VTC5500 70p
VS55, VS66 80p	918 75 p	VXL90, VCR34, VTV 100, 100n	NV366 100p	VTC9100, VTC9300 140p
VS4, VS6, VS8, VS9 95p VSA77 120p	VBR330, VBS7500, VBS7600,	200 100p VXL4, VXL35, VTV300 70p	NV777, NV788 100p NV2000, NV2010, NV3000 80p	VTC1100, 1300, 1500, VHR1100, 1110, 1150, 1200, 1300,
VSS99 105p	VBS9900 100p VBS3500 75p	VXL5, VXL6 100p	NV7000, NV7200, NV7800 75p	VHR1500, 2370, MVR220 80p
ALBA	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10,	VXL3, VXL20 90p	NV8600, NV8610, NV862 145p NV230, 250, 280, 430, 431, 433, 450, 460, 465.	VHR2100, VHR2300, VHR2500, VHR2700 100p
VCR40000 130p VCR5000, VCR6000 105p	FVHP20 110p FVHD230, 250, 270, 370, FVHP1100, 1200.	HITACHI VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38.	470, 650, 730, NV770, 810, 870, 890, 970, AG	VHR3100, 3110, 3150, 3300, 3310, 3400, 3500, 3700,
VCR5000, VCR6000 105p VCR161, VCR222 100p	1250, 130, 132,	39, 88, 165, 5030 75p	1000, 1050 85p NV370, NV380, NV480, NV630, NV780,	3800, VHRD500, 700, TLS1000, TLS1001 65p VHR120, 130, 14, 141, 143, 14, 150, 151, 153,
VCR3000X, VCR4000, VCR4000X 75p	FVHP1340, 1400, 1410, 1440, 1500, 2000, 200,	VT5000, VT5500, VT18 120p VT7000, VT8000, VT8030, VT8040, VT8300,	NV830, NV850 70p	154, 15, 16, 171, VHR194, 220, 23, 235, 240,
VCR7000, VCR7800, VCR8000, VCR8800 110p VTV10 105p	210, 250, 3, 300, 310, 320, 2000, 410, 420, 430, 440, 445, 470,	VT8500, 8700 60p	NV600, NV688, AG6010, AG6015 85p	244, 250, 251, 274, 297, 310, 330,VHR335, 390,
AMSTRAD	475, FVSD2905 85p	VT680, VT6500, VT6800, VT9300, VT9500, VT9700, 9900 75p	NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, NVH70 50p	4100, 4105, 4150, 4200, 430, 4300, 4350, 474, VHR4770, 5080, 5100, 5200, 5300, 5350, 5700,
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, NVMS1, 4 70p	6850, 7100, VHR7200 7250, 7260, 7300, 7400,
VCR5200 80p	990 95p G.E.C.	640 60p	NVMS1, 4 70p NVM 1, NVM3, NVM5 70p	7500, 7520, 7530, 7530, VHR7540, 7700, 774, 7800, 7810, 8000, 8100, 8200, 8250,
VCR7000 80p VCR1000, 2000, 6000, 6100, 6200, 8600, 8602,	4005 150p	VT3000 120p VT100, 110, 111, 113, 115, 118, 120, 125, 128,	PHILIPS	8500, VHR8800, 8801, VHRD4400, 4410, 4500,
8603, 8604,	V4004 100p	130, 135, 138,	VR6460, VR6920 170p VR6540 100p	4600, VHRD4610, 4710, 4890, 6700 60p VMD66, VMD68P 80p
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 70p
9244, 9340, DD8900, DD8904, TVR4 100p	GOLDSTAR GHV1221, 1232, 1233, 1240, 1241, 1242, 1243,	VM500 VM600 90p	VR2025, VR2580 100p	VTC6010 75p SHARP
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,	VC200, 381, 384, 385, 386, 388, 390, 393, 838
9500 75p VS1004 105p	GHV1246, 1247, 1248, 1250, 1266, 51, 8000,	HR3300, HR3330, HR3360, HR3660, HR4100 1300	311, 312, 313, 3210, 3219, 322, 32, 29, 323,	9100, 9300, 9500, VC9700 80p
VS1004 105p BLAUPUNKT	8200, 8210, 8215, 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 110p
RTV100 200p	GHV1290, 1291, 1295, 1296, VCP4000, 4200,	HR7350, HR7600, HR7610, HR7650,	31DVI. 31DV2. 31D. V3. 3SB11. 3SB12. 3SB13	VC8300 115p
RTV200, RTV222, RTV224 90p	4300, 4301, VCP4305, 4306, 4310, 4311, 4315, 4320, 4321,	HR7655 50p HR7700 50p	72SB8, VR30DV2, 35B02, 35B03, 635B7, 715B4, 715B5, 715B8, VR865B2, 915B2,	VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481 80p
RTV202, RTX200 150p 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,	GRANADA	BP5000 60p HRD140, 141, 143, 150, 152, 157, 158, 160,	6290VR6291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561,	VCSF3, VC8581 80p 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	755, HRP50 45p HRD170, 171, 180, 210, 211, 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,	VHSBH1, VHSCH 1 150p	320, 321, 330, 337, HRD350, 370, 400, 430,	VR445B9, VR445B920, VR445B922, VR6443,	787, 793, 800, VC7810, 7822, VCA100, 102,
RTV317 50p RTV301, RTV333, RTV338, RTV404,	VHSBP1 135p VHSAN3 110p	440, 44 1, 500, 530, 700, 750.950, HRS5000, 5500, 8000, 9000, BR9060, BRS600,	6843, 6843, VR6943 100p VR3260, 6349, 6448, 6449, 6548, 6648,	103, 104, 131, 140, 170, 202, 03, VCA234, 501, 502, 502, 5011, VCB311, 361, VCD801, 802,
RTV424 85p	VHSDS2 125p	605, 920, 925 45p	49SB620, 644869S, 49SB6 110p	VCH851, 852, 882, VCM73, VCT72 65p
FERGUSON	VHSAY3 125p VHSBY3 100p	HRD227, 520, 52 1, 522, 527, 600, 610, 620,	VKR6850, VKR6855 70p VR501 110p	VCA10, 103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA36, 37, 40, 43, 454.
3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901, 8902, 8903, 8904.	VHSEY1, VHSEY2 70p	637, 641, 650, 830, HRD840, HRDX20, 22, HRJ200, 205, 300, 305,	VKR6800, VKR6810, VKR6820 70p	48, 50, 505, 51, 52, 53, 54, 55, 56, 57, 58,
8902, 8903, 8904, 8906, 8909, 8912, 8922 120 0	VHSCC1 100p	SR330, HRS10 125p	SE4104, VR231, 2310, 2319, 231, 232, 2329.	VCA60, 605, 615, 67, 68, 1031, VCB320,
3V23, 8923, 8924, 8929 50p	GRANADA VHSDP1, VHSFV2 80p	HRD840, 550, 560, 580, 590, 640, 660, 670, 720, 730, 740, 770, HRD820, 860, 870, 880,	237, 23, 241, 2410, 2419, 242, 243, 245, 2469, 247, 2479, 251, 252, 256, 257, 258, 33, 19, 332,	VCBS97, VCD805, VCD806, 810, 815, VCH80, 81, 85, 865, 910, VC51000,
3V29, 3V30, 8930, 8931, 8933, 8940 65p	VHSTJ1, VHSTJ2 150p	910, 960, 980, HRDX20, 25, HRJ2 10,	3329, 333, 337, 339, 3419, 342, 343, 3469, 347,	VCT212, 310, 410, 610, VCT1314, VCTS312,
3V31, 3V32, 8941, 8942 60p	VHSTJ3 65p VHSWJ1, VHSWJ2 120p	HRJ215, 315, 316, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ6 10, 615, 715, 97,	3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437, 442, 4229, 432, 437, 442, 44, 5, 4469, 447,	313, VC790ET 80p VCC10 70p
3V35, 3V36, 3V38, 3V39, 3V49, 8943,	VHSXJ3 85p	HRS4700, 5800, SR3200, SRS368E 60p	4479, 451, 452, 457, 458, 459, 512, 522, 5229.	SONY
60p 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54,	VHSYJ2 80p VHSFJ2 140p	HRJ600 40p	6379, 642, 647, 722, 7229, 723, 7379, 747, 8389, 948, 9489 70 p	SLC6, SLJ10, SLT6ME 140p SLC5, SLC7, SLJ7, SLJ9, SLT7ME 140p
3V55, 3V57,	VHSFS1, VHSFS2 130p	LOGIK VR955 180p	SAISHO	SLC5, SLC7, SLJ7, SLJ9, SLT7ME 140p SLC9, SL8000, SL8080, SLT50 165p
8945, 8947, 8948 45p 8V58, 3V43, 3V44, 3V59, 3V64, 3V65, 8950,	VHSFG1, VHSFG2, VHSFG3, VHSFG4, VHSF63 180p	MATSUI	VR2000, VHL3 90p VR3800, 3200, 3300, 3500, 3600, 3650,	SL8000E, SL8080E, SL8200, SL8600 175p
3951, FV10, FV11, FV12, FV13, FV14, FV20,	GRUNDIG	VX600, 730, 735, 750, 755, 765, 850, 6000,	VRS4400, 5000 75p	SLV255, 125, 213, 225, 262, SLVX1, 20, 3 95p
V21, FV22, FV26, FV32, FV39, VC141L 45p	MVS400, 440, VS400, 410, 415, 435, 440, 441,	VS888 75p VX1000, VX2000, VX2500, VX3000,	VR3400 100p	TOSHIBA
-V31R 110p -V61L, FV62, FV67, FV68, FV70, FV71, FV72,	450, 456, 460 55p VS180, 200, 220, 226, 262, 265, 267, 2X40800,	VX6000 80p	SAMSUNG SV716, 717, V1616, V~621, V1626, VX616,	V55, V57 85p V33, V31, V32, V51, V52, V53, V9600,
-V74, FV77 50p	0850, 0880,	VX800 70p	VX617, VX619, X626, VX627, VX629,	V9680 85p
V43H, FV44L, FV46T, FV57H 125p V37H 80p	1600, 2000, 2080, 2200, 2280, MVS200RC 90p	MITSUBISHI HS200 200p	VX714 75p VB520, 510, 610, 616, 617, 619, 620, 626, 627,	V61, V63, V65, V66, V67 150p
™37H 80p 3V52 55p	VS150 160p	HS300, 301, 302, 307, 310, 337, 338, 347, 349,	629, V1510, 520, V1611, 616, 621, 626, VX510,	DV80B, DV80D, V71, 73, 74, 75, 77, 81, 83, 85, 86 80p
V41R, FV42L 100p	VS310, 311, 315, 320, 326, 340, 345, 380, 385, 445 85p	411, 412, 421, 480, HSB10, 20, 30, HSE10, 20, 30, 70 80p	511, 520, VT320, 5600 aOp	V108, 109, 110, 120, 130, 140, i99, 209, 210,
IDELITY IQS200, VCR1000, 2000, 600, 6000,	VS150 75p	HS303, HS304, HS306, HS307, HS330, HS400,	PX980, 981, 982, SE9001, SV9001, SVX307,	211, 220, 221, 411,V421, 609, 610, 611, 659, 660, 711, 880 120p
180p	LC290N, LC295SN, SVS 180, VS 170 70p VS 160, BARCELONA, FLORENZ, GV4000,	HS700 110p HS318, HS319, HS410 110p	319, 322, VB750, 770, 8220, 8225, V1770, 790, 8220, 8225, VK8220, VPX31, VX750, VX770,	V91 G, V95G 115p
/CR100 160p	4000, 4001,	HSM1000, 16, HSM23, 25, 33, 34, 35, 37, 54,	790, 8220, 8225, SE9000, 9001 90p	V212, 213, 22-2, 3i2, 322, 403, 412, 413, 610, 703, 813 50p
/TR1000, VTR1001 100p	GV4002, 400, 401, 4010, 402, 403, 404, 405,	55, 57, 58, 59, 68 55p	SVX301, 303, 305, SX7301, VB710, 971,	VCP81E 110p

REPLACEMENT IDLERS & PULLEYS

										IULLEIS		
Make	Models					ription		Make	Models			Description
Hitachi	VT11, 14, 17, 19,	33, 34, 35	, 38, 39, 52, 57,	, 61, 62, 63, 64, 65, <mark>85</mark> ,			.	Ferguson		3V31, 3V32, 3V353V36, 3V38, 3V39, 3	3V49, 8930,	Take Up Clutch PU 51380
Order Code	86, 330, 350, 640,	105, 503	v			w Idler 688679 100p	_			8940, 8941, 8942, 8943, 8944		•
Hitachi	VT680, 6500, 680	0 0300 0	F001/T0700 00	00		dler 6861482 68	001401	J.V.C.	HR7200, 760	0, 7650, 7655, 7300, 7350, 7610		Take Up Clutch
Order Code		0, 3300, 3	500 1 1 57 00, 33			: 180p						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	4. 478. 707	,					Philips		520, 6843, 644		Reel Idler
Goldstar	GHV1221, 1232, 1	240, 1241	1, 1242, 1243, 1	244, 1245, 1246, 1247	, Idler			Sharp		681, 682, 684, 685, 693, 699, 700, 783	I, 6FR, 6V3,	Idler Assembly
Grundig	MVS400, 440, VS	3200, 8210 400 410), 8215, GVHP5	51, VCP4100, 4130	141				6F3			NPLYV0107GEZZ
National	NV230, 250, 260	280 370	380 NV430 43	, 31, 433, 450, 460, 465,	Idler			Order Code:				Price: 615p
	470, 480, 630, 650	0. 730. 780). NV810, 830.	850, 870, 890, NVG7.		ATTE VAF 0521				3, 44SB9, VR44SB920, 44SB922, 694		Reel Drive Unit
	9, 10, 11, 12, 14, 1	15, 16, 18,	30, 130, 400, 4	AG1000, AG1050, 1200),			Sharp		781, 782, 785, 786, VC787, 800, 793,		idler
D 1 -1-	1500, 1810, AG21	00, 2200.	NVH65, 70				-		/822, VCA10	0, 102, 104, VCA131, 140, 170, 202, 2	03, 234, 501,	NPLTV0111GEZZ
Philips Order Code	VR6460, VR6520,	VR6920				rm 40340162			VCA602, 50	11, VCD801, 802, VCH851, 852, VCH8	32, VCM73,	
Amstrad	VCB7000				Price				VCT72, VC7	32MK11		
Sharp		384.385	386. VC388. 39	0, 393, 3300, 8381,	Idler 1	50280		Order Code: N.E.C.		16 017 0012 001200014 0010 000	0004 00	Price: 700p
	9100, 9300, 9500,	9700		0, 555, 5500, 6501,	Idler N	IDL0005GEZZ	,			16, 917, 9012, 9013N9014, 9016, 903		
Order Code						: 100p	.			, 9056, 9066, 9096, N9110, 9120, 9510), 9520, 9530,	
Philips	VR6540				Idler			Order Code:		000, 1600, 2000, DX3000, PX1200		Idler Arm Assembly
Sharp	VC300, 387, 402,	471, 473, ^j	477, VC481, 48	2, 483, 486, 488, 496,						VR211, 2115, 212, 213, 223, 286, 291,	202 244	Price: 270p
	500, 571, 573, 581, 582, 583, 584	E0E 040			Idler	006GEZZ				10, 3219, 322, 3229, 323, 535BO, VR4		Pressure Roller Assembly PS403-40205
Order Code		, 202, 040	1, 2F3, 2WZUE			: 100p				I, 201, 202, VR203, 302, 303, 305, 618		
Akai	VS10				Reel Ic					5291, 6293, VR6362, 6367, 6390, 6391		
Ferguson	3V23, 3V29, 3V30	. 3V31. 3V	323V35, 8923,	8924, 8929, 8930,	neern					5561, 6570, 6581VR6670, 6676, 6710,		
-	8931, 8940, 8941,	8942				ller PU48967				970, 6975, 86B1, 63SB7, 68SB4, 71S		
J.V.C.	HR7200, 7300, 73	50, 7600, 1	7610, 7650, 76	55, 7700		ller PU48967				18, 92SB31, 20DV1, 20DV2, 20RW7, 2		
Order Code:					Price:					2, 2SB11, 2SB12, 30DV2, 31DV1, 310		
Ferguson	3V39, 3V30, 3V31, 8931, 8933, 8940,	, 3V32, 3V	353V36, 3V38,	3V39, 3V49, 8930,	Take U	Ip Idler PU 514	102			03, 3SB05, 3SB11, 3SB12, 3SB13	···., 510*,	
J.V.C.	HR7200, 7600, 76	50. 7655	2,0343,0344 7300 7350 76	10, HRD110, 111, 120,	Take U	In Idler PH 514	1024		V91, V95	,		Pressure Roller Assembly
	121, 225		, 550, 7550, 70	10, 1112 110, 111, 120,	iake U		+V2A		, ,00			PS403-40205
Order Code:					Price	100p		Order Code:	PR232			Price: 300p
		_							-			
		R	FPI_	CEME	'N'			P TV	DES			ARRIVA
							עת				1	N= A
Akai	M32773	T01	Ferguson	PU51380	IT07		VXP043	13	IT15		A	e Page 654
	MZ366960J2	IT02		PU51402A	1108		VXP04		IT16	Price:		
Goldstar	VXP0521	IT17		PU55373	IT09		VXP052		IT17	20p each	1 Asa	
Hitachi	6861471	IT03		PU55374	IT10		VXP058		IT 18	16p each pack of 5	ZSE	c rage 054 =:
	6861482	IT04	National	VXP0329	IT11		143066	2T15620	IT19	13p each pack of 10	EX	-
	6886971	IT05	Panasonic		IT12	Sharp		05GEZZ	IT20		4.	5
JVC	PU48697B	IT06		VXP0344	IT13	,		06GEZZ	IT21	Packs are for each model		ARRIVAL
				VXP0401	IT14		NPLY01	07GE77	IT22	r auna are rur each mudel	· •	1 DntVIII

