

THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

TELEVISION

SERVICING • VIDEO • SATELLITE • DEVELOPMENTS

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The Green issue:

Low-power standby technology

Pioneer's DVD and flat-screen
TV developments

Servicing the Philips
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modifications

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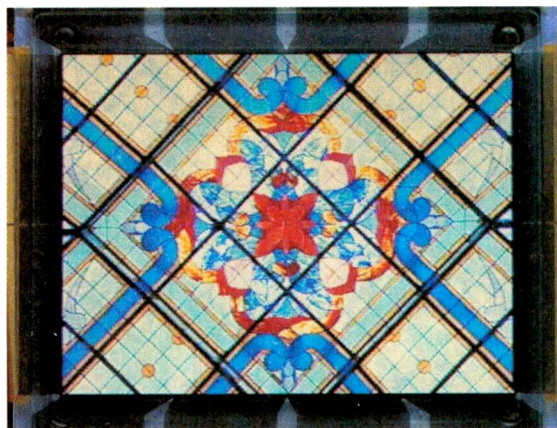
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February issue on sale
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Digital Terrestrial Television Testing

The TV Transmitter Adjustment Programme

Broadcasts from 21 new Digital Terrestrial Television (DTT) transmitters have started and testing of some of the remaining 60 is already under way. To comply with the requirements of the licences issued for DTT, the TV Transmitter Adjustment Programme (TV TAP) has been set up to deal with any interference to *existing analogue television reception* that may be caused by digital terrestrial transmissions.

In areas where it is predicted that existing TV pictures are likely to be affected, householders are being informed before the tests take place, by a mail shot which gives a Freephone number to ring. A technician from the TV TAP is then sent out to deal with the problem, at no cost to the householder.

In transmitter areas where there is predicted to be no interference to existing TV reception, the TV TAP will not be contacting householders by post. There is still a very small chance, however, that the test broadcasts in these 'low risk' areas will affect some television sets. If local television retailers and maintenance engineers receive reports of any interference to TV reception, then they should pass the details to the special 'trade only' Freephone number given below. Arrangements will then be made to send out a technician from the TV TAP.

The terms of the DTT licences do not require the TV Transmitter Adjustment Programme to deal with the specific problem of interference on Video Cassette Recorder or Satellite Decoder outputs. Consequently, any householders experiencing this particular type of difficulty will need to arrange for the necessary adjustments to be made by a suitable television retailer or maintenance engineer, if they are unable to cure the problem themselves. The Independent Television Commission (ITC) has an information sheet about how to deal with this type of interference, which is available from its Regional offices.

In adjusting VCR/Satellite Decoder outputs, care should be taken to avoid using a channel which is allocated for future use by local DTT transmissions. Details of DTT channel allocations are available on the Independent Television Commission's Web Site:

www.itc.org.uk/divisions/eng_div/dtt_freq_plan/

It should be noted that the TV transmitter Programme can only deal with TV *reception* problems that are caused by the test broadcasts: also that the existence of digital interference does not necessarily mean that a householder will be able to receive satisfactory DTT transmissions.

Initial test transmissions typically run from 8am to 7pm daily. The test period is later extended to 24 hours a day. TV trade organisations, such as retailers and repair shops, whose details appear in Yellow Pages or Thompson Local Directories, will receive a mail shot immediately before a DTT transmitter begins testing in their area. In addition, full details about the current DTT Transmitter Test Programme and TV TAP are available to the trade on the TV TAP Web Site:

www.tvtap.mcmail.com

The TV TAP may be contacted for TV trade enquiries only on:

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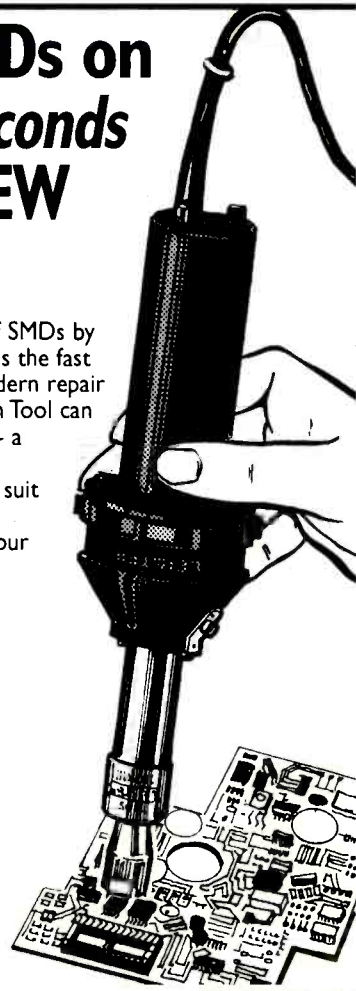
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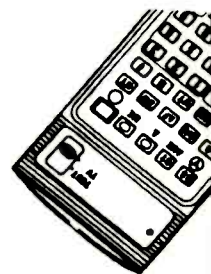
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Servicing: to license or not?

By law, all businesses that carry out gas work must be registered with the Council for Registered Gas Installers (CORGI). Since gas is dangerous stuff, it is right that only qualified fitters should be allowed to install and service equipment that uses it. The question is, should the same principle be applied to electrical goods, brown and white? Electricity is after all as lethal as gas.

There are powerful advocates for registration/licensing in the trade, and the logic is inescapable: anyone who sets out to provide consumer repair services for the public should be able to prove his/her competence to do so. The problem lies in the practicality of establishing a system to supervise the trade and clamp down on unauthorised practitioners. Such a scheme would inevitably be expensive, and would have to be set up at a time when consumer electronics servicing is barely viable because of the low cost of new equipment. The public could find that it is deprived of servicing facilities unless the goods are still under guarantee. Understandably, this wouldn't go down well. Quite apart from cost, there is the problem that few colleges are today running servicing courses, which means that the supply of qualified servicing personnel is drying up. This in turn encourages the cowboy element.

We all deplore cowboy activity – shoddy, often dangerous work, whether an excessive or a reasonable charge is made for it. You will never be able to eliminate the small-scale bodger however. There are those who think they know what to do when they patently don't, and there is the traditional friend of a friend. If you make it illegal for such people to

dabble with equipment, what about qualified electrical/telecommunications engineers (say) if they don't possess a relevant servicing qualification? Such people are often better qualified than a service technician. At the professional servicing level, possession of qualifications doesn't always guarantee the absence of a cowboy/bodger attitude to servicing, which can be encouraged in even quite large organisations when the pressure is on to maximise work throughput.

Anything that can be done to maintain high standards of workmanship is clearly worthwhile. But it would be impossible to do much by way of checking on work done unless a complaint is made. There are already means of handling this. Then there is the question of what exactly constitutes a bodge (other than something obvious)? There are 'bodges' which are safe and work but wouldn't be approved by those who maintain that equipment must always be restored to the manufacturer's original specification (something that can and does change). What are you to do when parts are not longer available, or the original manufacturer or importer is no longer in business? Scrap equipment that is otherwise perfectly sound – or engage in a bit of creative engineering?

I am also tempted to ask how electrical safety know-how is to be disseminated? The subject is a vast one in itself, calling at its highest level for a thorough knowledge of BS415/EN60065 and the principles of design to meet BEAB requirements. There are also some important but quite obscure electronic safety problems, as the correspondence in these pages on double insulation and

floating circuitry highlighted early last year. OK, at the basic servicing level it's a question of what should and shouldn't be done in terms of component replacement and safe mounting. But even here there is scope for argument.

Then there's the small business problem. The big boys in the industry don't want to know about keeping old sets going. To fill the gap, many small firms have been set up. Most do a perfectly good job, but are unlikely to be able to cope with the complications of regulation. Many would have to give up. That would hardly be in the public interest.

The government probably wouldn't consider the introduction of legislation to introduce an electrical 'CORGI' system as a high-priority matter. But if there was sufficient pressure from within the trade it would have to take notice. The question is, what action would be taken? How heavy-handed would it be? Would it be illegal for an owner to tamper with his own equipment unless he/she had a relevant qualification?

The subject is not an easy or simple one. We will probably continue to muddle along for some years yet – unless a diktat comes from Brussels! The situation is not entirely analogous with that in the gas industry. People still expect to pay a respectable sum for a central-heating/hot-water system. They don't expect to pay much for or to repair consumer electronic equipment!

The best course would be to disseminate practical know-how on electrical safety at all levels within the trade, and to warn the public – not just by means of stickers that fall off and handbooks that get lost.

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SATELLITE FAULT FINDING GUIDE

NEW EDITION No. 5

You could say that what Martin Pickering doesn't know about satellite receivers isn't worth knowing. What he does know has become legendary. Having been at it since the start of consumer satellite TV, he has built up a massive database of on satellite TV receivers. Not only on their faults, common and less common but also on modifications and upgrades. Martin brings in-depth expertise to the subject, having previously been involved with equipment reliability testing and component specification. Originally entitled "Satellite Repair Manual", this book has become established as a bible for satellite TV repair.



But the subject doesn't stand still. New models, new faults - there is always something to add. So here we have the fifth edition, which has been completely updated and now has 300 pages and a more attractive cover. In addition to receiver fault notes and general information you'll find

many useful button sequences for resetting parental lock codes, resetting installation choices to factory defaults and other less well known operations, practical information on LNB's with typical current drains, a list of manufacturers and suppliers addresses, other useful information and a beginners section. Digital receivers are now available so the manual includes a chapter to deal with these too.

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What

a Life!

**This month the customers are decidedly stranger than the TV faults they bring in – until an incorrect colour problem comes along.
Donald Bullock's service commentary**

Walter Winghurst is a wizened little chap with protruding ears. He called in the other day with a 21in. Matsui colour set.

"Went wrong last night" he said, "and didn't half send the missus into a state. Went pop, started whistling then died."

"Sorry to hear about that" I replied, "but she always had her problems. What's up with the set?"

"Went pop, started whistling then died" he said.

"Same as the missus, eh?" I replied.

He gave me a funny look, then edged out.

Steven took the back off the set and made a couple of quick meter checks. There was HT, but it wasn't present at the line output stage. A 2A circuit protector had gone open-circuit. Some further checks revealed that the line output transformer was faulty with shorted turns.

Several different types of line output transformer have been used in these sets. This one had a Philips transformer, which seems to fail more often than the others. SEME do an excellent replacement, made by the Spanish company HR. We had one in stock, and after fitting it the set was as good as ever.

More Matsuis

Nan Finch is a big woman who suffers from bad indigestion and tends to intrude into other people's conversations. She came in with a Matsui 209T just as Mrs Webcross was putting her Matsui 1481B on the counter. I like old

Mrs Webcross. A real country lady.

"Jolly cold today, Mr Bullock" she said.

"Nah. It's 'ot" said Nan.

Mrs Webcross turned round, surveyed her, then turned to me again. She drew her finger across the centre of the screen. "Just a line" she said.

I filled a card in for her set. When she'd departed, I asked Nan what the problem was.

"Flashed and died" she said.

Paul was looking at the 1481B. A quick check revealed that the supply to the UPC1488H field output chip was missing. It comes from a rectifier that takes its feed from the line output transformer. The surge limiting resistor here, R437 (1.8Ω, 0.5W safety type), was open-circuit. A replacement restored the field scanning. Easy, that one.

The 2AT mains fuse in Nan's set had died a violent death – it was blackened. The obvious thing to check was the chopper transistor, which was short-circuit. We fitted a replacement then started the set up via our variac. It groaned briefly as the voltage was wound up, but refused to get going and drew no current. Further investigation led us to the standby switching transistor in the HT supply. It was leaky all ways. Once this had been replaced the set worked correctly.

Comedy Acts

Two fellows then appeared carrying a massive 28in. Hitachi set, Model CPT2808.

"Straight on to the bench!" I

said, "what's wrong with it?"

"Dead, just ticking" they replied. "Can we come in tomorrow to see if it's done?" They spoke in unison.

Not long after, Terence Reeve came in with a 21in. Akai Model CT2115. He tends to look down his nose at you. I gave him a stern look as I drew up a job card.

"What's the trouble?" I asked.

"Nothing" he replied.

"So why have you brought it in?" I asked.

"Cos there's nothing" he said.

I plugged the set in and connected an aerial. All I got was a plain raster, with no sound.

"See, nothin'" he said.

As I waved him out Mr McTurdy came in. He was wearing gumboots, which didn't do much for the floor.

"Hah, Mester Balloch. Now, what 'ud you do if you 'ad a pie that kept buzzin? Nut'n but buzzin?"

"I'd refuse to eat it. In fact I'd give it to you."

"Roight" he replied, "and I'll be returnin' the compliment. It's in the car."

Out he went, squelching, then back again, this time carrying a Pye colour set – one fitted with the Philips 2A chassis.

I waved him out and turned to Steven. "That's three comedy acts in a row" I said. "Do you think we'd better shut shop and scoot off before the midgets and jugglers start to come in?"

Repairs

But it was time to get down to business. Steven took the back off

the Hitachi set. The cause of the trouble was immediately obvious: the mains bridge rectifier's reservoir capacitor C909 (150 μ F, 400V) had discharged its electrolyte over the PCB and was open-circuit. A replacement brought the set back to life.

There were additional symptoms with the Akai set. The front control buttons didn't do anything, neither did the remote control unit's buttons. A problem like this is often related to the lowest supply line, say 5V. As expected, it was missing. Before long we found that C832 (1,000 μ F, 6.3V) was dead short. A replacement restored the LT supply and the set came to life.

I was having a go at the Pye set. It was buzzing all right, with no sound output. The TBA120S intercarrier sound chip was faulty. Once a replacement had been fitted there was perfect sound.

Mitsubishi Problem

"My husband went hoppin' mad last nigh, Mr Snoddy" said a bulky woman who came in clutching a 21in. Mitsubishi set, model CT21M3TX. "We wuz just settling down with a drop of larrup to see ol' whasisname – you know, the slimy one with the sickly grin – whasisname? . . . Go on, remind me!"

"Could be almost any of 'em, couldn't it?" I replied, "and more if it was Channel 5."

"Any 'ow he just faded out. Left us with nuthin'. Nuthin'! Just faded out. Never left us with nuthin'. 'T'aint right now, is it? I mean, he costed us alloa money. We got 'im because of Bruce Forsythe."

"He'll be the trouble" I said.

This model is fitted with the Euro 14 chassis. Steven went straight to the 2AT mains fuse F991. It was a sand-filled ceramic one and was open-circuit.

"The times we've had to replace that!" Steven said. "Don't know why it goes, but it does. Mitsubishi recommends fitting an ordinary glass fuse when it fails for no apparent reason."

Mrs Bulky was delighted when she came back to collect her set. "I never said nuthin' to yuh. Thought it was the tube. It's thanks to me we gollim done so cheap: my 'usband allus takes it to Gumboils but I said no, let's give that Mr Snoddy a chance." She gave me a wink.

"O' course, me and my 'usband are two different people" she added.

"Ah yes, of course" I said.

A Sanyo

Paul had a Sanyo CBP2152 (E4-A21 chassis) on the bench. When he switched it on there was a bright white screen with flyback lines. This means check the HT supply (180V) to the tube base panel – for the RGB output stages. It was missing.

As usual, the supply is derived from the line output transformer. When Paul checked here he found that the 10 Ω surge limiter resistor R478 (safety type) was open-circuit. A replacement restored the picture.

Mr Oddun

By now we were pretty up-to-date with our repairs. Then Mr Oddun came in.

"I've an old Logic telly" he announced, "ha, ha."

"Why the joke?" I asked, "I don't find them all that funny, I can tell you."

"Ha ha" he continued, "it's got a green picture. Ha, ha, ha."

"I see" I replied, "ha ha ha."

When he'd laughed his way out, we took the back off the set and found that it was fitted with the Ferguson TX90 chassis. I never did find it very funny. When we switched the set on there was a green sunbather on a red lawn.

I explained to Steven and Paul that this fault, once common but now so rare, would be caused by an ident problem. The set's chroma switching was, I said, out of step with that at the transmitter. I went on to describe the technicalities of the PAL colour system. "The cause of the trouble," I concluded, "has to be in the chroma circuitry. The set is switching in red instead of green, and vice versa."

I tried adjusting the oscillator potentiometer in the colour decoder. This made no difference. Neither did anything else I tried. Later I got into the chroma circuit with a scope, but couldn't find anything wrong. By now I didn't feel so clever.

Paul went to make a cup of tea. While he was away my brain started to tick over. I'd had this very fault years ago with one of these sets, and the cause had been nowhere near the chroma circuitry. Now what was it? I racked what



"He was wearing gumboots, which didn't do much for the floor."

was left of my brain. Then it came back to me.

I reached for the degaussing wand and swept it about in front of the tube's screen. As I did so, the picture came right. I switched the set off, waited a minute or two, then switched it back on again. The fault was back.

I then dived for the posistor (Z102) in the degaussing circuit, took it out and rattled it by my ear. It sounded like a box of pills. I opened it and found that the VDR tablets had crumbled to gritty dust.

I fitted a replacement, degaussed the tube again and switched on. Up came a perfect picture – just as Paul returned.

He looked at the picture. "Which part of the chroma circuit was at fault?" he asked.

I rubbed the side of my nose. "Er, when I said that the cause was an ident problem, I should have said the cause was nearly always an ident problem. In this case the cause was simply a magnetised tube."

I showed him the little pile of dust that had been the tablets in the degaussing posistor.

"Astonishing" he said.

"Mortifying" I added.

TELETOPICS

Interactive TV

British Interactive Broadcasting has decided to use the name Open for its services, which are due to start this spring via SkyDigital. GUS, Woolworth, Iceland and the Midland Bank (HKS) have signed contracts with BIB. The services are to include home shopping and banking, games, information and e-mail, with free access for SkyDigital subscribers. The plan is for a low-key initial launch, building up to a full service in the autumn. BSkyB has announced that

its Sky Interactive Programming (SIP) service will work with Open.

SES has signed an £11m contract with Nortel for ground network and satellite interactive terminals for its Astra-Net system. This will offer interactive services via the 29.5-30/18.3-18.8GHz bands, using the Astra 1H and 1K satellites, in early 2000.

British Telecommunications is to introduce the BT Interactive service, which will offer internet and multimedia operation, including

streamed video, using a PC.

Telewest Communications, the UK's largest cable television company, is reviewing its decision to use the Open TV system to provide interactive shopping and banking services. The alternative is an internet-based approach using the HTML standard, which is used to format internet documents. Use of this standard would provide increased flexibility and bring Telewest into line with the rest of the cable industry.

Chippery

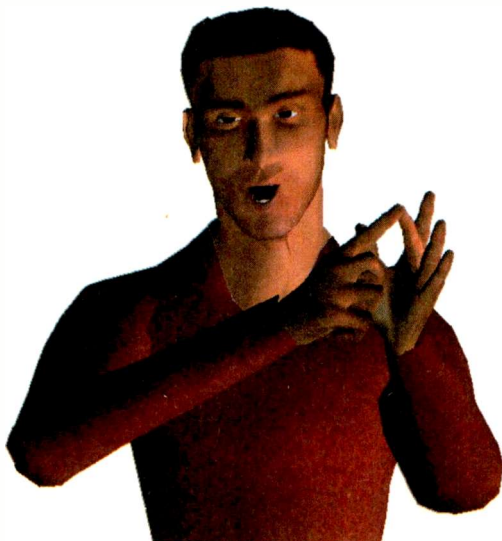
Philips Semiconductors has introduced the SAA4977H picture improvement processor for field rate doubling (50/100Hz or 60/120Hz) and to act as a digital gateway for other memory-based picture-enhancement processors. It incorporates AD and DA converters and works with a 2.9Mbit serial field memory. Setmakers can use it to insert additional video processors in the YUV signal path, for example to provide 2D noise reduction, line flicker reduction or add Philips' natural-motion processor.

US firm Equator Technologies

has released details of what it claims to be the fastest digital signal processor to date, the MAP1000, which is intended for use in set-top boxes, HDTV sets, MPEG encoders/decoders etc. As with Philips' Trimedia chip, the processing is controlled by stored software rather than dedicated silicon hardware. This gives greater flexibility – formats can easily be changed or updated for example. The MAP1000 incorporates a VLIW (Very Long Instruction Word) processor that runs at 200MHz: it's able to carry out over three billion multiply-and-

accumulate operations per second.

The Power Integrations TinySwitch series of ICs for AC/DC adopters is now available from Sequoia Tekelec Ltd. These chopper type chips incorporate a 700V power MOSFET and enable consumption in the standby mode to be reduced to less than 100mW. They are suitable for use with portable TV sets, PCs and cellular handset chargers. The devices themselves consume 30-60mW in the no-load condition. For further details check with Sequoia on 0118 925 8000 or fax 0118 925 8020.



On-screen Sign Language

The research and development arm of the ITC, the University of East Anglia and technology company Televirtual have developed an on-screen sign-language system that's presented by a virtual human known as Simon. The system converts subtitle data into sign language using special software called SignAnim. Part of the software consists of a linguistic module that captures the subtitle data stream and analyses it. The subtitle data is then edited to remove words that are not used in sign language, and reorganised into a more appropriate word sequence.

This editing process also helps the system keep pace with the TV programme.

The edited text data is sent to a dictionary of sign words which are stored on a hard disc as motion-capture data. The relevant signings are extracted, and special techniques are used to create a smooth animated sequence. There are plans to use characters other than Simon, to appeal to different types of deaf viewers including children. The developers hope to be able to put the software into set-top boxes by the end of the year.

Video News

The DVD system is establishing itself as an international consumer product. There was a sharp increase in sales of both hardware and software in North America last year – a million players are understood to have been sold in the USA. According to Philips, sales are running at ten times the rate of CD players at the same stage in the launch cycle. Some 2,000 titles were available in the USA by last Christmas, while in Europe there were some 500 titles. European player sales are expected to reach half a million this year.

JVC has launched two new digital video camcorders, Models GR-DVF1 and GR-DVF10, in what it calls the RealVision range. Amongst the features incorporated in these models are super digital zoom (160x); eleven digital effects including black-and-white, sepia, classic film and strobe; eighteen scene transitions including mosaic fader, slide wipe and dissolve; and JVC's exclusive picture stabiliser to eliminate shaky pictures even with long-zoom shots. An option to purchase the VU V856 high-capacity battery kit, which provides seven hours of battery use, comes with both models. The GR-DVF10 (see photograph) has a built-in 2.5in. LCD monitor that can be tilted to provide high-, low-angle and self portraits.

Dolby Laboratories and an Australian company, Lake DSP, are to develop technology that enables multi-channel surround sound to be heard using a pair of stereo headphones. The Dolby Headphone technology will be based on a digital signal processor chip that could be incorporated in DVD players, set-top boxes, digital TV sets, VCRs, PCs,



video games consoles and personal stereo systems.

Californian start-up company TiVo has developed an intelligent digital video recorder that learns which programmes to store by monitoring the user's viewing habits. It can record up to twenty hours of TV without need for user programming. While viewing you can pause, rewind or fast-forward. When the unit is released in the USA the cost is expected to be about \$300.

The JVC digital camcorder Model GR-DVF10.

Business News

As part of a restructuring of South Korean industry it is likely that Samsung will swap its automobile interests for Daewoo's consumer electronics business. This could lead to the closure of Daewoo's VCR factory in Northern Ireland, with the loss of some 1,000 jobs. Samsung's European manufacturing capacity is concentrated in eastern Europe.

Alcatel, DirectTV, Microsoft and NEC have each bought a 7.5 per cent stake in Thomson Multimedia. As a result, 30 per cent of the French consumer electronics company will pass to the private sector.

Alba's pre-tax profits advanced 17 per cent in the half year to September 30th. The company's TV and VCR divi-

sion, which accounted for 39 per cent of sales, has gained market share – its products are some 20-25 per cent cheaper than mid-priced Japanese models.

According to government figures the average price of TV sets, VCRs and camcorders fell by 17 per cent last year. They are now half the price they were ten years ago.

Test Equipment

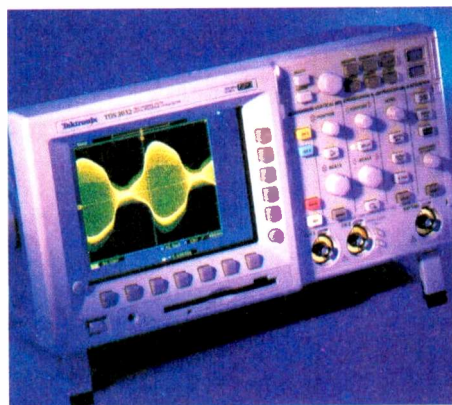
Tektronix has introduced the TDS3000 series of digital phosphor oscilloscopes (DPOs) at prices that start from £2,035 plus VAT. There are six models in the range, with bandwidths from 100-500MHz, either two or four channels and sampling rates from 1-25-5Gsamples/sec. The scopes have LCD displays and are mainly intended for design engineers and manufacturing test technicians. The DPO technology is interesting. After analogue-digital conversion the waveform is rasterised in a dynamic, three-dimensional database called digital phosphor, the information being sent to the display system periodically. At the same time and in parallel, a microprocessor performs automatic measurements and maths functions. Our photograph shows Model TDS3052. For further details check with Tektronix on 01628 403 453 or fax 01628 403 458.

Premier Electronics (GB) Ltd. has introduced the Digisat digital satellite signal-strength meter. It's designed for accurate

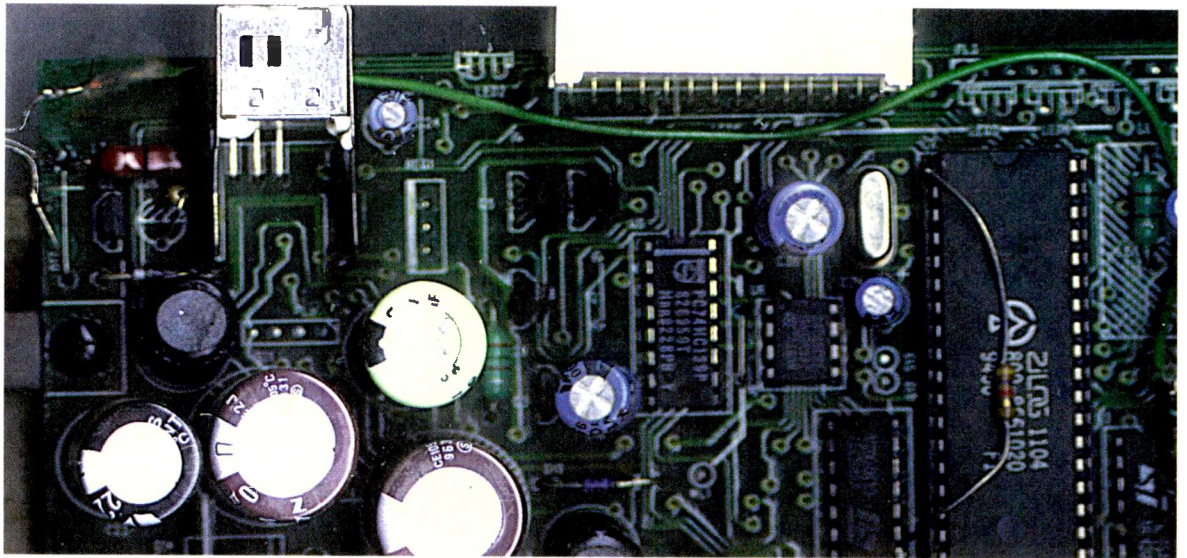
alignment of dishes for digital TV reception, using a unique satellite information data system – this looks at two transponders, match-ess frequency, bit error rate, polarity, symbol rate and FEC. The results are presented on a 16-character, two-line LCD panel. Accurate alignment usually takes less than two minutes. While programmed for reception from Astra signals at 28.2°E, software is available to enable units to identify any other major satellite. For further details contact Premier on 01476 514 611 or fax 01476 514 662.

The Grundig Digimess range of fourteen instruments is available from Vann Draper Electronics Ltd. The range consists of three fully-programmable power supplies with dual or triple outputs; two universal timer-counters; three automatic RLC meters; two millivolt meters (RF and LF); a 4-5-digit automatic bench multimeter; and three signal/function generators. All instruments (except the RF1000 RF millivolt meter) have a high-resolution LCD with backlight and a

microprocessor self-test. Optional software packages provide a soft workshop or individual product operation via a PC. For further details contact Vann Draper on 0116 277 1400 or fax 0116 277 3945.



The Tektronix TDS3052 oscilloscope, one of a new range that use DPO technology.



Pace PRD Series Modification

Martin Pickering describes a simple way of providing automatic LNB supply switch-off. The advantage is cooler running and thus improved reliability

Most satellite receivers run too warm for their own good. My own Pace PRD900 was no exception. I had already fitted the reliability upgrade kit Relkit 1 (see below), which includes a resistor to lower the supply voltages slightly, and had mounted the receiver on an open shelf. But it still felt very hot to the touch.

Pace receivers continue to supply current to the LNB when they are in the standby mode. The original reason for this was to protect the LNB from the effects of sudden temperature changes. As the LNB supply in Amstrad and a few other makes of satellite receiver is turned off in standby, I could see no reason why it shouldn't be in my PRD900. Most modern LNBs require 200-250mA at 13V, so the power saving would be significant.

Modification Details

A simple modification (see Fig. 1) will switch the LNB voltage to zero when standby is selected, provided the receiver is in the vertical polarisation mode when this is done. The position of the three components to be added is shown at (a) in Fig. 1, while (b) shows the relevant circuitry. Very little is required: a 1k Ω resistor, a 1N4148 (or similar) diode and an FXT749 transistor. This pnp-type transistor is critical, because its rating is 1A with a very low voltage drop, and it's in a tiny e-line package.

Fitting the components is a very simple matter – you don't even need to remove the board from the chassis

(which often leads to damage). Solder the added FXT749 transistor across diode D17, with its collector (the centre leg) to D17's cathode (indicated by the cross on the PCB) and its emitter to D17's anode. Cut out D17 and discard it. Solder the anode of the additional 1N4148 diode to the base of the FXT749 transistor, and the diode's cathode (bar end) to the 1k Ω resistor. To complete the modification, solder a lead from the 1k Ω resistor to pin 2 of IC U3. This pin goes high when standby is selected. So the added transistor will be switched off, removing the V-polarisation supply to the LNB.

Secure the resistor, the diode and wire with glue to ensure that they can't touch anything and thus cause a short-circuit.

With my receiver there was a significant reduction in the heat produced by the power supply. If you insist on keeping yours in a nice warm cabinet on top of a VCR or if, as in most modern houses, your room temperature is quite high, you might in addition consider fitting a miniature cooling fan.

The modification is also applicable to the PRD800 version of the receiver. It would be possible to switch the LNB supply off regardless of the polarisation. To do this, leave D17 in place and connect the added FXT749 transistor in series with L3. But to do this you would have to remove the PCB. It's simpler to carry out the modification as described and remember to have the receiver switched to vertical polarisation when standby is selected.

Another Modification

Another modification is to fit a 22kHz tone generator board (see photo alongside). This can be soldered to the side of the tuner module and connected, with three wires, in accordance with the instructions that are supplied with the board. The tone can be set to be on or off by menu selection for each individual channel.

When the tone generator is on, it will send an 0.5V peak-to-peak tone signal to the LNB via the tuner. If the LNB is a universal type, the tone will switch it to high-band operation by changing the local oscillator frequency from 9.75 to 10.6GHz. Astra at 19.2°E has nothing watchable in the high band. But, if you can swing your dish to other satellites, you might be surprised!

Alternatively you could buy an external tone-operated switch that can select one of two LNBs, thus increasing the number of satellites available to you.

Availability

You can order an FXT749 transistor, the fan kit, Relkit 1 and/or the tone generator board from SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA (telephone 01270 753 311). For a list of kits etc. send two 26p stamps and your address to SatCure. You may also like to take a look at the massive web site at

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

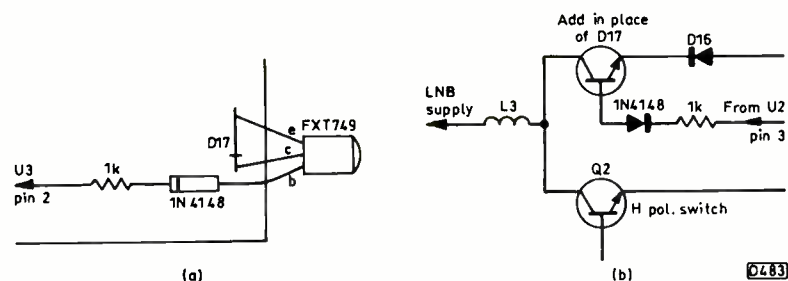
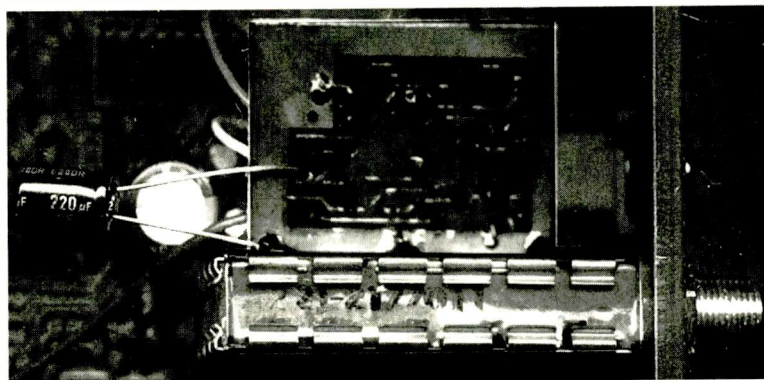


Fig. 1: The LNB power supply modification. (a) Location of components, (b) the relevant circuitry.



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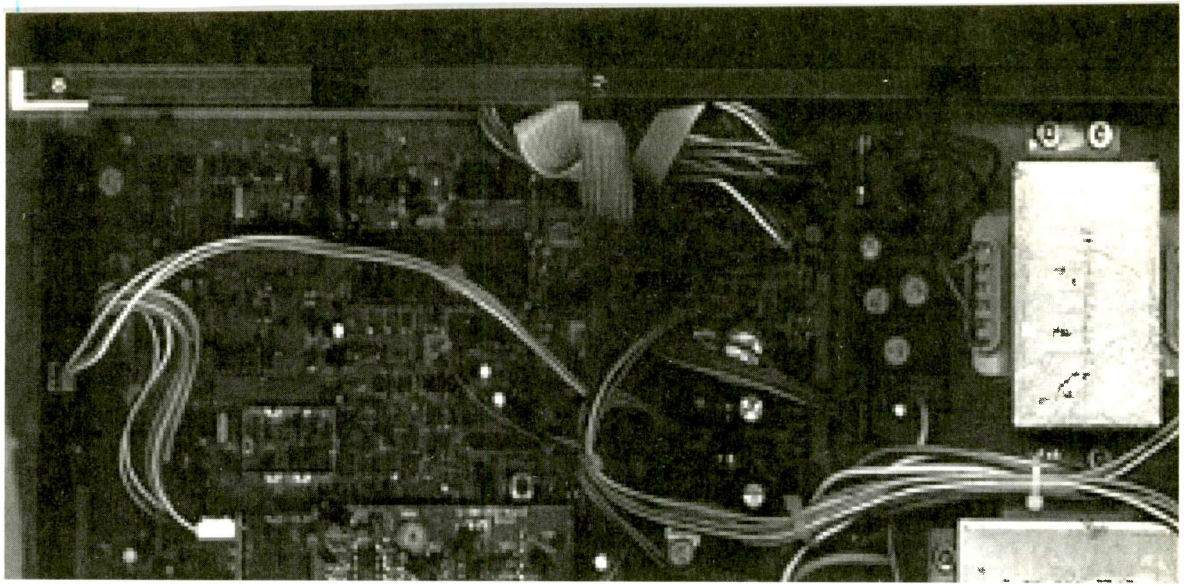
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Satellite Notebook

**Reports
from
Colin J. Guy
and
Hugh Cocks**

Amstrad SRD510

I've encountered problems with two of these receivers recently. The first one had a poor response to commands from the remote-control unit. It would sometimes respond if the unit was held near the front. At other times it wouldn't respond at all. When the RC unit was tried with another receiver it proved to be OK. The problem was solved by cleaning off the hot-melt glue at the back of the IR receiver PCB, which is mounted on the SRD510's front panel.

The complaint with the other receiver was patterning on the picture. This time it wasn't caused by faulty electrolytics in the power supply – they had all been replaced during a power-supply rebuild. The cause was C86 (100 μ F), which decouples the 9V supply to the tuner and is mounted near this item. C.J.G.

Shaded Dish

The customer complained about very snowy pictures. When I called, the cause of the problem was obvious: the house was at the bottom of a steep hill, with the 1.2m Astra dish just pointing over the top of the hill. Immediately in front of the dish some very rapid-growing shrubbery had increased in height.

The house was used only intermittently, for holiday lets. The shrubbery must have had a growth spurt at the end of summer, when no one was living there – no problem had been reported during the peak occupancy period! H.C.

Nokia Digital Receivers

We've recently done a couple of installations for Dutch TV, using the Nokia 9500 MPEG digital receiver. Physically it's similar to 9200 and 9600 series receivers, but

there's an Irdeto conditional-access module within the case and, unlike the 9600/9602, the card slot is independent of the CAM.

A useful feature with all the Nokia receivers I've come across is a received digital signal 'goodness-factor' display on the front panel. This helps with the Dutch signals, which we receive at quite widely differing strengths from the various Astra-1 series satellites that transmit the Dutch channel package.

The signal-strength display in the channel search menu doesn't help much as it is based on the receiver's tuner AGC reading. You can have a fair length of coaxial cable that reduces the AGC reading, producing a low signal-strength display, though the quality of the digital signal is perfectly acceptable. In fact I've found that for best results Nokia tuners often prefer not to be presented with too much IF signal from the dish.

To activate the goodness-factor facility, enter the 'red menu'. Press radio (music symbol), 99, radio and menu on the remote-control unit fairly quickly. Within a second or so a red display will be seen at the left-hand side of the screen. The wait for the menu can be confusing, but don't touch any other remote-control buttons during the delay. If the menu doesn't appear after a few seconds however, try the procedure again.

Once the menu has appeared, select option 8 'receiver set-up menu' by pressing 8 on the handset. A red bar will then be seen at the top of the screen, listing single options that can be scrolled through using the inner up and down buttons above and below the OK button. Go through the options until "select indicate RS errors" is displayed (RS = Reed-Solomon). At this stage the

front panel will say "err".

Now press the OK button. A number will start to appear on the front panel only, updated every second. To return to normal operation, press the button to the left of OK. You are then returned to the previous left-hand side 1-9 red-menu options. Press TV, radio then TV in quick order and the receiver will return to normal operation, except that when each channel is selected its name is displayed only briefly and if a signal is present the number will appear on the display.

Good reception is possible when the display says 70 upwards. Very strong signals reach 150. Just about lockable, jerking pictures marred by squares on the screen are present when the display reads about 45-50. Each channel within the same multiplex group will produce the same reading, but the readings will differ with different channel multiplexes. This is particularly useful when you are checking the level of SCPC (Single Channel Per Carrier) MPEG TV signals with low symbol rates – none of these are transmitted via the Astra satellites however.

Once you've finished checking the signal quality, return to normal operation by switching the receiver to standby then back on again.

The red-menu facility can be confusing, and should be treated with extreme caution. While in red option 8, "select signal quality QPSK" will be seen when you scroll through the list. It might seem more logical to use this than "indicate RS errors", but I can't make the receiver display anything when this option is selected! One would also expect the RS errors to decrease when signal strength increases. All the receivers I've tried display similar signal-quality (RS error) numbers.

We've also found this helpful with Swedish and Norwegian expatriates for whom there are digital subscription services in the low (10.95-11.7GHz) band and who often have an old dish and LNB that can be used. Older LNBs can have phase-noise problems that cause signal degradation. The receiver's number readout shows the problem up immediately. Surprisingly perhaps, most of the older LNBs I've come across so far are stable enough for digital use. **H.C.**

Mixing Old and New

We installed a brand-new French digital satellite system. The customer then told us that he wanted the audio output connected to his nigh-on 50-year old radiogram, so that he could listen to France Musique without having to switch the TV set on. Fortunately the radiogram had a standard DIN external audio input socket. Once the valves had warmed up, the sound quality was actually very good!

Later that day I made up an audio lead for a customer so that he

could transfer his 78 r.p.m. record collection to 3in. Mini disc format. It turned out that the 78 pickup needle (not stylus!) needed replacement. I wondered about the recording medium, say fifty years hence, to which the 3in. Mini disc recordings might be transferred. **H.C.**

Drake ESR250

This US-manufactured integrated receiver-positioner was a few years old. It had given trouble-free operation to date, but its owner complained that there were now "poor pictures on some channels". This proved to be a fair description. Some channels were more or less OK. Others, such as RAI-3 at 13°E, provided clearer pictures at each side of the main dish peak, maximum signal producing a noisier picture.

