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Jotrange how situations change. It seems not so long ago that Japan and its industries, particularly electronics, could do no wrong. They taught us how to make cars and TV sets properly. They invested heavily and came up with a seemingly endless stream of desirable, innovative products. Both outsiders and insiders could see no end to this success story. We were told, by more than one leading Japanese electronics industrialist, that the 2 lst century would be the Japanese one, when Japan became predominant industrially and culturally.

For the last couple of years the situation has been somewhat different. Japan is still the world's second largest economy, but the previous confidence has gone. The economy has stalled, and doesn't look like getting going again for some time. Profitability has become appalling, and the talk now is all of restructuring and job losses.

Sony has announced that some 17,000 jobs will be lost worldwide, ten per cent of its workforce, while fifteen of its seventy factories are to be closed. Mighty Hitachi, whose activities span a much wider field and whose turnover is equivalent to over two per cent of Japan's gross domestic product, has launched a detailed review of its businesses. 6,500 of its 66,000 parent company employees are to be made redundant by March next year. On a consolidated basis Hitachi is Japan's largest employer, with 330,000 staff. Businesses are to be dropped or reorganised. The story from Mitsubishi Electric is similar: there is to be a "sweeping restructuring of its portfolio of businesses". In the UK, the latest manifestation of this is the closure of Mitsubishi's VCR plant at Livingston. 14,500 jobs will go ( 8,400 in Japan) at Mitsubishi Electric,

## Dilemma

nearly ten per cent of the workforce. Other manufacturers who have announced poor results and restructuring recently include NEC, Matsushita, Sharp and Toshiba. It's all a long way since the time when, it seemed, all the Japanese had to do was to get the product right and produce more and more of it.

Some of this was foreseeable. Markets reach saturation point; new products are not always a runaway success; if investment in new plant is excessive you end up with too much capacity; and so on. Then there is the fact that Japan is not isolated from economic problems elsewhere: no economy that is heavily dependent on exports can be. But there are also more specific Japanese problems. The banking system is beset by nonperforming loans that Japanese bankers are reluctant to write off. The bubble economy of a few years ago, when asset values rose to unrealistic levels, collapsed. This is part of the cause of the banking system difficulties. Then there is the practice of crossownership, with firms owning substantial stakes in each other. This can work nicely when everything is doing well: when recession looms, it aggravates the problems.

Japan's unemployment rate hit a new high of 4.8 per cent $(3.39 \mathrm{~m})$ in March, partly because of the corporate sector restructuring. Japanese industrialists hope to improve their profitability in the second half of the year, and will be helped by improved conditions in SE Asia. But it will be hard going, particularly to improve domestic market conditions. The Japanese have always had a high propensity to save. This increases when the economic climate is poor, with unemployment a threat. Right now Japanese consumers are saving rather than buying. No one seems to know how to alter their
behaviour. There is also a demographic problem: the Japanese population is ageing.

Japanese interest rates are negligible. So borrowing is not a problem. But conversely all those savings are bringing in little income. In the Western world interest rate changes often have a considerable impact on the economy. This economic tool is not available when interest rates are negligible. The Japanese have been advised to get their banking system sorted out, but that's not the sort of thing that can be done overnight. Right now the best opportunity for Japan seems to be to export its way out of its difficulties, something that shouldn't be too difficult once worldwide expansion has resumed. Bat the high value of the yen is a drawback.

From the economic viewpoint it's an extremely interesting situation, one in which the laws of economics have little to offer. This could be because such laws are, basically, descriptive rather than prescriptive. In the real world you can't always initiate economic activity through monetary or fiscal means. Some commentators have gone so far as to suggest that the Japanese governmenı should spend, spend, spend and print money to kick-start the economy. This is a dangerous course that can go badly wrong. It has already been tried by the Japanese government to a limited extent, with similarly limited success.

The one thing that we do know is that economies are not stable. Change is ever present in one form or another. The problem lies in trying to control it. This is all rather humbling, and certainly something of a comeuppance for the rather arrogant Japanese industrialists who had talked about the century of Japanese economic hegemony.

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# A great start to the day soon came to an end. Then back to the workshop and a day's problems with sets and their owners. Donald Bullock's servicing commentary 

It was a day in a million, warm and balmy. I knew it would be. Last night the sky was peach red in the west, and there'd been not a trace of a breeze. So I'd decided to go after a few tench in Collins waters. That's why I'd got ready and set the alarm for five.

The car hummed nicely as I set out. What's that ahead? Midnight the Milk's van, crawling and weaving across the road as though there's no one else about. Needs waking up. I'll wait till I'm just beside him, then give him a blast on the horn.

Ha, ha. That was good. Boy see him go!

The pool looked good. A carpet of mist in the sun. And the rooting tench sending up clouds of tiny bubbles. What's that sign? No fishing! But I've been fishing here for half a century! Take no notice. I'll fish in this hole, under cover of the rushes. In with a bit of groundbait first. Now set up my rod.

What a lovely bite! See that float ride.

Eh? Who are you? The bailiff!? What club? Who are all these chaps? Fishing contest this morning, here? So I've to clear off?!

Oh well. Might as well get back to the workshop and make an early start.

## A Thorn/Philips Portable

It was cold and dark in the workshop. I picked up the first set in the pile, a Thorn PI470R 14in. portable, and saw that it contained a Philips GRI-AX chassis. Philips and Thorn in cahoots?! Times change indeed.

The set was dead with its stand by light flashing. I checked the HT voltage and found it well down at 70 V . So I headed for the line output transistor and hooked it out. It tested OK. Perhaps there was a shorting diode in the stage? I began to work through them, starting with the bulkier ones that live harder lives. Nothing wrong with any of them. I then gave the transformer an unfriendly look.

We didn't have a replacement, but we did have a Philips set with the same chassis. When I tried its transformer in the Thorn receiver everything was OK. So I put it back and ordered a new one.

The phone rang. At half past six! "Who could it possibly?" be I thought as I lifted it.

## Featherhough

"Is that Mr Bullock? a voice whined. "I'm Mr Featherhough. Ian Featherhough. Sorry to call you so early, but I can't sleep with the worry of it all. I'm not well, and you've been recommended."
"Mr Featherhough" I said, "I'm not a doctor. I'm a TV engineer - I think."
"I know, yes I know" he moaned, "I want you to come and repair my set. I can't see the picture."
"Why's that?" I asked.
"Because there isn't one" he snivelled.

I booked the call.

## A 2lin Panasonic

The next set was a 2 lin. Panasonic, Model TX3 (Alpha 1 chassis). "Only screams" said the card. It
was right. When I switched the set on the channel LED lit but there was nothing on the screen. The set, clearly in distress, was screaming its head off. I disconnected the speaker, reached for the meter and checked the HT voltage. Only 20 V . Out of habit I checked the 2SDI439 line output transistor. It was leaky, not short-circuit. I fitted a replacement, reconnected the loudspeaker and tried the set again, thankful for an easy job. But it was now quite dead, well past the screaming stage.

There was no HT anywhere in the line output stage. What might I have overlooked? Yes, there's a 1 A circuit protector, CP567, in the HT feed. It was open-circuit. A replacement got the set going.

## VCR Problem

There was a rattling at the door. It was Henry Hoxton, who sometimes brings our mail. He danced in with a Philips video recorder and placed it on the counter.
"You're up bright and early aren't you, Don?" he breezed.
"No" I replied. "Only early. And I wish I hadn't bothered. What's up with this Philips machine, apart from its chewing-gum pinch wheel? And how's the missus?"
"Stopped dead last night and blew out a puff of smoke" he said.
"That's bad" I replied, "and what's wrong with the recorder?" Laughing at my excellent joke, I waved him through the door.

When I opened the VCR I saw that it contained a jammed cassette. Looking further, I saw that the puff of smoke had signalled the end of

IC7101, which had blown its top. It's the drive chip for the loading motor, and is mounted on a subpanel at the front of the machine. The $0.22 \Omega$ fusible resistor in the supply to it had also blown. Once these items had been replaced the machine at least worked.

It was time to open the shop. As I did so a tiny fellow marched in.

## Granada Monster

"It's real big, I'm tellin yuh" he boomed, in the deepest voice I've ever heard. "Come and see."

I followed him out to his estate waggon, in which a 28 in . Granada receiver (Model CD66JS) sat.
Between us we managed to get it in and on to the bench. He then departed, leaving me draped over it.

When I'd recovered I switched it on. Field collapse. I took the back off and got into the field timebase circuit. The voltages all seemed to be about right. When I looked about I found that the joints on the scan coil socket were dry. Resoldering them restored the field scanning, but there were horizontal red lines at the top of the picture. It took me a while to find the cause, which turned out to be C703. It sits next to the TDA8170 field output chip. This electrolytic capacitor should have a value of $100 \mu \mathrm{~F}$. The reading I obtained was $30 \mu \mathrm{~F}$.

## Grundig Trouble

Paul and Steven then arrived, so I decided to slip out to see Mr Featherhough, whose house is in the posh area of the town. To my surprise I found that he lived in the basement. His wife answered the door. She was pale and distraught.
"He's a great worry my dear" she said, "he's had so many nervous breakdowns I've lost count. Gets very upset when his television set doesn't work properly."

Featherhough, a tall, slender old boy, was sitting in a upright armchair in front of a Grundig T51720. He was trying to follow the picture, but it rolled continuously and was very snowy. He'd occasionally have a go at the controls. "Can't stand it, I can't" he complained, "stop it tumbling Mr Bullock, do please."

I couldn't lock the field scanning and decided I would have to take the set back to the workshop. Mr Featherhough broke down at the news. "But I need it. Can't be without it, Mr Bullock" he cried.

I explained that the set would have to be dismantled and inspect-
ed. I needed test equipment.
Mrs Featherhough came to the door with me. "He's such a trial, Mr Bullock" she said, "needs 24hour attention, but he's my life and I adore him."

As I carried the set into the shop the phone rang. It was Mrs
Featherhough. "Is it done, Mr Bullock? Only Pops is distraught without it . .."

Steven had a go at the set. He hooked up a scope and found that there was no field sync. On further investigation the RF/IF module turned out to be riddled with dryjoints. Once these had been resoldered we had an excellent picture. I hurried back to the Featherhoughs with the set.

Mr Featherhough rubbed his hands and chuckled. He not only paid our bill but gave me the biggest tip I've ever had.

Mrs Featherhough showed me to the door. "You've made him so happy" she said, "I'll call you again if there's any need."

## Sharp Problem

When I returned Steven had a 20 in . Sharp receiver, Model DV5103H (Euro DSI chassis), on the bench. "Can't understand this set" he said. "It's dead with a low, varying HT supply $-10-50 \mathrm{~V}$. I've replaced just about everything but it remains the same."

Half an hour later he was still struggling.

Paul looked over. "Have you tried replacing the HT preset? he asked.
"Er, no, not that. Do you think it could be the cause?"

He took out the potentiometer, R755 ( $2 \cdot 2 \mathrm{k} \Omega$ ), and fitted a replacement. The HT supply then came up and was fully adjustable.

Steven examined the old one with a magnifying glass. Although it read correctly, there was a hairline crack in the track. "Should have checked it first" he confessed.
"We're all the same" I commented, "I've done the same thing dozens of times. We never seem to suspect the potentiometer concerned, only the rest of the components. I recall an early Philips valve set with an upright chassis. It had an inaccessible bank of three potentiometers printed on a Paxolin strip. They used to go high in value and it took me ages to find the cause the first time I had the problem."

## Went off

Henry Chickworth called in with


The rooting tench sent up clouds of tiny bubbles
his Alba VCR7200. "Just went off" he said. "All I've got is the display flashing a 3 at me."

Paul put it on the bench while Henry waited. "I know of two ways to deal with this fault" he announced, "there's the slow way and the fast one."
"What's the slow way?" Henry asked.
"Put the machine under the bench for three weeks then plug it in. It'll be perfect."
"OK, and the fast way?"
"Disconnect the positive side of the capacitor 'battery' and reconnect it at once."
"Er, I don't wanna wait three weeks" Henry said.

## A Philips Portable

## Paul had a Philips I4GR2326 14in.

 portable (G90B chassis) on the bench. The screen was blank and there was no sound. The HT was low. This time Steven was able to help."Had one like that the other day" he said. "Try the reservoir capacitor for the 5 V supply. It's $\mathrm{C} 2660,680 \mu \mathrm{~F}, 16 \mathrm{~V}$. I found that the value had fallen to about $90 \mu \mathrm{~F}$.

Paul switched the set off, discharged the capacitor and tested it. The value was down at $80 \mu \mathrm{~F}$. A replacement did the trick.

## TELETOPICS Digital Warfare <br> n the battle to become predominant in

,the digital pay-TV market, gaining as many subscribers as soon as possible is obviously the number one priority. To this end BSkyB and ONdigital have launched new marketing initiatives, including free set-top decoders. With C\&W Digital, which will start a phased introduction of its service in Manchester and the North West in July, and other cable digital TV providers the decoder will come as part of the monthly subscription and will thus not appear as an 'up-front'cost.

ONdigital is offering a free set-top box during May when a subscription is taken out and a TV set that costs $£ 200$ or more is bought. SkyDigital's offer is quite complex. You get the STB free


CPC has added over fifty products to its range of satellite equipment, including items from Amstrad, Grundig and Philips. The newly stocked products include a selection of universal and digital LNBs, a range of Triax multiswitches, the new BSkyB TV link remote control extender system, and the new BSkyB-approved digital satellite kit which is designed for domestic digital satellite installations and features an elliptical feedhorn. The RC extender system enables satellite and off-air channels to be distributed around the house to sets with an aerial tap. For further details check with CPC on 01772654455 or fax 01772654466.
(no time limit at present) but have to pay a $£ 40$ installation charge plus fees for most channels. There are other possible charges, such as $£ 30$ if you want to keep your existing analogue system or have to replace your downlead with something better. The digital transfer fee is $£ 25$, so SkyDigital can cost $£ 65$ to over $£ 280$ for starters. SkyDigital's channel subscription rates rise by $£ 2$ a month from June 1 st, but will be frozen for existing subscribers till September 2001. BSkyB is providing other incentives however: free internet access (via a PC) - this is called SkyNow; and 40 per cent off phone-call costs for subscribers who use BT (cable subscribers have discounted phone calls). BSkyB expects
to generate substantial revenues from its subscriptions, advertising, and online services to be offered, but at present profits have been substantially reduced. $£ 315 \mathrm{~m}$ has been set aside for promotional expenditure, and dividend payments are being suspended for the foreseeable future.

Right now both SkyDigital and ONdigital see the cost of a set-top box as the biggest deterrent for prospective subscribers, hence the free box offers. The latest figures suggest that SkyDigital is pulling ahead. It claims to have had some 551,000 subscribers on May 3rd. ONdigital is understood to have secured some 160,000 subscribers by end-March. BSkyB analogue transmissions will end in 2002.

Monitor Service Data
M-House Editrice published the first volume in the Monitor Service series in 1996, in paper format. As a result of advances in technology, the publisher decided to issue the second volume, in March 1997, in CD-ROM form. The dedicated software used enables you to display, in the best way possible, the sections and subsections you require in a service manual. Each manual includes alignments, service notes, block diagrams, component details, PCB layouts, circuit diagrams and servicing advice. Amendments can be made to the manuals.

The fourth volume has now been published, again in CD form. The software, with continuous development, has become more user friendly. For further details consult the internet at www.m-house.net

The publisher is M-House Editrice, Di Morselli Luca, Via Ernesto Breda 20, 20126 Milano, Italia. Phone/fax +39022570447.

## Satellite News

According to SES one in three homes in the UK is now receiving programmes from the Astra satellites. Year-on-year growth for the year ending December 1998 was 730,000. Europe ONline has taken two Astra transponders (at $19.2^{\circ} \mathrm{E}$ ) to provide a high-speed internet service aimed at STB and PC owners: the service started on May 15th. NTL has announced that S4C and the BBC are taking capacity in its second shared digital multiplex via Astra 2 A .

Eutelsat's W3 satellite was successfully launched on April 12th. After tests it will replace II F4 at $7^{\circ} \mathrm{E}$. The craft has 24 Ku -band transponders and will carry consumer and professional TV and telecommunications services.

Easynet Ltd. has started a service called EasySat via Eutetsat's Hot Bird 4. It provides internet connection at a flat rate of $£ 49.99+$ VAT a month, or $£ 550+$ VAT a year. The subscription includes a fully-featured internet account with unlimited e-mail addresses, unlimited personal web space, a news service and round-the-clock technical support at local call rates. The data is incorporated in a DVB multiplex that's uplinked by BT Broadcast Services. A 60 cm dish and internal PC card are required for reception - several cards are readily available, offering plug-
and-play operation and features such as reception and display of over sixty free-to-air digital TV channels. The service has been launched following a year of successful trials.

The recently introduced Smart Priority switch, the latest addition to the Philex Select range, is the easy way to connect two receivers to one dish. It determines which receiver controls the LNB. When the digital receiver is turned on, it controls the LNB; when it's turned off, the analogue receiver takes over LNB control. The switch has a frequency range of $950-2,300 \mathrm{MHz}$ and is housed in a zinc diecast box with solder shielding bottom plate. The SLX4 'digital-ready' four-way amplifier, for TV, satellite and FM receivers, is another recent addition to the Philex Select range. It's designed to improve TV and FM reception, with a gain of 10.5 dB at all ports. There are separate UHF/VHF inputs and the isolation between outputs is greater than 22 dB . The UHF socket has provision for line powering at 25 mA . The amplifier is of compact design, is finished in gunmetal grey and is double insulated for safety. For details of these and other Philex products, contact Philex Electronic Ltd., Philex House, 110-124 The Broadway, West Hendon, London NW9 7PP. Phone 0181 2021919.

## Trade News

According to market research company GfK, widescreen sets accounted for eleven per cent of TV sales in the UK in January - thirty per cent of the total value. BREMA expects sales to reach 750,000 sets this year: as a result, well over a million UK homes could have a $16: 9$ set. This would make the UK the fastest-growing widescreen TV market in the world. BREMA also forecasts that half of UK homes will have some form of digital TV receiver, either IDTV or STB, by the year 2003.

Willow Vale Electronics has been appointed UK distributor of universal remote control units manufactured by Siel Electronics. The range is being marketed in Europe under the brand name Zapping. Models include the Universal Zapping, Cosmos, Planet and Replay, at trade prices from $£ 4.99$ to $£ 9.99$ each. The range provides a variety of control facilities and has distinctive colouring. For further details contact the Willow Vale Sales Office on 01189876444 . WVE has also been appointed UK distributor to the service trade for Censol aerosol products, which include freezer spray, a solvent degreaser, the Pocket Rocket switch cleaner, a foam cleaner and an air duster.

Sony and JVC have announced the joint development of an IEEE 1394 (FireWire) interface for the D-VHS system. It will enable a D-VHS machine to be connected to a suitably-equipped digital set-top box.


A new firm, Circuit Trace, that sells direct via the world-wide web has introduced the CT100 hand-held connectivity checker. It enables all interconnected points on a PCB, whether legitimate or not, to be located within seconds. You simply connect the checker's clip to the circuit point of interest, say an IC pin where the voltage is incorrect, then wipe the conductive brush over the board surface and listen for an audible tone, which indicates the presence of a connection. The edge of the brush or a separate singlepoint test probe that comes with the unit can then be used to home in on the connection's exact location. The idea is to eliminate lengthy track tracing: the checker is particularly helpful for boards with bus paths or surface-mounted components, where locating short- or open-circuits with ultra-fine tracks can be a frustrating business.

The CT100 costs $£ 93.50$ complete with test probes, circuit marker, carrying case and a comprehensive user manual. Circuit Trace is at PO Box 70, Retford DN22 0SY (phone/fax 01777248 993),
e-mail mrbass@globalnet.co.uk
Circuit Trace's web site (www.toneohm.com) contains much useful information on the CT100, including an application note.


The Citizen ST855 is claimed to be the world's smallest LCD CTV with AM/FM radio. It's comfortable to hold and easy to use.
Technical features include a UHF/VHF tuner; a high-definition, non-glare super twisted nematic screen; and an AV input so that it can be used as a monitor with a camcorder or other video source.

For trade enquiries contact GB Consultancy on 01869233 200, fax 01869232746.

# Satellite WORKSHOP 



## Amstrad SRD510

I sometimes wonder why I bother! This morning I came into the workshop to discover that the receiver I has spent an hour 'repairing' last night now had a rolling picture and no sound. It's fortunate that I had left it on soak test.

The original fault report had been "wavy pictures". When I had first tested the machine there was sound but just a blank screen. Someone had already been inside and replaced C54 ( 100 nF ), which is a common cause of picture faults. They had also lost three screws. I should have given up right then, but I'm a glutton for punishment.

I traced the cause of the initial lack of signal to R9 (470 2 ), which had suffered from the corrosive effects of black glue. Once this problem had been dealt with there was sufficient signal to provide weak, inverted video. The receiver was well cooked, another reason why I should simply have jumped up and down on it! But I carried on testing and measuring.

More components were replaced
before I got a brief flash of good, strong picture when I touched C54. The cause of the trouble was then clear: whoever had replaced the capacitor had broken a track nearby.

So this morning I'm faced with the choice of still more work or cutting my losses. Do you hear that satisfying sound of crunching? That's size ten Doc Martins improving the shape of a zero-value SRD510. I can use the power supply for another repair.

## Scrambled Music

MTV transmissions destined for Europe are not scrambled but carry VideoCrypt data which tells a Sky decoder that it is! As a result a UK satellite receiver which contains a decoder will scramble the picture by routing the unencrypted video signal through the decoder circuit!

I've had lots of requests from those who want to watch this programme. The simplest solution is to disable the sync separator circuit, so that the decoder no longer works. In the Amstrad SRD5 10 for example you can add a switch that short-circuits the $3,300 \mathrm{pF}$ capacitor C292 on the little daughter board. It's connected to pin 5 of the TEA2029C chip.

In most receivers that use a PTV111 sync separator chip, for example Pace MSS variants and the Nokia SAT1700 Mk 2, you can add a switch to disconnect the $1 \mu \mathrm{~F}$ capacitor next to it. In Pace PRDseries receivers, connect one side of a switch to the central test pin labelled TST2 and the other side via a $1 \mathrm{k} \Omega$ resistor to pin 1 of the microcontroller chip U2 ( 5 V supply). That should do the trick!

## Pace Apollo

You may recall Frank from the Lion and Swan, whose PRD800 I repaired recently. No more than a week after I had fixed it and made it reliable he had the urge to "trade it in for a better one" from one of his customers. This turned out to be a Pace Apollo (basically the same as the MSS200/300/500 etc.) which
apparently had a sharply-defined vertical white line on Sky Sports.

It took a long time for the fault to appear. When it did, I discovered that it affected all the decoded channels (including Sky News and Ch. 5) but not the unencrypted ones. The line was 2 mm wide and approximately 100 mm high (on a 14in. screen). It was about a third in from the left-hand edge of the screen and was very intermittent. Although it occurred at a specific temperature, it couldn't be brought on by using a hairdryer and freezer in the vicinity of the PTV-type decoder chips.

By replacing each IC in turn, I eventually traced the cause of the trouble to the PTVI14 graphics inserter chip U9. It was, of course, the very last PTV IC I replaced. It was not possible to narrow the cause to $\mathbf{U} 9$ by heating/freezing, because changing the temperature of any of the PTV chips made the line appear or disappear.

## Amstrad SRD520

The complaint with this receiver was "severe lines on the picture". In fact the symptoms were rather like those you get with the Pace SS9000 when the capacitor in the tuner is faulty.

My first move was to fit the capacitors in Relkit 3, but this did not help at all. In fact I now had a blank screen!

I got a weak picture (still with lines) by removing the C-band switch and fitting a wire link in its place. TR7 had glue around it, so I fitted a replacement. I was now back where I had started half an hour previously - with a picture that was heavily obscured by lines.

For good luck I replaced all the electrolytic capacitors in the power supply with low-ESR types. No good. Working blind is not the best of ideas, so I decided to do the job properly. A quick prod with the oscilloscope showed that there was serious HF ripple on the 12 V supply from TR304. This transistor, in combination with the op-amp IC300, is supposed to provide a
smooth output. When the associated resistors were checked I found that R8 (1k ) was open-circuit But fitting a new one didn't cure the ripple fault! Nor did replacing TR304. In desperation I replaced the LM392 op-amp (IC30)). Success at last. The picture was clean and stable and the audio was good.

## Amstrad SDR510

I don't do many customer call-outs nowadays. Since I started to charge "a pound a minute" the timewasters have stayed away in droves. A little old lady just around the corner tempted me with a cup of tea and a bun however, so I trotted round immediately.

Her receiver worked perfectly. But once it had warmed up the voltage at pin 8 of its TV scart socket wouldn't drop below IV at switch-off. Because of this the TV set stayed in the AV mode. The voltage was 12.2 V when the receiver was switched on, so I felt that the TV set was being rather unreasonable in treating IV as 'high

I soldered a $10 \mathrm{k} \Omega$ resistor between the TV scart pin 8 and chassis. This extra load reduced the
off voltage to 0.85 V and the problem went away. I departed when the teapot was empty.

## Pace PRD900

My wife was complaining again she likes to keep in practice. "It won't record. The timer is stupid." I agreed to take our PRD900 to the workshop later to test it. but she wanted it done now. "And if it does record it plays the wrong programme, with a flashing clock, or just a blue screen."

I hate to admit it, but she was right. I tried setting a number of timed events and the results were somewhat random to say the least. Sometimes the receiver remained on the wrong channel but flashed a clock symbol on the screen and a $t$ in the LED display indefinitely, until manually cancelled by pressing F then Standby. Sometimes it seemed to change channel but left a blue screen, as if the desired frequency had been overshot and lay outside the "capture range' of the phase-locked loop system associated with the Nicky chip U9.

I fixed this particular fault by pressing $F$ with the LNB menu displayed, so that the AFC was dis-

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

## jack@netcentral.co.uk

One model per message - state make/model and fault symptoms. If you have no e-mail facilities you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.
abled. It was then a matter of retuning a few channels manually to remove the sparklies. I measured all the power supply voltages, and checked the ESR of all the electrolytics around the power supply. Everything was perfect. The timer function was still erratic however, so I replaced the microcontroller chip U2. That cured the problem.

I've never known a micro chip develop a fault like this, and doubt whether I'll ever come across the problem again. It's extremely unusual. My wife thinks it's typical.

## Test Case 438

Dave Dawson didn't like April showers. Not that they would have made him wet as he sat indoors in front of his telly. The problem was that they spoilt his viewing of the satellite channels, for which he was paying nearly thirty pounds a month. Rain made the interference to his pictures worse. It had been gradually increasing. To start with a sparkly effect had invaded brightly-coloured areas of the screen, now it was present all over the picture. Some channels were worse than others, especially when the weather was poor. Sky One was almost unwatchable during a downpour, while Channel Five for example came through relatively unscathed - at least when the weather was fine. So Dave picked up the phone and called us.