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Model Price	Model Price	Model Price	Model Price	Model Price
AKAI VS10, VS9300, VS9500, VS9700, VS9800,	FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730,	BRS600, 605, 747, 777, 920, 925 140p HRS10 140p	NS7000 140p ORION	681, 682, 684, 685, 693, VC699, 700, 772, 750, 779, 780, 781, 7810,
VP7100, VP77 140p VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9,	FVHP810, 830, 840 140p 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,
VS29 140p VS29 140p 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,	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,	NEVHM, NEVHML, TVP230RC, VCP, VH04, 30, 103, 300, 358, 360,	VC220 140p VCA10, 30G, 60, 103, 105, 106, 111, 113, 131,
VS512 140p	FVHP320410, 420, 430, 440, 445, 470, 475, FVSP290S, 495, 2905 140p	HRS5800 350p PINCH ROLLER ASSEMBLY	362, 400, 416, 512, 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,
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467,	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10,	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, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613,
VS485, 765, 766, 767, 768, 865, 867, 965, 967, VSA77, VSA650,	FVHP20 140p 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,	VCB311, 320, VCBS97, VCD805, 806, 810, 815,
VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33	FVHS10, 30 1350p 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,
VSF260, 261, 262, 265, 270, 274, 275, 280, 290, 340, 350, 410, 420, 43C	1243, 1244, 1245, 1246,140p GHV1247, 1248, 1250, 1266, 1290, 1291, 1295,	HRD540, HRD550, HRD580, HRD660, HRD860, HRD960 700p	4020, 4300, 5020, VP 10, 200, 220, 225, 245, VR821, 925, 1032,	VCA340, 43, 47, 50, 60, 605, 615, VCD806, 815, VCH80, 81, 83, 85,
VSF441, 440, 450, 455, 480, 490, 497, 510, 560, 580, 590, 599, 600,	1296, 1392, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 4410,	PINCH ROLLER ASSEMBLY HRJ600, HRJ605, HRJ815,	2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30 140p	VCH865, 87, 910, VCS 1000, VCT212, 310, 410, 510, 610, VCTI314,
VSG20, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75,	51, 8000, 8200, GHV8210, 8215, 8430 GHVP1240, 1241, 1247, 1248, 1290, 1291,	HRS9200 875p MATSUI	PHILIPS VR6460 VR6920 140p	VCTS313 525p
VSP110, VSX560, VSX580 140p VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53,	GHVP1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, VCP4306, 4310, 4311, 4315,	VX6000, 730, 735, 750, 755, 765, 800, 850, VS888 140p	VR2020, VR2021, VR2022, VR2023,	PINCH ROLLER ASSEMBLY
55, VSA77 775p PINCH ROLLER ASSEMBLY	4316, 4320, 4321, 4325, 4326, 4350, GSE1290, 1291, 1295, 1296, 1297, 1891, 1910, 20005,	VX1000, VX2000, VX2500, VX3000,	VR6711 140p	VHL3, VR1000, 2000, 2500, 3200, 3300, 3500,
VS422, 425, 426, 427, 462, 465, 467, 485, 498, 765, 766, 767, 768, 865,	2000 140p	MITSUBISHI	VR6540 140p DV856, 586, VR702, 703, 6485, 6585, 6589, 200 0040 0040	3600, 3650, 3800, VRS4400, VRS5000 140p VR3400 140p
867, 965, 967, 708, 865, 867, 965, 967, VSA650, VSF10, 11, 12, 14, 15, 180, 190, 200, 210, 220,	HITACHI VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38,	HS12, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82,	6785, 6880, 6948 140p VR445, VR6442, VR6542, VR6643, VR6843,	SAMSUNG SV716, 717, VB510, 520, 610, 616, 617, 619,
221, 222, 230, 240, 30, 300, 301, 310, 320, 33, 330, 4, 500, 510, 600,	39, 88, 330, 680, 4200, VT5000, 5030, 5500, 6500, 6800, 7000, 8000,	HSE12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 15	VR6943, 44SB9 140p DV464, 662, VR2220, 2300, 2324, 2330, 2334,	620, 626, 627, 629, 900,
VSR110, VSX100, 400, 450, 470 800p	8300, 8500, 8700, 930, VT9500, 9700, 9900, VM600 140p	0, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35, 36, 37, 370, 380, 45, 450, 5	2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560,	V910, V1510, 520, 611, 616, 621, 626, 900, 910, VX510, 520, 616,
PINCH ROLLER ASSEMBLY VSS99 140p	VT8, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100, 110, 111, 113, 115, 118,	4, 55, 555, 57, 58, 59, 68, HSMS2, 9, HSS11, 14, 15, 17, 19, 25, 5600, HV	VR6660, 6860, 6861, 6862, 6863 140p N-1700, VR2870 140p	VX617, 619, 626, 627, 629 140p SVX301, 303, 305, 307, 319, 322, VB710, 713,
ALBA VCR3000X, VCR4000 140p	VT120, 122, 125, 128, 130, 135, 138, 145, 150, 168, 170, 175, 220, 225.	F125, 150, 303, 85, SV8900, 8930 750p PINCH ROLLER ASSEMBLY PART NO:	VR2025, VR6580, VR6581 140p 49SB6, VR3260, 6349, 6448, 6449, 6548,	750, 770, 971, 8220, VB8225, V1710, 730, 750, 770, 790, 8220, 8225, 970, VX710, 712,
VCR5000, VCR6000 140p VCR161, VCR222 140p	VT250, 255, 258, 260, 400, 405, 410, 413, 414, 415, 416, 418, 420, 425	948D020010 HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51,	6648 140p PRESSURE ROLLER ASSEMBLY PS403-40205	VX720, 730, 750, 770, 790, 825, 8225, 970, 971, 972, 8220, PX980, 981, 982, SE9000,
VCR7000, VCR7800, VCR8000, VCR8800 140p	VT426, 428, 430, 431, 435, 438, 450, 498, 510, 515, 517, 518, 520, 525,	52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150,	DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313,	9001, SX7120, 7121, 7220, 7221, 7230,
VTV10 140p AMSTRAD	VT526, 530, 535, 536, 540, 545, 546, 548, 570, 575, 576, 580, 585, 588	HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30, 33, 34, 35, 36, 37, 370, 38, HSM380, 40, 45,	VR3210, 3219, 322, 3229, 323, 535BO, 486, 471, 562, 582, 571, 761,	SX7301, VK8220, VPX31 140p
VCR1000, 2000, 4500, 4600, 4700, 5200, 6000,	VT640, 830, VTF660, 665, 70, 770, 774, 775, 780, 785, 860, 861, 865,	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.	VX9880 140p PX31 R, 32R, PXR30, SV80, SX3230, 3231,
6100, 6200, 8600, VCR8602, 8603, 8604, 8700, 8704, 8714, 8800,	VTL30, 1000, 2000, VTLC50, VTM598, 620, 622, 625, 626, 630, 635	15, 17, 19, 21, 25, 5600, HVF125, HVF150, 303, 85, SV8900, 8930 140 p	VR6291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561	3260, 3261, VS390, VX30, 31, 32, 3560, 3561, 370, 375, 380, VXK300, 301, 306, 307, 320,
8804, 9000, 9005, VCR9244, 9340, DD8900, 8904,	VTM636, 640, 645, 646, 720, 722, 725, 726, 727, 728, 730, 731, 735,	HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS360,	VR6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970,	VXK321, 326, 330, 331, 336, 337, 350, 351, 356 140p
TVR1, 2, 3, 4 140p VCR7000 140p	VTM736, 740, 745, 746, 748, 753, 754, 820,	HS700 140p	VR6975, 86B1, 63SB7, 68SB4, 71SB4, 71SB5,	PX990, 991, 992, \$11230, 1240, SVX4000, 503, 504, 600, SX1230,
DD8900, DD8904, VCR6000, 6100, 6200, 8600, 8602, 8603, 8604,	821, 822, 825, 830, 831, VTM835, 838, 840, 841, 845, 920, 921, 922,	HS306, HS307, HS318, HS319, HS337, HS338, HS347, HS349, HS400, HS410, HS411, HS412,	72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 2SB01, 2SB02, 2SB11, 20DV2, 23DV2, 2SB01, 2SB02, 2SB11,	SX1231, 1260, 1261, 1566, V11560, VPK43,
VCR8700, 8800, 900>9, 9140, 9244, 9340 700p	925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200,	HS421, HS480, HS710, HSB 10, HSB20, 30, HSE 10, 20,	2SB12, 30DV2, 31DV1, 31DV2, 31DV33SB02, 3SB03, 2SD04, 2SD14, 2SD1	VX1230, 1260, 1261, VX1560, 1561, 1850 140p
PINCH ROLLER ASSEMBLY PART NO: 153148 TX3650, UF20, VCR3000, VCR3002, VCR4000,	3280, 500, VMS7200 140p VT3000 140p	30, 70 140p NATIONAL PANASONIC	3SB05 3SB11 3SB12 3SB13 280p VR231, 232, 332, 422, 4229, 512, 5229, 722,	SONY SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ 10,
VCR9500 300p PINCH ROLLER ASSEMBLY PART NO:	VT410, 420, 428, 430, 450, 498, 518, 520, 522, 530, VTF770, 780,	NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321,	7229, 723 140p VR501 PR38 140p	SLT6ME, SLT7ME 140p
2554966 DD9900, 9904, TX3650, UF20, 22, 24,	VTM598, 622, 722, 740, 748, 753 650p PINCH ROLLER ASSEMBLY	AG6010, 6015, 6100, 6200, 6400, 6800, 7450 140p	SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100,	SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11, 20, 25, 30, 35, 60, 100,
VCR3000, 3002, 9500 140p VS1004 VS1104 140p	VTF150, 155, 180, 185, 250, 255, 260, 265, 280, 285, 350, 351, 355,	NV230, 250, 260, 280, 370, 380, 430, 431, 433, 450, 460, 465, 470, 480	2300, 2370, 2500, VHR2700, 3330, MVR220 140p	SLF200, SLF60PS, SLF90E, SLFH150, 850, SLK88, 95, SLT20ME, SLT30ME,
FERGUSON 3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292,	VTF360, 365, VTM140, 141, 145, 145, 210, 211, 212, 215, 220, 221,	NV630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000,	VTC5000, 5150, 5300, 5350, 5400, 5500, 6000, 6010, 6500, 9100,	SLT50ME 140p BMC 100, BMC200, BMC500 140p
8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 140p	VTM230, 231, 235, 284, VTS390 140p HINARI	NV7000, 7200, 7800, 8050, 8150, 8170, 8200, 8300, 8400, 8500, 8600	VTC9300, VTCM10, 20, 11, 21, 30, 31, 40, 50, VPR5800 140p	SLV201, 202, 301, 302, 401, 402, 801,
3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931,	V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90, H13V, VTV100, 200 140p	NV8610, 8620, NVG11, 14, 16, NVG7, 10, 12, 15, 18, 30, 130, 400	VHR3100.3300, 3310, 3400, 3500, 3700, 3800, VHRD500, 700 140p	802 140p SLV210, 270, 273, 275, 300, 353, 373, 410, 415,
8933, 8940, 8941, 8942 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 2V45, 2V46, 2V46, 2V45, 2V45, 2V46	VXL2, VXL3 140p VXL4, VXL20, VXL35 140p	AG 1000, 1050, 1200, 1500, 2100, 2200, 6500, 6810, 7500, 7510,	VTC3000 140p VHR120, 130, 14, 141, 143, 14, 150, 151, 153,	474, 656, 715 300p SLV757, 777 140p
3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FVII, FV12, FV14, 5042, 5044, 5045, 5047, 5048, 1405	VXL4, VXL20, VXL35 1400 VTV100, VXL10, VXL11, VLX9, VXL90 700p	NVH70 140p NVG9, NVG120 140p	154, 15, 16, 171, 194, 22 0VHR23, 235, 240, 244, 250, 251, 274, 27, 297,	SLV255 140p
FV14, 8943, 8944, 8945, 8947, 8948 140p 3V52 140p	PINCH ROLLER ASSEMBLY	AG6840, 6720, 7150, 7330, 7350, 7355, 7650, NVH65, 75, NVJ30, NVL20, 23, 25,	310, 330, 335, 350, 390, VHR4100, 4105, 4150, 4200, 430, 4300, 4350, 4400, 474, 4770, 5080,	SLV275, 282, 315, 325, 353, 363, 373, 410, 415, 416, 474, 625, 656, SLV715, 725, 727, 757, 777, 915, 925, SLV720, 50, 55
8950, 8951, FV10B, 11R, 13H, 14T, 20B, 21R, 22L, 26D, 31R, 32L,FV33H, 39S, 41R, 42L, 50B, 51D, 52L, VC141	V20H, VXL5, VXL6 MOD KIT 275p J.V.C.	28, NVG300, NVF65, NVF70, NVFS1 NVFS	4200, 430, 4300, 4350, 4400, 474, 4770, 5080, VHR5100, 5200, 5300, 5350, 5600, 5700, 6850, 7100, 7200, 7250, VHR7260, 7300, 7400, 7440,	815, 825, SLVX30, 50, 55 SLV125, 213, 225, 252, 255, 262, SLVXI,
51R, 52L, VC141L 140p FV37H, FV44L, FV46T, FV43H,	HR2200, 3300, 3330, 3360, 3660, 4100, 7700 140p	100, NVG 19, 20, 25, 33, 40, 50, NVV8000 140p NVD48, NVD80, NVG21 NVG45 140p	7500, 7520, 7530, 7540, 7700, 774, 780, 0VHR7810, 8000, 8070, 8100, 8200, 8250,	20, 3 140p SLV215, 216EE, 275, 282, 315, 325, 353,
FV57H 140p 3V35, 3V36, 3V38, 3V39, 3V49, 8943,	HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655 140p	NVJ700PX 140p	8500, 8800, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700, VHRS700 140p	363EE, 373, 393, 410, 415, SLV416EE, 474, 494EE, 555UC, 559, 575UC,
8944 1100p PINCH ROLLER ASSEMBLY	HRD110, 111, 120, 121, 140, 141, 142, 143, 150, 152, 156, 157, 158,	NVHD100, NVHD101, NCHD90, NVSD30, NVSD40 1125p	VCR100 140p VHR120, 135, 150, 190, 4150, 4160, 4350,	579, 585HF, 595HF, SLV60W, 615, 625, 656, 676UC, 686HF, 696HF, 715, 725, 727, 757,
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947, 8948 1350 p	HRD160, 220, 225, 250, 257, 445, 455, 565, 566, 725, 755, HRP50, BP5000, BR7000,	PINCH ROLLER ASSEMBLY AG5150, 5250, 5700, 6024, NVD38, 48, 80,	5200, 5240, 5350, 7200, 7250, 7260, 7700,	SLV767B, 777, 815, 825, SLVE7, 8, 9SLVX30AS,
PINCH ROLLER ASSEMBLY FV37, FV57, FV58 350p	BRS611, 811 140p HRD520, 540, 550, 560, 580, 600, 610, 620,	NVF55, 65, 70, 75, 77, NVFS1, 100, 200, 88, 90, NVG 19, 20, 21, 22,	VHRD4410, 4610, 4710, 4890, 5450, VHRS700 975p	SLVX35AF, SLVX50AS, SLVX55DH,
PINCH ROLLER ASSEMBLY FV31R 140p	637, 640, 641, 650, 660, HRD670, 720, 730, 740, 770, 820, 830, 840,	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 PINCH ROLLER ASSEMBLY PART NO:
FV41L, FV42L 925p PINCH ROLLER ASSEMBLY	860, 870, 880, 910, 960, HRD980, HRDX20, 22, 25, HRJ200, 205, 210,	42, 45, 47, NVL20, 23, 25, 28, NVW 1 300p	VHRD500, 7000 1350p PINCH ROLLER ASSEMBLY	X37277701 SLV210, 212, 270, 273, 275, 285, 300, 310, 335,
3V58, 3V59, 3V64, 3V65, FV10, 11, 12, 13, 14, 20, 21, 22, 26, 30, 32, 33	215, 300, 315, 316, 318 HRJ400, 405, 407, 410, 411, 415, 416, 507,	PINCH ROLLER ASSEMBLY	SHARP VC200, 381, 383, 384, 385, 386, 388, 390, 393,	425, 427 350p PINCH ROLLER ASSEMBLY
FV39, VC141L 875p PINCH ROLLER ASSEMBLY	600, 605, 610, 615, 715, 815 HRJ97, HRS4700, 5800, 5900, 6800, 6900,	N830, 831, 832, 833, 895 140p PVC2300, 2400, 740, 744, 746, 760, 764,	800, 2300, 3300, 6000, VC6200, 6300, 7300, 7700, 7750, 7800, 8300,	SV6700.8750, 9700, VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 1350p
FV43H, FV44L, FV45X, FV46T 700p PINCH ROLLER ASSEMBLY	SR3200, 330, 368 140p HRD170, 171, 180, 210, 211, 217, 230, 300,	766 140p DX1000, 1600, 1800, 2000, 3000, N9012, 9013,	838, 9100, 9300, 9400, VC9500, 9600, 9700, 9800 140p	PINCH ROLLER ASSEMBLY
FV61, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77 775p	320, 321, 330, 337, 350, HRD370, 400, 430, 440, 441, 470, 500, 530,	9014, 9016, 9033 N9034, 9053, 9054, 9055, 9056, 9066, 9096,	VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571,	SL100, 200, SLC20, 30, 33, 34, 40, 44, 80, 88, 9, SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90,
PINCH ROLLER ASSEMBLY	700, 750, 950, HRS5000, 5500, 8000, 9000, BR7030, 7040,	9110, 9120, 9510, 9520, N9530, 9610, PX 1200 140p	573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E, VCA1031 140p	SLHF100, 150, 950, SLK85, 95, SLO1700, SLS550, SLT0, 30, 50 300p
FVHP420, 520, 530 140p	9060,	DS6000G, DX4000, N9077	VC108, 208, 405, 408, 550, 600, 651, 671, 674,	PINCH ROLLER ASSEMBLY
		VIDEO LAMPS	S	

Models & Description Ord	der Code	Price	Models & Description Order	Code	Price	Models & Description	Order Code		Models & Description	Order Code	
UNIVERSAL VIDEO LAMP 9V	VL01	25p		VL05	100p	AKAI, GRANADA (VHSTJ2),	VL01	25p	AUTHENTIC (N850), DECCA	VL07	40p
80mV (310mm WIRES)	1		BLAUPUNKT, FERGUSON, FIDELITY,			HITACHI (VT3000), ITT (VR3912,			(VR8300), GRANADA (VHSTJ3,		
PANASONIC VIDEO LAMPS	VL02	30p	FISHER, FUJITSU, FUNAI, G.E.C., GOLDSTAR, GRANADA, GRUNDIG,			VRP3833), JVC (HR2200, 3300, 3330, 3660), MITSUBISHI (HS200	6				
SHARP VIDEO LAMPS	VL02	30p	HINARI, HITACHI, ITT, JVC (HRD			TELEFUNKEN (VR510, 519, 610),			WJ1, WJ3), ITT (VR3913, 3914,		
HITACHI 5381682 (VT63, VT64)	VL04		SERIES), MATSUI, MITSUBISHI,			THOMSON (VK300, 305, 306, 330			3963) JVC (HT7200, 7300, 7350	,	
VIDEO LAMPS			NEC, ORION, NATIONAL,			FERGUSON (3V00, 16, 22, 24, 32			7700) TELEFUNKEN (VR450, 52	20	
AKAI IVS10).GRANADA	VL06	40p	PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP,			8900, 8901, 8902, 8903, 8909, 591 8922, 8925)	Ζ,				
(VHSXJ3), TT (VR3993,3994), JVC		•	SIEMEN, SONY, TELEFUNKEN,					20	529, 540, 549, 620, 640, 920, 19	20),	
(HR2650, 7600, 7610, 7650, 7655),			THOMSON, TOSHIBA			BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200.2010, 3000,	VL02	30p	THOMSON (V4100, VK308, 309	, 312,	
TELEFUNKEN (VR530, 535, 539, 550 630, 650), THOMSON (V309, 316, 31			GRANADA (VHSAY3),SHARP	VL08	45p		10,		410), FERGUSON (3V23, 29, 30		
VK309, 411,TX8000), FERGUSON	,		(VC200, 381, 384, 385, 386, 388,			8620), SHARP (VC2300, 6000, 62					
(3V31, 8941, 8942)			390, 393, 9300, 9500, 9700)			6300, 7300, 7700, 8300)			8923, 8924, 8929, 8930, 8931, 8	940)	