I checked the dish alignment, which was OK. The wideband dish-alignment meter confirmed that maximum signal coincided with the noisy RAI signal. Fortunately the solution was simple - I'd come across the same problem with another Drake receiver several years ago.

When you remove the lid of the tuner you have access to two solid-looking though small trimmers. All that's required is a small adjustment to the one nearest to the RF input (F socket) end. When this was carried out the sparklies on the RAI picture suddenly cleared and the picture brightened up considerably. I checked other signals at different frequencies across the band: all had improved dramatically.

We've had very occasional failure of this tuner, the symptoms being similar to those you get with a low-gain Pace SS9000 tuner - lots of streaks and generally awful-looking pictures.

The later version of the ESR250 has the full 2,050MHz tuning range (early ones tune up to 1,750MHz), with independent AFC on each channel. With earlier units the AFC centres each channel slightly differently depending on its strength. This can be annoying under certain reception conditions, with either black or white sparklies on different channels. With care a compromise AFC setting can be achieved, but it's a very tedious procedure. **H.C.**

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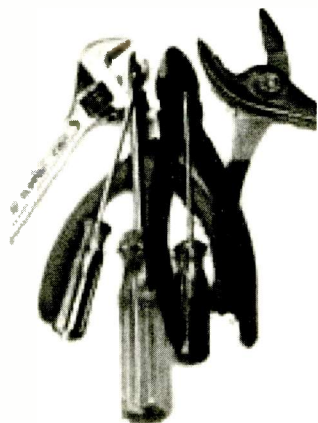
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John Edwards' Casebook

JVC AV21H1EK (JX II chassis)

The phone rang at 8.30 a.m., on the dot. When I picked it up a quiet, well-spoken, almost timid voice greeted me.

"No picture, just lots of snow and 'shushing' noises. My husband said to tell you it was the aerial box inside the set, so could you bring one with you so that you can fix it here?"

I drew a deep breath, thanked her for being so helpful in telling me what was wrong, but said I would have to check the set myself. I added that this might save them some money.

She said she would have to get in touch with her husband at work and would call me back if he agreed.

"That's OK" I replied, "I'll sit by the phone and wait."

Dead on 6.30 p.m., as I was tidying up the workshop, the phone rang. This time it was the husband.

The conversation dragged on for ages, and seemed more like an interview than a routine repair enquiry. In the end, after sticking to my guns and politely refusing to give him a price, the part number of the "aerial box", where to get it, how to fit it or suggesting what else could be the cause, he succumbed and agreed to let me call next day. He expressed disappointment that I could not make it that evening.

I called next day as arranged. The set was awaiting my attention, already switched on and displaying the no-signal symptom. I checked the aerial lead, which seemed to be OK, then plugged my portable pattern generator into the scart socket. When I selected AV input, the colour bars appeared on the screen and the speakers produced an audio tone.

"Wonderful" she exclaimed, "that didn't take long!"

I removed the back while explaining that it was just part of the test procedure. At that moment the phone rang. It was the husband.

"Wants to know how you're getting on?" she called.

"Tell him I'm working on it" I replied.

She told him to hang on while I fixed it, then continued filling in time on some domestic matter.

I checked the voltages at the tuner's pins. They were all correct except for the 33V tuning input, which was at 50V. I switched off, cut one leg of the 33V zener diode D001 and measured its resistance. It was open-circuit.

"Wants to know how you are getting on" she again called.

I was beginning to get annoyed and wanted to leave. So I reached for the phone, which she handed me. "Right, sir. It's not the aerial box, it's a voltage supply problem. Cost would be about £80. OK?"

I imagined him pulling out a handkerchief and reaching for a chair. But the grilling then started again. This time I was having none of it. Interrupting him in full flow, I said "do you want it done or not, sir. That's all I want to know."

He paused, then replied "I'll phone you tonight."

"Oh no sir" I heard myself say, "I can't spend any more unpaid time on this job."

He then agreed that I should take the set away to fix it.

Back in the calm atmosphere of the workshop I replaced the zener IC. I then had the correct 33V supply, but still only snow and no tuning or on-screen display. My heart sank. Perhaps the tuner had been damaged by the excessive voltage? I phoned a supplier who wanted £60 plus VAT for a new one. I then phoned MCES, but they don't fix this type. I sat down, contemplating. If ever a job was jinxed, it was this one. The thought of trying to explain the situation to the customer and revise the estimate was mind blowing.

Then, suddenly, the set burst into life, with a normal picture and sound. I couldn't believe it. All the channels worked as well. Instinctively, I flexed the main board. The channels disappeared and the snow was back. I didn't mind. I knew what it was. Confidently (will I never learn?) I withdrew the large mother board, turned it over and peered at the two regulator chips IC521 (12V) and IC522 (5V) in the line output department. They were both badly dry-jointed. After resoldering them I switched on again.

All was now well. Time to celebrate. With a child-like smile on my face, I reached for the kettle.

Sony KV27XRTU (SX chassis)

This set was dead with no 135V HT supply at the connector (F4). I found that there was a dead short-circuit reading from the cathode of the HT rectifier D651 to chassis, the cause being the line output transformer which had broken down. When a replacement had been fitted there was still no HT at the connector. This time L651, which is in series with D651, was found to be open-circuit. All was well once this item had been replaced.

Ferguson 59H3 (TX100 chassis)

When this set was first switched on there was no sound or picture, just a faint purring noise from the power supply. After about five minutes the noise slowly subsided and a normal picture appeared, with sound. The culprit was C117 (100µF, 16V) which couples the drive to the chopper transistor. It was leaky.



Reports from David C. Woodnott

Sony CCDR55E

This model was popular some years ago. One came in recently with an uncommon fault: it operated correctly in all modes but wouldn't produce an output when the RF unit was used – the AV signals were fine when fed to a monitor directly. Investigation showed that Q201, a 5V regulator, was open-circuit because C204 (10µF, 16V) had gone short-circuit. Once these items had been replaced all was well.

Samsung VPH65

The complaints with this newish model were as follows: "white dots" on the playback picture and a noise from within the mechanism. A faulty capstan motor was the cause of both symptoms – its rotor was fouling the FG sensor. There was no further trouble once a new motor had been fitted.

These camcorders, and some Canon models that use the same mechanism, very often come in for repair because of "failure to accept a tape" or symptoms that are obviously caused by lack of FG control. Invariably the FG sensor is damaged.

Note that two Samsung mechanisms, found in similar models, use different capstan motors which are not interchangeable.

Sony CCDR55E

There was no audio for a number of minutes when this camcorder was first used. The pictures were OK in all modes, but there was no sound at all. Inspection of the audio PCB

Camcorner

revealed that the electrolytic capacitors there were all leaking. Everything was OK once they had been replaced – after thoroughly washing the board.

It's as well to check all the electrolytics on the video and syscon boards as they commonly fail in the same way. The good thing is that there aren't too many of them in this model.

Sony CCDR105E

No playback was the complaint with this compact, middle-aged unit. All was well mechanically, but there were no playback pictures. The E-E mode worked correctly.

Some time was spent chasing the paths of the Y and C signals on the video board without much progress being made. Then, when the unit was turned upside down, something fell out. It was a small inductor – a nice discovery, but where did it belong? On the video board, hopefully! In fact it did – it turned out to be L605. Once it had been refitted, playback was back to normal.

The customer later admitted that the unit had failed after he'd dropped it – well, of course!

Canon UC10E

One of these popular machines arrived with a tape stuck in the mechanism. No functions worked. I've on previous occasions reported trouble with this mechanism (the Canon UC), usually because force has been applied to the cassette housing tray while inserting a tape. As a result, the supply reel spindle is bent. You then get faults such as going into the 'caution' mode etc.

The supply reel spindle was OK in this machine. But it wouldn't release the tape, though 'straining noises' were heard from the loading motor area.

A complete mechanism strip down was required to reveal the cause. There's a shiny 'plate guide' (item 33) on the take-up side of the mechanism. It's positioned adjacent to one of the capstan motor

fixing screws. Because it had been damaged it had caught against the underside of the take-up coaster guide assembly, which was locked fast. The loading motor was not aware of this 'jam-up' and continued on its merry way – damaging even more parts before giving up and itself becoming jammed! The plate guide, the P5 skate assembly and the slide gear assembly all had to be replaced.

Some caution is required when reassembling this mechanism, as the timing is not as straightforward as with most decks. Reference to the UC Mechanical Chassis manual (part no. DY8-3391-504-201) is recommended.

Fortunately the unit worked once it had been reassembled. A general service and the replacement of a few capacitors completed the repair.

Panasonic NVR50B

One of these camcorders was brought in because the EVF pictures were intermittent. This model has a colour LCD type of EVF, with most of the drive circuitry within the main body of the camcorder.

The coupling to the display is via a ribbon cable, which is flexed each time the EVF is moved in use. As a result the cable can become faulty. A replacement cured the problem.

We've since had ribbon-cable faults with another of these units and a similar one.

Sony CCDR45E

Everything worked except the viewfinder, which was totally blank. With this model it's not uncommon to have EVF problems because of leaky capacitors. But the fault symptom is then generally a blank white raster, possibly with horizontal foldover etc.

On this occasion the cause of the fault was a missing supply to the EVF PCB because L228 (on the video PCB) was damaged. A replacement cured the problem, and a service completed the repair.



Faulty operation of an Amstrad printer turned out to be simple to cure, as Quintin Blane explains. Also a tip on how to get more use from the cassette

A Printer Problem

I had been thinking about buying a wordprocessor when D.B. Wheatly's article on the Amstrad PCW range appeared (*Television*, June 1997). He spoke well of these machines, and it occurred to me that one would fit the bill. So I started to look around, watching the advertisements in the local papers etc. By chance, while on holiday, we visited an auction room. Amongst the furniture, washing machines, TV sets etc. there was this ivory-coloured outfit, obviously not bang up-to-date but clean and looking good. I went over to have a look, thinking I should be so lucky: there it was, an Amstrad PCW9512 complete with a daisy-wheel printer.

It was being sold "as seen", which in salerooms usually means faulty. But I decided to bid for it, as I knew I could deal with run-of-the-mill faults – at least in the monitor. I set my bid limit at £50: it was knocked down to me for £20 plus charges, a total of £24.68. A start-up disc was included, but there was no users' manual – I was given one later as a present.

On Test

Back at home I set up the machine, noting that the printer was connected to the socket in the monitor by a short cable which was terminated with a large 7-pin DIN-type plug. I know of old that such sockets are often secured to the PCB by the soldered joints only, and can give trouble if someone tries to push the plug in with the key misaligned. I kept this in mind.

When the start-up disc was inserted, the computer booted up satisfactorily and worked well in every respect. I had mixed feelings about this: it probably meant that the printer was defective, and my experience of such items was nil. I was pleased to note that

the disc drive seemed to be in good condition however.

The printer (monochrome) was very basic, without the bells and whistles you get with more modern machines. Any size of paper could be used up to 15.5in. wide, but the font could be altered only by changing the daisy wheel. A bit restricted by today's standards, but quite adequate for my purposes. I prepared the machine for printing, fed in a sheet of paper and keyed in 'print'.

The print-head was parked at the extreme left. I expected it to move on to the paper, leaving a margin before printing. Instead it started tapping away on the bare platen (the black roller against which the sheet of paper rests, as with a typewriter), traversed to the centre of the paper then returned, printing the while. It moved all the way to the extreme left, trying to print well outside its normal limits. This, I suppose, is why it had arrived at the saleroom.

Fault Finding

I opened up the monitor to check the joints at the output socket. Sure enough three of the seven had tell-tale rings around them. I resoldered the lot. Then, full of hope, I again tried the printer. I was disappointed to find that things were no better. Evidently contact at the faulty joints had not been lost. Perhaps there was a motor fault? But its action had been positive, with no sign of sluggishness when printing. So I decided to take a look at the electronics.

Once five screws had been removed the whole top cover could be lifted off exposing, amongst other things, the PCB. On close examination everything appeared to be in order, apart from some dubious-looking joints. I checked voltages as far as I could without service data, and found nothing untoward.

After resoldering a number of doubtful joints I tried again. This time the print-head almost reached the paper before starting to print, and on returning it didn't go to the extreme left. As I seemed to be on the right track I did a few more joints, after which the print-head moved on to the edge of the paper before printing commenced.

I resoldered the remaining joints – the PCB is quite small. When paper was fed in, the print-head traversed right to the centre of the sheet. When 'print' was keyed in, the head swooped back and commenced printing, leaving a one-inch margin. Feeling quite good, I put some work through and was satisfied with the results – better than drudgery with a pen!

Next day I sat down confidently to print a couple of letters. But when I fed in the paper the print-head did not traverse to the centre of the sheet: it stayed firmly at the extreme left. My confidence evaporated and, yes, when I keyed in 'print' the head tapped away at the bare platen, printed to the middle of the sheet then back again to the extreme left. I was back at square one. The 'improvements' I had noted after resoldering the joints had been purely coincidental.

There are several high-value electrolytic capacitors on the PCB. Though they looked good, I replaced them all to be on the safe side. There was no improvement, and I began to wonder about the motor again – not because I was led to it by any logical train of thought but simply because I was running out of ideas.

The Motor

It dawned on me that the motor's performance had improved when it had been in use for a few minutes. I wondered whether this was because it had warmed up a little. So I removed the two small fixing screws and lifted the motor as far as the slack in the connecting wires allowed.

The internal magnets made it quite difficult to turn the little armature, and I was unable to judge the amount of friction in the bearings. They were not sealed however, and it took only a few minutes to inject a drop of fine oil into each and then refix the motor in position.

I tried again. As usual, the print-head was lurking at the extreme left. But when paper was fed in it moved smartly to the middle of the sheet and, on receiving the command to print, did so without hesitation and with the required margin. This looked like success at last. It was: the printer has been working well for some months now.

In an attempt to find out why the motor had led me up the garden path by moving hesitantly at the initial positioning of the print-head and robustly when printing, I made some voltage checks at the motor windings. In the initial, positioning mode the reading was under 1.5V, while in the printing mode it was higher at about 2V. A simple answer to the problem!

The Cassette

There are 103 metres of printing ribbon in the cassette, which gives the impression that it will last a very long time. It's fed through quite rapidly however, and before long the message "ribbon out" appears on the screen.

It is not difficult to prise the cassette open carefully with a knife and attempt to rewind the ribbon. I tried it with one cassette, but found that I couldn't wind the ribbon neatly enough to prevent it jamming and breaking in use.

When the next one ran out, I studied it closely and came to the conclusion that it should be possible to change over the two reels so that the full one is again on the right and the empty one on the left ('reel' is something of a misnomer – the ribbon is wound on two bosses, the confines of the cassette keeping it on the straight and narrow).

I made a sketch of the ribbon path, the positions of the two boss retaining springs, the small ribbon tension spring and the two little cogs that drive the ribbon. The two bosses were then carefully transposed and their springs refitted. The bosses are not identical however: one is toothed while the other isn't. As the toothed one was now to be on the take-up side, facing the ribbon drive cogs, I covered the teeth with a few turns of PVC insulating tape, cut to width, to ensure a smooth drive. The ribbon was attached to the end of this tape. The ribbon was then set on its exact path, using tweezers, the little ribbon tension spring and the drive cog wheels were put in place, and the cassette was rebuilt. A fiddly job, but then readers of *Television* are not unaccustomed to fiddly jobs!

After this the ribbon worked well, with no reduction in print quality.

In Conclusion

It was a stroke of luck to obtain such a machine for just over £24. I wonder how many of them have been disposed of simply for want of a couple of drops of oil?

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During a recent visit to Pioneer, Japan **George Cole** was able to see recent developments in optical disc and flat-screen display technology



A Visit to Pioneer

I was recently given the opportunity to visit Pioneer's headquarters in Tokyo to see some of the technological developments on which the company is now focusing. They include optical discs and flat-screen displays.

DVD-Audio

The DVD format was designed to be more than just a means of providing prerecorded videos. There is in fact a family of discs intended for audio, video and computer applications. The DVD-Video standard was established in December 1995. Soon afterwards a new working group, WG4, was set up to decide on a standard for DVD-Audio discs. These would provide much better quality sound than today's CD audio format, with some extras. The WG4 group included electronics companies such as Hitachi, JVC, Matsushita, Pioneer, Samsung and Sharp, also organisations from other sectors including Dolby Laboratories, IBM and Intel. Philips and Sony were also members of WG4, but these two companies have developed an alternative "super audio" format - more on this later.

What does DVD-A offer that the audio CD doesn't? The main advantage is that DVD can adapt to improvements in audio technology. When the CD standard was established by Philips and Sony in the late Seventies, it had to make use of the best technology then available, including the audio filters and the digital-to-audio converters (DACs) of the time. The result was a specification whose main points include linear pulse-code modulation (LPCM), a 44.1kHz sampling rate of 16-bit resolution.

CD sound quality is good, but it could be improved. The snag is that the CD standard leaves little room for any improvement to be introduced. Developments such as Sony's 20-bit Super Bit Mapping system and Technic's MASH noise-shaping technology can help, but for a major improvement a new audio format is required. Enter DVD-Audio.

Specifications

DVD-Audio also uses LPCM, but it goes much farther than CD. Each DVD-Audio disc can store up to 4.7Gbytes of data, which is seven times more than a CD. This extra capacity has been used to improve the quality of the sound rather than to extend the playing time. Thus a DVD-Audio disc, like a music CD, stores about 74 minutes of audio. But the bit rate is 9.6Mbits/sec in comparison with about 1.5Mbits/sec for the CD.

The DVD-Audio standard specifies several alternative sampling rates and digital quantisation values, which are arranged in two groups. The first group has sampling rates of 44.1kHz (same as CD), 48kHz (same as DAT), 88.2kHz and 96kHz, which can be combined with either 16-, 20- or 24-bit resolution. Up to six channels can be provided. This group is referred to as Scalable Linear PCM Multichannel Audio. There are also two higher sampling rates, 176kHz and 192kHz, which can again be coupled with either 16-, 20- or 24-bit resolution, but in this case the number of channels is limited to two. This group is referred to as Super High Quality Linear PCM Audio.

In addition to six-channel sound, DVD-Audio discs

Our heading photograph shows Pioneer's prototype 5.2in. Organic EL display.

can carry multimedia material such as text, pictures (one still picture per 'track'), web-site addresses and video. The latter is based on the DVD-Video format. Audio discs that contain multimedia material are known as DVD-Audio (V) – V for video. Incidentally, DVD-Audio discs do not use the DVD-Video Regional Coding system that prevents discs from one part of the world being played by a machine designed for use in a different world region.

Practical Assessment

What does DVD-Audio sound like? Keiichi Onodera, senior assistant manager of Pioneer's Home Theatre and AV section, demonstrated the DVD-Audio system using a prototype player. He played a series of pop, classical and jazz titles using various sampling rates and two- and six-channel arrangements. Many titles were compared with a CD audio recording.

It's always hard to make direct comparisons in such a situation. DVD-Audio certainly sounded fuller and richer than reproduction of a CD. On some material the multichannel sound added a lot to the experience.

Launch and Prospects

DVD-Audio is due to be launched in Japan this summer (1999). It will probably reach Europe during the first quarter of the following year. Pioneer is upbeat about the prospects, noting that most music companies, including EMI, BMG and Polygram, support the format.

But DVD-Audio faces a number of challenges. The first is that most people are probably happy enough with CD sound quality and will see little reason to trade up to DVD-Audio. Hi-fi buffs will probably be the ones to take to DVD-Audio, at least in the early stages. There is also the question of disc prices – it's hard to see DVD-Audio discs costing the same as their CD counterparts – and compatibility.

DVD-Audio machines will also play audio CD discs, but the new discs will not play on CD machines. Current DVD-Video machines can't play DVD-Audio music tracks, though they will be able to play any video content. According to Pioneer the situation will change when Universal players come on the market some time in 2000: they will be able to play DVD-Audio, DVD-Audio (V) and DVD-Video discs. Pioneer forecasts that Universal player sales will reach a million in 2000 and 2.1m the following year.

But Sony and Philips have confused the issue with their development of a rival format, Super Audio CD (SACD). It will provide similar features and performance to DVD-Audio, but uses a different, incompatible data encoding system. SACD is set for launch late this year but, so far, only one music company (Sony Music) has agreed to support the format. If the two systems are launched together, the prospect of either format succeeding is poor. One has to hope that the two parties will settle their differences before the launch.

DVD-Rewritable (DVD-RW)

Pioneer has high hopes of a new format it has developed, DVD-Rewritable (DVD-RW). As the name suggests, a DVD-RW disc can be used and reused like a video tape or floppy disc – up to a thousand times according to Pioneer, though some recording media companies feel the figure could be ten times greater than this.

Pioneer has already launched a DVD-Recordable (DVD-R) player and discs. Data recorded on these discs cannot be altered or erased: the format is intended for archiving computer data. Dr Masao Sugimoto, head of Pioneer's R&D programme, says that in contrast DVD-RW is aimed at the audio-video market. It's a bit con-

Table 1: Specification for prototype colour Organic EL display.

Size	5.2in.
Pixels	320 x RGB x 240
Pixel pitch	0.33mm
Drive method	Simple matrix
Drive duty ratio	1:120
Colour range	260,000 (64 tones for each colour)
Luminance	150cd/m ²
Contrast range	Better than 100:1
Power consumption	1.8W average brightness (30% emission); 6W with 100% emission
Operating life	2,000 hours

fusing that there is already a rewritable DVD format on the market, DVD-RAM, and that Sony, Philips and others have developed a rival format known as DVD+RW or PC+RW.

These rewritable discs all use phase-change technology, which means that for recording the surface is changed from an amorphous (non-reflective) to a crystalline (reflective) state or vice versa – the two states represent digital one or zero. The differences between the discs lie in the file format/coding systems used.

Mr Masami Morishita, manager of Pioneer's new product planning department, says that DVD-RW is aimed at the replacement VCR, home theatre and camcorder markets. Industry estimates suggest that in the year 2002 53 million VCRs, 13m camcorders and 12m DVD players will be sold worldwide.

One interesting and novel feature that a DVD-RW recorder could provide would alter the concept of time-shifting. Say you are recording a TV programme and leave the room for the first fifteen minutes. With a suitably-equipped DVD-RW recorder you could return to the room, sit down and watch the start of the programme while the machine continued to record the rest of it. This is made possible by feeding the recorded video to a memory store and reading it out from there.

Each DVD-RW disc can store up to 4.7Gbytes of data, which is equivalent to two and a quarter hours of high-resolution (400-line) images. This resolution is about the same as S-VHS, but not as good as prerecorded DVD-Video titles (about 500 lines). A long-play option can provide up to six hours of VHS-quality (250 lines) recording.

Pioneer says that DVD-RW has the support of the DVD Forum, which sets the DVD standards, because the format is compatible with DVD-Video and DVD-ROM (some of the latter drives can also play DVD-Video discs). But DVD-RW has yet to be approved by the Copyright Protection Work Group (CPWG), which

Pioneer's DVD-R player.



A prototype DVD-RW player.



includes representatives from the film industry. If approval is gained in time, Pioneer says that the first DVD-RW players could be launched some time this summer and become available in Europe next year.

Flat-screen Displays

Pioneer has, like many Japanese electronics companies, developed flat-screen displays. The company is focusing on two technologies, gas-plasma and organic electroluminescence (Organic EL).

Gas-Plasma

CRT technology has served the TV and PC markets well, providing displays that are relatively cheap to produce and have a number of positive features, including excellent picture quality (assuming a good signal source and correct setting up) and a wide viewing angle. But CRT-based systems are power-hungry and bulky, especially with large-screen TV sets and monitors. For years we have been promised flat-screen displays instead: now they are here, though hardly at mass-market prices.

While CRTs use electron-beam scanning to produce

the raster, with a plasma display the screen is divided into cells which are activated to produce the illumination. Each cell represents a pixel. The cells are filled with neon gas: to activate the cell, an electric discharge is released into the gas, producing ultra-violet rays that strike either R, G or B coloured phosphor to produce a coloured-light output. It sounds simple but, as Fig. 1 shows, the cell structure is pretty complex. It includes a magnesium-oxide protective layer.

Pioneer's 50in. plasma display panel (PDP), type PDP501MX, was released last year (see Teletopics, November, page 7). It provides XGA-graphics quality (1,280 x 768 pixels) with a viewing angle of 160°. The display is just 9.8cm deep and, in the UK, sells for about £14,000. This price includes a DVD player and speakers.

Organic Electroluminescence

Pioneer has been working on Organic EL flat-screen display technology since 1988. The basic technology is patented by Kodak and works by passing an electric charge through organic materials (Pioneer won't reveal the composition) that glow. Fig. 2 shows the basic cell structure and electrode arrangement.

The Organic EL display offers a number of advantages compared with other technologies such as LCD, including high picture quality, a high brightness level, lower power consumption (no backlight is necessary) and a faster response to input data (more than 1,000 times faster than an LCD). It also has a wide viewing angle. Since the structure of an Organic EL display is simpler, production yields are higher and, as a result, manufacturing costs are lower. But there is at present one big disadvantage with an Organic EL display, its short operating life which is currently about 2,000 hours. Pioneer hopes to extend this to 10,000 hours: this is still much lower than LCD technology, which typically provides a working life of some 30-50,000 hours.

Pioneer launched its first consumer product to use an Organic EL display in October 1997: the mono-colour display was part of an in-car audio-visual system. Pioneer has since developed a prototype colour Organic EL panel (see photo on page 246) with a 5.2in. screen area. Table 1 provides a basic specification.

I was able to look at the display and compare it with an LCD. The Organic EL was certainly brighter, and could be viewed from a much wider angle, but a number of fine lines run across the display, suggesting that Pioneer has yet to refine the technology. The company plans to launch consumer products that use colour Organic EL displays in about the year 2000.

Acknowledgements

Many thanks to Dr Masao Sugimoto and his R&D team, Pioneer Japan and Pioneer UK for their help in the preparation of this article.

Fig. 1: Basic plasma display panel structure.

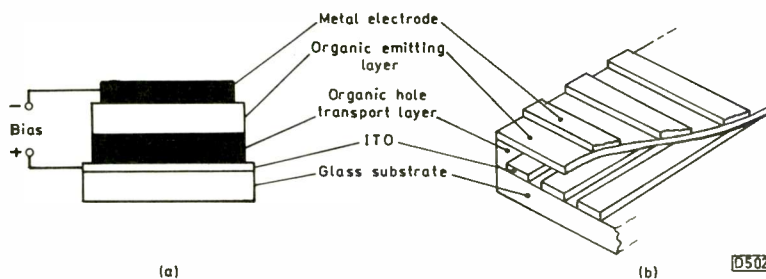
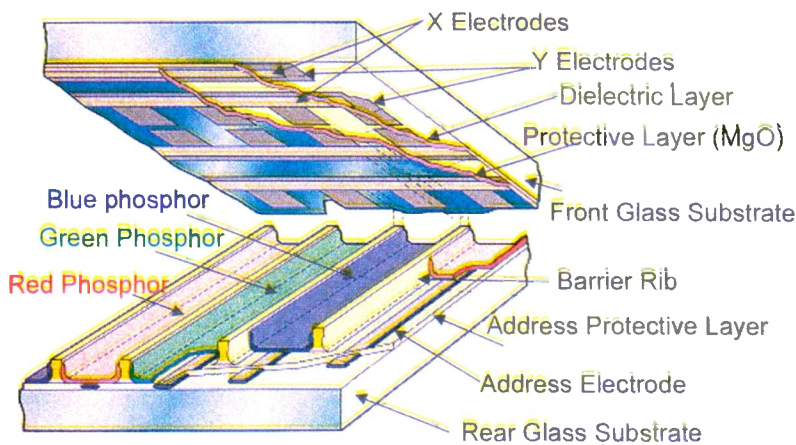


Fig. 2: Basic cell structure (a) and electrode arrangement (b) used by the Organic EL colour display panel.

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TDA8170	1.25
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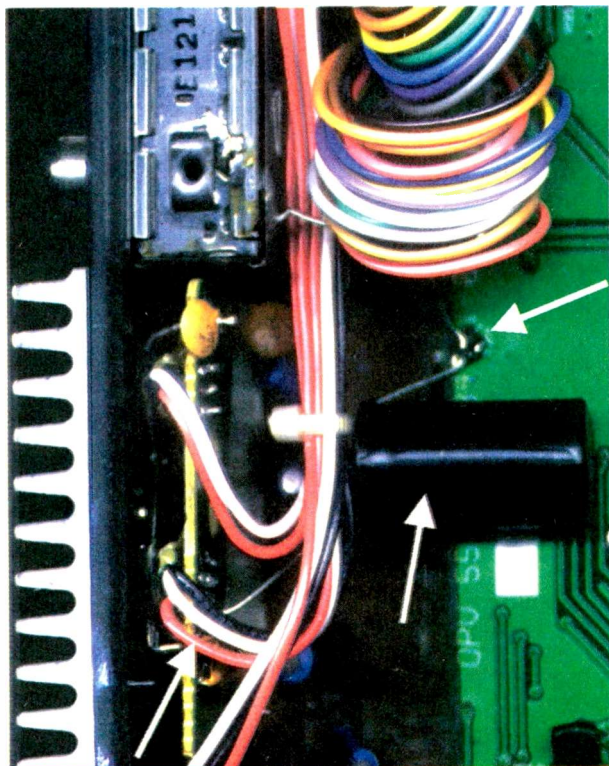
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Satellite WORKSHOP



Jack Armstrong

BT SVS250/Matsui OP10

Don't you just love it when the phone rings while you are in the middle of a really brain-taxing repair? It was a local number, so I answered the call.

"I've done everything in the book but now it's dead, so can I bring it along for you to look at?" a male voice said.

"What, a dead book?"

"No, I mean it's a satellite."

"What sort of 'satellite'?"

"Oh pee ten" the voice said proudly.

"I beg your pardon!"

"I read it on the front panel: it's a Matsui oh pee ten."

"Good, you can read then" I murmured then, louder, "you'd better bring it in."

"Can I watch?"

"Watch what?"

"Can I watch while you do it?"

"While I do it? Oh, while I repair it! Yes, certainly. I charge an extra ten pounds an hour for an audience. It's the insurers, you know. They worry."

"Ah. Never mind. I'll drop it off."

Meanwhile I was struggling with a late version of this model, the one that has a regulator heatsink on the rear panel. The earlier version has a large, black heatsink inside, with a horizontal projection that cooks the decoder board. Putting the heatsink outside the box seemed like a good idea to me.

There was a hum bar across the screen, and I could hear a 100Hz hum on the sound. So it wasn't an individual rectifier fault – that would have resulted in a 50Hz hum. The cause had to be an electrolytic capacitor, a regulator chip or simply excessive load, i.e. a short-circuit somewhere.

Since the receiver appeared to be almost new I decided that the capacitors should be all right. The fault was intermittent and, as the new heatsink is so small, I suspected the regulators. My oscilloscope showed that there was ripple on the output from the centre, 6V regulator. So I replaced it, applying lots of heatsink compound to all three. But the fault was still present. Drat!

There was a fairly large ripple on the input to the regulator, which had perhaps 0.5V of 'headroom'. Most regulators like to have at least a volt of headroom, so it seemed that the cause of the fault could be a capacitor after all. To save a lot of time, I soldered a new 2,200µF capacitor directly between the regulator's red input wire and a point at chassis potential on the decoder board (see photograph). As this cured the fault, I secured the capacitor with glue and left it in place. It wouldn't do any harm to leave the intermittently faulty electrolytic in place.

At that moment my telephone customer arrived with his Matsui "oh pee ten" satellite. He left it on the counter and beat a hasty retreat.

I saw that the cover screws were a bit mangled, and there were what looked like teeth marks around the plastic cover! The receiver didn't light up, and no secondary voltages reached the regulators on the heatsink. It took me ten minutes, probing with a multimeter, to trace

the cause of the fault to a board crack. One track was cracked right through. It was beneath link W94, to the left of the rear, right hexagonal brass support pillar for the decoder. Clearly the owner had leaned on his screwdriver with considerable force.

Once I had repaired the track the receiver lit up but, as you quite often find with this model, there were no decoder messages. It's a waste of time trying to trace the cause to one particular component since the problem is usually caused by failure of a dozen capacitors. So I opened a Relkit 17 (from SatCure, 01270 753 311) and changed all the capacitors supplied, including several on the main board.

The 503kHz ceramic resonator was covered with glue. I desoldered it and scraped away all traces of the black stuff. Finally, to improve reliability, I removed the horizontal heatsink plate that fries the decoder board and refitted the 6V regulator to the main heatsink, using thermal grease and the nut and bolt supplied in the kit.

Pace MSS1000IP

Herr Mueller phoned me and explained the problem with his Pace MSS1000IP receiver.

"Ven I turn it on, I get ze rrollink pictures, ja. Unt ze screen is ferry dunkel – dark as you say – mit no decoder nachrichten. Unt sometimes I see ze 'motor error' message."

Now my father spent five years in a German prisoner of war camp. No, he doesn't hate them: he learnt the language and, as I grew up, he would speak to me in German. In addition, we Yorkshiremen naturally speak with flat vowel sounds and rather weak 'r's. Consequently, I mean consequently, what Herr Mueller said made perfect sense to me. I told him to bring his receiver to my workshop.

I rather expected to see a short, rotund man in lederhosen, so I was somewhat surprised to meet a tall, gaunt man in a business suit. He left the receiver and headed for the nearest bank – I'd told him the repair would be expensive.

I was right. Everything inside looked black – it had been well cooked! My TV screen remained blank, though I could hear sound and a weak, flickering picture was available via the decoder scart socket. Fitting all the capacitors in Relkit 10 made very little impression, though the nasty interference that my scope had revealed on every supply voltage on the secondary side of the chopper circuit had been greatly diminished.

Q58 is often the cause of low video level, so I replaced it. I then had a weak, rolling picture from the TV scart socket but nothing from the VCR scart socket. When the buffer transistor Q35 had been replaced there was a weak, rolling picture from the VCR scart socket, but all was still not well. I inspected the board carefully. There was a very dark spot above the position of what I identified from the service manual as being Q41. Once this transistor had been replaced there were good, bright pictures and decoder messages.

As the front panel fluorescent display looked dim I replaced C2, using the Pace-recommended 1µF, 50V multilayer ceramic capacitor. When the Dolby Pro-Logic board had been refitted everything worked normally. The “motor error” problem had gone, probably thanks to C216 (1,000µF, 63V) in the Relkit. This capacitor is a common cause of problems. In later production receivers an ultra-

low ESR type is used in this position: it seems to last a lot longer.

When Herr Mueller returned I smiled at his nice fat wallet.

“Es war etwa gekocht” I said, “das heisst ganz durch!” (it was rather cooked – in fact it was well done).

He smiled and said the magic word “wieviel?” (how much!).

A Pace Prima

I can't imagine why a Mexican family should settle in England, let alone the frostbitten wastes of North Yorkshire. But Pablo Rodriguez did just that. He whittled a living out of wooden artifacts and pottery, and seemed generally contented. Much of his life appears to be spent sleeping in front of his cottage, while his eight children play joyfully by the river. But Pablo is a Simpsons addict, and was distraught when his Pace Prima failed.

“Helloa Senor Arm Sterong.”

“Ah, Pedro, que tal todo?”

“No es bueno” he replied sadly, “Dos cervezas, por favor.”

He sank into my chair sadly as I poured him the requested beer and put a spare can beside him.

This seemed to cheer him up. He handed me a Pace Prima: “no va!” he explained.

I promised to have a look at it and he taught me some interesting new Mexican words as he drank his beer and cursed technology in general.

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems via e-mail. He can be reached via the internet at:

jack@netcentral.co.uk

One receiver 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.

When Pablo had left I tested his Prima. “LNB short!” it announced on the TV screen as soon as I connected my dish cable. To inhibit low LNB voltage detection, I lifted the cathode of zener diode D15 and linked it to the cathode of D5. This enabled me to make some measurements. The LNB supply voltage passed through pnp transistor Q1 (FXT749) and arrived at the collector of the npn transistor Q2, a TIP31A which is mounted on a heatsink. There was no output voltage from this device. The track to Q2's centre leg was fractured just where it joined the solder pad. After a quick repair with thin, Teflon-covered wire all was well. It must have been damaged by a knock or vibration.

“Bueno!”

Test Case 434

The VCR was a Sanyo VHR3300, ten years old if it was a day. It had come fresh from the shop's “used bargains” department, with a price tag which said £34.95. The problem was that it had developed a fault! Do they really manage to sell life-expired hulks like this at such a price when you can buy a new VCR for less than £100? Plainly they do. When the workshop technician involved quizzed our shop manager he said that they sell a lot of machines like this for prices like that. Wow!

The technician involved was TechnoCrat, and the job card said “tuner locked out, CLEAR button does not reset”. What TechnoCrat actually found was that an orange channel-indicator digit was flashing on and off, initially 1 but subsequently any other number that might be selected. It was not possible to select a two-digit number. All you could get, no matter what you did at the remote or front-panel keyboards, was a single flashing number on the fluorescent display panel. The display was rather dim, and the machine didn't get any TV channels. Oh dear!

By playing a known good tape, TechnoCrat ascertained that the heads, deck mechanics and control system were in good order. He decided that the most cost-effective way of dealing with the problem was to replace the front control PCB – rather than attempt to locate the cause of what looked like a very nasty fault in the tuning-control system. There were half a dozen Sanyo 3300s in the scrap pile, mostly with worn-out capstan

motors or ‘sticky’ lower drums. TechnoCrat fired up a suitable donor machine and saw that its channel-selector system and front-display panel were in good order. So he removed its front PCB (TM4, display and timer) and fitted it in the shop-stock machine. To his surprise, the results were exactly the same as before, even down to the dim display . . .

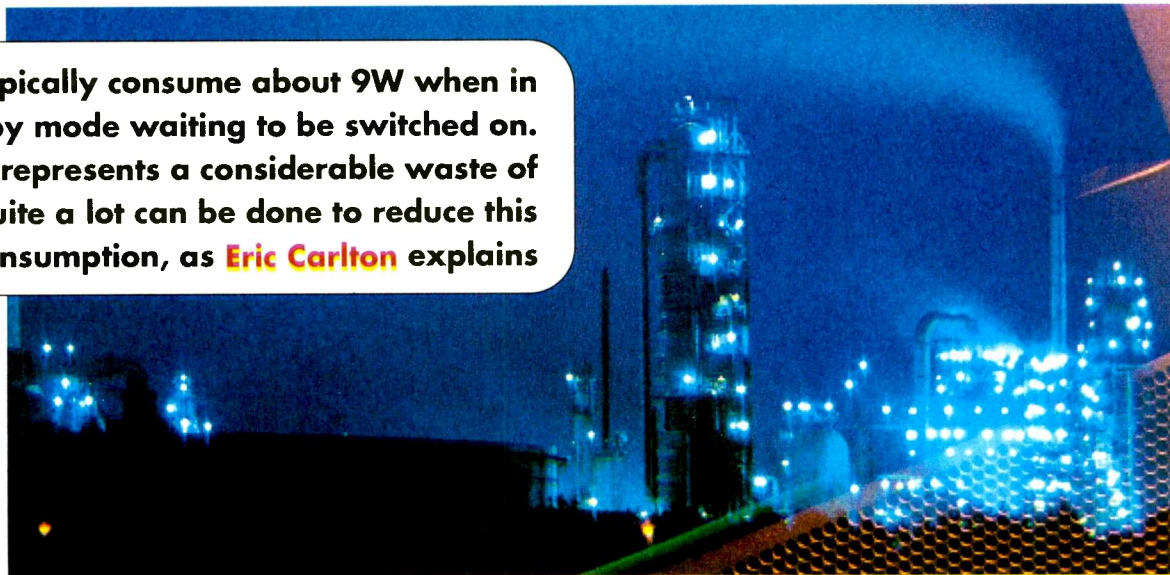
So the cause of the fault wasn't on board TM4. TC saw that it communicates with the main processor. The same scrap machine had a good SY1 system control board, and it was the work of a few minutes to fit this in the troublesome stock machine. What a surprise it was to find that the same symptom was still present – despite two known-good replacement panels having been fitted. TC could have continued to try out bits of the scrap machine in the stock one. Instead, he decided to check the fault condition more thoroughly.

He discovered that once he had started the station-tuning process he could tune each programme slot progressively, the machine behaving normally: it would automatically step to the next key setting each time a station was memorised. The problem arose at the end of the complete tuning process: the machine then reverted to its original trick of flashing an orange digit in a dim display with no off-air reception.

The solution to the problem finally dawned on TechnoCrat. What was it? Not a difficult one really, when all the symptoms are taken together. For the solution, see page 293.

TV sets typically consume about 9W when in the standby mode waiting to be switched on.

This represents a considerable waste of energy. Quite a lot can be done to reduce this consumption, as **Eric Carlton** explains



Low-power Standby Operation

Standby operation has long been a requirement for nearly all TV receivers, regardless of screen size, while the growing need to reduce greenhouse gas emission from electricity power stations is fast becoming a crucially important issue worldwide. As a result, there have been some important low-power standby operation developments.