Our first-line service is generally provided by Doc Colin. Having been given details of the symptoms, he felt that his call would be a waste of time without a means of checking the outdoor equipment. He was right! A replacement receiver produced exactly the same symptoms. So Colin called in our Force Two, which actually consists of Cathode Ray, a big white van and a double-extension ladder. If the dish is too high for that, the job is put in the hands of a "proper' aerial rigging firm - expert in the windy and salty seaside conditions here.

Dave Dawson's house is in an exposed and widswept location, but is not tall. It was certainly within reach of our Ray's ladder, so up he went, spanner in one hand, signal strength meter in the other. The most likely cause of the trouble was that the dish had shifted and was in need of realignment. The badly-corroded dish-fixing bolts didn't look as if
they had shifted. In fact they had seized solid, and it took time, effort and penetrating oil to slacken them. This was finally done, and the signal-strength meter was then connected to the LNB's F socket to align the dish. The meter's tone was peaked by panning and tilting the dish, after which it was clamped up again and the downlead was reconnected.

When Cathode Ray went indoors to check the picture he found, to his surprise, that the signal was not noticeably stronger than before. The sparklies were still there, and subsequent adjustment of the angle of the LNB on the boom (polar alignment) didn't help. So it seemed that either the LNB or the downlead was faulty. Our simple satellite signal checker is of little help here because it doesn't, as with most terrestrial field-strength meters, give a quantitative reading. The LNB was the easiest thing to check next. Having been there for some years, it was of the early type with a 10 GHz oscillator. There was a Global channel expander behind the satellite receiver.

Ray fitted a known-good replacement LNB of exactly the same type as the original one. He's got lots of them, made redundant after being replaced by enhanced types or digital gear. Once again the results displayed on the TV screen were no different, exonerating the original LNB and suggesting that the cable was the culprit - cable deterioration often causes this sort of trouble. Could there have been another cause? Ray squinted across the face of the dish to check whether it was bent or distorted. It wasn't. Even so, the cable wasn't the cause on this occasion. Any ideas? Turn to page 583 for the solution.


## IBM 8515

The complaint was "screen flooded plus flyback lines, very intermittent". The fatigued solder joint at the A1/focus block's earth pin was attended to as a routine matter during the visual inspection. When the monitor was put on soak test with a peak white display, I noticed that there were horizontal bands of ripple on the brightness. As these drifted vertically, it was difficult to estimate the number per frame - which would have provided a clue of course. I would say about $30-50$.

After checking the various snubber circuits I set about the electrolytics. It was becoming apparent that the fault was temperature-sensitive. Attention should be concentrated on the cluster of electrolytics in the middle of the PCB - don't leave out the strays around the cluster. The electrolytics themselves weren't faulty: their pins had worked loose in the solder fillets. During manufacture, the tall electrolytics are 'steadied' by sticking them together with blobs of silicone sealant. The blobs are applied near the top, and thermal expansion of the PCB produces minute movement: as the capacitors are tall, the leverage is considerable. The small amount of movement pulls the capacitor leads free inside the solder fillets without conspicuous damage. As the leads remain a tight fit, most users will wait for something else to go wrong before having the unit serviced - the onset of symptoms is slow and subtle!

Only the high-voltage, small-

Monitors
value electrolytics usually need to be replaced. The others should be scraped, including removal of silicone sealant, and refitted. If the use of sealant is considered necessary, apply it close to the PCB. I.F.

## HIT KT46-4NLR

I had carried out a fair bit of work on shoring up the cracked PCB by the time I realised that this repair was not going to make a profit. The crack had not been visible until the chassis had been completely removed: it ran from the edge of the PCB, between the frame output chip and the front panel controls towards the middle of the board.

Where possible, 22 SWG bracing links were used to give some strength to the repair, but there were many fine tracks. The only suitable repair material was stripped from multi-strand equipment wire.

When the damaged print had been repaired, the monitor powered up with excessive width and the frame output came to an end after a couple of minutes. The cause of the width fault was Q709 (2SD669A), which was short-circuit. The frame fault disappeared after a considerable amount of rework, checking for dry-joints and double-checking the repairs to the copper print.

Once I was convinced that the repair was sound, I gave the monitor a good shake to see if it really was! The result was a new intermittent fault - a jagged yellow picture. The cause turned out to be a massive dry-joint at the CRT's blue cathode pin. I.F.

## ICL 15505-002

This elderly VGA monitor appeared under a number of guises, including Apricot and Olivetti. Despite its low specification, it remains popular because of its reliability. Also because its push-button feature of green, amber or blue text screens makes it attractive as a DOS wordprocessor. This one was dead with the power LED on. It had been
dropped, the result being a crack in the PCB next to the LOPT. When the damage had been repaired, it produced a horizontal line.

R320 (4-7 , 1W) was burnt, D302 (RGP15J) gave odd readings and Q301 (TDA1675 - no A suffix!) had failed. I didn't have a ' 1675 but a ' 1675 A worked fine!

Some of these monitors have an electrolytic capacitor connected to the print side of the PCB beneath Q301. As there are no markings on the PCB for this component, it's easy to get the connections mixed up after replacing the frame output chip. The positive lead goes to the IC pin for which no solder pad is provided, while the negative lead goes to the chip's chassis pin (middle of the shorter row of pins). I.F.

## AOC CM335

Whistling with no EHT is the symptom when the line output transistor blows. In addition you will sometimes find that D109 on the secondary side of the chopper transformer is short-circuit. Alternatively the line output transformer could be the cause of this fault. R.P.

## Crown EM1428

This monitor was dead with a shortcircuit line output transistor and dry-joints at the flyback tuning capacitors. C617 ( $47 \mu \mathrm{~F}, 50 \mathrm{~V}$ ) should also be checked: it can decrease in value to about $1.8 \mu \mathrm{~F}$. You'll find it on the primary side of the line driver transformer. R.P.

## GoldStar StudioWorks 76i (CS770)

This monitor was dead. A few checks showed that there was a short-circuit across the 80 V output from the power supply. The cause was quickly narrowed down to the relevant rectifier diode D909 (RGP10J), which was replaced. When the monitor was powered again there was a second when everything seemed to be OK. This was quickly followed by a loud pop
and a flashover around the area where the new diode had been fitted. Checks showed that it had gone short-circuit again, and had blown up a discrete pre-regulator circuit that consists of two 2SC2316 transistors (Q903/4) and an $8 \cdot 2 \mathrm{~V}$,
500 mW zener diode (D918). Once all these items had been replaced there was a perfect display. G.M.

## ViewSonic 6E

This dead monitor made a clicking noise. As usual, the cause was a short-circuit BU2508AF line output transistor (Q310). The reason for its demise was not so usual however: someone had turned the HT preset VR601 to maximum. The correct adjustment is for 90 V at pin 2 of connector M301. G.M.

## Siemens Nixdorf MCM151V

This monitor produced a vertically expanded, liney, jittery display. The cause turned out to be C619
$(100 \mathrm{nF}, 100 \mathrm{~V})$ in the frame output stage.

If one of these monitors has no green in its display, check L805 $(2.7 \mu \mathrm{H})$ which is in the 63 V feed to the green output transistor. It tends to go open-circuit.

The glue around C838 and R855 (the first anode supply connection on the tube base panel) can cause problems by becoming conductive. The first anode (G2) voltage then falls and there's no picture. Simply scrape the glue away. G.M.

## Dell Ultrascan 17FSEN

Two of these Mitsubishi-made monitors came in at the same time. The first one kept blowing the 4AT fuse. The cause was the STRS6308 chopper chip IC901 which was short-circuit between pins 1,2 and 3. A replacement restored normal operation.

The second one had no blue drive. The video amplifier/output section, on the CRT PCB, is an awesome affair. There are several ICs and transistors, including a dedicated chip (IC201, type 93804S0R), a hybrid chip (IC202, type CP267P042A30) and IC203 (LH2426S). The transistors all seemed to be OK. In theory I could have borrowed the ICs from the first monitor for substitution checking, but instead I decided to replace the LH2426S device. Fortunately my guess was right, especially as it's expensive - over $£ 20$. C.H.

## Compaq 460

This monitor blew its mains fuse at
random. Several dry-joints were dealt with, but the real cause of the problem was the slightly overtanned degaussing posistor PTC901 Once it had been removed from the board its rattling sound confirmed the diagnosis. C.H.

## Zenith ZM1400/Hyundai HM413

The most common faults with these monochrome monitors occur in the power supply. Replacing the following items should get you going: Q501 (BUT46A, BUTI 1 or BUT56A); Q502 (KN2222, PN2222, 2N2222 or BC639 - note that not all 2222 transistors have the same pin connections); optocoupler IC501 (MCT2102, CNX35
CNX36, TIL114, TILI17 or SL5500); C506 ( $33 \mu \mathrm{~F}, 50 \mathrm{~V}$ ); C501 ( $10 \mu \mathrm{~F}, 50 \mathrm{~V}$ ); C502 ( $3.3 \mu \mathrm{~F}, 50 \mathrm{~V}$ ); and R514 ( $4.7 \Omega$ or $6.8 \Omega, 5 \mathrm{~W}$ ). Note that an IRF740 MOSFET line output transistor is fitted: the IRF840 is a suitable replacement. C.H.

## Belinea 104010

This monitor had a very annoying line jitter and phase drift. Each time I attempted to locate the cause, the fault disappeared for a few days. Fortunately several of these monitors were in at the same time, so it was possible to swap components. After changing everything from the LOPT backwards I eventually found that C612 (?) was the culprit. It's a blue, 470 pF capacitor that's connected to pin 2 of U602. A.S.

## Opus CM1438T

The green power LED was alight but this monitor was otherwise dead. Checks showed that the supplies were all OK , and the line oscillator was working. But L401 was open-circuit, so there was no line scanning. A.S.

## Belinea 104010

There was no display and the green LED was flashing. The monitor does this when it's in the green, standby mode. So, after initially being deceived into thinking that there were no line pulses from the computer, I looked for a possible cause of excess current and found that D152 in the power supply was short-circuit. We don't stock this UF1007 device, but the manufacturer has fortunately allowed for fitting a larger diode with fatter legs. A UF5408 drops in a treat. A.S.

## Model 29J56N/JD156N

Another monitor with no brand name - yet two model numbers!

The green LED was blinking because the power supply was in the shut-down mode. I had to spend some time drawing out the power supply circuit from the print layout, and after the repair added important voltages. So if you come across one of these monitors, the following information should be useful.

There are four rectifier diodes on the secondary side of the chopper transformer. The output from D812 should be 83 V , or 0 V with no signal; the main HT rectifier D813 should produce 56 V with no signal, 66 V in the VGA mode and 74 V in the SVGA mode; there should be 15 V at the output from D814 and 8 V at the output from D815.

In this particular monitor there was no HT output from the power supply because FET Q801
(2SK1917) was short-circuit between its drain and source. It acts as a variable resistor across the HT line to alter the voltage depending on the input signal's frequency/ mode. Q801's gate terminal is connected to the output (pin 3) of a 555 timer chip which provides a PWM squarewave drive whose mark/space ratio is set by flyback pulses from the line output transformer - they are fed to pin 2 via Q811.

I didn't have and couldn't find a supplier for the 2SK1917, so I fitted a 2SK 1036 instead. It ran cool and the monitor worked correctly. J.E.

## CTX 15695

You very often find that the 25 V regulator Q106 (2SB772) is dryjointed - I now check the soldering here before powering up. In one case recently the symptoms were intermittent failure to start or stopping after a while. The fault could also apply with Model 1565D, which has a similar power supply.

In one 1569S monitor I found that Q106's base and emitter leads were bent over and touched intermittently under the board.

Many of these monitors arrive with the main board jammed half in and half out of the runners. In this event it's quite common to find that the front control panel has snapped in two. Removal of the main board, which is usually undamaged, can be quite a tussle - and you can't reach Q106 otherwise!

Bad soldering on the tube base board is also quite common, particularly at the tube base pins.

One monitor had a very bright display because R726 ( $1 \mathrm{M} \Omega$ ) in the first anode supply network was open-circuit. R.B.


# Satellite Notebook 

## Reports from

 Hugh Cocks Christopher Holland Chris Watton Kevin J. Green and Martyn Davis
## Pace SS9000

This elderly receiver had been kept very cool-running during its life. It even had the original Hitachi tuner and black mains transformer, which is far more reliable than its pink successor. But after some lightning it refused to come back on. There were no obvious short-circuits. and HT was present at the mains bridge rectifier's reservoir capacitor. When power was disconnected however the capacitor discharged quite rapidly, which doesn't normally happen with an inactive
chopper transistor.
When I replaced the TDA8380 chopper control chip U23 the receiver came back to life. I'd given it a major electrolytic capacitor refit a year ago, so the pictures were good and no work was required to remove the characteristic power-supply type interference from the picture! H.C.

## Astra Digital Frequencies

When there are reception problems with certain digital channels it can be useful to know the frequencies
of the various Astra 2A transmissions - to possibly identify a transponder/frequency problem. Table 1 lists the current channel allocations. Future channels may of course be added, and Sky can move the frequencies around with
receivers automatically tuning them in. C.H.

## Amstrad SRD500

There was no reception of the ver-tically-polarised channels. The cause was the LA4960 LNB voltage switch IC501: its togic input

Table 1: Astra Digital channel frequencies.

| $\begin{aligned} & \text { Frequency } \\ & (G H z) \end{aligned}$ | Pol | Channels |
| :---: | :---: | :---: |
| 11.720 | H | BBC1, BBC2, BBC Choice, BBC News 24, BBC1 NI |
| 11.740 | V | Living, Challenge, Trouble, Bravo, TVX, Travel Shop |
| 11.758 | H | Ch 4, Ch 5, Film 4, The Box, CNBC, CNE*, Sky Sports News |
| 11.778 | V | Music Choice 1946, 1947, 1948* This is also the receiver's default frequency |
| 11.798 | v | BBC $/$ /Choice Wales and Scotland, BBC Choice NI |
| 11.817 | V | UK Style, Horizons, Arena, UK Gold, UK Play, Screen Shop, UK Gold Classics |
| 11.837 | H | Sports 1, Sky 1, Sky Premier, Sky MovieMax, Box Office 1-5 |
| 11.856 | V | Sports 2, Premier 2, MovieMax 2, N. Geographic, Box Office 6-10 |
| 11.876 | H | Animal Planet, All Discovery channels |
| 11.895 | V | MTV, VH1, M2, Nickelodeon, Paramount Sci Fi |
| 11.914 | H | Sports 3, Premier 3, MovieMax 3, Info Channel (999), Box Office 11-15 |
| 11.934 | V | Premier 4, MovieMax 4, Retail Info Channel (997), Box Office 16-20 |
| 12.012 | V | Open (was BIB) |
| 12.032 | H | Travel* |
| 12.051 | V | Travel, CNN, Cartoon Network, Shop!, QVC, CNN Radio* |
| 12.070 | H | Sky News, Sky Cinema, Cartoon Network+1HR, Box Office 21-25 |
| 12.090 | V | Sky Cinema 2, Disney, Box Office 26-30 |
| 12.129 | V | S4C Wales |
| 12.148 | H | BBC Parliament, Bloomberg, Granada Plus, Men \& Motors, Box Office 31-35, Digital Info Channel (999) |
| 12.168 | V | Tara, Sky Soap, MUTV, Sky Travel, Guide Info (998), Box Office 36-40, 18+ (Ch 751 in EPG) |
| 12.226 | v | Breeze, History, Racing, Dot TV, Playboy, Box Office 41-46 |
| 12.246 | v | Box Office 47/48/50, Box Office Preview, Sky Premier Widescreen, Fox Kids, Open TV Promo. Box Office 49 does not exist at present but will probably be on this frequency |

was OK but its output wouldn't change. C.W.

## Amstrad SRD400

This receiver wouldn't tune to any stations. Checks showed that the tuning voltage output at pin 2 of the UAA2001 driver and latch chip IC105 in the microcontroller section was stuck at approximately 4 V . It took a lot more searching to find that $\mathrm{C} 111(0.01 \mu \mathrm{~F})$, which couples the prescaler output from the tuner to pin 11 of the
PLL/microcontroller chip IC101, was almost short-circuit. K.J.G.

## Pace MSS500

A large square pattern made up of white dots in neat columns and rows overlaid every picture. The culprit was the graphics generator chip U7. M.D.

## Echostar DSB9800

This Dutch digital package receiver was totally dead following recent storms and a series of power cuts.

Some care is required when removing the top of the receiver, because the Irdeto conditional
access module (CAM) slots into the lower side of the case and is held in with a retaining clip which is visible only when looking at the bottom of the box! This is confusing, because the CAM has to be removed before the top will come off.

Once the top had been removed I saw that the receiver consists of the main PCB and a separate power supply PCB. I was not surprised to find that the mains input fuse Fl was open-circuit.
Unfortunately the power supply PCB had totally unfamiliar component numbers and appeared to be of Far Eastern origin.

I checked the chopper device, which appeared to be OK, also the two transistors associated with it. There are several regulators on the secondary side of the chopper transformer, allso an optocoupler. I was hoping there would be no problems there!

As no shorts were evident around the chopper device, which seemed to be similar to the TOP202 used in modern Pace receivers, I replaced the fuse and switched on. The fuse didn't blow,
but the receiver didn't work though there was HT across the mains bridge rectifier's reservoir capacitor. Best to look for a highvalue start-up resistor I thought.

Two large $1.5 \Omega$ resistors in series by the chopper device looked slightly the worse for wear, but there was nothing in the region of $100 \mathrm{k} \Omega$. What did the two nearby transistors do I wondered? Then I spotted a smallish $680 \mathrm{k} \Omega$ resistor which, when I traced the track beneath the PCB, I discovered should have fed HT to one of the two transistors. It was virtually open-circuit.

I fitted a replacement with a somewhat higher wattage rating. The receiver then came to life and said, after its digital boot-up sequence, that I might like to check the aerial as it couldn't find a signal. What a helpful receiver, especially as I hadn't connected an aerial!

Good pictures appeared when I connected the workshop Astra $19.2^{\circ} \mathrm{E}$ feed - the Dutch package is transmitted in the digital high band at $19.2^{\circ}$ E. H.C.


## Servicing

# the Panasonic Euro-2 Chassis 


#### Abstract

Chassis that use digital signal processing present their own brand of problems - in addition to the usual power supply and timebase output stage ones. Brian Storm summarises experience with the Euro-2 chassis: several versions have been used in a variety of models


The Panasonic Euro- 2 superseded the Euro- 1 digital TV chassis in 1995. Sets fitted with the Euro-1 chassis first appeared in 1992. There are two main versions of the Euro-2 chassis, the advanced digital chassis which is used in models suffixed AD, and the leader or base versions which have fewer features and are used in models suffixed MD or LD.
With the Euro-2, digital signal processing came to be used in a wider range of TV sets fitted with a greater number of different tube types and sizes. All models have Nicam sound, and the standard range of features includes new on-screen menus, auto intelligence (AI) to extend the contrast range and bring out more detail in dark and light areas of the picture, and an automatic tuning and channel naming system. There are two scart connectors, one of which (AV2) accepts separate Y and C signals. The sets are capable of NTSC 3.58 or 4.43 signal processing via these $A V$ inputs.
AD models also have a separate on-screen volume control for headphones and additional front-input AV jacks. Some are equipped with Dolby Pro-Logic facilities. Models in the extensive Euro-2 range include those listed in Table 1.
There are 'hidden' model changes throughout the earlier ranges, a number of suffix letters indicating a CRT variation. There were at least four versions of the TX25MD1, including the TX25MD1/L, TX25MD1/B and TX $25 \mathrm{MDI} / \mathrm{M}$ : from the viewer's point of view they are almost identical, but from the servicing point of view it's important to note that they have chip sets with incompatible software.

## Power Supplies

Two entirely different power supplies were used in the Euro- 2 chassis. The base models (LD and MD) have a
chopper power supply based on the TDA4601 control chip. It's very similar to the power supply circuit used in the Euro- 1 chassis. AD models have a completely new TDA4605-based chopper power supply. The TDA4605 IC's output stage is designed to drive a FET chopper transistor. As a FET draws almost no drive current, the control chip has reduced power dissipation and doesn't require an integrated heatsink. In fact the newer TDA4605 comes in a small dual-in-line package.
Fig. 1 shows the TDA4605-based chopper power supply circuit. A start-up feed is provided by R621 and R626, which charge C622. When the voltage at pin 6 of the IC reaches 12 V it becomes active and starts to drive the chopper MOSFET Q624. Initially, drive switch-off is controlled by the input at pin 2 , which is compared with the regulation feedback input at pin 1. When Q624 is switched off, the energy stored in the chopper transformer T639 is released. Rectifier diode D622 then takes over the supply to pin 6 of I611. C623, which is connected to pin 7 of the chip, helps to provide a softstart.
Power supply regulation is controlled by the voltage at pin 1 of I611, while pin 8 is used to control the duty cycle. Increased loading reduces the switching frequency. The power supply provides regulation with load variations between 40 W and 260 W and mains input variations between 180 V and 270 V . Pin 3 of 1611 is monitored internally to provide protection against overloads.
The outputs on the secondary side of the circuit are 150 V ( 125 V with 2 lin . models) for the line output stage, 29 V for the line driver stage, 42 V for the audio output stage and 12 V and 5 V for the digital and smallsignal circuitry. Q681 and Q682 provide additional regulation for the audio output stage supply, reducing the


Fig. 1: The TDA4605-based power supply circuit used in some versions of the Panasonic Euro-2 chassis. Note that R668 is omitted in later production - see text.
voltage but increasing the current flow as the audio output IC approaches maximum power. This regulation helps to protect the chip from damage while allowing it to run at its maximum rated power.
There are very few common faults with these power supplies. A common cause of a blown mains fuse is the degaussing thermistor, which is either R808 or R619. In later AD type sets R668 in Q667's base circuit is removed to prevent CRT spot burn should relay RL6101 stick when the set is switched to standby.

## Standby Operation

The standby power supplies consume typically IW in the standby mode. In fact the standby transformer T6101 is of such low power ( 90 mA ) that assistance from the main power supply's 12 V output is required to sustain the outputs when current is drawn as the set emerges from standby operation. Fig. 2 shows a typical circuit.
Most Euro-2 sets use a relay to control the feed to the

Table 1: Models fitted with the Euro-2 chassis

TX21MD1
TX21MD3
21 in. model with Dolby Pro-Logic but no additional speakers (3D sound)

TX25MD1
TX25MD3
TX25XDP3
TX25AD1
TX25AD2
TX25AD1DP
TX25AD2DP
TX28LD1
TX28MD3
TX28XDP3
TX29AD1
TX29AD1DP
TX29AD2DP
$25 i n$. base model
Replacement for the TX25MD1
25 in . model with 3D sound and wood-panel trim
Advanced 25 in. digital model
Replacement for the TX25AD1
Advanced 25 in . Dolby Pro-Logic model with four additional speakers
Replacement for the TX25AD1DP. Has three additional speakers
28 in . base model
Replacement for the TX28LD1
28 in . model with 3D sound and wood-panel trim Advanced 29in. digital model
Advanced 29in. digital model with Dolby Pro-Logic
Replacement for the TX29AD1DP with three additional speakers

Note: this list is not exhaustive.
main power supply. The relay is activated by the main microcontroller chip, which is IC1801 in AD models, IC1201 in base models. Some sets however, notably the TX21MD1, TX25MD1 and TX28LD1, use a switching


Fig. 2: Typical standby power supply circuit.


Fig. 3: Simplified block diagram of the VDP3108 video/defiection processor chip.


Fig. 4: Simplified block diagram of the MSP3410 sound processor chip. Two different, incompatible versions were used.
transistor, Q801, which is mains-isolated by an optocoupler, D808.

## Field Output Stage

The field output stage in the Euro-2 chassis is based on the ubiquitous TDA8 175 chip and is again very similar to that in the Euro- 1 chassis.
With base models the top of the picture is sometimes cramped, showing the CRT black-level sampling lines at the top. The cause is usually leakage in D456. An MA2160 or 0.5 W 16 V zener diode will usually cure the problem.
The most common field fault I've had with AD models has been intermittent black lines near the bottom of the screen. The cause of this has been D508 or D507.
Dry-joints at R464 can cause varying height with base models.
Most early circuit diagrams show an arrow coming from pin 7 of the IC: in fact this is the input.
If the field slowly rises and falls when a set comes on this is almost certainly not a field fault in the normal sense. Suspect the non-volatile memory device, which is IC1941 in AD sets, IC1203 in base sets.

## Line Output Stage

The line output stage is entirely conventional but now has a BU2508AX output transistor. This has an internal diode which is not shown in the circuit, though it's hinted at by the dotted line around the component.
Intermittent failure of the line output transistor is often caused by the standby relay sticking. The line driver stage should, as standard practice, be checked for dryjoints though these are rare. It never struck me as a good idea to feed the line drive via a connector so, in AD sets, check the integrity of connector W1511.
The line output transformer occasionally causes problems. When there's an overload in the line output stage the power supply will pulse on and off.

## EW Drive

The east/west drive circuitry is also fairly conventional. It uses four transistors in AD models and a TEA2031A chip (IC701) in base models.
Failure of Q593 can be lessened by connecting a 39V zener diode across its collector and emitter - this was done in later production sets. Poor or no EW correction with base models can occur when D556 is leaky.