		VIDEO SERVICE KI	ITS	
AMSTRAD VCR700 Contents BELT SET. PINCH ROLLER. REEL IOLER. VIDEO LAMP Order Code: SK41 £	E5.50	HITACHI VT11/VT33 Contents BELY SET. PINCH ROLLER. TENSION BANO. IOLER TYRES Order Code: SKO8	£5.00	NV500/NV568 Economy KH Contents Contents ELT SET, PINCH RDLLER PLAY IOLER, FF/REW IOLER, PLAY IOLER TYRE, FF/REW TENSION BANO IOLER TYRE Order Code: SK25 E12.00
FERGUSON & JVC 3V42/43 HRD455/HR0725 Contents BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION SUPPLY CLUTCH, TAKE UP BANO		VT11/VT33 Contents Economy Kit Contents BELT SET. T/UP REEL TABLE BELT SET. VUP REEL TABLE TYRE. SUPPLY REEL TABLE FF/REW TABLE TYRE. SUPPLY REEL IDLER. CLUTCH PLATE. TABLE TYRE TENSION BANO Order Code: SK45 £13.00 Order Code: SK46	£3.75	NVT30/NVT70 Contents SLOT IN BELT. LOADING BELT SLOT IN BELT. LOADING BELT SLOT IN BELT. LOADING BELT PINCH ROLLER. IDLER UNIT, PINCH ROLLER. IDLER UNIT, PINCH ROLLER. IDLER TYRE TENSION BAND Order Code: SK19 £5.50 Order Code: SK20 £3.00
Order Code: SK37 £16.00 Order Code: SK38 £ 3V58/59/64/65 HR0170/180/210/230/300/320/370/400/430/530/700/750 HR55000	E9.00	VT52/61/62/63/64/65/85/86/640 VT52/61/62/63/64/65/85/86/86/640 Contents BEUT SET, PINCH ROLLER, BEUT SET, PINCH ROLLER, F/REW ARM, CUTCH PLATE. F/REW UBLR	6.75	NV370/NV380/480/630/780/830/850/AG 2100PK/AG 2200PK Contents Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER IOLER, TENSION BANG IOLER TYRE
Contents BELT SET, PINCH ROLLER, IOLER ARM, TENSION BANO	E7.00	TENSION BAND Order Code: SK49 £14.00 Order Code: SK50 VT400/405/10/13/14/15/18/20/25/26/29/430/31/35/48/450/498/ 510/220/22/25/305/36/54/64/46/48/5707/55/5680/85/88	£3.00	Order Code: SK21 £5.00 Order Code: SK22 £2.75 NV777/NV788 Contents Economy Kit Contents BELT SET, PINCH ROLLER BELT SET, PINCH ROLLER
HR7200/7300/7350 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BANO, IOLER TYRES	25.00	Contents Contents TIMING BELT. PINCH ROLLER, FF/REW ARM. CLUTCH BASE. TENSION BAND Order Code: SKS2	£9.75	IOLER UNIT. TENSION BANO IOLER TYRE Order Code: SK17 £6.00 Order Code: SK18 £4.00 SHARP VC381
3V35/36, 38/39/49 HR0110/11/1/20/225 Contents BeLT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES		VT100/110/11/13/115118/120/25/128/128/128/130/135/138/145/158/ 175/220/225/250/255/258/250/VTL30 Contents BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND		Contents Economy Kit Contents BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER REEL IDLER. TENSION BAND. REEL IDLER TYRE VIDEO LAMP Order Code: SK47 £8.00 Order Code: SK48 £3.25
Order Code: SK04 £ 3V31/3V42 HR7600/7610/7650/7655 Contents Economy Kit Contents	E5.00	Order Code: SK51 PANASONIC NV2000/NV200/NV7200/NV7800 Contents Economy Kit Contents	£14,00	VC500/VC571/VC581/VC582/VC584/VC5F3 Contents Economy Kit Contents BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER REEL DILER. TENSIDN BAND REEL DILER
BELT SET, T/U REEL TABLE BELT SET, T/U REEL TABLE TYRE. PINCH ROLLER. REEL TYRE. PINCH ROLLER. REEL IDLER. T/U CLUTCH. T/U IDLER. ENSIDN BAND. VIOEO LAMP T/U CLUTCH	E5.00	Contents ECUTION AND CONTRACT	£5.00	Order Code: SK60 £9.50 Order Code: SK61 £5.09 VC781/VC7810/VC7822/VC785/VC785/VC793/VC800/ VCA100/VCA102/VCA104/VCA202 Contents Economy Kit Contents
3V35/36/38/39/49 HRD 110/111/120/121/225 Contents Economy Kit Contents BELT SET. T/V REEL TABLE BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. SUPPLY REEL TABLE	-	BELT SET. PINCH ROLLER, TENSION BAND. IOLER TYRE Order Code: SK01 NV2000/INV2010 Contents Economy Kit Contents	⁴ £5.00	BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TO SION REEL DRIVE UNIT TYRE BAND Order Code: SK64 £13.50 Order Code: SK64 £13.50 Order Code: SK65 £3.75 VC681/VC682/VC685/VC683/VC693/VC659/VC67JVC700 VC681/VC682/VC685/VC693/VC93/VC693/VC693/VC693/VC693/VC93/VC693/VC693/VC693/VC69
TYRE. PINCH ROLLER. T/U TYRE. PINCH ROLLER. T/U CLUTCH. T/U IDLER. REEL CLUTCH. T/U IDLER TYRE. REEL · IDLER, TENSION BAND IDLER TYRE	E5.50	BELT SET, PINCH ROLLER. FF BELT SET, PINCH ROLLER. IDLER: PLAY IDLER, TENSION IDLER TYRE. PULLEY TYRE BANO, VIDEO LAMP Order Code: SK13 £5.00 Order Code: SK14	£3.50	Contents Economy Kit Contents BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER REEL DRIVE UNIT. TENSION REEL DRIVE UNIT TYRE BAND BAND
3V29/3V30 HR07200/7300/7350 Contents Economy Kit Contents BELT SET. T/U REEL TABLE BELT SET. T/U REEL IDLER TYRE. SUPPLY REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL TYRE. PINCH ROLLER. REEL		NV7000/NV7200/NV7200 Contents Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER IDLER UNIT, PLAY IDLER. IDLER TYRE. CLUTCH TYRE TENSIDN BAND Order Code: SK11 £8.50 Order Code: SK12	£3.25	Order Code: SK62 £13.50 Order Code: SK63 £5.00 FOR MORE DETAILS OF OVER 500 TYPES OF SERVICE KITS
IOLER, T/U CLUTCH, T/U IOLER, IOLE TYRE, T/U IOLER TYRE. TENSION BAND. VIDEO LAMP T/U CLUTCH Order Code: SK31 £10.00 Order Code: SK32 £ 3V44/45/48/53/54/55/57 HRP50/HR0140/150/158/160 K32 £	E5.00	NV300/NV333/NV340/NV356 Contents Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER IDLER UNIT, PLAY IDLER. IDLER TYRE. PLAY IDLER TENSION BAND Order Code: SK15 £7.00 Order Code: SK16	£3.25	PLEASE RING US! SERVICE KIT & UPGRADE FOR ONWA TV CHASSIS
HRD250/257/564/566/755 Contents Economy Kit Contents BELT SET. FINCH ROLLER BELT SET. PINCH ROLLER CLUTCH MECHANISM. TENSION BANO		NG57/NVG9/NVG1a/NVG11/NVG12/NVG14/NVG15/NVG15/ NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PXACI/ AG1810 (P/K) Contents Economy Kit Contents		FAILURE OF ZD401 (ZD401 ON THE 20/21 CHASSIS) IS NOT UNCOMMON. THIS KIT HAS BEEN ASSEMBLED AS A REPAIR KIT FOR COMPONENT FAILURES AND AS AN UPGRADE FOR THE
	E9.50	LOADING BELT. CAPSTAN LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER. TENSION BANO TYRE Order Code: SK27 £500 Order Code: SK28	£3.00	POWER SUPPLY. THE KIT CONSISTS OF ALL THE REQUIRED COMPONENTS AND COMES COMPLETE WITH FULL INSTRUCTIONS AND
BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER. IDLER. GEAR IDLER UNIT. IDLER TYRE TENSIDN BANO	E5.00	NV332 Contents Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER PLAY IDLER, FF/REW IDLER TYRE, FF/REW TENSION BAND. FF/REW TYRE IDLER TYRE		CIRCUIT DIAGRAM. THE KIT IS DESIGNED TO FIT THE FOLLOWING MAKES AND MODELS. * ALBA / BUSH * AKAI
PWP615/618/620/622/710/711/715/716/720/721/722/725/ 730/830/640 <i>Contents Economy Kit Contents</i> BELT SET, PINCH ROLLER. BELT SET, PINCH ROLLER.		Order Code: SK29 £12.00 Order Code: SK30 NV230/250/260/280/430/450/460/470/550/810/890/ AG1200PK/AG1500PK Contents Contents Economy Kit Contents	£5.10	* GOODMANS * HINARI * JVC * MATSUI
IDLER. GEAR IDLER UNIT. IDLER TYRE TENSION BAND		BELT SET, PINCH ROLLER, IDLER. TENSION BAND Order Code: SK23 65.00 Order Code: SK24	63.25	ORDER CODE : ONWAKIT PRICE: 1200p • SOME MANUFACTURERS HAVE ALREADY TAKEN STEPS TO UPGRADE THE POWER SUPPLY

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	V\$35, V\$53, V\$55,				FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM,		
	VS56, VS75	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,		
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400,				HRD 540, 580, 830, 860, 910, 960,				410G, 610	CH24	2500p
	73401, GSE1295P, GSE1891P,				HRD970, HRDX20,			TELEFUNKEN	VR2970	CH02	2800p
	20001Q, 20051Q, VCP4200, 4300,			FERGUSON	FV57H	CH27	2400p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
	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, G HV8000,				VR3916, 3926, 3946, 3948, 3976,			TDSHIBA	V55, V57	CH01	2800p
	8200	CH26	2900p		3986, 3995, 3997, 6948	CHD2	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,				· · · · · · · · · · · · · · · · · · ·		<u> </u>
	120, 121, 225	CH01	2800p		N833EG	CH01	2800p	AAAAAA	*******	N M N	XX
	3V42, 3V43, 3V44, 3V45, 3V48,				N895	CH02	2800p	🛣 AMST	FRAD MOD 	ZTT	*
	3V53, 3V54, 3V55, 3V57, 8945,			PHILIPS	CASSETTE LIFT ASSEMBLY (691203	66)		AND	KAD MOD F		
	8947, 8948, HRD 140,				DV186, 190, 286, 471, 562, 761,			*	1972 - C	1.11	*
	141, 150, 157, 158, 160, 250,				VR6180, 6182, 6185, 6285, VR6290,						
	HRD257, 455, 565, 566, 725, 755	CHO2	2800p		6291, 6293, 6362, 6367, 6393, 6467,			FITS :			☆
	8948, 8950, FV10B, 12L, 13H, 14T,				6468, 6470, VR6561, 6670, 6760,			🏠 VCR 4500 , 46	00,4700,5200,TVR 1	,2,3	
	20B, 21R, 22L, 26, 395, HRD230,				6761, 6870, 6970	CH05	1100p	*			*
	430, 530	CH03	2800p		VR6443	CH22	2900p				
	3V58, 3V59, 3V64, 3V65, FV11R,				VR6448	CH23	2500p	👷 🛛 PRICE	E : £2.25 + VAT ea	acn	*
	8950, 8951, HRD170, HRD180,			A	49SB6	CH24	2500p	A	A A A A A A A	A	
	HRD370	CH04	2800p	SHARP	VCA100, VCH851, VCH852	CH22	2900p	****	****	VXV	XX