In the UK alone some 25 million TV receivers may work in the standby mode for about sixteen hours a day, every day of the year, with a typical power consumption of 9W. This represents a total power requirement of 53kW hours per set, costing the consumer about £3.45 a year, while the electricity industry has to generate some 1.33GW. The need to reduce this figure is obvious. In the following article we will look at techniques used to provide low-power standby operation and describe some developments that have helped setmakers to achieve this goal.

History

Standby operation was originally a feature of larger-screen TV sets only. Basically it involved switching off all power to the set except that required for the remote-control receiver and its associated circuitry. This was frequently achieved by using a separate power supply, see Fig. 1. It consisted of a low-VA mains transformer (T1) and rectifier circuit to provide a separate, isolated low-voltage supply which was used by the standby switching system. Standby switching was carried out by a double-pole mains relay switch that was connected in series with the feed to the TV set's main power supply.

This system worked all right but was relatively expensive to implement and was not particularly economical in terms of power consumption, which was typically 12W. The reason for this was the need to guarantee successful operation over the European mains supply range of 180-265V and the fact that the mains transformer was only fifty per cent efficient.

The high cost of this arrangement encouraged several manufacturers to seek a more cost-effective approach. One technique, illustrated in Fig. 2, was to replace the

relay and mains transformer with a special 'solenoid-latching' double-pole mains switch. The customer uses this switch as a mains-disconnection device, in the normal manner: it also provides remote-control turn off when current is passed through the solenoid winding, which was part of the switch assembly. The standby mode is in effect replaced by remote-off operation, activated by a command from the remote control system. With the arrangement shown in Fig. 2 the RC decoder has an open-collector output, with low being the on condition.

The disadvantage of this system was that the user had to get up to switch the set on again. The advantage was zero power consumption in the off mode. It proved to have limited appeal in the market place.

Switch-mode Techniques

With rapid developments taking place in the design of switch-mode (chopper) power supplies for TV receiver chassis, it was only a matter of time before the main power supply in a TV set was adapted to provide a standby mode of operation. Setmakers went about this in several different ways, but the various schemes have common features, including only a limited reduction of power consumption in the standby mode, 8-15W being typical.

The reason for this is chiefly as follows. Though chopper power supplies are generally very efficient when operating normally, i.e. when providing 40-110W of output power, they tend to be much less efficient when running with a light load, i.e. in standby. The losses associated with a power MOSFET switch, the snubber network, clipper/damping networks and the control circuit are often much in excess of the power required to keep the remote-control system in operation. The latter consists of the remote-control receiver, an on-indicator LED and a dedicated remote-control chip or, more recently, a microcontroller chip.

In most chassis that use the main chopper power supply to provide standby power, all non-essential circuits are turned off in the standby mode. Since much of the

circuitry in such chassis is powered by supplies derived from the line output transformer, by either scan waveform or flyback pulse rectification, it is almost universal with this approach to inhibit the line drive when in standby. Fig. 3 illustrates this. Thus all power consumption resulting from EHT generation, line and field scanning, and the provision of supplies for the CRT's heaters and the RGB output stages is eliminated. This leaves only the small-signal circuits, including the tuner, IF section, colour and teletext decoders and part of the audio circuitry, with power.

Additional power reduction can be achieved by placing switches in series with secondary LT circuits, such as a 12V or similar supply. An example of this is the adjustable regulator arrangement shown in Fig. 4. The output from the LM317 adjustable regulator IC1 is normally controlled by the ratio of the values of the two resistors R1 and R2. In the standby mode Tr1 is switched on, shorting out R2. The output from IC1 then falls from 12V to 1.5V. Tr1 is switched by the remote-control receiver or microcontroller chip. Note that this system can also be used to disconnect the degaussing circuit.

14-21 in. 90° sets that use this approach consume about 9W in the standby mode.

Green SMPS Controllers

Further reduction in standby power consumption has become possible with the advent of so-called 'green' chopper power-supply controller chips. They have appeared in chassis from several manufacturers over the last year or two. A number of these controller chips have become available, the best-known devices being the Motorola MC44604 and the more recent Philips TEA1504. Though such controllers differ in their detailed operation, they generally share a common design principle. To illustrate this, a more detailed description of the MC44604 is given below.

To understand better how the controller works, it is worth considering the power needs of a modern I2C-bus controlled TV receiver in the standby condition. A dedicated 5V line is used to supply the remote-control receiver, standby LED and microcontroller chip. These devices consume 10, 10 and 30mA respectively, a total of 50mA (note that the microcontroller chip consumes about 90mA in normal operation). Since the dedicated 5V supply is obtained from a linear voltage regulator, and there is a forward-voltage drop of 0.7V because of the chopper power supply's flyback-rectification process, the total standby power requirement is 0.5W.

As suggested earlier, a chopper power supply designed to run at between 40-110W cannot operate stably at such a low output power level. Transition delays within the control circuit, in conjunction with the turn-off time of the power MOSFET and driver stage, mean that more energy than needed is supplied during a single switching cycle. The result is incomplete energy transfer and an uncontrolled burst-mode type of operation. In this condition the losses associated with the control circuit and chopper switching device become predominant, accounting for some 4-5W.

What's required is a 'controlled-burst' mode of operation, with the chopper supply providing power during a limited number of switching cycles in a regular, periodic manner. This enables stable and silent operation to be maintained, with overall switching losses reduced by at least three times compared to those incurred during normal, light-load operation. Such a scheme has been implemented by Motorola in its MC44604 green controller chip.

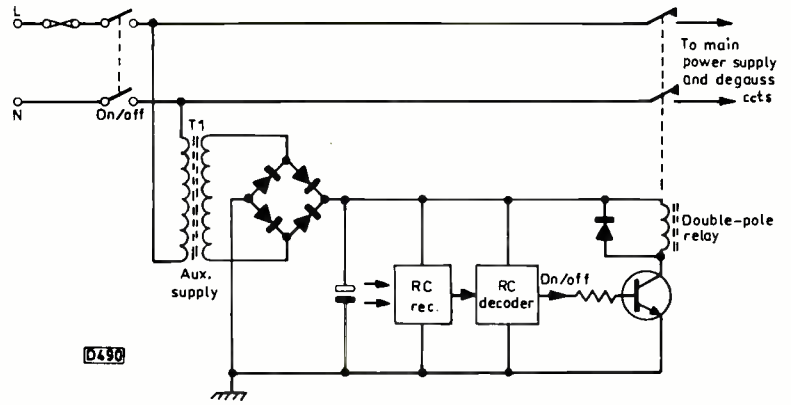


Fig. 1: Standby operation using a relay-controlled switch.

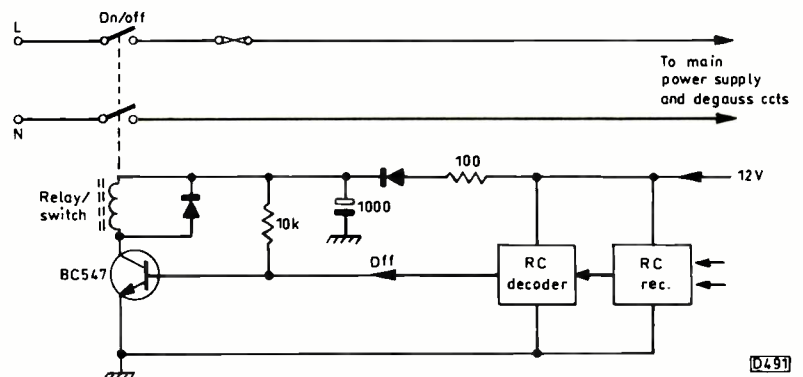


Fig. 2: Remote-off feature using a latching mains switch.

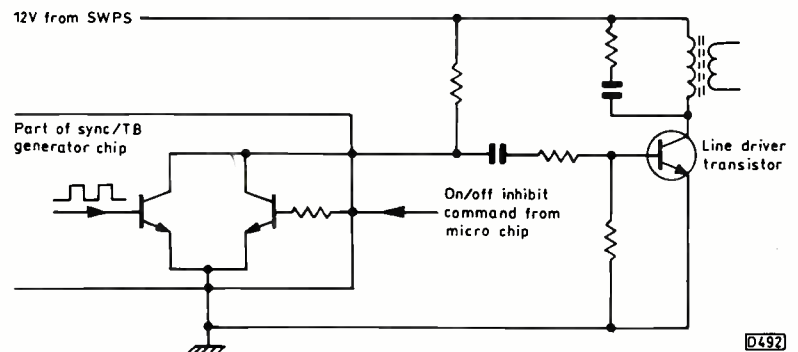


Fig. 3: Standby implemented by inhibiting the line drive.

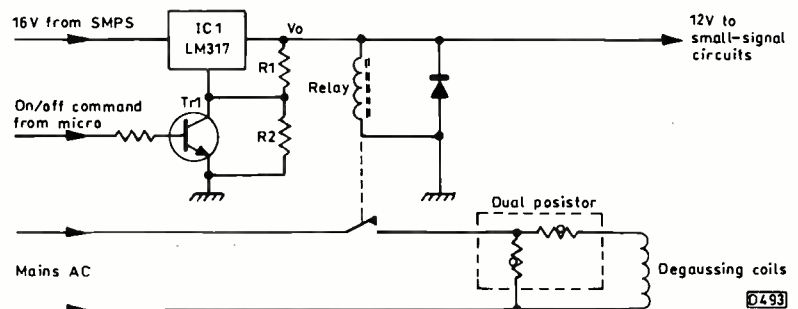


Fig. 4: Use of an adjustable regulator IC1 to switch off auxiliary supplies, such as those used by the small-signal circuits, obtained from the chopper power supply. This also illustrates switched control of the degaussing circuit. When Tr1 is on, Vo is reduced to 1.5V.

the chopper transformer (via D1) is reduced in this way, the chip cannot operate in the normal continuous mode: it switches to the burst mode, as during the normal soft-start sequence. In this state the power consumption is very low, the conditions being similar to start-up operation.

The MC44604 chip's start-up voltage, which is derived from the rectified mains supply via the 220kΩ resistor R1, increases until it reaches 14.5V (a typical data sheet start-up voltage). At this point the chopper control circuit comes into operation. Power consumption increases, as energy is stored in the chopper transformer. But the supply for the chip provided by D1/C1 is insufficient for normal operation. The chip's supply voltage starts to decrease, with a slope that depends on the energy stored by C1 and the standby-circuit load.

The burst of operation ends when the chip's supply voltage falls below V_{disable}, which is typically 12.5V. Power consumption becomes almost zero, at which point the supply to the chip (provided by R1/C1) starts to rise again.

As a result of this, the voltage fed to the 5V regulator that supplies the microcontroller chip etc. is not constant in the standby mode: it contains a ripple component whose value is chosen so that the voltage generated across C3 (Fig. 6) between bursts doesn't fall below the 5V regulator's minimum input for regulation – about 7.5V.

Regulation

The ripple voltage across C3 varies between a peak value at the end of a circuit operation burst and a trough value, determined by the standby load, during the chopper's non-active phase. Regulation during standby operation consists of switching off when the voltage across C3 reaches the chosen peak value. For this purpose feedback is applied to pin 15 of the MC44604 chip, see Fig. 7. The current at this pin must be sufficient (1) for use as a feedback signal to the error amplifier in the normal mode, (2) to enable the chip to detect a transition from the normal to the standby mode and vice versa, and (3) to ensure the correct mode of operation at each mains power-up and enable the circuit to work in the standby mode and perform regulation in this state.

The MC44604 chip is designed so that in the standby mode the peak chopper MOSFET drain current is limited by the voltage at pin 9. This is used as a power limit for the burst period – the normal soft-start circuit is turned off in standby, as it would limit the amount of energy that could be stored during the active burst period.

In normal operation, regulation is carried out by feedback to pin 15 via an optocoupler (Fig. 7). A TL431 adjustable shunt regulator senses the HT voltage at its reference pin, controlling the current that flows via the optocoupler's internal LED. In the standby mode this regulation is inhibited. Instead, Tr1 links the LED's cathode to chassis via zener diode Z1. This device senses the nominally 8V supply to the 5V regulator and thence the microcontroller etc. When the microcontroller supply reaches maximum, the current at pin 15 exceeds an internal threshold I_{reg} and the output is turned off until the next start-up pulse from the mains supply arrives via R1. Fig. 8 shows standby regulation conditions.

Normal and Standby Detection

For a mains power up, if the current at pin 15 is higher than I_{reg} the output is shut down again. The circuit is arranged so that it must detect a current at pin 15 lower than I_{reg} before being able to latch the control circuit on – the requirement for normal operation. This detection process occurs during the first 5μsec of the circuit coming into operation, to ensure that all internal circuits are stable before the decision is made. The circuit configuration is decided in this way for every mains power-up sequence.

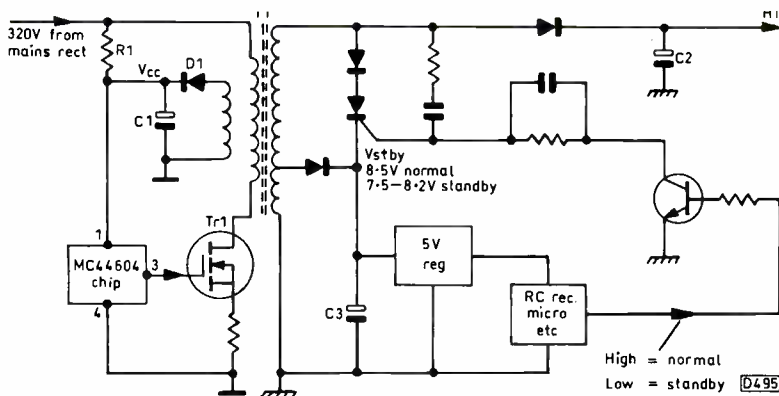


Fig. 6: Method of using the MC44604 to implement low-power standby operation.

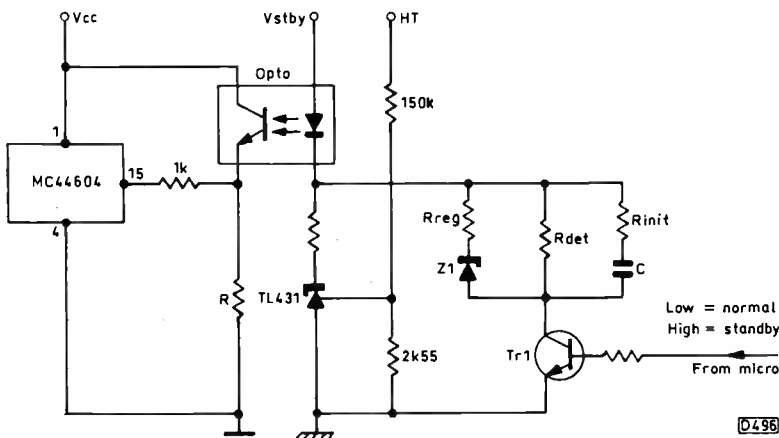


Fig. 7: Method of controlling the voltage/current at pin 15 of the MC44604 chip for normal/standby operation.

The current at pin 15 is compared with an internal reference current I_{det}. A higher current than I_{det} at pin 15 establishes the standby mode, while a lower current at pin 15 establishes the normal mode.

For the MC44604 to decide on normal or standby operation, reliance is placed on the transition conditions between these modes. For transition from normal to standby, the chip compares the current at pin 15 to an internal threshold limit. When the current at pin 15 is higher, the chip turns off and initiates a start-up in standby operation. This is brought about by the microcontroller switching on Tr1 (Fig. 7), at which point the current that flows as C charges produces a current at pin 15 greater than I_{det}.

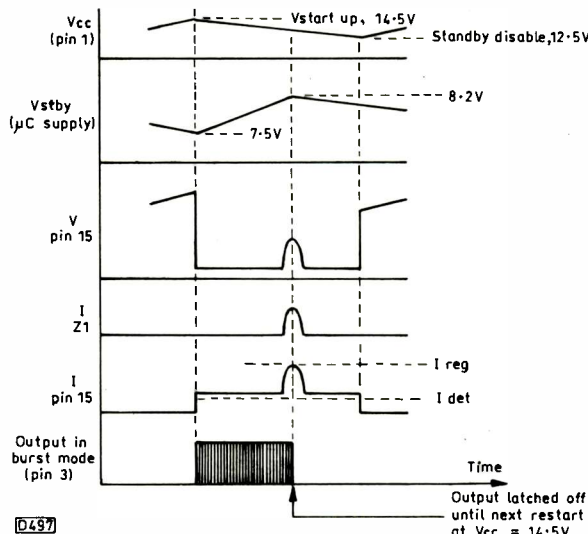
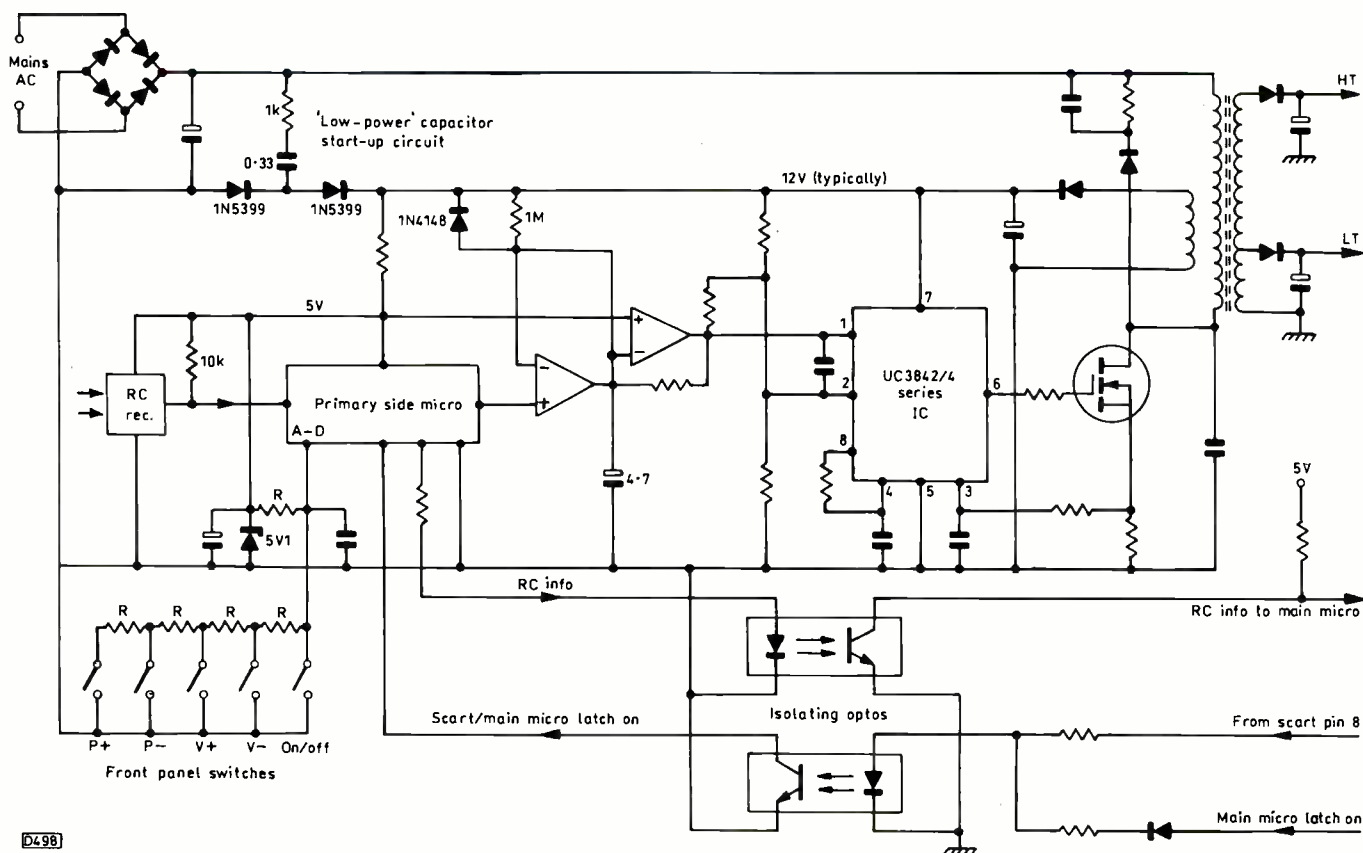


Fig. 8: Standby regulation conditions.



D498

Fig. 9: Way of implementing very low-power consumption (less than 1W) in the standby mode.

For transition from the standby mode to normal operation, the chip detects a current at pin 15 less than I_{det} then turns off so that at the next start-up the circuit comes on in the normal-operation mode. When the microcontroller is told to end standby operation, the appropriate pin turns off Tr1 and the optocoupler temporarily ceases to supply current to pin 15.

Standby Power Consumption

An overall power consumption of 4.5W is achievable using this system. Just over 2W of this is attributable to the degaussing posistor. Thus the figure can be further reduced to 2.5W by switching off the mains supply to the degaussing circuit as shown in Fig. 4, using either a relay or a triac for the purpose. Use of a relay is preferred by most manufacturers, as it provides isolation between the degaussing circuit on the primary side of the supply and the microcontroller chip on the secondary side. It also avoids the spurious triggering sometimes associated with triacs.

Future Trends

There are already schemes to reduce the standby power consumption to less than 1W. They will no doubt find their way into TV receivers in the not too distant future.

A proposal that's finding favour is to transfer the remote-control receiver and some of the microcontroller functions to the live side of the mains isolation barrier. When this is done these circuits can be powered directly from the mains supply via the start-up circuit already incorporated to power the chopper-supply controller chip. The chopper supply can thus be totally shut down in the standby mode, the only power consumed by the receiver being that taken by the start-up circuit (assuming that the degaussing circuit is switched off using a relay or triac, as mentioned above). The general idea is shown in Fig. 9.

A key function of the primary-side microcontroller is to decode the on/off command and start up the chopper power supply only after a valid on command. All other commands

from the remote-control receiver would, once the power supply is working normally and the power-on reset has taken place, be linked to the other side of the isolation barrier via an optocoupler.

Should power to the set be removed then replaced while it's in the standby mode, the primary side microcontroller would look at its internal non-volatile memory contents to decide whether the set should remain in standby or be switched on by, in this case (Fig. 9), releasing pin 1 of the chopper-controller chip.

Power up using the TV set's front controls, i.e. no remote-control handset, could be achieved by using one of five tactile switches arranged as part of a resistive ladder network connected to the primary-side microcontroller chip's A-D input pin. The other four switches could provide programme and volume up/down. The need for an expensive mains switch is eliminated.

Should it be necessary to wake the set up via a scart input connector, which is sometimes a requirement when a VCR is used in the playback mode, this is also possible but would require an extra optocoupler to pass information from the scart socket to the primary-side microcontroller. The set would then come on as a 'slave' to the VCR, but only when playback was selected.

It seems likely that this arrangement will at some stage in the future be fully integrated, with the chopper-control circuit and microcontroller functions on a single piece of silicon. This would minimise the number of external components and thus the cost of manufacture.

In Conclusion

This article has highlighted the importance now being placed by manufacturers on providing a cost-effective solution to low-power standby operation, meeting the latest recommendations to reduce the power consumption to less than 1W and, in doing so, cut the contribution made by TV sets – when they are not in normal use – to global greenhouse gas emissions.

Book Reviews

The RSGB Guide to EMC, by Robin Page-Jones, C.Eng., M.I.E.E., G3JWI. Published by the Radio Society of Great Britain, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE (tel. 01707 659 015) at £18.75 plus post and packing. Paperback, 204 pages 244 x 172mm.

This excellent book was originally published as *The Radio Amateur's Guide to EMC*. Considerable revision and additions have been made for this second edition, including coverage of the new EU EMC regulations that came into effect in 1996 and the impact of computers on radio reception.

Electromagnetic compatibility (EMC) is a bit of a mouthful: what it means is radiation/interference, which can cause problems for anyone involved with electronic equipment. The aim of the book is to help avoid EMC problems through good radio housekeeping, and to assist in the diagnosis and cure of any problems that do occur. Although it is aimed at the amateur radio operator, most of the information in the book is of general relevance and will be helpful to anyone who has to deal with interference problems.

The underlying causes of interference radia-

tion and the remedies possible are clearly described, and a considerable amount of reference data is included, particularly on suitable filters and braid-breakers – the characteristics of various filters and ferrites are listed and illustrated. Clear diagrams and photographs throughout enable the principles of effective interference suppression to be put into practice.

I can recommend this book as a source of sound practical solutions to interference problems and an invaluable reference manual. J.A.R.

Technical Information Modules TIM1, 2, 3 and 6. Written by Steve Beeching, I.Eng. Available from Grove Farm Publications, Grove Farm, Long Lane, Barnby-in-The-Willows, Newark, Notts NG24 2SG (tel. 01636 626 895, fax 01636 626 767). Prices below include post and packing.

Quite why these publications are called modules is not clear: they are well produced booklets, 6 x 8.25in., with numerous clear diagrams and durable card covers. At present there are four titles in the series:

TIM1 VCR Colour Recording and Playback,

45 pages, £10.99. Describes the techniques used to record and play back the chroma signal, covering the VHS, Betamax and 8mm systems. Of particular relevance to service engineers who need to understand the chroma sections of VCRs.

TIM2 Digital Video and Camcorder Recording Technology, 51 pages, £12.99. Brings you bang up to date with the latest video technology – there's even a section on the FireWire digital equipment interconnection system. I have to admit that I found this one hard going in places.

TIM3 Magnetic Recording Theory for Video Recording, 31 pages, £10.99. Describes the fundamentals of video signal recording on magnetic tape. Very helpful as NVQ and C&G learning material and for anyone who wants to brush up on the basics.

TIM6 Soldering and Desoldering, 47 pages, £9.99. Covers the latest products and techniques, including those relevant to surface-mounted devices. An ideal guide to current practice and the equipment now on the market. If you need to renew/update your soldering equipment, read this first. J.A.R.

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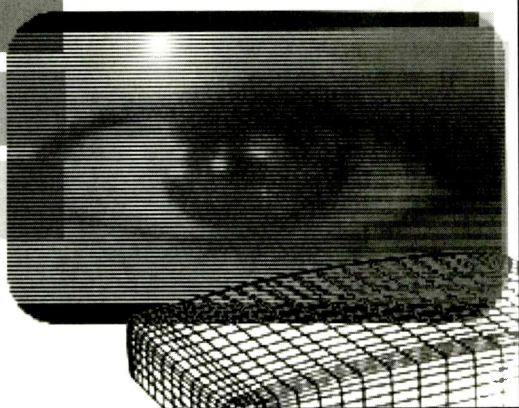
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Monitors



Reports from
John Edwards
Ian Field
and
Roger Burchett

IBM 6312-002

The customer said that he sometimes had to switch this monitor off and on several times before it would start up. There were numerous dry-joints in the power supply area, and C028 (1 μ F, 100V) was discoloured. In fact it was leaky. Once this capacitor had been replaced, and a thorough resoldering operation in the power supply and the line output stages had been carried out, the monitor powered up each time it was switched on. **J.E.**

Amstrad PCD14DSM

This monitor was very dead. The STK73410 chopper chip had been destroyed along with R012 (100 Ω , 2W), R011 (1 Ω , 2W) and C014 (4.7 μ F, 50V) which had split open and exploded. Unfortunately for me, when I'd replaced these items the monitor worked for only about two minutes then failed. I had to replace them all again before I discovered that the cause of the trouble was C012 (470pF, 2kV). **J.E.**

Tatung TM4401

This monitor had an EW fault and the user width control had no effect. After about five minutes the line output transistor would overheat, shutting down the power supply. As there is a pair of 2SD2125 transistors in this chassis, one each for line scan and EHT generation, I could discount the possibility of LOPT failure. The chassis is a later version of the Y2/Y2V, which often turns up disguised as an

Amstrad, but none of the literature I had was of much help with this fault.

Width control is based on a closed-loop circuit around the LM348 op-amp IC408. The loop includes TR416 (2SB1015), whose collector is connected to pin 13 (an inverting input) of IC408 via R493 (56k Ω). The voltage at this input was low, just under 1V, which compared with about 5.8V at the associated non-inverting input pin 12. As a result the line scan circuit was being driven flat out. The cause of the problem was R493, which had gone open-circuit.

Once R493 had been replaced the user width control and several presets (two width and one EW) worked but it was apparent that every preset on the board had been twiddled! The line and width transistors continued to overheat, and the power supply shut down. New transistors made a considerable improvement, proving that the originals had been damaged, but the width was still insufficient and the replacement transistors were getting too hot.

Just in time I realised that the set-HT preset at the rear of the chassis had also been tampered with. Once this had been adjusted the geometry could be set up without further difficulty. **I.F.**

Dell 1528LS

This monitor was tripping because the 2SC5129 line output transistor Q424 was short-circuit. Fractured soldered connections to the line output transformer could have been the cause – the collector pin looked as if arcing had occurred. But any 2SC5XX9-series transistor should be regarded with the deepest suspicion: it's unusual to find any other cause of failure. **I.F.**

HIT KT81-144C/8M

The problem was random shutdown/restart. Very few are this easy! There's a link, J474, next to the line output transistor. It connects the transistor's base pin to R435/6/C415. The solder pad, which is very close to the transis-

tor's emitter pin, had a smudged solder blob that appeared to be in contact with the latter. As the monitor ran most of the time it was obviously not a good contact – only at certain temperatures! **I.F.**

CTX 1451CLR

Monitors of this type fitted with the Samsung M34KUN35X15 CRT are being returned with very low-emission tubes after about two years' use. The first one I came across responded very well after turning the first anode voltage right up for about thirty seconds. Other tubes have returned to acceptable emission after increasing the heater voltage for a while. It appears that the cathodes become contaminated rather quickly. **R.B.**

AOC MM413S

The problem with this mono VGA monitor was lack of width and curved raster sides. Checks revealed that the main 30V supply was low because D734 (1N4148) was short-circuit and the 15V zener diode ZD735 was leaky. These two diodes link the 12V regulator IC700 to chassis. **R.B.**

CTX 1565D

A number of monitors have come my way recently after being subjected to rough treatment. There were several obvious PCB cracks in this one – the control panel under the CRT had snapped in half.

When I got it going it seemed that the EHT would occasionally rise (raster shrinking) followed by line oscillator failure: the X-ray protection circuit was coming into operation. There was another crack by the screw that holds the bracket which supports the input cable. Electrically, the crack was between R716/R717 – the track was broken near a jumper. The result was lack of EHT regulation.

Another CTX1565 some time back exhibited this symptom very occasionally, and only when cold. In retrospect I think the cause was probably the same. In future I'll check very carefully for faults in this area. **R.B.**

TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	
BC107	8p	BD434	30p	BU126	65p	BUV48AF	325p	MJ4502	300p	AN35	50p	LINEAR ICs	AN6340	600p	BA335	55p	BA7004	200p		
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ10012	300p			AN203	210p	AN6341	200p	BA338	80p	BA7007	200p	
BC109	8p	BD436	31p	BU133	125p	BUV50	425p	MJ11015	250p			AN210	165p	AN6342	325p	BA340	75p	BA7021	180p	
BC108C	10p	BD437	28p	BU137	150p	BUV81	1000p	MJ11016	300p			AN211	150p	AN6344	440p	BA343	60p	BA7022	350p	
BC140	20p	BD438	36p	BU180	100p	BUV70	200p	MJ11032	800p			AN214Q	170p	AN6345	400p	BA336	175p	BA7025L	100p	
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11033	800p			AN217P	95p	AN6346	350p	BA401	60p	BA7107	475p	
BC143	20p	BD440	40p	BU204	65p	BUV93	375p	MJ15003	250p			AN228	280p	AN6350	610p	BA402	60p	BA7212S	200p	
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	300p			AN252	150p	AN6352	450p	BA511	145p	BA7604N	100p	
BC149	8p	BD533	50p	BU206	100p	BUW11AF	225p	MJ15015	250p			AN259	250p	AN6359	500p	BA516	150p	BA7751LS	150p	
BC159	8p	BD534	50p	BU207	150p	BUW12	125p	MJ15016	250p			AN262	140p	AN6360	320p	BA518	150p	BA7752	250p	
BC160	30p	BD535	38p	BU208	70p	BUW12A	150p	MJ15022	400p			AN274	250p	AN6362	400p	BA521	100p	BA7755	150p	
BC171	10p	BD536	38p	BU208A	75p	BUW12F	250p	MJ15023	400p			AN277B	400p	AN6363	375p	BA524	240p	BA7767AS	150p	
BC172	10p	BD537	38p	BU208AT	200p	BUW13A	200p	MJ15024	400p			AN278	60p	AN6365	400p	BA526	180p	BA8504	350p	
BC177	14p	BD538	40p	BU208B	200p	BUW32A	500p	MJ15025	700p			AN301	300p	AN6368	275p	BA527	95p	BA15218	60p	
BC178	14p	BD643	40p	BU209	130p	BUW48	550p	MJE340	25p			AN303	330p	AN6371	350p	BA532	100p	CA3140E	38p	
BC179	14p	BD645	50p	BU209	90p	BUW49	550p	MJE350	80p			AN304	350p	AN6372	480p	BA534	220p	CN62A	50p	
BC182	7p	BD647	50p	BU225	120p	BUW50	400p	MJE520	30p			AN305	350p	AN6377	100p	BA536	150p	CN682A	60p	
BC182L	7p	BD649	50p	BU226	120p	BUW81A	150p	MJE2955T	65p			AN306	350p	AN6380	400p	BA546	160p	CN85A	80p	
BC183	7p	BD675	40p	BU312	90p	BUW84	75p	MJE3055T	100p			AN315	210p	AN6382	450p	BA547	120p	CX136	600p	
BC183L	7p	BD676	40p	BU325	55p	BUX85	180p	MJE13004	70p			AN316	350p	AN6383	400p	BA548	120p	CX139A	750p	
BC184	7p	BD677	38p	BU326A	75p	BUX10	350p	MJE13005	60p			AN317	350p	AN6385	450p	BA549	120p	CX139B	750p	
BC184L	7p	BD678	40p	BU406	60p	BUX11	200p	MJE13007	100p			AN318	350p	AN6386	450p	BA550	120p	CX139C	750p	
BC212	7p	BD679	40p	BU406D	85p	BUX12	150p	MJE13009	100p			AN319	350p	AN6387	450p	BA551	120p	CX145	725p	
BC212L	7p	BD680	40p	BU407	55p	BUX20	350p	MJE15028	200p			AN320	350p	AN6388	450p	BA552	120p	CX150B	325p	
BC213	7p	BD681	40p	BU500D	225p	BUX80	180p	MJE15029	200p			AN321K	350p	AN6389	450p	BA553	120p	CX175	325p	
BC213L	7p	BD682	45p	BU500E	50p	BUX85	180p	MJE15030	250p			AN322K	350p	AN6390	450p	BA554	120p	CX187	825p	
BC214	7p	BD705	50p	BU408D	75p	BUX23	900p	MJE15031	400p			AN323K	350p	AN6391	450p	BA555	120p	CX2015A	600p	
BC214L	7p	BD707	50p	BU409	85p	BUX37	220p	MJE18004	125p			AN324K	350p	AN6392	450p	BA556	120p	CX2015B	75p	
BC237	7p	BD709	50p	BU412	175p	BUX39	450p	MJF18004	175p			AN325K	350p	AN6393	450p	BA557	120p	CX2015C	140p	
BC238	7p	BD711	50p	BU413	175p	BUX40	450p	MJF18024	175p			AN326K	350p	AN6394	450p	BA558	120p	CX2015D	140p	
BC239	7p	BD736	50p	BU414B	250p	BUX41	200p	OC28	25p			AN327K	350p	AN6395	450p	BA559	120p	CX2015E	140p	
BC300	20p	BD826	50p	BU415A	170p	BUX42	200p	OC29	25p			AN328K	350p	AN6396	450p	BA560	120p	CX2015F	140p	
BC301	20p	BD828	50p	BU426A	70p	BUX47A	220p	OC35	350p			AN329K	350p	AN6397	450p	BA561	120p	CX2015G	140p	
BC302	20p	BD839	55p	BU433	120p	BUX48A	150p	OC36	250p			AN330K	350p	AN6398	450p	BA562	120p	CX2015H	140p	
BC303	20p	BD897	50p	BU500	100p	BUX55	800p	S2000A3	175p			AN331K	350p	AN6399	450p	BA563	120p	CX2015I	140p	
BC304	25p	BD899	50p	BU500D	225p	BUX80	180p	S2000AF	90p			AN332K	350p	AN6400	450p	BA564	120p	CX2015J	140p	
BC327	7p	BD977	50p	BU505	90p	BUX81	160p	S2055A	175p			AN333K	350p	AN6401	450p	BA565	120p	CX2015K	140p	
BC328	7p	BDX33	60p	BU505D	90p	BUX84	50p	S2055AF	175p			AN334K	350p	AN6402	450p	BA566	120p	CX2015L	140p	
BC337	7p	BDX37	100p	BU505DF	90p	BUX85	50p	S2530A	100p			AN335K	350p	AN6403	450p	BA567	120p	CX2015M	140p	
BC338	7p	BDX44	100p	BU506	100p	BUX86	50p	TI29	15p			AN336K	350p	AN6404	450p	BA568	120p	CX2015N	140p	
BC441	20p	BDX47	75p	BU506D	100p	BUX87	50p	TI29A	15p			AN337K	350p	AN6405	450p	BA569	120p	CX2015O	140p	
BC446	8p	BDX54C	75p	BU506DF	100p	BUX98A	350p	TI29C	25p			AN338K	350p	AN6406	450p	BA570	120p	CX2015P	140p	
BC477	18p	BD62AC	150p	BU508A	60p	BUZ71	75p	TI29E	25p			AN339K	350p	AN6407	450p	BA571	120p	CX2015Q	140p	
BC516	22p	BD63AC	175p	BU508AF	60p	BUZ71AF	100p	TI30	25p			AN340K	350p	AN6408	450p	BA572	120p	CX2015R	140p	
BC537	25p	BDX64C	175p	BU508APH	60p	BUZ72A	100p	TI30C	25p			AN341K	350p	AN6409	450p	BA573	120p	CX2015S	140p	
BC546	8p	BDX65	80p	BU508B	60p	BUZ72AF	100p	TI31A	22p			AN342K	350p	AN6410	450p	BA574	120p	CX2015T	140p	
BC547	8p	BDX66C	80p	BU508DF	60p	BUZ73AF	150p	TI31C	22p			AN343K	350p	AN6411	450p	BA575	120p	CX2015U	140p	
BC548	8p	BDX67C	275p	BU508DR	85p	BUZ73AF	60p	TI32	24p			AN344K	350p	AN6412	450p	BA576	120p	CX2015V	140p	
BC549	8p	BDX71	100p	BU508V	110p	BUZ76A	110p	TI32A	21p			AN345K	350p	AN6413	450p	BA577	120p	CX2015W	140p	
BC550	8p	BDX77	70p	BU508VF	100p	BUZ80	135p	TI32C	21p			AN346K	350p	AN6414	450p	BA578	120p	CX2015X	140p	
BC556	8p	BDX87C	175p	BU526	75p	BUZ80AF	200p	TI33	50p			AN347K	350p	AN6415	450p	BA579	120p	CX2015Y	140p	
BC557	8p	BDX88C	150p	BU536	100p	BUZ82	200p	TI33C	60p			AN348K	350p	AN6416	450p	BA580	120p	CX2015Z	140p	
BC558	8p	BDW24	50p	BU546	125p	BUZ90A	180p	TI34	60p			AN349K	350p	AN6417	450p	BA581	120p	CX2015AA	140p	
BC559	8p	BDW93	50p	BU603	125p	BUZ91A	260p	TI34C	60p			AN350K	350p	AN6418	450p	BA582	120p	CX2015AB	140p	
BC560	8p	BDW94	50p	BU606D	225p	BY448	20p	TI35C	60p			AN351K	350p	AN6419	450p	BA583	120p	CX2015AC	140p	
BC637	20p	BDY29	225p	BU608D	120p	BY111	25p	TI36	60p			AN352K	350p	AN6420	450p	BA584	120p	CX2015AD	140p	
BC638	20p	BDY56	225p	BU610	110p	BY112	25p	TI36A	20p			AN353K	350p	AN6421	450p	BA585	120p	CX2015AE	140p	
BC640	20p	BDY58	225p	BU605	130p	IRF130	475p	TI34C	62p			AN354K	350p	AN6422	450p	BA586	120p	CX2015AF	140p	
BCV33	200p	BDY90	125p	BU706DF	175p	IRF140	550p	TI42C	22p			AN355K	350p	AN6423	450p	BA587	120p	CX2015AG	140p	
BCV34	200p	BDY92	100p	BU706F	150p	IRF230	550p	TI42C	22p			AN356K	350p	AN6424	450p	BA588	120p	CX2015AH	140p	
BCV70	16p	BF137	35p	BU724A	100p	IRF240	425p	TI47	40p			AN357K	350p	AN6425	450p	BA589	120p	CX2015AI	140p	
BCV71	16p	BF167	30p	BU801	70p	IRF248	375p	TI48	20p			AN358K	350p	AN6426	450p	BA590	120p	CX2015AJ	140p	
BD112	30p	BF181	20p	BU806	70p	IRF500	600p	TI50	60p			AN359K	350p	AN6427	450p	BA591	120p	CX2015AK	140p	
BD115	30p	BF183	20p	BU807	70p	IRF340	325p	TI51	80p			AN360K	350p	AN6428	450p	BA592	120p	CX2015AL	140p	
BD124P	50p	BF195	7p	BU807F	75p	IRF350	750p	TI52	80p			AN361K	350p	AN6429	450p	BA593	120p	CX2015AM	140p	
BD131	25p	BF199	8p	BU808DF	210p	IRF450	650p	TI54	85p			AN362K	350p	AN6430	450p	BA594	120p	CX2015AN	140p	
BD132	25p	BF200	15p	BU810	110p	IRF510	110p	TI54	85p			AN363K	350p	AN6431	450p	BA595	120p	CX2015AO	140p	
BD133	25p	BF205	15p	BU812	110p	IRF520	110p													