## The Digital Video/Deflection Processor

Video signal processing and generation of the timebase drives was initially carried out by a VDP3108-29 dual-in-line chip, IC601. Fig. 3 shows a simplified block diagram. The main operations carried out by this chip are as follows: PAL/NTSC/Secam colour signal decoding; AI processing (automatic black-level expansion); generation of a line drive output at pin 27; generation of a field drive output at pin 6; generation of an $E / W$ drive output at pin 5; AV switching, composite and Y/C, with inputs at pins $38,40,42$ and 44 ; analogue RGB interfacing, with inputs at pins 61, 63 and 64 ; digital RGB interfacing, with inputs at pins $12,13,19,20$ and 21 ; automatic grey-scale tracking, with the sensing input at pin 53 ; and generation of RGB drive outputs at pins 59,57 and 55.
IC601's working parameters are set at switch on via an $I^{2} \mathrm{C}$ bus, the clock input being at pin 10 and the data input at pin 14. All customer controls and service adjustments are carried out in this way.
For fault finding the important pins are 28 , which should be at 5 V even in standby, the reset pin 31 and the
20.25 MHz oscillator pins 16 and 17. In operation pins $15,45,47$ and 60 are also provided with 5 V supplies.
Automatic grey-scale correction is controlled by a flyback pulse at pin 62: this sets the range of an internal AD converter. Sensing is carried out at pin 53, with reference to the current flowing via resistors connected between pins 50 and 51 . This analogue voltage is converted to digital form and is then passed via the $I^{2} \mathrm{C}$ bus to the main microcontroller chip where the data is compared with data held in memory. Any correction required is calculated and sent back to IC601.
The main microcontroller chip also collects data from IC601 for automatic black-level expansion (AI). The level of AI can be selected from the user menus. The microcontroller chip also monitors data from IC601 to check that the dynamic range of the video signal is within certain limits. If the range is too compressed, the contrast gain within IC601 is increased.
The digital RGB inputs (pins 12, 13, 19, 20 and 21) along with the priority codec inputs at pins 3 and 4 and the main sync signal (MSY) at pin 34 provide digital information about the main picture. This is used by the teletext processor (either IC1701 or IC3502). During text displays IC601 produces interlace suppression pulses at pin 29.
A field flyback pulse is monitored at pin 34. If there is an abnormal condition here the RGB signals are blanked.
Later versions of the Euro-2 chassis use a VDP3108APPA1 processor. This is not compatible with the VDP3108-29.
These digital signal processor chips have been pretty reliable, but some symptoms can be obscure. One of the first I came across was blue flecks that appeared in the background when the set had been working for some hours. Another symptom seen, again when the set has been on for some hours, looks almost like line drift: as the fault gets worse, the set often lapses into standby. This can also be caused by the crystal connected to pins 16 and 17. I change the crystal first (fewer pins!). It can also cause colour loss or drift, usually intermittently. The processor chip can be responsible for faint vertical green lines in the background of the picture.
A video symptom that's usually not caused by IC601 is a completely or partially blanked picture. The cause is nearly always the non-volatile memory chip (the EAROM).
It's always worth checking the voltages around the chip carefully before you condemn it, as the small capacitors connected to various pins are often the cause of faults when they develop leakage, which can be considerable. For example low brightness can be caused by C310 being leaky.
The combined RGB drive chip IC351 on the CRT's base panel can be the cause of a varying grey scale with base models.

## Sound Processing

The sound signal processing is likewise highly integrated. In most sets an MSP3410-15TV digital sound processor chip carries out the following main functions: simultaneous processing of Nicam and FM sound; handling three separate left and right channel AV inputs; providing two separate left and right channel AV outputs; digital volume, bass, treble and pseudo-sound control; headphone drive; audio output stage drive.
Fig. 4 shows a simplified block diagram of the main sections used in the Euro-2 chassis. The MSP341015 TV can demodulate a wide range of stereo and mono TV sound signals. In the UK, Nicam and 6 MHz FM
sound are demodulated simultaneously. The selection of standards, features and adjustments is carried out via the $\mathrm{I}^{2} \mathrm{C}$ interface.
The sound processor's clock frequency is set by an 18.432 MHz crystal at pins 62 and 63 . The chip receives 5 V at pins 18 and 57 and 8 V at pin 39 . There is a reset at pin 24. The $I^{2} \mathrm{C}$ bus pins are 10 clock and 9 data.
In later versions of the Euro-2 chassis an MSP3410BPPF7 chip is used for sound signal processing. It's not compatible with the MPS3410-15TV.
The main faults caused by the sound processor chip are distorted or absent Nicam sound. Almost any sound fault can however be caused by either these devices or the associated software chips (control or memory)

## Dolby Pro-Logic

The addition of Dolby Pro-Logic with some models introduced a number of problems. At least three different Pro-Logic PCBs have been used. They all have an on-board power supply for the additional power amplifier chips.
Configuration of the Pro-Logic setups varies from model to model. Some have four additional speakers ( L , R, Lrear, Rrear), some three (centre, Lr, Rr) and others four again (centre, $\mathrm{Lr}, \mathrm{Rr}$ and sub-woofer). Some models have 3D sound, which is supposed to simulate the surround-sound ambience.
The wary service engineer should always disconnect the Pro-Logic PCB if the set is dead or tripping - or isolate the $\mathrm{I}^{2} \mathrm{C}$ clock and data lines. Having been run at full bore for most of their lives, one of the output chips is certainly going to fail as Arnold Shwarzenegger repels yet another helicopter attack. When it has gone shortcircuit, the safety resistor in its supply will have gone open-circuit - but not before a very large glitch has had time to wreak havoc throughout the Pro-Logic board. Basically this means that when one of the output chips is faulty you should not expect to have sound after replacing it: instead, check the audio paths through the various processors carefully - usually at least two of them are defective.

## Text Processing

Teletext processing is carried out by a TPU3040-18 chip, with an external DRAM chip for additional page and OSD memory. Composite video is fed to pin 3 of the TPU3040-18 chip, which should have 5 V at pins 4 and I 1 , and $\mathrm{I}^{2} \mathrm{C}$ inputs at pins 23 (clock) and 22 (data). The digital RGB connections to IC601 are at pins 6-9 and 12. The teletext chip shares IC601's $20 \cdot 25 \mathrm{MHz}$ clock signal at pin 17, its reset at pin 16 and receives its main sync signal output at pin 20.
No text because of a dry-joint at the video input coupling capacitor C3508 was quite common with earlier base sets. The display cancel and text update facility didn't work with earlier models because of an EEPROM (IC1202 or IC1871) programming error. This was subsequently corrected.
The text processor could be responsible for the intermittently dead symptom with early Euro- 2 sets.

## Device Control

Digital processing is under the control of IC1801 (IC1201 in base models). This CCU30001-05 microcontroller chip is connected to all the digital processing ICs, the tuner, the IF and AV switching ICs and the non-volatile memory device (the EAROM) via three $I^{2} \mathrm{C}$ bus systems ( 1,3 and 4 ) as follows:

Bus 1 is connected to the video/deflection processor, the
sound processor, the text processor and the non-volatile memory (EAROM).

Bus 3 is used to read and write from/to an external memory pack and some Pro-Logic processors.

Bus 4 is connected to the tuner unit, the IF and AV switching chips and some Pro-Logic processors.

The operating conditions for the digital processor chips have to be loaded at switch on. This is carried out by the CCU chip IC 1801/IC1201 under the control of the operating software, which is stored in the EEPROM (IC1871 or ICl202). The operating levels, customer settings, tuning information and service adjustments are stored in the EAROM (IC1941 or IC1203). These are first sent to the microcontroller chip which then sends them to their correct locations, i.e. the processing chips. This procedure also occurs when the set is switched out of the standby mode.

## Service Mode

The Euro-2 chassis has a number of built-in servicing features. Service mode one is used for normal service settings such as picture geometry and grey-scale tracking. To enter this mode, set the bass to maximum and the treble to minimum, then press volume down on the TV set while pressing reveal on the remote control unit. Once in service mode one, use the red and green Fastext buttons to step through the adjustments and the yellow

and blue buttons to alter the settings as required. Press store to retain the settings.

## Self-check

The self-check mode can be used to check the communication between the microcontroller chip and the digital signal processor chips. When the self-check mode has been left, the device control system will be reset. This can be important if the CCU, the EEPROM or the EAROM have been changed. One symptom of the need for a reset is when the receiver comes on with the sound at minimum and on channel one.

## Memory Problems

The EAROM (IC1941 or IC1203) can be the cause of a number of fault symptoms, including a dead set or an intermittently dead set. This can usually be isolated by running the set with pins 5 and 6 desoldered. One thing to beware of is R558 in the beam limiter circuit going high in value or open-circuit: this can cause a dead or intermittently dead set, with the symptom apparently cured when the EAROM is disconnected. The EAROM has been the cause of some bizarre video faults, and could in theory be the cause of almost any fault in a TV set.
The EEPROM (IC1871 or IC1202) was reprogrammed for several reasons including Macrovision problems, channel naming and sorting, and text page updating in the display cancel mode.
It cannot be sufficiently emphasised that when the EAROM or EEPROM is replaced it must be the correct type for the particular set. For example, the ICs for a Model TX25AD2DP/B are not be suitable for Model TX25AD2DP/M.
After either or both of these memory ICs is/are changed, it is advisable to enter the self-check mode to reset the operating conditions.
It is not always necessary to replace these two ICs as a pair, but this is advisable when the set is an earlier ADI, MD1 or LD1 type as the Macrovision upgrades will cause instability if only the EAROM is changed.
Replacing the EEPROM and EAROM can sometimes cause field jitter. If this happens, the video/deflection processor chip IC601 must also be replaced.

## Fault Finding

The main problem with high-level integration, especially with a digital set, is the unseen software content of an IC. If data has been incorrectly loaded into a digital processor virtually anything can happen. If no data is loaded because the EEPROM chip is faulty, nothing will happen and the set will be completely dead. The $I^{2} \mathrm{C}$ bus protocols always check that data has been received: if there is no acknowledgement, the data will be sent again and again. If a digital processor doesn't accept data, the set will usually be dead.
If a faulty device connected to an $\mathrm{I}^{2} \mathrm{C}$ bus is pulling down the bus lines, the set will again usually be dead because data cannot be transmitted along a defective bus line. Devices that can pull down data bus lines include the EAROM and AV switching ICs: the UHF tuner is another common offender. The voltage on the bus lines should be about 5 V . If not, disconnect devices until the 5 V level is restored.
Also remember that a microcontroller chip must have a clean and accurate supply, i.e. with less than a fifth of a volt variation from the specified 5 V . There must also be a reset and a clock feed. It is pointless, though sadly rather common, to replace a microcontroller chip before carrying out these vital checks.

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A.R.D.

## John Coombes presents a quick guide to CD player servicing: a summary of what can go wrong and what to check

# CD Player <br> Servicing <br> perish or wear, can cause jumping or in some cases 

Field service calls to deal with CD player faults are not practical nowadays. When a collection has to be arranged, it can help if whoever brings the player in finds out whether problems like jumping or skipping, which may be intermittent, are caused by certain discs. A selection of discs that demonstrate the fault condition can also be a big help to the bench technician.

## The Lens

The cause of failure to read the TOC (Table of Contents) can be a soiled lens. A dirty lens can also be responsible for no disc output, failure to display the track number and total music number, failure to play or jumping tracks. If the RF signal and the eye pattern are of low amplitude before the lens has been cleaned, check them again after cleaning to ensure that the laser's output has now returned to specification. If not, replace the pick-up assembly or optical block and carry out alignment. When there is a repeated dust or nicotine contamination problem it may be appropriate to suggest to the customer that the unit is placed in a housing.
On the subject of lens cleaning, Pioneer and Sony both recommend the use of isopropyl alcohol (part nos. GED-008 Pioneer, KK-91 Sony). Wipe the lens with a spiral motion from the centre outwards. If an incorrect lens cleaner is used, the result can be a cracked coating or a dim lens, with premature failure of the laser block.

## Laser Checks

If the laser is suspect, check whether it emits light. Note that it is dangerous to view the lens directly. Ensure that the laser power is low (not more than about 0.25 mW ), view the lens from the side, at a distance of at least 30 cm , and do not watch for more than ten seconds. If the laser is not alight, check the laser current. This differs between models and manufacturers: with Pioneer players the laser power is generally about 0.13 mW and the current about 30 mA . If the current is lower than this, there may be an open-circuit between the control IC and the laser diode. If the current is much higher, at 60 70 mA , the laser diode is faulty.
If the laser doesn't light and the laser current is correct, check that the focusing operates correctly. If these tests give normal results, suspect the optical block: check it by replacement.
Some optical units have rubber floats which, if they
half-moon shaped scratching on the surface of the disc.

## Excessive Disc Speed

If the disc rotates at excessive speed, suspect the optical block. But before replacing it, check the focus error/tracking balance, ensure that the lens is clean and that the disc is OK.

## Disc Faults

Faulty discs can cause various symptoms. One of the most common problems is scratches caused by user mishandling. The direction of the scratch line tangent will determine whether the result is jumping or no playback. If the scratch is wide there is bound to be jumping.
On rare occasions you find that the disc centre is misaligned. The result is no playback. Disc damage can also result in light showing through, or the signal surface may peel off. This will distort the signal, again with jumping. A black spot can form on the surface of the disc during manufacture: this can also cause jumping.

## Spindle Motor Problems

If the spindle motor is worn, the frequency of the RF eye pattern will fluctuate. As a temporary measure, remove the motor and connect a battery across its terminals. Then reverse the connections so that the motor has rotated in both directions. It will now operate correctly, but only temporarily, enabling the operation of the rest of the player to be checked for reading of the TOC.
Ensure that the disc table is fitted correctly and set at the correct height after replacing a spindle motor. If the height is incorrect, the disc may not play at all or there may be skipping.
If the spindle motor is OK , check the drive circuit.
If, with some players, the spindle motor doesn't operate, use a scope to check that the RF blip is present. If so, suspect a faulty optical block. Recheck the focus and tracking servos. If they don't work correctly, check the laser diode output power. If this is too high, the amplitude of the RF waveform will be excessive because of incorrect reflection from the surface of the disc.

## Ribbon Connectors

Many CD players have very thin and sometimes insufficiently flexible ribbon connectors. These can cause
many problems, which may be permanent or very intermittent. Incorrect laser unit operation for example, or no power or no spindle motor power.
With machines that have a multi-play unit or two-three dise turntables a ribbon connector fault may be responsible for no rotation from one disc to another or failure to operate.

## The Drawer

A broken or fractured ribbon cable can be the cause of the drawer loading and unloading on its own, or in some cases failing to load at all. The most common cause of the drawer not going in and out is the loading belt when one is used. If the belt is OK, check whether the grease along the runners has hardened. The resistance this introduces will cause incorrect drawer operation. If these points are all OK, remove the belt and see if the motor rotates. If it does, it may have insufficient torque to drive the loading belt and tray. If it doesn't, check whether the DC supply is open-circuit.
Incorrect limit switch operation is another cause of failure of the drawer to open or close. If this is OK, check that the logic signals are correct.
A faulty limit switch may also prevent the pick-up unit returning to the start position.

## The Sled Motor

A faulty sled (carriage) motor can cause track jumping or juddering or sticking in one place. It may be necessary to remove the motor and clean its spindle, and the runners or cogs depending on model and make. To pre-


Fig. 1: Basic CD player block diagram. Models fitted with a radial optical assembly have a radial servo instead of separate tracking and sled servos.
vent binding, ensure that the unit is well cleaned and lightly lubricated.

## General Points

With modern units the pick-up assembly mechanism and laser power are preset.
It may be necessary to check and adjust the tangential skew to prevent jumping. Bad wear here will prevent player operation. The same effects can be caused by incorrect grating adjusiment.


# Servicing 

## J. LeJeune provides a detailed fault-finding guide for the deck and the electronics used in these popular low-cost machines

# the Daewoo V50 and V60 

These two VCRs are virtually identical, the main difference being that the V60 has the VideoPlus option enabled. They use the Daewoo FM deck, which is simple and easy to service. On the electronics side the motherboard contains the servos and system control circuitry and the interconnections. There are six modules: power supply, modulator, tuner, pre-rec (Y/C), IF/demodulator and input-output board. There is a second microcontroller chip on the front panel PCB: it's used to drive the fluorescent display and convert key-presses and IR commands into data for the main microcontroller chip on the motherboard.
The Sony SOPS-2021 power supply module gives little trouble.

## Dismantling the Machine

The mechanical side is responsible for most faults. Several components age, wear or can be damaged by inconsiderate use. Make sure that the mains supply is disconnected before you remove the deck from the machine. Five securing screws hold the top cover. Remove it then the brace that goes across the cassette platform at the front of the machine. The front panel can then be removed - it snaps into place.
The cassette platform is held by two screws, the deck by a further five. One of these is at the rear edge of the machine, to clamp a sheet-steel bridge plate whose other end is screwed to the deck, close to the audio-control (A/C) head. This bridge plate is useful as a handle when the deck is lifted out. There are two screws at the rear corners of the deck. Another one between them secures part of the pre-rec module. The remaining screw is along the front edge of the deck. Once the screws have been removed the deck can be lifted out, giving relatively easy access to all parts.

Fig. 1: The old (left) and later (right) idler assemblies.

## Deck Servicing

First take a look at the idler assembly. If it resembles the type shown on the left in Fig. 1, replace it with the later version shown on the right. Then examine the clutch, which comes out easily when the split washer that secures it has been removed. The thrust plate should be lightly greased: the clutch should feel firm, not slack. If the belt between the capstan motor flywheel and the clutch is very shiny, replace it - most of the ones I've come across in two-three year old mechanisms have been satisfactory. Check the connectors for the motors: the contacts blacken over a period of time and will always benefit from being cleaned.
Index marks for the alignment of the mechanism, in the stop mode, are shown in Figs. 2-5
Failure of the mechanism to load properly and the brakes to operate correctly is frequently the result of relay plate-distortion or a loose pin on it. The plate is shown in Fig. 6. In severe cases there will be no fast forward or rewind operation. The pin is the cam follower, which engages with the cam gear. Replace the plate. To release it, take out the relay gear on the underside of the deck, the pinch roller assembly and the loading motor and cam gear. Reassembly is easy when you have the diagrams to help you or the manual.
If you are happy with the condition of the deck, place it back on the motherboard - watch out for the connectors at the rear of the loading motor assembly: make sure that they actually connect and that there are no bent pins. Once everything has been reconnected the loading platform can be replaced. Make sure that the cassette carriage is fully retracted in the unload position. Refit the front PCB and switch on.
Run a tape past the $A / C$ head in the cue and review modes. If the tape moves up or down, the pinch roller is probably misaligned and due for replacement.
Should rewind, particularly fast rewind, be poor the most likely cause is the small brake dragging on the take-up spool hub - it's the left-hand one of the two brakes on this assembly. A quick cure for this is use the tip of a soldering iron to heat the elbow of the brake arm and ease the shoe away from the hub by about a millimetre. Check that this is enough. It should be. If you overdo it there will be tape spillage and looping when the brakes are applied.
The FM deck is easy to service. Most problems are commonplace and easy to diagnose. Daewoo seems to
have been confused about how much grease to apply to the mechanism during production: a light application of grease is all that's required for satisfactory operation. Some decks have a heavy application, others seem to have barely enough.
The cassette loading platform gives little trouble: it's easy to service and of simple construction. If the tape loads but there is no drum or capstan rotation, check Q861 which is probably open-circuit.
The cause of no full erase in one machine turned out to be a foreign body that prevented full swing of the backtension lever. This held the tape away from the FE head! Daewoo uses foam rubber strip around the machine to prevent drumming noises. A piece of this was the culprit.

## The Drum

These machines have no head heater. So many that are brought into the workshop have tape wrapped around the drum. Once you have freed the drum and checked that the mechanics are working correctly you might find that the machine doesn't produce pictures or sound - the screen is dark grey with noise on it, or has a jazzy black-and-white pattern on it. This is a sign that the drum needs cleaning. If at first you don't succeed, don't give up! It may take four or five attempts to get good pictures and sound.
The Blue Diamond or 'titanium' heads are vulnerable to dirt and may require several attempts at cleaning even after only normal use.

## The Power Supply

The Sony power supply uses a TOP type chopper chip. It has three connections, for earth, feedback and output, the latter going to the primary winding of the chopper transformer. Pace used one of these devices in the MSS100 analogue satellite receiver. It makes the component count very low and the circuit almost foolproof.
The most common problem is failure to start because the $390 \mathrm{k} \Omega$ start-up resistors R55 and R56 have gone high in value or open-circuit. They are of a very lowwattage type and take up very little space on the PCB. A metal-film type would be better able to withstand the rectified mains voltage. A less common cause of failure to start is diodes D54 and D55, which become leaky.
Sometimes the power supply fails with a blackened fuse, which usually means that the chopper device has gone short-circuit. A replacement will restore operation, but it's worwhile checking the output from the mains bridge rectifier. The reading should be about $290-310 \mathrm{~V}$. If the reading is low, the value of the reservoir capacitor has probably decreased. This can cause failure of the TOP device.
As a check on whether the power supply is providing what it should, Table 1 shows voltage readings to expect. They were measured in the stop mode.
A strange symptom I had with one machine was sequential flashing of the clock digits in the fluorescent display. The cause was traced to the optocoupler that's used for feedback and isolation between the secondary and primary sides of the power supply.
Should the switched 5 V supply be low, check whether Q854 is running hot. The normal cause is that C857 is leaky. A neighbouring capacitor, C859, can cause problems with the switched 12 V supply, including erratic motor speed and hum bars on the picture.

## Tuning Problems

One of the most common problems is tuning drift. Leakage in the 33 V regulator D851 is one cause of this.


Fig. 2: Datum positions of the relay plate and cam gear.


Fig. 3: Datum positions of the mode switch and cam gear.


Fig. 4: Datum positions of the main plate and relay gear.


Fig. 5: Datum position of the loading-gear assembly.

Fig. 6: The relay plate.

Fig. 7: Signal flow diagram. 0181 should have oV at its collector, 2.2 V at its base and 3 V at its emitter.


Note that the correct type, as fitted, must be used: an ordinary 33 V zener diode will not do. Another cause is poor earthing of the tuner can to the PCB. Grabbing the can and gently squeezing it will highlight this problem. The cure is to remove the covers and retension the pressed-out lugs by using a screwdriver blade to lever them away from the plate. Only a small amount is required: a millimetre will suffice to re-establish solid contact.
If you forget to connect an aerial to the VCR when auto-tuning you will end of with a blue screen.
To reset the memory, turn off the mains supply and short-circuit C623 (alternatively sort-circuit the anode of D603 to the PSU's screening can). This action may be necessary when a machine has to be retuned to a new set of channels.
Since the arrival of digital services, the auto-tune facility will log these in as well as the analogue ones. This is obviously a nuisance, and means that station deletions have to be made when tuning is complete. A colleague uses a 12 dB attenuator in series with the aerial lead when auto-tuning these machines: the digital signals are then below the machine's acceptance level, but the analogue signal strength is sufficient for channels to be recognised and stored. This calls for a little trial-anderror, and can be done only at a fixed location such as a workshop.
Record and playback do not work during auto-tune, but you can wind the tape fast forward or rewind it.

## Electronics

The electonic circuitry in V series machines is good, with any problems normally well defined. A good service manual would be a distinct help when troubleshooting. Unfortunately some essential information, such as signal flow diagrams, is not provided in the manual. Fig. 7 may be of help in this respect.
Table 1: Power supply voltages

| L803 | 5.9 V | D851 cathode | 32.25 V | D852 cathode | 12.75 V |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| L804 | 14.5 V | D853 cathode | 12.5 V | D854 cathode | 13.75 V |  |
|  |  |  |  |  |  |  |
| Transistor | Collector | Base | Emitter |  |  |  |
|  |  |  |  |  |  |  |
| 0851 | 14.3 V | 12.9 V | 12.2 V |  |  |  |
| O852 | 14.3 V | 12.7 V | 12 V |  |  |  |
| O853 | 14.3 V | 11.4 V | 12.1 V |  |  |  |

One machine I had on the bench recently showed all the signs of an early death. Multimeter checks showed that it was very much alive however. The fluorescent display was extinguished because ZD605 (3.9V) was open-circuit. When this happens the display filament pins both read -22 V with respect to chassis.
Another machine, which was stuck in standby, was on the point of going through the window when I discovered an intermittent section of cabling between P603 and P701, joining the front PCB to the motherboard.
Microcontroller chip failures are rare. The main one can sometimes be the cause of apparent tape-end sensor or tape-motion sensor failure however. Before reaching for the blowlamp, check whether the 16 MHz crystal oscillator is working. I've had one or two 'sticky' crystals. Also check for a reset pulse at pin 37 or, more easily done, at pin 1 of IC604.
Crystal X401 at pins 17 and 18 of IC301 can also be sticky. The symptom is either intermittent colour or no colour at all.

## A Warning

As with many other low-cost machines, be wary of pressed metal parts. They can have very sharp edges and can cause deep wounds. The edges of the cabinet top and the strap across the front of the loading platform are particularly dangerous in these machines.

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## Sharp DV5935H/ DV6635H (BCTV-A chassis)

The cause of any of the following symptoms can be that the NV memory needs reprogramming: no or intermittent FM mono, Nicam or scart sound: no Nicam and a whistling noise in the background with mono sound. The data list can be obtained from Sharp Technical or the Willow Vale technical help pages on COPS, and fed to the receiver via remote control or the front keyboard - the NVM data is not included in the service manual Alternatively you can obtain a preprogrammed NVM from Sharp as a spare part. P.B.

## Philips 25PT4101/05 (AA5 AB chassis)

In the event of failure of the line output transistor, check for dryjoints at the rear of the connector on the scan coils. P.B.

## Tatung B Series Chassis

If the set is dead with the standby LED flashing, check D810
(BY399) for leakage. It's part of an elaborate network associated with the chopper FET Q801. P.B.

## Grundig CUC5361 Chassis

The beam limiting system didn't work in this set. So when the picture had a lot of white in it the set

TV
Fault Finding
switched to standby. The beam limiting voltage is fed to pin 12 of the RGB module (29504-165-55). As the beam current increases, the voltage at pin 15 of IC5150 (TDA4658) should fall. It did, but the chip took no notice. A new TDA4685 restored normal operation. P.B.

## Sharp 51AT-15H (5BS-A chassis)

A neighbouring engineer had given up on this one - I found out why the hard way. The initial symptom was reduced height with the scan cramped at the top and bottom. The field timebase supplies had a lot of ripple on them, so $\mathrm{C} 712(220 \mu \mathrm{~F})$ and C713 ( $1,000 \mu \mathrm{~F}$ ) were replaced. This removed the ripple - and also the field scan! The ripple must have been producing what little scan there had been.

Cold checks in the field output stage revealed the following faulty items: Q502 (BD825), Q504 (BD828), Q509 (BC635), Q510 (BC338) and D501 ( 1 N 4148 ). The field scanning was correct once replacements had been fitted, but the picture was snowy and tap-sensitive in the area of the tuner unit. Resoldering the few suspect joints that could be seen in the tuner had no effect: in fact the cause of the low gain turned out to be a faulty SAWF (SF201). P.B.

## JVC AV25SXIEK

This Dolby model would come out of standby but almost immediately shut down again. Although the HT voltage was correct, during the short time the set worked the EHT was over 30 kV . Capacitor C1521 ( $3,800 \mathrm{pF}, 1.5 \mathrm{kV}$ ) had decreased in value. Its part no. is QFZ01 17 3801S). P.B.

## Crown CRP21T

These sets seem to suffer from line
driver stage faults. When the set is intermittently dead, the cause is usually the 2 SCl 573 A line driver transistor Q579. It may test OK, but a replacement will cure the intermittent loss of line drive. If the set is permanently dead, the cause is usually the line driver stage feed resistor R599 ( $2 \mathrm{k} \Omega$, 5 W ). We always replace Q579 as well. M.Dr.

## Ferguson B49F (Thomson TX90 chassis)

Loss of the tuning voltage usually means that RH04 ( $27 \mathrm{k} \Omega$ ) has failed. You'll find it in front of the line output transformer. M.Dr.