MODE CHUTCH						
MODE SWITCH		A	UDIO CON	FROL HE	EADS	
NV2000, 2010, 7000, 7200, 7800 (VS50048)	AMSTRAD ORIGI		R.		io Control Video Soun	d Head
NV230, 260, 430, 810, 870, 2300, 4300 £3.50			R4600, 4600MKII, 4700, 5600, 6600, VIP3000, 5000	for National Pana	sonic	
(VSS0110) £2.25			, PROLINE, SCHNEIDER, DER CODE: AH01 PRICE: 1350p	PART NUMBER	MODELS	PRICE
NV830 (VSS0091) £2.10				VBR 0091	NVG7 etc	875
	Used on: AMSTR	AD DD8900, 8904	, VCR2000, 6000, 6100, 8600, 8602,	VBR0050	NV300, NV340 etc	875;
NV300, 333, 340, 366, 688, 777, 778		8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD-			NV777 etc	875
(VSS0060 £3.75	HAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEI- DER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA,			VBR0103A	NV250, NV450 etc	625)
NVG21, 25, NVH65, NVD80 (VSS0175A) £2.00	UNIVERSUM		DER CODE: AH02 PRICE: 1450p	VBR0125		625
	V]	IDEO	TOOLS			
VIDEO CLEANING STICKS			VCR ALIGI			
Price 17p each 15p each pack of 10pcs	CONTAINS:	SET OF 7 H	EAD & TAPE PATH ALIGNE	RS	SET OF 8 ALLEN	
13p each pack of 25pcs Order Code: SP14	RCA TYPE RCA ADJU		1.27mm 1.5	0mm 0mm		
VIDEO MAINTENANCE TOOLS	RCA TYPE					0mm 0mm
Set of 8 Allen keys packed	• TENSION A • VCR ADJU	-	NT TOOL FOR VARIOUS U	SES	2.4011111 3.0	
in a plastic wallet Order code: TOOL 9, Price 125p	VCh ADJU			с	IRCLIP PLIERS	
Specifically designed for video maintenance		SPRIN	G HOOK		CREWDRIVER	
UNIVERSAL HEAD EXTRACTOR]			EXTRACTOR L 10, Price 2900p	•	
Hand tool designed for extracting hard to		TR	ANSPARENT REPAIR/	ADJUSTMENT C	ASSETTE	
remove heads without damage to either the head or the mounting assembly.	This transpa		assette replaces a normal			ents and
Adjustable so as to suit various heads.			. The mechanical parts co	me into sight and be		
Order code: TOOL 8, Price 600p	_		Order code: TO(DL 23, Price 500p		
	BACK	CUP F	BATTERIES			
PHILIPS			FERGUSON			
Part Nos: 138 - 101138, 138 - 10313 1.2v 90m	AH		Part No: 00E6 - 067	001 1.2V 100mA	н	
Order Code: BB01		rice: 75p	Order Code: BB03		P	rice: 90
Part Nos: 138 - 10229, 2.4v 100mAH	D-		Part Nos: 00E6 - 606	- 8001 2.4V 100m		iaa, 150
Order Code: BB02	Pr	ice: 135p	Order Code: BB04		FI	ice: 150
	S	ATEI	LITES			
MAKE & MODEL	CODE	PRICE	MAKE & MODEL	•	CODE	PRICE
PACE PRD800, PRD900	SATPSU1	600p				
	JAIFSUL		PACE MSS200/300	APPOLL	SATPSU9	900p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p	PACE MSS200/300 PACE MSS500/1000		SATPSU9 SATPSU10	900p 1230p
PACE SS9000, 9200, 9010, 9210, 9220	· · · · · · · · · · · · · · · · · · ·	4				+ +
	SATPSU2	550p	PACE MSS500/1000)	SATPSU10	1230p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500	SATPSU2 SATPSU3 SATPSU4	550p 600p 600p	PACE MSS500/1000 FERGUSON SRD4	0	SATPSU10 SATPSU11	1230p 650p 1600p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520	SATPSU2 SATPSU3 SATPSU4 SATPSU5	550p 600p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500	0 700/8700	SATPSU10 SATPSU11 SATPSU12	1230p 650p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500 AMSTRAD SRX340, SRX345, SRX350 PACE D100/150	SATPSU2 SATPSU3 SATPSU4 SATPSU5 SATPSU6	550p 600p 600p 600p 650p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500 ECHOSTAR 6500/7 AMSTRAD SRD600	0 0 700/8700	SATPSU10 SATPSU11 SATPSU12 SATPSU13 SATPSU14	1230p 650p 1600p 2750p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500 AMSTRAD SRX340, SRX345, SRX350 PACE D100/150 CHURCHILL D2MAC	SATPSU2 SATPSU3 SATPSU4 SATPSU5 SATPSU6 SATPSU7	550p 600p 600p 600p 650p 650p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500 ECHOSTAR 6500/7 AMSTRAD SRD600 MIMTEC (Surensen	0 0 700/8700	SATPSU10 SATPSU11 SATPSU12 SATPSU13	1230p 650p 1600p 2750p 2600p 700p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500 AMSTRAD SRX340, SRX345, SRX350 PACE D100/150	SATPSU2 SATPSU3 SATPSU4 SATPSU5 SATPSU6	550p 600p 600p 600p 650p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500 ECHOSTAR 6500/7 AMSTRAD SRD600 MIMTEC (Surensen AMSTRAD SRD700, SR950, SF	0 700/8700) RX100, 301, 501, 5	SATPSU10 SATPSU11 SATPSU12 SATPSU13 SATPSU14 SATPSU15 SATPSU16	1230p 650p 1600p 2750p 2600p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500 AMSTRAD SRX340, SRX345, SRX350 PACE D100/150 CHURCHILL D2MAC	SATPSU2 SATPSU3 SATPSU4 SATPSU5 SATPSU6 SATPSU7	550p 600p 600p 600p 650p 650p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500 ECHOSTAR 6500/7 AMSTRAD SRD600 MIMTEC (Surensen AMSTRAD	0 700/8700) RX100, 301, 501, 5	SATPSU10 SATPSU11 SATPSU12 SATPSU13 SATPSU14 SATPSU15 SATPSU16	1230p 650p 1600p 2750p 2600p 700p
PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500 AMSTRAD SRX340, SRX345, SRX350 PACE D100/150 CHURCHILL D2MAC PACE MSS100 SATELLITE TUNERS	SATPSU2 SATPSU3 SATPSU4 SATPSU5 SATPSU6 SATPSU7 SATPSU8	550p 600p 600p 600p 650p 650p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500 ECHOSTAR 6500/7 AMSTRAD SRD600 MIMTEC (Surensen AMSTRAD SRD700, SR950, SF	0 700/8700) RX100, 301, 501, 5	SATPSU10 SATPSU11 SATPSU12 SATPSU13 SATPSU14 SATPSU15 SATPSU16	1230p 650p 1600p 2750p 2600p 700p
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PACE SS9000, 9200, 9010, 9210, 9220 AMSTRAD SRD510, SRD520 AMSTRAD SRD500 AMSTRAD SRX340, SRX345, SRX350 PACE D100/150 CHURCHILL D2MAC PACE MSS100 SATELLITE TUNERS PACE PRD800/MSS200 2Ghz (221 ORDER CODE: TUNER01 PRICE: 1 PACE PRD900/MSS1000 2Ghz (221 ORDER CODE: TUNER02 PRICE: 1	SATPSU2 SATPSU3 SATPSU4 SATPSU5 SATPSU6 SATPSU7 SATPSU8 -2077062) 400p + VAT -21770112) 400p + VAT	550p 600p 600p 600p 650p 650p	PACE MSS500/1000 FERGUSON SRD4 ECHOSTAR SR5500 ECHOSTAR 6500/7 AMSTRAD SRD600 MIMTEC (Surensen AMSTRAD SRD700, SR950, SF 1002, 2001, SRD200 The Satmeter is a pr designed for the ins	0 700/8700 3X100, 301, 501, 5 00 SAT250 SATMETE rofessional portat tallation and main can be used as st n loop.	SATPSU10 SATPSU11 SATPSU12 SATPSU13 SATPSU14 SATPSU15 SATPSU16 S02, SATPSU16	1230p 650p 1600p 2750p 2600p 700p 650p emeter
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	PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP710T, PDP720T, PDP910M,		
2500p	PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDT310, PDT510, PDZ, PDZ570T, PDZ74T,		
	PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S505DM, S505DT, S707DM,	PEA1030	4400p
	S707DTM, S909DM, S990DT, XCP410M, XCP410T, XDZ54T, XDZ55T, XDZ64M, XDZ84T, XRP310, XRP320 PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730,	FERIOS	44000
1800p	PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M,		
2000p	PD7303, PD7403, PD7303, PD7303, PD7340M, PD7350M, PD25001, PD2721, PD2731, PD251M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	4800p
		1 11 1003	40000
2150p	SAMSUNG	НОРМЭ	
	CD20		2150p
1800p			
2000p	CD1200, CD1310, SCM-6000, SCM6900	KSS210A	1800p
2000p 2500p	CD1200, CD1310, SCM-6000, SCM6900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900		
2000p 2500p 3400p	CD1200, CD1310, SCM-6000, SCM6900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO	KSS210A	1800p
2000p 2500p	CD1200, CD1310, SCM-6900, SCM6900 RCD1200, RCD1300, RCD1350, RCD1600, RCD600, RCD990, RCD995, SCM6900 SANYO DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10.	KSS210A SOH90T4N	1800p 3600p
2000p 2500p 3400p 3000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142168655	KSS210A SOH90T4N 614218	1800p 3600p 2300p
2000p 2500p 3400p 3000p 2150p	CD1200, CD1310, SCM-6000, SCM6900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCFS3, DCT85, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142186555 DCFS5, MCD450K, 660K, MCDZ30L, 60F, PART No. 6142205006	KSS210A SOH90T4N 614218 614220	1800p 3600p 2300p 5600p
2000p 2500p 3400p 3000p 2150p 1800p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142168655 DCF55, MCD450K, 660X, MCDZ30L, 60F, PART No. 6142205006 DCX1000MD, DCX1030, DCX500MD, DCX903, DCX915	KSS210A SOH90T4N 614218	1800p 3600p 2300p
2000p 2500p 3400p 3000p 2150p	CD1200, CD1310, SCM-6000, SCM6900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX602, DCX691, DCX891N, MCD210. PART No, 6142168655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No, 6142205006 DCF56, MCD450K, 660K, MCD230L, 60F, PART No, 6142205006 DCK1000MD, DCX1003, DCX800MD, DCX903, DCX915 DCD1010, DCD20, DCD304, DCC69, DCD304, DCC69, DCB40, DCX51, DCX110, DCX120,	KSS210A SOH90T4N 614218 614220	1800p 3600p 2300p 5600p
2000p 2500p 3400p 3000p 2150p 1800p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX831, DCX891N, MCDZ10. PART No. 612188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 614205006 DCK1000MD, DCX1030, DCX930 DCK100MD, DCX1030, DCX930, DCX931 DCC11U, DC220, DC230, DC330A, DC230, DCX915 DCC100, DC210, DC230, DCX930, DCX915 DCX100MD, DCX1030, DCX930, DCX931, MCDM50L, MCDMS50L, MCDMS60L, MCD21L,	KSS210A SOH90T4N 614218 614220 KSS210A	1800p 3600p 2300p 5600p 1800p
2000p 2500p 3400p 3000p 2150p 1800p 2000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCD210. PART No. 6142168655 DCF55, MCD450K, 660X, MCD230L, 50F, PART No. 5142205006 DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915 DCD10, DCD11U, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCM51, DCX110, DCX120, DCX10, DCX210, DCX93, DCX994, MCDM340L, MCDMS50L, MCDX160, MCD21L, MCD22L, MCD23L, PART No. 614239130	KSS210A SOH90T4N 614218 614220 KSS210A 614239	1800p 3600p 2300p 5600p 1800p 3300p
2000p 2500p 3400p 3000p 2150p 1800p 2000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DC153, DCT55, DCX502, DCX701, DCX702, DCX802, DCX801, DCX891N, MCDZ10. PART No. 6142186555 DCF55, MCD450K, 660K, MCD230L, G5F, PART No. 6142205006 DCK1030MD, DCX1030, DCX930, DCX9305, DCX915 DCD110, DC210, DC230, DC3930, DCX930, DCX915 DCX1020MD, DCX200, DCX930, DCX930, DCX915 DCX1020MC, DCX200, DCX930, DCX930, DCX915 DCX1020, RC320, DCX930, DCX930, DCX9150, DCD0150, MCDX10, DCX110, DCX120, DCX210, CX20, DCX930, DCX931, DCX90, MCD0MS40, MCDMS50L, MCDMS60L, MCDZ1L, MCDZ12, PART No. 6142391303 DCD121, PART No. 6142391303	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005	1800p 3600p 2300p 5600p 1800p 3300p 3700p
2000p 2500p 3400p 3000p 2150p 1800p 2000p	CD1200, CD1310, SCM-6000, SCMe8000 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142205006 DCX1000MD, DCX1030, DCX930MD, DCX930, DCX915 DCC1010, DCD1101, DCD20, DCD30AT, DC66, DCD8U, DCMS1, DCX110, DCX120, DCX310, MC220, DCX930, DCX934, MCDMS40L, MCDMS50L, MCDMS60L, MCDZ1L, MCD27L, MCD23L, PART No. 6142391303 DCD12, PART No. 61450055966 MCD231L, MCD241L, MCD271L, MCD271L	KSS210A SOH90T4N 614218 614220 KSS210A 614239	1800p 3600p 2300p 5600p 1800p 3300p
2000p 2500p 3400p 3000p 2150p 1800p 2000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCFS3, DCTS5, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCD210. PART No. 614126855 DCF55, MCD450K, 660K, MCD230L, 60F PART No. 614205006 DCK1000MD, DCX1003, DCX900MD, DCX903, DCX915 DCD10, DCD11V, DC220, DCD30, DCC3904, DCD6, DCD8U, DCMS1, DCX110, DCX120, DCX10, DCX20, DCX93, DCX994, MCDMS40L, MCDMS50L, MCDMS660L, MCD21L, MCD221, MCD23L, PART No. 6142391303 DCD13, DC231L, MCD241L, MCD261L, MCD271L SNARP	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005	1800p 3600p 2300p 5600p 1800p 3300p 3700p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p	CD1200, CD1310, SCM-6000, SCMe8000 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142205006 DCX1000MD, DCX1030, DCX930MD, DCX930, DCX915 DCD10, DCD11U, DC200, DC290, DC290AT, DC66, DCD8U, DCMS1, DCX110, DCX120, DCX310, MC220, DCX939, DCX940, MCDMS40L, MCDMS50L, MCDMS60L, MCDZ1L, MCD27L, MCD23L, PART No. 6142391303 DCD12 PART No. 645095966 MCD231L, MCD241L, MCD261L, MCD271L SNARP CD-111, CD-301, CD-302, CD-304, CD-310, CD-C3, CD-1700, CD-4800, CD-U1, CD-U10, CD-X10,	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005	1800p 3600p 2300p 5600p 1800p 3300p 3700p
2000p 2500p 3400p 3000p 2150p 1800p 2000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCD210. PART No. 6142186855 DCF55, MCD450K, 660X, MCD230L, 60F, PART No. 5142205006 DCF50, DCX100, DCX1003, DCX900MD, DCX900, DCX915 DCD10, DCD11V, DCD20, DCD300, DCC3004, DCX915 DCD10, DCX100, DCX903, DCX900MD, DC4000, DCX910 DCD10, DCD11V, DCD20, DCD300, DCC3004, DCX915 DCD10, DCX100, DCX930, DCX9304, MCDMS40L, MCDMS50L, MCDX110, DCX110, DCX120, DCX210, DCX231, MCD231L, MCD21L SMARP CD-111, CD-301, CD-304, CD-310, CD-23, CD-1700, CD-4800, CD-U1, CD-U10, CD-X10, CD-X10, CD-X15, CD-X16, CD-X17, CD-X16, CD-X17, CD-X15, CD-X16, CD-X17, CD-X16, CD-X17, CD-X16, CD-X17, CD-X160, DX-150, DX-150, DX-150, DX-450, DX-45	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005	1800p 3600p 2300p 5600p 1800p 3300p 3700p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX831, DCX891N, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142205006 DCK1000MD, DCX1003, DCX930MD, DCX930, DCX915 DCK10100MD, DCX1003, DCX930MD, DCX930, DCX915 DCX1010, DCX200, DCX230, DCX930, DCX915 DCX1010, DCX200, DCX230, DCX931, MCDMS40L, MCDMS50L, MCDMS60L, MCDZ1L, MCD27L, MCD221, PART No. 6142391303 DCD121 PART No. 6142391303 DCD231L, MCD241L, MCD261L, MCD271L SMARP CD-111, DC-310, CD-302, CD-304, CD-310, CD-23, CD-1700, CD-4800, CD-U1, CD-U10, CD-X10, CD-X10, CD-X12, CD-X16, CD-X15, CD-X150, CMS956C) DC112, PA41, DX 650, DCX991, DCX30, CX 450, CMS950C), DX-150, DX-150	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005	1800p 3600p 2300p 5600p 1800p 3300p 3700p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM66900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891, MCD210. PART No. 6142168655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 5142205006 DCF150, DCX100, DCX5030, DCX9361, DCC66, DCD8U, DCM51, DCX110, DCX120, DCX203, DCX9351, DCX930, DC23047, DCC66, DCD8U, DCM51, DCX110, DCX120, DCX210, DCX230, DCX9353, DCX934, MCDM540L, MCDM550L, MCDM560L, MCD21L, MCD221, PART No. 614239130 DCD12, PART No. 6450055966 MCD231, MCD241, MCD251L, MCD271L SMARP CD-111, CD-301, CD-302, CD-30, CD-23, CD-L700, CD-4800, CD-U1, CD-U10, CD X10, CD-X10, CD-X10, CD-X10, CD-X10, CD-X150, DX-150, DX-450, DX-450, DX-475, DX-8750, DX-8	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005	1800p 3600p 2300p 5600p 1800p 3300p 3700p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1330, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX831, DCX891N, MCDZ10. PART No, 6142188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142205006 DCK1000MD, DCX103, DCX803MD, DCX803D, DCX815 DCK1000MD, DCX103, DCX800MD, DCX803D, DCX915 DCK1010, DCX20, DCX930, DCX934 DCX102, NC220, DCX930, DCX934 DCX111, DC220, DCX930, DCX934 DCX120, MC232, DCX939, MCM0MS40, MCDMS50L, MCDMS60L, MCDX110, DCX120, DCX210, DCX210, DCX931, DCX310, DCX210, DCX210, DCX230, DCX931 DCD111, LCD230, LCX20, DCX931, DCX941, MCDMS50L, MCDMS60L, MCDX660L, MCDZ1L, MCDZ31L, MCDZ21L, MCDZ31L, MCDZ31L, MCDZ31L, MCDZ31L, MCDZ31L, MCDZ41L, MCDZ61L, MCDZ71L SMARP CD111, LCD-301, CD-302, CD-304, CD-310, CD-23, CD-1700, CD-4800, CD-11, CD-110, CD-X10, CD-X10, CD-X10, CD-X10, CD-X10, MCX60, DX-9100, DX-21500, JX-450, DX-450,	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005 KSS210B	1800p 3800p 2300p 5600p 1800p 3300p 2700p 2000p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p 3000p	CD1200, CD1310, SCM-6000, SCMe8000 RCD1200, RCD1330, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 5142205006 DCK1000MD, DCX103, DCX930MD, DCX930, DCX915 DCC1010, DCD110, DCD20, DCD30AT, DCD6, DCD81U, DCM51, DCX110, DCX120, DCX210, DCX220, DCX933, MCDM540L, MCDM550L, MCDM560L, MCDZ1L, MCD22L, MCD27L1, M	KSS210A SOH9074N 614218 614220 KSS210A 614239 645005 KSS210B	1800p 3800p 2300p 5600p 1800p 3300p 2000p 5760p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, CD1310, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DC155, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, G0F, PART No. 614205006 DCX1000MD, DCX1030, DCX800MD, DCX9030, DCX915 DCC1010, DC1101, DCD20, DCD30AT, DCD6, DCD30AT, DCD6, DCD80L, DCM110, DCX120, DCX210, DCX20, DCX930, DCX941, MCDMS40L, MCDMS50L, MCDMS60L, MCD21L, MCD221, MCD221, PART No. 6142391303 DCD2111, MCD241L, MCD261L, MCD271L SMARP CD1111, CD-301, CD-302, CD-304, CD-310, CD-3, CD-1700, CD-4800, CD-U11, CD-U10, CD X10, CD-X12, DC-X13, DC-X16, DX-R550, DX-R50, DX-160, DX-450, CD-3302, CT-3302, DX-450, DX-450	KSS210A SOH90T4N 614218 614220 KSS210A 614239 645005 KSS210B	1800p 3800p 2300p 5600p 1800p 3300p 2700p 2000p
2000p 2500p 2500p 3400p 3400p 2000p 2000p 4000p 5000p 3000p	CD1200, CD1310, SCM-6000, SCMe8000 RCD1200, RCD1330, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 5142205006 DCK1500MD, DCX103, DCX930MD, DCX930, DCX915 DCC1010, DCD110, DCD20, DCD30AT, DCD6, DCD81U, DCM51, DCX110, DCX120, DCX220, DCX930, MCDM540L, MCDM560L, MCDX100, DCX120, DCX210, DCX220, DCX931, MCDM540L, MCDM550L, MCDM560L, MCD21L, MCD221L, MCD221, MCD23L, PART No. 614281303 DCD12, PART No. 646005966 MCD231L, MCD24LI, MCD21L, MCD271L SMARP CD-111, CD-301, CD-302, CD-304, CD-310, CD-23, CD-1700, CD-800, CD-111, CD-110, CD-X10, CD-X10, CD-X12, CD-X16, MCD211, MCD21L, MCD221L, MCD221, MCD23L, MCD271L, MCD221, MCD23L, MCD271L SMARP CD-111, CD-301, CD-302, CD-304, CD-310, CD-200, CD-100, CD-1800, CD-111, CD-110, CD-X10,	KSS210A SOH9074N 614218 614220 KSS210A 614239 645005 KSS210B RH8122A RH8122A	1800p 3800p 2800p 5600p 1800p 2000p 2000p 5760p 2900p
2000p 2500p 3400p 3000p 2150p 1800p 2000p 4000p 5000p 3000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1350, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCF53, DC155, DCX502, DCX701, DCX702, DCX802, DCX801, DCX891, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, GF, PART No., 614205006 DCX1000MD, DCX1003, DCX930, DCX930 DCX1020MD, DCX1030, DCX930, DCX930 DCX1020MD, DCX1030, DCX930, DCX931 DCX201, DC220, DC2930, DCX934, MCDMS40L, MCDMS50L, MCDMS60L, MCD21L, MCD21L, MCD21L, MCD21L, MCD231L, MCD241L, MCD261L, MCD271L SMARP DC111, DC301, CD-302, CD-304, CD-310, CD-2, CD-1700, CD-1800, CD-U11, CD-U10, CD-X10, CD	KSS210A SOH9074N 614218 614220 KSS210A 614239 645005 KSS210B RH8122A RH8122A	1800p 3800p 2800p 5600p 1800p 2000p 2000p 5760p 2900p
2000p 2500p 2500p 3400p 3400p 2000p 2000p 4000p 5000p 3000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1330, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142265066 DCK1000MD, DCX1003, DCX930MD, DCX930D, DCX915 DCC1010, DCD110, DCD20, DCD30AT, DC66, DCD8U, DCMS1, DCX110, DCX120, DCX210, DCX20, DCX930, DCX931 DCX120, DCX203, DCX930MD, DCX930, DCX915 DCCX10, MCD220, PART No. 6142391303 DCD121, MCD241L, MCD261L, MCD271L SMARP CD-111, DC-302, CD-304, CD-310, CD-23, CD-1700, CD-1800, CD-11, CD-110, CD-X10, CD-X10, CD-X12, CD-X15, CD-X15, CD-X15, CD-X30, CRX55, DX-R550, DX-R50, DX	KSS210A SOH9074N 614218 614220 KSS210A 614239 645005 KSS210B RH8122A RH8122A RH8122A RH8130AF	1800p 3800p 2300p 5600p 1800p 3300p 2700p 2700p 2700p 2900p
2000p 2500p 2500p 3400p 3400p 2000p 2000p 4000p 5000p 3000p	CD1200, CD1310, SCM-6000, SCM6900 RCD1200, RCD1300, RCD1300, RCD1300, RCD1900, RCD990, RCD990, SCM6900 SANYO DC153, DCTB5, DCX502, DCX701, DCX702, DCX802, DCX801, DCX931, MCDZ10. PART No. 6142168655 DCF55, MCD450K, 660K, MCD230L, 69F, PART No. 6142205006 DCX1000MD, DCX1003, DCX800MD, DCX903, DCX815 DCK1000MD, DCX1003, DCX800MD, DCX903, DCX915 DCK1000MD, DCX1003, DCX800MD, DCX903, DCX915 DCX1010, DCX103, DCX800MD, DCX903, DCX915 DCX102, MC220, DC930, DCX930, DCX915 DCX102, DCX20, DCX930, DCX940, MCDMS40L, MCDMS50L, MCDX10, DCX110, DCX110, DCX10, DCX20, DCY830, DCX941, MCD211L, MCD2112, MCD12, MC1100, DC1100, DC1100, DC110, DC110	KSS210A SOH9074N 614218 614220 KSS210A 614239 645005 KSS210B RH8122A RH8122A RH8122A RH8123AF RH8130AF	1800p 3800p 2300p 5800p 1800p 3300p 2700p 2700p 2900p 2900p 4500p
2000p 2550p 3400p 3000p 2150p 1800p 2000p 2000p 3000p 3000p 3000p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1330, RCD1350, RCD1600, RCD2900, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No, 612188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142265066 DCK1000MD, DCX1003, DCX930MD, DCX930D, DCX915 DCC1010, DCD110, DCD20, DCD30AT, DC66, DCD8U, DCMS1, DCX110, DCX120, DCX210, DCX20, DCX930, DCX931 DCX120, DCX203, DCX930MD, DCX930, DCX915 DCCX10, MCD220, PART No. 6142391303 DCD121, MCD241L, MCD261L, MCD271L SMARP CD-111, DC-302, CD-304, CD-310, CD-23, CD-1700, CD-1800, CD-11, CD-110, CD-X10, CD-X10, CD-X12, CD-X15, CD-X15, CD-X10, CD-302, SCR540, MCS05CD, DX-150, DX-150, DX-150, DX-150, DX-150, DX-150, DX-450, DX-98, DX-810, DX-82, DX-840, DX-2100, DX-21500, GFCD55, GT-30CD, OT-30CD, D1-30CD, D1-30CD, D1-30CD, OT-3020, DX-2100, DX-21500, GFCD55, GT-30CD, OT-3020, DX-3100, DX-21500, GFCD55, GT-30CD, OT-3020, DX-3100, DX-21500, GFCD55, GT-30CD, OT-3020, DX-3100, DX-21500, GFCD55, GT-30CD, OT-3020, DX-450, DX-98, DX-810, DX-810, DX-8100, DX-7150, DX-450, DX-98, DX-810, DX-810, DX-810, DX-850, DX-850	KSS210A SOH9074N 614218 614220 KSS210A 614220 KSS210A 614229 645005 KSS210B RH8122A RH8122A RH8120AF RH8130AF RH8130AF RH8130AF	1800p 3800p 2300p 5600p 1800p 3300p 2700p 2000p 2900p 2900p 2900p 2900p 2900p
2000p 2550p 3400p 3000p 2150p 1800p 2000p 3000p 3000p 3000p 1800p 1800p	CD1200, CD1310, SCM-6000, SCMe900 RCD1200, RCD1350, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900 SANYO DCF53, DCT55, DCX502, DCX701, DCX702, DCX802, DCX831, DCX891N, MCDZ10. PART No, 6142188655 DCF55, MCD450K, 660K, MCD230L, 60F, PART No. 6142205006 DCK1000MD, DCX103, DCX803MD, DCX803D, DCX815 DCK10100, DCX103, DCX800MD, DCX803D, DCX915 DCK1020MD, DCX103, DCX800MD, DCX803D, DCX915 DCX1010, DCX20, DCX930, DCX934 DCX102, PART No. 6140291303 DCD211L, MCD221L, MCD261L, MCD271L SMARP DC111, DC301, CD-302, CD-304, CD-310, CD-C3, CD-1700, CD-4800, CD-011, CD-010, CD-X10, CD	KSS210A SOH9074N 614218 614220 KSS210A 614220 KSS210A 645005 KSS210B RH8122A RH8122A RH8130AF RH8130AF RH8136AF KSS240A	1800p 3800p 2300p 5600p 1800p 3300p 2700p 2000p 2000p 2900p 4500p 2500p 2500p 2500p
2000p 2550p 3400p 3000p 2150p 1800p 2000p 2000p 3000p 3000p 3000p	CD1200, CD1310, SCM-6000, SCM6900 RCD1200, RCD1300, RCD1300, RCD1300, RCD1900, RCD990, RCD990, SCM6900 SANYO DC153, DC155, DCX502, DCX701, DCX702, DCX802, DCX891, DCX991N, MCDZ10. PART No. 6142186855 DC155, MCD450X, 600X, MCD230L, 60F, PART No. 6142205006 DCX1000MD, DCX1003, DCX800MD, DCX903, DCX815 DCK1000MD, DCX1003, DCX800MD, DCX903, DCX915 DCK1000MD, DCX1003, DCX800MD, DCX903, DCX915 DCX1000MD, DCX1003, DCX800MD, DCX903, DCX916 DCX100, DCX103, DCX800MD, DCX903, DCX915 DCX100, DCX103, DCX800, MCM30L, MCMS40L, MCMS50L, MCDX10, DCX110, DCX110, DCX10, DCX20, DCY830, DCX891, MCD840L, MCD21L, MCD21	KSS210A SOH90T4N 614218 614220 KSS210A 614220 KSS210A 614229 645005 KSS210B RH8122A RH8122A RH8120AF RH8130AF RH8130AF RH8130AF KSS210A	1800p 3600p 2300p 5600p 1800p 3300p 2700p 2000p 2000p 2900p 2900p 2900p 2900p 2900p 2900p 1800p
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RC70 Fisher RC905B	RC894 RC879	650p 650p	A511940 655602H ITT	RC906 RC1920	650p 650p	RC5002,5154 KT3 NON TEXT 69117032	RC134 RC135 RC178 RC180	650p 650p 650p 650p	T ATUNG FXA RC70 FX70 FASTTEXT	RC877 RC883 RC894	650p 650p 650p
GRANADA UNIVERSAL TEXT MK4 TEXT, 70155G, 70115G, 70133G 95288E 94490D	RC309 RC880 RC882 RC884	650p 650p 650p 650p	IFB 13, 14, 15 FS4 RG305 RG306	RC143 RC148 RC305 RC306	650p 650p 650p 650p	69117194 RC5991-UNIV RC38 KT3 TEXT RC5352	RC300 RC301 RC5301 RC5352	550p 650p 650p 650p	TELEFUNKEN FB632 FB639 THORN/FERGUSON	RC632S RC639	650p
GRUNDIG TP 160E TP 200, TP 300 TP 400	RC107 RC380 RC401	650p 650p 600p	FS9/1-10/1 VS5 RUK VS4-1 MULTICONTROL (17C20)	RC307 RC308 RC308 RC311	650p 650p 650p 650p	RC5375 RC5 STANDARD RC5903 SALORA	RC5375 RC300 RC5903	550p	3V35-42 3V31-32 3V57-58 TX10 TEXT	RC342 RC344 RC628 RC732	600p 650p 650p 575p
TP590-600 TP390, TP610 TP621 TP630, TP650	RC600 RC610 RC612 RC650	650p 650p 650p 650p	LOEWE OC11 MATSUI 010270601	RC146 RC889	650p 650p	SERIES L 86173 SANYO RC218, RC222, RC228, RC238	RC190 RC882 RC140	650p 650p 650p	TX10 STEREO TEXT TC9-90-100 3V55, FV11 TX100 FASTTEXT	RC738 RC740 RC783 RC789	575p 600p 650p 650p
TP666 TP661 HITACHI CLE800-CLE830	RC660 RC661 RC140	650p 650p 650p	VX770 NOKIA SATELLITE ORION	RC892 RC550	650p 650p	JXGE JXDE VHR2300 RC628 SHARP	RC878 RC884 RC890 RC865	650p 650p 650p 650p	TX 100 ST, FASTTEXT PROFESSIONAL T OSHIBA CT937	RC789 RC790 RC950	650p 650p 650p
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00 D-4-208-001	LO 179	1600p	2433441	LOT188 190		LOT190 1		TLF 70162G	LOT72 1600p	RTRNF 2002 CEZZ		1.400-000-1	
00 D-4-208-002	LOT79	1600p	2433442	LOT191 160		LOT196 1		TLF 77001 B	LOT274 1550p	RTRNF 2003 BMZZ		1-433-333-1	
- 00 D-4-235-002	LOT240		2433451	LOT81 135 LOT82 125		LOT194 1 LOT22 1		PHILIPS 4822 140 10142	LOT142 1800p	RTRNF 2004 BMZZ RTRNF 2005 BMZZ			
00 D-4-235-002 HTI		1350p	2433452 2433453	LOT82 125		LOT198 1		4822 140 101145	LOT134 1450p	RTRNF 2006 BMZZ		1-453-303-2	
00 D-4-235-00201G		1350p	2433455	LOT234 160		LOT27 1		4822 140 10146	LOT112 1700p	RTRNF 2007 BMZZ			
00 D-4-260-004 HTI		1250p	2433521	LOT85 160		LOT193 1		4822 140 10151	LOT102 1700p	RTRNF 2023 BMZZ			
00 H-0-701-2400 06 D-3-083-001	LOT182 LOT82	1450p 1250p	2433581	LOT22 125		LOT179 1	550p	4822 140 10161	LOT103 1250p	SONY		1-439-416-1	
06 D-3-083-001	LOT82	1250p	2433721	LOT83 140		LOT207 1		4822 140 10171	LOT104 1500p	3753100	LOT275 15	00p 1.439-416-2	
06 D-3-084-001	LOT23	1400p	2433751	LOT01 130			650p	4822 140 10176	LOT114 1150p	1-439-243-00		00p 1.439.416.2	
06 D-3-087-001	LOT23	1400p	2433752	LOT01 130		LOT193 1		4822 140 10194	LOT105 1500p	1-439-243-11		00p 1-439-416-4	
06 D-3-088-001	LOT84	1450p	2433752	LOT250 135		LOT27 1		4822 140 10198 4822 140 10201	LOT116 1600p LOT104 1500p	1-439-243-12 1-439-243-31	LOT91 16 LOT229 17	00p 1-439-416-5	
06 D-3-093-001	LO T204	1600p	2433891 2433892	LOT23 140 LOT84 145		LOT200 1 LOT56 1	400p 650p	4822 140 10201	LOT104 1550p	1-439-243-32	LOT229 17	00m 1-439-430-2	
06 D-3-095-001	LOT87	1000p	2433893	LOT23 140		LOT196 1		4822 140 10246	LOT111 1500p	1-439-243-41	LOT229 17	154125A	LOT275 1500p
06 D-3-095-002	LOT87	1000p	2433952	LOT33 100			650p	4822 140 10247	LOT105 1500p	1-439-244-00		IUSHIBA	107101 4450-
06 D-333-512-001	LOT204		2434002	LOT200 140			550p	4822 140 10254	LOT107 1460p	1-439-244-11		00p 37010 37011	LOT131 1450p LOT131 1450p
FETX 100 90 DEG	LOT04	1500p	2434141	LO T33 100			450p	4822 140 10263	LOT117 1550p	1-439-244-21		00p 27012	LOT131 1450p
FETX 90 WHITE FETX 100 100 DEG	LOT06	1650p 1500p	2434141	LOT33 100			450p	4822 140 10269	LOT210 1350p	1-439-244-31			LOT131 1450p
GRUNDIG	10134	Tooob	2434274	LOT44 105			650p	4822 140 10271	LOT208 1650p	1-439-256-00		1300 1 27014	LOT131 1450p
29201.008.01	LOT153	17500	2434274	LOT44 105 LOT86 160		LOT22 1	250p	4822 140 10274 4822 140 10282	LOT123 1450p LOT122 1300p	1-439-256-11 1-439-256-21		150p 37014 150p 37015	LOT131 1450p
29201.014.01	LOT140		2434453 2434455	LOT86 160 LOT234 160		LOT51 1	550p	4822 140 10282	LOT104 1500p	1-439-256-22		37016	LOT131 1450p
29201.015.01	LOT149	1400p	2434593	LOT44 105			500p	4822 140 10294	LOT125 2150p	1-439-276-21	LOT230 17	00n 37017	LOT131 1450p
29201.017.01	LOT60		2435062	LOT296 140			450p	4822 140 10306	LOT110 1200p	1-439-280-00		100m 37018	LOT131 1450p
29201.018.01	LOT163		2435121	LOT87 100		LOT50 1	450p	4822 140 10325	LOT132 1500p	1-439-280-13		100p 37019	LOT131 1450p
29201.018.02	LOT61	1700p	2435131	LOT251 145			600p	4822 140 10326	LOT122 1300p	1-439-286-00		1810951 2433751	LOT55 1400p LOT01 1300p
29201.019.01	LOT62	1250p	2435141	LOT282 130		LOT295 1		4822 140 10328	LOT124 1450p	1-439-286-11		vop	LOT250 1350p
29201.019.02	LOT62 LOT63	1250p 1700p	2435301	LOT88 145			550p	4822 140 10349	LOT106 1250p	1-439-286-12		2433752 23236023	LOT281 1300p
29201.022.01 29201.022.02	LOT165		2435671	LOT89 160 LOT109 120			500p	4822 140 10353 4822 140 10356	LOT284 1450p LOT284 1400p	1-439-286-13 1-439-286-21		23236052	LOT131 1450p
29201.022.02	LOT165		2436201 2436202	LOT109 120 LOT109 120			500p	4822 140 10350	LOT286 1400p	1-439-288-00	LOT228 17		LOT288 1400p
29201.022.04	LOT165		2436202	LOT79 160		LOT273 1		4822 140 10369	LOT109 1200p	1-439-288-12	LOT228 17	50p 23236198	LOT288 1400p
29201.022.04A	LOT 165		2433451H	LOT81 135		LOT272 1		4822 140 10381	LOT128 1300p	1-439-289-00		23236255	LOT289 1500p
29201.024.01	LOT65		2433453H	LOT82 125		LOT279 1		4822 140 10384	LOT127 1550p	1-439-289-21		00p 23236424	LOT129 1400p
29201.024.04	LOT164	1400p	2433891H	LOT23 140		LO 178 1	1500p	4822 140 10395	LOT116 1600p	1-439-289-22		23236425	LOT288 1400p
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51 14184 1	LOT24 LOT24	1500p 1500p	4515 01 15 4515 01 16	LOT136 160 LOT139 167		10102 1	1500p	094-00020/0.9	LOT113 1400p	1-439-303-00		500p TFB 4035 A	
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TELEVISION July 1998