PLEASE PHONE US FOR TYPES NOT LISTED AS WE
HAVE OVER 50,000 ITEMS IN STOCK.
QUOTATIONS GIVEN FOR LARGE QUANTITIES

LINEAR C's

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
HA13001	650p	LA2800	350p	LA7096	275p	LF353	48p	MC3302	52p	SAB3029	52p	STK3102 II	530p	STK5478	380p	STR16006	500p	TA7281	200p
HA13002	200p	LA3120	200p	LA7113	200p	LF355	60p	MC3401	50p	SAB3035	275p	STK3106	2500p	STK5479	300p	STR17006	500p	TA7282	160p
HA13006	400p	LA3150	200p	LA7116	125p	LF357	70p	MC3423P	100p	SAB3036	725p	STK3122 III	725p	STK5480	470p	STR20005	450p	TA7210	200p
HA13108	280p	LA3160	120p	LA7123	1300p	LF398	300p	MC3485AP	250p	SAB3037	700p	STK3152 II	200p	STK5482	285p	STR20012	450p	TA7213	200p
HA13117	175p	LA3210	65p	LA7122	150p	LH2426S	600p	MC34063AP	600p	SAB3042	825p	STK3156	500p	STK5483	440p	STR20015	450p	TA7284	400p
HA13118	140p	LA3226	60p	LA7124	150p	LM301	26p	MN1220T	600p	SAB3064	130p	STK4017	400p	STK5486	450p	STR30110	350p	TA7284P	400p
HA13119	140p	LA3246	75p	LA7220	125p	LM311	35p	MN1226	450p	SAB3209	225p	STK4019	480p	STK5487	525p	STR30115	275p	TA7291P	200p
HA13127	350p	LA3300	140p	LA7222	110p	LM319	165p	MN1228	600p	SAB3210	250p	STK4021	380p	STK5488	480p	STR30120	400p	TA7292P	325p
HA13128	400p	LA3301	110p	LA7224	150p	LM324	30p	MN1276	1300p	SAB86456	125p	STK4024 II	550p	STK5490	450p	STR30123	450p	TA7294P	400p
HA13130	450p	LA3361	100p	LA7225	250p	LM335Z	120p	MN1280	70p	SAB8648	225p	STK4025	530p	STK5632	450p	STR30125	550p	TA7295	200p
HA13135	500p	LA3365	70p	LA7292	275p	LM339	35p	MN3004	600p	SAB8651AP	700p	STK4026	480p	STK5720	400p	STR30130	250p	TA7302P	75p
HA13139	600p	LA3370	70p	LA7294	200p	LM358	45p	MN3005	2000p	SDA2003	450p	STK4028	550p	STK5725	450p	STR40090	500p	TA7302P	75p
HA13150A	1150p	LA3373	70p	LA7295	160p	LM380	85p	MN3011	4000p	SDA2004	325p	STK4032 II	1050p	STK5730	350p	STR40115	600p	TA7303	700p
HA13151	875p	LA3375	300p	LA7297	120p	LM381	150p	MN3101	110p	SDA2005	700p	STK4034 X	925p	STK6316	450p	STR41090	330p	TA7307	100p
HA13403	400p	LA3376	80p	LA7305A	350p	LM382	130p	MN3207	375p	SDA2007	300p	STK4036	470p	STK6324B	500p	STR43111	950p	TA7310	100p
HA13406V	400p	LA3380	300p	LA7308	70p	LM386	60p	MN3208	950p	SDA2008	400p	STK4038	680p	STK6328A	1200p	STR44115	550p	TA7312	120p
HA13408	350p	LA3390	250p	LA7311	200p	LM397	100p	MN630B	750p	SDA2120	200p	STK4040 II	650p	STR45111	550p	STR50020	350p	TA7313	700p
HA13412	500p	LA3400	250p	LA7320	120p	LM389N	105p	MN6163A	500p	SDA2121	200p	STK4042 II	800p	STR50025	550p	STR50092	350p	TA7314	175p
HA13426	500p	LA3401	90p	LA7323	325p	LM393	45p	MTA001M	600p	SDA2208	450p	STK4046	950p	STR5103A	260p	STR6007	500p	TA7315	200p
HA13432	400p	LA3410	150p	LA7330	350p	LM431	50p	NE555	200p	SDA4212	750p	STK4048	1280p	STR50113	500p	STR6072	725p	TA7317P	120p
HA13441	450p	LA3430	135p	LA7331	250p	LM710	45p	NE556	40p	SDA5241	725p	STK4050 II	1600p	STR6822	900p	STR60115	500p	TA7322	130p
HA17524	250p	LA3600	60p	LA7332	225p	LM723	40p	NE558	80p	SDA5243-2	500p	STK4051	510p	STR6922	400p	STR60115	500p	TA7322	130p
KA2102	100p	LA3605	100p	LA7340	300p	LM74DIL	45p	NE558	110p	SDA5243-2	500p	STK4056	510p	STR6922	400p	STR60115	500p	TA7322	130p
KA2103	100p	LA3607	125p	LA7376	150p	LM741MET	45p	NE567	115p	SDA5640	200p	STK4101	500p	STR6922	400p	STR60115	500p	TA7322	130p
KA2131	110p	LA4030	180p	LA7391	550p	LM747	55p	NE571	290p	SDA5642	450p	STK4111	500p	STR6922	400p	STR60115	500p	TA7322	130p
KA2206	150p	LA4031	140p	LA7520	200p	LM1017	200p	NE592	85p	SGSF444	500p	STK4112	500p	STR6922	400p	STR60115	500p	TA7322	130p
KA2209	125p	LA4032	140p	LA7530	200p	LM1035N	350p	NE5532P	140p	SGSF465	500p	STK4121	480p	STR6922	400p	STR60115	500p	TA7322	130p
KA2210	230p	LA4051	160p	LA7535	175p	LM1040N	650p	SAA1000	350p	SLA4031	750p	STK4122	560p	STR6922H	600p	STR60115	500p	TA7322	130p
KA2212	85p	LA4100	85p	LA7545	160p	LM1203	225p	SAA1004	650p	SLA7020M	450p	STK4131	480p	STR6922	400p	STR60115	500p	TA7322	130p
KA2213	130p	LA4101	80p	LA7550	275p	LM1209AN	225p	SAA1005	325p	STK4312	450p	STK4132 II	600p	STR6922	400p	STR60115	500p	TA7322	130p
KA2214	100p	LA4102	100p	LA7555	150p	LM1875T	330p	SAA1006	300p	STK4312	450p	STK4133 II	750p	STR6922	400p	STR60115	500p	TA7322	130p
KA2224	50p	LA4110	120p	LA7620	500p	LM1881N	375p	SAA1008	450p	STK401A	220p	STK4141 II	420p	STR6922	400p	STR60115	500p	TA7322	130p
KA2224	75p	LA4120	270p	LA7680	675p	LM1886	250p	SAA1010	400p	STK403A	270p	STK4142	530p	STR6922	400p	STR60115	500p	TA7322	130p
KA2261	100p	LA4138	105p	LA7681	650p	LM1889	300p	SAA1024	250p	STK405A	280p	STK4147 II	1450p	STR6922	400p	STR60115	500p	TA7322	130p
KA2263	100p	LA4140	60p	LA7710	250p	LM1894N	200p	SAA1025	250p	STK431A	250p	STK4151	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2264	100p	LA4142	65p	LA7800	90p	LM1895N	275p	SAA1026	400p	STK432A	220p	STK4152	650p	STR6922	400p	STR60115	500p	TA7322	130p
KA2284	75p	LA4145	65p	LA7831	190p	LM2901N	35p	SAA1027	600p	STK434A	270p	STK4161	650p	STR6922	400p	STR60115	500p	TA7322	130p
KA2309	175p	LA4160	100p	LA7802	300p	LM2902N	40p	SAA1029	150p	STK435A	270p	STK4162	550p	STR6922	400p	STR60115	500p	TA7322	130p
KA2401	150p	LA4162	110p	LA7806	260p	LM2903N	40p	SAA1042	325p	STK441A	220p	STK4164 II	1175p	STR6922	400p	STR60115	500p	TA7322	130p
KA2412	225p	LA4178	150p	LA7808	250p	LM3900	40p	SAA1043P	675p	STK4451C	280p	STK4171	900p	STR6922	400p	STR60115	500p	TA7322	130p
KA2912	125p	LA4180	150p	LA7820	100p	LM3909	100p	SAA1044	400p	STK456C	240p	STK4172 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2913A	175p	LA4182	180p	LA7823	200p	LM3911N	200p	SAA1056	300p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2914	200p	LA4184	190p	LA7824	200p	LM3911N	200p	SAA1056	300p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2923A	200p	LA4190	180p	LA7830	200p	LM3915	160p	SAA1058	225p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2927	200p	LA4200	170p	LA7830	90p	LM3915	160p	SAA1058	225p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2931	200p	LA4200	170p	LA7831	85p	LM3916	270p	SAA1060	375p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2932	200p	LA4201	120p	LA7832	130p	LM3916	270p	SAA1060	375p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2933	200p	LA4260	230p	LA7835	150p	LM3916	270p	SAA1060	375p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2934	200p	LA4281	300p	LA7837	150p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2935	200p	LA4282	300p	LA7838	150p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2936	200p	LA4283	300p	LA7839	150p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2937	200p	LA4284	300p	LA7840	150p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2938	200p	LA4285	300p	LA7850	225p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2939	200p	LA4286	300p	LA7851	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2940	200p	LA4287	300p	LA7852	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2941	200p	LA4288	300p	LA7853	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2942	200p	LA4289	300p	LA7854	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2943	200p	LA4290	300p	LA7855	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2944	200p	LA4291	300p	LA7856	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2945	200p	LA4292	300p	LA7857	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p
KA2946	200p	LA4293	300p	LA7858	200p	LM3960	150p	SAA1062	250p	STK471	210p	STK4173 II	680p	STR6922	400p	STR60115	500p	TA7322	130p</

LINEAR ICs/JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
TA8164P	100p	TD1A180	120p	TD2760	400p	TD44661	225p	TD48391	675p	UPC1004C	130p	2SA771	90p	2SA1177	25p	2SB861	30p	2SC738	15p
TA8184P	350p	TD1A185A	120p	TD2780	600p	TD44670	475p	TD48395	675p	UPC1009	950p	2SA773	50p	2SA1179	20p	2SB862	20p	2SC739	15p
TA8189P	130p	TD1A190	80p	TD2791	275p	TD44680	350p	TD48405	550p	UPC1018	170p	2SA777	35p	2SA1182	20p	2SB864	15p	2SC761	110p
TA8200AP	325p	TD1A200B	80p	TD2795	150p	TD44685	275p	TD48415	650p	UPC1020	200p	2SA778	100p	2SA1184	120p	2SB866	30p	2SC762	85p
TA8201AK	60p	TD1A210A	50p	TD2800	60p	TD44700A	750p	TD48416	925p	UPC1023	80p	2SA781	15p	2SA1185	200p	2SB868	50p	2SC783	85p
TA8207K	175p	TD1A236	240p	TD2824	85p	TD44714C	350p	TD48417	550p	UPC1024H	75p	2SA786	25p	2SA1186	500p	2SB869	30p	2SC790	50p
TA8210	260p	TD1A251	150p	TD2840	200p	TD44716C	450p	TD48421	300p	UPC1025	230p	2SA794	50p	2SA1198	40p	2SB860	500p	2SC792	380p
TA8211AH	200p	TD1A270	150p	TD2840	200p	TD44718A	250p	TD48425	500p	UPC1026	95p	2SA798	30p	2SA1201	40p	2SB861	60p	2SC805	225p
TA8214K	260p	TD1A327	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1028	90p	2SA812	15p	2SA1202	25p	2SB805	25p	2SC828	20p
TA8215	300p	TD1A330	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1031H	150p	2SA814	60p	2SA1204	25p	2SB806	25p	2SC829	15p
TA8216H	300p	TD1A410	220p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1032	60p	2SA816	70p	2SA1206	25p	2SB832	45p	2SC839	20p
TA8217P	120p	TD1A412	35p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1035C	110p	2SA817	20p	2SA1207	25p	2SB833	80p	2SC867	900p
TA8220AH	500p	TD1A506	275p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1043C	125p	2SA825	20p	2SA1208	70p	2SB841	12p	2SC870	175p
TA8221AH	600p	TD1A508	175p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1158H	70p	2SA836	20p	2SA1209	100p	2SB847	20p	2SC897	175p
TA8225H	475p	TD1A510	175p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1181	110p	2SA837	200p	2SA1210	120p	2SB848	45p	2SC900B	30p
TA8225L	475p	TD1A512	140p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1187	125p	2SA839	110p	2SA1216	50p	2SB849	35p	2SC930	15p
TA8229K	250p	TD1A514	325p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1198H	200p	2SA841	20p	2SA1216	60p	2SB853	100p	2SC936	300p
TA8229K	200p	TD1A515A	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1173	200p	2SA844	20p	2SA1217	100p	2SB876	85p	2SC941	140p
TA8400P	200p	TD1A516Q	350p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1176C	120p	2SA847	25p	2SA1220	75p	2SB888	90p	2SC944	150p
TA8410K	200p	TD1A517	150p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1178H	250p	2SA854	30p	2SA1221	70p	2SB873	90p	2SC945	10p
TA8410P	200p	TD1A518	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1180C	200p	2SA861	45p	2SA1222	50p	2SB705	200p	2SC950	40p
TA8432	200p	TD1A519A	140p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1185H2	400p	2SA872	25p	2SA1226	25p	2SB707	200p	2SC959	225p
TA8605N	350p	TD1A520	275p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1187A	300p	2SA877A	50p	2SA1227	250p	2SB716	20p	2SC980	40p
TA8606N	350p	TD1A521	210p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1188H	350p	2SA879	30p	2SA1232	180p	2SB718	60p	2SC982	40p
TA8607P	320p	TD1A522	110p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1191	300p	2SA884	100p	2SA1237	25p	2SB727	100p	2SC983	120p
TA8611AN	250p	TD1A524	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1192	140p	2SA885	35p	2SA1238	30p	2SB733	75p	2SC1000	20p
TA8615N	480p	TD1A526	225p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1193H	150p	2SA886	45p	2SA1239	30p	2SB734	35p	2SC1001	950p
TA8628N	900p	TD1A534	140p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1210	150p	2SA887	20p	2SA1240	45p	2SB735	25p	2SC1002	30p
TA8631	500p	TD1A540	420p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1215V	125p	2SA889	25p	2SA1244	120p	2SB744	55p	2SC1012	75p
TA8632N	500p	TD1A541	500p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1222	130p	2SA896	40p	2SA1245	55p	2SB750	60p	2SC1013	170p
TA8644N	425p	TD1A542	250p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1225H	200p	2SA890	45p	2SA1246	80p	2SB753	100p	2SC1014	140p
TA8646	375p	TD1A543	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1227V	225p	2SA904	20p	2SA1248	35p	2SB754	80p	2SC1030	150p
TA8653N	1500p	TD1A552Q	35p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1232AH	100p	2SA907	20p	2SA1249	45p	2SB757	100p	2SC1031	250p
TA8659AN	900p	TD1A553Q	85p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1235A	300p	2SA912	60p	2SA1252	20p	2SB765	70p	2SC1047	20p
TA8690N	700p	TD1A555Q	35p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1237HA	70p	2SA912	70p	2SA1253	30p	2SB772	25p	2SC1050	280p
TA8691N	450p	TD1A557Q	300p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1238	120p	2SA913	100p	2SA1256	30p	2SB774	50p	2SC1051	250p
TA8701AN	275p	TD1A558Q	300p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1241H	150p	2SA914	90p	2SA1257	30p	2SB775	100p	2SC1061	85p
TA8718N	550p	TD1A560Q	675p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1242H	150p	2SA915	30p	2SA1258	70p	2SB777	110p	2SC1067	175p
TA8720	525p	TD1A571	300p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1245V	130p	2SA916	60p	2SA1264	150p	2SB786	35p	2SC1070	65p
TA8739P	450p	TD1A572	175p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1247H	200p	2SA921	40p	2SA1262	110p	2SB791	130p	2SC1079	300p
TA8722N	450p	TD1A574	125p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1274V	250p	2SA928A	25p	2SA1263	280p	2SB794	40p	2SC1080	225p
TA8A550	25p	TD1A576	175p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1277	240p	2SA933	30p	2SA1264	280p	2SB795	45p	2SC1096	40p
TBA120S	40p	TD1A578A	210p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1278	230p	2SA934	30p	2SA1265	200p	2SB810	15p	2SC1098	120p
TBA396	70p	TD1A579	130p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1288V	240p	2SA935	40p	2SA1268	50p	2SB815	15p	2SC1106	180p
TBA520	350p	TD1A589	275p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1292CA	300p	2SA961	60p	2SA1269	60p	2SB817	175p	2SC1118	415p
TBA530	100p	TD1A591	275p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1300	200p	2SA909	500p	2SA1252	20p	2SB818	70p	2SC1119	280p
TBA540	90p	TD1A596	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1297HA	300p	2SA939	140p	2SA1286	60p	2SB819	60p	2SC1115	290p
TBA560	90p	TD1A598	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1313A	300p	2SA940	50p	2SA1289	50p	2SB822	40p	2SC1116	280p
TBA800	40p	TD1A600	160p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1316C	70p	2SA942	60p	2SA1290	150p	2SB824	60p	2SC1124	270p
TBA810AS	40p	TD1A602A	400p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1318	300p	2SA949	70p	2SA1293	110p	2SB825	135p	2SC1161	110p
TBA820	55p	TD1A607A	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1330HA	80p	2SA950	18p	2SA1294	40p	2SB826	15p	2SC1162	30p
TBA820M	100p	TD1A620	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1351	320p	2SA951	60p	2SA1301	260p	2SB827	200p	2SC1164	600p
TBA920	100p	TD1A701	500p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1352C	450p	2SA952	30p	2SA1302	300p	2SB828	200p	2SC1165	750p
TBA950	100p	TD1A711	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1360C	200p	2SA954	60p	2SA1303	400p	2SB829	75p	2SC1166	100p
TBA990	60p	TD1A710A	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1362C	250p	2SA957	185p	2SA1304	110p	2SB857	80p	2SC1172	150p
TC5020	200p	TD1A872A	275p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1363	190p	2SA958	60p	2SA1306	45p	2SB861	120p	2SC1175	35p
TC5081AP	100p	TD1A904	200p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1365	150p	2SA962	120p	2SA1307	100p	2SB862	220p	2SC1195	210p
TC5082P	170p	TD1A905	80p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1366	150p	2SA965	30p	2SA1309	50p	2SB865	25p	2SC1212	35p
TC5090A	230p	TD1A908A	90p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1367C	300p	2SA966	25p	2SA1315	100p	2SB868	180p	2SC1213	10p
TC9125BP	410p	TD1A910	160p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1368C	130p	2SA968	55p	2SA1317	30p	2SB885	45p	2SC1214	15p
TC9130P	150p	TD1A940	180p	TD2840	200p	TD44725	750p	TD48432	550p	UPC1370C	300p	2SA970	25p	2SA1318	20p	2SB889	35p	2SC1215	25p
TC9134	750p	TD1A94																	

JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2261	700p	2SC2719	125p	2SC3263	280p	2SC3798	220p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A	60p	2SK312	750p
2SC1678	80p	2SC2267	90p	2SC2721	25p	2SC3264	390p	2SC3807	120p	2SD287	25p	2SD882	25p	2SD1328	60p	2SD1764	60p	2SK315	70p
2SC1683	100p	2SC2270	60p	2SC2724	15p	2SC3269	50p	2SC3808	70p	2SD291	25p	2SD889	35p	2SD1330	50p	2SD1765	70p	2SK320	120p
2SC1684	300p	2SC2271	25p	2SC2728	200p	2SC3270	50p	2SC3811	80p	2SD313	25p	2SD892A	75p	2SD1347	70p	2SD1769	110p	2SK323	130p
2SC1685	300p	2SC2274	15p	2SC2749	350p	2SC3271	75p	2SC3831	250p	2SD315	75p	2SD894	35p	2SD1348	65p	2SD1773	100p	2SK332	175p
2SC1729	900p	2SC2275	50p	2SC2750	300p	2SC3272	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p	2SK359	40p
2SC1730	10p	2SC2278	70p	2SC2751	270p	2SC3279	30p	2SC3833	250p	2SD330	65p	2SD896	220p	2SD1376	60p	2SD1783	70p	2SK363	50p
2SC1735	70p	2SC2283	700p	2SC2752	75p	2SC3280	200p	2SC3851	100p	2SD348	30p	2SD898B	225p	2SD1378	60p	2SD1785	160p	2SK367	40p
2SC1740	10p	2SC2280	1800p	2SC2767	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK364	40p
2SC1741	35p	2SC2291	40p	2SC2769	400p	2SC3284	600p	2SC3853	220p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1796	120p	2SK367	40p
2SC1755	90p	2SC2298	35p	2SC2773	700p	2SC3293	85p	2SC3855	220p	2SD358	40p	2SD916	130p	2SD1382	60p	2SD1802	75p	2SK369	30p
2SC1756	35p	2SC2307	300p	2SC2774	500p	2SC3298	50p	2SC3857	500p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK373	40p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3299	120p	2SC3858	550p	2SD361	100p	2SD921	320p	2SD1390	350p	2SD1812	45p	2SK374	45p
2SC1760	70p	2SC2312	300p	2SC2786	20p	2SC3300	400p	2SC3866	275p	2SD362	100p	2SD923	360p	2SD1391	250p	2SD1815	50p	2SK386	600p
2SC1775	10p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3868	100p	2SD371	240p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK389	115p
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3870	200p	2SD380	65p	2SD947	100p	2SD1395	80p	2SD1827	120p	2SK400	700p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	60p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843	70p	2SK405	450p
2SC1808	40p	2SC2324	120p	2SC2793	700p	2SC3309	150p	2SC3883	210p	2SD382	75p	2SD951	200p	2SD1397	100p	2SD1846	350p	2SK414	550p
2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD386	70p	2SD957A	520p	2SD1398	120p	2SD1847	275p	2SK415	500p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1849	280p	2SK427	50p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	280p	2SD1850	325p	2SK423	75p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	40p	2SK427	50p
2SC1827	60p	2SC2330	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p	2SK430	200p
2SC1829	500p	2SC2331	50p	2SC2825	900p	2SC3328	50p	2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1405	80p	2SD1857	75p	2SK431	450p
2SC1833	27p	2SC2333	200p	2SC2826	200p	2SC3330	20p	2SC3893	225p	2SD414	45p	2SD973A	70p	2SD1406	60p	2SD1858	40p	2SK431	325p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p	2SK432	160p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p	2SK433	350p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK434	350p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD989	70p	2SD1411	85p	2SD1878	160p	2SK435	700p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p	2SK437	900p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	360p	2SK438	350p
2SC1855	85p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	350p	2SK439	1100p
2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	80p	2SD471	20p	2SD1021	120p	2SD1417	75p	2SD1884	300p	2SK444	30p
2SC1865	700p	2SC2362	50p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p	2SK452	250p
2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3953	50p	2SD525	50p	2SD1024	650p	2SD1426	135p	2SD1887	225p	2SK453	225p
2SC1871	425p	2SC2369	10p	2SC2882	60p	2SC3377	50p	2SC3955	60p	2SD526	70p	2SD1027	850p	2SD1427	160p	2SD1884	300p	2SK455	320p
2SC1875	220p	2SC2371	20p	2SC2883	60p	2SC3378	120p	2SC3954	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1885	225p	2SK455	320p
2SC1881	70p	2SC2373	210p	2SC2888	200p	2SC3379	1200p	2SC3972	250p	2SD549	120p	2SD1031	75p	2SD1430	280p	2SD1910	175p	2SK456	500p
2SC1890	150p	2SC2383	50p	2SC2889	50p	2SC3381	130p	2SC3973	210p	2SD551	30p	2SD1036	600p	2SD1431	200p	2SD1911	300p	2SK457	400p
2SC1895	50p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK459	600p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD555	500p	2SD1047	180p	2SD1433	300p	2SD1929	50p	2SK459	400p
2SC1907	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3986	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK460	580p
2SC1926	20p	2SC2412K	50p	2SC2912	120p	2SC3399	50p	2SC3997	1250p	2SD558	200p	2SD1055	60p	2SD1439	165p	2SD1933	45p	2SK466	470p
2SC1909	250p	2SC2440	200p	2SC2921	650p	2SC3400	35p	2SC3998	800p	2SD560	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p	2SK466	70p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK462	80p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p	2SK464	950p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1958	80p	2SK485	1150p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	35p	2SD596	25p	2SD1065	160p	2SD1450	60p	2SD1959	210p	2SK499	100p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK719	300p
2SC1929	180p	2SC2470	65p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK724	500p
2SC1940	110p	2SC2481	120p	2SC2939	400p	2SC3419	120p	2SC4056	200p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1991	50p	2SK725	550p
2SC1941	27p	2SC2482	20p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	40p	2SK726	425p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1996	25p	2SK727	475p
2SC1944	350p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	175p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK739	400p
2SC1945	350p	2SC2485	400p	2SC2979	160p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK758	300p
2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	10p	2SD1128	200p	2SD1468	40p	2SD2011	60p	2SK769	500p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	85p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	50p	2SK786	200p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK787	200p
2SC1957	70p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1496	300p	2SD2033	80p	2SK787	200p
2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497	230p	2SD2061	100p	2SK791	225p
2SC1962	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	40p	2SD645	18p	2SD1142	350p	2SD1497-02	350p	2SD2066	250p	2SK792	300p
2SC1967	1300p	2SC2517	120p	2SC3020	14														

REPLACEMENT VIDEO HEADS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI		VHSAN3	800p	HRD750, HRD830, HRD860	1900p	NVFS 100	4500p	TL51100	3100p
VS105, 112, 115, 116, 120, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82, VSP82	850p	VHSAY3	1200p	HRD250, HRD257	1800p	NVFS1	4200p	VHR120, 130, 14, 141, 143G, 145P, 151, 15, 16, 171, 220, 243, 244, 247, VHR310, 330, 410, 411, 420, 4200, 4300, 4300, 4400, 4500, 5080, 5100, VHR5200, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 7810, 8005P, 88015P, VHRD4400, 4410, 4500, 4600, VHRD4610, 6700, 4800	3100p
VP7100, VS9300, VS9500	850p	VHSBH1, VHSCH1	2100p	HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L	1600p	N.E.C.		VHR1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000	4250p
VS1	900p	VHSBP1	850p	HRD370, HRD430, HRD470, 3V58, FV13H	1800p	N911, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, N9034, 9040, 9053, 9054, 9055, 9056, 9063, 9065, 9066, 906, 9077, N9099, DX1000, 1600, PX1200	850p	TL52000	4250p
VS2	900p	VHSB3	2600p	HRD530, HRD700, HRD840, HRD870	2300p	N911A, 914C, 915A, 916A, 917, 9110, 1210	2400p	VHR3500EX	4150p
VS3	900p	VHSD2	1600p	HRD900, HRD330, 337, 440, 441, 637, 641, 660, 670, 720, 730, 740, 820	1600p	PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774	1650p	VHR3500EX	4150p
VS10	1350p	VHSE1H, VHSOH2	1500p	HRF1000, SR3300MS, FV44L	1600p	N830, N831, N830, N831, N832, N833, N834, N835, N836	550p	VHR3500EX	4150p
VSP1	900p	VHSE2H, VHSV2	1400p	HRD950, HRD960, HRD980	4500p	B261A001 (FOR MODEL DX3000)	2400p	VHR1235, 235E, 4150, 4160, 4350	1950p
VS33, 35, 37, 38, 38EOG, MK11, 53, 55, 66, 765, 766, 767, 768, 865, 867, VSF30, 34, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497	1600p	VHSTJ1, VHSVH4, VHSWH1, VHSXH1, VHSYH2	700p	FV46, FV46E, FV46S, FV46T, FV46U, FV46V, FV46W, FV46X, FV46Y, FV46Z, FV46AA, FV46AB, FV46AC, FV46AD, FV46AE, FV46AF, FV46AG, FV46AH, FV46AJ, FV46AK, FV46AL, FV46AM, FV46AN, FV46AO, FV46AP, FV46AQ, FV46AR, FV46AS, FV46AT, FV46AU, FV46AV, FV46AW, FV46AX, FV46AY, FV46AZ, FV46BA, FV46BB, FV46BC, FV46BD, FV46BE, FV46BF, FV46BG, FV46BH, FV46BJ, FV46BK, FV46BL, FV46BM, FV46BN, FV46BO, FV46BP, FV46BQ, FV46BR, FV46BS, FV46BT, FV46BU, FV46BV, FV46BW, FV46BX, FV46BY, FV46BZ, FV46CA, FV46CB, FV46CC, FV46CD, FV46CE, FV46CF, FV46CG, FV46CH, FV46CI, FV46CJ, FV46CK, FV46CL, FV46CM, FV46CN, FV46CO, FV46CP, FV46CQ, FV46CR, FV46CS, FV46CT, FV46CU, FV46CV, FV46CW, FV46CX, FV46CY, FV46CZ, FV46DA, FV46DB, FV46DC, FV46DD, FV46DE, FV46DF, FV46DG, FV46DH, FV46DI, FV46DJ, FV46DK, FV46DL, FV46DM, FV46DN, FV46DO, FV46DP, 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FV46SE, FV46SF, FV46SG, FV46SH, FV46SI, FV46SJ, FV46SK, FV46SL, FV46SM, FV46SN, FV46SO, FV46SP, FV46SQ, FV46SR, FV46SS, FV46ST, FV46SU, FV46SV, FV46SW, FV46SX, FV46SY, FV46SZ, FV46TA, FV46TB, FV46TC, FV46TD, FV46TE, FV46TF, FV46TG, FV46TH, FV46TI, FV46TJ, FV46TK, FV46TL, FV46TM, FV46TN, FV46TO, FV46TP, FV46TQ, FV46TR, FV46TS, FV46TT, FV46TU, FV46TV, FV46TW, FV46TX, FV46TY, FV46TZ, FV46UA, FV46UB, FV46UC, FV46UD, FV46UE, FV46UF, FV46UG, FV46UH, FV46UI, FV46UJ, FV46UK, FV46UL, FV46UM, FV46UN, FV46UO, FV46UP, FV46UQ, FV46UR, FV46US, FV46UT, FV46UU, FV46UV, FV46UW, FV46UX, FV46UY, FV46UZ, FV46VA, FV46VB, FV46VC, FV46VD, FV46VE, FV46VF, FV46VG, FV46VH, FV46VI, FV46VJ, FV46VK, FV46VL, FV46VM, FV46VN, FV46VO, FV46VP, FV46VQ, FV46VR, FV46VS, FV46VT, FV46VU, FV46VV, FV46VW, FV46VX, FV46VY, FV46VZ, FV46WA, FV46WB, FV46WC, FV46WD, FV46WE, FV46WF, FV46WG, FV46WH, FV46WI, FV46WJ, FV46WK, FV46WL, FV46WM, FV46WN, FV46WO, FV46WP, FV46WQ, FV46WR, FV46WS, FV46WT, FV46WU, FV46WV, FV46WW, FV46WX, FV46WY, 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VS45, 48, 54, 55, VXS450, VXS470	1600p	VHSTJ2, VHSVH5, VHSWH2, VHSXH2, VHSYH3	700p	HRJ200, HRJ205	3300p	N895	2400p	VHR7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000	2750p
VS512, VS515, VS516	2250p	VHSTJ3, VHSVH6, VHSWH3, VHSXH3, VHSYH4	700p	HRJ300, HRJ305, HRJ315, HRJ316, HRJ317, HRJ318, HRJ319, HRJ320, HRJ321, HRJ322, HRJ323, HRJ324, HRJ325, HRJ326, HRJ327, HRJ328, HRJ329, HRJ330, HRJ331, HRJ332, HRJ333, HRJ334, HRJ335, HRJ336, HRJ337, HRJ338, HRJ339, HRJ340, HRJ341, HRJ342, HRJ343, HRJ344, HRJ345, HRJ346, HRJ347, HRJ348, HRJ349, HRJ350, HRJ351, HRJ352, HRJ353, HRJ354, HRJ355, HRJ356, HRJ357, HRJ358, HRJ359, HRJ360, HRJ361, HRJ362, HRJ363, HRJ364, HRJ365, HRJ366, HRJ367, HRJ368, HRJ369, HRJ370, HRJ371, HRJ372, HRJ373, HRJ374, HRJ375, HRJ376, HRJ377, HRJ378, HRJ379, HRJ380, HRJ381, HRJ382, HRJ383, HRJ384, HRJ385, HRJ386, HRJ387, HRJ388, HRJ389, HRJ390, HRJ391, HRJ392, HRJ393, HRJ394, HRJ395, HRJ396, HRJ397, HRJ398, HRJ399, HRJ400, HRJ401, HRJ402, HRJ403, HRJ404, HRJ405, HRJ406, HRJ407, HRJ408, HRJ409, HRJ410, HRJ411, HRJ412, HRJ413, HRJ414, HRJ415, HRJ416, HRJ417, HRJ418, HRJ419, HRJ420, HRJ421, HRJ422, HRJ423, HRJ424, HRJ425, HRJ426, HRJ427, HRJ428, 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VCR BELT KITS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI VP1700, VS9300, VS9500, VS9700, VS9800	120p	TX3650, VCR3000, VCR3002, VCR9500	75p	406, 407, 4092, 410, GV411, 412, 414, 415, 416, 417, 4192, 4200, 420, 430, 434, 435, GV437, 440, 450, 4592, 460, 464, 470, 500, 501, 5050, 5095,	100p	N.E.C. N830, N831, N832, N833	100p	V1710, 730, 750, 970, VX710, 712, 720, 730, 970, 971, 972	100p
VS1, VS2, VS3, VS5, VS12, VS15, VP88 VS10	70p	FISHER VBS7000	245p	GV5105, 511, 530, 5395, 540, 560, 5695, NV4005, 4105, SE4100, 4104, 4120, 5102, 5104, 5106, TVR37001	80p	N825 PVC2300, PVC2400	80p	VX9880	110p
VS9, VS105, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, VS24, 240, 244, 245, 247, 248, 250, 512, 515,	65p	VBS9000	120p	475, FVSD2905	70p	DX1000, 1600, 1600, 2000, 3000, N9012, 9013, 9016, N9033, 9034, 9035, 9054, 9055,	180p	SX7121	95p
516	200p	FVHP830, 840	60p	5104, 5106, TVR37001	80p	9056, 9066, 9096, 910, 910, 9120, N9510, 9520, 9530, 9610	80p	SANYO VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VS22, VS23, VS25, VS35, VS37, VS38, VS53, VS55, VS66	80p	FVHP905, 906, 907, 908, 910, 911, 915, 916, 918	75p	HINARI VXL1, VXL8, VXL19, VXL11, VXL19, VXL90, VXC34, VTV100,	80p	NATIONAL PANASONIC NV300, NV330PX, NV332, NV333 NV340, NV366	100p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VS4, VS6, VS8, VS9	95p	VBR300, VBS7500, VBS7600,	75p	VXL4, VXL35, VTV300	100p	NV3000, NV2010, NV3000	80p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VS77	120p	VBS9900	100p	VXL5, VXL6	100p	NV7000, NV7200, NV7800	75p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VS59	105p	VBS5300	75p	VXL3, VXL20	90p	NV8500, NV8610, NV862	145p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
ALBA VCR4000	130p	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20	110p	HITACHI VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, 39, 85, 165, 5020	75p	NV220, 250, 280, 430, 431, 433, 450, 460, 465, 470, 650, 730, NV770, 810, 870, 890, 970, AG1000, 1050	85p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR8500, VCR6000	105p	FVHD230, 250, 270, 370, FVHP100, 1200, 1250, 130, 132,	120p	VT5000, VT5500, VT18	120p	NV370, NV380, NV480, NV630, NV780,	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR161, VCR222	100p	FVHP1340, 1400, 1410, 1440, 1500, 2000, 200, 210, 250, 3, 300,	60p	VT8500, 8700	60p	NV830, NV850	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR3000X, VCR4000, VCR4000X	75p	310, 320, 2000, 410, 420, 430, 440, 445, 470, 475, FVSD2905	85p	VT6800, VT6500, VT6800, VT9300, VT9500, VT9700, 9900	75p	NV600, NV688, AG6010, AG6015	85p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR7000, VCR7800, VCR8000, VCR8800	110p	FVHP9000, 5005, 5050, 5075, 5100, 975, 980, 990	95p	VT9200	60p	400, NVH70	130p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VTR123, VCR4600, VCR4700,	80p	G.E.C. 4005	150p	VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 86, 86, 840	60p	NVVF1, NVVM10, 3000, 3300, 40, 7, 9000, 9900, NVMS1, 4	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR5700	80p	V4004	100p	VT3000	60p	NVM1, NVM3, NVM5	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR1000, 2000, 6000, 6100, 6200, 8600, 8602, 8603, 8604,	75p	V4007	80p	VT100, 110, 111, 113, 115, 118, 120, 125, 128, 130, 135, 138,	120p	VR6460, VR6920	170p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR8700, 8704, 8714, 8800, 8804, 9000, 9005, 9244, 9340,	105p	GOLDSTAR GHV1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245,	100p	VT145, 150, 168, 170, 175, 220, 225, 250, 255, 258, 260, VTL30,	90p	VR6540, VR6542	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
DD8900, DD8904, TVR4	75p	GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215,	80p	VM500, VM600	90p	VR2025, VR2580	100p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
TX3650, UF20, 22, 24, VCR3000, 3002, 4000, 9500	75p	VCP4100, VCP4130	80p	J.V.C. HR3300, HR3330, HR3360, HR3660,	120p	VR186, 190, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, 203, 211, 215, 212, 213, 223, 311, 312, 313, 3210, 3219, 322, 32, 29, 323,	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VS1004	105p	GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301,	80p	HR4100	130p	535, VR20DV1, 20DV2, 20RW7, 21DV1, 21DV2, 21DV3, 25B01, 25B02, 11, 12, 302, 303, 305, 31DV1, 31DV2, 31D, V3, 35B11, 35B12, 35B13,	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
BLAUPUNKT RTV100	200p	VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326	120p	HR4755	50p	72SB8, VR30DV2, 35B02, 35B03, 615B7, 715B4, 715B5, 715B8, VR6582, 915B2, 925B3, VR6180, 6182, 6185, 6285, 6290VR6291, VR6293, 6362, 6367,	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV200, RTV222, RTV224	90p	GHV1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245,	100p	HR7700	50p	67690, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, VR6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, VR6858A, 865B1,	75p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV202, RTX200	150p	GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215,	80p	HRD110, 111, 120, 121, 220, 225, 8P5000	60p	VR6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, VR6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, VR6858A, 865B1,	75p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV322, RTV248	100p	VCP4100, VCP4130	80p	HRD140, 141, 143, 150, 152, 157, 158, 160, 190, 250, 257, 310, HRD455, 565, 566, 725, 795, HRF50	45p	925B3	75p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707	135p	GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301,	80p	HRD170, 171, 180, 210, 211, 217, 230, 300, 320, 321, 330, 337, HRD350, 370, 400, 430, 440, 441, 500, 530, 700, 750, 950	45p	VR445B9, VR445B920, VR445B922, VR6443, 6843, 6843, VR6943	100p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV211, RTV214	140p	VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326	120p	HR55000, 5500, 8000, 9000, BR9060, BR5600, 605, 920, 925	45p	VR3260, 6349, 6448, 6449, 6548, 6648, 495B80, 644895, 495B6	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV324, RTV32565p	140p	VHS11, VHS43H	100p	HRD227, 520, 521, 522, 527, 600, 610, 620, 637, 641, 850, 830,	100p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV315, RTV316, RTV319, RTV320, RTV317	50p	VHSV4, VHSWH1, VHSXH1	60p	HRD40, HRD20, 22, HRJ200, 205, 300, 325, SR330, HR510	125p	VCR6800, VCR6810, VCR6820	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
RTV301, RTV333, RTV338, RTV404, RTV424	85p	VHSY2, VHSY1	70p	HRD840, 550, 560, 580, 590, 640, 660, 670, 720, 730, 740, 770, HRD820, 860, 870, 880, 910, 960, 980, HRD20, 25, HRJ210,	100p	SE4104, VR231, 2310, 2319, 231, 232, 2329, 237, 241, 241, 2419, 242, 243, 245, 2469, 247, 2479, 251, 252, 256, 257, 258, 33, 19, 322, 329, 333, 337, 339, 3419, 342, 343, 3469, 347, 3479, 35, 1, 352, 357, 358, 422, 4229, 422, 437, 442, 4229, 432, 437, 442, 44, 5, 4469, 447, 4479, 451, 452, 457, 458, 459, 512, 522, 529, 6379, 642, 647, 722, 7229, 723, 7379, 742,	70p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FERGUSON 3232, 3V00, 3V01, 3V16, 3V22, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922 3V23, 8923, 8924, 8929 3V29, 3V30, 8930, 8931, 8933, 8940	120p	VHSY2, VHSY1	70p	HRJ215, 315, 316, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ610, 615, 715, 97, 97	125p	VR5010, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944	60p	VHSC11	80p	HRJ620	40p	VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948	45p	GRANDIG MVS400, 440, VS400, 410, 415, 435, 440, 441, 450, 456, 460	55p	LOGIK VR955	180p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
3V58, 3V43, 3V44, 3V59, 3V64, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26, FV32, FV39, VC1411	45p	VHSG1, VHSFG2, VHSFG3, VHSFG4, VHSF63	180p	MATSUJI VX600, 730, 735, 750, 755, 765, 850, 6000, V8888	75p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FV21, FV22, FV26, FV32, FV39, VC1411	45p	GRANDIG MVS200RC	90p	VX1000, VX2000, VX2500, VX3000, VX6000, VX800	80p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FV31R	110p	VVS150	160p	MITSUBISHI HS200	200p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FV37H	50p	VVS310, 311, 315, 320, 326, 340, 345, 380, 445	85p	HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, 480, HS810, 20, 30, HSE10, 20, 30, 70	80p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FV43H, FV44L, FV46T, FV57H	125p	VVS150	75p	HS303, HS304, HS306, HS307, HS330, HS400, HS700	110p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FV37H	80p	LC290N, LC295N, SVS180, VS170	70p	HS138, HS319, HS410	110p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
3V52	55p	V5160, BARCELONA, FLORENZ, GV4000, 4000, 4001,	100p	HS1100, 16, HSM23, 25, 33, 34, 35, 37, 54, 55, 57, 58, 59, 68	55p	VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FV41R, FV42L	100p	GV4002, 400, 401, 4010, 402, 403, 404, 405,	100p			VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
FIDELITY	180p					VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
HOS200, VCR1000, 2000, 600, 6000, 6100	160p					VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VCR100	160p					VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p
VTR1000, VTR1001	100p					VR6950, VCR6855	110p	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	65p