## Matsui 2180TT/Saisho <br> FST212T

The complaints with this set were field jitter and intermittent field collapse. When I tested the set I found that the field drive output at pin 23 of the $\mu \mathrm{PC} 1420 \mathrm{CA}$ colour decoder/timebase generator chip IC401 was varying in amplitude, but a new chip made no difference.

Because of the intermittent nature of the fault, a lot of time was spent making scope and voltage checks. I finally discovered that in the fault condition the voltage at the anode of D606 rose to about 1.5 V . This diode is connected to the service switch SW601, which is used to collapse the field scanning. The anode of D606 is normally at 0 V : for field collapse it rises to 12 V . The rogue voltage was coming from SW601, which must have been leaky. A replacement from a scrap set cured the problem. M.Dr.

## Sharp. DV5165H (4BS-B chassis)

The line output transistor in this set had blown for no obvious reason. So I fitted a replacement and switched on. The set tripped slowly for a few minutes, then the EHT
suddenly appeared and the new transistor got red hot.

While scoping around I discovered that the line drive frequency was incorrect. The line oscillator is in the MC44007 colour decoder/ timebase generator chip IC2801. Checks here showed that the 5 V supply was low at $3 \cdot 8 \mathrm{~V}$. This supply comes from a three-terminal 5 V regulator, IC75I (KA7805PI). When its output pin was disconnected from the print the voltage returned to normal. This turned out to be a red herring, and resulted in a lot of wasted time. The regulator was faulty, but only under load. M.Dr.

## Ferguson T49F (TX91 chassis)

Very low sound was the complaint with this set. The cause was traced to a leaky BC858C surface-mounted transistor, TV02. M.Dr.

## Onwa Chassis

The set in question was a JVC Model C14ET1EK, but we've had the same problem with a number of other sets that use these chassis. If you find the surge limiter resistor open-circuit but no obvious shortcircuit is present, check the protection capacitors in the mains bridge rectifier circuit, C904-7 in this case They are small, green disc capacitors marked 472 (4.7nF). A black pinhole in the side of the body is the give-away. M.Dr.

## JVC C1480EK

This set was dead. The mains supply was present at lead connector CON3 but had disappeared by the time it should have reached the mains filter choke LF901. A hairline crack was found in the PCB where it slots into runners moulded in the case. The mains supply is routed from CON3 to the choke directly next to the chassis support at the left-hand side. I can only put the cause down to rough handling. P.G.

## Goodmans 2180

Intermittent low brightness, mainly from switch-on, was the complaint with this set. I at first suspected a first anode supply fault at the line output transformer. When the set was switched on, the first anode voltage was only 240 V . After some time it rose to the normal 450 V , with correct brightness levels. Further investigation revealed that the cause of the fault was on the tube base panel, where some strange-coloured glue had been
applied around the AI feed wire during manufacture. This glue had become conductive. Its removal cured the fault. P.G.

## Bush 2159NTX

There was just a blank raster, with no picture or sound. Quick checks at the tuner unit's 12 V supply pin produced a reading of 0 V , also a short-circuit reading. Not surprisingly, the $2.2 \Omega$ safety resistor R327 in the feed to this pin was open-circuit. The short-circuit was found inside the tuner, which I had to remove for examination. A hairline solder splash was present at the BU pin's feedthrough capacitor. Once this had been removed there was normal vision and sound. P.G.

## Matsui 209T

Two field faults are quite common with these sets. Failure of C307 $(2 \cdot 2 \mu \mathrm{~F}, 50 \mathrm{~V})$ in the feedback circuit produces crossover distortion, with a bright-up across the centre of the screen. Failure of the bootstrap capacitor $\mathrm{C} 302(10 \mu \mathrm{~F}, 50 \mathrm{~V})$ can upset the blanking circuit, the result being text data visible at the top of the screen. C.W.

## Goodmans C2043T

For low HT when the set is cold, replace the $33 \mu \mathrm{~F}, 160 \mathrm{~V}$ capacitor situated close to the power supply transformer. C.W.

## Samsung Cl537 (P55 chassis)

Loss of one colour is a fairly common fault with these sets. There are three $33 \mathrm{k} \Omega$, 2 W resistors (R803/ 811/818) on the CRT base panel they provide DC feedback in the RGB output stages. One is usually open-circuit. Replace them all. C.W.

## Hitachi CPT1446 (NP84CQ chassis)

The problem was field collapse. The voltages around the field output transistors were correct, but there was no scanning because the $47 \mu \mathrm{~F}, 160 \mathrm{~V}$ field scan coupling capacitor C603 was open-circuit. C.W.

## Nokia Euro Stereo 2 Chassis

This was a tricky fault. The S2000AF line output transistor would go short-circuit, and sometimes the line driver transistor would go open-circuit. Various components, including the EW diodes and tuning capacitors, were replaced and a thorough investiga-
tion was carried out for dry-joints, but the problem persisted.
Replacement of the line driver transformer cured the fault. I assume that it would develop short-ed-turns under load, as the DC resistances were correct and its pins were properly soldered. C.W.

## Sharp DV5150H (S3B chassis)

There was a very low-contrast picture, with various coloured flashes on the screen. The cause was one of the BF421 transistors on the CRT base panel. I felt it best to replace all three. They are in the auto grey-scale feedback circuit. C.W.

## Tafung 180 Chassis

This set would instantly blow its S2000AF line output transistor Q403. Various items were replaced but the set kept eating line output transistors. The cause of the trouble was C433 ( $6.8 \mathrm{nF}, 2 \mathrm{kV}$ ) in the EW diode-modulator network: it was open-circuit. J.S.R.

## Ferguson TX100 Chassis

When the relay chatters the cause is usually failure of the line output transformer or transistor. Not this time. The chattering continued when the HT supply to the line output stage had been disconnected and a 100 W lamp was rigged up as a dummy load. The cause of the fault was in the chopper circuit, on the primary side, where the 12 V supply was low at 10 V . The reservoir capacitor $\mathrm{Cl} 19(22 \mu \mathrm{~F})$ had fallen in value. J.S.R.

## Panasonic TX21MD1 (Euro-2 chassis)

This set's picture had very severe yellow smearing to the right of objects, much the same as you would expect from a CRT that's seen better days. The tube was blameless however, the cause of the fault being the VDP3108-25 colour processor chip IC601. S.H.

## Sharp DV5105H (Deco-4 chassis)

The set was stuck in standby with a main 5 V supply problem. This supply comes from the emitter of regulator transistor Q753. The associated electrolytics were OK, and a replacement transistor made no difference. I eventually found the cause of the fault in the rectifier circuit that feeds Q753: safety resistor R751 had risen in value from $0.33 \Omega$ to about $1 \Omega$. A Sharp expert I subsequently spoke to said
it's a fairly common fault. S.H.

## Tatung D Chassis

This set produced a very green picture. The cause was loss of the tube's blue drive. The culprit was the feedback/bias resistor R922 ( $100 \mathrm{k} \Omega$ ) in the blue output stage. R932 and R912 are the corresponding resistors in the green and red output stages. S.H.

## Goodmans 2575

After switching on, this set would revert to standby within seconds. There were some strange DC readings around the TDA4601 chopper control chip IC14, so the associated electrolytics were checked. The culprit turned out to be C108. C.H.

## Samsung CI6844N (SCT12B chassis)

 I've had two problems with these sets recently. The first one was dead: IC801 (STRS6709) and Q805 (Darlington type TIP102) had to be replaced to bring it back to life. The second set wouldn't power up, with the LED flashing in a strange, yellowish colour. If you get this symptom, check that IC901 is receiving its 5 V supply. If it is, check for oscillation at pins 31 and 32. If there is no oscillation, suspect the 32.768 kHz crystal X 90 l . S.H.
## Tatung 190 Chassis

This portable took anything from five minutes to five hours to power up after being switched on. The cause of the problem was one of the start-up resistors in the power supply, R803 (16k $\Omega$ ). It read correctly out of circuit, but went highresistance under load. S.H.

## Samsung Cl3312Z (P58SC chassis)

There was a nasty crackle on the sound. A check at pin 12 (audio output) of the TDA8305 IF/timebase generator chip IC101 revealed that the noise was present here. Several capacitors in this area were checked before the culprits were found C603 and C605 (both 22nF). S.H.

## Ferguson TX90 Chassis

There was sound but no picture. All voltages at the CRT were low, including the EHT. Checks in the power supply revealed that the 'boost HT' was about twenty per cent low. When I had replaced the boost line smoothing capacitor C191 ( $22 \mu \mathrm{~F}, 160 \mathrm{~V}$ ) the voltage was almost normal and there was a distorted picture that was modulated
by a hum bar. On close inspection of the PCB in the power supply area I found small cracks around the connections to the switching transistor TR 107. Once these had been repaired the boost voltage could be adjusted. I thought that all was now OK, with a good picture, but when the brightness and contrast controls were advanced there was a ripple effect on the picture and a squeal on the sound. A new boost reservoir capacitor (C189$22 \mu \mathrm{~F}, 50 \mathrm{~V}$ ) completed the repair. K.E.

## Goodmans 2875

There were low-resistance readings in the collector circuit of the line output transistor in this dead set. On closer inspection a dry-joint was seen at C134, where arcing had occurred. This had destroyed the EW modulator diodes D45/47 and the pincushion chip IC18.
Replacement restored normal operation. K.E.

## Sony KV2705

There were striations on the lefthand side of the picture. A scope check on the 135 V HT supply showed that a lot of ripple was present. The two $33 \mu \mathrm{~F}$ electrolytics in the power supply proved to be OK, but there's another one (C804) on the scan panel. A replacement cured the fault. M.O.

## Sanyo CTP7135 (80P chassis)

A slow ripple modulated the verticals and there was foldover at the top inch of the screen. The cause of both these faults was C322 $(470 \mu \mathrm{~F}$, 100 V ), which is the reservoir capacitor for the 45 V output from the chopper power supply. This supply is used by the LA7800 timebase generator chip IC401. M.O.

## Alba CTV55

There was an overbright picture. When the setting of the first anode control was reduced, the picture had black bars spaced about an inch apart in the background. The cause of the fault was the reservoir capacitor for the HT supply to the RGB output stages, C437( $22 \mu \mathrm{~F}, 250 \mathrm{~V}$ ). M.O.

## Mitsubishi CT2101TX

The standby LED was on. That was all. When the standby switch was pressed the LED went out but there was still nothing. A check on the HT supply showed that it was low at only 37 V . The cause of the fault was traced to C910 and C911,
which are both $1 \mu \mathrm{~F}, 50 \mathrm{~V}$ electrolytics. M.O.

## Sharp DV5105H (Deco-4 chassis)

The MJF 18004C chopper transistor Q702 was short-circuit, also the TEA1039 chopper control chip IC700 between pin $9(\mathrm{Vcc})$ and chassis - as a result R706 and R710 (both $3.3 \Omega$ safety) had blown. When the set was switched on after replacing these four items they went up in a puff of smoke. The cause of the trouble was the chopper transformer T700, which had an internal short. I've had to replace it on previous occasions. C.D.N.

## Philips Anubis B Chassis <br> There was no teletext operation.

 Heat and freezer applied to the text panel soon revealed the cause, which was the 27 MHz crystal. It had become unstable. A replacement restored the text modes.C.D.N.

## Toshiba 1400TB

This set produced a very grainy picture. When I removed the tuner unit and opened it I saw that one of the lecher lines had become corroded, though there was no sign of liquid spillage. Part of the corrosion lay across the air gap between this and another lecher line, which it was touching. Gentle cleaning restored normal operation. C.D.N.

## Ferguson IKC2 Chassis

This set would sometimes blow its chopper transistor at switch on. At other times the transistor would last for about fifteen minutes. The culprit was CP29 $(2.2 \mathrm{nF})$, which is in the snubber network. It's a box component, and had a very slightly swollen appearance at one terminal - this could be seen only when the capacitor had been removed. It measured OK when checked with two different capacitance meters. C.D.N.

## JVC C1480EK

Stations wandering off tune, or failure to memorize after tuning, is quite a common problem with this model. The station select module, type SBX-M903A, is a small PCB that's covered with surface-mounted components. I find that the cost of a replacement puts most customers in a bad mood! Before you condemn it, note that there are four surfacemounted capacitors of the same type used in camcorders. Replacing all four is usually a successful cure for tuning faults. C.D.N.