Panasonic

Sony Philips

Hitachi

Mitsubishi

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/for disposal: Require circuit diagram/spec information for the Tripole Data TC1017 17in. monitor. Have for disposal a Microvitec 16in. open-frame RGB/PAL monitor with separate Philips UHF/VHF/teletext tuner at £30. Adrian Casper, 25 Cheltenham Place, Kenton, Harrow, Middx HA3 9NB. 0956 398 452. Wanted: Service information for the National TV Model TC212MRN and the Sony Model HCD-H7 mini hi-fi system. D. Leong, PO Box 350, Seria KB1133, Brunei-Darussalam. Wanted: Power supply and/or service manual for the Brother BCN3286/52 80286-16 computer. Mike Newsome, 28 Horne Street, Denby Dale Road, Wakefield, W Yorks WF2 8EA. 01924 379 867. For disposal: 240V input autotransformer with 120V output at 17.4A, 2,000VA. Upright shrouded. US style outlet. $4.5 \times 6.6 \times 6$ in. \pounds 50. Very heavy – buyer to collect. David Martin, 10 Alpha Place, Bishop's Stortford, Herts CM23 2HN. 01279 656 426. Wanted: Complete plug-in power supply for the Philips VR6585/05 VCR or whole working machine. W. Murgatroyd, 7 Currie Hill Close, London SW19 7DX. 0181 946 0415 Wanted: Main PCB with RF con-

verter for the Amstrad VCR6100, also 8-push button unit for the Ferguson TX100 chassis (mechanical tuning). M.J. Putt, 32 Raynham House, Massingham Street, Stepney, London E1 4EB. 0171 702 7501 or 0956 195 760. **Wanted:** Circuit diagram and any other servicing information for the Heathkit OS2 oscilloscope. O.C. Wells, 45 Levendale Road, Forest Hill, London SE23 2TP. 0181 291 4402.

Wanted: Lower drum unit for the Panasonic VCR Model NVF65 – or complete upper/lower drum assembly if the lower drum is known to

be working. Duncan Hutson, 72 Winterhill Road, Richmond Park, Kimberworth, Rotherham, S. Yorks S61 2EN. 01709 558 750. Wanted: A TDA1770 and a TDA1950 IC for the Grundig CUC95 chassis - alternatively a panel would do (no. 29504-007-92). Also require circuit diagram for this chassis, photocopy or loan OK. S. Hooper, 74 Gloucester Road, Littlehampton, W. Sussex BN17 7BS. 01903 722 936. Wanted: Service manual (photocopy OK) for the Sanyo CP17 CD player. F.D. Kemplay, 85 Marina View, Hebburn, Tyne and Wear NE31 1RY. 01914 835 634. Wanted: Module F1 or F2 (VTF0560409T) for the Pioneer PD70CD. T. Hand, 36 The Close, Portchester, Hants PO16 8AZ. 01705 371 148. Wanted: Syscon/timer IC, circuit reference no. IC6001, for the Amstrad Model VCR9000 (new version). Or does anyone know of an alternative or a supplier? CPC no longer do it, nor do the compa-

nies that purchased the Amstrad spares. H. Clifford, 12 Heol y Foel, Llantwit Fardre, Pontypridd CF38 2EQ. 01443 202 553. Wanted/for disposal: Require

Tatung TT17 teletext PCBs; service manual for the Grundig SC303; *Television* Jan. 1988, Nov. 1989, Feb. and March 1990 issues. I have for disposal *Television* Nov. 1992 to Jan. 1993 and May 1993 to Jan. 1994. A Plenderleith, Border Electronics, Unit 10, Edenside Workshops, Kelso TD5 7JR. 01573 224 864.

For disposal: Two Betamax VCRs, a Toshiba V9600B working OK and a Toshiba V8600B working but no colour. Also a Philips TV Model G20C560/05 (G8 chassis) in working order. Rafe Greenacre, 33 High Street, Airmyn, Nr. Goole, Yorks DN14 8LF. 01405 764 160. For disposal: Gould OS3000A dual-trace scope, £100. Tektronix 475 series 200MHz scope, £350. Gould SG200 RF signal generator, 16kHz-230MHz, £30. Leader 2channel AC millivoltmeter, 1mV-300V, £45. Insulation tester 250V-1kV, tests to 1,000M Ω , £65. All in good condition. Moving house so must reduce size of collection! J.P. Bell, 23 Barn Common, Woodseaves, Stafford ST20 0LR. 01785 284 388 (tel/fax). Wanted: For local school, an early JVC or Hitachi video camera, 1985 era, with the round multipin plug for a 3V32 or Hitachi VT6000E (not camcorder). Working if possible. Also wanted a main board with working power supply for the Ferguson ICC5 chassis, or complete set if cheap. Items would be collected or carriage paid. Ken Darville, Avia Electronics, Station Road, Yeoford, Devon EX17 5HU. 01363 84 017 or 0181 569 5696 and leave message. Wanted: Working U20 control module for the Philips VR2020 or VR2021 VCR. Sound coil (T101) for the Bush 1006. Sound coil for the Nikkai TLG100T (T101) or TLG2121 (T203). These sound coils are no longer available but any one used with a TDA4505E chip would probably do. Also a circuit diagram for the Granada C22BY4. Paul Hardy, 43 Sheridan Avenue, Caversham, Reading RG4 7BQ. 01189 475 869. Free to collector: Electronics World issues from May 1991-July 1997 and Television issues from July 1989-April 1997. Geoff Lewis,

63 Mount Road, Canterbury, Kent CT1 1YF. 01227 769 567. Wanted: Remote-control handsets for the following VCRs: Mitsubishi HSM55, Sanyo VHRD4410E. E.J. Edwards, 43 Hoose Court, Market Street, Hoylake, Wirral L47 5AB. 0151 632 0614.

Wanted: Tuner for the Philips Model 10CX1120/05R. Robert Crooks, 42 Edenderry Village, Shaws Bridge, Belfast BT8 8LG.



Reports from Michael Maurice John Coombes M. J. Cousins, MIEEIE Pete Gurney, LCGI Russ Phillips and Owen Green

Panasonic NVJ30B

This machine would intermittently load or unload, sometimes stopping at various modes. I replaced the rather worn and blackened mode switch, but this failed to cure the problem. A replacement solenoid was the solution, proved by a prolonged soak test. M.M.

Toshiba V411B

This machine wouldn't accept a tape. The belt that connects the cassette housing to the eject gear next to the capstan motor had fallen off. Replacing it wasn't the end of the story however. The machine still wouldn't load, because the motor 14V supply was low. TR201 (BD202) was found to be open-circuit. It had failed because the loading motor was faulty: when I tested it with a 12V supply it became hot and drew 3A! A replacement loading motor finally completed the repair. M.M. 203

Sony SLVE40

When play or record was selected there was a clicking noise from the mechanism and, in play, an unsteady picture would appear with wow on the sound. I found that in these modes the clutch wasn't slipping. In this mechanism there's a gear that engages with the clutch in the rewind, fast-forward and unlace modes: it engages with both sections of the clutch to give full torque in these modes. In play and record it should disengage, but didn't.

VCR Clinic

The cause of the problem was on the top side of the mechanism, where the arm assembly trigger gear (item no. 932) that engages with the top plate was missing. Fortunately I was able to obtain one from a scrap Alba machine. This provided a complete cure. The part number is 3-946-920-01. **M.M.**

Osaki VCR34

The cause of intermittent playback with these machines can usually be traced to dry-joints at the plugsocket connections on the top side of the deck. J.C.

GoldStar GSE1290IQ

If one of these machines won't accept a tape, check whether diode D521 is open-circuit. J.C.

Akai VSF410

The cause of intermittent no results was traced to dry-joints at transistor TR3. Resoldering restored normal operation. **J.C.**

Samsung SV421K

There was no rewind or fast-forward operation. After the usual checks to ensure that the brakes were not jammed on and the spools were free to move I found that the lever pinch cam (T228) was incorrectly seated. Once its position had been corrected I had rewind and fast forward. J.C.

Matsui VX1100

The problem was intermittent cutting out in the playback, rewind and fast-forward modes. After a lot of checking, the mode switch was found to be the cause. **J.C.**

Sony SLV353

This fault occurs only after very fast rewind: when play is pressed at the end of the rewind, the cassette is ejected. The cause is the end-of-tape leader overlapping the sensor, thus preventing correct operation. In this case however I found that the PH001 supply-reel sensor Q001 was open-circuit. J.C.

Tatung TVR6111

A fault you sometimes get is intermittent operation/display. The mechanical operation can also be intermittent. Check crystal X801 which may be faulty or dry-jointed.

The cause of no rewind/fast forward is usually the rubber damper, part no. U153091. J.C.

Matsui VP9402

It said no rewind on the ticket, but fast forward didn't function correctly either – it consisted of a series of very violent, erratic jerks. The deck mechanism, which is the same as in the VXA1100, lifts off the mother PCB. To start with I checked the mode switch, timing and idler, which were all OK.

I then turned to items 31 and 34, the clutch-gear supply and take-up assemblies respectively. They can be inspected by removing the polyslider washers. The assemblies flew apart to reveal that the shafts, which should have been hexagonal, were completely rounded on the supply assembly and partly worn on the take-up assembly. This explained the loss of rewind and erratic fast forward, as the shafts would just slip to varying extents. Replacement assemblies restored correct operation.

The only other problem I've had with these decks has been intermittent stopping and shut down, caused by the two reel sensors. **M.J.C.**

Ferguson FV80B (R4000 Series)

There was cassette loading failure: when a cassette was inserted it flopped in rather than being drawn in, and the mode motor laced up without the cassette even being seated.

Tape loading should take place as

follows. When a cassette is inserted it activates a microswitch to power the loading/mode motor which drives the master cam. This is linked to the 'lever cam gear casting', which is in turn connected to the cassette rack.

Because of metal fatigue the lever cam gear casting had failed. It's positioned under the master cam. The replacement was easy to fit and restored normal operation. **M.J.C.**

GoldStar GHV12401

Tape damage was the main complaint. An initial check revealed a worn reel idler: once this had been replaced the sluggish rewind/fast forward speeded up. So far so good. But there was an extra fault comment, that the tape wouldn't rewind fully. This was a more troublesome problem.

When I watched the tape in the rewind mode it would just stop, with no sign of slowing down, struggling etc. A new reel sensor optocoupler made no difference.

A scope check showed that reel pulses were present at pin 23 of the syscon chip IC501, but they were of low amplitude. The only components between the reel sensor and the chip form a digital transistor circuit on the deck junction board. The culprit was the $8.2k\Omega$ resistor R601. It feeds Q6D0, which amplifies and sharpens the reel pulses. **M.J.C.**

JVC HRJ220

The customer complained about tape lamage. Tests showed that when ewinding and stopping there was nuch spillage from the take-up spool. I cleaned the brake pads – hey are of the black-material type hat seems to disintegrate on touch – but this made no difference. So eplacement brakes were ordered, also a mode switch as a preventative neasure. The brake part nos. are PQ46308A-2 (main brake) and PQ46309A-4 (sub-brake).

Mode switch replacement is quite complex, as it's buried beneath the control cam. Once the mechanism has been removed, along with the assette housing, the machine can be out into the "mechanism assembling node". This is done by turning the node motor belt towards the front intil a hole in the cam aligns with a iole in the deck: at this point the arious holes in components line up with holes in the deck. Thus alignnent is easy.

The replacement brakes comletely cured the tape damage probem. M.J.C.

Sanyo VHRD4890E

The complaint with this S-VHS machine was poor sound/picture in the standard VHS mode, S-VHS operation being OK. When I plugged it in however the power supply was tripping and failed to start. A quick check on the capacitors on the primary side of the power supply revealed that C5013 (22μ F, 10V) was leaking electrolyte. When this and C5010 (1μ F, 25V) had been replaced – they are both rated at 105° C – the VCR powered up.