REPLACEMENT IDLERS & PULLEYS

Make	Models	Description	Make	Models	Description
Hitachi	VT11, 14, 17, 19, 33, 34, 35, 38, 39, 52, 57, 61, 62, 63, 64, 65, 85, 86, 330, 350, 640, 16S, 5030	FF Rew Idler 6886792	Ferguson	3V39, 3V30, 3V31, 3V32, 3V35V36, 3V38, 3V39, 3V49, 8930, 8931, 8933, 8940, 8941, 8942, 8943, 8944	Take Up Clutch PU 51380
Order Code: IDL01		Price: 100p	J.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610	Take Up Clutch PU 53462A PU 51380
Hitachi </					

PINCH ROLLERS

Model	Price	Model	Price	Model	Price	Model	Price
AKAI VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77 140p VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9 VS12, VS15 140p VS105, 112, 115, 116, 120, 125, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516, VSX9 VS201, 301, 303, 304, 603, 606, 607, VSP8, VSP82, VP58, VP82 140p VS125, VS155, VS165, VS220, VS240, VS250, VS512 140p VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 766, 767, 768, 865, 867, 965, 967, VS477, VSA650 140p VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VFS300, 4, 5, 500, 550, VSP88, VSR100, VSX400, 450, 470 140p VSF260, 261, 262, 265, 270, 274, 275, 280, 290, 340, 350, 410, 420, 43C VSR441, 440, 450, 455, 480, 490, 497, 510, 560, 580, 590, 599, 600, VSG20, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VSX560, VSX580 140p VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53, 55, VSA77 775p PINCH ROLLER ASSEMBLY VS422, 425, 426, 427, 462, 465, 467, 485, 498, 765, 766, 767, 768, 865 140p VCR3000X, VCR4000 140p VCR5000, VCR6000 140p VCR161, VCR222 140p VCR7000, VCR7800, VCR8000, VCR8800 140p VTV10 140p AMSTRAD VCR1000, 2000, 4500, 4600, 4700, 5200, 6000, 6100, 6200, 8600, VCR8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9005, VCR9244, 9340, DD8900, 8904, TVR1, 2, 3, 4 140p VCR7000 140p DD8900, DD8904, VCR6000, 6100, 6200, 8600, 8602, 8603, 8604, VCR8700, 8800, 9000-9, 9140, 9244, 9340 PINCH ROLLER ASSEMBLY PART NO: 153148 TX3650, UF20, VCR3000, VCR3002, VCR4000, VCR9500 300p PINCH ROLLER ASSEMBLY PART NO: 2554966 DD9900, 9904, TX3650, UF20, 22, 24, VCR3000, 3002, 9500 140p VS1004 VS1104 140p FERGUSON 3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 140p 3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942 140p 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FV11, FV12, FV14, 8943, 8944, 8945, 8947, 8948 140p 3V52 8950, 8951, FV10B, 11R, 13R, 14T, 20B, 21R, 22L, 22L, 31R, 32L, FV33H, 39S, 41R, 42L, 50B, 51R, 52L, VC141L 140p FV37H, FV44L, FV46T, FV43H, FV57H 140p 3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944 1100p PINCH ROLLER ASSEMBLY 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947, 8948 1350p PINCH ROLLER ASSEMBLY FV37, FV57, FV58 350p PINCH ROLLER ASSEMBLY FV31R 140p FV41L, FV42L 925p PINCH ROLLER ASSEMBLY 3V58, 3V59, 3V64, 3V65, FV10, 11, 12, 13, 14, 20, 21, 22, 26, 30, 32, 33 FV39, VC141L 875p PINCH ROLLER ASSEMBLY FV43H, FV44L, FV45X, FV46T 140p PINCH ROLLER ASSEMBLY FV61, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77 775p PINCH ROLLER ASSEMBLY FISHER FVHP420, 520, 530 140p FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, FVHP810, 830, 840 140p FVHP905, 906, 907, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, FVHP 5000, 5005, 5050, 5075, 5100 140p VBR330, VBS3500, 7000, 7100, 7500, 7600 140p 9000, 9900 FVHP230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100, FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200, FVHP3200410, 420, 430, 440, 445, 470, 475, FVSP2905, 495, 2905 140p FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 140p FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 45, 47, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220, 225, 230, 235, 240, 245, 250, 255, 260, 400, 405, 410, 413, 414, 415, 416, 418, 420, 425 VT426, 428, 430, 431, 435, 438, 440, 498, 510, 515, 517, 518, 520, 525, VT526, 530, 535, 536, 540, 545, 546, 548, 570, 575, 576, 580, 585, 588 VT640, 830, VTF660, 665, 70, 770, 774, 775, 780, 785, 860, 861, 865, VTL30, 1000, 2000, VTLCS0, VTM598, 620, 622, 625, 626, 630, 635 VTM636, 640, 645, 646, 720, 722, 725, 726, 727, 728, 730, 731, 735, VTM736, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, VTM835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935, VTS80, 85, 890, 895V2000, 2300, 2380, 3200, 3280, 500, VMS7200 140p VT3000 140p VT410, 420, 428, 430, 450, 498, 518, 520, 522, 530, VTF770, 780, VTM598, 622, 722, 740, 748, 753 650p PINCH ROLLER ASSEMBLY VTF150, 155, 180, 185, 250, 255, 260, 265, 280, 285, 350, 351, 355, VTF360, 365, VTM140, 141, 145, 145, 210, 211, 212, 215, 220, V21 VTM230, 231, 235, 284, VTS390 140p HINARI V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90, H13V, VTV100 140p VXL2, VXL3 140p VXL4, VXL10, VXL35 140p VTV100, VXL10, VXL11, VXL9, VXL90 700p PINCH ROLLER ASSEMBLY V20H, VXL5, VXL6 MOD KIT 275p J.V.C. HR2200, 3300, 3330, 3360, 3660, 4100, 7700 140p HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655 140p HRD110, 111, 120, 121, 140, 141, 142, 143, 150, 152, 156, 157, 158, HRD160, 220, 225, 250, 257, 445, 555, 565, 566, 725, 755, HRP50, BP5000, BR7000, BR5611, 811 140p HRD520, 540, 550, 560, 580, 600, 610, 620, 637, 640, 641, 650, 660, HRD670, 720, 730, 740, 770, 820, 830, 840, 860, 870, 880, 910, 960, HRD980, HRDX20, 22, 25, HRJ200, 205, 210, 215, 300, 315, 316, 318 HRJ400, 405, 407, 410, 411, 415, 416, 507, 600, 605, 610, 615, 715, 815 HRJ97, HRS4700, 5800, 5900, 6800, 6900, SR200 140p HRD170, 171, 180, 210, 211, 217, 230, 300, 320, 321, 330, 337, 350 HRD370, 400, 430, 440, 441, 470, 500, 530, 700, 750, 950, HRS5000, 5500, 8000, 9000, BR7030, 7040, 9060, 140p BRS600, 605, 747, 777, 920, 925 HRS10 140p BP5000, HRD110, 111, 120, 220, 225, 455 1100p PINCH ROLLER ASSEMBLY HRD140, 141, 142, 143, 150, 152, 157, 158, 160, 565, 566, 725, 755, HRP50 1350p PINCH ROLLER ASSEMBLY HRD1520, 510, 520, 521, 522, 525, 527, 560, 600, 610, 620, 637, 641, HRD650, 720, 830, 840, 910, HRJ205, HRS5800 350p PINCH ROLLER ASSEMBLY BR7030, BRS600, HRD160, 170, 171, 180, 190, 210, 211, 217, 227, HRD230, 271, 300, 310, 320, 321, 330, 337, 350, 400, 430, 440, 441, HRD470, 500, 530, 700, 750, 950, HRS5000, 5500, 9000 875p PINCH ROLLER ASSEMBLY HRD540, HRD550, HRD580, HRD660, HRD860, HRD980 700p PINCH ROLLER ASSEMBLY HRJ600, HRJ605, HRJ815, HRS9200 875p MATSU VX6000, VX7, 735, 750, 755, 765, 800, 850, VS888 140p VX1000, VX2000, VX2500, VX3000, VX6000A 140p MITSUBISHI HS12, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSE12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 82 HS11000, 110, 120, 15 0, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35, 36, 37, 370, 380, 45, 450, 5 4, 55, 555, 57, 58, 59, HSM2, 9, HSS11, 1, 15, 17, 19, 25, 5600, HV F125, 150, 303, 85, SV8900, 8930 750p PINCH ROLLER ASSEMBLY PART NO: 948D020010 HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30, 33, 34, 35, 36, 37, 370, 38, HSM380, 40, 45, 450, 50, 54, 55, 555, 57, 58, 59, 60, 68, HSM52, 9, HSMX1, 18, 19, 2, HSS11, 12, 14, 15, 16, 17, 21, 25, 5600, HVF125, HVF150, 303, 85, SV8900, 8930 140p HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS360, HS370 140p HS306, HS307, HS318, HS319, HS337, HS338, HS347, HS349, HS400, HS410, HS411, HS412, HS421, HS480, HS710, HSB 10, HSB20, 30, HSE 10, 20, 30, 70 140p NATIONAL PANASONIC NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 789, 3321, AG6010, 6015, 6100, 6200, 6400, 6800, 7450 140p NV230, 250, 260, 280, 370, 380, 430, 431, 433, 450, 460, 465, 470, 480 NV630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2100, 3000, NV7000, 7200, 7800, 8050, 8150, 8170, 8200, 8300, 8400, 8500, 8600 NV8610, 8620, NVG11, 14, 16, NVG7, 10, 12, 15, 18, 30, 130, 400, AG 1000, 1050, 1200, 1500, 2100, 2200, 6500, 6800, 7500, 7510 140p NVH70 140p NVG9, NVG120 140p AG6840, 6720, 7150, 7330, 7350, 7395, 7650, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVH65, NVF70, NVF51, NVF5 100, NVG 19, 20, 25, 33, 40, 50, NVV8000 140p NVV48, NVV80, NVG21, NVG45 140p NVJ700PX 140p NVHD100, NVHD101, NCHD90, NVSD30, NVSD40 1125p PINCH ROLLER ASSEMBLY AG1550, 5250, 5700, 6024, NVJ38, 48, 80, NVF55, 65, 70, 88, 90, NVG 19, 20, 21, 22, 25, 28, 300, 33, 40, 45, 46, NVG50, NVH65, 75, 77, NVJ30, 33, 35, 37, 40, 42, 45, 47, NVL20, 23, 25, 28, NVV 1 PINCH ROLLER ASSEMBLY N.E.C. N830, 831, 832, 833, 895 PVC2300, 2400, 740, 744, 746, 760, 764, 765 140p DX1000, 1600, 1800, 2000, 3000, N9012, 9013, 9014, 9016, 9033 N9034, 9053, 9054, 9055, 9056, 9066, 9096, 9106, 9110, 9510, 9520, N9530, 9610, PX1200 140p DS6000G, DX4000, N9077 NS7000 140p ORION VH1, VH2 140p VC150, 180, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 1000, 2848, 3030, 3312 VHF2A, VP2948 140p COMB 15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML, TVPM230RC, VCP, VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790 VH800, 200, 850, 888, 893, 900, 930, 940, 942, 974, 1012, 1040, 1050, VH1060, 1070, VH1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4300, 5020, VP 10, 200, 220, 225, 245, VBR21, 925, 1032, 2849, 2959, 2957, 2966, 2979, 2980, VTV3000, VXL20, 25, 30 140p PHILIPS VR6460 VR6920 140p VR2020, VR2021, VR2022, VR2023, VR2024 140p VR6711 140p DV856, 586, VR702, 703, 6485, 6585, 6589, 6785, 6880, 6948 VR45, VR642, VR6542, VR6643, VR6843, VR6943, 44589 140p DV464, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, NVR660, 6860, 6861, 6862, 6863 140p N-170, VR2870 140p VR2025, VR6580, VR6581 140p 49586, VR3260, 6349, 6448, 6449, 6548, 6648 140p PRESSURE ROLLER ASSEMBLY PS403-40205 DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 535B0, 486, 471, 562, 582, 571, 761, VR201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, VVR291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561 VR6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970, VR6975, 8681, 635B7, 685B4, 715B4, 715B5, 725B8, 725B8, 925B31, 20DV1, 20DV2, 20VR77, 21DV1, 21DV2, 25B01, 25B02, 25B11, 25B12, 30DV2, 31DV1, 31DV2, 31DV33S802, 35803, 35B05 35B11 35B12 35B13 280p VR231, 232, 332, 422, 4229, 512, 5229, 722, 7229, 723 140p VR501 PR38 140p SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2700, 2500, VHR2700, 3330, MVR220 140p VTC5000, 5150, 5300, 5350, 5400, 5500, 6000, 6010, 6500, 9100, VTC9300, VTCM10, 20, 11, 21, 30, 31, 40, 50, VPR5800 140p VHR3100, 3300, 3310, 3400, 3500, 3700, 3800, VHRD500, 700 140p VTC3000 140p VHR120, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, 194, 22 VHR232, 235, 240, 244, 250, 251, 271, 27, 297, 310, 330, 335, 350, 390, VHR4100, 4105, 4150, 4200, 430, 4300, 4350, 4400, 474, 4770, 5080, VHR1500, 5200, 5300, 5350, 5600, 5700, 6850, 7100, 7200, 7250, VHR7260, 7300, 7400, 7440, 7500, 7520, 7530, 7540, 7700, 774, 780, 8000 VHR7810, 8000, 8070, 8100, 8200, 8250, 8500, 8800, VHRD400, 4410, 4500, 4600, 4610, 4710, 4890, 6700, VHR5700 140p VCR100 140p VHR120, 135, 150, 190, 4150, 4160, 4350, 5200, 5240, 5350, 7200, 7250, 7260, 7700, VHRD4410, 4610, 4710, 4890, 5450, VHR90 975p PINCH ROLLER ASSEMBLY VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 1350p PINCH ROLLER ASSEMBLY SHARP VC200, 381, 383, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000, VC6200, 6300, 7300, 7700, 7750, 7800, 8300, 838, 9100, 9300, 9400, VC9500, 9600, 9700, 9800 140p VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571, 573, 581, 582, 583, 584, 585, 8481, VCF5F3, VCSV20E, VCA1031 140p VC108, 208, 405, 408, 550, 600, 651, 671, 674, 681, 682, 684, 685, 693, VC699, 700, 772, 750, 770, 779, 780, 781, 7810, 782, 782MK2, 7822, 783, VCT785, 786, 793, 800, 7810, 7822, VCT72, VCF63, VCV63, VCA 100, 102, 104, 132, 140, 170, 202, 203, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCR361 140p VCA20 140p VCA10 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCS597, VCD805, 806, 810, 815, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90 140p VCR790, VCA10, 103, 1031, 105, 106, 211, 244, 254, 250, 30, 35, VCA300, 43, 47, 50, 60, 605, 615, VCD806, 815, VCH80, 81, 83, 85, VCH865, 87, 910, VCS 1000, VCT212, 310, 410, 510, 610, VCT1314, VCT313 525p PINCH ROLLER ASSEMBLY SAISHO VHL3, VR1000, 2000, 2500, 3200, 3300, 3500, 3600, 3650, 3800, VRS4400, VRS5000 140p VR3400 140p SAMSUNG SV716, 717, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 900,							

MODE SWITCH

NV2000, 2010, 7000, 7200, 7800 (VSS0048)	
NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110)	£3.50
NV830 (VSS0091)	£2.25
NV300, 333, 340, 366, 688, 777, 778 (VSS0060)	£2.10
NVG21, 25, NVH65, NVD80 (VSS0175A)	£3.75
	£2.00

AUDIO CONTROL HEADS

AMSTRAD ORIGINAL NO: 150751
 Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000
 Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM
ORDER CODE: AH01 PRICE: 1350p

AMSTRAD ORIGINAL NO: 153134
 Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244
 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD-HAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEIDER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM
ORDER CODE: AH02 PRICE: 1450p

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NV67 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875p
VBR0103A	NV250, NV450 etc	625p
VBR0125		625p

VIDEO TOOLS

VIDEO CLEANING STICKS

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

VIDEO MAINTENANCE TOOLS

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

UNIVERSAL HEAD EXTRACTOR

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

VCR ALIGNMENT KIT

CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS

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

3 REVERSIBLE SCREWDRIVERS
SPRING HOOK

SET OF 8 ALLEN KEYS

0.77mm	0.90mm
1.27mm	1.50mm
1.60mm	2.00mm
2.40mm	3.00mm

CIRCLIP PLIERS
MICRO SCREWDRIVER
VCR HEAD EXTRACTOR
Order code: TOOL 10, Price 2900p

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

This transparent videocassette replaces a normal videotape during measurements, adjustments and inspection. The mechanical parts come into sight and become accessible.

Order code: TOOL 23, Price 500p

BACK UP BATTERIES

PHILIPS

Part Nos: 138 - 101138, 138 - 10313 1.2v 90mA
 Order Code: BB01
 Part Nos: 138 - 10229, 2.4v 100mA
 Order Code: BB02

Price: 70p

Price: 135p

FERGUSON

Part No: 00E6 - 067 - 001 1.2V 100mA
 Order Code: BB03
 Part Nos: 00E6 - 606 - 8001 2.4V 100mA
 Order Code: BB04

Price: 90p

Price: 150p

SATELLITE PSU REPAIR KITS

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

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

SATELLITE TUNERS

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

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

SWITCH MODE TRANSFORMERS

PACE 9000
 ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900
 ORDER CODE: PRD800 PRICE: 550p

SATMETER

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

Through operation with satellite RX powering the LNB.

* Acoustical signal: On signal strength *LED indicator: Vert/Hori

* Frequency Range: 900 to 2050 Mhz *Input impedance: 70 Ohm

* Power amplifier: 18db *Detection Range: -60 to -10 DBM

* Max. input signal: -10 DBM

ORDER CODE: TOOL22

PRICE: 8500p

REPLACEMENT TV SWITCHES

GRUNDIG

PART No: 29703, 29102
 USED ON:
 C7500, C8500, C8502, C8712 . . . ETC
 Order Code: SW1 Price: 100p

PHILIPS

USED ON:
 K30, K35, K40, KT3, KT4
 Order Code: SW13 Price: 95p

SONY

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

USED ON:
 KV1400, KV1440, KV2040, KV2060
 (POWER SWITCH 26mm)
 Order Code: SW12 Price: 110p

SONY

USED ON:
 KV2020
 (POWER SWITCH 21mm +Remote)
 Order Code: SW6 Price: 130p

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9 Price: 35p

FUSES

CURRENT RATING	TIME LAG (20mm)		QUICK BLOW (20mm)	
	ORDER CODE	PRICE	ORDER CODE	PRICE
100mA	FUSE36	75p	FUSE37	60p
160mA	FUSE01	75p	FUSE17	60p
250mA	FUSE02	75p	FUSE18	60p
315mA	FUSE03	75p	FUSE19	60p
400mA	FUSE04	75p	FUSE20	60p
500mA	FUSE05	75p	FUSE21	60p
630mA	FUSE06	75p	FUSE22	60p
800mA	FUSE07	60p	FUSE23	60p
1A	FUSE08	60p	FUSE24	60p
1.25A	FUSE09	60p	FUSE25	60p
1.6A	FUSE10	60p	FUSE26	60p
2A	FUSE11	50p	FUSE27	60p
2.5A	FUSE12	50p	FUSE28	60p
3.15A	FUSE13	55p	FUSE29	50p
4A	FUSE14	55p	FUSE30	50p
5A	FUSE15	60p	FUSE31	50p
6.3A	FUSE16	60p	FUSE32	50p

CERAMIC PLUG TOP

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

32 mm CERAMIC SLOW BLOW

CURRENT RATING	ORDER CODE	PRICE
8A	FUSE44	185p
10A	FUSE45	185p
15A	FUSE46	185p
20A	FUSE47	210p

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

20mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
6.3A	FUSE38	100p
8A	FUSE39	100p
10A	FUSE40	100p
3.15A	FUSE41	85p
4A	FUSE42	85p
5A	FUSE43	85p

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

** ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES **

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Euroslot

ORDER CODE: TOOL11

PRICE: 220p

SPRING HOOK

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

ORDER CODE: TOOL20

PRICE: 265p

FAULT FINDING / COMPARISON BOOKS

Satellite Fault Finding Guide Issue 1.
Listing about 1,000 faults for over a range of 24 different brands.

Order Code: BOOK05.

Price £8.50 - No VAT.

TELEVISION

Edition 7

This new A5 size guide lists more than 9600 faults and is approx. 480 pages in size.

Price: 1650p only - no VAT (+ £2 Postage)

Order Code: BOOK02

SEMICONDUCTOR COMPARISONS 1998/99

With over 650 pages listing more than 34,200

Semiconductors with suitable alternatives complete with descriptions and base information.

Price: 1900p only - No VAT (+ £2 Postage).

Order Code: BOOK04

Satellite Repair Manual Edition 4

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

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

SEMICONDUCTOR COMPARISONS 1998/99

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

Price: £47.00 only - No VAT (+ £5 Postage).

Order Code: BOOK06

Video Recorders Edition 5 1997

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

Price £15.00 - No VAT. Order Code: BOOK01

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

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15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
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SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	S109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
DESOLDERING AIDS		
SOLDER MOP STANDARD GAUGE 1.2MM X 1.5M	S107	100p
SOLDER MOP 1.2MM X 10M	S113	420p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p

I.C. PROTECTORS

ICPF10, ICPF15, ICPF20,
ICPF25, ICPF38, ICPF50,
ICPF75

ICPN5, ICPN10, ICPN15,
ICPN20, ICPN25, ICPN 38,
ICPN50, ICPN75

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MONO HEAD	90p
STEREO HEAD	110p
MINI HEAD	150p
AUTO REVERSE HEAD	200p

CD PICK UPS

Models & Description	Order Code	Price
AIWA		
XC007	KSS151A	1900p
DX-990A, DX-DIA	KSS152A	1600p
CX160, CX166G, CX180, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN540, CXN550G, CXN990, CXN999, CXNV20, CXSL70, DXZ9100M, FDN636, FDN6636, FON993, LCX60, LCX66G, LCX70M, LCX80, M7400, M75, NSX320, NSX360, NSX400, NSX430, NSX990, NSX992, NSX999, NSXD638, NSXD939, NSXV20, SXPNS50, SXPNS520, XC300, XC350, XC750, XC900, XC950, XC990, XG320, XG360, XG400, XG990, ZD3000M, ZD3100M, CXAP1, CX17, CX18G, CXLC50P, CXZ58, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX85, LCXAP1, XC002, XC004, XC005, XC777	KSS152A	1600p
XP31, XP33, XP55, XP90G, XP6, XP7	KSS210B	2000p
	KSS220A	2500p
	KSS331A	3400p
AKAI		
CD73, DC93	KSS151A	1900p
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79, CDM480, CDM600, CDM670, CDEM770, CDM959, MX550, MX750, MX650, MX670, MX750, MX950	KSS210A	1300p
DENON		
DCD1500L, DCD1520, DCD3E320	KSS151A	1900p
DCD1400, DCD600, DCD800	KL152A	1600p
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KSS210A	1300p
DCD1015, DCD1290, DCD2060, DCD2066G, DCD315, DCD480, DCD580, DCD615, DCD715, DCD825, DCD890, DCD895, DN2000F	KSS240A	2000p
GOLDSTAR		
CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222AL, FFH272L, FFH333L, FFH373K, FJ605, FR606L	KSS210A	1300p
CD320AL, CD3630S/L, FFH212AL, FFH212E	KSS210B	2000p
GRUNDIG		
CD360, CD435	HOPM3	2150p
CD300, CD101MCD904, MC10, NEW ORLEANS CD	KSS210A	1300p
KRCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS210B	2000p
CDP60, CDP90	KSS220A	2500p
CDP65	KSS331A	3400p
CD95	OPTIMA5	1600p
HITACHI		
OA5W50	HOPM3	2150p
FX-10	KSS210A	1300p
AXC10	KSS210B	2000p
J.V.C.		
1990-1992, LATE 1987-1988 - XLE300BK, XLE318K, XLE518K, XLE900BK, XLME918K, XLV101BK, XLV211BK, XLV222BK, XLV311BK, XLV333BK, XZ1010TN, XLZ411BK, XLZ444BK, XLZ555BK, XLZ611BK, CD-RADIO CASSETTE, MINI SYSTEMS - MODELS 1990-1992	OPTIMA3	4000p
CA-C33, CA-MX300K, CA-MX330K, UX-A5, UX-A6, XL-M309, XL-M403BK, XL-M408, XL-M409, XL-M504BK, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V131BK, XL-V151TN, XL-V221BK, XL-V241TN, XL-V242BK, XL-V251TN, XL-V252BK, XL-V260TN, XL-Z551TN, XL-Z552BK	OPTIMA5	1600p
1994 ONWARD - CAE48BK, CAM657, CAMXG5, CAS20BK, CAS30BK, VAS50, CAS60RKB, MX520, MX530, MX560, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620, RCX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216, XLMC100M, XLMXG7, XLMXG8, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK, XLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XT560	OPTIMA6S	1600p
KENWOOD		
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DP1030, DP1510, DP2010, DP2030, DP3010, DP3050, DP4030, DP451, DP5010, DP5030, DP5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650, DPM6630, DPM7730, DPM850, DPM991, DX6620, M225, M245, M450, M850, PD3030, PDM991, RDX25, RXDC3, RXDC3L, UD202, UD302	KSS210A	1300p
DPC42, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p
OP1650, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DPB9, M77A, PD3060, UD502, UD70, UD701, UD90, XE5	KSS240A	2000p
DPC321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS331A	3400p
DP1060, DP2060, PART No. RCTRHB136AFZZ	RH8136A	4500p
PANASONIC		
SLP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A, SLP6100A, SLP6200A, SLP6400A, SLP6500AK, SLP6500AS, SLPJ24A, SLPJ26A, SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	5500p

Models & Description	Order Code	Price
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PHILIPS		
AZ8304, CD070, CD080, 690, 910, 920, PART No. 4822-691-20768	4822-691	3100p
CD100, CD130, CD1380, CD1482, CD200, CD204, CD210, CD300, CD303, CD304, CD380, CD480, CD482, CD500, CD502, CD582, CD583, CD584, CD610, CD620, CD630, CD780, CD781, CD782, CD840, CD853, CD960, CDFA, CDMA419, CD1185	691-30209	5500p
AS440, AS445, AS440, AS440, AZ8048, AZ8640, CD070, CD080, CD091, CD163, CD165, CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD925, FW17, FW21, FW26, FW330, FW36, FW360, FW400, FW401, FW46, FW56, FW66, FW68	CDM12.1	1800p
CD121040	CDM12.4	2200p
AZ806	KSS210B	2000p
FW11	OPTIMA6S	1600p
PIONEER		
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N32, N90M, PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65, PD6500, PD6700, PD7700, PD8700, PD9700, PDCP420, PDCP520M, PDCP520T, PDJ400T, PDJ500T, PDJ800M, PDJ900M, PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP110T, PDP270T, PDP310M, PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDS101, PDS110, PDS120, PDS130, PDS140, PDS150, PDS160, PDS170, PDS180, PDS190, PDS200, PDS210, PDS220, PDS230, PDS240, PDS250, PDS260, PDS270, PDS280, PDS290, PDS300, PDS310, PDS320, PDS330, PDS340, PDS350, PDS360, PDS370, PDS380, PDS390, PDS400, PDS410, PDS420, PDS430, PDS440, PDS450, PDS460, PDS470, PDS480, PDS490, PDS500, PDS510, PDS520, PDS530, PDS540, PDS550, PDS560, PDS570, PDS580, PDS590, PDS600, PDS610, PDS620, PDS630, PDS640, PDS650, PDS660, PDS670, PDS680, PDS690, PDS700, PDS710, PDS720, PDS730, PDS740, PDS750, PDS760, PDS770, PDS780, PDS790, PDS800, PDS810, PDS820, PDS830, PDS840, PDS850, PDS860, PDS870, PDS880, PDS890, PDS900, PDS910, PDS920, PDS930, PDS940, PDS950, 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PDS2070, PDS2080, PDS2090, PDS2100, PDS2110, PDS2120, PDS2130, PDS2140, PDS2150, PDS2160, PDS2170, PDS2180, PDS2190, PDS2200, PDS2210, PDS2220, PDS2230, PDS2240, PDS2250, PDS2260, PDS2270, PDS2280, PDS2290, PDS2300, PDS2310, PDS2320, PDS2330, PDS2340, PDS2350, PDS2360, PDS2370, PDS2380, PDS2390, PDS2400, PDS2410, PDS2420, PDS2430, PDS2440, PDS2450, PDS2460, PDS2470, PDS2480, PDS2490, PDS2500, PDS2510, PDS2520, PDS2530, PDS2540, PDS2550, PDS2560, PDS2570, PDS2580, PDS2590, PDS2600, PDS2610, PDS2620, PDS2630, PDS2640, PDS2650, PDS2660, PDS2670, PDS2680, PDS2690, PDS2700, PDS2710, PDS2720, PDS2730, PDS2740, PDS2750, PDS2760, PDS2770, PDS2780, PDS2790, PDS2800, PDS2810, PDS2820, PDS2830, PDS2840, PDS2850, PDS2860, PDS2870, PDS2880, PDS2890, PDS2900, PDS2910, PDS2920, PDS2930, PDS2940, PDS2950, PDS2960, PDS2970, PDS2980, PDS2990, PDS3000, PDS3010, PDS3020, PDS3030, PDS3040, PDS3050, PDS3060, PDS3070, PDS3080, PDS3090, PDS3100, PDS3110, PDS3120, PDS3130, PDS3140, PDS3150, PDS3160, PDS3170, PDS3180, PDS3190, PDS3200, PDS3210, PDS3220, PDS3230, PDS3240, PDS3250, PDS3260, PDS3270, PDS3280, PDS3290, PDS3300, PDS3310, PDS3320, PDS3330, PDS3340, PDS3350, PDS3360, PDS3370, PDS3380, PDS3390, PDS3400, PDS3410, PDS3420, PDS3430, PDS3440, PDS3450, PDS3460, PDS3470, PDS3480, PDS3490, PDS3500, PDS3510, PDS3520, PDS3530, PDS3540, PDS3550, PDS3560, PDS3570, PDS3580, PDS3590, PDS3600, PDS3610, PDS3620, PDS3630, PDS3640, PDS3650, PDS3660, PDS3670, PDS3680, PDS3690, PDS3700, PDS3710, PDS3720, PDS3730, PDS3740, PDS3750, PDS3760, PDS3770, PDS3780, PDS3790, PDS3800, PDS3810, PDS3820, PDS3830, PDS3840, PDS3850, PDS3860, PDS3870, PDS3880, PDS3890, PDS3900, PDS3910, PDS3920, PDS3930, PDS3940, PDS3950, PDS3960, PDS3970, PDS3980, PDS3990, PDS4000, PDS4010, PDS4020, PDS4030, PDS4040, PDS4050, PDS4060, PDS4070, PDS4080, PDS4090, PDS4100, PDS4110, PDS4120, PDS4130, PDS4140, PDS4150, PDS4160, PDS4170, PDS4180, PDS4190, PDS4200, PDS4210, PDS4220, PDS4230, PDS4240, PDS4250, PDS4260, PDS4270, PDS4280, PDS4290, PDS4300, PDS4310, PDS4320, PDS4330, PDS4340, PDS4350, PDS4360, PDS4370, PDS4380, PDS4390, PDS4400, PDS4410, PDS4420, PDS4430, PDS4440, PDS4450, PDS4460, PDS4470, PDS4480, PDS4490, PDS4500, PDS4510, PDS4520, PDS4530, PDS4540, PDS4550, PDS4560, PDS4570, PDS4580, PDS4590, PDS4600, PDS4610, PDS4620, PDS4630, PDS4640, PDS4650, PDS4660, PDS4670, PDS4680, PDS4690, PDS4700, PDS4710, PDS4720, PDS4730, PDS4740, PDS4750, PDS4760, PDS4770, PDS4780, PDS4790, PDS4800, PDS4810, PDS4820, PDS4830, PDS4840, PDS4850, PDS4860, PDS4870, PDS4880, PDS4890, PDS4900, PDS4910, PDS4920, PDS4930, PDS4940, PDS4950, PDS4960, PDS4970, PDS4980, PDS4990, PDS5000, PDS5010, PDS5020, PDS5030, PDS5040, PDS5050, PDS5060, PDS5070, PDS5080, PDS5090, PDS5100, PDS5110, PDS5120, PDS5130, PDS5140, PDS5150, PDS5160, PDS5170, PDS5180, PDS5190, PDS5200, PDS5210, PDS5220, PDS5230, PDS5240, PDS5250, PDS5260, PDS5270, PDS5280, PDS5290, PDS5300, PDS5310, PDS5320, PDS5330, PDS5340, PDS5350, PDS5360, PDS5370, PDS5380, PDS5390, PDS5400, PDS5410, PDS5420, PDS5430, PDS5440, PDS5450, PDS5460, PDS5470, PDS5480, PDS5490, PDS5500, PDS5510, PDS5520, PDS5530, PDS5540, PDS5550, PDS5560, PDS5570, PDS5580, PDS5590, PDS5600, PDS5610, PDS5620, PDS5630, PDS5640, PDS5650, PDS5660, PDS5670, PDS5680, PDS5690, PDS5700, PDS5710, PDS5720, PDS5730, PDS5740, PDS5750, PDS5760, PDS5770, PDS5780, PDS5790, PDS5800, PDS5810, PDS5820, PDS5830, PDS5840, PDS5850, PDS5860, PDS5870, PDS5880, PDS5890, PDS5900, PDS5910, PDS5920, PDS5930, PDS5940, PDS5950, PDS5960, PDS5970, PDS5980, PDS5990, PDS6000, PDS6010, PDS6020, PDS6030, PDS6040, PDS6050, PDS6060, PDS6070, PDS6080, PDS6090, PDS6100, PDS6110, PDS6120, PDS6130, PDS6140, PDS6150, PDS6160, PDS6170, PDS6180, PDS6190, PDS6200, PDS6210, PDS6220, PDS6230, PDS6240, PDS6250, PDS6260, PDS6270, PDS6280, PDS6290, PDS6300, PDS6310, PDS6320, PDS6330, PDS6340, PDS6350, PDS6360, PDS6370, PDS6380, PDS6390, PDS6400, PDS6410, PDS6420, PDS6430, PDS6440, PDS6450, PDS6460, PDS6470, PDS6480, PDS6490, PDS6500, 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REPLACEMENT LINE OUTPUT TRANSFORMERS