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| $2 \mathrm{SC1675}$ | 90p | 2SC226 | 700p | 2 SC 2719 | 25p | $2 \mathrm{CC3263}$ | 280p | $25 C 3798$ | 220p | 2SD257 | 195p | 2SD880 | 40p | 2SD1327 | 15 | 2SD1763A | P | （312 | 750p |
| $2 \mathrm{SC1678}$ | 80 | 2SC226 | 90 p | 2SC2721 | 120p | 2SC3264 | 390p | $25 C 3807$ | 120p | 2SD28 | 250p | 2SD882 | 25p | 2S | ${ }^{60 p}$ | 2SD1764 | p | 15 | 70 p |
| 2SC1683 | 100p | 2SC2270 | 60 p | 2SC | pp | 2 S |  | 2s |  |  |  |  |  |  | 50p |  |  | 25k320 | 120p |
| $2 \mathrm{SC1684}$ | 30p | 2SC2271 | 25p | 2SC2738 | pp | ${ }^{25 C 3270}$ | ${ }^{50}$ | 2 SC 381 | ${ }^{80 p}$ | 2 SD 31 | ${ }^{25 p}$ | 2 25D8 | 75p | 2SD1 | 70 p | 2 S | 110 p | 2SK323 | 130p |
| $2 \mathrm{SC1685}$ | 30p |  | 15p | 2SC2749 | Op | $2 \mathrm{SC327} 1$ | 5p | $2 \mathrm{SC3831}$ | 250p | $2 \mathrm{SD31}$ | ${ }^{75 p}$ | $2 \mathrm{2SD} 8$ | 35p | 2 2SD3 | 65p | 2SD17 | ${ }^{100 p}$ | 2SK332 | 175p |
| ${ }^{25 C 1729}$ | 900 p | $2 \mathrm{SC22}$ | 50 p | 2 S | 300 p | $2 \mathrm{2SC3}$ | 280 p |  | 135p |  | 30p | ${ }_{2} \mathbf{2 S D 8 9 5}$ | ${ }^{100 p}$ | 2SD1350 | $150 p$ 600 | ${ }^{\text {2SD1776 }}$ | 70p | 25359 |  |
| $2 \mathrm{SC1730}$ | 10 p | 25 C 2278 | 700 | 2 | ${ }^{270 p}$ | $2 \mathrm{SC3279}$ | 30 p | ${ }^{2 S C} 188351$ | 250p 100 p | $\begin{aligned} & \text { 2SD330 } \\ & \text { 2SD348 } \end{aligned}$ | 65 p $\mathbf{3 0 0 p}$ 30 | ${ }_{\text {2SD896 }}^{\text {2SD88 }}$ | 225p | 2SD1378 | 600 | ${ }_{2 S D 1785}$ | 160p | 2SK363 | 50p |
| $2 \mathrm{SC1735}$ |  |  |  |  | $75 p$ $300 p$ | 2SC3280 | 2000 | ${ }^{\text {S }}$ C3852 | 80p | 2SD350 |  | 2SD900 | 400 p | 2SD1379 | 100 p | 2SD178 | Op | 2SK364 | $\mathrm{p}^{\mathrm{p}}$ |
| 2SC1740 | 10p | 25 | 00 p | ${ }^{25 C 2767}$ | op |  | 200p | $2 \mathrm{LC3852}$ |  | ${ }_{25 \mathrm{~S} 357}$ | 320 p |  |  | 2501380 | 100 p |  |  |  |  |
| 2SC174 | 35p | 25 | 40 | 2SC2769 | 400p | $2 \mathrm{SC3284}$ | 600 p | 2SC385 | 220 | 25 | 40 p |  | 450 p |  | $100 p$ |  |  |  | p |
| $2 \mathrm{SC1755}$ |  | 25 |  | 2SC2773 | p | $2 \mathrm{SC3293}$ | ${ }^{85 p}$ | 2SC385 | 220p | 2SD358 | 40 p | 2SC916 | 130p | 2SD1382 | 60p | 2SD1802 | $75 p$ | 2SK369 | 30p |
| 2SC1756 | 35 | $2 \mathrm{SC2307}$ | 300p | 2 Sc 277 |  | $2 \mathrm{CC329}$ |  |  |  |  |  |  |  |  | p |  |  |  | p |
| 2SC1758 | 30 | 25 | 10 p | 2SC278 | ${ }^{40 p}$ | ${ }^{25 C 329}$ | ${ }^{120} \mathrm{p}$ | ${ }^{25 C 385}$ | 550 p | 2 25D36 | 100 p | 2SD921 | 320 | 25D33 | 350p | 2SD1812 | 45p | 2SK | 45p |
| $2 \mathrm{SC1760}$ |  | $2 \mathrm{SC2312}$ |  | $2 \mathrm{SC2786}$ | ${ }^{20 p}$ | 25 | 400p | $2 \mathrm{SC3866}$ | 275p | 250362 | 100 p | ${ }^{25 \mathrm{D} 923}$ | 360 p | ${ }^{25 D 139}$ | 250p | 2SD1815 | 50p | 2SK386 | p |
| $2 \mathrm{SC1775}$ | 10 p | 2SC23 | 70p | 2SC27 |  | 2SC33 |  |  |  |  | 2 |  |  | 2SD |  | 2 S | P | 25K389 | 5p |
| $2 \mathrm{SC1781}$ | 20p | $2 \mathrm{SC2316}$ | 150p | 2SC279 | 500 p | 2 SC 3306 | 130 p | ${ }_{2 \mathrm{c}}^{2 \mathrm{C} 388}$ | 200 p | ${ }_{25 \mathrm{~L}}^{2}$ | 650 p | 2SD9 | 100 | ${ }^{2} 5 \mathrm{D} 13$ | －800 | 2SD1843 | 700 | 25 K 400 | 700p |
|  |  | 2SC232 |  |  |  |  |  | ${ }_{\text {2SC3883 }}$ | $25 p$ | ${ }_{\text {2SD382 }}$ | 75p | ${ }_{2 S 5951}^{251}$ | 200 | 2SD1397 | 100p | 2SD184 |  |  |  |
| $2 \mathrm{SC1809}$ | ${ }^{40}$ | 2SC232 | 120 | 2SC279 |  |  |  |  | 2109 2000 | 2SD386 | \％ | ${ }_{2}$ 25957 | 520 p | 2SD1398 |  | 2SD1847 |  |  |  |
| ${ }^{2 S C 1810}$ | 250p | 2SC2328 | 50 | ${ }^{25 C 28}$ | 40 p | ${ }^{25 C 331}$ | 125p |  | 2009 250 | 2SD3 |  | 2SD95 | Op | 2SD139 | 300p | 2SD184 | 280p | 2SK | 500p |
| ${ }^{2 S C 1815}$ |  | 2SC23 |  |  |  |  |  | 2 SC 3885 A | 290p | 2SD389 | $60 p$ | 2SD965 | 35p | 2SD140 | 280p | 2SD185 | 325p | 2SK423 | 5p |
| ${ }^{2 S C 1819}$ | 70p | 2SC2315 | 175p |  |  |  |  |  | 2750 |  |  | $2 \mathrm{SD970}$ | 50， | 2SD1402 | 120 |  |  |  |  |
| 2SC1826 | 60 | $2 \mathrm{SC2329}$ | 30p | $2 \mathrm{SC28}$ | 40p | 2 C 332 | 50 | $2 \mathrm{2S3}$ | 275p |  | 14 p | 2S897 | \％ | 2SD1 |  |  |  | 2SK427 | \％p |
| $2 \mathrm{SC1827}$ | 60 p | 2SC2230 | 300p | 2SC282 | 75p | 2SC3327 | 60p | 2SC389 | 15 | 2SD40 | 50 | 2SD972 | 40 p | 2 2S1 | 225p | ${ }^{2518556}$ | 40 p | 25K430 | 200p |
| $2 \mathrm{SC182}$ | p | 2SC233 |  |  |  | $25 C 3328$ | 50p | 2 SC | 250p | 2SD | 20p | 2SD973 | ${ }^{60 p}$ | 2SD140 | p | 2SD1857 | $75 p$ | 2SK511 | p |
| ${ }^{2 S C 1833}$ | ${ }^{27 p}$ | ${ }^{25} \mathrm{~S} 23$ | 200 p | $2 \mathrm{SC28}$ | 200 p | 2 S | 250 | 2 S | $225 p$ 3250 | ${ }_{2 S D}^{2 S D}$ | 45p | 2SD97 | 00 | 2SD1 | 60p | 2SD1858 2SD1863 | 45p $\mathbf{3 5 p}$ | 2SK513 | 325p |
|  | 50p 12 p | ${ }_{\text {2SC2335 }}$ | 85p | ${ }_{\text {2SC2832 }}$ | 300p | ${ }_{25 C 3333}$ | 120p | 2Sc389 | 400 p | 2SD424 | 350p | 2SD985 | 120p | 2SD1 | 125p | 2SD186 | 5p | 26 | 160p |
| 2 SC | 50 p | 233 | 25p | $2 \mathrm{SC283}$ |  | 2SC33 | 100p | 2SC389 | 400 | 2SD4 |  | 2SD986 | 120p | 2SD1 | 170p | 2501877 | 175p | 2SK531 | 350p |
| $2 \mathrm{SC1845}$ | 15p | 2 SC 2344 | 150p | 2SC283 | 25 | $2 \mathrm{SC33}$ | 130 | 2 Sc 39 | 250 p | D4 |  | 2SD9 |  |  |  |  |  |  |  |
| 2 SC 184 |  | 2SC2347 | 35p | 2SC283 | 40 p | $2 \mathrm{SC3352}$ | 0p | $2 \mathrm{SC3927}$ | 250 p | 2SD43 | ${ }^{35 p}$ | 2SD10 | 40 p | 2SD | 75p | 25 D | 275p | 2Sk537 | 900 p |
| 184 | 45p | 2SC2353 | 120p | 2SC285 |  | 2 |  | $2 \mathrm{SC39}$ |  |  |  |  |  |  |  |  |  |  |  |
| 2 2C1855 | $85 p$ | 2SC2360 | 20p | $2 \mathrm{SC2873}$ | ${ }^{60 p}$ | 2SC335 |  | 2sc39 |  |  | 15 | 2SD102 |  |  |  | 250188 |  | 2S | 1100p |
| 2 SC 1856 |  | $2 \mathrm{SC2361}$ | 150p | 2 SC 2877 | 120 p | ${ }^{25} 5$ | p | 2 SC 39 | ${ }^{80}$ | 2SD4 | 20 | 2 SD 102 | ${ }^{120}{ }^{20}$ | 2SD1 | 75p | 2SD1 | 300 p | 2SK544 | \％p |
| 2 SC 186 |  | 2 S |  |  | 20p | $2 \mathrm{SC3} 3$ |  |  | 1200 |  | 50p | ${ }_{\text {2SD } 102}$ | ${ }_{\text {250p }}$ | 2SD1425 |  | 2SD1887 | 5p | 2SK552 | \％ |
| $25 C 1870$ | 700 p | $2 \mathrm{SC2365}$ | 280 | $2 \mathrm{SC28}$ | ${ }^{3200 p}$ | 2SC33 | 300p | $25 C 39$ | 50 p 600 | 2SD5 | 70p | 2SD1027 | 850p | 2SD142 | 165p | 2SD18 | 300p | 2SK553 | 225p |
| ${ }_{2}^{25 C 18}$ |  | 2SC2369 | 25p | － $\begin{aligned} & \text { 2SC2882 } \\ & \text { 2SC283 }\end{aligned}$ | 60 p | 2Sc3378 | 120p | 2 C 3964 | 100p | 2SD5 | 18p | 2SD1030 | 75p | 2SD1428 | 180p | 2SD1 |  | 2S |  |
| 2 SCl 8 |  | $2 \mathrm{SC237}$ |  | 2SC28 |  | 2SC33 | 1200p | 2 SC | 25 | SD5 |  | 2SD 1031 | 70p | 2SD1430 | 28 | 2SD1910 | 175p | 2SK566 | 500p |
| 2 SC 1890 | 15 p | 2 Sc 238 | 50p | 2 SC 289 | 50p | 2SC33 | 130p | $2 \mathrm{SC3}$ | 210p | 2SD5 |  | 2SD103 | 60 | 2SD |  | 2SD1 |  | 2SK557 |  |
| 2 SC 18 |  | （23 |  | C290 | 609 | 2SC33 | 80p | 2SC39 | 210p | 25 | 225p | 2SD104 | 200p | 2SD143 | 40 | ${ }^{251913}$ | 50 p | $2 \mathrm{~K} \times 59$ | p |
| 2 SC 190 | 125 | $2 \mathrm{SC24}$ | 110p | 2SC29 | 25p | 2S |  | $25 \mathrm{C3} 3$ |  |  |  | 2 2SD 104 |  |  |  |  | 50 p | 2SK560 | 580p |
| SC1906 | 15p | 2SC2408 | 120 p | $2 \mathrm{SC29}$ | ${ }^{80}{ }^{\text {p }}$ | 2sc33 | 20 p | 2SC39 | S00 |  |  | 25 D 1 | 130 |  |  | 2501930 | 50 p | 2SK566 | 5p |
| $2 \mathrm{SC190}$ |  | C2412 |  | $2 \mathrm{SC2912}$ |  |  |  |  | 1250p |  |  |  |  |  |  |  | 65 p | K606 | p |
| SC19 |  | 2SC24 |  |  |  | $2 \mathrm{SC34}$ | $35 p$ | 25 C 39 | 800 p | 2 L | 50p | ${ }^{\text {2SD1060 }}$ | 130 p 150 p | 2SD144 | 220p | 2SD1941 |  | K612 | p |
| $\begin{aligned} & \text { 2SC1913 } \\ & \text { 2SC1914 } \end{aligned}$ | $90 p$ $30 p$ | ${ }_{2 S C 245}^{2 S}$ | 10p | ${ }_{2 S C}^{2 S C}$ | $480 p$ $75 p$ | ${ }^{2 \mathrm{SC}}$ | 50p | ${ }_{2 S C 4}^{25 C 4}$ | $100 p$ 150 | 2 S | 530p | 2 SD | 20 | 2SD | 200 p | 2SD1944 | 50 p | ${ }^{25 \times 684}$ | p |
| $2 \mathrm{SC1921}$ | 15p | 2SC2 | 55p | 2SC29 | 50p | $2 \mathrm{SC34}$ | 130p | $2 \mathrm{SC4023}$ | 325p | 2SD592 | 25p | 2SD1064 | 250p | 2SD144 | \％ | 2SD19 | ${ }^{80 p}$ | 2SK685 | 1150p |
| 2SC 1922 | 175p | 2SC2486 | 275 | 2SC29 |  | $2 \mathrm{SC3409}$ |  | S | 350 p | 5996 | 25p | 2SD1065 | 180p | 2SD145 | \％ | 2SD1959 | 20p | 2SK699 | 100p |
| 2 SC 1923 | 10p | 2SC2492 | 50p | 2SC2934 | 75p | $2 \mathrm{SC3416}$ | 30p | 2SC40 | $45 p$ | 2SD | 30p | 2SD1069 | 15 | 2SD1 | 200p | 2SD1 | 50 p | 2SK | 300p |
| 2 SC 1929 |  | 2SC24 |  | 2SC2937 | 50p | $2 \mathrm{SC3417}$ | p | 2SC40 | p | 2 SD | 40p | 2SD107 | 35 | 2 SD 1 | 27 | 2SD19 | 60 p | 2S | 500p |
| 2SC1940 | 110 p | 2SC24 | 120 | 2SC2939 |  | C34 |  | $2 \mathrm{SC4}$ |  |  |  | 2SD | 150 p | 2SD | pp | 2 SD 1 | 50 p | 2 Sk | 55 |
| 2SC 1941 | 27p | 2SC248 | 20 p | 2 SC 29 | 30 | 2 S |  | 2SC40 | 40 | 2 LD |  | 2SD1 |  | ${ }_{2 S D}^{2 S D}$ | 250p | 2SD1996 |  | 2SK726 | 425p |
| $2 \mathrm{SC1942}$ | 350p | 24 | 200 | 2SC29 |  | 2 | 45 p | 25 |  |  | 300p | 2SD1 | 20 p | 2SD14 | 50p |  | $75 p$ | 2SK | 475p |
| $2 \mathrm{SC19}$ | 350 | $2 \mathrm{SC24}$ | 185 | C29 | 800 | 2Sc34 |  | ${ }_{\text {2SC4107 }}^{2 S 4106}$ | 175p | ${ }^{2 S 5613}$ | 70 p | 2SD1113 | 225p | 2SD1459 | 60p | 2SD2010 |  |  |  |
| 2SC1945 | 350p | 2SC2485 | 400 | 2SC297 | 160p | $2 \mathrm{SC34}$ | $65 p$ |  | 175p |  | ${ }_{10 \mathrm{p}}$ | 2SD1128 | 200p | ${ }_{2 S D 1468}$ | 40 p | 2SD2011 |  | Sk |  |
| 2SC1946 | 1500p | 2SC249 | 200 | 2sc298 | 250 | 2 SC 34 | 65p 50p | ${ }_{2}$ | 230p |  | ${ }^{15 p}$ | 2 LD |  | 2s | 225 p | 2SD2012 | 50 p | Sk | Op |
| ${ }^{2 S C 1953}$ | 45p | C250 |  |  |  | 25 |  | ${ }_{\text {2SC4137 }}$ | 275p | 2SD639 | p | 2SD1138 | 40 p | 2SD149 | 300 p | 2SD2033 | p | 2SK |  |
| 2 SC 1957 | 70 p | 2SC250 | 140p | ${ }_{2 S C}^{2 S C} 29$ | ${ }_{\text {1400p }}$ |  | 200p |  | 200 | 2 S | 350p |  | p | 2SD149 | 230 p | 2SD2063 |  |  |  |
| 195 |  | ${ }_{\text {2SC2503 }}$ |  | ${ }^{\text {2SCC3001 }}$ | ${ }^{320 p}$ | ${ }_{2 S C 3459}$ | 180 | $2 \mathrm{SC4157}$ | 400 p | 2SD655 | 18p | 2SD1142 | 350p | 2SD1497 | 350p |  | 50p |  |  |
| $2 \mathrm{SC19}$ | 1300p | $2 \mathrm{SC2517}$ | 120 |  |  | 2SC34 |  | $2 \mathrm{SC4159}$ | 100 | 2SD66 | 60 p | 2SD1145 | 25p | 2SD1505 | 90p | 2SD21 | 180p | ${ }_{2 S k} \mathbf{2} 973$ |  |
| $2 \mathrm{SC196}$ | 160p | 2 SC 2519 |  | 2SC3022 | 1850p | $2 \mathrm{SC34}$ | 275p | 2SC416 | 125p | 2SD | 25p | 2SD1 | 5p | 2 2S1 | 50 p | ${ }^{\text {2SD2 }}$ | 85p |  | 315p |
| 2SC1970 | 100p | $2 \mathrm{SC2527}$ | 300p | 2SC3025 | 500p | 2SC34 | 225p | 2SC416 | ${ }^{60}$ | 2SD | 20 p | 2sD1 | 30p | 25 D 1 | 60 p |  | 35p | 96 |  |
|  | 400 | 2SC25 | 15 | C302 | 450 | 硡 | 70 p | ${ }^{25 C 419}$ |  | 研 | 5p | $2 \mathrm{SD11}$ | 65p | 25 D 15 | 100 p | 2 2SD2 | 175 |  | 850 p |
| 2SC1972 | 600 p | 2SC2535 | 300p | 2 SC 30 | $300 p$ | cas | ${ }^{300}{ }^{\text {p }}$ | 2 SC 4 |  | ${ }^{2 S 0}$ |  | 2SD11 | 150 | 2SD | 75p | ${ }^{2 S D 2255}$ | 175p $250 p$ |  |  |
| 2SC1973 | 150 | ${ }^{2 S C 2538}$ | 100p | ${ }^{2 S C 30}$ | 125 | 2 SC 34 | $275 p$ 2750 | $2 \mathrm{2S}$ | 250p | 2S | ${ }_{180 p}^{250 p}$ |  | 220p | 2SD1 | p | 2SD233 | 250p | ${ }^{25 K}$ | 325p |
| ${ }_{2}^{2 S C 19}$ | $120 p$ $30 p$ | 2SC2540 | ${ }_{3} 19$ | ${ }_{2 S C 30}^{2 S C 303}$ | 125p | ${ }_{2}{ }^{\text {SC3535}}$ | 50p | ${ }_{2 S C 4235}$ | 45 | ${ }_{2 S D 718}^{2 S}$ | 85 p | 2SD1168 | 270p | 2SD1525 | 450p | $2 \mathrm{SD23}$ | 225p | ${ }_{2} \mathrm{Sk} 8$ | 550 p |
| 2 SC 1983 | 75p | 2 SC 2545 | 55p | 2SC3040 | 280 | $2 \mathrm{SC3503}$ | P | 2SC423 |  | 2SD7 | 24 | 2SD1169 |  | 2SD15 | p | ${ }^{25} 548$ | ${ }_{7} \mathbf{4 2 5 p}$ | 2SK872 | 650 p |
| 2SC1984 | 150p | 2SC2546 | 25p | 2SC3042 | 300p | 2SC350 | 120p | 2SC4242 | 120 p | 2 SD 27 | 2000 | 2SD11 | 3509 | 2SD15 |  | ${ }^{25156}$ | 00p | 25K875 | 475p |
| 2 SC 19 | 100 | 2SC25 | 65 | 25 C 30 | 30 p | ${ }^{2} \mathrm{SC} 3505$ | 240p | ${ }^{25 C 4278}$ | 1750 | ${ }^{25 D 726}$ | 275 | 2SD11 | ${ }_{400 p}^{280 p}$ | 2 2SD1 | 275p |  | ${ }^{80 \mathrm{p}}$ | 2SK903 | 500p |
| $2 \mathrm{SC1986}$ | $100 p$ | 2SC2550 | 50 p | 2SC305 | 150p | $2 \mathrm{SC35}$ | 250p | $2 \mathrm{SC4}$ | 650 p | 25 | 250p | 2SD1 |  |  |  |  | 320p | 25K | 00p |
| $2 \mathrm{SC2001}$ | 15p | 2SC2551 | 70 p | ${ }^{25 C 30}$ | ${ }^{60 p}$ | ${ }^{25 C 350}$ | ${ }^{650 p}$ |  |  | 2 2SD | 250p | 2SD1 | 120p | 2SD1 | 170p | ${ }_{2 S}$ S779 | 225p | 2SK951 | 275p |
| 2 SC | 15 | 2SC255 | 30p | Sc30 | 5p | ${ }_{2 S C 35}^{2 S C 35}$ |  |  | 225 p | 2SD74 | 120 p | 2SD1192 | 90 p | 2SD155 | 150p | 2SJ103 | 75p | 2SK9 | 7p |
| ${ }_{2} \mathrm{SC2003}$ | ${ }_{20 p}^{20 p}$ | ${ }^{2 S} 25$ | 20p | ${ }^{2 \mathrm{LSC3}} \mathbf{2}$ | 25p | 2 SC 35 | 120p | ${ }_{2 S C 431}$ | 6000 | 2SD74 | 130 p | ${ }^{\text {SSD1196 }}$ | 150p | 2SD155 | 225p | 2SJ109 | 200p | 2SK955 | 450p |
| ${ }_{2 S C 202}^{25}$ | 110 p | ${ }_{2 S}{ }^{\text {SC2562 }}$ | 90p | 2 SC 3074 |  | 2SC3519 |  | 25C438 | 150p | 2SD75 | 120p | 2SD119 | 150p | 2SD15 | 75 | 2 S | 1050p | 2SK | 400p |
| $2 \mathrm{SC202}$ | $180 p$ |  | 200p | $2 \mathrm{SC30}$ |  | 2 C 3526 | 45p | $2 \mathrm{CC4382}$ | 200p | 2SD760 | 70 p | 2SD1198 | 60 p | 2SD15 | 170 p | 2 SJ 114 | 1150 p | 2SK96 | 700p |
| $2 \mathrm{SC202}$ | 30p | 2SC2568 | 120p | ${ }^{2 S C 30}$ | ${ }^{120} \mathrm{p}$ | 2 SC 35 | 750 | 2SC | 2755 | 2 S | 100 | $2 \mathrm{SD120}$ | ${ }_{280 \mathrm{p}}^{480}$ | 2 SD | ${ }_{200}^{1000}$ | ${ }^{2 \mathrm{SJJ116}}$ |  | 2SK1 | p |
| $2 \mathrm{SC2027}$ | p | ${ }^{2 S C 2570}$ | 30 p | $25 C 3086$ | 150p | ${ }^{25 C 3531}$ | 225 | 2 SC | 4250 50 50 | ${ }_{2 S}$ | 140p 180 p | 2SD1 | $280 p$ 1200 | 2SD | 150p | ${ }_{2 S J 1}^{2 S J 1}$ |  | 2SK1036 | 450p |
| ${ }_{2}^{2 S}$ | 50 p 500 | ${ }^{2 S C 257}$ | 350p | ${ }_{2 \mathrm{LSC3}}^{2 \mathrm{SC3}}$ | \％ | 2SC3549 | $200 p$ $270 p$ | ${ }_{\text {2SC4403 }}$ | 509 2750 | ${ }_{\text {2SD772 }}$ | 200p | ${ }_{2 S D 1213}$ | 2200 | ${ }_{2}$ 2SD157 | 250p | ${ }_{\text {2SJ }} 162$ | 680p | 2 SK 1057 | p |
| $2 \mathrm{SC2053}$ | p | 2sc2578 | 170p | $2 \mathrm{SC3112}$ | 35p | 2SC3568 | 200 | ${ }^{2 S C 443}$ | \％ | 2SD | \％ | 2SD12 | 75 p | ${ }^{2 S D 15}$ | p | 2 S | ${ }^{200 p}$ | 2SK105 | p |
| 2SC2055 | 150p | 2SC2579 | $110 p$ |  | 40 p | ${ }^{25} 53577$ | 2750 | ${ }^{2 \mathrm{SC} 4466}$ | 325 p | ${ }_{2}^{25 D 77}$ | 30p | ${ }^{25 \mathrm{~S} 122}$ | 75p | 2 SD | 100 p | ${ }_{2 S}^{2 S}$ | 1509 6250 |  | 450p |
| $2 \mathrm{SC205}$ | 20p | 2SC2580 | 175p | $2 \mathrm{SC3116}$ | 75 | 2 SC | 200 p | ${ }_{2 S}^{2 S}$ | $175 p$ $250 p$ | ${ }_{\text {2SD784 }}^{2 S D 77}$ | 600p | ${ }_{2 S D} 1227$ | 40p | 2SD159 | 310 p | 2SJ307 | 175p |  |  |
| 2SC2060 2SC2061 | 40p | ${ }_{2}$ 2SC2 | 225p | 2 C | 120p | ${ }_{2 S}$ | 220p | ${ }_{2 S C 4517}^{2 S 448}$ | 200p | ${ }^{2 S D 786}$ | ${ }^{100 p}$ | 2SD 122 | $250{ }^{\text {2 }}$ | 2SD1593 | $125 p$ | 2SK19 | $45 p$ | 2Sk | 250p |
| 2 SC 2068 | 60p | 2 2SC2590 | 40 p | $2 \mathrm{SC3148}$ | ${ }^{145 p}$ | 2 SC 3597 | 75p | ${ }^{2 S C 4517 A}$ | 225p | ${ }^{2515787}$ | ${ }^{20 p}$ | ${ }^{25 D 1237}$ | 300p | $2 \mathrm{2SD15}$ | 70 p | 2SK33 | 40 p | 2 Kk | 225p |
| 2 SC 2071 | 140p | 2SC2591 | 50p | $2 \mathrm{SC3149}$ | $180 p$ | $2 \mathrm{SC3}$ | 140p | ${ }^{2 S C 4531}$ | 450p | 2SD788 | 30p | 2SD 1238 <br> 2 SD 1244 <br> 1 | $300 p$ 250 | ${ }^{2 S D 16}$ | ${ }^{210 p}$ | 2SK | 50p 1000 | 2SK1120 | $550 p$ |
| C 2073 | 40 p | ${ }^{25 C 2592}$ | 200 | $2 \mathrm{SC3150}$ | 100 p 1750 | ${ }_{2 S}^{2 S}$ | $175 p$ 1000 | ${ }_{2}^{2 S C 454}$ | 10009 400 p | ${ }^{\text {2SD78 }}$ | 200p | 2SD12 | 25p | ${ }^{2 S D 16}$ | 320p |  | 100 p | 2Sk1190 | 350p |
| SC2075 | ${ }_{95 p}^{60 p}$ | le $\begin{aligned} & \text { 2SC2603 } \\ & \text { 2S2610 }\end{aligned}$ | 109 $60 p$ | ${ }_{\text {2SC3151 }}$ | $175 p$ $130 p$ | ${ }^{\text {2SC3606 }}$ | 10 | 2SC4742 | 400p | ${ }_{\text {2SD794 }}$ | 33p | ${ }^{2 S D 1247}$ | 40 p | 2SD163 | 50p | 2Sk73 | 75p | 2SK119 | $800 p$ |
| C2085 | $100 p$ | $2 \mathrm{SC2611}$ | 30p | $2 \mathrm{SC3153}$ | $175 p$ | 2SC3608 | $65 p$ | 2SC474 | 350p | 2SD795 | $140 p$ | ${ }^{25 D 1251}$ | ${ }^{1800}$ | 2SD1647 | 40 p | 2S5 | 200 p | 2SK121 | 7009 |
| 2SC2086 | p | $2 \mathrm{SC2621}$ | p | $2 \mathrm{SC3156}$ | 350p | ${ }^{25 C 3616}$ | 45p | $2 \mathrm{SC4745}$ | 550 5 | ${ }^{2515798}$ | 175p | 2 2D1254 | 55 p | 2SD16 | 260 | 2 SK | 40 p | 2Sk | 200p |
| 2SC2092 | 100p | 2SC2625 | 190p | $2 \mathrm{SC3157}$ | 2009 | ${ }^{2 S C 3636}$ | ${ }^{280 p}$ | $25 C 4747$ | $375 p$ | 2SD799 | 150p | 2 25D1263 | 95 | 2SD165 | ${ }^{150 p}$ | 2Sk10 | 40p | SK127 | 275p |
| $2 \mathrm{SC2094}$ | 1200p | 2SC2626 | s00p | $2 \mathrm{SC3158}$ | 260p | $2 \mathrm{SC3642}$ | 225p | $25 C 4757$ | 200p | ${ }^{25 D 809}$ | $45 p$ | ${ }^{25 D 1264}$ | 55p | 2SD16 | ${ }^{150 p}$ | $2 \mathrm{2S}$ | ${ }^{150 p}$ | 2Sk129 | Op |
| 2SC2097 | 2300p | $2 \mathrm{SC2630}$ | 1800p | $2 \mathrm{SC3159}$ | 200p | ${ }^{2 \mathrm{SC} 3655}$ | 400p | $2 \mathrm{SC4762}$ | 300p | ${ }^{2 \mathrm{LSD81}}$ | 450 p 300 p | ${ }^{2 S D 1265}$ | 759 1800 | ${ }^{\text {2SDD }}$ 2S 16 | 250p 350 p | ${ }_{2 \mathrm{l}}^{2 \mathrm{SK}}$ | ${ }_{50}^{50 p}$ | 2SK1299 | 50p |
| 2SC2099 | 2500p | 2SC2639 | 20 p | 25 C3164 | ${ }^{270} \mathrm{p}$ | ${ }^{25} \mathbf{5} 3659$ | 600 p | ${ }^{25 C 4769}$ | 220p | 2SD819 2SD820 | 300 p 250 p | 2SD126 2SD 126 | $180 p$ 550 | $2 \mathrm{2S}$ | 350 $50 p$ | 2SK | 50p 1000 | 2Sk1 | 900p |
| 2SC2118 | 1100p | 2 2S2632 | $35 p$ | ${ }^{25 C 3169}$ | 150 p | ${ }^{25 C 3668}$ | ${ }_{\text {100 }} 120 \mathrm{p}$ | ${ }^{\text {2SC4770 }}$ |  | 2SD820 | $250 p$ $550 p$ | ${ }^{\text {2SD } 1267}$ | 55p | 2SD1667 | 50p | 2SK125 2SK 133 | ${ }_{650}$ | 2SK133 | 50p |
| ${ }_{\text {2SC2 }}{ }_{\text {2SC2122 }}$ | 10 p 300 p | ${ }^{25} 2{ }^{2 S C 2634}$ | 10p | 2SC3170 2Sc3173 | 300 p 180 p | 2SC3675 2Sc3678 | 100 p $\mathbf{2 8 0}$ | 2SC4882 | $225 p$ 700 | ${ }_{2 S 8822}^{2 S 827}$ | 290p | ${ }^{2 S D 1271}$ | 225p | ${ }^{2 S D 1668}$ | 90p | ${ }^{25 K 147}$ | 160 p | 2SK134 | 500p |
| 2SC2131 | 550p | 2SC2637 | 120 p | 2SC3175 | 150p | 2SC3679 | 140p | 2SC4891 | воор | 2SD826 | 30 p | 2SD1272 | 200p | 2SD166 | 85p | 2SK152 | 40p | 2SK1342 | 500 p |
| $2 \mathrm{SC2} 14$ | \％ | 2 SC 2640 | 1800p | $2 \mathrm{SC3178}$ | 125p | $2 \mathrm{SC3680}$ | 3800 | 2 SC 4923 | ${ }^{400}$ | ${ }^{250829}$ | 375 | ${ }^{25 D 1273}$ | 50 p | ${ }^{2515167}$ | \％p | 25 K | 30 p | 2SK1350 | 200p |
| $2 \mathrm{SC2153}$ | 40 p | 2SC2653 | $100 p$ | ${ }_{2 S C 3179}$ | 700 | ${ }^{25 C 3685}$ | 450 p | ${ }^{25 C 4924}$ | 250 p | 2SD836 | 50 p | 2SD1274 | ${ }_{50}^{80 p}$ | 2SD16 | 225p | 2SK | 40 p | 2SK1356 | 225p |
| $2 \mathrm{SC2166}$ | 80p | 2SC2654 | 180 p | $2 \mathrm{SC3180}$ | $175 p$ | ${ }^{25 C 3687}$ | ${ }^{300 p}$ | 2SC4927 | 500p 300 p | ${ }^{2508364}$ | 50p 550 |  |  |  |  |  |  | 2SK135 | 350p |
| 2SC2168 | 120p | $2 \mathrm{SC2655}$ | 50p | 2SC3181 | 200p | 2SC3688 | 550 p | 2SC5002 | 300p | ${ }^{250837}$ | 55p | ${ }_{2 S D 1276}^{25072}$ | 60p | $2 \mathrm{2SD16}$ | 70p 3250 | 2SK | p | 2SK135 | 400p |
| $2 \mathrm{SC2188}$ | 70p | 2SC2656 | $550 p$ | $2 \mathrm{SC3182}$ | ${ }^{120}$ | ${ }^{25 C 3692}$ | 150 p | 2SC5003 2SC5027 | 350 p 100 p | ${ }^{2515838}$ | 500p 110 p |  | 1909 $600 p$ | ${ }^{\text {2SD170 }}$ | 43009 | ${ }_{2} \mathbf{2 S K 1 9 2}$ | $35 p$ $45 p$ | 2SK137 | 50p |
| 2SC2200 2Sc2209 | $250 p$ $50 p$ | ${ }_{\text {2SC2660 }}$ | 100p | 2SC3198 | $30 p$ $40 p$ | ${ }^{2 S} \mathbf{2 S C 3 7 1 5}$ | 480 p 120 p | ${ }_{\text {2SC5048 }}$ | $100 p$ $300 p$ | ${ }_{\text {2SD8844 }}$ | 200p | ${ }_{2 S D 1288}^{2501279}$ | ${ }^{\text {175p }}$ | 2SD170 | 375p | 2SK193 | 40 p | 2SK1400 | 50p |
| C2216 | 50p | ${ }_{\text {2SC2668 }}$ | 10 p | ${ }_{2 S C 3202}$ | $25 p$ | 2SC3729 | 450 p | 2 SC 5044 | 250p | 2SD850 | 170p | 2SD1289 | 250p | 2SD1710 | 2009 | 25K195 | 150p | 2SK1404 | 290p |
| 2SC2221 | 6509 | ${ }_{2 S C 2671}$ | 00p | 2SC3209 | 1200 | 2SC3746 | 100p | 2SC508 | 250p | 2 25856 | 48p | 2SD1291 | 280 | ${ }^{2 S D 1718}$ | 275 | ${ }_{\text {2SK197 }}$ | 1400 | 2SK1461 | 220p |
| 2 SC2228A | 60p | 2 SC 2681 | 170p | 2SC3210 | 550p | $2 \mathrm{SC3747}$ | 120p | 2SC5129 | 300p | ${ }^{2518558}$ | ${ }^{250 p}$ | $2 \mathrm{SD1292}$ | ${ }_{70} 6$ |  |  |  |  |  |  |
| $2 \mathrm{SC2229}$ | 15p | 2SC26 | 70p | 2SC321 | 220p | 2SC3748 | 100p | 2SC5148 | 300p | ${ }^{25 D 863}$ | 230 | 2SD1293 2SD1297 | $70 p$ 3000 | ${ }_{\text {2SD }}^{2 \text { 2S } 1730}$ | $275 p$ 250 | 2SK214 2SK216 | $170 p$ $200 p$ | 2SK1487 2Sk1507 | 3009 |
| ${ }_{2 S}^{2 S C 2230}$ | 80p 1000 | ${ }_{\text {2SC2688 }}$ | ${ }_{\text {cop }} \mathbf{2 7}$ | ${ }_{\text {2SC3212 }}$ | 260 p 50 p | ${ }_{2 \mathrm{LC} 37}^{2 \mathrm{SC3}}$ | 250p | 2SC5149 2SC5250 | 300 p 300 p | ${ }_{2 S D 86}^{25086}$ | 200p | ${ }_{2 S D 1302}$ | 30pp | ${ }_{2 S D 173}$ | 1880 | 25k223 | 50p | 2SK1529 | 300p $700 p$ |
| 2235 | 60p | 2SC2694 | 3500 p | 2SC3242 | 30p | $2 \mathrm{SC3782}$ | $75 p$ | 2SD188 | $350 p$ | 2 25886 | 140p | 2SD1306 | 45p | ${ }^{2 S D 174}$ | 125 | 2 Sk 2 | 40 p | 2SK15 | 400 p |
| 2SC2236 | 20p | 2SC2705 | ${ }^{0}$ | 2SC3244 | 45p | 2SC3783 | 300p | 2SD198 | 140p | 2 20867 | 350 | 2SD1308 | $80 p$ | ${ }^{2 S D 174}$ | ${ }^{909}$ | 2Sk24 | 30p | 2SK154 | Op |
| ${ }^{25 C 2237}$ | 540 p | ${ }^{25 C 2706}$ | 250p | ${ }^{2 S C 3246}$ | 500 | ${ }^{25 C 3787}$ | 100p | 2SD199 | 195p |  | $260 p$ 150 | 2SD1309 |  | ${ }^{2 S 5175}$ |  | 2SK2 |  | 2SK17 | 275p |
| ${ }_{2} 2 \mathrm{SC2238}$ | 5 p |  |  | 2SC3259 $2 \mathrm{SC3260}$ | $350 p$ 2200 | 2SC3788 2Sc3789 | 609 $75 p$ | 2SD200 | 180 p 260 | 2SD869 | $150 p$ $140 p$ | 2SD1310 | 140p | 2SD1758 2SD1760 | $80 p$ | 2SK301 | 25p | 2SK2038 | 295p |
| $2 \mathrm{SC2240}$ | 15p | 2 SC 2 | 20 p | ${ }_{2} 25$ | $220 p$ | ${ }^{25 C 3790}$ | 120 p | ${ }^{2 S D 213}$ | 250p | $2 \mathrm{LS871}$ | 280p | 2SD1313 | 1000p | 2SD1761 | 60 p | 2SK303 | 40p | 2Sk2039 | 750p |
| C2259 |  | 25C2714 |  | ${ }_{2 S C 3262}$ | 2800 | ${ }_{2 S C 3795}$ | 140 p | 2SD234 | 硡 | 析 |  | D1 | 20 | 2SD1762 | 50 | 2SK304 | 25p | 2SK2134 | 225p |