Before the power supply was recased, I checked the capacitors on the secondary side for ripple with a scope. C1 (47μ F, 50V) and C10 (330μ F, 6·3V) were low in value and, on removal, were found to be leaking electrolyte. At this point all the other electrolytics on the secondary side were replaced as a precaution.

Finally to the original fault, which turned out to be severe patterning and hiss on sound. They were not present in the S-VHS mode or at the scart socket. The UHF modulator was the cause. **P.G.**

Sharp VCA63

This centre-deck machine frequently died then returned to life again. In view of the customer's report I suspected dry-joints, and a good look around revealed that plug PA in the power supply was virtually unsoldered. But after resoldering it the fault was still present. A further check around the power supply, with a magnifier, brought to light the fact that one leg of C9 had a hairline crack around the joint. This turned out to be the actual cause of the fault. **P.G.**

Mitsubishi HSB32

This VCR came in with a partially laced-up tape stuck inside. At switch on the machine returned to standby after five seconds or so. Checks in the power supply produced correct voltage readings during the brief period before shutdown, so attention was turned to the loading motor where a voltage check confirmed the lack of any drive.

I disconnected the motor at the plug and socket on the servo deck and, to unlace the tape, applied to its contacts 9V from a variable-voltage power supply. I find that this is usually the best way, before proceeding further, of checking the deck for correct operation – customers have a nasty habit of attempting tape removal by force, which results in additional problems once the original fault has been put right. While the tape was unlacing I noticed that the motor had a bad spot on its commutator. As a result the motor frequently stopped and drew excessive current.

After replacing the motor I checked the TA72915 drive chip IC4A2 and found that this had also died – in fact it had split in two! Once this item had been replaced the machine worked correctly. **P.G.**

Ferguson FV72

The mechanism was jammed and there was a tape in the fully loaded position. At power up the capstan motor could be heard to run just before the machine shut down. Removal of the base plate gives only limited access, but enough in this case to be able to see that the plastic pulley on the capstan motor had fallen off. It hadn't split, and could be reattached soundly with a small amount of Araldite. After that the machine worked correctly. **P.G.**

Panasonic NVSD260

This reasonably new K-deck machine intermittently failed to load a tape. The cause was dry-joints at the end sensors. To be on the safe side, and because the mechanism had to be removed to get at the offending items, I also resoldered the sensor LED. **R.P.**

Panasonic NVD80

This machine worked all right but the display didn't light up. There was no 33V feed from the power supply because R1016 ($2\cdot 2\Omega$, 0.5W) was open-circuit. **R.P.**

Hitachi VC102

The power-on indicator switched off after about ten seconds because the microcontroller chip sent an 'off' signal to the power supply. There was a tape inside the machine. After chasing a few red herrings I found that the STK5471 regulator chip was the cause of the fault. **O.G.**

Ferguson FV105HV

Tape loading problems were caused not only by broken gears on the cassette housing but also by a tiny microswitch on the main circuit board, underneath the mechanism assembly. **O.G.**

Samsung SI7220

There were no mechanical functions and the loaded tape wouldn't eject. Checks showed that the 12V supply was low at only 2V. The cause of the problem was the STK5333S power regulator chip. **O.G.**

A guide to which models have been fitted with which CTV chassis over the past ten years. Compiled by Giles Pilbrow

Sony Chassis Guide

The following list of the models fitted with each Sony CTV chassis released over the past ten years can be particularly helpful when the service manual for a particular model is not available.

AE1 Chassis

A modular, large-screen chassis produced during 1987-90. Model numbers that end in T or 1 incorporate a teletext decoder. An M in the model number indicates mono sound. Nicam adaptor kits were available for some sets. Remote control units RM670, RM671. Models are as follows:

KV21XMTU	KV21XMU	KVDX21TU
KVDX2112U	KVDX27TU	KVDX271TU
KVM21TU	KVM21U	KVM2511U
KVX2121U	KVX2129U	KVX2521U
KVX2529U	KVX21TU	KVX25TU

AE1A/AE1B Chassis

These chassis are similar to the AE1 but have different power and system control circuits. Nicam sound is standard. Produced in 1990. Remote control unit RM689. Models are:

KVD2512U	KVD2912U	
KVE2512U	KVE2912U	
KVX2132U	KVX2532U	KVX2932U

AE1C Chassis

As AE1A/B but with different microcontroller circuits. Some sets have a sophisticated colour decoder with a digital comb filter. Produced during 1991-2. Remote control units RM816, RM817, RM813. Models:

KVA2112U	KVA2122U	KVA2512U
KVA2522U	KVA2912U	KVA2922U
KVC2122U	KVC2522U	KVE2922U
KVE2925U	KVM2521U	KVM2531U
KVX2142U	KVX2152U	KVX2542U
KVX2545U	KVX2552U	KVX2942U
KVX2952U		

BE1 Chassis

Basic mono sound chassis for small-screen sets produced during 1989-91. Model numbers that end with T or 1 incorporate teletext. Remote control units RM670, RM657, RM658. Models:

KVM14TU	KVM14U	KVM16TU
KVM16U	KVM19TU	KVM2120U
KVM2121U	KVM2130U	KVM2131U

BE2/BE2A Chassis

Basic mono sound chassis for small-screen sets pro- |

duced during 1991-94. Model numbers that end with 1 incorporate teletext. Remote control units RM694, RM841, RM820, RM826. Models:

KVM1400U	KVM1401U	KVM1410U
KVM1411U	KVM1420U	KVM1421U
KVM1620U	KVM1621U	KVM2101U
KVM2140U	KVM2141U	KVM2150U
KVM2151U	· · · ·	· ·

AE2 Chassis

Replaced the AE1C chassis for large-screen sets. Many functions controlled by an I2C bus. The first Sony sets to have service mode for all adjustments. All sets have Nicam and teletext. Produced during 1992-93. Remote control units RM830, RM832. Models:

KVB2512U	KVB2912U	KVE2532U
KVE2932U	KVS2912U	KVS3412U
KVX2162U	KVX2562U	KVX2962U

AE2A/AE2B Chassis

These two chassis are very similar. They differ from the original AE2 in that they don't have a separate teletext board – the teletext circuitry is incorporated on the M board. Models with G in the number have a built-in Astra satellite receiver with a VideoCrypt decoder. The KVA2542/2942U have Dolby Pro-Logic sound. Sets produced during 1993-94. Remote control unit RM831. Models:

KVA2132U	KVA2532U	KVA2542U
KVA2932U	KVA2942U	KVE2542U
KVE2942U	KVG2515U	KVG2915U
KVS2922U	KV\$3412U	KVS3432U
KVX2172U	KVX2572U	KVX2972U

AE2F Chassis

This is a top-of-the-range chassis with 100Hz scanning. The KVW2812U was Sony's first widescreen model. The KVW3212U is fitted with a PAL Plus decoder. Produced during 1994-95. Remote control unit RM842. Models:

KVS2942U KVW2812U

KVW3212U

BE3B Chassis

A stereo sound chassis to replace the AE2B, though the AE2B Dolby Pro-Logic sound models were continued. Produced during 1994-96. Remote control units RM833, RM837. Models:

KVX2102U	KVX2502U	KVX2902U
KVX2182U	KVX2582U	KVX2982U
KVX24WS1	KVX28WS1	KV25T1U

3 Chassis

p-of-the-range digital chassis with 100Hz scanning, Iby Pro-Logic sound and digital picture effects such picture-in-picture (PIP) and picture-and-picture AP). Production started in 1995. Model KVS2952U is urrent model. Remote control units RM831, RM838. bdels:

28WS3U KV32WS3U KVS2952U

4 Chassis

1

nilar features and specification to the AE3 chassis. duced in 1996. Remote control unit RM862. Models:

32WS4U KV32WX4U

BE3D Chassis

New stereo sound chassis to replace the BE3B. Much of the circuitry on the main board remains the same as in the earlier chassis, but the A board is quite different. Production started in 1996, still current. Remote control units RM839, RM862. Models:

KV25F1U	KV29F1U	KV25F2U
KV29F2U	KV25F3U	KV29F3U
KV25X1U	KV29X1U	
KV24WX1U	KV28WX1U	KV24WS2U
KN28WS2U	KV28WF1U	KV32WF1U
KV29FX11U		•

BE4/BE4A Chassis

Mono sound chassis to replace the BE2 series. The BE4 chassis is used for portables, the BE4A in 21in. models – much of the circuitry is identical however. The first

KL37W1U

LE1 Chassis

KL50W2U

		· · · · · · · · · · · · · · · · · · ·				
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Sony chassis to incorporate all the teletext circuitry within the main microcontroller chip. Production started in 1995, still current. Remote control unit RM836. Models:

KVM1440U	KVM1441U	KVM2170U
KVM2171U	KV16WT1U	KV21M1U
KV21T1U	KV21M3U	KV21T3U
KV14M1U	KV14T1U	

BE5 Chassis

A stereo sound chassis for use in small-screen sets. Production started in 1996, still current. Remote control unit RM836. Models:

KV21X1U	KV21X4U	KV16WS1U
KV20WS1U		

GE1 Chassis

A very sophisticated digital chassis with 100Hz scanning. The first sets to feature Sony's completely flat FD Trinitron tubes. Also the first Sony domestic TV sets to have VGA inputs to provide direct connection to a PC. Production started in 1997, still current. Remote control unit RM862. Models:

Sony's first LCD back-projection models for domestic

use. Sets are considerably more compact than conven-

tional CRT projection ones. Production started 1996, still current. Remote control unit RM838. Models:

KL50W1U

KV28FD1E KV32FD1E

Servicing

The Mitsubishi Euro 12 Chassis

John Coombes on what to check when tracing the causes of faults in these 21, 25 and 29in sets

The Mitsubishi Euro 12 chassis was used in a number of models that were on sale during the period 1991-93, including the CT21A2STX, CT21A3STX, CT25A2STX, CT25A3STX, CT25A4-STX, CT25A6STX, CT29A4STX and CT29A6STX. As usual, we'll start with the power supply.

Power Supply Faults

The power supply circuit is shown in Fig. 1. It's a chopper arrangement that uses a master-slave IC control system, with transformer coupling (T902) between the master chip (TEA5170) on the secondary side of the circuit and the slave chip (TEA2261) on the primary side.

The most common fault is no results. The mains on/off switch S991 may have failed – it tends to go open-circuit, possibly at only one pole, live or neutral. Check the 2AT mains input fuse F991, which may have blown violently. Also check whether the 4.7Ω , 10W surge limiting resistor R901 is open-circuit. If either of these items is open-circuit, the things to check are the four BYW56 mains bridge rectifier diodes D901-4, the degaussing posistor RP901 and the 2SD1887 chopper transistor Q901. If the latter is short-circuit, the RD3 oFB1 zener diode D908 that's in series with it will probably also have shorted: don't check D908 in-circuit – the lowvalue current-sensing resistors R911/12 in parallel with it may result in a false short-circuit reading.

Q901 may have failed because of a dry-joint at its collector. Check this carefully. Also check for dry-joints at its heatsink. A dry-joint here can result in a flashing picture for several weeks before Q901 fails. It may be necessary to replace the two chips, IC901 (TEA2261) and IC950 (TEA5170) if Q901 has failed. Always replace them as a pair. Another item to check is zener diode D909 (RD4·3EB2) which may be short-circuit.

Another possible cause of fuse blowing is the chopper transformer T901. It may have shorted turns.

If the receiver is just dead, check the start-up resistors R902 ($10k\Omega$, 2W) and R903 ($8.2k\Omega$, 2W) which may have gone high in value or open-circuit. If they are OK, check whether R920 (5.6Ω , 3W) is open-circuit. Other things to check if necessary are D911 (EQA02-14B), which may be short-circuit, and D905 (BYD33G) and R904 (15Ω , 2W), either of which may be open-circuit. It may be necessary to replace IC901/IC950, again as a pair. On a few occasions we have found that dry-joints at the chopper transformer T901 are the cause of this problem. Resoldering should cure this

Another thing to check on the primary side of the circuit is whether L902 is dry-jointed.

The set may be dead because of a fault in the HT cir-

cuit. The HT at TP91 should be about 120V. If there is no voltage here or a very low reading, check whether the RU4AM HT rectifier diode D951 is open-circuit or its reservoir capacitor C972 (100 μ F, 200V) is short-circuit. A low HT voltage reading could be because C972 or C971 (also 100 μ F, 200V) is open-circuit. The alternative is a short-circuit in the line output stage. This can be checked by disconnecting one end of R557 (8·2 Ω , 10W) and adding a 60W bulb across C971 as a dummy load. If the lamp lights and a multimeter connected at test point TP91 produces a reading of 120V, the fault is in the line output stage. See later. If the reading is low or missing check the power supply.

You might however find that the HT voltage is high. In this event check whether Q901's base drive coupling capacitor C906 (47μ F, 50V) is open-circuit. In this event the HT line usually rises to about 200V and the line output transistor Q552 goes short-circuit. If C906 is OK, check D907 (RD3 0FB1) and R907 (18 Ω , 0.5W). It may be necessary to replace all three components.

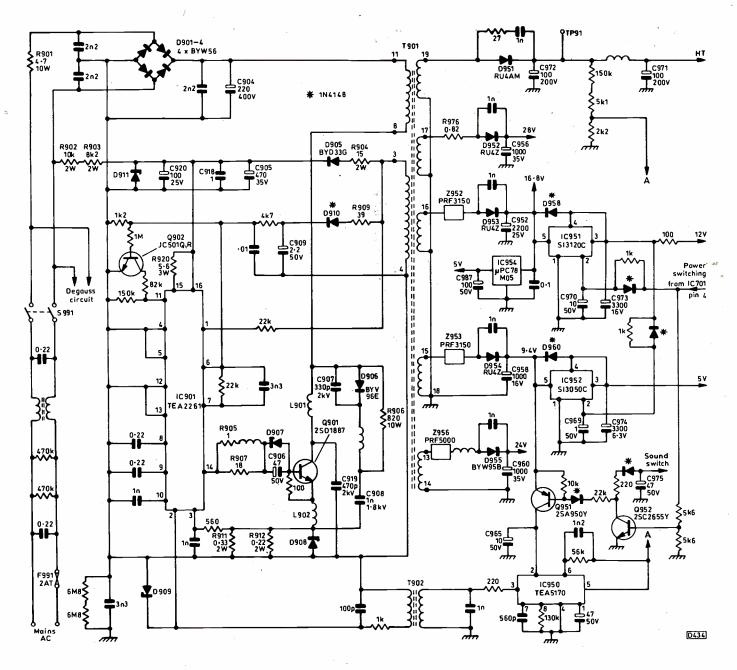
No results may mean that the 5V supply is missing. Check whether circuit protector Z953 (PRF3150) is open-circuit. If so, D954 (RU4Z) and/or C958 (1,000 μ F, 16V) is probably short-circuit. Alternatively the SI3050C 5V regulator chip IC952 might be dead or dryjointed – possibly at all of its connections.

The 12V supply is protected by Z952 (PRF3150). When it goes open-circuit there is no feed to the tuner and IF unit. If the SI3120C 12V regulator IC951 is faulty there may be patterning on the screen. If necessary check whether C952 (2,200µF, 25V) and/or C973 (3,300µF, 16V) is open-circuit or intermittent.

Loss of the 5V or 12V supply could of course be due to a short-circuit across the line. Loss of the 24V supply means no audio – also no degaussing, see below. Check whether protector Z956 (PRF5000) is open-circuit. If so D955 (BYW95B) and/or C960 (1,000 μ F, 35V) could be short-circuit. If they are OK the short is in the audio section – see later.

The 28V line supplies the field output stage. If this supply is missing, check whether R976 (0.82Ω) is opencircuit and/or D952 (RU4Z) or C956 $(1,000\mu F, 35V)$ is short-circuit. Otherwise check for a short in the field output stage – see later.

The degaussing circuit is a little unusual, see Fig. 2. In addition to the conventional posistor there's a relay to control the degaussing. The relay driver transistor Q903 receives at its base a command from pin 5 of the microcontroller chip IC701. When it's switched on, the relay contact closes and degaussing takes place. The relay circuit is supplied by the 24V line.



The Line Timebase

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The majority of line timebase faults will also produce the no results symptom. The most common fault is a short-circuit line output transistor (Q552), which is type 2SD1877 in 21in. sets and type 2SD1878 in largerscreen sets. A short-circuit line output transistor could mean that the HT is high because of failure of C906 in the power supply, see the previous section. If the HT is correct, check for dry-joints at Q552's heatsink. The first symptom that these produce may be interference lines on the picture. If this is allowed to carry on, Q552 will eventually be destroyed. The interference on the picture plus an arcing sound can also be caused by dryjointing at the collector of Q552. Shorted-turns in the line output transformer T552 will also destroy Q552. Another thing to do if necessary is to check for dryjoints at the small choke (L556) that's in series with the emitter of Q552. For repeated failure of Q552, check whether there are dry-joints at the line driver transformer T551.

If there are no short-circuits in the line output stage, check whether the 120V supply is reaching the collector of Q552. The feed resistor R557 (8.2 Ω , 10W wire-

wound) could be open-circuit if this supply is missing. If R557 is OK with no voltage at its input side, check back to the power supply. If there is voltage at both sides of R557, check carefully for open-circuits or dryjoints at pins 1, 6 and 2 of T552.

There could of course be no line drive. If there is no supply at the collector of the 2SC2482 line driver transistor Q551, check the driver transformer T551 for an open-circuit or dry-jointed primary winding and, if necessary, whether the feed resistor R554 ($6.8k\Omega$, 5W) is open-circuit.

If there is no line drive at the base of Q551 or the waveform is incorrect, the MC44000VCJ colour decoder/timebase generator chip IC201 is suspect. It may be necessary to check this chip by replacement.

If there is still no line output stage operation, the scan coils might have shorted turns.

Field Timebase Faults

Field collapse is the most common fault here. First check whether the 28V supply is present at pin 2 of the TDA8178S field output chip IC451. If not, check R976 (0.82 Ω , 0.5W), D952 (RU4Z) and C956 (1,000 μ F, 35V)

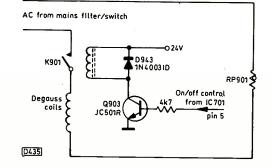
Fig. 1: The chopper power supply circuit used in the Mitsubishi Euro 12 chassis. Some sets have more than one mains filter choke. Fig. 2: The de-

unusual in hav-

ing a relay for

control.

gaussing circuit is



in the power supply. R976 will go open-circuit if D952 or C956 is short-circuit or there's a short in IC451. If there is still field collapse after replacing IC451, check whether the flyback boost capacitor C452 (220μ F, 35V) is open-circuit. IC451 will be ruined if this capacitor is faulty. Also check whether the associated 1N4003ID diode D451 is open-circuit.

If necessary check for field drive at pin 7 of the MC44000VCJ colour decoder/timebase generator chip IC201, and that there's a field ramp at pin 6. IC201 is suspect if these waveforms are missing – check it by replacement.

If still in trouble, check whether the field scan coils are open-circuit and for dry-joints at the connection plug and socket. Ensure that they are making correct contact. If there is intermittent field collapse, check all the pins of IC451 for dry-joints. Check pins 6 and 7 of IC201 if necessary.

Colour/display Faults

If there's just a bright raster, check for a dry-joint at pin 6 of the line output transformer T551. Then check whether R553 ($2\cdot 2\Omega$, $0\cdot 5W$ safety) and/or D556 (BYD33G) is open-circuit. If so, check whether C565 (47μ F, 250V) is short-circuit. Check the connector (LB) to the tube base panel: ensure that there are no dry-joints at pin 1 at either end.

If there is a bright raster and the 200V supply at the tube base panel is OK, check the RGB outputs at pins 17, 18 and 19 of the MC44000VCJ chip IC201.

If the raster is very bright with flyback lines, the tube's first anode supply control may be defective. This fault may intermittent, flickering up and down.

The reverse condition, a blacked out screen or just very low luminance, can also be caused by a faulty screen (A1) control. Alternatively, the luminance output at pin 29 of IC201 may be missing. If so replace IC201. It may be necessary to check the luminance signal path via pins 3 and 6 of the NJM2209S sharpness control chip IC202 to pin 17 of the TDA4565 CTI chip IC602. Check the waveforms and DC conditions at these pins carefully.