Part No.	Code	Price	HITACHI	LOT44	1050p	4515 01 19	LOT169	1500p	TLF 14520 F	LOT40	1500p	094-01020/0.7	LOT59	1400p	1-439-303-31	LOT94	1300p
AKAI			2424593	LOT44	1050p	4515 01 24	LOT137	1600p	TLF 14521 F	LOT39	1850p	094-01021/0.6	LOT59	1400p	1-439-303-32	LOT94	1300p
45150344	LOT56	1650p	2432101	LOT79	1600p	4515 01 46	LOT136	1600p	TLF 14567 F	LOT39	1850p	094-01027/0.0	LOT186	1825p	1-439-311-00	LOT95	1550p
101-214017-03	LOT278	1300p	2432461	LOT169	1500p	4515 03 01	LOT169	1500p	TLF 14568 F	LOT40	1500p	094-01038/0.7	LOT245	1900p	1-439-311-11	LOT95	1550p
101-220005-03A	LOT72	1600p	2432611	LOT80	1800p	4515 03 02	LOT180	1500p	TLF 14584 F	LOT41	1700p	094-01052/0.8	LOT186	1825p	1-439-311-11	LOT95	1550p
D 050/37	LOT27	1450p	2432651	LOT80	1800p	4515 03 04	LOT169	1500p	TLF 14586 F	LOT42	1700p	094-01057/1.1	LOT285	1450p	1-439-311-31	LOT95	1550p
D 053/37	LOT207	1550p	2432761	LOT169	1500p	4515 03 05	LOT180	1550p	TLF 15608 F	LOT256	2000p	610.018.6620	LOT189	1850p	1-439-311-32	LOT95	1550p
D 056/37	LOT207	1550p	2432811	LOT37	1200p	4515 03 06	LOT168	1500p	TLF 70012	LOT78	1500p	610.018.6637	LOT215	1800p	1-439-331-22	LOT96	1550p
D 059/37	LOT200	1400p	2432861	LOT37	1200p	4515 03 08	LOT22	1250p	TLF 70012 F	LOT78	1500p	SHARP			1-439-331-41	LOT98	1500p
D 069/37	LOT56	1650p	2432881	LOT37	1200p	4515 03 09	LOT178	1500p	TLF 70012A	LOT78	1500p	RTRNF 1220 CEZZ	LOT39	1850p	1-439-332-00	LOT99	1600p
FCM 2015 AL	LOT78	1500p	2433011	LOT171	1600p	4515 03 10	LOT168	1500p	TLF 70018	LOT274	1550p	RTRNF 1783 BMZZ	LOT202	1600p	1-439-331-00	LOT99	1600p
FERGUSON			2433012	LOT171	1600p	4515 03 13	LOT30	1250p	TLF 70018 F	LOT274	1550p	RTRNF 1783 CEZZ	LOT202	1600p	1-439-332-21	LOT99	1600p
00 D-3-508-001	LOT38	1250p	2433013	LOT169	1500p	4515 03 14	LOT174	1400p	TLF 70161	LOT278	1300p	RTRNF 1786 BMZZ	LOT211	1850p	1-439-332-41	LOT100	1500p
00 D-3-508-002	LOT38	1250p	2433014	LOT169	1500p	4515 03 15	LOT30	1250p	TLF 70162	LOT72	1600p	RTRNF 1786 CEZZ	LOT211	1850p	1-439-332-52	LOT101	1450p
00 D-3-508-003	LOT276	1400p	2433015	LOT172	1350p	4515 03 18	LOT192	1250p	TLF 70162B	LOT72	1600p	RTRNF 2000 BMZZ	LOT214	1600p	1-439-332-52	LOT100	1500p
00 D-3-515-001 PL1	LOT276	1400p	2433016	LOT189	1900p	4515 03 19	LOT190	1650p	TLF 70162B	LOT72	1600p	RTRNF 2002 BMZZ	LOT307	1450p	1-439-333-00	LOT270	1550p
00 D-4-208-001	LOT79	1600p	2433017	LOT189	1900p	4515 03 20	LOT190	1650p	TLF 70162B	LOT72	1600p	RTRNF 2003 BMZZ	LOT307	1450p	1-439-333-11	LOT270	1550p
00 D-4-208-002	LOT79	1600p	2433018	LOT191	1800p	4515 03 22	LOT196	1550p	TLF 77001 B	LOT274	1550p	RTRNF 2003 BMZZ	LOT308	1350p	1-439-363-11	LOT268	1400p
00 D-4-208-002	LOT79	1600p	2433019	LOT181	1350p	4515 03 24	LOT194	1550p	PHILIPS			RTRNF 2006 BMZZ	LOT308	1350p	1-439-363-21	LOT268	1400p
00 D-4-208-002	LOT79	1600p	2433020	LOT81	1350p	4515 03 25	LOT22	1250p	4822 140 10142	LOT142	1800p	RTRNF 2006 BMZZ	LOT308	1350p	1-439-387-11	LOT311	1450p
00 D-4-235-002 HTI	LOT81	1350p	2433452	LOT82	1250p	4515 03 26	LOT198	1550p	4822 140 10145	LOT134	1450p	RTRNF 2006 BMZZ	LOT308	1350p	1-439-387-21	LOT311	1450p
00 D-4-235-00201G	LOT81	1350p	2433453	LOT234	1600p	4515 03 28	LOT27	1450p	4822 140 10146	LOT112	1700p	RTRNF 2023 BMZZ	LOT310	1500p	1-439-416-11	LOT255	1600p
00 D-4-260-004 HTI	LOT38	1250p	2433454	LOT85	1600p	4515 03 29	LOT193	1550p	4822 140 10151	LOT102	1700p				1-439-416-12	LOT255	1600p
00 H-6-701-2400	LOT182	1450p	2433521	LOT85	1600p	4515 03 30	LOT179	1350p	4822 140 10161	LOT103	1250p	SONY			3753100	LOT275	1500p
06 D-3-083-001	LOT82	1250p	2433522	LOT22	1250p	4515 03 31	LOT207	1550p	4822 140 10171	LOT104	1500p	1-439-243-00	LOT91	1600p	1-439-416-21	LOT255	1600p
06 D-3-083-002	LOT82	1250p	2433523	LOT83	1400p	4515 03 32	LOT207	1550p	4822 140 10176	LOT114	1150p	1-439-243-11	LOT91	1600p	1-439-416-21	LOT255	1600p
06 D-3-084-001	LOT23	1400p	2433751	LOT01	1300p	4515 03 34	LOT56	1600p	4822 140 10194	LOT105	1500p	1-439-243-12	LOT91	1600p	1-439-416-21	LOT255	1600p
06 D-3-087-001	LOT23	1400p	2433752	LOT250	1350p	4515 03 35	LOT193	1550p	4822 140 10198	LOT116	1600p	1-439-243-13	LOT91	1600p	1-439-416-51	LOT255	1600p
06 D-3-088-001	LOT84	1450p	2433753	LOT23	1400p	4515 03 38	LOT27	1450p	4822 140 10201	LOT104	1500p	1-439-243-32	LOT229	1700p	1-439-416-51	LOT271	1550p
06 D-3-083-001	LOT204	1600p	2433891	LOT84	1450p	4515 03 40	LOT200	1400p	4822 140 10206	LOT118	1550p	1-439-243-41	LOT229	1700p	154125A	LOT275	1550p
06 D-3-095-001	LOT87	1000p	2433892	LOT84	1450p	4515 03 41	LOT56	1600p	4822 140 10236	LOT118	1550p	1-439-244-00	LOT48	1600p	37010	LOT131	1450p
06 D-3-095-002	LOT87	1000p	2433893	LOT23	1400p	4515 03 43	LOT56	1600p	4822 140 10246	LOT111	1500p	1-439-244-11	LOT48	1600p	37011	LOT131	1450p
06 D-3-095-001	LOT87	1000p	2433894	LOT23	1400p	4515 03 44	LOT56	1600p	4822 140 10247	LOT105	1500p	1-439-244-21	LOT48	1600p	37012	LOT131	1450p
06 D-3-095-002	LOT87	1000p	2433895	LOT23	1400p	4515 03 45	LOT56	1600p	4822 140 10254	LOT107	1450p	1-439-244-31	LOT48	1600p	37013	LOT131	1450p
06 D-333-512-001	LOT204	1600p	2434141	LOT33	1000p	4515 03 50	LOT27	1450p	4822 140 10263	LOT117	1550p	1-439-256-00	LOT45	1650p	37014	LOT131	1450p
FETX 100 90 DEGE	LOT04	1500p	2434142	LOT33	1000p	4515 03 51	LOT27	1450p	4822 140 10269	LOT210	1350p	1-439-256-11	LOT45	1650p	37015	LOT131	1450p
FETX 90 WHITE	LOT06	1650p	2434143	LOT44	1050p	4515 03 75	LOT56	1650p	4822 140 10271	LOT208	1650p	1-439-256-21	LOT45	1650p	37016	LOT131	1450p
FETX 100 100 DEG	LOT34	1500p	2434274	LOT44	1050p	4516 16 01	LOT22	1250p	4822 140 10274	LOT123	1450p	1-439-256-22	LOT45	1650p	37017	LOT131	1450p
GRUNDIG			2434453	LOT86	1600p	MITSUBISHI			4822 140 10282	LOT122	1300p	1-439-256-22	LOT45	1650p	37018	LOT131	1450p
29201.008.01	LOT163	1750p	2434454	LOT234	1600p	731003	LOT51	1550p	4822 140 10283	LOT104	1500p	1-439-256-22	LOT45	1650p	37019	LOT131	1450p
29201.014.01	LOT140	1500p	2434455	LOT44	1050p	276-16399	LOT49	1500p	4822 140 10294	LOT125	2150p	1-439-280-00	LOT92	1600p	1810951	LOT55	1400p
29201.015.01	LOT149	1400p	2434553	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10306	LOT110	1200p	1-439-280-13	LOT92	1600p	2433751	LOT01	1300p
29201.017.01	LOT60	1250p	2434554	LOT296	950p	334 B 08104	LOT74	1600p	4822 140 10325	LOT132	1500p	1-439-280-13	LOT92	1600p	2433752	LOT01	1300p
29201.018.01	LOT163	1300p	2434555	LOT251	1450p	334 B 08104	LOT74	1600p	4822 140 10326	LOT122	1300p	1-439-280-13	LOT92	1600p	2433753	LOT01	1300p
29201.018.02	LOT61	1700p	2435121	LOT251	1450p	334 P 18506	LOT51	1550p	4822 140 10327	LOT124	1450p	1-439-280-13	LOT92	1600p	2433754	LOT01	1300p
29201.019.01	LOT62	1250p	2435131	LOT282	1300p	334 P 18506	LOT51	1550p	4822 140 10328	LOT124	1450p	1-439-280-13	LOT92	1600p	2433755	LOT01	1300p
29201.019.02	LOT62	1250p	2435141	LOT282	1300p	5908-05008A-AA	LOT75	1500p	4822 140 10349	LOT284	1400p	1-439-280-13	LOT92	1600p	2433756	LOT01	1300p
29201.019.02	LOT62	1250p	2435301	LOT88	1450p	D 108/37	LOT75	1500p	4822 140 10356	LOT284	1400p	1-439-280-13	LOT92	1600p	2433757	LOT01	1300p
29201.022.01	LOT63	1700p	2435671	LOT89	1600p	DCF1577	LOT75	1500p	4822 140 10367	LOT284	1400p	1-439-280-13	LOT92	1600p	2433758	LOT01	1300p
29201.022.02	LOT166	1600p	2436201	LOT109	1200p	KFS 60226B	LOT75	1500p	4822 140 10369	LOT284	1400p	1-439-280-13	LOT92	1600p	2433759	LOT01	1300p
29201.022.03	LOT166	1350p	2436202	LOT109	1200p	MSH-1FBW08	LOT75	1500p	4822 140 10377	LOT284	1400p	1-439-280-13	LOT92	1600p	2433760	LOT01	1300p
29201.022.04	LOT165	1350p	2432101-2	LOT79	1600p	NIKKAI			4822 140 10381	LOT284	1400p	1-439-280-13	LOT92	1600p	2433761	LOT01	1300p
29201.024.01	LOT165	1350p	2433451H	LOT81	1350p	NIKKAI			4822 140 10384	LOT284	1400p	1-439-280-13	LOT92	1600p	2433762	LOT01	1300p
29201.024.01	LOT165	1350p	2433453H	LOT82	1250p	NIKKAI			4822 140 10395	LOT284	1400p	1-439-280-13	LOT92	1600p	2433763	LOT01	1300p
29201.024.04	LOT164	1400p	2433891H	LOT23	1400p	NIKKAI			4822 140 10406	LOT284	1400p	1-439-280-13	LOT92	1600p	2433764	LOT01	1300p

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NEW ARRIVALS

FAST BLOW

RATING	ORDER CODE	PRICE
0.04A	FUSE53	60p
0.05A	FUSE54	35p
0.063A	FUSE55	35p
0.08A	FUSE56	35p
0.1A	FUSE57	30p
0.125A	FUSE58	30p
0.16A	FUSE59	30p
0.2A	FUSE60	30p
0.25A	FUSE61	30p
0.315A	FUSE62	30p
0.4A	FUSE63	30p
0.5A	FUSE64	30p
0.63A	FUSE65	30p
0.8A	FUSE66	30p
1A	FUSE67	30p
1.25A	FUSE68	30p
1.6A	FUSE69	30p
2A	FUSE70	30p
2.5A	FUSE71	30p
3.15A	FUSE72	30p
4A	FUSE73	30p



ASSORTED WICKMAN FUSES

This Kit consists of Assorted Wickman Fuses both Slow & Fast Blow: 17 Different Types 10 of Each Type 170 Fuses in Total Packed in a Plastic Storage Box
Order Code: Wickmankit
PRICE £40.00

SLOW BLOW

RATING	ORDER CODE	PRICE
0.05A	FUSE74	65p
0.063A	FUSE75	65p
0.08A	FUSE76	65p
0.1A	FUSE77	35p
0.125A	FUSE78	35p
0.16A	FUSE79	35p
0.2A	FUSE80	30p
0.25A	FUSE81	30p
0.315A	FUSE82	30p
0.4A	FUSE83	30p
0.5A	FUSE84	30p
0.63A	FUSE85	30p
0.8A	FUSE86	30p
1A	FUSE87	30p
1.25A	FUSE88	30p
1.6A	FUSE89	30p
2A	FUSE90	30p
2.5A	FUSE91	30p
3.15A	FUSE92	30p
4A	FUSE93	30p
5A	FUSE94	30p

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HELP WANTED

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

Wanted: Capstan motor and an X0491GE241 chip for a Sharp VC-A105HM VCR, also a complete head drum for a Panasonic NVD80. R. Flitcroft, 69 Cartmel Court, Blackley, Manchester M9 7HT. 0161 683 0817.

Wanted: LOPT (part no. 94628) for the Murphy Model V759A. Copies of the *Murphy News* and *Murphy Service News* publications. IC type MAB8441P TO93 for the Tatung 170 series chassis. Phil Marrison, 43 Park Road, Alrewas, Nr Burton-on-Trent, Staffs DE13 7AG. 01283 790 747 (phone/fax).

Wanted: Manual and circuit diagram, or a good photocopy, for the Telequipment S52 scope. C.E. Scott, 258 Edmund Road, Sheffield S2 4EN. 0114 272 3984.

Wanted: Stereo Betamax VCR, domestic or industrial, faulty considered; Sony Super Beta PAL/NTSC; Sony RM101, RM2001 and RMT223 remotes; Sony PCM601. Phone Graham on 01604 843 536.

Wanted: Working power supply for the Goodmans VN6000 VCR, or information on a source of this item. J. Andrews, 69 Hope Street, Liverpool L1 7BJ.

Wanted: Loan of manual or purchase of photocopy for the Sword monitor (Cotron 01H337DGC1) dating from the mid 80s. Particularly require information on the input socket wiring and the internal option links. Bob Mitchell, 5 Second Row, Linton, Morpeth, Northumberland NE61 5SQ.

Wanted: Programming information (manual, etc.) for the Uniden UST771 dish controller. C.A. Rigby, 1 Route D'Anton, Petit Caudos, Mios. 33380, France. E-mail Anthonyrigby@compuserve.com

Wanted: Assembled TV board for the Waltham portable TV/radio/cassette player Model W154. A.J. Williams, 39 Alder Moor Avenue, Coxford, Southampton SO16 5GJ.

For disposal: Mullard A51-570X colour tube, brand new not regunned. Offers please. H. Turney, 135 North

Road, Bellshill, Strathclyde ML4 1QY. 01698 844 382.

Wanted: Circuit diagram for the Ferguson Courier 12in. monochrome portable Model G2-23 38000. D.J. Rockcliffe, 3 Hewell Lane, Barnet Green, Nr Birmingham B45 8NZ. 0121 445 5360.

For sale: Newnes *Radio and Television Servicing* books, seven volumes 1955-1961. Offers please. D.D. Sutton, 15 Tom Mann Close, Barking, Essex IG11 7YF. 0181 924 1967.

Wanted: Service manual for the Sharp VLC780H camcorder. G. Thomas, 16 Stuart Street, Merthyr Tudful, Glamorgan CF47 8SA. 01685 373 368.

For sale: Various spares for the Sanyo ED1 colour TV chassis. Also full service manual, CRT, LOPT etc. Please write to C.A. Lounds, 12 Mansfield Road, Sutton in Ashfield, Nottinghamshire NG17 4GR.

Wanted: Text panel for the Panasonic Model TX2472. The number on the PCB is TNP107058. Paul Bentley, 43 Breach Road, Marlpool, Heanor, Derbyshire DE75 7NL. 01773 765 258.

For disposal: Geodimeter Geodat 124 at bargain price. F. Nedza, 40 Brynhyfryd, Glynneath, Neath SA11 5BA. 01639 720 429.

Wanted: Mains transformer for the Trio stereo integrated amplifier type A-3X. Russ Pinder, 218 Cantley Lane, Doncaster, S. Yorkshire DN4 6PA. 01302 539 111.

Wanted: Circuit diagrams etc. for the Skyscan satellite receiver/positioner Model K1 (made in Canada). D. Benyon, Marshland View, St. Annes Hill, Bude, Cornwall EX23 0LT. 01288 353 373.

Wanted: Circuit diagram for the Uher CG300 cassette deck. G. Vine. 01473 645 416 (day), 01255 821 655 (home) or e-mail graham_vine@geocities.com

For disposal: Approximately 100 assorted TV and 80 video and satellite manuals and circuit diagrams. They range from the mid Eighties to

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Wanted: 510ABCB22P CRT for the Mitsubishi Model CT2027, with working scan coils. Would also like to contact anyone who successfully built the ESR capacitance meter featured in the April 1993 issue. M.J. Levy, 19 Totternhoe Close, Kenton, Harrow, Middx HA3 0HS. 0181 907 3620.

For disposal: Copies of *Television* from January 1983 to October 1998. Could deliver locally but would otherwise have to be collected. W.J. Knight, 532 Rochester Way, Eltham, London SE9 1SQ. Can usually be reached on 0181 850 4147.

For disposal: *Television* magazine 1972 to 1996 - odd copies missing. *Input* magazine (computers) first issue, complete set. *Elector* magazine from issue 11 to 1997, odd copies missing. Spectrum 48K (working) with Opus 3.5in. disc drive interface with parallel printer port, Romantic Robot interface and many games and utilities. Olympic electric typewriter (wide carriage), old type - uses an electric motor. Any offers? Please phone Colin Carter on 01494 533 558.

For sale: Maxicamera A gamma camera signal processor type 46-4060440G10 for use with gamma camera, made by General Electric Nuclear Medical £50. BBC, Acorn and Archimedes stuff: parts, books, hardware and software, list available - send 38p stamp. dBase 5 for DOS, complete and unregistered, swap for OS/2 version or sell for £150. Smith Corona XE1630 portable electronic typewriter, three pitch sizes, full line memory correction, word eraser, bold, super- and subscript, auto-centring, as new with manual £40. Julian Bohan, 01522 514 241 or mobile 0958 771 319.

Philips Turbo Deck

Alan J. Roberts describes the main features of the Philips Turbo VCR deck mechanism and provides notes on general servicing and some points that can cause confusion

The Philips Turbo VCR mechanism has been around for a number of years and has proved to be efficient and reliable. The wind/rewind speed is very fast, hence its name. A unique feature is the absence of a mode switch. Replacement parts are usually supplied as kits, so that all associated gears or levers are replaced at the same time, ensuring a reliable repair.

Considerable experience has been gained over the years in servicing these decks and in dealing with various problems that have cropped up with them. Most repairs are fairly straightforward and don't call for explanation. Some points can cause confusion however. The following notes should be of help when a VCR fitted with one of these decks comes in for service. The reference numbers used in the text refer to the exploded view in the service manual, which should be to hand.

Initial Work

Virtually all mechanical repairs have to be carried out with the deck removed from the machine. The deck is normally held in place by three screws, two under the cassette lift and one at the centre rear. To gain access to the front two screws the cassette housing has to be in the down position. This is fine if there's no cassette stuck in the machine. If there is, it must be removed first.

Depending on the nature of the problem, this can be a bit awkward. For the moment we'll assume that there is no tape in the machine, the deck is fully unthreaded and the lift is in the eject position. Unscrew the centre rear screw first. The cassette housing next has to be moved forwards to gain access to the two front screws. The two protection locks, one at the left and one at the right, can be released using your fingers. It should then be possible to move the lift forwards sufficiently to gain access to the front two screws. Alternatively the loading motor can be turned to move the lift forwards. Once the screws have been withdrawn, the VCR's front panel should be removed and any connecting leads released from the deck. It should then be possible to remove the deck completely.

What do you do if the machine has taken in a tape and refuses to give it back? First try turning the loading motor by hand. If you are lucky, the mechanism should unthread (if it has reached this state), the index lever should swing back to its rest position and the housing should start to rise. To prevent tape looping, turn the capstan motor as you do this. You should then be able to

bring the lift to the eject position and extract the tape.

If only life was that simple! Let's suppose that because of some mechanical problem the housing refuses to rise. This means that you will be unable to remove the deck from the cabinet. If you can get the deck into the unthreaded position but no farther, try turning the smaller of the two gears on the side of the housing. All being well, this will enable the lift to be brought to the eject position. If the lift is stuck hard you will have to turn the whole machine over and unscrew the lift retaining screws. These are No. 8 Torx size. There is also a red retaining hook at the right-hand side – it has to be unclipped. You should then be able to remove the lift, gently, complete with the tape.

Tape damage is almost inevitable with a really jammed deck, particularly if the deck remains in the threaded position. It may even be necessary to cut the tape to free it.

Once the housing is free, bring it to the eject position by turning the side gears and remove the tape.

The deck retaining screws can then be removed as described above.

Stuck Cassette

One of the most common faults, and one of the easiest to deal with, is when a machine comes in for repair with a cassette stuck inside it. On test the machine may make a raucous, whining noise when eject is pressed, or you may just hear the loading motor turn but nothing moves. The cause is usually a fractured gear at the end of the main worm shaft. This gear drives the two small gears that engage with the housing, at the side of the mechanism.

Repair is simple. Remove the lift as already described, then withdraw the faulty worm shaft from its fixings. Philips recommends that the drive shaft from the loading motor is also replaced – at the end of this there's a bevelled gear that can also fracture, bringing the whole mechanism to a stop. The two items are supplied as a pair under part number 4822 310 10657. They can be used with any Turbo deck.

The worm gear has a butterfly vane at one end. This interrupts the infra-red light from the optosensor that protrudes through the deck. As the worm gear spins, the pulses from the optosensor are counted by the deck's microcontroller chip so that it knows the deck position. This does away with the need for a mechanical, and less

reliable, mode switch. It's important to ensure that the butterfly vanes are undamaged.

One point needs explanation. The drive shaft (item 47 in the manual) is clipped in position at the gear end while the other end is clamped under an inverted U-shaped bracket that's part of the loading motor mounting. You simply cut the inverted U-shaped bracket halfway down and ease the drive shaft out. The new one can then be easily fitted. Fig. 1 shows the idea. This is not a bodge, and is accepted by Philips.

Once the new drive shaft and worm gear have been fitted, you are ready to reassemble the lift. This has to be done with the lift in the down position. So release the latches and turn the gears on the side of the housing to take the lift down. The two arrows on the side gears should point towards each other. Next turn the loading motor on the deck by hand until the timing hole in the main cam is at three o'clock. Position the lift, making sure that the smaller gear on the side engages with the drive gear on the deck. Clip back the red retaining hook. Invert the deck carefully so that the four Torx screws that hold the lift can be replaced.

Check the operation of the deck by turning the loading motor by hand. It should be possible to go through a complete cycle. From the lift-down position, turning the motor clockwise should take you through the entire eject sequence. Watch carefully as the timing hole in the main cam moves towards the six o'clock (eject) position. Gear 103 should start to turn and the lift should start to rise. It should do so smoothly, with no sense of catching. If all is well, it should be possible to bring the lift to the full eject position.

Turning the motor anticlockwise should take the lift down (remember to release the safety locks) then go through the entire threading cycle. Smooth operation of the lift depends on gear 103 disengaging from the main drive at the correct moment.

The Main Cam

The main cam comes as a kit with the worm shaft, pinch-roller helter-skelter and pinch-roller holder. For reliable operation these parts should be replaced together. It's important to order the correct cam for the model being repaired. They are not all the same: some machines have fully-threaded wind/rewind operation

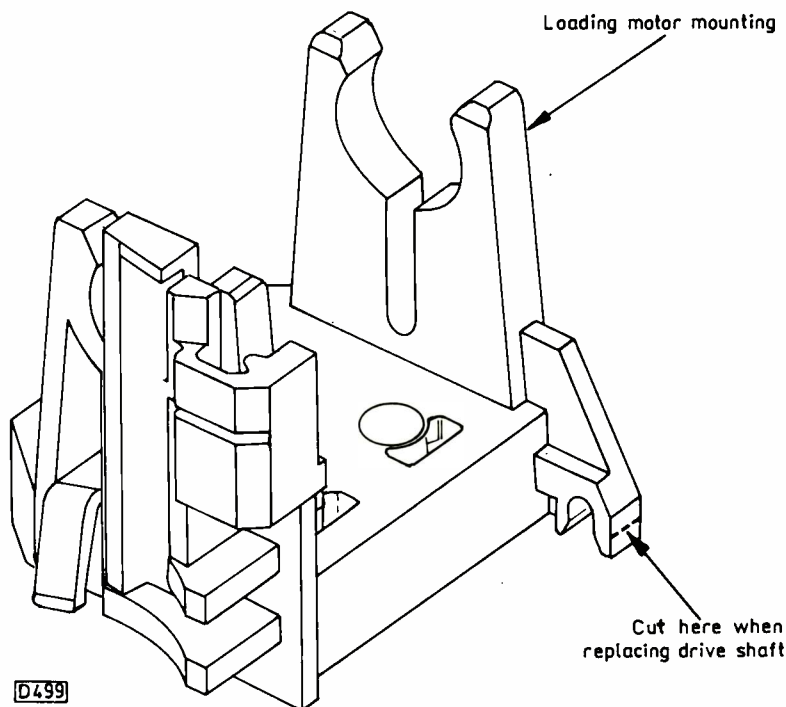


Fig. 1: Position of the inverted U-shaped bracket that holds one end of drive shaft 47. The bracket is part of the loading-motor mounting. Cut the bracket as shown above when replacing the drive shaft.

while others have unthreaded wind/rewind. This means that the cams are different, and fitting the wrong type will result in a jammed mechanism.

To gain access to the cam, the lift must be removed as previously described. In addition, the worm shaft should be unclipped. Before the cam can be removed, it's necessary to remove the index lever and the pinch-roller assembly. First turn the main cam to its full-eject position (hole at the six o'clock position). Remove plastic retainer 30F, then reverse lever 29F, followed by index lever 31F. Finally, carefully unclip the intermediate lever 32F. See Fig. 2.

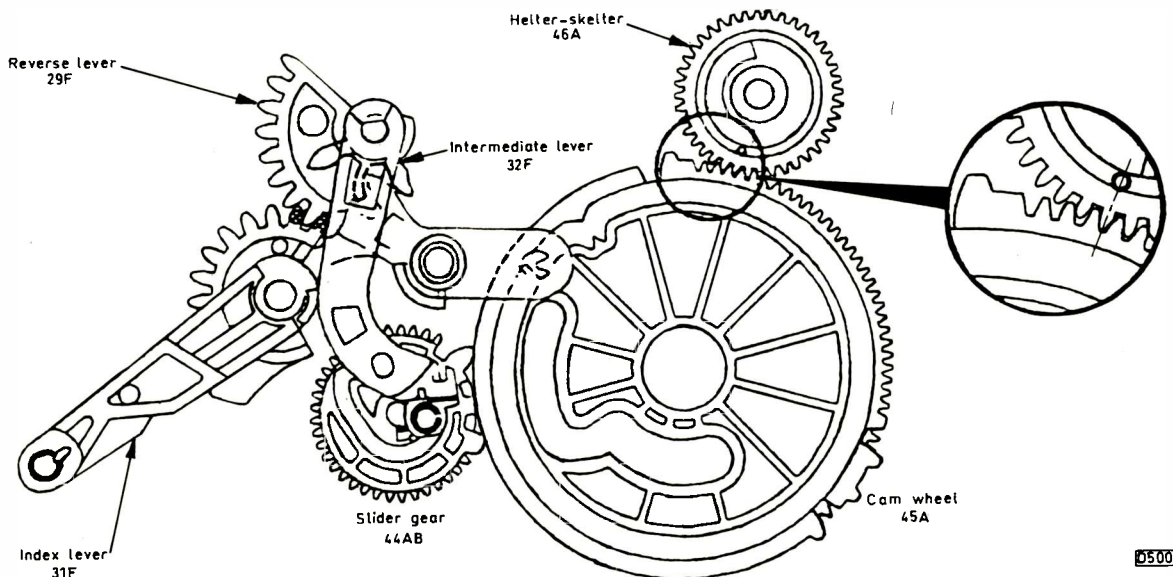


Fig. 2: Top view of the main cam and its associated levers and gears.

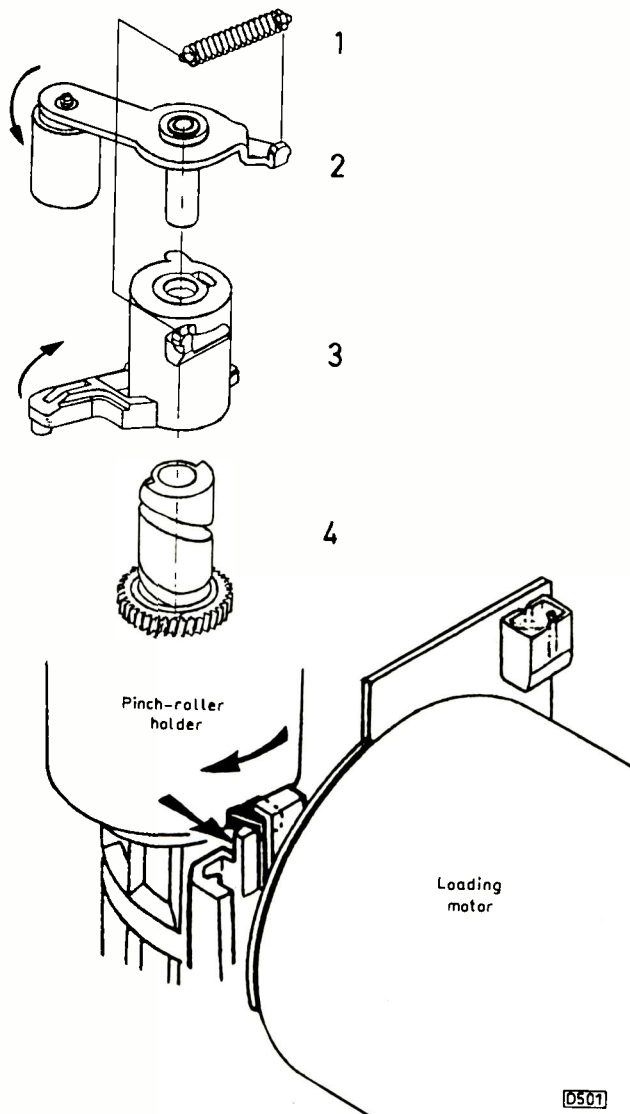


Fig. 3: The pinch-roller assembly. 1 Tension spring; 2 pinch-roller bracket; 3 pinch-roller holder; 4 helter-skelter gear.

To remove the pinch roller, first release the strong tension spring (see Fig. 3) then swing the pinch-roller bracket outwards slightly and remove. The pinch-roller holder should lift off upwards after pushing the retaining tab towards the loading motor. Finally, turn the cam so that the hole is at the three o'clock position and remove the helter-skelter gear 46A. This all sounds rather involved, but in fact takes only a few moments and reassembly is very easy.

A three-pronged spline holds the cam in place. There's no official tool for releasing the spline, but a call to Philips Technical produced a simple solution at no cost. All you need is the plastic cap from a felt-tip pen or similar. You might have to try a couple before you find one that's the right size and fits neatly over the spline to push the claws in. Then lift the cam straight off its fixing.

Fitting the new Cam

Installing the new cam is basically the reverse of the above procedure. To get the timing perfect at first attempt however, I suggest the following approach.

I usually find that it's best to replace the cam when it is in the stop position (timing hole at three o'clock). An elastic band looped around the loading arms and

the left-hand turntable helps by keeping them in the fully unthreaded position. This keeps gear 44AB in the correct place, enabling the cam gear to be fitted easily.

The underside of the cam operates two levers, one for the brakes and the other for the eject gears. You will see two pins, one metal and one nylon, that protrude through the deck. Push the nylon one towards the right, and the metal one roughly central in its slot. If it's to the extreme left and appears to be under spring tension, push it towards the extreme right of its slot and the brakes will come on with a click. The pin can then be centralised in its slot.

Take the new cam and place it lightly over the centre spline. Do not press it down at this stage. Set the timing hole in the three o'clock position, then gently press the cam down. You may need to rotate the cam gently back and forth as you press it down. If the two levers are correctly positioned, the cam will snap down firmly.

Timing

To check that the timing is correct, rotate the cam clockwise so that the timing hole is at six o'clock. It should not go any farther. Now rotate the cam anti-clockwise back to the three o'clock position and carry on turning. There will be several points of slight resistance, as the levers are moved against spring tension. Carry on turning the cam. It should be possible to go through a complete threading cycle with the timing hole stopping at roughly the four o'clock position. The loading arms should be fully engaged.

Now turn the cam clockwise again, making sure that the loading arms return fully. Set the timing hole at three o'clock.

If the cam jams during any of the above moves, remove it and follow the setting instructions again.

We can now refit the pinch-roller assembly.

The Pinch-roller Assembly

The helter-skelter gear has a timing hole. Place the gear on its spindle, but don't press it down fully yet. Set the timing hole so that it's between the third and fourth tooth of the cam, see Fig. 2. When satisfied about this, press the gear down fully.

Now turn the cam so that its timing hole is at six o'clock. Place the pinch-roller holder loosely on the helter-skelter, so that the long, lower arm rests against the capstan spindle. Then rotate it anti-clockwise until the small square tab at the rear snaps into the guide behind the loading motor. Fit the pinch-roller bracket into the hole at the top, and refit the tension spring.

Before going any farther, check that the timing is correct by turning the cam through a complete cycle as before. Make sure that the pinch roller engages fully with the capstan spindle.

The index and reverse levers can now be refitted.

Index and Reverse Levers

First examine the intermediate lever 32F for signs of damage. If there are any, an order for the appropriate kit will bring all four items to be replaced together. Make sure that the main cam is in the three o'clock position. Place the lever on its fixing bush, as shown in Fig. 2, and push down firmly.

Next fit the index lever on its shaft. There are two timing dots on the teeth of the index lever and three dots on the teeth of the reverse lever. The centre dot of the three should be between the two dots on the index lever. Finally fit the retainer.

When the main cam is turned, both levers should now

swing to their respective positions. When you are satisfied that the timing is correct, clip the worm shaft back into place. Before you refit the cassette housing, as previously described, you can check the operation by connecting a 9V supply across the connections to the loading motor. The deck should operate smoothly through its entire cycle.

The Brakes

Having dealt with the top of the deck, we'll take a look beneath. Once again, all major brake parts are supplied as a kit which should cure most problems. With the majority of the earlier Turbo decks this is kit E.

A common problem is that when the machine unclases from play a small loop of tape is left hanging from the cassette. Then, as the cassette is ejected, the loop gets caught in the cassette flap and is damaged.

One of these machines was in my workshop recently with this very problem. I fitted kits E and I and replaced clutch 115. This improved the operation of the deck, but the fault was still present. After much time had been spent observing the deck's operation, I noticed that the brakes were not being fully applied when stop was pressed. I couldn't figure out why.

A call to Philips brought the solution. Pulse roller 107E and pulse lever 110E are located in plastic bushes on the main chassis. They can fracture, the result being poor brake operation. A reliable repair is possible using the kit of parts that Philips supplies to replace the bushes.

The pulse lever bearing had fractured in my faulty deck. I had to dismantle the deck sufficiently to gain access to the part, then carefully cut it away from the chassis – right down to the base metal. The new piece was then carefully fitted into the two vacant holes. A small dab of Superglue held it firmly, then I was able melt the two plastic tabs over neatly to form a solid bond. When the deck was reassembled the brakes worked perfectly. The machine would otherwise have been a write-off.

The above is likely to happen only with older machines. Most repairs will simply involve ordering and fitting the appropriate repair kit(s).

General Servicing Notes

Most other repairs are routine and don't require explanation. The pole bases simply clip on to the loading arms, replacement taking only a few moments. The brakes on top of the deck again just clip on and are supplied as a kit.

You sometimes find that the plastic hook which holds the record-protect lever retaining spring has broken. The repair kit mentioned previously contains a replacement hook that provides a reliable repair.

Head fixing was changed during production. The original version was held by a single screw. Later versions are held by a quick-release clamp for which a special tool is required. Details will be found in the relevant service manual.

On all but the latest versions of the deck the sensor panel is supplied complete and fits under the mechanism. It contains the start and end sensors, the reel sensors, the deck sensor and the record-protect switch. With later decks the sensors are fitted to the main PCB. Later versions of the deck also have a modified braking system that eliminates the problems experienced with fractured plastic mountings, as described above.

The loading motor can be responsible for sluggish operation or failure to load or unload completely. If the motor is suspect, check it by removing the loading belt

and turning the pulley by hand. This will usually prove the point. If it feels rough, change the motor along with the driver chip which can also be damaged. To avoid "chicken-and-egg" situations, it's best to replace them as a pair.

Some versions of the deck use a different capstan motor. Make sure that you order the correct type for the machine being repaired.

In Conclusion

As previously mentioned it is *very* important to order the correct repair kit for the version of the deck you are servicing. There are major differences in the main cams and brake assemblies on later decks. So it's essential to have the correct service information available. The details in the notes above are intended to provide guidance only: they have been prepared on the basis of experience with existing models. Differences that are not covered in these notes may be found with some Turbo decks.

To maintain the high standard of performance, genuine Philips parts should be used when carrying out repairs. Any improved parts will be supplied with the relevant repair kit. This is particularly true of pinch-roller assemblies.

BACK ISSUES

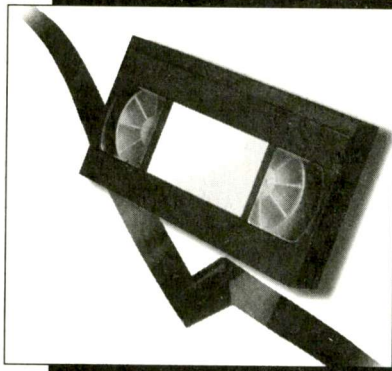
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**Reports from
Philip Blundell, AMIE
Graham Richards
Keith Evans
Terry Lamoon
and
Pete Gurney, LCGI**

Toshiba V110B

"Funny sound" was the customer's complaint. When I played back a known good tape the sound was fine for about ten minutes. Then the capstan began to speed up every five seconds or so.

A torque-cassette check proved that the back tension and take-up torque were OK, but scope tests at test point BT23 (playback CTL pulse) and pin 15 of IT18 (capstan FG signal) showed that large interference pulses were present at both. After a fruitless half hour spent checking the supplies and at the other pins of IT18 – the CTL amplifier chip – I decided to try a replacement capstan motor. This cured the fault. **P.B.**

Philips VR665

This Paolina range VCR didn't produce playback pictures – there was just noise. A scope check on the head amplifier's FM output seemed to show that one head was providing noise while the other was producing a signal. So a new drum was fitted, to no effect. Oh dear!

Attention was turned to the head amplifier IC. The head switching pulse SWIN differs from that in previous Philips models. It's not the usual 5V peak-to-peak square-wave, and has more than two voltage levels – a table on the head amplifier circuit diagram explains this. The signal level selects one or other of the LP or SP heads as required by the function selected,

VCR Clinic

e.g. for trick functions.

By this time another VR665 had arrived in the workshop, so comparisons could be carried out. These showed that the SWIN signal was correct. The complete chassis were eventually swapped over, which proved that the cause of the trouble was on the mother board. While these tests were being carried out I noticed that the faulty machine was also partly erasing the tape. This was being done by the rotary heads, not the full erase or ACE head.

Time for a phone call to the nice man at Philips Technical. He had heard of the fault, and suggested that we replace transistor Tr7411 (BC848B). Once this had been done the machine was all right. **P.B.**

Akai VS22EK/VS23EK

There was hum on playback: the report said picture jumping. I replaced the following electrolytic capacitors in the power supply: C6 (220µF, 25V), C60 (1,000µF, 25V) and C4 (47µF, 25V). The machine then worked correctly. **G.R.**

Sony SLVE710

This machine would accept a tape after which the mechanism would move part way in then eject. When you get this problem the remedy is to remove the cassette lift assembly and look at the connect and eject gears, which will be mistimed. They have timing marks on them.

Retiming cured this particular machine. But will the customer learn not to force tapes in back-to-front! **G.R.**

Hitachi VTF860E

This hi-fi, Nicam machine's fault, loss of mono audio playback, was apparent only with tapes recorded on a basic (non hi-fi) machine. Scope checks showed that the signal failed to emerge from the linear audio processing chip IC401.

A new chip restored normal operation. **K.E.**

Akura VX150

The problem was a jammed mechanism with the cassette still in situ and laced up. When the bottom cover had been removed I saw a group of interconnecting sprockets and pulleys that are responsible for tape loading and cassette lift operation. An attempt to free the jam manually was fruitless – something unseen was preventing any progress. To locate the defect it would be necessary to strip down the gear train, but without a service manual reassembly would be difficult.

The nice people at Akura told me that the service manual didn't contain the mechanism timing information and said they would send a separate data sheet free of charge. Once I had this timing information I set about dismantling the gears and pulleys. This revealed that the post-capstan tape-guide operating pin, which extends from the upper deck to locate with the main operating cam, had somehow become bent and was detached from its track in the cam gear.

Normal operation was restored once the pin had been straightened and relocated. I could find no reason why the fault had arisen in the first place. **K.E.**

Hitachi VTF360E

More centre-loaders are beginning to appear on the bench as their older, better-made and arguably more reliable predecessors are being consigned to the scrap heap. It was with this thought in mind that I began to tackle the problem of intermittent loss of the E-E and playback sound. The flimsy ribbon connectors and PCB headers now common are likely to be a source of trouble the more often a unit is dismantled.

In this case the cause of the fault

was a fractured common/earth return connection at the head amplifier/audio panel PCB connector to the main board. **K.E.**

Sanyo VHR1300E

There was a cassette stuck inside this machine. When power was applied the mechanism protested with a loud screeching noise. After removing the cassette manually I set about investigating the cause of the problem. My trusty blank cassette was inserted and loaded without any problem. But after playing with all the functions for several minutes a piercing scream came from below the deck. When I inspected the lower deck mechanism I saw that the main operating cam-coupling gear – the one that's belt-coupled to the capstan motor – was not meshing reliably. Hence the noise.

On closer examination I saw that the mounting plate on which the gear sits had parted company with the plastic deck moulding. I drilled a small hole through the plastic moulding and installed a very small screw. The result was a permanent repair. **K.E.**

Toshiba V611B

This well-used machine produced some strange visual symptoms. In the playback mode there was a monochrome picture with occasional flashes of colour: the E-E signal produced rapid, pulsating colour drop-out. Wow!