REPLACEMENT VIDEO HEADS

| Pdel Price | Model Price | odel | Model Price | ode |
| :---: | :---: | :---: | :---: | :---: |
|  | VHSAN3 ${ }^{\text {a }}$ | HRD750, HRD830, HRD860 1900p |  |  |
| VS:05, 112, 115, 116, 120, 125, 126, 201 <br> 202, 205, 220, 240, 244, 245, 247, 248 |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | VHSEY1. VHSEY2 | HRDP910, FV14T, FV57HGRC1, GRC2, VV41BR9060, HRD $330,337,440,441,637,641$, |  |  |
|  |  |  | N911A, 914C, 915A, 916A, 917, 9110,9120 | 7810,8000 SP, 8801 SP, VHRD 4400,4410, 4500,4600, |
|  | 130 |  |  | 200 |
|  | נ3. |  |  | R53 |
| $765,766,767,768,865,867$, |  |  |  | VHR16, 235, 335E, $4150,4160,4350$,  <br> $7250,7260,8250$ $1950 p$ <br> VTC 3000 1400 p <br> SHAP  |
|  |  |  |  |  |
|  | VHS |  |  |  |
|  | DIG |  |  | SHA |
|  | VS410, 415, 435, 450, 456, 460, 500, 505, |  |  | VC390, VC393, VC496VC488 |
| 2, 1 | Sel |  | N9052, N9530, DX |  |
|  |  |  | PVC2300, 2400, 740, 744, 760 |  |
|  | SE5100, 6100, 6110, 9100 <br> TVR 4500, 4510, 5510, VS $400,440,4$ |  |  | VC200, 220, 300, 381, 383, 384, 385, 386, |
|  | VS5180, VS6 190 , 700, 900, 901, 902 |  |  |  |
|  |  |  | VH3, VH555, VH600, VH700, VH844, |  |
|  |  |  |  | ${ }^{\text {VC }} 108.08 .208,382,402,405,408,500,550 \mathrm{p}$ |
|  |  |  |  | 571, 573, 581, 582, 583, VC5W20E, 600, |
|  | MVS550, 620, VS550, 620, 630, 640, |  |  |  |
|  |  |  |  | 700, 772, 7810, 782, 7822, VC783, 8481, 8581, VCA 10, 100, 102, 103, 1031, 103, 104, 105, 106. |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  | 211, 234, 244, 254, 255, 30, 35, VCA40. VCB311N, 320, VCD801, 802, VCM73, VCT212,310, 410, VCT510, 72, VCT1314. |
|  | 6690 |  |  |  |
|  | MVS710, 720, 910, SE7120, 9120, VS710, <br> 716, 720, 800, 810, 910, 920, <br> VS922, 9291,GV210, 211, 220, 2292, <br> MV2 105, 2115, SE2120 1700p |  |  |  |
|  |  |  | VR6760 VR6761, VR6762, VR63SE7 |  |
| 100EDG H00EM. 110, VSX400 12 |  |  |  |  |
|  |  | MITSUBISHI |  |  |
|  | HINARI |  |  |  |
| 3450 |  |  | 20DV1, 20DV2, 20RW7, 21DV1, 21DV2, 21DV3, 2SB01, 02, 11, 12, 30DV2, 31DVI, |  |
|  |  | HS307 $\mathbf{1 9 0 0 p}$ <br> HS319 $\mathbf{1 9 0 0}$ <br> HS330 $\mathbf{1 9 0 0}$ <br> $H S 300$ $\mathbf{2 0 0 0}$ |  |  |
|  |  |  |  | VFH815 ${ }^{\text {2800p }}$ |
| VSG20, 204, 204, 205, 206, 20, 21, 21 |  |  |  | VCH82, VCH81, VFH815 ${ }_{\text {VCHO }}$ |
|  | HITACHI <br> VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, | , |  | VCA33, VCA36, VCA43, VCA44, VCA46. |
|  |  |  |  |  |
| SG415. VSG415EA, VSG425 2 |  |  | 3219, 322, 3229, 323, 501, 6180, 6182, $6185,6290,6291$, VR6293, 6362,6367, | VCA550 |
|  |  | HSE10, HSE 11, HSE20, HSE21, HSE41, HSB 10 HSB20 |  | SONYDSR-19R FOR SL-T $9 M E$ DSR-21 R FOR SLC 8-C9 $3100 p$$2600 p$ SLF1E2 PIN, SLC24PS, 33E, 34, 44PS |
|  |  |  |  |  |
| $\begin{aligned} & \text { LBA } \\ & \hline \text { R3 } \end{aligned}$ | $125,128,220,225,400,405$. <br> VT $410,413,414,415,416,418,510,515$ $517518,520,525,526$ | HS300, HS3801, HS 302, HS310, 1500p | VR601 1800p <br> 49S86,  <br> VR66548, VR6648, 2750p |  |
|  |  |  |  |  |
| TV10 <br> CR7000, $7800,8000,8800$ | VTM625, 626, 725, 210, 211, 275, 726, <br> 727, 728, 820, 821, 825, 920, |  |  | SLF11, 30PF, 35, 60PS, SLK85, |
|  |  |  | SAISHO <br> VR100, 605, 705, 805, 905, 1000,1100 , <br> 1200,1600 VR3650X 1200 <br> VR3300X, VR3600X VR3650X VR3800 | DSR-43R FOR SLC7 RANGE, SL5000, <br> SL5100 SL3000 1 PIN SLC6E SL36ES |
|  | VT 4000 , VT 4200, VT 5000 , VT $55000,{ }^{\text {V }}$ |  |  |  |
| TVR1 |  | HS811, HSB2) ${ }^{16}$ |  |  |
|  | $V 777,680,6500,6700,6800,7000,8000$, 8030, 8040, 8100, 8300, 8500 | HSB52, HSE50, 52G, HSM $36,50,54$, |  | SL3000, SL8000, SL8080, SLC5E, SLT7ME |
|  |  |  | VR2000, VR3300, VR3600 1400p <br> VR2500  <br> VRS5000 2650p <br> VR 6000 A  |  |
|  |  |  |  | SLV201, SLV202 $\mathbf{1 5 0 0 p}$ <br> SLK95, SLT50ME $\mathbf{2 9 0 0}$ |
|  | VT8,9, 56, 57, 570, 575, 576, 580, 585, |  |  |  |
|  |  |  | Salora |  |
|  |  |  |  |  |
| 4. VCR8704, VCR8 |  | HSM 40HSM59, HSM68E | SV7300, SVB200, SV8300, 1500, |  |
|  |  |  |  |  |
|  | VT438, 535, 536, VTL30, 301, VTM 630, | 2010, 3000, 7000, 7200.7500, NV7800, | SV7400, SV8400 $\begin{array}{l}\text { 1800p } \\ \text { SV8100 }\end{array}$ <br> 12000  | SLV353UB ${ }^{\text {CCOF340 }}$ CCDF500E, CCDVGOE ${ }^{21000}$ |
|  | VT52, VT60, VT61E, VT62E, VT63, VT64. VT640 850p |  | SV900, SV9900 3450p <br> SV601, SV611, SV69 SV <br> SV80, SV810 1500 p <br> SV6700, SV8710, SV8750 $\mathbf{2 8 0 0 p}$ <br> SV00p  |  |
|  |  |  |  |  |
|  |  | NATIONAL PANASONIC |  |  |
|  |  |  |  | ${ }^{\text {SLVV335 }}$ SLV210, SLV212, SLV270, SLV273, ${ }^{1}$ |
|  | 20, 622, 720, 722, ${ }_{13}$ |  |  |  |
| FVHP7 $21,722,730,830,905,906,907$ |  |  |  | SLV285, ${ }^{\text {SLVV300 }}$ (125, 213, 225, 252, 255, 262, 280 ${ }^{\text {950p }}$ |
|  |  | ${ }_{\text {AG6840 }}^{\text {NV100, }} \mathrm{NV} 200 . \mathrm{NV} 370, \mathrm{NV} 380 . \quad \mathbf{2 0 0 0}$ |  |  |
|  | VTT570, VT575, VT580, VT585, VT588 |  | $\begin{array}{ll}\text { S23N } \\ \text { SV8600, } \\ \text { SV8700 } & \\ \text { SV8420 }\end{array}$ | SLV363, SL̇V416, SLVX50, |
|  | VT540, 545, 546, 548, VTD660, 665, VTM, 545, 546, 548, | NV630NVD80,NVH65$\mathbf{6 7 5 p}$ <br> $\mathbf{2 6 0 0}$ |  | SLV $\times 75$, SLVX90, SLVX95 ${ }^{\text {S0000 }}$ |
|  |  |  | $\begin{array}{ll}\text { SV8820 } \\ \text { SV8620 } & \\ \text { S } & \text { 2400p } \\ \text { 2100p }\end{array}$ |  |
|  |  | AG5150, AG5250 NVF65, NVH75, NVH77 | SV99300 SV8830 | SLV282, SLVX30, SLVX35 2025p |
| 5100 , FVHD720 110 |  | NVF51 | SV | SLVE90 ${ }^{\text {a }}$ |
| FVHP98 |  |  |  |  |
|  | 865 | NV J30, NVHJ33, NVL 10, 20, NVL21, NVG30, 31, 40, 130, NVJ37, 40, 42, | 8500 | SLV6 15, SLV625, SLVE600, SLVE700, SLVEB00 $\mathbf{3 4 5 0 p}$ |
|  | VTF780, VTF785 $\mathbf{2 0 0 0 p}$ <br> VTF 180, VTF185, VTF280 $\mathbf{4 8 0 0}$ <br> VTF350, VTF351  <br> VTM220. VTM220E, VTM220UK $\mathbf{5 1 5 0}$ <br> VTS3000  <br> VTM $\mathbf{5 1 5 0 p}$ |  |  |  |
|  |  |  | SV8500 SV $\times 301$, VB900, 910, VVT510, VT320. |  |
|  |  | NVM 1. NVM3 NVM5 <br> AG2100 AG2200 $\mathbf{4 2 0 0 p}$ <br> N00p  | ${ }^{56}$ | $V 9680$  <br> $V 8600, V 8650, ~ V 8700$ $3400 p$ <br> $V 21, V 31, V 32, V 33, V 50, V 59, V 52, V 53$,  |
|  |  | NV430, NV431, NV433, NVSD2, NVSD | V8, ${ }^{\text {V }}$ |  |
| , |  | NVSD25, NSVO3 ${ }^{\text {NV730 }}$ NV730F NV770 |  |  |
|  | J.V.C. \& FERGUSON <br> HR2200, 3300, 3320, 3330, 3350, 3360. | $\stackrel{4}{4} \mathrm{H}$ | $900,910$. <br> SVX319, VB770, V1710, 730, 731, 735. | V71, v73, V74, V75, v77, v80, v81, V82, |
|  | $3660,3750,3860,4100$ <br> $3292,8900,8901,8902,8903,8906,8922$. |  |  |  |
|  |  | $\begin{array}{ll}\text { NV21HO, NV 180, NVD48 } \\ \text { NV7881, } & \text { 1700p } \\ \text { 1700p }\end{array}$ | 750, 751,770, VB750, VK8220, V×750, VX7330, VK770, VK8225, VR 1730,1735, | V88 DV90. 96. 97, NM 3 , V. $08,109,1050 p$ |
|  | 8928, 3V01, 3V06, 3V22 HR3660, $7600,7610,7650,7700$, HRD110. |  |  | DV90, 96, 97, NM3, V108, 109, <br> 199, 200, 202, 205, 207, 209, 80, |
|  | 111, 120, 121, 220, 225, <br> HRS $100,8904,8923,8924,8925,8929$, | (ll | XR20 V11560, VN $1560, ~ V N 1561, ~ V \times 1530, ~$ |  |
|  |  |  |  |  |
|  | HRS 100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944, |  |  | V880MS |
|  | 3V39, 3 4 49 l | N9, 7000 PX , NVSD20EE, |  |  |
|  | ER1600, HRD $140,141,142,143,150,152$. 156, 157, 158, 160, 5101 |  |  |  |
|  |  |  | $321,326,336$$\mathrm{~S} 1230,1240, \mathrm{SV} \times 600, \mathrm{~S} \times 1230,1231$. | V300G, V301, V305, V306. 2900p |
|  | HRS $10,8947,8948,3 V 42,3 V 44,3 V 45$, $3 \mathrm{~V} 46,3 \mathrm{~V} 47,3 \mathrm{~V} 52,3 \mathrm{~V} 54$, <br> 3V55, 3V56, 3V57 | $\begin{array}{ll}\text { 450, } 465 & \\ \text { NVG78 } \\ \text { VG72, }\end{array}$ |  |  |
|  |  |  | 1260, 1261, 7120, 7121, 7220, SX7221. |  |
| V ¢ $4320,4321,4325,4326$, $\mathbf{9 0 0}_{\mathbf{p}}$ | 3vs | NVD48 120 | 7230, 730 |  |
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|  |  |  |  |  |
|  |  |  |  | V609, V610v610B, v6 10Uk, v611, ${ }^{\text {a }}$ |
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| 1500p |  |  |  | TEL: 0181-900 2329 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  | AG7330, AG7350, AG7355, <br> AG7450 |  |  |

## ALL TV \& VIDEO PARTS SOLD ARE REPLACEMENT PARTS

## VCR BELT KITS

| Model | Price | Model Price | Mode |
| :---: | :---: | :---: | :---: |
| AKAI <br> VP7100, VS9300, VS9500, VS9700, VS9800 |  | TX3650, VCR3000, VCR3002. VCR9500 | 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, <br> GV5 105, 511, 530, 5395, 540, 560, 5695, MV4005, 4105, SE4100, 4104, $4120,5102$. 5104, 5106 , TVR37001 <br> VXL2 <br> VXL7, VXL8, VKL9, VXL10, VXL11, VXL19, <br> VXL90, VCR34, VTV 100, <br> 200 <br> VXL4, VXL35, VTV300 <br> VXL5, VXL6 <br> VXL3, VXL20 <br> hitachi <br> $V T 11,14,16,17,19,33,330,34,35,350,38$, <br> 39, $88,165,5030$ <br> VT5000, VT5500, VT 18 <br> VT7000, VT8000, VT8030, VT8040, VT8300, <br> VT8500, 8700 VT680, VT6500, VT6800, VT9300, VT9500, <br> VT9700, 9900 <br> VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 86, <br> 64 <br> VT $100,110,119,113,115,118,120,125,128$, <br> \$30, 135, 138, <br> VT145, 150, 168, i70, 175, 220, 225, 250, 255, <br> 258, 260, VTL30 60p 90 p <br> J.V.C. <br> HR3300, HR3330, HR3360, HR3660, <br> HR4 100 <br> HR7200, HA7300 <br> HR7350, HR7600, HR7610, HR7650, <br> HR7655 <br> HR7700 <br> HRD170, 171, 180, 210, 21 1, 217, 230, 300, <br> 320, 321, 330, 337, HRD350, 370, 400, 430. <br> $440,441,500,530,700,750.950$, <br> HRS $5000,5500,8000,9000$, BR9060, BRS600, <br> 605, 920, 925 <br> HRD227, 520, 52 1, 522, 527, 600, 610, 620, <br> 637, 647, 650,830 , <br> HRO840, HROX20, 22, HRJ200, 205, 300, 305, <br> SR330, HRS 10 <br> HRD840, 550, 560, 580, 590, 640, 660, 670 , <br> $720,730,740,770$, HRD820, $860,870,880$ <br> 910, 960, 980, HRDX20, 25, HRJ2 10, <br> HR. $215,315,3: 6,318,400,405,407,410$, <br> 411, 415, 416, 507, HRJ6 10, 615, 715, 97, <br> HRS4700, 5800, SR3200, SRS 368 E <br> MATSUI <br> $V \times 600,730,735,750,755,765,350,6000$, <br> VS888 |
|  |  | FISHER |  |
| v |  | $\begin{array}{ll}\text { VBS7000 } \\ \text { VBS9000 } & \\ \text { 245p }\end{array}$ |  |
|  |  |  |  |
| VSK9, |  | FVHP520. FVHP530, FVHP420 60p <br> FVHP615, 618, 620, 622, 710, 711, 715, 720, |  |
| 155, 165, 205, 220, VS $24,240,244,245,247$, 248, 250, 512,515, |  |  |  |
|  |  | $721,722,725,730,$ |  |
| VS22, VS23, VS25, VS 35 , VS37, VS38, VS |  | 行, 906, 907, 908, 910, 911, 915, 916. |  |
| VS55, |  |  |  |
| VS4, VS6, VS8 |  | V8R330, VBS 7500, VBS7600 |  |
| SA77 | ${ }^{120}{ }^{\text {p }}$ | VBS9900 |  |
| VS | 5p | BS |  |
| AL |  | FVVO140, FVHD40, FVHO55, FVHP1, FVHP10 |  |
| vc |  | FVHD230, 250, 270, 370, FVHP1100, 1200, |  |
|  |  |  |  |
| VCR161, VCR22 | 100 p | 1250, 130, 132, |  |
| VCR 3000 X VCR4000, | 75p | FVHP 1340, 1400, 1410, 1440, 1500, 2000, 200,$210,250,3,300,$ |  |
| VCR7000, VCR7800, VCR8000,VCR |  |  |  |
| VTV10 | 105 | 310, 320, 2000, 410, 420, 430, 440, 445, 470, 85 |  |
| AMSTR |  | P5000, 5005, 5050, 5075, 5100, 975, 980, |  |
| TVF123 ${ }^{\text {V }}$ |  | FV oo |  |
|  |  |  |  |
| VCR $1000,2000,6000,6100,6200,8600,8602$ |  |  |  |
|  |  | 4005 150p <br> $V 4004$ 100 p |  |
| VCR8700, 8704, 8714, 8800, 8804, 9000, 9005, 9244, 9340, |  |  |  |
|  |  | V4007 80p |  |
|  |  | GHVI221,1244,1245 |  |
| DD8900, OD8904. TVR4TX3650, UF20, 22 24, VCR 3000,3002 , 4000, |  |  |  |
|  | 75p | GHV1246, 1247, 124日, 1250, 1266, 51, 8000 |  |
|  | 5 |  |  |
| blaupun |  | VCP4100, VCP4130 80p |  |
| RTV100 | 200p | GHV1290, 1291, 1295, 1296, VCP4000, 4200, $4300,4301$. |  |
| RTV200, RTV222, |  |  |  |
| RTV202, RTX200 | 150 p | VCP4305, 4306, 4310, 4311, 4315, 4320, 4321., |  |
| RTV 306, 307, 309, 310, 311, 312, 328, 414, |  | GRANADA |  |
|  |  |  |  |
| 434,444,707 |  | VHSH1, VHSAH3 |  |
| RTV211, RTV214 | 140p | VHSVH4, VHSWH 1 |  |
| RTV324, RTV325 |  | VH |  |
| RTV315, RTV316, |  | VHSEH 1, VHSCH 1 |  |
| RTV3:7 | Op | 135 |  |
| RTV301. |  | VHSAN3 110 |  |
| RTV424 | 85p | VHSOS2 $\quad 125$ |  |
|  |  | VHSAY3 ${ }^{\text {VHSY3 }}$ |  |
|  |  | VHSBY3 |  |
| 3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901, 8902, 8903, 8904, |  |  |  |
| 8906. 8909, 8912. 8922 |  | GRANADA |  |
| 3V23, 8923, 8924, 8929 |  | VHSOP1, VH |  |
| 3V29, 3V30, 8930, 8931, |  | VHSTJ1, VHSTJ2 150 |  |
| 8940 |  | VHSTJ3 65p |  |
| 3V31, 3V32, 8941, 8942 |  | VHSWJ1, VHSWJ2 ${ }^{\text {2 }}$ |  |
| $3 \mathrm{~V} 35,3 \mathrm{~V} 36,3 \mathrm{~V} 38,3 \mathrm{~V} 39,3 \mathrm{4} 49,89$ |  | VHSX |  |
|  |  | VHSYJ2 80 |  |
| $3 \mathrm{~V} 42,3 \mathrm{4} 43,3$ |  | VH |  |
| 3V55. 3V57, |  |  |  |
| 8945, 8947, 89.18 |  | VHSFG 1, VHSFG2, VHSFG VHSFG4, VHSF63 |  |
| $3 V 58,3 \mathrm{~V} 43,3 \mathrm{~V} 44,3 \mathrm{~V} 59$ 895? FV10. FV11, FV12 |  | GRUNDIG |  |
| FV21, FV22, FV26, FV32, FV39, VC141L | 45p | MVS 400,440, VS $400,410,415,435,440,44$ |  |
| FV31R | 110p | 450, 456, 460 , 55 |  |
| FV61L, FV62, FV67, FV68, FV70, FV71, FV |  | VSi80, 200, 220, 226, 262, 265, 267, 2X40800 |  |
| FV74.F |  |  |  |
| FV43H, |  | MVS200RC 90p |  |
|  |  | VS150 180p |  |
| 3V52 FV41R, |  |  |  |
| FV41R, FIDELITY | 100 |  |  |
| FIDELITY |  |  |  |
| HCS200 |  | LC290N, LC295SN, SVS 180, VS 170 |  |
|  | 180p | ARCELONA FLORENZ GV |  |
| VCR100 | 160p | 400 |  |
| VTR1000, VTR 100 ? | 100 | GV4002, 400, 401, 4010, 402, 403, 404, 405, |  |


| Model Price | Model Price |
| :---: | :---: |
| N.E.C | V1710, 730, 750, 970, V $\times 710,712,720,730$ |
| N830, N831, N832, N833 100p | 970,971,972 100p |
| N895 80p | V×9880 110p |
| PVC2300, PVC2400 180p | S×7121 95p |
| DX1000, 1600, 1800, 2000, 3000, N9012, 9013. | SANYO |
| 9014,9016, N9033, 9034, 9053, 9054, 9055, | VTC5000, 5150, 6000, 6500, VTCM 10, 11, 20, |
| 9056, 9066, 9096, 9110, 9120, | 21,30,31,50 65p |
| N9510,9520,9530,9610 80p | VTC5300, VTC5350, VTC5400. |
| NATIONAL PANASONIC | VPR5800 80p |
| NV300, NV330PX, NV332, NV333 NV340, | VTC5500 70p |
| NV366 100p | VTC9100, VTC9300 140p |
| NV777, NV788 100p | VTC1 $100,1300,1500$, VHR $1100,1110,1150$, |
| NV2000, NV2010, NV3000 ${ }^{\text {80p }}$ | \{200, 1300. |
| NV7000, NV7200, NV7800 75p | VHR1500, 2370, MVR220 80 |
| NV8600, NV86 10, NV862 145p | VHR2100, VHR2300, VHR2500, |
| NV230, 250, 280, 430, 431, 433, 450, 460, 465. | VHR2700 100p |
| 470, 650, 730, NV770, 810, 870, 890, 970, AG | VHR3 $100,3110,3150,3300,3310,3400,3500,3700$, |
| 1000, 1050 85p | 3800, VHRO500, 700, TLS 1000, TLS 1001 65p |
| NV370, NV380, NV480, NV630, NV780, | VHR120, 130, 14, 14t, 143, 14, 150, 151, 153, |
| NV830, NV850 70p | 154, 15, 16, 171, VHR194, 220, 23, 235, 240, |
| NV600, NV688, AG60 10, AG6015 85p | 244, 250, 251, 274, 297, 310, 330,VHR335, 390, |
| NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, | 4100, 4105, 4150, 4200, 430, 4300, 4350, 474, |
| 400, NVH70 50p | VHR4770, 5080, 5100, 5200, 5300, 5350, 5700, |
| NVFV1, NVM 10, 3000, 3300, 40, 7, 9000, 9900. | 6850, 7100, VHR7200 7250, 7260, 7300, 7400, |
| NVMS1,4 70p | 7500, 7520, 7530, 7530, VHR7540,7700, 774. |
| NVM 1, NVM3, NVM5 70p | 7800, 7810, 8000, 8100, 8200, 8250, |
| PHILEPS | 85 |
| VR6460, VR6920 170p | 4600, VHRDP4610, 4710, 4890,6700 60p |
| VR6540 100p | VMD66, VMD68P 80p |
| VR6442, VR6542 70 p | VTR 1000 |
| VR2025, VR2580 100p | VTC6010 75p |
| DV186, 190, 286, 291, 292, 468, 471, 562, 571, | SHARP |
| 761, VR201, 202, 203, 211, 2115, 212, 213, 223, | VC200, 381, 384, 385, 386, 388, 390, 393, 838, |
| 311, 312, 313, 3210, 3219, 322, 32, 29, 323, | 9100, 9300, 9500, VC9700 80p |
| 535, VR200V1, 20DV2, 20RW7, 210V1, 210V2. | VC7300, VC7700. VC7750, VC7800, |
| 210, V3, 25BO1, 25BO2, 11, 12, 302, 303, 305, | VC8000 110p |
| 31DV1, 31DV2, 31D, V3, 3SB11, 3S812, 3SB13, | VC8300 ${ }^{115 \mathrm{D}}$ |
| 72SB8, VR300V2, 35BO2, 35803. 635B7, | VC300, 387, 471, 473, 481, 482, 483, 486, 488, |
| 715B4, 71585, 715B8, VR865B2, 915B2. | 496, 8481 81 80p |
| 925B3, VR6180, 6182, 6185, 6285, | VC402, 500, 571, 573, 581, 582, 583, 584, 585, |
| 6290VR6291, VR6293, 6362, 6367, | VCSF3, VC858 1 80p |
| VR6390, 6391, 6393, 6467, 6468, 6470, 5561 | VC108, 405, 408, 550, $600,651,674,681,682$. |
| 6570, 6581, 6670, VR5676, 6710, 6760, 6761 | 682, 684, 685,693 |
| 6762,6870, 6970, 6975, VR68SB4, 86SBI, | VC700, 750, 783, VC6F3, VC6V3 70p |
| 92SB3 75p | VC208, 671, 772, 779, 780, 781, 782, 785, 786، |
| VR445B9, VR4458920, VR4458922, VR6443, | 787, 793, 800, VC7810, 7822, VCA 100, 102. |
| 6843, 6843, VR6943 100p | 103, 104, 131, 140, 170, 202, 03, VCA234, 501. |
| VR3260, 6349, 6448, 6449, 6548, 6648, | 502, 602, 5011, VCB311, 361, VCD801, 802, |
| 49SB620, 644869S, 49S86 110p | VCH851, 852, 882, VCM73, VCT72 65p |
| VKA6850, VKR6855 70p | VCA10, 103, 105, 106, 113, 11613, 211, 234, |
| VR50? 110p | $244,254,30,33,35, ~ V C A 36, ~ 37, ~ 40, ~ 43, ~ 454, ~$ |
| VKR6800, VKR6810, VKR6820 70p | 48, 50, 505, 51, 52, 53, 54, 55, 56, 57, 58, |
| SE4104, VF231, 2310, 2319, 231, 232, 2329. | VCA60, 605, 615, 67, 68, 1031, VCB320, |
| 237, 23, 241, 2410, 2419, 242, 243, 245, 2469, | VCBS97, VCD805, VCD806, 810, 815, VCH80, |
| 247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, | 81, 85 |
| 3329, 333, 337, 339, 3419, 342, 343, 3469, 347, | VCT2 12, 310, 410, 610, VCT1314, VCTS312. |
| 3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437, | 313. VG790ET 80p |
| 442, 4229, 432, 437, 442, 44, 5, 4469, 447, | VCC10 70p |
| 4479, 451, 452, 457, 458, 459, 512, 522, 5229, | SONY |
| 6379, 642, 647, 722, 7229, 723, 7379, 747, | SLC6, SLJ 10, SLTGME $140 p$ |
| 8389, 948, 9489 70p | SLC5, SLC7, SLJ7, SLJ9, SLTMME 140p |
| SAISHO | SLC9, SL8000, SLa080, SLT50 165p |
| VR2000, VHL3 30 9p | SL8000E, SL8080E, SL8200, SL8600 175p |
| VR3800, 3200, 3300, 3500, 3600, 3650, | SLV255, 125, 213, 225, 262, SLVX1, |
| VRS 4400 , 5000 75p | 20,3 95p |
| VR3400 100p | toshial |
| SAmsung | V55, V57 85p |
| SV716, 717, V1616, V 621, V1626, VX616, | V33, V31, V32, V51, V52, V53, V9600, |
| VX617,V×619, X626, V $\times 1427, V \times 629, \quad$ 75p |  |
| VB520, 510, 610, 616, 617, 619, 620, 626, 627, | DV80B, OV800, V71, 73, 74, 75, 77, 81, 83, 85, |
| 629, V1510, 520, V1619, 616, 621, 626, VX510, |  |
| 511,520, VT320,5600 80p | V108, 109, 110, 120, 130, 140, 199, 209, 210. |
| VB900, VB910, V1900, V1910 110p | 211, 220, 221, 411, V421, 609, 610, 611, 659, |
| PX980, 981,982, SE9001, SV9001, SVX307. | 660,711,880 120p |
| 319, 322, VB750, 770, 8220, 8225, V1770, 790, | V91 G, V95G 115p |
| 8220, 8225, VK8220, VPX31, VX750, VX770, | V212, 213, 22-2, 312, 322, 403, 412, 413, 610, |
| 90, 8220, 8225, SE9000, 9001 90p | 703,813 50p |
| SVX301, 303, 305, SX7301, VB710, 971, | VCPB1E 110p |