For loss of one colour, check the relevant 2SC2688/2SC2482 output transistors on the tube base panel. These are Q651/658 red, Q652/659 blue and Q653/660 green. The loss may be intermittent. In this case check for dry-joints at these transistors. Check the DC conditions at their pins carefully.

Loss of one colour can be caused by a faulty tube. The emission of one gun could be very low. Check also for a possibly open-circuit heater – this fault can usually be seen, with only two of the heaters in the row lit. Check for dry-joints at the CRT pins and ensure that they are making correct contact with the base.

If the symptom is incorrect grey scale, check the 1N4148 diodes D655/6/7 which can become leaky. Otherwise the output transistors and IC201 are suspect.

If necessary check Q710 (JC501Q, R) by replacement – it's associated with the microcontroller chip.

For complete loss of colour IC201 (MC44000VCJ) is suspect, but check for dry-joints at its pins before trying a replacement. The 17.7MHz crystal X601 is also suspect. It may be dry-jointed or faulty. On rare occasions you might find that the CXP80424 microcontroller chip IC701 has set the colour at a low level. It may be incorrectly programmed or need replacement.

Tuner/IF Faults

A broken aerial socket can be the cause of snowy/grainy pictures: if the fault is intermittent, the socket could be dry-jointed. Check the aerial as well. If there is white, chalky dust in the socket, water is probably coming down the inside of the aerial lead. The water usually enters at the aerial connection on the roof and is then sucked down by syphonic action. Another cause of snowy pictures is a low-gain tuner (TU101) – the RF amplifier packs up. Because of the compact construction, it's advisable to replace rather than try to repair the tuner.

If there's no tuning, check for 33V at pin 14 of the tuner unit. Absence of this voltage usually means that R971 (18k Ω , 2W) is open-circuit or IC955 (μ PC574JK) is short-circuit.

Dry-joints in the tuner and/or IF module can cause many intermittent symptoms such as a blacked out picture, black lines flickering across the screen, loss of signals when the set has been on for a long time or a blank screen with loss of the on-screen graphics. Dry-joints in the IF unit can cause a double-image effect, akin to picture ghosting. It's best to replace the tuner and IF module as a pair. The tuner is part no. 295P397030, the IF module (IP101) part no. 305P700030.

Sound Faults

The sound output chip is IC361 (TA8200AH). If there's no sound, check the DC conditions at the pins of this chip, which may have failed. If still in trouble, check the DC voltages at the Nicam board's connection pins. Crackling on sound or Nicam dropout is usually caused by dry-joints on the Nicam PCB.

With some earlier sets you can get an audible whistle at about 1kHz when a Nicam transmission is being received. Use of the volume control varies this whistle. To cure the fault, connect a wire link between the negative terminals of C3342 and C3346 on the print side of the Nicam PCB. This link should be insulated and run as close to IC3305 as possible.

Incorrect EEPROM Operation

Corrupted data in the X24C04P EEPROM IC702 can cause many different faults such as no text, no Nicam sound, and incorrect height, width, brightness etc. settings. A kit is available from Mitsubishi, part no. 263P434020. It includes two pull-up resistors and an 0.1μ F capacitor. After fitting it, refer to the service manual for reprogramming information.

Remote Control Faults

If the handset does not emit command signals, check the batteries and/or the battery terminals. Check for corroded contacts or dry-joints. If necessary check the LED for dry-joints and the crystal (X1) for dry-joints or broken connections.

A cracked PCB or liquid contamination can result in non-operation, intermittent operation or incorrect operation of the pushbuttons.

The M50461-113FP chip may be faulty. Contamination can cause corrosion or clogging between its pins.

A Hi-8 Video Problem

One of our customers asked us to look at his Sony EVS1000E Hi-8 VCR, which he used for editing camcorder tapes and for transfer to VHS. It had suffered from an unusual fault from new. When he used it to play back a standard-play (SP) Hi-8 recording made by his camcorder, the picture was covered with white spots – similar to the effect produced by a poorly earthed head drum. Playback of the VCR's own recordings was reasonably good. LP camcorder recordings were also played back with little problem. The EVS1000E is a well-specified machine, with good slow-playback modes via a jog/shuttle feature, Nicam offair sound, PCM and hi-fi stereo etc.

Our first checks were on the anti-static brush and the earthing of the head drum and head amplifier sections. Everything was OK. We next checked and set up the tape path alignment, tape tension etc. The FM signal was checked, also the supplies and the signals to the head amplifier assembly. No problems. After finding that the DOC adjustment was correct, we decided to check the head Q (playback frequency) adjustments, using the relevant test tape.

There are two SP-mode adjustments, one for each head. Both could be set up all right, but the ch. 1 adjustment also altered the picture's spottiness. Unfortunately we didn't appreciate the significance of this at the time! Our next step was to replace the upper drum assembly. This was not a good move – it's expensive, and made only a small difference to the symptom.

What was going on? The important points were that only SP

camcorder recordings produced the fault symptom, and that the EVS1000E has an unusual head drum configuration. It has separate SP and LP heads, unlike the customer's CCDV800E and most 8mm camcorders which use LP heads for both tape speeds. LP heads have a narrower gap than SP ones of course.

As the camcorder has only LP heads, its SP-mode recordings have guard bands between the tracks (the VCR has full trackwidth SP heads that don't produce guard bands). The cause of the trouble was that one of the VCR's LP heads was permanently switched on. During playback of the machine's own SP recordings some off-tape information was picked up. This did not degrade the picture significantly – after all, the two LP heads are active in the trick-playback modes, providing good still pictures etc. But when an SP camcorder tape was being played back the active LP head was looking at either the guard band or was completely off-tape, thus producing the 'static' type interference. It took us a while to figure out what was happening!

Why was one LP head permanently active? Because of a manufacturing error: C102 (1.5μ F electrolytic) had been fitted the wrong way round. It's part of the head switching circuit, which normally shorts out the ch. 1 LP head in the SP mode.

You are unlikely to come across exactly the same component problem, but the effect on the picture produced by different head types and thus different track layouts may be worth bearing in mind. D.C.W.



ANTEX NOT JUST ANY OLD IRON



Powermax and Clipper Remote Control Extenders

Eugene Trundle tests some UHF remote control extender systems imported by Celtel Ltd. The user in one part of a house can operate equipment in another part

Most households now have more than one TV set. Typically there's a large-screen set in the living room and one or more smaller ones in other rooms. Very often they are all fed from the main, external aerial via an RF distribution amplifier: indoor types are readily available from DIY stores. The satellite receiver and VCR are seldom duplicated elsewhere in the house – because of the expense and the need for a dual-LNB where two satellite boxes are to be fed from one dish.

But satellite TV and video playback can be viewed on any of the smaller sets so long as the aerial feed to the RF distribution system is looped through the satellite box and VCR, whose UHF outputs can be added to the off-air broadcast signals. They can then be tuned in by any of the receivers. The problem that arises is how to control the satellite receiver and VCR from the bedroom or wherever: IR commands cannot pass through walls and floors!

Mode of Operation

Hence the Celtel units reviewed here, which extend the operating range of an IR handset housewide. Working to Approval Standard MPT340, they use an RF link at about 418MHz, with a maximum power of 250μ W. Basically the IR light beam is detected and converted into a low-UHF signal for transmission to a small telescopic aerial on a repeater unit. The latter is placed within sight of the equipment in the living room and recreates the original IR control code. Hey presto, the gear does what it is told, maybe freeze-framing a winning goal kick or zapping through late-night satellite programmes, wherever you happen to be using the handset.

Clipper

With this version the transmitter consists of a batterypowered extension at the front of the handset. About half the size of a matchbox, it's fixed by a Velcro pad – two pad sets are provided. A LED flasher shows when it is working: there's no need for an on-off switch or aerial. Its RF output is picked up by the mains-powered repeater unit, which is a stylish, dark-toned 'squashed dome' with a 17cm telescopic aerial. This design has the advantage of complete freedom of handset movement, because you carry the tiny transmitter with you.

I tried it at various sites and at most of them had no communication problem – modern houses tend to have plasterboard internal walls that RF signals pass through with ease. There were a few dead spots in a large, Thirties house that had solid brick internal walls, particularly when linking from a back first- or second-floor room to the living room at the front on the ground floor. I'm told that there is a possible mod to overcome this should it be required – with too much sensitivity you run the risk of interaction between devices operating in adjacent houses. In practice this is, I gather, not too big a problem. Apart from this the device worked very well.

Powermax

This extender uses the same sort of repeater unit as the Clipper, but the remote control IR receiver/RF converter consists of a second mains-powered dome (no aerial) which is placed in the room from which control is to be exercised. The test one went on the bedroom dressing table. While command transmission is now confined to one room, there's the advantage of an unencumbered handset – and as many of these can be used as you like,

Our heading photo shows the Powermax PC extender units.

TEST REPORT

the codes from each being faithfully replicated in the living room. So this system lends itself to such things as remote control of a Hi-Fi system with extension speakers in addition to the role previously described. You can zap radio stations, control the volume and navigate around CDs.

This system also worked well for me, with no transmission problems, the link being point-to-point rather than mobile.

Conclusions

In the workshop, which is a lively environment from the equipment and interference point of view, I didn't come across any bad effects with either system – no radio reception nasties, and no interaction between remote commands. I was unable to get inside any of these modules to explore their secrets!

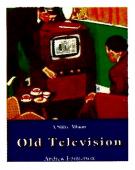
One of our customers discovered a perhaps unique application. A keen videographer, he has a camcorder and auto-editor in his den and uses a Powermax to relay the latter's IR commands to an S-VHS VCR in the living room. He can thus produce an edited master tape from afar, saving the need to buy a second deck or carry the first one to and fro!

These useful and ingenious systems are worth their price to the sorts of households that have a use for them, and are a good sideline for dealers and workshops involved with TV, video and satellite sales, installation and repairs.

The list price of each of these extender systems is $\pounds 49.95$, but they are typically offered for sale at about the $\pounds 40$ mark – both figures include VAT. Trade discounts are available from distributors such as Willow Vale, also from the importer Celtel Ltd., PO Box 135, Basingstoke, Hants RG25 2HZ – phone 01256 364 324, fax 01256 818 064.

Book Review

Old Television by Andrew Emmerson, published by Shire Publications Ltd., Cromwell House, Church Street, Princes Risborough, Bucks HP27 9AA (telephone 01844 344 301, fax 01844 347 080) at £2.95. 32 pages.



This entertaining and well-illustrated little book tells the story of early TV from the period of Baird's initial experiments in the mid-Twenties to the start of colour television in the UK in 1969. So its main concern is with the 405-line era and the early dualstandard days. Throughout there's much on the sets of the time, without going into circuit technicalities. Rather, the book is intended, as it says

in the introduction, as a handy guide to television in general, and to viewing television in particular.

In the chapter headed "the culture of the first television generation" we get a fascinating account of TV's impact on home life in the Fifties and Sixties. This is followed by information on channels, stations and idents. To conclude, the book tells you about the vintage-TV hobby, where you can get to see early TV sets and other equipment, and provides a list of societies and sources of information.

While I appreciate that Andy had limited space in which to cover what is quite a large subject, I do feel that he – and others in the UK – have been a little unfair to the achievements of pioneers in the USA in the early days, by RCA in particular. Vladimir Zworykin had filed a patent application for an electronic camera tube – the key to practical television – in 1923, while working for Westinghouse. His research continued for several years. In the early Thirties EMI, working along similar lines in the UK, patented the first practical electronic camera tube. This was the Emitron, in 1932. Zworykin had joined RCA in 1929 however, and had by 1931 taken the development of his iconoscope tube an important stage further. A practical iconoscope tube was announced by RCA in June 1933. That same year RCA demonstrated a complete, all-electronic TV system, with transmissions from the company's W2XBS transmitter atop the Empire State Building. The standard was 240 lines with 24 sequential frames per second. By June 1936 RCA was using 343 lines with 30 interlaced fields per second. In the same year the US Radio Manufacturers' Association proposed a 441-line system, which was successfully developed by Philco with a demonstration on February 11th 1937.

Yes, EMI and the BBC got there first, in 1936, with a regular 405-line TV broadcasting service. But had it not been for the Depression and bickering over standards, TV broadcasting in the USA would have started earlier than it did (in 1939). Really, it was neck and neck.

Others – Telefunken in Germany for example – were pretty far advanced by the mid-Thirties. And it's important to appreciate that Prof. Boris Rosing (Zworykin was a pupil of his) gave the first demonstration of a crude TV system, with a mirror-drum scanner and a CRT for the display, in St. Petersburg in 1907.

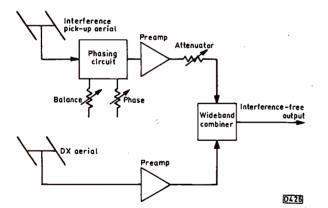
But enough of this! If you are interested in TV's impact during its early years you will find Andy's book a good read. J.A.R.

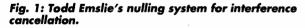


DX and Satellite Reception

DX and satellite TV news and reception. A phase-shift system for interference cancellation. The 1998-2000 edition of the World Satellite Yearly reviewed. **Roger Bunney** reports

Some Sporadic E reception during late April suggests that the 1998 season will be an improvement on last year. At 0745 on the 23rd I saw a weak, slow-fading PM5544 test pattern on ch. 4, with the aerial pointing to the SE. Its identification was too fuzzy to discern, and the signal faded out after fifteen minutes. A slow-fading tropo-type signal in Band I is characteristic of very long single-hop





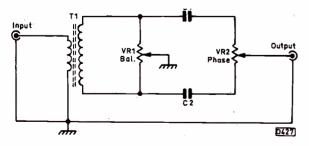


Fig. 2: The phase-shift circuit. T is a 1:4 $(75/300\Omega)$ transformer. VR1 and VR2 are both $5k\Omega$ linear potentiometers. C1 and C2 are 0.01µF. The components should be housed in a small metal box. SpE reception. Peter Schubert (Rainham) noted weak SpE activity on chs. E3/R2 on April 26/27th. Then a strong SpE opening occurred on May 1st, with TVE (Spain) ch. E4 received in the early evening – a bullfight of course! Only days now to the proper start of the season!

Todd Emslie (NSW, Australia) has written about recent reception highlights there. F2 layer reception from the States across the Pacific has improved, reaching as high as 36MHz. F2 back-scatter has been noted, giving New Zeland ch. 1 (44.25MHz) from the NE in mid-April. Highlights of the past season include Thailand ch. E3 and China ch. R1 on March 25th, also Japanese beacons/radio amateurs at 50MHz. Last December Hawaii Khon-TV ch. A2 was received in both Christchurch NZ and Victoria Australia.

Like many other DXers, Todd suffers from interference problems. He has designed an effective but extremely simple nulling circuit that covers from 40-220MHz! Details will be found later in this column.

Satellite Sightings

Eutelsat II F4 at 7°E has ever fewer analogue news circuits. But perhaps the most unusual sighting for me this month was from II F4 on April 23rd. When checking this satellite I received, at 2315 BST onwards, 11·145GHz horizontal, colour bars plus the idents "Newsforce DSNG4" and "Alftah Broadcast Chad". Thinking it might be a latebreaking news story I stayed tuned. But all that appeared during the next hour were more colour bars plus inserts of, I presume, the local TV programme – revolutionary dancing plus waving of a red flag. Newsforce pioneered digital satellite newsgathering, and the signal would have been a European analogue redistribution. Unusually, this was clear analogue: even sound in syncs hadn't been used.

The mid-summer World Cup and Tour de France transmissions will be distributed across Europe using EBU digital capacity, with MPEG-2 coding. The full EBU/Eurovision network, with 55 transmit/receive stations in 48 countries, is to go digital by September. The number of EBU TV channels will be increased from thirteen to over twenty. So there will be more to see – if you have a digital receiver.

A serious Spanish coach crash was heavily featured via Intelsat K on April 26th, with the local test patterns of TV Valencia and Canal Sur.

Several SNG evening magazine programme inserts for BBC regional services are still uplinked in analogue form. The BBC's Northern Ireland truck (UKI120 DGSP) was in early April feeding news material and live reports for several news programmes via the 12.608GHz horizontal transporter aboard Telecom 2C at 3°E. This was during the talks on and the eventual peace deal in the Province.

John Womersley (Bradford) has bought a Nokia 9602 digital receiver and writes in some detail on its operation. There are many grey imports with which Nokia will not guarantee reception. Certain 9200

11 1 1

and 9500 receivers now on the market contain v.2.0 software, similar to Model 9602. It enables you to avoid going into red menus for access to certain tuning options. More on red menus via the internet at

www.eurosat.com/digital/dbox.hmtl

or

¢.

C

www.xs.4all.nl/~satje/dbox/secret.html

Many digital feeds are available via Sirius-2 at 5°E. The following provides sports offerings: 12·346GHz with S/R 3332, VPID 33, APID 32, FED 3/4 and PCR 33. John uses a 1m dish, a universal LNB, a Global A/B switcher, a Pace MSS300 analogue receiver and his Nokia 9602.

Roy Carmen (Isle of Wight) noticed a Canal Fiat corporate programme via Telecom 2C in early April, at 12.650GHz vertical, with Lancia and Alfa Romero cars. Interesting that the feed was clear D2-MAC.

Many Vauxhall dealers now have an 1.8m offset dish to provide ex-factory sales information and training for engineers. A visit to your local Safeway store will also reveal dishes, and it's understood that Sainsburys is to have a corporate TV network soon. Can anyone tell us when such material is aired and in what format? I've heard that Eutelsat II F2 at 10°E is a favourite for corporate signals. Any information will be welcome.

Broadcast News

Sweden: The following digital terrestrial transmitters are in operation: Horby ch. E22, Vastaras ch. E37, Stockholm ch. E59, Norrkoping ch. E36, Uppsala ch. E40, Malmo ch. E22, Goteborg ch. E40 and Linkoping ch. E42. The plan is for each transmitter site to have six digital multiplexes providing a total of 24 channels. Each site will transmit SVT and TV4 in both analogue and digital form. Channels above E60 will be progressively used for DTT transmissions.

Finland: The Nelonen channel now has a full teletext service. Lithuania: The Moscow TV6 relay has been converted from SECAM to PAL. The country has adopted Central European Time: thus summer time will be GMT plus two hours, winter time GMT plus one hour.

Singapore: DTT has started on a

test basis, run by Advent TV with TCS progamming. The plan is for a full service by the end of the year.

Northern Ireland: Ulster TV, Belfast plans to open a local digital service early next year with programme material from both sides of the border, including RTE and the new commercial channel TV3. This will be in addition to the ITV DTT package.

Burma: A TV transmitter has been opened in the East Shan State to relay government progamming to the nearby mountainous regions. UK Radio: The Isle of Man government has made the 279kHz long-wave frequency available for a high-power radio service with wide coverage. The transmitter power will be reduced at night to avoid co-channel interference. United Christian Broadcasters, The Isle of Man International Broadcasting Company and an old favourite, Radio Caroline, have expressed interest.

Nulling System

Todd Emslie's nulling system, mentioned earlier, is shown in Fig. 1. Fig. 2 shows the phase-shift circuit. The idea is to cancel interference by adding the signal from the DX aerial to that, after phase shifting, from the interference aerial. The phase-shift circuit uses a $70/300\Omega$ transformer, two capacitors and two $5k\Omega$ linear potentiometers. It should be followed by a preamplifier then an in-line 0-20dB variable attenuator - the latter can be obtained from Cirkit, stock no. 10-01520, at £3.94. An amplifier is also used in the feed from the DX aerial. A wideband ferrite combiner such as the Antiference CS1000 or Tratec ES02 is used to add the two signal feeds: do not use a resistive combiner/splitter or the cheapie ferrite splitters from the Far East.

After connecting the units, adjust the attenuator so that the levels of the interfering signal inputs to the combiner are roughly equal. Then adjust the phasing and balance potentiometers – a 360° phase shift can be obtained. The interference will be reduced or will disappear.