I decided that the power supply would be a good place to start and found that the voltages around the STK7253 regulator chip were incorrect. A new chip put matters right. **K.E.**

Philips VR6290

It was a nice change to come across one of these Charlie deck machines with something other than a mechanism fault. There was no E-E or playback vision though the playback audio was OK.

It seemed sensible to check the LT supplies to the relevant circuitry. This proved to be a wise move: the 5V supply to the front-end subpanel was missing because the small series choke L6 was open-circuit. A replacement was obtained from a scrap machine. **K.E.**

JVC HRJ210

The complaint with this machine was that it wouldn't play. When I opened it up I saw that there was no reel drive. Further investigation revealed that the clutch had dropped down because the circlip wasn't in position.

As I couldn't find the offending item anywhere I had to fit a replacement. Once it was in and secured the machine behaved correctly. **T.L.**

Matsui VX1105

This machine would load a tape then immediately eject it. With this type of fault it's always worth checking the tape sensors first. There was no surprise when one sensor failed to react to light. A replacement restored normal operation. **T.L.**

Sanyo VHR287

If one of these machines intermittently switches off when record is selected and the display goes off, check PR512. If it looks blackened or reads high, change it. A quick cure! **T.L.**

Akai VSG815

This machine is a little different as its display is in the cassette flap: it also has a small arm, just inside, that runs across the cassette as it goes in and out. Unfortunately if anyone pushes in a cassette with a damaged or missing window this arm gets stuck and jams the cassette. This is not serious, as a little coaxing from inside will release it without damage.

Problems start when the customer tries to pull the cassette out. This can damage the mechanism, and had happened with a machine I had for repair recently. I removed the cassette, then had to realign the mechanism's timing. This got the machine working but, because of no brake release, there was no fast rewind. Lever M had lost its location pin – a new one cured the problem.

I now usually warn customers about faulty cassettes and the possible costs of removing them from this machine forcibly. **T.L.**

Matsui VXA1105

If the problem with one of these machines is an over-bright picture or some other luminance problem, replace IC4001 and IC4002. This will probably cure the fault. **T.L.**

Daewoo V21

The complaint with this machine was no E-E sound. I've had few electronic problems with these VCRs, and it took a little time to sort out what goes where – the circuit diagram is spread over several sheets. Playback sound was OK, and a scope check on the output from the IF can showed that the signal was present.

The voltages given in the manual for the BA7790LS audio chip IC201 were all well within limits. There are

several pins to check before condemning the chip. Pin 17 is the mute line, and pin 11 is for E-E switching: nothing wrong here. There was audio at pin 16, which doubles for the off-air and AV inputs. A new chip restored perfect sound. **P.G.**

Akai VSA650

The customer complained that this machine was dead. But a tape could be loaded and played. The real problem was no display or tuner operation. I suspected a power supply fault and found that the 40V and -35V outputs at pins 11 and 10 respectively of connector P1 were almost non-existent.

These supplies have a common source: they are derived from the 20V supply via a voltage-doubler arrangement. The cure was to replace C24 (22µF), C25 (1µF) and C26 (47µF), using 105°C types as the board runs quite hot. **P.G.**

Hitachi VTM230

The customer said that this machine jammed when a tape was loaded. On inspection there was nothing obviously amiss, and all the deck timing marks appeared to line up. So I loaded a dummy cassette and watched the deck sequence. The mechanism jammed at the point just after the half-loading arm attempted to take the tape under the pinch roller assembly – just prior to the pinch roller descending.

The cause of the problem was the plastic collar that secures the pinch roller: it had split and, as a result, the pinch roller had slipped down the shaft by about 3mm. This was enough to foul the half-loading arm. I cured the fault with a plastic collar salvaged from a Panasonic G deck pinch-roller assembly. **P.G.**

Perdio D2700

No play was the complaint with this machine, which uses the same mechanism as the **Amstrad VCR6000** series. All the other functions worked correctly when a tape was inserted, but when play was selected the machine laced up then, shortly after the pinch roller made contact with the capstan shaft, it shut down.

The cause of the trouble was traced to extremely dry capstan shaft bearings. When the capstan belt was removed and the pulley was rotated the resistance was obvious: the addition of pressure from the pinch roller was enough to seize the assembly temporarily. The cure was to apply a small quantity of sintered bearing oil. **P.G.**

Test Report



Wallis *Universal* Remote Controls

Eugene Trundle finds these recently introduced universal remote control units easy to set up, good performers and good value

For many years remote control handsets made by companies other than the manufacturers of the original equipment have been available for use with TV sets, VCRs and similar items. They have always been cheaper than the original units, and availability has been better. The range of these handsets has steadily widened, while prices have dropped.

Universal Handsets

Over the years the 'universal' type of handset, with its ability to control a wide range of equipment, has evolved: there have been 'learning' devices, which take on board the command codes from an existing handset and reproduce them thereafter; and ROM-based types, which are preprogrammed with a huge number of complete code sets that can be selected for use with any particular piece of equipment.

The learning type is no good at all if the original handset is faulty, has been damaged or lost – which after all is why most people buy a replacement! The ROM-based type could, in some versions, involve a long and laborious button-thrashing session to bring to light the required codes each time there is a piece of equipment that needs to be controlled. Which brings us to these new universal handsets. They are made in Italy by Wallis, cut down the set-up time, and have been designed for easiest possible use. This is why they have been given the name and logo 'Point and Go'.

Set-up and Test

I tried two handsets, the CM100 for simple control of one TV set (including text), and the CM200 for 'elaborate' control of one TV set and simple control of one VCR. The former retails for about £15 while the latter sells for some £20.

We'll start with the TV functions. Both units work the same way for setting up. You look up a brand code on

the instruction card, for example Mitsubishi is code 24, and stroke this in on the keyboard while keeping a red set-up button depressed. In the vast majority of cases the TV set will immediately respond to the new zapper. If not, you hold down another (blue) set-up button while keying in 1 to 9. Stop as soon as the TV set responds. In rare cases you need go to a third (yellow) set-up button and progress through the numbers as before.

So long as the brand name was listed, I couldn't find a single TV set that failed to respond to the new handset. The older and more obscure the TV model, the longer its code took to be brought out – my ancient 28in. Sanyo responded on yellow 9, the very last code available!

The coverage is very good – my checks involved seven or eight different TV brands, with the age of the sets ranging from quite new to ten years old. It could well be that some codes are missing, but if so I didn't find them.

The difficulty is when you have a TV set whose make isn't listed. Such brands include Ferguson, Tatung, Saisho, Nikkai and others. Here in the UK I would cheerfully have traded them for Elbe, Grandin, First Line, Mivar, Rex, Sei, Sinudyne and Magnadyne that are amongst the list of 28 brand names in each zapper's ROM. I'm told however that the distributors (Wallis) have available, by phone or fax, some codes for unlisted makes and models.

The CM100 has a facility to select and control teletext to a limited degree, and a sufficient data back-up time to allow two minutes for battery changing.

VCR Control

The larger CM200 has the same ROM code store, selection system and back-up time as the CM100: for the extra fiver you get more comprehensive operation (lots more buttons!) and a VCR control facility.

Finding the required VCR code is a little different

from the TV-matching process. Switch the VCR on and insert a cassette. Then hold the play and record keys down simultaneously while pointing the zapper at the VCR. A whole series of different play commands will be transmitted sequentially at three-second intervals. Let go when the machine enters the play mode. All the other keys will then operate correctly.

Codes for the most popular VCR makes and models are again quickly found. Others can take up to five minutes to find. Interesting that the late-coming codes include those for two Tatung VCRs, a brand not listed amongst the TV ones available.

I couldn't find a VCR that failed to respond to this zapper – provided I was patient in holding down the search keys. As with TV sets, the machines checked ranged from a few months to ten years old. But I can't promise that this device will operate every single VCR you may encounter.

General Checks

I found that the infra-red output from both these zappers was stronger than that provided by the original handsets. As a result they operate reliably even when they are pointed away from the TV set or VCR.

The P+/- key of my test CM200 tended to stick down. This was no doubt a one-off teething problem.

When I looked inside the zappers I found that the material and construction were similar to those of a modern TV set's remote control unit.

The instruction sheets, whose clarity is so important for non-technical users, are well written and, with their colour pictures, are easy to follow.

Verdict

So long as the TV brand is featured in the availability list, I consider that these zappers are good performers. They are easy to operate and are good value for money – especially with the discount available to bona fide trade customers.

The large buttons and clear presentation, especially with the CM100 TV-only model, make the units easy to operate, particularly by those who are elderly or disabled – they are in many cases easier to use than the originals. At their price these zappers are more 'dispensable' than the originals. This is a useful point for rental concerns.

It is a pity that no one has, so far, brought out inexpensive replacement VCR handsets with LCD programming display panels. I've had to scrap many a good ex-rental machine for want of one.



The Point and Go range is available from Wallis UK at Unit A109, Riverside Business Centre, Bendon Valley Road, London SW18 4UQ. Phone 0181 870 3388, fax 0181 870 9988.

New from SoftCopy

A complete index to *Television* issues dating from November 1987 to October 1997 plus all the fault reports, fault finding articles, test cases and other servicing information is now available as a complete package on CD-ROM. The disc can be obtained from SoftCopy at £195, representing a saving of £45 in comparison with the same information supplied SP on 3.5" floppy discs. Those who have all the previous fault report discs can upgrade to CD-ROM for £45 (please quote the serial number of your Index disc).

For those who prefer their data on floppy discs, there are now two discs (Vol. 1 and 2) with fault finding articles on particular TV chassis, VCRs, etc.; service briefs; test cases; and What a Life! features. They are available at £15 each (3.5" HD). As with the eleven fault report discs (TV fault finding, VCR Clinic, Monitors etc.) access is via the Television Index disc. For further details see page 293.

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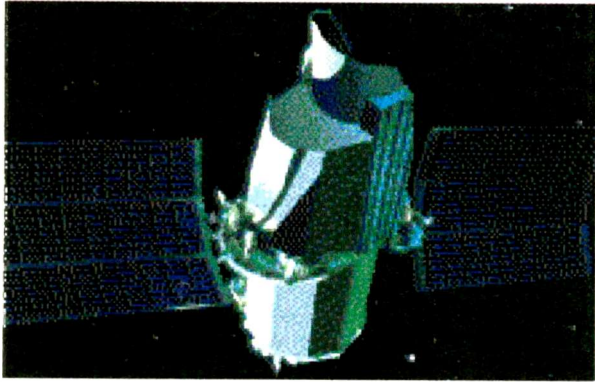
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DX and

Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and from the satellite belt. How to search for digital satellite TV signals. Whatever happened to chs E1 and A1? Roger Bunney reports

The long-awaited Leonids meteor storm on November 17th, feared by certain satellite companies, came and went almost unnoticed! A few reports mention slightly increased Band I activity at the time, and several people went outside to take a look. George Gaskin, at the eastern side of Gibraltar, counted about eight prominent meteor burns per hour average during the time he spent viewing the heavens. There was cloud coverage over most of the UK that night, giving little scope for sightings. In Australia Robert Copeman noted MS activity above the norm, but it occurred eight hours earlier than the predicted times. A whole 24 hours before the predicted peak Ryn Muntjewerff (The Netherlands) logged Band I signals from Scandinavia and Iceland via low-profile Leonid

Solar outage situation, with the dish focusing on the sun as it passes behind the Clarke belt. The shadow of the LNB assembly is at the dead centre of John Locker's dish.

meteors. Perhaps the year of the storm will prove to be 1999?

Because of increased solar activity, there's been a rise in the Maximum Usable Frequency (MUF) this winter. On 'good' days 50MHz has been reached – low VHF signals from Africa have been heard in the southern UK, and one report suggests that the Australian ch. A0 (46.25MHz) has been heard. Remember that noon between the transmitter and the receiver is required for optimum MUF, and don't forget the possibility of transequatorial skip (TE) reception from the south in the early evening on chs. E2 and 3. High solar activity can mean flares/storms on the sun, so check out to the north for auroral occurrences.

November DX reception was poor. Peter Schubert (Rainham) received unidentified Sporadic E signals on the 8th, in channels E3 and R2, and again on the 24th in channel E4. There's nothing else worth reporting.

In the 50MHz amateur radio group newsletter *Six News* there is mention of UK amateur G3HBR being in two-way communication with N5JHV in New Mexico at 50.097MHz, 1737 GMT on August 16th. The link was via multi-hop SpE propagation. During the day David Batcho (N5JHV) had been logging ch. E2 video carriers at 48.250, 48.242 and 48.260MHz. Then the band opened up. In total David was in contact with about eight UK amateurs, one German (DL7QY) and two Dutch stations. Prior to his European contacts

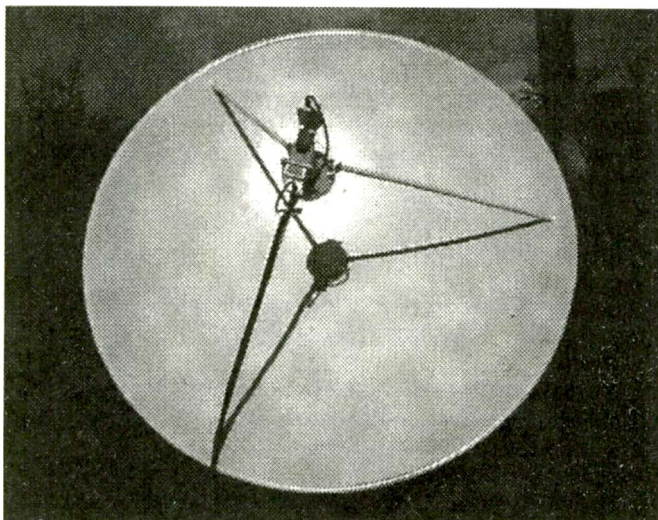
David had been in communication with mid-US amateurs via single-hop SpE. A remarkable day.

Satellite Reception

Roy Carman recently moved from Lake, Isle of Wight to mid-Surrey. This has given him improved access to the Clarke belt. He continues to use his Echostar SR8700 and LT8700 receivers, now with two 90cm Gregorian dishes driven by Polish H-to-H motors. This gives him coverage from 68°E to 60°W – an enviable location. It seems that the results obtained with the Gregorian dishes equal those provided by his previous 1.2m Channel Master dish. He's using 0.5dB noise figure Echostar LNBs. The next step will be to go digital, perhaps using a Nokia series 9800 receiver.

Roy uses a veteran SR50 manual receiver for signal hunting and rapid band checking. The Polish H-H motors have metal gears that require a little grease annually. Other units on the market have plastic gearing and are not suitable for constant 'DX' use. In early November Roy monitored the severe flooding in Germany via the 11.551 and 12.591GHz vertical transponders aboard Kopernikus-2 at 28.5°E. We wish Roy and Angela well in their new home.

John Locker (Wirral) has sent us photos that illustrate the October solar outage. The one we reproduce shows the LNB shadow at the dead centre of his 1.8m dish. When a solar outage occurs, usually in mid-April or mid-October, the sun



passes behind the satellite belt so that a dish will see both satellite and sun. The result is a hot spot focused on the LNB, with possible damage. Once again this year I forgot about it until it happened while I was actually watching the screen. As the signal from PAS-5 at 58°W dissolved into the solar noise, the centre of my LNB feed cap melted.

Signal strength improved once Hot Bird 5 and W2 had arrived on station at 13°E and 16°E respectively, though John noticed BBC World at 13°E in difficulties: the transponder's output had apparently gone low, and the channel was moved to another frequency.

A close watcher of news feeds, John comments that Sky News is a little elusive with its feeds. He feels that there are still a couple of 'hidden' ones to be discovered. Check 12.535GHz horizontal via W2 at 16°E for Sky digital feeds. There are more in use – somewhere! The BBC often uses Orion at 37.5°W for UK location-studio circuits. The Corporation is also elusive.

Intelsat K at 21.5°W continues to provide interesting analogue programmes. Prima-TV, using the 10.978GHz vertical transponder, gave us Arsenal v. Tottenham at 2200 on October 14th, but with Italian-language sound. Other football intended for Italy was monitored in successive weeks. Italian football has been seen as "Football Italia RAI" at 11.530GHz horizontal, with playouts from Todd-AO (UK) Ltd.

There was a major corporate event on November 15th, with rehearsals plus programme on the merger of Daimler and Chrysler: "Day One" was at 11.676GHz vertical, with English sound at 6.6MHz and German at 7.2MHz. The event included live pictures from Wall Street.

Digital Operation

Now that my RSD ODM300 receiver, made in Scotland, is at last operational I can comment on initial experiences with digital reception. The receiver had to be returned to the manufacturer because of "picture lock lost" problems: it came back 'adjusted', and is now working correctly with my five-year old Chaparral LNB.

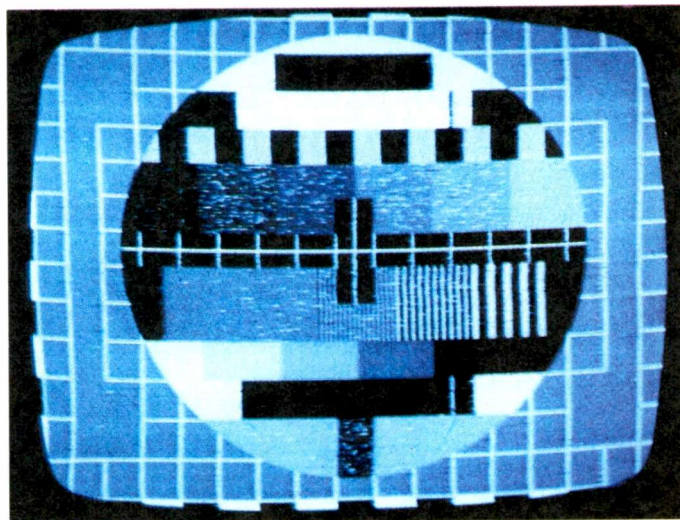
Those thinking of going digital may be interested in the way I operate – I understand that others search for digital signals in a similar manner. My first digital reception from Intelsat K was achieved with advice from John Locker, who

told me to tune to 11.566GHz vertical or horizontal, tap in an FEC of 3/4 and a bit rate of 5632. When I did this Reuters Washington came up noise free. When the dish was moved slightly the picture cut out – you don't get increasing sparklies with digital, it's a good picture or nothing. All I need to do in fact is to tap in the frequency and 'auto' for the FEC and bit rates – this shows on the in-laid screen and the receiver – and press OK. The receiver then checks the frequency and, if anything is there, the digital 'secrets' will suddenly scroll up with a message such as "found four new video channels, found six new audio channels". These are entered in the memory for future selection and viewing.

With analogue reception I turn a rotary knob to check out the bands quickly and easily: reducing the IF bandwidth or switching in threshold extension lifts a weak signal. Operation has to be more precise with digital signals, and DX hunting (if you can call it that!) has changed. There are lists that show the preferred frequencies used by broadcasters and facility companies. But you still need a search technique to find new digital frequencies.

The output from the Ku-band LNB is connected to an eight-output Global DA, with LNB voltage/polarity control from an external, modified CB power supply. All the receivers have been modified or have DC blocks to prevent a receiver-derived LNB voltage getting into the system. For searching I use the Manhattan LT6300 Plus Mk 2 analogue receiver I reviewed in the December issue. Its fast-scan feature enables it to move rapidly across the LNB's IF band, from one end to the other, stopping at signals that cannot be received as analogue ones – there is just a screen of shash. This is where you find the digital signals: they lurk in the shash. The point is that the Manhattan receiver detects the signal and stops, displaying its frequency. This is then entered into the digital receiver which carries out a search at that frequency. If you are lucky, the signal scale suddenly appears and you have FEC, lock etc. – the digital secrets are revealed!

It may sound odd using an analogue receiver to find digital signals, but it works. I must admit that I am not yet used to digital reception. It will take time. With increasing use of digital transmission how-



ever this is the way we must go.

I received an interesting letter last week from Jim Scofield of Lake, Isle of Wight. He's using a Nokia 9600-series receiver with a 1m Lenson-Heath dish and a Grundig LNB and says that he now does very little searching for analogue signals. The digital searching

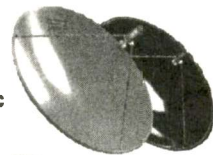
Reversed PM5544 test pattern - a very basic encryption technique. Received from ArabSat at 30.5°E as part of an Asian Broadcasting Union news feed. The news footage itself is often reversed and upside down!

Aerial Techniques



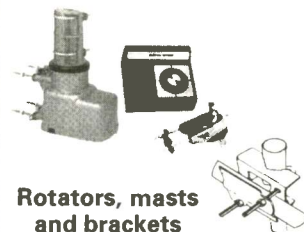
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A digital signal from New York via Paris, received from Eutelsat II F2 °E.

takes him a long time. He sums it up as follows: "so easy with analogue, a right pain with digital". But there's satisfaction when "a good one, especially a Sky pay-per-view boxing event, is found". He sent a five-page listing of digital feeds received during the past few months. So, with patience, digi-DX can be successful. More on digital next time.

Terrestrial News

Spain: Digital terrestrial TV is to start next year, with the closure of analogue services planned for 2012, two years later than originally envisaged. The main programme providers, TVE, Canal + Espana, Tele 5 and Antena 3, will transmit some 25 channels.

Gibraltar: A new site and transmitter is planned for the GBC Medium Wave service – the existing transmitter at Wellington Front is nearing the end of its life. The new site is up against the west side of the Rock, which is not very helpful for the estimated 100,000 or so expatriates living along the Costa de Sol east of the Rock.

Isle of Wight: Viewers attempting to receive the TV 12 RSL transmissions from Rowridge on ch. 54 are experiencing considerable difficulties. Problems are caused by the relatively low power (1kW), the fact that people use group A aerials for the main transmissions, the local terrain and potential co-channel pickup from Mendip. Even locations two miles south of Rowridge receive nothing. Keith Cummins at Chale, South Wight receives just a hint of signals – with vertical polarisation though the transmissions are horizontally polarised! Gareth Foster received nothing when carrying out tests atop St. Boniface Down, Ventnor, despite being in view of the Rowridge mast. Yet here at Romsey, some 25 miles to

the north, the pictures are quite watchable!!

Arabian Gulf: A digital terrestrial MMDS TV service is due to start in Qatar next month (March), using the 11.4-12.5GHz band. When the system is up and running there will be at least sixty channels, including pay-movie offerings. Test transmissions have already started, in tandem with the current thirty-channel analogue TV service.

Hungary: The two main high-powered ch. R1 transmitters have now been closed down.

Satellite News

The BBC's Prime/World services at 13°E have been transferred from Eutelsat II F1 to Hot Bird 5, extending coverage far into Russia and the Middle East. Prime is digital, World analogue. Eutelsat W2 is now in operation at 16°E, replacing II F3. Eutelsat has taken over the old German TV-SAT 2 craft for temporary use at 12.5°W to provide data transmission to Russia, controlled by the German Usingen station. Another Eutelsat pensioner, I F5, is to move to this slot, operating alongside TV-SAT 2. Eutelsat II F1 is to be moved slightly to 12.5°E, where it will operate at lower power for SNG and general telecom work – check this out for news feeds!

GlobeCast Northern Europe is to use Hot Bird 5 for distribution across Europe. The contract lasts until 2003.

NileSat 101 (7°W) is providing excellent digital signals in the UK and Western Europe. The success has led to confirmation that NileSat 102 will be in operation by the end of the year at the same location. Palestine TV and the Lebanese Future TV are new arrivals here. We hope to see Jordan TV and perhaps Kol Yisrael before long.

Keep a watch on the Russian hot spot at 36°E, where the recently launched (November 19th) Bonum-1 satellite will be able to provide some fifty digital TV channels for Russia/Siberia and East/Central Europe. If the Russian financial crisis worsens however there could be delays to the start of services.

The EU's anti-piracy directive continues to move through the legal process (see Teletopics, December). This will knock the use of MAC-D2 decoders, since pirate smart cards will be illegal. Viewing of porn channels such as Bizarre, Eros etc., which have been banned in the UK, could come to an end.

Channels E1 and A1

A few months ago the Benelux DX Club brought up the subject of what happened to the European TV channel E1: we are all familiar with the 48.25MHz vision carrier channel E2, but there's no ch. E1.

There's no American channel A1 either. There was, in the early days. From 1938-40 it was 44-50MHz. Then, between 1940-46, it was moved to 50-56MHz to accommodate FM radio proposals. It went back to 44-50MHz during 1946-48, when US broadcasting was in a state of transition. In 1948 there was a further reallocation of frequencies, and as a result TV ch. A1 was finally dropped.

The early European CCIR TV Band I assignment had four channels, with channel E1 at 40-47MHz. It was used by at least two transmitters, one at a Philips factory in Eindhoven (from the late 40s to early 50s), the other a West German transmitter in the Bremen region. It's uncertain why ch. E1 was dropped: the UK and France used similar frequencies, for channels B1 and F2 respectively, until the mid-Eighties.

More Interference?

The AMP company of Great Britain Ltd. has introduced a wireless LAN (Local Area Network) system for office and industrial use. A local area network usually consists of a computer/data/phone system within a large building, connected by conventional wiring – coaxial or balanced pairs. By using RF distribution (2.4-2.4835GHz) instead, flexibility is greatly increased. Typical output powers for the transmitter units are quoted as 100mW, with ranges of 130m indoors and 300m outdoors.

There are proposals for the transmission of digital data via power lines, with minimal domestic EMC protection: the result would be a radiating home wiring system. A variation on his theme is to use domestic phone wiring to transmit HF data around the house: the unscreened wire pairs again form a radiating aerial, for both the fundamental frequency and harmonics. With a digital signal, harmonic generation is likely to be high. These systems would use low HF, typically between 2-10MHz. The harmonics are likely to cause problems within the house however – for example with the largely unscreened IF strip in many modern TV sets.

Amstrad

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Currently we have approximately 90 models throughout the consumer electronics range consisting of CD Clock Radios, Portable Stereos, Portable CD Stereos, Personal CD Players, Micro Systems, CD Micro Systems, Mini Hi-Fi, Midi Hi-Fi, 14" TV, 20" TV, 28" TV, 33" TV, TV - VCR Combinations, Non Videoplus VCR, Videoplus VCR, Videoplus VCR, Nicam 4 head VCR and of course new innovative products continually being released for the UK market.




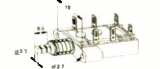
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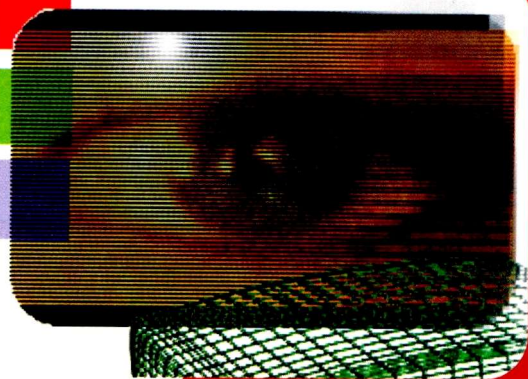
Please mark all references from this advertisement for the attention of Mr T James, Operations Manager.

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<tr><td>STR10006</td><td>STR41090</td><td>6.00</td></tr> <tr><td>STR41090</td><td>STR50020</td><td>6.50</td></tr> <tr><td>STR50020</td><td>STR50105</td><td>6.50</td></tr> <tr><td>STR50105</td><td>STR54041</td><td>5.50</td></tr> <tr><td>STR54041</td><td>STR58041</td><td>5.50</td></tr> <tr><td>STR58041</td><td>STR59041</td><td>6.50</td></tr> <tr><td>STR59041</td><td>STR6545</td><td>10.00</td></tr> <tr><td>STR6545</td><td>STRD1706</td><td>7.99</td></tr> <tr><td>STRD1706</td><td>STRD1806</td><td>4.99</td></tr> <tr><td>STRD1806</td><td>STRD1816</td><td>5.99</td></tr> <tr><td>STRD1816</td><td>STRD4420</td><td>6.00</td></tr> <tr><td>STRD4420</td><td>STRD5441</td><td>6.00</td></tr> <tr><td>STRD5441</td><td>STRD5541</td><td>7.99</td></tr> <tr><td>STRD5541</td><td>STRD6008X</td><td>6.00</td></tr> <tr><td>STRD6008X</td><td>STRD6108</td><td>7.99</td></tr> <tr><td>STRD6108</td><td>STRD6202</td><td>7.99</td></tr> <tr><td>STRD6202</td><td>TAB205</td><td>3.80</td></tr> <tr><td>TAB205</td><td>TAB211</td><td>2.60</td></tr> <tr><td>TAB211</td><td>TAB210</td><td>3.50</td></tr> </table>	AKAI	1451R	16.99	CT2569E	AN5515	16.99	CT2892E	NIKKAI	16.99	AKURA	BABY 10	16.99	CX10	NT14	16.99	BEKO	NT20	16.99	16328NX	PANASONIC	16.99	16228NX	TLF14567	20.00	BUSH	TLF14568	20.00	2114T	TLF14585	20.00	3114T	TLF14586	20.00	DECCA	TLF14592	22.00	DN8652	TLF15505	22.00	DT9476	TLF15506	22.00	DV9499	TLF15534	28.00	TN9422	PHILIPS	16.99	FERGUSON	2A3A	16.99	TX85/86	CTXE/S	16.99	TX90	GR1AX	16.99	TX100	GR22AA	22.00	51P7	CP90	16.99	59K7	CP110	22.00	66M3	SAISHO	16.99	AS1F	CT149R	16.99	FINLUX	CT149TXA	16.99	2482	SAMSUNG	16.99	GOLDSTAR	CB514F	16.99	CBT2162E	CT541ZG	16.99	CIT9508	GOODMANS	16.99	CTV14R	CTV14R	16.99	CTV2180	CTV2180	16.99	TV220RC	GRUNDIG	16.99	CUC2401	CUC2401	21.50	CUC3400	CUC3400	21.50	HINARI	CT14	19.99	CT20R	DIGI 3 110	16.99	TVA1	TVA1	16.99	HITACHI	C2114T	24.99	C2118T	C2118T	24.99	C21P226	C21P226	24.99	C2558T	CPT2036	16.99	CPT2036	CPT2158	16.99	CPT2158	CP12178	16.99	CP12178	CP12478	16.99	ITT	COMP 80R	16.99	COMP 80R	C13425	16.99	C13425	DIGI 3 110	16.99	DIGI 3 110	ST3876	16.99	ST3876	TX3537	16.99	TX3537	JVC	16.99	JVC	C21E1E	16.99	C21E1E	LOEWE	16.99	LOEWE	ART 1	16.99	ART 1	CLASSIC M	16.99	CLASSIC M	PROFI S 2816	16.99	PROFI S 2816	MATSUI	16.99	MATSUI	1440A	16.99	1440A	209R/T	25.00	209R/T	MITSUBISHI	16.99	MITSUBISHI	CT2145EPH	16.99	CT2145EPH	CT2146LM	16.99	CT2146LM	NEI	16.99	NEI	AN5512	1.99	AN5512	AN5515	1.99	AN5515	BA3910	12.99	BA3910	NT14	16.99	NT14	BA3918	12.99	BA3918	BA3920	4.99	BA3920	BA5408	4.99	BA5408	BA5410	3.50	BA5410	BA5412	3.50	BA5412	BA6109	1.80	BA6109	BA6122	3.99	BA6122	BA6209	2.50	BA6209	BA6219	1.99	BA6219	BA6222	2.99	BA6222	BA6238	1.99	BA6238	BA6239	2.50	BA6239	BA6247	3.50	BA6247	CNX62A	1.99	CNX62A	CNX82A	1.99	CNX82A	CNX83	1.99	CNX83	CNY75	1.99	CNY75	CNY65	4.99	CNY65	HA11423	2.25	HA11423	HA13001	1.99	HA13001	HA13108	3.50	HA13108	HA13117	2.99	HA13117	HA13118	2.99	HA13118	HA13119	2.99	HA13119	HA13128	4.99	HA13128	HA13130	16.99	HA13130	HA13001	1.99	HA13001	HA13151A	14.99	HA13151A	LA4270	2.99	LA4270	LA4280	3.99	LA4280	LA4282	5.99	LA4282	LA4440	2.25	LA4440	LA4445	2.50	LA4445	LA4446	2.99	LA4446	LA4460	1.60	LA4460	LA4461	1.60	LA4461	LA4465	2.99	LA4465	LA4466	2.99	LA4466	LA4475	2.99	LA4475	LA4476	2.99	LA4476	LA4485	2.99	LA4485	LA4495	3.99	LA4495	LA4496	3.99	LA4496	LA4508	2.60	LA4508	LA4597	2.99	LA4597	LA4700	3.99	LA4700	LA4705	10.00	LA4705	LA7800	1.80	LA7800	LA7801	1.95	LA7801	LA7830	1.99	LA7830	LA7832	3.99	LA7832	LA7833	3.99	LA7833	LA7836	1.99	LA7836	LA7837	2.99	LA7837	LA7838	6.99	LA7838	M54544L	2.99	M54544L	TAB891N	8.50	TAB891N	TAB701AN	6.99	TAB701AN	TAB718	2.99	TAB718	TDA1515	2.50	TDA1515	TDA1552Q	6.99	TDA1552Q	TDA1553Q	6.99	TDA1553Q	TDA1514Q	6.99	TDA1514Q	TDA1557Q	3.99	TDA1557Q	TDA1558Q	3.99	TDA1558Q	TDA2030	1.70	TDA2030	TDA2040	1.70	TDA2040	TDA2052	3.60	TDA2052	TDA2578A	2.99	TDA2578A	TDA2579A	2.60	TDA2579A	TDA2653A	3.25	TDA2653A	M54545L	3.40	M54545L	M54549L	4.50	M54549L	M54648L	3.99	M54648L	MC13306T3	3.99	MC13306T3	PAL003A	20.00	PAL003A	PAL3029B	14.99	PAL3029B	STK4182	11.00	STK4182	STK465	11.00	STK465	STK3082 II	8.50	STK3082 II	STK4121 II	8.50	STK4121 II	STK4131 II	6.50	STK4131 II	STK4172 II	7.00	STK4172 II	STK4141 II	6.50	STK4141 II	STK4141 V	8.00	STK4141 V	STK4142 II	2.50	STK4142 II	STK4151 II	8.00	STK4151 II	STK4152 II	9.00	STK4152 II	STK4162 II	8.00	STK4162 II	STK4171 II	8.50	STK4171 II	STK4172 II	9.00	STK4172 II	STK4182	10.00	STK4182	STK4182 II	10.00	STK4182 II	STK5434	7.00	STK5434	STK5481	6.00	STK5481	STK5490	5.50	STK5490	STK7226	8.00	STK7226	STK7253	6.50	STK7253	STK7308	4.99	STK7308	STK7348	4.50	STK7348	STR73805	12.99	STR73805	STR73410	6.99	STR73410	STR4211	5.99	STR4211	STR5412	4.50	STR5412	STR6020	4.50	STR6020	STR10006	6.00	STR10006	STR41090	6.00	STR41090	STR50020	6.50	STR50020	STR50105	6.50	STR50105	STR54041	5.50	STR54041	STR58041	5.50	STR58041	STR59041	6.50	STR59041	STR6545	10.00	STR6545	STRD1706	7.99	STRD1706	STRD1806	4.99	STRD1806	STRD1816	5.99	STRD1816	STRD4420	6.00	STRD4420	STRD5441	6.00	STRD5441	STRD5541	7.99	STRD5541	STRD6008X	6.00	STRD6008X	STRD6108	7.99	STRD6108	STRD6202	7.99	STRD6202	TAB205	3.80	TAB205	TAB211	2.60	TAB211	TAB210	3.50	<table border="1"> <tr><td>TA7270</td><td>2.50</td></tr> <tr><td>TA7271</td><td>2.50</td></tr> <tr><td>TA7279</td><td>3.99</td></tr> <tr><td>TA7281</td><td>2.75</td></tr> <tr><td>TA7283</td><td>3.00</td></tr> <tr><td>TA7288</td><td>4.29</td></tr> <tr><td>TA7299</td><td>3.99</td></tr> <tr><td>TAB214</td><td>3.60</td></tr> <tr><td>TAB215</td><td>3.60</td></tr> <tr><td>TAB216</td><td>4.25</td></tr> <tr><td>TAB217</td><td>2.99</td></tr> <tr><td>TAB218</td><td>7.50</td></tr> <tr><td>TAB220</td><td>5.99</td></tr> <tr><td>TAB221</td><td>5.99</td></tr> <tr><td>TAB227P</td><td>3.99</td></tr> <tr><td>TAB427K</td><td>3.99</td></tr> <tr><td>TAB659AN</td><td>12.99</td></tr> <tr><td>TAB690AN</td><td>12.99</td></tr> <tr><td>TDA3560</td><td>3.25</td></tr> <tr><td>TDA3561A</td><td>3.60</td></tr> <tr><td>TDA3562A</td><td>3.99</td></tr> <tr><td>TDA3565</td><td>2.99</td></tr> <tr><td>TDA3640</td><td>3.99</td></tr> <tr><td>TDA3654</td><td>1.70</td></tr> <tr><td>TDA3653B</td><td>1.99</td></tr> <tr><td>TDA3651</td><td>1.99</td></tr> <tr><td>TDA4500</td><td>3.99</td></tr> <tr><td>TDA4503</td><td>5.25</td></tr> <tr><td>TDA4505E</td><td>4.99</td></tr> <tr><td>TDA4505M</td><td>12.99</td></tr> <tr><td>TDA4600</td><td>1.99</td></tr> <tr><td>TDA4601</td><td>1.99</td></tr> <tr><td>TDA4605</td><td>2.99</td></tr> <tr><td>TDA4950</td><td>1.99</td></tr> <tr><td>TDA8137</td><td>3.99</td></tr> <tr><td>TDA8138</td><td>3.99</td></tr> <tr><td>TDA8139</td><td>3.99</td></tr> <tr><td>TDA8170</td><td>2.99</td></tr> <tr><td>TDA8171</td><td>7.99</td></tr> <tr><td>TDA8172</td><td>3.50</td></tr> <tr><td>TDA8175</td><td>2.99</td></tr> <tr><td>TDA8177</td><td>3.50</td></tr> <tr><td>TDA8178FS</td><td>4.25</td></tr> <tr><td>TDA8179S</td><td>7.99</td></tr> <tr><td>TDA8305</td><td>10.00</td></tr> <tr><td>TDA83500</td><td>3.99</td></tr> <tr><td>TDA8380</td><td>2.60</td></tr> <tr><td>TEA1039</td><td>1.99</td></tr> <tr><td>TEA2018A</td><td>1.99</td></tr> <tr><td>TEA2019</td><td>1.99</td></tr> <tr><td>TEA2029C</td><td>3.99</td></tr> <tr><td>TEA2031A</td><td>1.60</td></tr> <tr><td>TEA2164</td><td>2.99</td></tr> <tr><td>TEA2165</td><td>3.99</td></tr> <tr><td>TEA2260</td><td>2.99</td></tr> <tr><td>TEA2261</td><td>2.99</td></tr> <tr><td>TEA5101A</td><td>4.25</td></tr> <tr><td>TLP621</td><td>2.99</td></tr> <tr><td>UC3842</td><td>1.99</td></tr> <tr><td>UC3844</td><td>1.99</td></tr> <tr><td>UPC1288</td><td>3.99</td></tr> <tr><td>UPC1298V</td><td>3.99</td></tr> <tr><td>UPC1310V</td><td>7.99</td></tr> <tr><td>UPC1335V</td><td>5.99</td></tr> <tr><td>UPC1379C</td><td>2.25</td></tr> <tr><td>UPC1394</td><td>1.99</td></tr> <tr><td>UPC1488</td><td>2.60</td></tr> </table>	TA7270	2.50	TA7271	2.50	TA7279	3.99	TA7281	2.75	TA7283	3.00	TA7288	4.29	TA7299	3.99	TAB214	3.60	TAB215	3.60	TAB216	4.25	TAB217	2.99	TAB218	7.50	TAB220	5.99	TAB221	5.99	TAB227P	3.99	TAB427K	3.99	TAB659AN	12.99	TAB690AN	12.99	TDA3560	3.25	TDA3561A	3.60	TDA3562A	3.99	TDA3565	2.99	TDA3640	3.99	TDA3654	1.70	TDA3653B	1.99	TDA3651	1.99	TDA4500	3.99	TDA4503	5.25	TDA4505E	4.99	TDA4505M	12.99	TDA4600	1.99	TDA4601	1.99	TDA4605	2.99	TDA4950	1.99	TDA8137	3.99	TDA8138	3.99	TDA8139	3.99	TDA8170	2.99	TDA8171	7.99	TDA8172	3.50	TDA8175	2.99	TDA8177	3.50	TDA8178FS	4.25	TDA8179S	7.99	TDA8305	10.00	TDA83500	3.99	TDA8380	2.60	TEA1039	1.99	TEA2018A	1.99	TEA2019	1.99	TEA2029C	3.99	TEA2031A	1.60	TEA2164	2.99	TEA2165	3.99	TEA2260	2.99	TEA2261	2.99	TEA5101A	4.25	TLP621	2.99	UC3842	1.99	UC3844	1.99	UPC1288	3.99	UPC1298V	3.99	UPC1310V	7.99	UPC1335V	5.99	UPC1379C	2.25	UPC1394	1.99	UPC1488	2.60	<p>VHS ALIGNMENT TAPE BAND TRACKING, TAPE TRANSPORT, FM PICTU CURVE, AUDIO SYNC HEAD AZIMUTH TRACKING PLAYBACK SWITCHING POINT £39.99</p>	<p>PATTERN GENERATOR Colour bar, Cross hatch, Staircase. COMPACT PORTABLE £84.99 only</p>	<p>Capacitance Meters Capacitance Meter PG015</p>  <p>An accurate, capacitance meter providing measurements over a very wide range. 0 TO 2000UF ACCURACY 0.5% £29.99</p>	<p>Transparent Service/Cassette £6.50</p> 	<p>Hitachi/Salora Mains Switch £1.99</p> 
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Reports from
Philip Blundell, AMIElec
Brian Storm
Kevin J. Green, TMIE
Eugene Trundle
Paul Hardy
Russ Phillips
Graham Colebourn
Alan J. Roberts
Keith Evans
Colin J. Guy and
Pete Gurney, LCGI

**Philips 32PW9631/05
 (5GFL2.30EAA chassis)**

This widescreen set's line output transformer had failed. When a replacement was fitted the set still wouldn't start up. The front LED went to green for approximately eight seconds, after which there was a flashing red LED display. The error code picked up by the Dealer Service tool suggested a geometry stage fault.