## REPLACEMENT IDLERS \& PULLEYS



## PINCH ROLLERS

| Model |
| :--- |
| $\begin{array}{l}\text { QKAI } \\ \text { VS10, VS9300, VS9500, VS9700, VS980 } \\ \text { VF7100, VP77 }\end{array}$ | VS1, VS2, VS 3, VS4, VS5, VS6, VS8, VS9, 140 p VS12, VS15

VS $105,112,115,116,120,125$ 126, 155, 165, 205, 220, 240, 244, 245 VS247,
VSX9 VSX9
VS201, 301, 303, 304, 603, 606, 607, VSP8,
VSP8, VS201, 301, 303, 304, 603, 606, 607, VSP8, 140 p
VSP82, V558, VP82
VS125, VS155, VS165, VS220, VS240, VS250, VS512
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425,
$\begin{aligned} & \text { 140p } \\ & 426, ~ 427,462,465, ~ 467, ~\end{aligned}$, 426, 427, 462, 465, 467, VS 485, 765, 766, $767,768,865,867,965,967$,
VSA77 VSA55, VSF 10, 11, 12, 15 221, 222, 230, 240, 30, 33, 200, 210, 220, 221, $22,23,240,30,33$
VSF $330,4,500,550$, VSP88, VSR 100, VS $\times 400$
450,470, 450, 470
VSF260,
VSF260, 261, 262, 265, 270, 274, 275, 280, $290,340,350,410,420,43 C$
VSF $441,440,450,455,480,4$
VSFA41, 440, 450, 455, 480, 490, 497, 510,
$560,580,590,599,600$,
VSG20, 21, 23, 24, 25, $30,33,34,35,51,54$,
$55,60,64,65,70,73,74,75$, $55,60,64,65,70,73,74,75$,
VSP110, VSX 560, VS $\times 580$ VSP10, VSX 560, VS X580
VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, VS $17,20,22,23,24,25,26,27,35,37,38,53$,
55, VSA⒎
775p 55. VSA77
PINCH ROLLER ASSEMBEY
VS VS $422,425,426,427,462,465,467,485,498$, $765,766,767,768,865$,
$867,965,967$, VSA 650, $867,965,967$, VSA 650, VSF $10,11,12,14,15$,
$180,190,200,210,220$, $221,222,230,240,30,300,301,310,320,33$,
$330,4,500,510,600$, VSR110, VSX100, 400, PINCH ROLLER ASSEMBLY
VSS99

VSA | YSSS99 |
| :--- |
| ALBA |

ALBA
VCR 3000 X, VCR4000
VCR5000, VCR6000
VCR161, VCR222
VCR7000, VCR7800, VCR8000,
VCRB800

## 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 2,2,
VCR 7000
VCRT000 8602, 8603, 8604
VCR8700, 8800, $900>9,9140,9244$

| 9340 |
| :--- |
| PINCH ROLLER ASSEMBLY PART NO |
| 1500 p |

PNCH ROLLER ASSEMBLY PART NO: 153148
TX3650, UF20, VCR 3000 , VCR 3002, VCR 4000 VCR9500 300 p PINCH RO
2554966
2554966, ${ }^{\text {DD9900, }}$, 9904, TX3650, UF20, 22, 24,
VCR $3000,3002,9500$
140p

## FERGUSON <br> <br> FERGUS

 <br> <br> FERGUS}3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292 $3900,8901,8902,8903,8904,8906,8909$,

$8912, ~ 8922, ~$ | $8912,8922,8923,8924,8925,8929,140 p$ |
| :--- |
| $3 \mathrm{~V} 29,3 \mathrm{a}$ |$|$ $8933,8940,8941,8942$

$3 \vee 35,3 \vee 36,3 V 38,3 \vee 3$, $3 \vee 35,3 \vee 36,3 \vee 38,3 \vee 39,3 \vee 42,3 \vee 43,3 \vee 44$,
$3 \vee 45,3 \vee 48,3 \vee 49,3 \vee 53,3 \vee 54,3 \vee 55,3 \vee 56$, $3 \vee 45,3 \vee 48,3 \vee 49$,
$3 \vee 57,3 \vee 58,3 \vee 59,3 \vee 65, F \vee 10, ~ F V 1, F V 12, ~$ $3 \vee 51$,
FV4, 8
$3 V 52$ FV44,
3 V 52
8950
 $22 \mathrm{~L}, 26 \mathrm{D}, 31 \mathrm{R}, 32 \mathrm{~L}$, FV $33 \mathrm{H}, 39 \mathrm{~S}, 41 \mathrm{R}, 42 \mathrm{~L}, 50 \mathrm{R}$,
$51 \mathrm{R}, 5 \mathrm{~L}$ 51R, 52 L, VC141L
FVI3
FV7H, FV44L, FV46T, FV43H, FV57H
$3 V 35,3 V 36,3 V 38,3 V 39,3 V 49,8943$ ${ }_{\text {PINCH ROLLER ASSEMBLY }}^{89}$ $3 V 42,3 V 43,3 \vee 44,3 \vee 45,3 V 48,3 V 53,3 V 54$,
$3 \vee 55,3 V 56,3 V 57,894$, 3VIN, HV56LER ASSEMBLY
PINCH ROLT FV37, FV57, FV58
PINCH ROLLER ASSEMBLY FV31R
FV41L, FV42L $\begin{array}{ll}\text { FV4 } 1 \text { R } & \text { 140p } \\ \text { PINCH ROLLER ASSEMBLY } & \mathbf{9 2 5 p}\end{array}$ PINCH ROLLER ASSEMBLY
$3 V 58,3 V 59,3 V 64,3 V 65, F V$ $20,21,22,26,30,32,33$
FV/39, VC141L FV43H, FV44L, FV45X FV46T PINCH ROLLER ASSEMBLY
FV61, FV62, FV67, FV68, FV70 FV61, FV62, FV67, FV68, FV70, FV71, FV72, 775 p
FV74, FV77 PINCH ROLLER ASSEMBEY $\left\lvert\, \begin{aligned} & \text { FISHER } \\ & \text { FVHP4 } 20,520,530 ~\end{aligned}\right.$

FVPP810, 830, 840
FVHP905, $906,907,908,910,911,9150 \mathrm{p}$ 918,990, $975,980,900$, FVHP 5000,5005, 5050, 5075,5100
VBR330, VBS $3500,7000,7100,7500,7600$ VBR 330, VBS $3500,7000,7100,7500,7600$,
9000,9900 FVHD 9300 250, 300, $310,1100,370,20000$, FVHP3, 210, FVHP 1200, 1250, 130, 132, 1340, 1340, 1400,
$1410,1440,4500,200$, $1410,1440,1500,200$
FVHP320440, 420, 430, 440, 445, 470, 475,
FVSP290S, 495,2405 FVSP290S, 495, 2905
FVHD140, FVHO40, FVHD55, FVHP1, FVHP10p FVHP20 20 FVHP20 VHS10, 30 1350 PINCH ROLLER ASSEMBLY
GOLDSTAR GOLDSTAR GHV51, 1221, 1232, 1233, 1240, 1241, 1242 , GHV1247, 1248, 1250, 1266, 1290, 1291, 1295, 1296, 1392, 1393, $1260,1290,1291,1295$, GHV1891, $1900,2145,3000,3010,4400,44$ 51, 8000, 8200 , GHV8210, 8215, 8430 GHVP 1240, 1241, 1247, 1248, 1290, 1291, GHVP1295, , 1296, VCP4000, 4100, 4130, 4200,
$4300,4301,4305, V C P 4306,4310,4311,4315$, $4316,4320,4321,4325,4326,4350$, GSE 1290 1291, 1295, 1296, 1297, 1891, 1910, 20005, 2000
VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38, 39, 88, 330, 680, 4200 VT5000, 5030, 5500, 6500, 6800, 7000, 8000, $8300,8500,8700,930$ VT9500, 9700,9900, VM600 18, 52, 57,61, 62,63, 64, 65, 85, 86, 88, 100, VT120, 122, 125, 128, 130, 135, 138, 145, 150, $168,170,175,220,225$. VT250, 255, 258, 260, 400, 405, 410, 413, 414. 15, $46,28,430,425$ V15, $517,518,520,525,435,438,450,498,510$,
$515,54,540,54,50$, VT526, 530, 535, 536, 540, 545, 546, 548, 570, 575,576,580,585,588 VT640, 830, VTF660, 665, 70, 770, 774, 775, $780,785,860,861,865$, C50, VTM598, 620, 622, $625,626,630,635$
VTM $636,640,645,646,720,722,725,726$, $727,728,730,731,735$,
VTM $736,740,745,746,748,753,754,820$, $821,822,825,830,83$ ?,
VMM835, 838, 840, B4), VTM835, 838, 840, 841, 845, 920, 921, 922, $925,930,931,935$
VSS $80,85,890,89$ 3280, 500, VMS 7200 VM $200,2300,2380,3200$, VT3000
$V T 410,420,428,430,450,498,518,520,522$, 530, VTF770, 780 ,
VTM598, 622,722,740, 748,753 650p VTF150, 155, 180, 185, 250, 255, 260, 265, 280 285, 350, 351, 355, VTF360, 365, VTM
$212,215,220,221$
VIM230, 231, 235, 284, VTS $390 \quad 140 \mathrm{p}$ HINARI
V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90, VXL2, VXL3
VXL4, VXL20, VXL35 VTV100, VXL10, VXL11, VLX9,

## VXL90

FNCH ROLLER ASSEMBY
$\mathrm{V} 20 \mathrm{H}, \mathrm{V} \times L 5, \mathrm{~V}$ ASSEMBLY
J.V.C.
HR2200, $3300,3330,3360,3660,4100$

HR2200, 3300, 3330, 3360, 3660, 4100, 7700
HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655
HRD110, 111, 120, 121, 140, 141, 142, 143, $150,152,156,157,158$, HRO160, 220, 225, 250, 257, 445, 455, 565, $566,725,755$,
BRS 611,811
HRD520, $540,550,560,580,600,610,620,140$ $637,640,641,650,660$,
HRO $670,720,730,740$,
HRD670, 722, 730, $740,770,820,830,840$,
$860,870,880,910,960$,
$860,870,880,910,960$,
HRO980, HRO $\times 20$,
HRDP980, HRD $\times 20,22,25$, HRJJ200, 205, 210,
$215,300,315,316,318$,
215, 300, 315, 316, 318
600, $605,610,615,715,41,415,416,507$,
$600,605,610,615,715,815$
HRJ97, HRS $4700,5800,5900,6800,6900$,
SR $3200,330,368$, $14100,680,6900$ HRD $170,171,180,210,211$
$320,321,330,337,350$,
$320,321,330,337,350$,
HRD $370,400,430,440,441,470,500,530$, $700,750,950$
HRS5000, 5500, 8000, 9000, BR7030, 7040,

| BRS600, $605,747,777,920,925$ | Price | Model |
| :--- | ---: | :--- | :--- |

HRS 10,
BP5000, HRD1 10, 111, 120, 220, 225, 455
PiNCH ROLLER ASSEMBIY 1100 p PINCH ROLLER ASSEMBLY
HROTH0, 141, 142, 143, 150, $152,157,158$, HROT40, 141, 142, 143, 150, 152, 157, 158,
$160,565,565,725,755$,
HRP50, PINCH ROLLER ASSEMBLY
HRD1520, $510,520,521,522,525,527,560$, $600,610,620,637,641$,
HRD650, 720, 830, 840, 910 , HRJ.J205,
HRS580, HRS5800
P:NCH ROLI ER ASSEMBLY ER7030, BRS 600
HRD230, 271, $300,310,320,321,330,337, ~$
350, $350,400,430,440,4$ HRD470, 500, 530, 700, 750,950 , HRS 5000 , 5500,9000
PINCH ROLLER ASSEMBLY
HRO540, HRD550, HRD580, HRD660, HRD860, HRDD960
HRD550, PINCH ROLLER ASSEMBLY HRJ600, HRJJ605, HRJJ15.

## HRS9200

MATSUI
X6000,730,735,750,755,765 VS888
V $\times 1000$, V $\times 2000$ V $\times 2500, ~ 140$
VX6000A 140 p
MITSUBISHI $31,32,41,51,52,82$,
HSE12, 16 17,
HSE $12,16,17,21,22,27,31,32,41,51,52$,
82, HSM1000, $110,120,15$, 82, HSM1000, 110, 120, 15
$0,16,170,190,210,23,25,250,27,33,34,35$ $0,16,170,190,210,23,25,250,27,33,34,35$,
$36,37,370,380,45,450,5$ 4, 55, 555, 57, 58, 59, 68, HSMS2, 9, HSS 11 , $14,15,17,19,25,5600$, HV
F125, 150, 303, 85, SV8900, 8930 F125, $150,303,85$, SV8900, 8930
PINCH ROLLER ASSEMBLY PART NO 9480020010
HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, $52,5300,5424,5600$, HSB11, 12, 16, 21, 27,
$31,32,41,51,52,82$, HSM $1000,110,120,150$, $31,32,41,51,52,82$, , $S M 1000,110,120,150$,
HSM $16,170,18,190,210,23,25,250,27,30$, $33,34,35,36,37,370,38$, HSM $380,40,45$, 44, 50, 54, 55, 555, 57, 58, 59, 60, 68,
HSMS 9 HSMX1 18, HSMS2, 9, HSMX1, 18, 19, 2, HSS 111, 12, 14,
15, 17, 19, 21,25, 5600, HVF 125 , HVF150, 303 15, 17, 19, $21,25,5600$, HVF125, HVF150, 303,
85, SV8900, 8930 HS 200, HS $300, H S 301, H S 302, H S 303, H S 304$, HS310, HS 320 , HS 330 , HS 360 ,

## HS700

HS306, HS 307, HS 318, HS319, HS337, HS338 HS 347, HS349, HS 400, HS 410, HS 411, HS 412
HS 421, HS 480, HS710, HSB 10, HSB20, 30 HS 421, HS480, HS710, HSE 10, HSB20, 30, HSE 10, 20
30,70
NATIONAL PANASONIC NV100, $180,300,330 \mathrm{PX}, 332,333,340,366$, 600,688, 7777,788, 3321.
AG6010, $6015,6100,6200,6400,6800$
$\begin{aligned} & 7450 \\ & \text { NV } 230,250,260,280,370,380,430,431,433\end{aligned}$ $450,460,465,470,480$ NV $630,650,730,770$, 890, 2000, 2010, 3000 ,
NV7000, $7200,7800,8050,8150,8170,8200$, $8300,8400,8500,8600$
NV8610, 8620, , NVG11, 14, 16, NVG7, 10, 12.
$15,18,30,130,400$,
$A G 1000,1050,1200,1500,2100,2200,6500$
6810, 7500, 7510.
NVH70

NVG9, NVG120
AG6840, 6720, 7150, 7330, 7350
7355, 7650 , NVH65, 75, NV 30 , NVL20, 23, 25,
100, NVG 19, 20, 25, 33, 40,50,
NVV8000
NVD48, NVD80, NVG21 NVG45 140p
NV 1700 NX
NVHD 100 NVHD101, NCHD90, NVSD30 140p NVSD40

> NVSDAO PINCH ROLLER ASSEMBLY

AG5150, 5250, 5700, 6024, NVD38, 48, 80 . NVF55, $65,70,75$,
NVFS $1,100,200,88,90$, NVG 19, 20, 21, 22, 25, 28, 300, 33, 40, 45, 46,
NVG50, NVH65, 75, 77, NVJ $30,33,35,37,40$, 42, 45, 47.
NVL20, 23, 25, 28, NWW $1 \quad 300 p$ NVL20, $23,25,28$, NUW 1
PINCH ROLLER ASSEMBLY

## N.E.C N 830 .

N830, 831, 832, 833, 895
PVC2300, 2400,
140p
PVC2300, 2400, 740, 744, 746, 760, 764, 140p
$76661000,1600,1800,2000,3000, N 9012,9013$

## 9014, 9016, 9033

| 9110, $9120,9510,9520$ |
| :--- |

N9530, 9610 , PX 1200

## $\frac{\text { NS7000 }}{\text { ORION }}$ <br> ORION VH1, VH2 VC150

VH1, VH2
VC150, $180, ~ V H 3, ~ 33,200, ~ 201, ~ 205, ~ 212, ~ 250, ~$
254, 254, 288, 300, 303, $312,201,205,212,250$,
VH $404,555,700,704,712,770,780,844$, VH404, 555, 700, 704, 712, 770, 780, 844, 900,
$1000,2948,3030,3312$ $1000,2948,3030,3312$
VHF2A, VP2948
COMB 15000, 16000, HV03, LVH50, NEVH COMB 15000, 16000 VP230RC, VCP, VH04, 30, 103, 300, 358, 360 $362,400,416,512$.
VH530, $532,535,536,600,630,635,640,666$, $730,735,744,774,790$
H800, 820, 850, 888, 893, 900, 930, 940, 942 $974,1012,1040,1050$
$500,1660,1800,2004$, 1120, 1204, 1440,
VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, $2970,3050$.
VH3060, 4000, 4008, 4010, 4012, 4015, 4015

$$
\begin{aligned}
& 4020,430,5020 \\
& \text { VP } 10,200,220,
\end{aligned}
$$

VP 10, 200, 220, 225, 245, VR821, 925, 1032,
$2949,2959,2957,2966,2979,2980$, VTV300
VXL20, 25, 30
140p
PHILIPS
VR6460 VR6920
VR2020, VR2021, VR2022, VR2023 VR2024
VR6711
$\begin{array}{ll}140 \mathrm{p} \\ \text { R6540 } & 140 \mathrm{p} \\ \text { OV85 } & 140 \mathrm{p}\end{array}$
DV856, 586, VR702, 703, 6485, 6585, 6589, 6785,6880, 6948 140p VR6943, 44SES
DV464, 662 VR2220, 2300, 140p 2340, 2350, 2414, VR2480, 2485, 2486, 2489, $2490,2498,2840,6462,6463,6464,6560$ VR6660, $6860,6861,6862,6863$ N-1700, VR2870
VR2025, VR6580, VR6581 $\begin{array}{cc}\text { VR2025, VR6580, VR6581 } & \mathbf{1 4 0 p} \\ \text { 4SB6, VR3260, } 6349,64140 p\end{array}$ 49SB6, VR3260, 6349, 6448, 6449, 6548, CRESSURE ROLLER ASSEMBLY PS 403 - 40205 OV186, 190 VR211, 2115, 212. 213, 223, 286 . 291, 292, 311, 312, 313, 21, , 223, VR $3210,3219,322,3229,323,53580,486$, 471, 562, 582, 571, 761,
VR201, 202, VR203, 302, 303, 305, 6180, 6182 , 6185, 6285, 6290 ,
VR6291, 6293, 6362, 6367, 6390, 6391, 6393 , VR6570, 6581 VR $66670,6676,6710,6760,6761$, 6762,6870, 6970,
VR6975, 86BI, $633 \mathrm{SB7}, 68 \mathrm{SB} 4,71 \mathrm{SE} 4,71 \mathrm{SBE}$,
 20RW7, 21DV1, 210V2, 2SB01, 2S802, 2SB!1
2SB12 30DV2, 31DV, $310 \mathrm{~V} 2,31 \mathrm{VV} 3 \mathrm{SB} 02$ 2SB12, 30
$3 S B 03$,
3SB05 3SB11 3SB12 3SB13 VR231, 232, 332, 422, 4229, 512 7229,723
VA501
VHR $1100,1110,1150,1200,1300,1500,2100$, 2300, 2370, 2500

MVR220
$5300,5350,5$ VTC5000, 5150, 5
$6010,6500,9100$,
6010, 6500, 9100,
VC 9300, VPR5800
VHR $3100,3300,3310,340,300,310,140 \mathrm{p}$
V VHR 3100.3300,
VHRD500, 700
VFRE
VRRD500, 700 140p
VTC3000
VHR120, 140p
154, 15, 160, 14, 141, 143, 14, 150, 151, 153,
OVHR23, $235,240,244,250,251,274,27,297$, $310,330,335,350,390$, VHR $410,4105,4150$, $4200,430,4300,4350,4400,474,4770,5080$, VHR5100, 5200, 5300, 5350, 5600, 5700, 6850 $7100,7200,7250$,VHR $7260,7300,7400,7440$, OVHR $7810,8000,8070,8100,874,780$, 8500,8800 VHP $8040,8100,8200,8250$ 4610, 4710, 4890, 6700, VHRS $700 \quad 140 \mathrm{p}$
VHR120, 135, 150, 190, 4150, 4160, 4350 ${ }^{\text {140p }}$ $5200,5240,5350,7200,7250,7260,7700$. VHRO4410, 4610, 4710, 4890, 5450 , VHRS700
FINCH ROL
PINCH ROLLER ASSEMBLY VHR $3100,3200,3300,3310,3400,3700,3800$,
VHRD500, 7000 PINCH ROLLER ASSEMBLY SHARP
VC200, 381, 383, 384, 385, 386, 388, 390, 393, 800, 2300, 3300,6000 ,
VC $6200,6300,7300,7700,7750,7800,8300$, $838,9100,9300,9400$,
VC9500, $9600,9700,9800$
VC $300,387,402,471,473,477,481,482,483$,
48
486, 488, 496, 500, 571,
$573,581,582,583,584,585,8481$, VC5F3,
VC5W20E, VCA1031,
VC108, 208, 405, 408, 550, 600, 651, 671, 140 p

VCA340, 43, 47, 50, 60, 605, 615, VCD806
VCA $340,43,47,50,60$,
$815, ~ V C H 80,81,83,85$,
VCH865, 87, 910, VCS 1000, VCT212, 310,410
510,610, VCT1314, VCTS313
PINCH ROL
SAISHO
VHL3, VR1000, 2000, $2500,3200,3300,3500$
VHL3, VR1000, 2000, 2500, 3200, 3300, 3500,
$3600,3650,3800$, VRS 4400, VRS $5000 \quad 140 \mathrm{p}$

## $\frac{\text { VR3400 }}{\text { SAMSUN }}$

## SAMSUNG

SV716, 717, VB510, $520,610,616,617,619$
$620,626,627,52,611,616,621,626,900$,
V20, 626, 627, 629, 900,


## MODE SWITCH

NV2000, 2010, 7000, 7200, 7800 (VS50048) NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110)
NV830 (VSS0091)
NV300, 333, 340, 366, 688, 777, 778
(VSS0060
NVG21, 25, NVH65, NVD80 (VSS0175A)
$£ 2.00$

## AUDIO CONTROL HEADS

AMSTRAD ORIGINAL NO: 150751
Used on: AMSTRAD TVR1, 2,3, VCR4600, $4600 \mathrm{MKII}, 4700$, 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, SCHNEI UNIVERSUM SA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM ORDER CODE: AH02 PRICE: 1450p

Replacement Audio Control Video Sound Head for National Panasonic

| PART NUMBER | MODELS | PRICE |
| :--- | :--- | :---: |
| VBR OO91 | NVG7 etc | 875 p |
| VBR0050 | NV300, NV340 etc | 875 p |
| VBR0061 | NV77 etc | 875 p |
| VBR0103A | NV250, NV450 etc | 625 p |
| VBR0125 |  | 625 p |

## 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

SET OF 8 ALLEN KEVS

- RCA TYPE AUDIO \& CONTROL HEAD POSITIONING TOOL - RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS
$0.77 \mathrm{~mm} \quad 0.90 \mathrm{~mm}$
- RCA TYPE BACK TENSION TOOL
$1.27 \mathrm{~mm} \quad 1.50 \mathrm{~mm}$
- TENSION ADJUSTMENT TOOL FOR VARIOUS USES - VCR ADJUSTMENT TOOL

3 REVERSIBLE SCREWDRIVERS CIRCLIP PLIERS
SPRING HOOK 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 90mAH Order Code: BB01
Part Nos: 138 - $10229,2.4 \mathrm{v} 100 \mathrm{mAH}$
Order Code: BB02

Price: 70p
Price: 135 p

FERGUSON
Part No: 00E6-067-0011.2V 100mAH
Order Code: BB03
Part Nos: 00E6-606-80012.4V 100 mAH
Order Code: BB04

Price: $90 p$
Price: 150 p

## SATEL LITE PSU REPAIR KITS

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

## SATELLITE TUNERS

PACE PRD800/MSS200 2Ghz (221-2077062) ORDER CODE: TUNER01 PRICE: $1400 \mathrm{p}+$ VAT PACE PRD900/MSS1000 2Ghz (221-21770112) ORDER CODE: TUNER02 PRICE: 1400p + VAT

SWITCH MODE TRANSFORMERS
PACE 9000
ORDER CODE: PACE9000 PRICE: 800p PRD800/PRD900
ORDER CODE: PRD800 PRICE: 550p

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

## 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 $R X$ powering the LNB.

* Acoustical signal: On signal strength *LED indicator: Vert/Hori
* Frequency Range: 900 to 2050 Mhz *Input impedence: 70 Ohm
* Power amplifier: $18 \mathrm{db} \quad$ *Detection Range: -60 to -10 DBM
* Max. input signal: -10 DBM

ORDER CODE: TOOL22
PRICE: 8500 p

## REPLACEMENT TV SWITCHES

| GRUNDIG |
| :--- |
| PART No: 29703, 29102 |
| USED ON: |
| C7500, C8500. C8502, C8712 . . ETC |
| Order Code: SW1 |