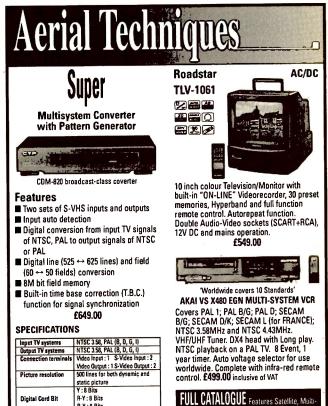
Todd reckons that the system reduces an S9 + 20dB ABN-2 (64·24MHz) interfering signal from a transmitter five miles away to an S1-2ish signal level. This enables him to receive MS pings and other weak signals in the same channel. The system is wideband, working from Band I through to 220MHz.



The Merlin Communications logo, received via Sirius-2 at 5°E.

Satellite News

Because of the problems with PanAmSat's PAS-6 satellite at 43°W a replacement, PAS-6B, will be launched later this year to maintain and expand services to South/Central America. It's being manufactured by Hughes and will



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B-Y:8 Bits 8M Bit

AC 110/220V

8M Bit 525 ↔ 625 line: 60 ↔ 50 fields

Memory size

Power supph

IJ.



A Spanish test card received via Intelsat K at 21.5°W.

have 32 high-power Ku-band transponders. Although PAS-6 was launched less than a year ago, problems with its solar panels have led to reduced power output. Because of this a decreased load programme has been initiated. PAS-6 and PAS-3, both at 43°W, will maintain services until PAS-6B arrives. The Greek government has proposed a single digital system with free access for both state and commercial broadcasters provided a common digital encryption standard is adopted.

The Sky Scottish channel from Glasgow closed on May 31st. Viewer figures were minimal. The channel had broadcast from 1800-2000 via Astra and local cable systems.

AsiaSat-3S is to be launched next spring, after which it should be in service within a month. The earlier AsiaSat-3 failed to go into orbit.

It might be an idea to hold off buying that new digital satellite receiver. Philips is to introduce a second-generation MPEG IRD chipset early next year. It's claimed to be faster and to have a lower power consumption – the three ICs will operate at down to 1.8V. At a cost of \$15 for the chips, complete receivers could be on sale for about \$200.

Intelsat waved goodbye to an old friend, 502, which was shifted out of orbit on April 14th, ending a record seventeen years' service. It was launched in December 1980 and was the oldest in the Intelsat fleet. The new 709 is to take up position at 50°W, offering DTH services to Brazil with +50dBW ku-band transponders. There has been an Intelsat shuffle as follows: 804 to 64°E; 801 to 31.5°W; 506 to 29.5°W; 511 to 29.5°W for cable distribution. 805 will go into service at 55.5°W, where 512 is to be de-orbited.

Intelsat has formed a spin-off company, called New Skies Satellites NV, which will be free to operate without the cumbersome Intelsat control (see Teletopics last month). The new company will operate 513 at 177°W, KTV at 95°E, 703 at 57°E, 803 at 21.5°W, Intelsat K at 21.5°W and 806 at 40.5°W.

Eutelsat has confirmed that Europesat-1 will enter service at 29°E in mid-2000. The 36transponder satellite will provide DTH TV, multimedia and corporate services. Its design will enable it to operate alongside the Astra craft at 28.2°E. A frequency-sharing plan is being arranged between the two satellite organisations.

Book Review

1998-2000 World Satellite Yearly, 5th edition, by Dr. Frank Baylin. Published by Baylin Publications at £59.

This substantial book has over 550 pages (10.7×8.4 in.) packed with information on satellite theory and practice, diagrams, footprints, addresses – in fact it's a complete reference guide to the technology and situation as at mid-1998.

The format is basically the same as in the earlier, successful editions. It starts with coverage of satellite basics – dishes, equipment, how and why satellites work in orbit etc. Scrambling and the MAC variants are well documented, but greater emphasis is now naturally placed on digital compression. Also pirate hacking: the subsection on page T-162 raises the question "Digital Television – The Next Target?" There is also an interesting section on marine satellite systems.

The main purpose of the book however is to gather together a mass of reference information, in particular downlink footprints etc., for every satellite now active (now being spring 1998) or expected to come into operation during the anticipated life of the book. So there's a massive section that provides details of who is using which transponder on which bird. There follows an equatorial trip westwards around the Clarke Belt from 180°E, pausing at each satellite to describe the craft's background, i.e. operator, launch date etc., then the details of the craft itself – construction, on-board loading, electronics, downlink frequencies and transponder powers, beacons and so on. There's a very detailed listing of transponder uplinks and downlinks, with frequencies, bandwidths, performance data, powers and other information.

Equally important are the satellite footprint maps, showing the main target regions and EIRP contours. For the enthusiast this provides an indication of reception possibility at a given location. AMOS-1 at 4°W for example would, via its European beam, have an EIRP of about 29dBW in South Hampshire, an indication of why it's a difficult signal to receive! The final satellite listed is Intelsat at 177°W, completing the course to 180°E. The book ends with an extensive listing of manufacturers' and companies' addresses and contact details.

No reference book of this magnitude could be 100 per cent accurate of course, even at the time of publication. Whilst preparing this review Intelsat has announced an orbital reshuffle, and there have been announcements from Eutelsat and PanAmSat. NileSat-101, at 7°W from early May to provide services for North Africa and the Middle East, is not listed. But these are quibbles.

In conclusion, this massive reference work is an essential item for the bookshelf of anyone, professional or enthusiast, concerned with satellite use and reception. But, because of its size and comprehensiveness, it is not cheap - if you are in the trade however it's an allowable expense to offset against tax. The book can be obtained by post from Swift Television Publications, 17 Pittsfield, Cricklade, Wilts SN6 6AN (phone 01793 750 620, fax 01793 752 399) at £65 inclusive of postage and packing. The price when supplied to European addresses is £70, and by airmail anywhere else in the world £80. Those in London may find the book at the Modern Book Company, Praed Street, Paddington, or Foyles in Charing Cross Road. Baylin Publications can be contacted by phone/fax at 01189 414 468.

Panasonic Young Technician of the Year - it could be You!

With ever more new, innovative technology being introduced in consumer electronics equipment, new blood coming into the industry is vital to its continuing success. Panasonic, an industry leader, has decided that now is the time to reward the best of the new technicians.

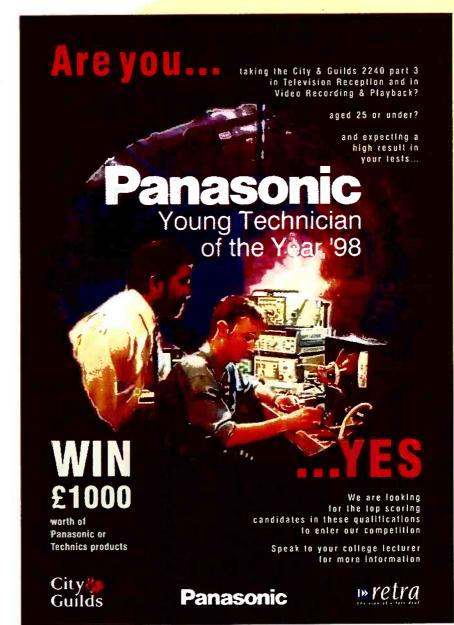
In conjunction with City & Guilds and Retra, Panasonic has launched an award scheme for the Top Ten results from this year's final examinations for City @ Guilds 2240 (part 3) in TV and VTR servicing. The only rule is that you must be 25 years or under at the time of sitting the examinations.

Panasonic is arranging a competition to find the first, second and third top technicians out of the ten finalists. All ten will, with a guest or partner, be invited to spend a day as guests of Panasonic at Bracknell, with a luncheon, presentation of certificates and over $\pounds 2,500$ worth of Panasonic products for the finalists (first prize worth $\pounds 1,000$).

In recognition of the support provided by employers for their trainees, Panasonic is to present to each of the ten finalists' employers an inscribed plate proclaiming the achievement of the organisation in the field of training.

The top three finalists will then be taken to a luxury hotel in Cardiff for an evening as special guests of Panasonic. On the following day there will be a fascinating tour of the Panasonic European TV factory in Cardiff and a lunch.

All in all this will be a super event fully endorsed and supported by Retra.



So, all you young technicians, make that extra bit of effort for those all-important final examinations this year. You could be Panasonic Young Technician of 1998!

đ



Reports from Nick Beer and David Woodnott

Hitachi VCM1E

I'd not had one of these twist-andshoot models for repair before. They clearly suffer from the surface-mounted electrolytic capacitor problem. This particular one recorded perfectly when twisted into the camera mode. In the untwisted VCR mode however it would intermittently either refuse to carry out any deck functions, or the buttons would select the wrong functions, or the machine would permanently be in the rewind or another mode.

The control switches appear to be connected to a resistive ladder network. An examination revealed that some of the through-the-board links in front of the connector (PG802) to the switches had become corroded. The answer lay on the other side of the PCB: C234 (100μ F, 6·3V) and C244 (47μ F, 6V) were leaking.

There were leaky electrolytics in other areas as well. **N.B.**

Panasonic NVM10B

This full-sized camcorder was dead. It was no surprise to find that the 0.025 Ω fusible resistor R1051 (part no. VSF0059) was open-circuit, but the short that could be measured between its business end and chassis had a rather unusual cause. Much lifting of chokes to isolate circuit areas confirmed that the cause of the problem was somewhere in the middle of the power supply. The chopper transistor was OK, but the transformer had a short-circuit between its primary winding and chassis. It's T1001, part no. ELL10R010. A

Camcorner

replacement transformer and fusible resistor restored normal operation. **N.B.**

Panasonic NVMC30B

This one arrived with a tape stuck in the mechanism and a note to say that it would remain powered up for only a few seconds. It's not an uncommon fault with this model, the cause usually being faulty regulator transistors in the power supply. In this case however the power supply was OK. Inspection of the unit at power up, with the tape still loaded, revealed that the drum didn't rotate. In fact it was completely jammed! We removed, cleaned and refitted the drum, after which all was well. Dirt of some sort must have made the drum stick. D.C.W.

Sanyo VMD6P

A faulty AV socket is quite a common problem with these popular, middle-aged camcorders. The socket is available at modest cost from CHS. Sometimes however you find that the printed circuit has been damaged by excessive AV connector wriggling. So a new PCB has to be obtained. This is also available from CHS, though not at quite such a modest price.

We've on occasions found that some audio circuit setting up is required after fitting a replacement board. The usual symptom is low or distorted sound. Information on this is included in the relevant service manual. **D.C.W.**

Sony CCDTR305E

The customer said that this newish camcorder had operated intermittently for some time but had now ceased to do anything at all. There was a tape, which couldn't be ejected, in the mechanism. An initial inspection showed that the unit would power up in the VTR mode but not in the camera mode. No functions worked however.

When the RM95 remote unit was connected the VTR functions could be operated by the buttons, but there was no camera mode as the CAM/VTR switch is in the main body of the camcorder. A replacement Switch Block Control, as Sony call the complete control-button assembly, was required. This cured all the symptoms – albeit at a price. **D.C.W.**

Sharp VLE30H

This early Viewcam model has been generally reliable. Until recently we've not seen many of them. This one came in for a general service. There is nothing much to report, except for something that those with little experience of these machines (like us!) should note.

After its service the unit was put on test and performed well. As we didn't have the customer's AV connector, we were able to check the results only by looking at the LCD screen and by using another camcorder to play back a tape, which was OK.

The unit soon came back however, with a report to say that while it now worked well there were no outputs via the AV connector. We had failed to notice a peculiarity with the connectors used in this model. The ribbon cable connectors used by most manufacturers have a grip system that, when released, enables the cable to be removed. Refitting is the reverse procedure. With the Sharp version, as used in this model, it's possible for the whole section to come away at the cable end when the grip is released. This is of no consequence if the grip is not removed from the cable. If it should fall off, as it must have done in this case, it can be refitted incorrectly. This might not be noticed the connector can appear to be correctly recoupled to the PCB socket. When it's incorrectly fitted however a section of the plastic grip partinsulates the ribbon cable end from the connecting pins on the PCB.

This was where we had made our mistake with the AV connector. It was simple to rectify once we realised that this reversed connection is possible. It can obviously occur with any of the other similar connectors, causing various symptoms – thankfully none fatal, as the worst that can happen is an opencircuit. We live and learn! **D.C.W**.

Answer to Test Case 427 - see page 631 -

There were false trails and chicken-and-egg theories with the Daewoo set – but no field scanning! Those who remember the AN5521 field drive/output chip used in older Panasonic sets, and probably some other makes and designs, may recall that it wouldn't produce a ramp to drive the field scan coils unless it had some feedback from the output side of the circuit. This made fault diagnosis very difficult, as a fault anywhere in the field feedback loop removed the output. The hapless technician could be sent round in circles.

It seems that the field generator section of the TDA8362 chip has the same irksome characteristic. Unless the conditions at its feedback pin 41 are correct, it won't produce a field drive output at pin 43. Pin 41 expects to receive a sawtooth waveform from the height control potentiometer VR301, which is at the earthy side of the field deflection current path. A $2 \cdot 2nF$ capacitor, C302, is connected between pin 41 and chassis. This was the cause of the trouble – it was leaky.

As IC designers sit at their drawing boards – computer terminals nowadays no doubt – thinking up wondrous feedback, driver and output arrangements, all long-tail pairs and so on, it would be nice if they could manage to spare a thought for bemused technicians like Techocrat, who have to deal with the problems when things go wrong.

NEXT MONTH IN TELEVISION

Digital Satellite Receiver Design

Chris Carter describes the SGS-Thomson design for a lowcost digital satellite TV receiver.

Low-ohms Meter Extender

There are many situations where it's helpful to be able to measure low resistances reliably. Alan Willcox has devised a simple meter range add-on unit that extends a digital meter's resolution down to 0.01Ω (0.001Ω is possible).

Servicing the Mitsubishi EE3 Chassis

John Coombes on how to tackle faults experienced with this CTV chassis.

CabSat '98 Report

This year's Cable and Satellite Show was particularly significant, with digital TV equipment being displayed and demonstrated. George Cole reports.

How the Internet Helps

Is the operation of the internet still a bit obscure to you? If so, Peter Marlow's description of the system and how it can help you could be valuable reading.

Toshiba Service Briefs

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Latest know-how from Toshiba Technical on the company's CTVs and VCRs.

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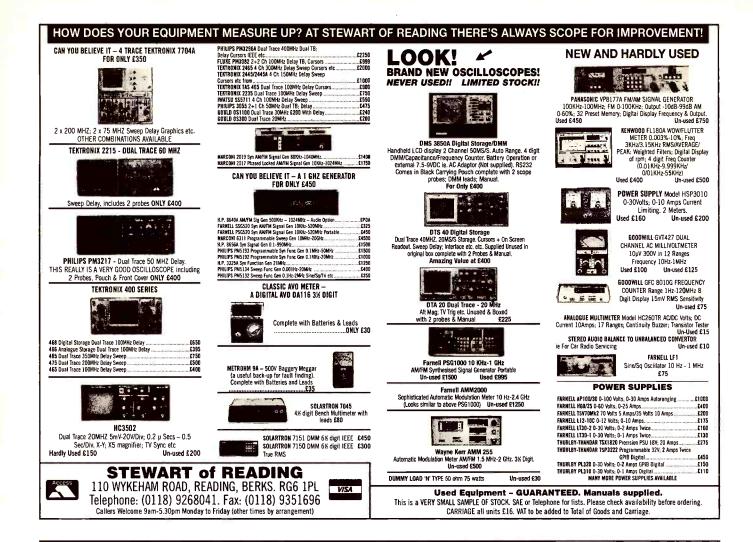
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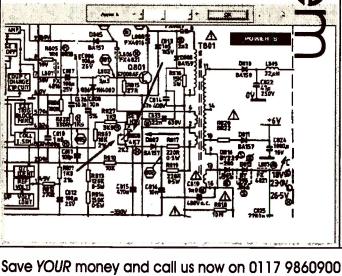
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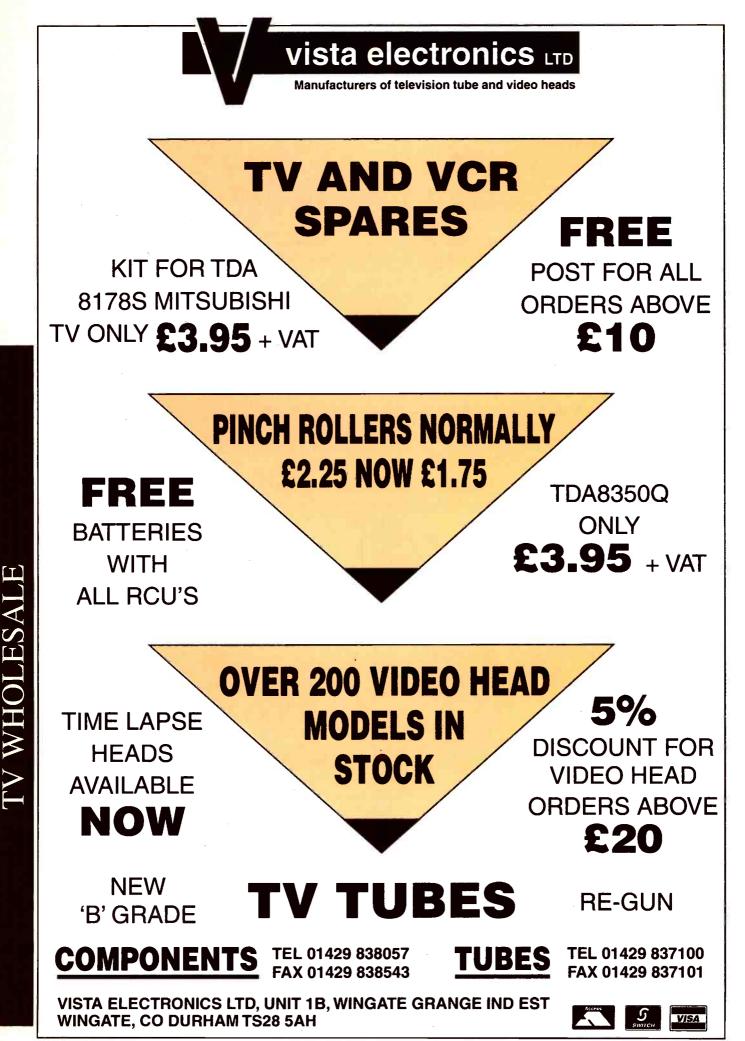
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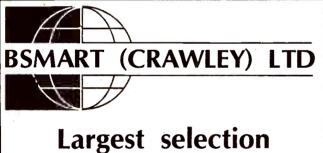
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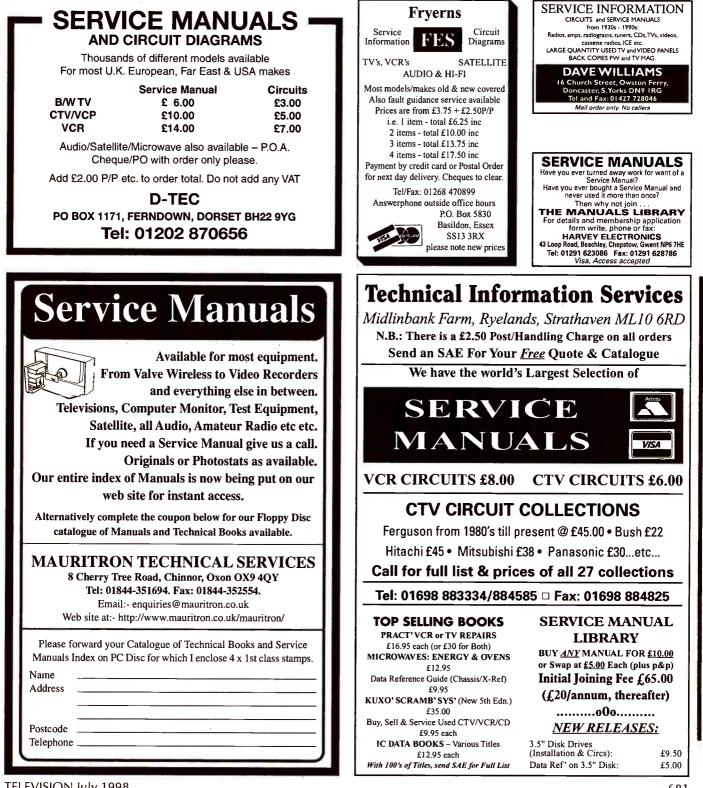
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