One of the checks that the DDP module carries out is to monitor the amplitude of the line flyback pulses. If they are low during the start-up phase, the module signals a fault condition, pulsing the protection line to shut the set down. I found that the line flyback pulses and the EHT did measure low during the few seconds before the set shut down.

The 'line switch' FET in the 141V supply normally allows the HT to rise gradually. In this case however the supply reached only 45V before the set returned to standby. Resistance checks in the line-switch stage showed that zener diode D6480 (BZX79C10V) was leaky.

After an excess-current problem in the line output stage, it's a good move to check the line-switch FET

TV

Fault Finding

and surrounding components in case they have been damaged. **P.B.**

Sharp 59CS03H

If there is no line drive, check C714 (100µF, 16V) by replacement. **P.B.**

**Philips 28SL5770/05B
 (FL1.0 chassis)**

If there is no off-air sound, external sound being OK, check whether there are sound and Nicam IF outputs from the tuner/IF module. If both are missing, replace the TDA3856 IC in the module. **P.B.**

Panasonic TX21AD2 (Euro 2 chassis)

As reception was very poor I suspected the tuner. It was blameless of course! So attention was turned to the IF processor chip IC102, where the voltage at pin 13 was found to be unnaturally low. The culprit turned out to be C111 (0.068µF) which was leaky. There was a good, clean picture once a replacement had been fitted. **B.S.**

**Panasonic TX25MD1/B
 (Euro 2 chassis)**

The top half of the picture was completely blacked out. In a half-hearted attempt to be logical I replaced the digital video processor chip, but the fault was still present. In this chassis the digital processing ICs are 'loaded' at switch on by the EEPROM chip IC1202 and the EAROM chip IC1203.

Replace-ment of IC1203 cured the original fault, but there was a new problem: the line sync was very unstable. This fault was eventually cured by replacing IC1202. It seems that the software has been improved during production, as later EAROMs are not entirely compatible in this respect with earlier EEPROMs.

It is very important, especially with these earlier Euro 2 sets, to note the model number suffix, e.g. TX25MD1/M or TX25MD1/B. The suffix indicates a CRT variation and therefore a software difference. This is embedded in the memory chips mentioned above (or IC1871 and IC1941 in some sets). The various software versions for the different CRTs are not interchangeable, despite the similarity of some of the part numbers. Service manuals are available for all the variants. **B.S.**

Philips CP90 Chassis

This set had very bad line linearity at the centre of the screen. The cause was the two diodes in the EW modulator circuit – D6609 and D6610. We had to check them by substitution as the originals didn't read faulty when checked with a meter. **K.J.G.**

Panasonic TX25AD2 (Euro 2 chassis)

This set had a very intermittent fault – to make matters worse the job was a chargeable one. The symptom was field jump/jitter at the bottom of the screen, with some black lines, because of disturbance to the field scan. Its cause was eventually traced to D507/D508 and R507. The diodes seemed to be OK when checked with a digital meter. **K.J.G.**

Hitachi C28WD2TN

This widescreen model produced, very intermittently, dotted vertical contours of picture features, widely removed from the features themselves – in fact they were delayed by more than half a line period. At it's worst, the set radiated interference that was picked up by other sets in the workshop: these would then display the same eerie dotted lines!

The cause of the trouble was a dry-joint at C875 (22 μ F, 250V) on the tube base panel: it decouples the velocity-modulation drive circuit. **E.T.**

Salora M Chassis

The customer's complaint was that this set, an Hitachi-badged 28in. model, would produce whistles and picture disturbances when it had been on for some time. After attending to lots of dry-joints, I left it on soak test. Five or so hours later the fault complained about occurred: the power supply squealed violently, and there was severe picture cogging.

The hybrid chip in the power supply can cause this, but I didn't have an LF0070 in stock and the customer wanted a quick repair. When I examined the chip with a magnifying glass I discovered a number of poor joints. Resoldering them cured the problem. I wonder how many of these chips might have worked normally after similar treatment instead of being consigned to the bin? **P.H.**

Matsui 2190

This set was dead: the mains fuse was open-circuit because the degaussing posistor TH80 had failed. The type used in the Ferguson ICC5 chassis is supposed to be the same, but after fitting one of these there were still slight purity errors that were most noticeable with teletext. They could be cleared by using a degaussing wand, but reappeared when the set was switched on. In the end I cured the problem by fitting a type 96009 posistor.

When the back was replaced the sound disappeared – the customer hadn't reported that. The cause was traced to bad joints on the small IF panel and where this panel is soldered to the main board. **P.H.**

Beko 15225NX

This set had stopped working and produced a burning smell. I'd no circuit diagram, but the cause of the trouble was obvious: L507 had become dry-jointed and had damaged the board. After filing away the carbonised area I supported the coil on strong wire. The set then worked normally. **P.H.**

Casio TV1400

This hand-held TV set had an intermittent power connection. I had great difficulty trying to get the case open. Once this had been

accomplished, broken print could be seen at the connector. A print repair with wire was possible. **P.H.**

Ferguson C51F (ICC6 chassis)

This set would intermittently scroll through the channels. It's supposed to do this if the channel up or down button is pressed and no signal is received on a programme number. The programme numbers are automatically sequenced until a station is found, at which point the process should stop. With this set channel changing continued even though signals were being received. The problem was cured by replacing the keyboard foil. **P.H.**

Orion C14LTXG

There was a raster but no snow. It didn't take long to find that there was no tuner supply because R425 (21 Ω , 0.5W safety) was open-circuit. **P.H.**

Sony BE1 Chassis

Field collapse is a common problem with these sets. With luck, all that will be required is to resolder the connections to the μ PC1488H field output chip IC501. If the chip has to be replaced, the following may have failed: the 0.6A protector PS501, which is in series with output pin 3, and safety resistor R801 (0.47 Ω , 0.25W) in the 24V supply. **P.H.**

Hitachi C2558TN (G8Q chassis)

The channel number was displayed but there was no EHT and the 12V supply was low at about 5V. The 12V supply's reservoir capacitor C933 (2,200 μ F, 25V) was leaky. **R.P.**

Ferguson C14C

After short time the field scan reduced to a few inches then collapsed completely. In the fault condition the 9V supply to IL01 (TDA8214B), which combines the line and field generator circuits and the field output stage, was low at 5V. The cause of the fault was DL08 (1N4148) which was open-circuit. **R.P.**

B&O MX3500

This set produced crackling sound, very similar to Nicam dropout, that stopped after about 20-30 minutes. A long, hard look with a magnifying glass and a strong bench light revealed dry-joints at the audio output chips IC3 and IC4. They are on PCB10, the bottom board. **R.P.**

Ferguson C14C

The complaint was low volume. I found that the maximum volume had been turned down in the lock-out menu. To gain access to this menu, switch the set on at the mains while holding down the remote-control unit's standby button for at least four seconds. Then press the violet personal adjustments button to select volume. The maximum output can then be adjusted by using the +/- buttons. **R.P.**

Sony AE1 Chassis

As this set warmed up it developed line sync jitter and the picture would sometimes roll. Obvious, I thought, dry-joints at the vision detector coils. Not so, but I resoldered them anyway. There were dry-joints at the 12V regulator IC608 (Q608 on the PCB), but resoldering them didn't cure the fault either.

A 1.8V peak-to-peak video signal should be present at pin 27 of IC501 to drive the sync separator. The amplitude of this signal was found to be low at only 0.3V p-p. Q598, the video amplifier, was the cause of the trouble. It's on the main board (D) under the tuner. **G.C.**

B&O 7430 (7702)

The complaint with this set was "intermittent loss of the picture". After a week on test with no picture loss we sent it home. The travelling was obviously food for the set, as it didn't return for five weeks. It came back with a more detailed description of the fault: "The picture blanks out for about a minute, then recovers for three-four minutes, then blanks again. When the picture returns it's red at first. Thumping makes no difference."

This time the set obliged us with repeated failure – even with the back removed! The detailed fault description saved us hours of work. As thumping made no difference, we didn't concentrate on a search for dry-joints, while the initially red picture meant that the automatic black-level balance had to be re-established after the fault.

When the fault was present the CRT's cathode voltages rose to the HT level and the heaters remained alight. So we decided to check the blanking circuitry. The field blanking drive at the collector of TR15 on the chroma panel (diagram B if you have the manual) fell from its normal 2.7V to only 0.5V in the fault condition. In fact the local 11.5V

supply was missing because the BC338 sub-regulator transistor TR2 at the left-hand side of the panel was faulty – it was going open-circuit base-to-emitter intermittently. A replacement restored normal operation and the owner's sanity. **G.C.**

Ferguson TX99 Chassis

If there's no teletext after removal of the main PCB for a repair, you have probably lost the 9V supply to the text panel. It's derived from the line output stage. Check whether the connector has been pulled off the single-pin plug PL22, which is just to the left of the LOPT. **G.C.**

Philips G110 Chassis

If one of these sets is dead and there are no blown fuses or major short-circuits, check the resistance across the BU508AF line output transistor Tr7545. Should the reading be low, say less than $1k\Omega$, isolate and check the transistor, the line output transformer (which can fail), the 390nF scan-correction capacitor C2550, and the line output stage tuning capacitor C2545 (1.2nF, 2kV ceramic disc). The latter can split open and go low-resistance. **G.C.**

Sony KV1612UB Mk I (SCC251 chassis)

Although these 16in. sets are quite old some of them can still produce an excellent picture, especially when the colour decoder is set up well. A seemingly dead set was found to have 330V across the mains bridge rectifier's reservoir capacitor but no 110V HT supply. The 2SC1942 series chopper transistor Q605 was short-circuit between all its pins – a BU208A is a suitable replacement. R637 (0.33Ω , 1W), which is in series with Q605, was open-circuit and R640 ($10k\Omega$) had burnt out.

Once these items had been replaced the power supply came back to life. I also checked the two HT reservoir capacitors C616 and C621, and R604 ($8.2M\Omega$). **G.C.**

Tatung A Chassis

Although the standby light went out, this set didn't come on as there was no 12V supply at pin 10 of the TDA2579A timebase generator chip IC401. The LM317T 12V regulator was dry-jointed. Once this had been attended to the set worked but wouldn't switch off. The mains switch contacts had welded themselves closed. **G.C.**

Philips GR1-AX Chassis

This set was dead except for a low,

growling noise that came from the speaker at switch-on. The 95V HT supply was OK, but there was no 9V start-up supply to the line driver stage. The 6.8 μ F capacitor C2523 that smooths the supply to this stage is a common cause of the fault, so I fitted a replacement – the value has been upgraded to 68 μ F.

The set then worked – until I refitted the PCB, when the original fault was back. The 9V supply was again missing, but about 4.5V was present at the 125mA fuse. Choke L5524 (1.5 μ H), which is in series with the supply, was open-circuit. As I didn't have a 1.5 μ H choke I fitted a 2.2 μ H one instead. Normal service was then resumed, and a long soak test proved that the set was now OK. **A.J.R.**

Matsui 20T1

This set had failed when under guarantee, and had failed again when about eighteen months old. The dealer didn't want to know about it, and some months later I was asked to have a look. The previous repairer had obviously changed the line output transistor using a blowtorch or something similar! The print had lifted from the board, and the efficiency diode was badly fitted and dry-jointed – its leadouts were black, with large blobs of solder around them. It was not surprising that the line output transistor was short-circuit again. A classic case of cowboy activity.

I removed the diode, which was OK, cleaned and tinned its leadouts, and refitted it. A new BUT12AF transistor was installed and the print tidied up to complete the repair. **A.J.R.**

Sharp DV5101 (Euro DS1 chassis)

All this set produced was a faint whistling noise from its power supply. I found that the line output transformer had shorted turns. Once a replacement had been fitted I was rewarded with a blue screen, though there was a very good picture when video was fed in at the scart connector. Obviously the front end wasn't working.

When voltage checks were carried out around the tuner and the IF chip IC250 I found that the supply to the latter was missing. It's applied to pin 7, where the decoupling capacitor C257 (330 μ F, 16V) was short-circuit. The supply comes via a 2.1V zener diode (D250) which was open-circuit. Replacements restored normal operation. **A.J.R.**

Philips GR2.4 Chassis

This set came from a dealer who had been unable to restore full field scanning. When the set was switched on there was a thin line across the screen with about two inches of noisy scan beneath it. The dealer had replaced all the transistors and diodes in the field output stage, but scope checks showed that only the 'bottom' transistor of the output pair was working.

Voltage checks showed that there was about 20V at the emitter of Tr7502 and 10V at the emitter of Tr7503. This meant a 10V drop across R3503 (4.7 Ω), which was open-circuit. A replacement restored normal scanning. **A.J.R.**

ITT 3896 (Digi-3 chassis)

I'd never seen one of these sets before. This one was brought in by a couple of people. They said that the picture took about ten minutes to settle down, after which it was OK.

From a glance at the picture it was obvious that there was some sort of IF instability – possibly AGC overload. So I decided to take a look inside the tuner/IF module. There were half a dozen or so electrolytics inside, some of which looked the worse for wear. A couple of 1 μ F electrolytics produced low readings, but I decided the best thing was to replace the lot. After that the set worked perfectly. **A.J.R.**

Sony AE1 Chassis

"Takes a long time to come on and the picture sometimes goes negative" the customer said. A check on the power supply showed that its outputs were all low – the HT was at 120V instead of 135V, while the 12V and 7V lines were at about 3V. Toggling the set in and out of standby made little difference. After ten minutes in the on condition there was a sudden burst of activity and the sound and picture appeared. I then noticed that the colour saturation was not even from the top to the bottom of the screen – the top third of the picture was displayed with a washed out appearance on certain scenes and colours. Could this be connected in any way with the temperamental power supply?

Further investigation in the power supply brought to light the fact that when the set was returned to standby the 14V output started to fall very slowly, and after a time the set wouldn't respond to an on command. The reservoir capacitor for this supply is C615 (1,000 μ F,

25V). A replacement restored normal power supply operation.

The cause of the negative picture was a fairly common one with these sets, dry-joints at T1 and T2 in the IF section. **K.E.**

Sanyo CBP2180

The problem with this ageing set was intermittent picture break up coupled with occasional field distortion. Careful tapping around the PCB and on various components revealed dry-joints at the 12V regulators IC551 and IC552. **K.E.**

B&O L2500

When this set was called out of standby the front panel LED would extinguish and the power supply would shut down. After checking the line output transistor and transformer and finding them to be OK I turned to the line driver stage, where transistor 4TR15 (BC328-25) was found to be open-circuit base-to-collector. **K.E.**

Bush 2020T (Indiana 100 chassis)

There was no teletext but when mix was selected page 100 would appear, line by line, over a period of several minutes. This text display wasn't synchronised with the picture – it was floating. The cause of this strange symptom was the VAD1250 chip on the text panel. **C.J.G.**

Goodmans 149TT (Onwa chassis)

The problem was field collapse. Its cause turned out to be R375 (180k Ω) which was open-circuit. It's connected to pin 33 of the AN5601 chip IC301. **C.J.G.**

Hitachi G7PS Chassis

The HT was low at 40V and the series chopper transistor Q903 was getting hot. This was because it wasn't oscillating: it was biased on by the start-up resistors and was acting as a series voltage dropper. The cause of the trouble was D905, which provides the supply for the error amplifier and chopper driver transistors. In was short-circuit. **C.J.G.**

Matsui 1436

There was no colour, with a streaking effect on the left-hand side of the screen. The symptoms were reminiscent of a certain ident fault you used to get with the Thorn 3000 chassis. The cause turned out to be C318 (2.2 μ F), which is connected to pin 12 of the TA7698

colour decoder/timebase generator chip IC301. **C.J.G.**

Ferguson B14R (Thomson TX80 chassis)

There was a buzzing noise and a weak, narrow raster, with a hum bar and the word "lock" just visible. The cause was DP15, which is one of three 1N4001 diodes connected in series with the base of the chopper/line output transistor TP10. It was open-circuit.

A replacement diode brought back the full raster, after which the child lock was released by switching to standby then back again, using the remote control unit. **C.J.G.**

Hitachi C2558

This set suffered from repeated failure of the TDA3654 field output chip – at about monthly intervals. Eventually I discovered an almost indiscernible dry-joint at one of the tags on the scan coils. Dealing with this seems to have cured the trouble – the set hasn't been back for some months.

Incidentally, when this type of chip is replaced in any set it's a good idea to replace the flyback boost capacitor which is connected to pin 6. The value is usually 47 or 100 μ F. **C.J.G.**

Ferguson ICC9 Chassis

This set's line output transistor was short-circuit. A replacement became very hot very quickly and threatened to go the same way. Normal operation was restored once TL61 (2SC2655) in the line driver circuit had been replaced, though the original measured OK when checked with a tester. **C.J.G.**

Tatung B Chassis

The Phantom had been at this set, which was dead with no power supply activity. After removing all the crud from the PCB and resoldering everything in the power supply I could see where I was going. The start-up voltage at pin 7 of the chopper control chip IC801 was low at 7V, though the feed resistors were OK. A replacement chip made no difference. The cause of the trouble was found to be D807, which takes over the supply to the chip when the circuit is fully operational. It's a 1N4148, but had turned itself into a quite effective 7V zener diode! **C.J.G.**

Bush 2857

This set came in because it was dead. Although there were virtually

no outputs from the power supply, there seemed to be plenty of activity on its primary side. A scope check confirmed that it was tripping silently.

I disconnected CN904 to isolate the power supply from the rest of the set, and connected a dummy load across its HT output. When the set was turned on again the power supply still refused to run. There were not a lot of components left to check. When C914 (4.7nF, 500V), which is connected in parallel with the HT rectifier, was checked it was found to have a resistance of 300 Ω . I fitted a replacement with a more substantial 2kV rating. **P.G.**

Philips CP90 Chassis

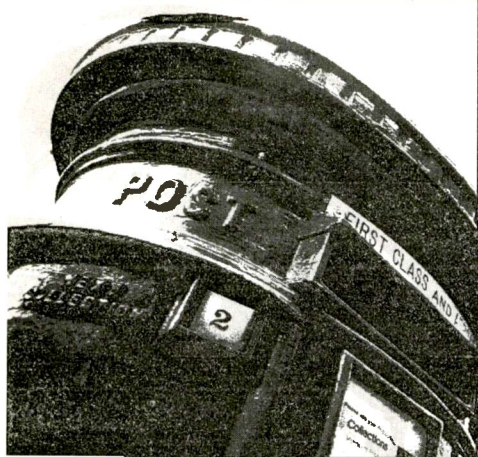
The complaint with a 14in. portable fitted with this chassis was no colour. Checks around the TDA3561A colour decoder chip showed that the chroma signal entered at pin 3, the crystal was active and all the pulses were present. The one obvious discrepancy was at the colour control pin 6, where the voltage refused to budge from 0V. The decoupling capacitor here, C2278 (22nF), had developed a 500 Ω leak. **P.G.**

Samsung CI5361A (P68SA chassis)

This set was dead though the power supply was running with the correct output voltages. There was no drive at the base of the line output transistor however. Voltage checks in the line driver stage showed that the transistor's collector voltage was missing. The cause turned out to be the 1N4003 diode D404 that provides the start-up supply. It was open-circuit. **P.G.**

Bush CTV1400

Intermittent loss of the picture and sound was the complaint with this set. When the fault eventually appeared I found that the set was going off tune, with nearly 30V present at the tuner's BT pin. The tuning arrangement is fairly straightforward, the PWM from the microcontroller chip being integrated by Q103 and its associated components. When checks were carried out around Q103 in the fault condition a voltage was measured at its emitter, which should be at chassis potential. The emitter connection to chassis is made via a very fine track that runs next to the tuner unit. This track had cracked, as a result of the tuner being flexed while connecting an aerial. **P.G.**



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.

Interference from DTTV

The arrival of Channel 5 caused great congestion in the UHF TV bands. It suddenly became difficult to find a clear channel for VCR and satellite receiver outputs. I didn't think things could get any worse – then digital terrestrial TV transmissions started!

Here in South Yorkshire the only clear channels between 21 and 54 will soon be 36 and 38, which are adjacent to Channel 5 on 37. I'm sure that the situation is much the same over large parts of the country.

Each of the six digital multiplexes occupies a conventional 8MHz channel. On the screen of a spectrum analyser they look just like a block of noise with a grassy top, filling the channel exactly from its lower to its upper limits. From the point of view of analogue reception this is precisely what they are – straightforward noise.

We all understand the concept of signal-to-noise ratio in its familiar form, where the noise floor is more-or-less fixed and a problem arises only when the signal is not far enough above it, in other words is "not strong enough". We must now become familiar with the concept of a varying, or unpredictable noise floor, since every transmitter in the land will soon in effect be pumping out six channels of noise.

Many engineers have already been called out to mystery VCR or

Letters

satellite faults because of this. I was completely taken by surprise when my first call came along. The customer rang up and said "the satellite picture is snowy, but if I unplug the aerial it's all right". This sounded unlikely, but turned out to be true. The satellite receiver's output was on ch. 30, and a digital signal on this channel from Belmont was the cause of the trouble. This was not in the Belmont service area.

The effect on the screen is indistinguishable from the snowy picture you get with a weak signal. My first thought was that the modulator must be faulty. But when the aerial was disconnected, hey presto the picture became perfect.

Since the digital transmissions are at about 20dB below the analogue ones, it's initially surprising that they can have such an effect. The reason lies in an analogue signal's extreme susceptibility to noise: visible impairment occurs with noise 40dB below the signal. Even when the aerial is not pointing directly at the source of the digital transmission, this level of interference is quite likely to be present. I wonder why the digital broadcasters are allowed to get away with it, when Channel 5 was made to spend millions on retuning VCRs?

What can be done? Where possible, abandon the RF output and fit a scart lead. If this isn't possible, for example where a VCR's or a satellite receiver's output feeds a distribution system, it might be worth attempting to find a clean channel by retuning the RF output from the VCR or satellite receiver. A better idea is to connect a notch filter to the aerial cable: a tunable notch filter can be adjusted to remove the offending signal, in this case noise, while passing all other channels. The virtues of this approach are that it's quick and foolproof – and the customer gets

a shiny little thing for his money! We all know that people value even very small physical items more than our time and effort.

I have always been in favour of a five-channel-pass filter/leveller at the aerial input of any distribution system that carries VCR and satellite receiver outputs. It seems to me that this will be more or less obligatory from now on. A channel-pass filter stops everything except the wanted channels. This is magic, because the whole band is cleared of unwanted signals, enabling VCR and satellite receiver outputs to use virtually any channel. These filters are a bit pricey, at £68 + VAT (from Taylor Bros of Oldham), but I think we have to see this as a sales opportunity rather than something sent to try us.

Interference from digital transmissions will not be confined to VCR and satellite receiver outputs. Off-air analogue reception is sure to suffer as well. Four of the digital multiplexes from Sutton Coldfield are on the same channels as Emley Moor analogue transmissions – and vice versa! It seems incredible that two adjacent main transmitters should share channels in this way. The result will be worse analogue-signal reception for people in fringe areas.

*Bill Wright,
Rotherham.*

Clanger?

In a letter in the January issue Michael Dranfield discusses the tuning-voltage arrangement used in the Hitachi Model C2118 and surmises that there is a fault in its design. Since the output from the microcontroller chip consists of a modulated pulse waveform, an oscilloscope check at the collector of the integrating transistor Q003 will reveal a series of pulses that vary in amplitude between 33V when the transistor is off (input

low) and almost zero when Q003 is switched on (input high). These pulses are filtered by the following RC network to produce a DC voltage which is fed to the tuner's VT input. A meter instead of a scope check would indicate the mean level of the pulses, which could well be 1.4V.

This method of tuning control has been widely used in recent years. I would guess that the original tuning drift was indeed caused by a faulty 33V voltage stabiliser, though leakage at the tuner's VT input is another possible cause. The drift mentioned when the HT rises is probably caused by a proportional increase in the tuner's 12V supply.

There is no need to implement the suggested modification, which is unnecessary.

*Dave Sergeant,
Dave Sergeant TV,
Bracknell, Berks.*

Since the input to integrating transistor Q003 in the Hitachi C2118 is a continuous pulse train, the transistor will be alternately cut off and saturated. So it won't be possible to read 33V across the voltage stabiliser ZD002. Michael Dranfield (Letters, January) wasn't happy until he changed the circuit to get a 33V reading. It's only by using a scope that any sense can be made of what is going on in this area. Contrary to what Michael assumes, the stabiliser was doing its job – by regulating the amplitude of the pulses fed to the integrating network. He had possibly cleared the fault by replacing ZD002 and its feed resistors but carried on, being unhappy with the low but normal voltage across the stabiliser.

Incidentally I still come across engineers who think that a 33V zener diode can be used instead of the dedicated 33V stabiliser IC normally employed in this position. But the IC regulator provides temperature stability by using a series chain of transistors with associated zener/avalanche diodes that operate in the 6V (approximately) zero temperature coefficient region.

*Alan Willcox,
Cardiff.*

Editorial comment: It was not suggested that the input to the integrating transistor was other than PWM. When the transistor is connected directly across the voltage stabilising device, the latter is



A satellite 'installation' spotted by Ken Taylor of Ken Taylor TV & Video, Rochdale, Lancs while on holiday at Lake Como, Italy.

being used as a pulse clipper rather than a stabiliser. In these conditions it is not likely to be able to provide effective stabilisation. This doesn't appear to be very good practice. The Hitachi circuit obviously works, but this is not the way in which a 33V stabiliser was originally intended to be used. A quick trawl through the circuit diagrams for a large number of other TV chassis has failed to find one, other than another Hitachi, in which the integrating transistor is not provided with a load resistor (usually 10k Ω , 22k Ω or 33k Ω) between its collector and a stabilised 33V source. Michael Dranfield's suggested modification seems to be perfectly valid, but any improvement it would contribute would appear to be a case of suck-it-and-see. Any other comments? **J.A.R.**

Servicing Matters

Alan Willcox (Letters, December) missed the meaning of my remarks concerning the ESR of a faulty capacitor in the Sharp Model DV5103. Yes, I would expect a good 50 μ F capacitor to have a low ESR. The point is that the capacitor in question should have been 2,200 μ F, was so marked, and certainly beeped when checked with my Capacitor Wizard (how did I survive 25 years in the trade without it?). Because of this, I passed it over several times before I discovered that it was the cause of the fault. When its value was checked with a capacitance meter, it was found to have fallen to 50 μ F. I was surprised simply because I have

never before come across a capacitor that was so far off its correct value while still showing a low ESR. But we live and learn.

On the subject of bodged repairs, I reckon that many of these are done by hard-pressed field engineers simply to get out of the house and on to the next job as quickly as possible. A good friend who works for a national rental company tells me that they are rated on how many jobs are completed on first call: if a set is taken back to the workshop, 'brownie' points are lost. So a bodge is a very tempting way out when the exact components required are not to hand.

In my view modern sets are not repairable in the field, and I tell my customers this. Naturally some people become suspicious, but I don't want untrusting people as customers anyway. In fact in 25 years I can recall only two people who insisted on an in-house repair and went elsewhere. One returned to me with his set a month later, after it had failed several times following 'repair' by the local Snoddies.

*Colin J. Guy,
Boston, Lincs.*

Low- Ω Unit

I have just built the low-ohms add-on unit described in the August 1998 issue, but had to make a couple of changes because of component availability problems.

I couldn't readily obtain a standard TL082 IC and had to settle for a TL082CN, which has a higher gain, but as a bonus I found that

I could obtain the full ohms range with only $\pm 6V$ supplies. As I find that batteries tend to die on me at the most inconvenient times, I used William Harrison's linear ohmmeter mains power supply (December 1981 issue) with 470Ω series resistors and $6.2V$ zener diodes.

I also found that the ZN423 zener device was not easy to find. Farnell suggested the ZR423 as an alternative, which is satisfactory. I did however find that there was some imbalance with the operation of the alternative VR1 arrangement. This prevented an accurate zero-setting, and was overcome by changing the value of the series resistor on the negative side of VR1 to $100k\Omega$.

Thank you, Alan Willcox: the unit works beautifully and will be very useful.

*Eric Kempshall,
Hove, East Sussex.*

Editorial note: The ZN423/ZR423 is listed by Maplin (order code GS86T). Other alternatives available from Maplin are the Zetex REF12Z (DB57M) and Harris ICL8069CCZR (YH39N).

Discharging Reservoir Capacitors

Having been 'bitten' on several occasions by fully-charged reservoir capacitors I decided to work out a safe routine for discharging them before handling a chassis. The most commonly adopted way of going about this is to use a high-wattage resistor, but in my experience the resistor tends to be 'borrowed' or get cleared away with leftover items. As an alternative I decided to use a $60W$ dummy-load lamp, which again often turned out to be unavailable for one reason or another.

My final solution was to use a salvaged NTC thermistor. The dull-green type marked SCK075 is suitable. It does produce a small amount of arc burn when applied to a capacitor's pins, but this – and indeed the degree of heating – give a useful indication of the capacitor's condition!

*Ian Field,
Letchworth, Herts.*

CD Player Lenses

Philip Blundell (CD Player Casebook, December) is not alone in finding CD pickups covered in dust, with the result that they skip or won't play. The problem has plagued midi systems for years.

Because these combined units require plenty of ventilation slots to keep the power sections cool, airborne dust inevitably finds its way on to the pickup lens. Unfortunately simply cleaning the lens may not be the end of the problem, as the dust also finds its way on to the internal optics, upsetting the operation of the various mirrors involved.

Aiwa suggests that you remove the cover from the pickup and very carefully clean both sides of the lens using a cotton swab with its tip bent. It is recommended that the mirrors are cleaned as well, using a cotton swab. Aiwa's three-disc carousel mechanism, which is fitted to many of the company's models, suffers severely from this problem. The very latest versions are fitted with a clever spring-loaded cover that flips over the lens when the CD player is not in use. The best solution is to replace the pickup, as it's difficult to guarantee precise cleaning. The price of pickups has fallen recently, making replacement a more viable proposition.

*Edgar M. Beddow,
Milton Keynes.*

Safety

I have paid $\pounds 10$ to the three winners of my PELV challenge (letters, December). They were Ian Muxworthy of Satfix, Swansea; Dave Langton from Bromley, Kent; and Dave Coombs from Ramsey, Cambridgeshire.

PELV stands for Protected Extra Low Voltage. The correct answer is $60V$ DC or $42.4V$ peak AC (some authorities state $25V$ AC). Anything higher than this is considered to be unsafe in apparatus connected to a telephone line, a requirement of BS6301 (now BSEN41003) and CENELEC HD384.

Dave Langton found the Building Research Establishment's website at www.bre.co.uk/bre/CEN/DOC6.TXT where you will find a transcript of the EC directive. Section 3.2.1 describes PELV.

*Martin Pickering, B.Eng.,
repairman@netcentral.co.uk*

Training

I am concerned about the education and training prospects for our trade, particularly now that digital TV is here. With the demise of the City and Guilds 2240 Radio and Television servicing course at all levels, and the NVQ and progres-

sion awards as the replacement, the situation doesn't look good.

Servicing requires an intuitive approach that's knowledge based. The method by which NVQs are gained does not instil the knowledge or the intuitive ability required for servicing at levels two and three.

How many engineers have an in-depth knowledge of digital design and application? How will new engineers gain the skills required to be able to act as a qualified service engineer? Is the trade really aware of what's happening in the field of education and training?

*Gordon Williams,
Hayes, Middlesex.*

Confessions of a Lecturer etc

Phasor's article in the November 1998 issue reminded me of the legendary TLO who had been persistently heckled by the proverbial 'bloke at the back' while describing his company's latest offering. Coming to tube replacement, he warned against getting the clamps (remember them?!) too tight. Then up jumps Heckleberry Hound: "how do you know when it's too tight?" Fixing him with an icy glare, the lecturer said quietly "tighten it up until the tube implodes, then slacken off a quarter of a turn!"

Eugene Trundle's servicing equipment supplement was timely, but do we need to spend our 'hard-earned' on all this gear?

Apparently not. Some while ago I called on a customer to see a Ferguson teletext portable. The husband had removed it from the cabinet ready for me. "Broke a corner off the circuit board thing. Still, most of it's there."

I said I would have to take it back to the workshop. As I was about to leave along came Jack. "Jack'll fix it. He's an expert" the husband said. "An expert on what?" I queried. "On everything. He can Artex ceilings!"

Jack told me what to do. "You just waggie all those little things about until you find the one where the sparks fly. That's the bit that is causing the trouble."

Against such genius I am powerless. So I left him to it. Forget about service manuals and sling your scope. Just waggie the bits about till the sparks fly and there you are. I think I'll stick to things with 12AU7s in them. This high-tech stuff is all too much for me.

*Pat Dennis,
Halstead, Essex.*

Answer to Test Case 434

- see page 251 -

The ancient Sanyo VHR3300 is now back in the shop window, still with its £34.95 price sticker. Even though it now works properly, it has yet to find a buyer!

TechnoCrat had belatedly realised what the repeated flashing of the orange digit meant: that there was no tuning data held in the machine's memory, even immediately after tuning and 'memorising' the local broadcast channels.

A relatively high negative voltage is required to write into the memory in these older machines - it's the very same voltage that operates the fluorescent display, which you will recall was dim. In fact the -30V supply was totally inadequate for these jobs: if memory serves correctly, the voltage had fallen to about -10V.

This low negative voltage was caused by a fault in the power supply. Rectifier diode D5006, which is fed from the mains transformer, develops -60V across reservoir capacitor C5003. This is stepped down by transistor Q5003 and reference diode D5012 to produce a regulated -30V supply. In the faulty machine there was no current through D5012 because one of its 4.3kΩ feed resistors R5006/7 was open-circuit. A new resistor was all that was required to cure the faulty machine.

NEXT MONTH IN TELEVISION

Design of an ESR meter

The importance of an electrolytic capacitor's ESR (effective series resistance) has been highlighted in several recent articles. To be able to check a capacitor's ESR in-circuit can save a great deal of time when fault finding. A couple of meters are available and have been reviewed in these pages. Alan Willcox now presents an ESR meter for the constructor. In doing so, he provides valuable insight into the design of such a meter and the operation of the circuitry used. To make battery operation feasible, low power consumption was a major consideration - the unit draws only 12mA.

Servicing the Panasonic NVSD25/30/40/HD100

This range of VCRs introduced the Panasonic K mechanism. Brian Storm describes the changes that took place and provides a servicing guide, including a list of fault codes and the various service modes provided.

Repairing CB Radios

As CB radios are inexpensive to buy, rapid fault diagnosis is essential if a repair is to be worthwhile. Chris Watton has serviced a quantity of these units recently: the experience gained provides a valuable guide on how to tackle these devices.

Test Report

While reviewing the Metcal surface-mount soldering rework system Steve Beeching provides interesting insights into the technology involved.

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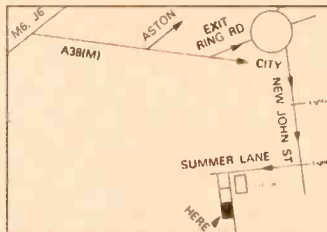
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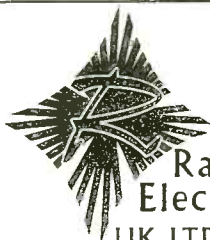
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IF MODULES:- 5827-01-51, 5827-03-51 EACH £8.00 5828-04-10, 5829-02-58 EACH £8.00 5929-03-41 EACH £8.00 TELETIX CONVERSION KIT CORE 2 90" ITT' TEXT PANEL £13.00</p> <p>1996/7 MATSUI VIDEO DECK COMPLETE P/P £5.00ea £16.00</p> <p>MATSUI DECK AND HEAD-VP9502 P/P £5.00ea £20.00 DECKS WITH HEADS - 3000/ORION P/P £5.00ea £16.00 HEAD-VCR-VX3000 £10.00 HEAD-VSR1500 = ORION D2096 £5.00 PANEL-MAIN-VSR1500 P/P £5.00ea £3.00 POWER SUPPLY-VSR1500 £5.00 POWER SUPPLY & REG - TYPE STK5343-VP9501 £8.00 POWER SUPPLY-SWITCH MODE-1500 £3.50</p> <p>PHILIPS DECODER-TEXT-K40-KT3 £10.00 IF PANEL FOR CP90-CP110 £5.00 INFRA-RED RECEIVER - HAND SET TESTER SOLDER IRON 25W-240V £6.00</p> <p>TEXAS NICAM BOARDS MK II £6.00</p>		<p>AMSTRAD EXPORT £3.00 4500 £3.00 6000 £5.00 6800 £15.00 6800 £4.00 UNIVERSAL £3.00 DECCA NICAM LCD £4.00 FERGUSON BSB £1.50 FV41R/V359 } £15.00 FV41R/VF42 - FV51-52 } ICCS } IK2000, IK7000 EACH £5.00 SRD2, SRD3, SRD4 EACH £1.00 T80 £2.00 TV/SATELLITE WITH FST HITCHHIK CPT2158 (NO REPLACEMENT) £5.00 VIDEO RM933E VIDEO PLUS £30.00 CLE874B £5.00 CLE883A = IR8512, CPT2196, CPT2578 £18.00 TV MODEL C2558 (IR1820)-CLE883A £30.00 MATSUI 1500 £5.00 VSR1500 £4.00 VX3000 £3.00 3000/ORION - TV AND VIDEO RCS = PACE 900, FERGUSON, SONY, GRUNDIG MITSUBISHI RM45 - VIDEO £5.00 RM45 - VIDEO £7.00 NOKIA RC202 £4.00 ORION TV AND VIDEO £2.00 VIDEO WITH LCD - 1992/93 MODELS PANASONIC EUR51142 £5.00 TC1632, TC1642, TC2232 EACH £8.00 TX2034, TX2044, TX2200, TX2234 EACH £8.00 TX2244, TX2300, TX2636, TX3300 EACH £8.00 RC201 - TV - REPLACES TNQ1411/2 £8.00</p>			
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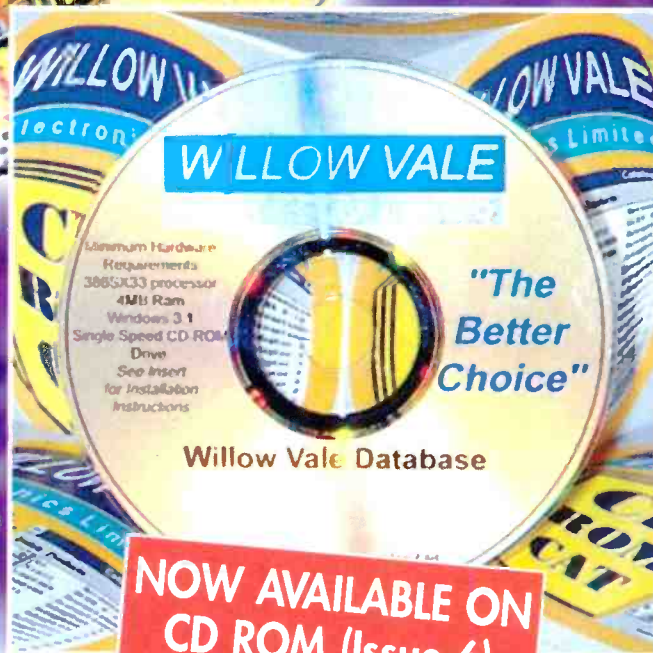
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