## PHILIPS

## USED ON:

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

## 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 21 mm +Remote) Order Code: SW6

Price: 130p

SONY 2 PIN FUNCTION SWITCH

|  | TIME LAG |  |
| :---: | :---: | :---: |
| CURRENT RATING | ORDER CODE |  |
| 100 mA | FUSE36 |  |
| 160 mA | FUSE01 |  |
| 250 mA | FUSE02 |  |
| 315 mA | FUSE03 |  |
| 400 mA | FUSE04 |  |
| 500 mA | FUSE05 |  |
| 630 mA | FUSE06 |  |
| 800 mA | FUSE07 |  |
| 1A | FUSE08 |  |
| 1,25A | FUSE09 |  |
| 1.6A | FUSE10 |  |
| 2A | FUSE11 |  |
| 2.5A | FUSE12 |  |
| 3.15A | FUSE 13 |  |
| 4A | FUSE14 |  |
| 5A | FUSE15 |  |
| 6.3 A | FUSE16 |  |
| CERAMIC PLUG TOP |  |  |
| CURRENT RATING | ORDER CODE | PRICE |
| 3A | FUSE33 | 100p |
| 5A | FUSE34 | 100 p |
| 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 BS 4265 \& BSI 362 safety standards and should not be compared with cheap imported types

## VOLTAGE TESTER

A terminal screwdriver incorporating continuity \& voltage with Euroslot ORDER CODE: TOOL11 PRICE: 220p

## 20 mm CERAMIC TIMIE LAG

CURIENTT RATING
ORIDER CODE
PRICE


FUSE38
FUSE40
FUSE4I
FUSE42
FUSE43
100 p
100 p
8 A
10 A

38 mm CERAMIC TIMI LAG
CURRENT RATING
ORDER CODE
PRICE

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

## SPRING HOOK

Spring Hook, to unlock springs in audio tape recorders \& VCRs ORDER CODE: TOOL20

PRICE: 265p

## FAULT IINDING / 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 $\mathbf{£ 8 . 5 0}$ - No VAT.

Video Recorders Edition 51997
Over 300 pages packed with more than 5500 faults for different brands
Price $£ 15.00$ - No VAT. Order Code: BOOK01

| DESCRIPTION | VOLUME | CODE | PRICE |
| :---: | :---: | :---: | :---: |
| VIDEO HEAD CLEANER | 75ML | SP01 | 145p |
| SWITCH CLEANER | 176ML | SP02 | 155p |
| SILICONE GREASE | 200ML | SP03 | 180p |
| FREEZEIT | 170ML | SP04 | 295p |
| FREEZE IT | 400 ML | SP16 | 580p |
| FOAM CLEANER | 400ML | SP05 | 180p |
| ANT-STATIC | 200ML | SP06 | 180p |
| AEROKLEANE | 200ML | SP07 | 200 p |
| AERO DUSTER | 200ML | SP08 | 340p |
| AERO DUSTER | 400 ML | SP17 | 580p |
| PLASTIC SEAL | 200 ML | SP09 | 250p |
| GLASS CLEANER | 200ML | SP10 | 160p |
| COLDKLENE | 200 ML | SP13 | 220p |
| EXCEL POLISH 80 | 200ML | SP18 | 160 p |
| ADHESIVE 120 | 500 ML | SP19 | 250p |
| LABEL REMOVER 130 | 200 ML | SP20 | 260p |
| REFURB 140 | 400 ML | SP21 | 260p |
| TUBE SILICON GREASE | 50 GRAMMES | SPI1 | 225p |
| TUBE SILICON SEALANT WHITE | 75ML | SP22 | 250p |
| TUBE SILICON SEALANT CLEAR | 75ML | SP23 | 250p |
| TUBE HEAT SINK COMPOUND | 25 GRAMMES | SP12 | 150 ${ }^{\circ}$ |
| DRIVE CLEANER | 200ML | SP24 | 150p |
| SCREEN CLEANER | 200 ML | SP25 | 145 |
| COMPUTER CARE KIT |  | SP26 | 2100p |

All the above items are manufactured by Servisol If you purchase more than one Servisol Product, postage \& package will be charged as follows
$\mathbf{3 0 0 p}$ for $2-5$ cans $\quad \mathbf{5 0 0}$ por more than 5 cans

## TELEVISION

 Edition 7This new A5 size guide lists more than 9600 faults and to approx. 474 pages in size. Price: 1650 p only - no VAT (+ £2 Postage) Order Code: BOOK02

## Satellite Repair Manual Edition 5

346 pages of receiver faults plus notes and general information such as many useful button sequences for resetting parental lock codes, resetting installation choice to factory defaults.
Price $£ 16.00$ - No VAT plus Postage $£ 1$ Order Code: BOOKO3

## SOLDERING ACCESSORIES

## DESCRIPTION

ANTEX SOLDERING IRONS 25 WATT 240 VAC (XS25W 240 V )
15 WATT 240 VAC (XS15W 240 V$)$ 25 WATT SPARE ELEMENT 15 WATT SPARE ELEMENT SOLDERING STAND \& SPONGES SOLDERING STAND (MADE BY ANTEX) SPARE SPONGE SOLDER 20 SWG 500 GRAMMES $\quad \$ 110 \quad 500 \mathrm{p}$ 22 SWG 500 GRAMMES DESOLDERING AIDS SOLDER MOP STANDARD GAUGE $1.2 \mathrm{MM} \times 1.5 \mathrm{M}$ SOLDER MOP 1.2MM X 10M DESOLDERING PUMP SPARE NOZZLE

SEMICONDUCTOR COMPARISONS 1999
With over 650 pages listing more than 34,200 Semiconductors with suitable alternatives complete with descriptions and base information Price: 1900 p only - No VAT (+ £2 Postage). Order Code: BOOK04
SEMICONDUCTOR COMPARISONS 1999 The new 1998 Jaeger Semiconductor comparison with 1100 pages packed with information on over 95,000 semiconductors in much greater detail plus marketing data on SMD devices and a separate generic table of all the type designations.
Price: $£ 47.00$ only $-\mathrm{N}_{\mathrm{o}}$ VAT ( $+\mathrm{E5}$ Postage). Order Code: B00K06

## I.C. PROTECTOBS

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

PRICE: 30p EACH ONLY


CAN'T FIND WHAT YOU'RE LOOKING FOR?

RING US...AS THIS IS ONLY A SELECTION OF THE ITEMS THAT WE STOCK

## CASSETTE DC MOTORS

6 V MOTOR
9 V MOTOR
170p
12 V CW MOTOR
12 V CCW MOTOR
13.2V MOTOR

CASSETTE TAPE HEADS
MONO HEAD 90p
STEREO
110p
MINI HEAD 150p
AUTO REVERSE HEAD 200p


| Description | Code | Price | Description | Code | Price | Description | Code | Price | Description | Code | Price |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AKAI |  |  | A512120/230 | RC900 | 650 p | PANASONIC |  |  | SONY |  |  |
| RC-V10A | RC876 | 650 p | A514790 | RC901 | 650p | EUR51200 | RC200 | 650 p | RM604, RM605, RM606 | RC140 | 650p |
| RCV 37 B | RC891 | 650p | A5088470 | RC902 | 650 p | TC2200 | RC204 | 650 p | 32 CHANNEL | RC140 | 650p |
| V25A | RC896 | 650p | A518612 | RC903 | 650 p | VS00357/NV730 | $\mathrm{RCL202}^{\text {R }}$ | 650 650 | RM613 | RC141 | 650p |
| decca |  |  | SCL002 | RC904 | 650 p | TNQ1621 |  | 6500 | RM632, RM636 | RC160 | 600p |
| RC70 | RC894 | 650p | ${ }^{\text {C2096 }}$ A511940 | RC905 | 650 p 650 p | $\begin{aligned} & \text { PHILIPS } \\ & \text { RC5002,5154 } \end{aligned}$ | RC134 | 650 p | $\underset{\text { TATUNG }}{\text { FXA }}$ |  |  |
| FISHER RC905B | RC879 | 650p | 655602 H | RC1920 | 650p | KT3 NON TEXT 69117032 | RC135 RC178 | 650 p 650 p | RC70 FX 70 FASTTEXT | RC883 RC894 | 650p 650 p |
| GRANADA |  |  | ${ }_{\text {\|FB13, 14, } 15}$ | RC143 | 650p | 69117194 | RC180 | 650p | FX70 FASTIEXT |  | 650p |
| UNIVERSAL TEXT | RC309 | 650p | FS4 ${ }^{\text {a }}$ | RC148 | 650 p | RC5991-UNIV | RC300 RC301 | 550p | FB632 | RC632S | 650p |
| MK4 TEXT, 70155G, 70115G, 70133G | RC880 | 650p | RG305 | RC305 | 650p | KT3 TEXT | RC5301 | 650p | FB639 | RC639 | 650p |
| 95288 E | RC882 | 650 p | RG306 | RC306 | 650p | RC5352 | RC5352 | 650p | THORN/FERGUSON |  |  |
| 94490 D | RC884 | 650 p | FS9/1-10/1 | RC307 | 650 p | RC5375 | RC5375 | 650p | 3V35-42 | RC342 | 600p |
| GRUNDIG |  |  | VS5 RUK | RC308 | 650 p | RC5 STANDARD | RC300 | 550p | 3V31-32 | RC344 | 650p |
| TP160E | RC107 | 650p | VS4-1 | RC308 | 650 p | RC5903 | RC5903 | 650p | 3V57-58 | RC628 | 650p |
| TP200, TP300 | RC380 | 650 p | MULTICONTRDL (17C20) | RC311 | 650 p | SALORA |  |  | TX10 TEXT | RC732 | 575p |
| TP400 | RC401 | 600 p | LOEWE |  |  | SERIES L | RC190 | 650p | TX10 STERED TEXT | RC738 | 575p |
| TP590-600 | RC600 | 650 p | DC11 | RC146 | 650p | 86173 | RC882 | 650p | TC9-90-100 | RC740 | 600 p |
| TP390, TP610 | RC610 | 650 p | MATSUI |  |  | SANYO |  |  | $3 \mathrm{~V} 55, \mathrm{FV} 11$ | RC783 | 650p |
| TP621 ${ }_{\text {TP630, TP650 }}$ | RC612 | 650 p 650 p | 010270601 | RC889 | 650 p | RC218, RC222, RC228, RC238 | RC140 RC878 |  | TX100 FASTTEXT | AC789 | 650p |
| TP630, TP650 TP666 | RC650 RC660 | 650p | VX770 | RC892 | 650 p | ${ }^{\text {J }}$ J $\times$ GE | RC878 | 650 p 650 p | TX 100 ST, FASTTEXT | RC789 | 650 p |
| TP661 | RC661 | 650p | NOKIA |  |  | VHR2300 | RC890 | 650 p | PROFESSIONAL | RC790 | 650 p |
| HITACHI |  |  | SATELLITE | RC550 | 650p | RC628 | RC865 | 650 p | TOSHIBA |  |  |
| CLE800-CLE830 | RC140 | 650 p | ORION |  |  | SHARP |  |  | CT937 | RC950 | 650 p |
| A617402/655602 | RC1920 | 650p | RC53 | RC892 | 650p | G0121CESA, 123CESA, 204, 251 | RC140 | 650p | CT9117 | RC951 | 650 p |

## WE STOCK REMOTE CONTROLS FOR OVER 5,000 DIFFERENT MODELS RING FOR MODELS NOT LISTED ABOVE ON 01819002329

[^0]2 way Preprogrammed Universal Remote

- Replaces up to 2 remotes (TV/Satellite)
- Simple key arrangement
- Set-up by library revie

Order Code: 2 WAV
PRICE: 925p

REPLACEMENT LINE OUTPUT TRANSFORMERS

| Part No. | Code | Price | HITACHI |  |  | 45150119 | LOT169 | 1500p | TLF 14520 F | LOT40 | 1500p | 094-010200.7 | LOT59 | 1400p | 1-439-303-31 | LOT94 | p |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AKAI |  |  | 2424593 | LOT44 | 1050p | 45150124 | LOT137 | 1600p | TLF 14521 F | LOT39 | 1850p | 094-01021/0.6 | LOT59 | 1400p | 1-439-303-32 | LOT94 | 1300p |
| 45150344 | LOT56 | 1650p | 2432101 | LOTT9 | 1600p | 45150146 | 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 | 45150301 | LOT 169 | 1500p | TLF 14568 F | LOT40 | 1500p | 094-01038/0.7 | LOT245 | 1900p | 1.439-311-11 | LOT95 | 1550p |
| 101-220005-03A | LOT72 | 1800p | 2432611 | LOT80 | 1800p | 45150302 | LOT180 | 1550p | TLF 14584 F | LOT41 | 1700p | 094-01052/0.8 | LOT186 | 1825p | 1-439-311-13 | LOT95 | 1550p |
| 005037 | LOT27 | 1450p | 2432651 | LOT80 | 1800p | 45150304 | 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 | 45150305 | LOT180 | 1550p | TLF 15606 F | LOT256 | 2000p | 610.018.6620 | LOT189 | 1650p | 1-439-311-32 | LOT95 | 1550p |
| D 056/37 | LOT56 | 1650p | 2432981 | LOT37 | 1200p | 45150306 | LOT168 | 1500p | TLF 70012 | LOT78 | 1500p | 610.018.6637 | LOT215 | 1800p | 1-439-331-22 | LOT96 | 1550p |
| D 059/37 | LOT200 | 1400p | 2432981 | LOT37 | 1200p | 45150308 | LOT22 | 1250p | TLF 70012 F | LOTT8 | 1500p | SHARP |  |  | 1-439.331-41 | LOT98 | 1550p |
| D 069/37 | LOT56 | 1650p | 2432982 | LOT37 | 1200p | 45150309 | 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 | 45150310 | LOT168 | 1500p | TLF 70018 | LOT274 | 1850p | RTRNF 1783 BMZZ | LOT202 | 1800p | 1-439-332-11 | LOT99 | 1600p |
| FERGUSON |  |  | 2433012 | LOT171 | 1800p | 45150313 | LOT30 | 1250p | TLF 70018 F | LOT274 | 1550p | RTRNF 1783 CEZZ | LOT202 | 1800p | 1.439.332-21 | LOT99 | 1000p |
| 00 D-3-508-001 | LOT38 | 1250p | 2433014 | LOT171 | 1600p | 45150314 | LOT174 | 1400p | TLF 70161 | LOT278 | 1300p | RTRNF 1786 BMZZ | LOT211 | 1850p | 1-439.332-41 | LOT100 | 1500p |
| 00 D-3-508-002 | LOT38 | 1250p | 2433212 | LOT168 | 1500p | 45150315 | LOT22 | 1250p | TLF 70162 | LOT72 | 1600p | RTRNF 1786 CEZZ | LOT211 | 1850p | 1.439-332-42 | LOT101 | 1450p |
| 00 D-3-508-003 | LOT276 | 1400p | 2433291 | LOT 172 | 1350p | 45150318 | LOT 192 | 1550p | TLF 70162A | LOT72 | 1600p | RTRNF 2000 BMZZ | LOT214 | 1800p | 1-439.332.52 | LOT100 | 1500p |
| 00 D-3-515-001 PL1 | LOT276 | 1400p | 2433301 | LOT246 | 1800p | 45150319 | LOT30 | 1250p | TLF 70162B | LOT72 | 1000p | RTRNF 2002 BMZZ | LOT307 | 1450p | 1-439-333-00 | LOT270 | 1550p |
| 00 D-4-208-001 | LOT79 | 1600p | 333441 | LOT188 | 1900p | 45150320 | LOT190 | 1650p | TLF 70162 G | LOT72 | 1000p | RTRNF 2002 CEZZ | LOT307 | 1450p | 1.439.333-11 | LOT270 | 1560p |
| $00 \mathrm{D}-4.208-002$ | LOT79 | 1600p | 42 | LOT191 | 1600p | 45150322 | LOT 196 | 1550p | TLF 77001 B | LOT274 | 1550p | RTRNF 2003 BMZZ | LOT308 | 1350p | 1-439-333-12 | LOT270 | 1550p |
| $00 \mathrm{D}-4.235-002$ | LOT240 | 1250p | 2433451 | L0781 | 1350p | 45150324 | LOT 194 | 1550p | PHILIPS |  |  | RTRNF 2004 BMZZ | LOT307 | 1480p | 1-439-363-11 | LOT268 | 1400p |
| $00 \mathrm{D}-4.235-002 \mathrm{HTI}$ | LOT81 | 1350p | 2433452 | LOT82 | ${ }^{\text {1250p }}$ 1250p. | 45150325 | LOT22 | 1250p | 482214010142 | LOT142 | 1800p | RTRNF 2005 8MZZ | LOT308 | 1350p | 1-439-363-21 | LOT268 | 1400p |
| 00 D-4-235-02201G | LOT81 | 1350p | 2433453 | LOT82 | 1250p | 45150326 | LOT198 | 1550p | 4822140101145 | LOT134 | 1450p | RTRNF 2006 BMZZ | LOT308 | 4350p | 1-439-387-11 | LOT311 | 1450p |
| $00 \mathrm{D}-4.260-004 \mathrm{HTI}$ | LOT38 | 1250p | 433455 | LOT234 | 1600p | 45150328 | LOT27 | 1450p | 482214010146 | LOT112 | 1700p | RTRNF 2007 BMZZ | LOT307 | 1450p | 1-439-387-21 | LOT311 | 1450p |
| $00 \mathrm{H}-0.701-2400$ | LOT 182 | 1450p | 2433521 | LOT85 | 1600p | 45150329 <br> 451503 | LOT193 | 1550p | 482214010151 | LOT102 | 1700p | RTRNF 2023 BMZZ | LOT310 | 1500p | 1-439-416-11 | LOT255 | 1600p |
| 06 D-3-083-001 | LOT82 | 1250p | 2433381 243721 | LOT23 | 1250p | 45150330 | LOT179 | 1350p 1550p | 482214010161 482214010171 | LOT103 | 1250p | SONY 3753100 |  |  | 1-439-416-12 | LOT255 | 1600p |
| 06 D-3.083-002 | LOT82 | 1250p | 2433751 | LOTO1 | 1300p | 45150334 | LOT56 | 1650p | 482214010176 | LOT114 | 1150p | 1.439.243-00 | LOT91 | 1600p | 1.439-416-21 | LOT255 | 1600p |
| 06 D-3.084-001 | LOT23 | 1400p | 2433752 | LOT01 | 1300p | 45150335 | LOT193 | 1550p | 482214010194 | LOT105 | 1500p | 1.439-243-11 | LOT91 | 1600p | 1-439-4 16-23 | LOT255 | 1000p |
| 06 D-3-087-001 | LOT23 | 1400p | 2433752 | LOT250 | 1350p | 45150338 | L0T27 | 1450p | 482214010198 | LOT116 | 1600p | 1-439-243-12 | LOT91 | 1600p | 1.439-446-41 | LOT255 | 1600p |
| 06 D-3-093-001 | LOT204 | 1600p | 2433891 | LOT23 | 1400p | 45150340 | LOT200 | 1400p | 482214010209 | LOT104 | 1500p | 1.439-243-31 | LOT229 | 1700p | $\begin{aligned} & \text { 1-439.476-51 } \\ & \hline \text { 1.439. } 430-21 \end{aligned}$ | LOT255 |  |
| 06 D-3-095-001 | LOT87 | 1000p | 2433892 | LOT84 | 1450p | 45150341 | LOT56 | 1850p | 482214010236 | LOT118 | 1550p | 1-439-243-32 | LOT229 | 1700p | $154125 A$ | LOT275 |  |
| 06 D-3-095-002 | L0T87 | 1000p | 2433893 243952 | LOT23 LOT33 | 1400p 1000p | 45150343 45150344 | LOT 196 | 1550p 1650p | 482214010246 482214010247 | LOT111 | 1500p | $1-439-243-41$ $1-439-24400$ | LOT229 | 1700p 1600 | toshiba |  |  |
| $06 \mathrm{D}-333-512-001$ | LOT204 | 9000p | ${ }_{2434002}$ | LOT200 | 14000p | 45150346 | LOT201 | 1550p | 4822140102470254 | LOT105 | 1500p | 1-439-2444-00 | LOT48 | 1600 p 1600 p | 37010 | LOT131 | 1450p |
| FETX 10090 DEG | LOT04 | 1500p | 2434141 | L0т33 | 1000p | 45150350 | LOT27 | 1450p | 482214010263 | LOT117 | 1550p | 1-439-244-21 | LOT48 | 1600p | 37011 | LOT131 | 1450p |
| FETX 90 WHITE | LOT06 | 1850p | 2434141 | L0т33 | 1000p | 45150351 | LOT27 | 1450p | 482214010269 | LOT210 | 1350p | 1-439-244-31 | LOT48 | 1600p | 37012 | LOT131 | 1460p |
| FETX 100100 DEG | LOT34 | 1500p | 2434274 | Lota | 1050p | 45150375 | LOT56 | 1650p | 482214010271 | LOT208 | 1650p | 1.439.256-00 | LOT45 | 1650p | 37013 | LOT131 | 1450p |
| GRUNDIG |  |  | 2434274 | LOT44 | 1050p | 45161601 | LOT22 | 1250p | 482214010274 | LOT123 | 1450p | 1-439-256-11 | LOT45 | 1650p | 37014 | LOT131 | 1480p |
| 29201.008 .01 | LOT153 | 1750p | 2434453 | LOT86 | 1600p | MITSUBISHI |  |  | 482214010282 | LOT122 | 1300p | 1.439--256-21 | LOT45 | 1650p | 37015 | LOT 131 | 1450p |
| 29201.014 .01 | LOT140 | 1500p | 2434455 | LOT234 | 1600p | 731003 | LOT51 | 1550p | 482214010283 | LOT104 | 1500p | 1-439-256-22 | LOT45 | 1650p | 37016 | LOT131 | 1450p |
| 29201.015 .01 | LOT149 | 1400p | 2434593 | LOT44 | 1050p | 276-16399 | LOT49 | 1500p | 482214010294 | LOT125 | 2150p | 1-439-276-21 | LOT230 | 1700p | 37017 | LOT131 | 1450p |
| 29201.017 .01 | LOT60 | 1250p | 2435062 | LOT296 | 950p | 334807803 | LOT50 | 1450p | 482214010306 | LOT110 | 1200p | 1-439-280-00 | LOT92 | 1600p | 37018 | LOT131 | 1450p |
| 29201.078 .01 | LOT163 | 1300p | 2435121 | LOT87 | 1000p | 334 B 078030 | LOT50 | 1450p | 482214010325 | LOT132 | 1500p | 1-439-280-13 | LOT92 | 1800 p | 37019 | LOT131 | 1450p |
| 29201.01 | LOT61 | 1700p | 2435131 | LOT251 | 1450p | 334 B 08104 | LOT74 | 1600p | 482214010326 | LOT122 | 1300p | 1-439-286-00 | LOT46 | 1300p | 1810951 | LOT55 | 1400p |
| 29201.022.01 | LOT63 | 1700p | 2435671 | L0T89 | 1800p | 334 P 18507 | LOT75 | 1550p | 4822140100349 | LOT284 | 1400p | 1-439-286-12 | LOT46 LOT46 | 1300p 1300 p | 23236023 | LOT281 | 1350p |
| 29201.022.02 | LOT166 | 1600p | 2436201 | LOT109 | 1200p | 5908-05008A-AA | LOT70 | 1500p | 482214010356 | LOT284 | 1400p | 1-439-286-21 | LOT46 | 1300p | 23236052 | LOT131 | 1450p |
| 29201.022 .03 | LOT165 | 1350p | 2436202 | LOT109 | 1200p | D 108/37 | LOT49 | 1500p | 482214010367 | LOT286 | 1400p | 1-439.288-00 | LOT228 | 1750p | 23236098 | LOT288 | 1400p |
| 29201.022.04 | LOT165 | 1350p | 2432101-2 | LOT79 | 1600p | DCF 1577 | LOT273 | 1700p | 482214010369 | LOT109 | 1200p | 1-439-288-12 | LOT228 | 1750p | 23236198 | LOT288 | 1400p |
| 29201.022.04A | LOT165 | 1350p | 2433451H | LOT81 | 1350p | DCF2077A | LOT272 | 1300p | 482214010381 | LOT128 | 1300p | 1-439-289-00 | LOT47 | 1400p | 23236255 | LOT289 | 1500p |
| 29201.024.01 | LOT65 | 1500p | 2433453 H | LOT82 | 1250p | KFS 60226B | LOT279 | 1550p | 482214010384 | LOT127 | 1550p | 1-439-289-21 | LOT47 | 1400p | 23236424 | LOT129 | 1400p |
| 29201.024 .04 | LOT164 | 1400p | 2433891H | LOT23 | 1400p | MSH-1FBW08 | 10778 | 1500p | 482214010395 | LOT116 | 1800p | 1-439-289-22 | LOT47 | 1400p | 23236425 | LOT288 | 1400p |
| HINARI |  |  | 2433892 G | LOT84 | 1450p | NIKKAI |  |  | 482214010406 | LOT73 | 1150p | 1-439-289-31 | LOT47 | 1400p | 23236428 | LOT289 | 1500p |
| 154138 K | LOT24 | 1500p | I.T.T. |  |  | BABYto | LOT67 | 1450p | 482214010421 | LOT109 | 1200p | 1-439-294-00 | LOT93 | 1450p | 3122113837011 | LOT131 | 1450p |
| 51139141 | LOT24 | 1500p | 45150108 | LOT113 | 1400p | ORION |  |  | 482214017078 | LOT103 | 1250p | 1-439-294-11 | LOT93 | 1450p | 150F6D | LOT131 | 1450p |
| 51141841 | LOT24 | 1500p | 45150115 | LOT136 | 1000p | 3714002 | LOT02 | 1500p | SANYO |  |  | 1-439-294-21 | LOT269 | 1550p | TFB 4039 AD | LOT293 | 1550p |
| CF 44 A | LOT24 | 1500p | 45150116 | LOT139 | 1675p | PANASONAC |  |  | 094-00020/0.9 | LOT113 | 1400p | 1-439-303.00 | LOT94 | 1300p | TFB 4048 AD | LOT281 | 1300p |
| HM51-1411834-1 | LOT24 | 1500p | 45150117 | LOT139 | 1675p | TLF 14512 F | LOT39 | 1850p | 094-00035/0.2 | LOT162 | 1350p | 1-439-303-11 | LOT94 | 1300p | TFB 4048 | LOT2 | 1300 |

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| 680 pF | 2000 v | CAP04 | 95p | 2200 pF | 2000 v | CAP11 | 130p |
| 820 pF | 3000 v | CAP05 | 150p | 3300 pF | 2000v | CAP12 | 145p |
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| $47 \mu \mathrm{~F}$ | 6.3 v | CAP15 | 110 p | $1 \mu \mathrm{~F}$ | 50 v | CAP23 | 110 p |
| $100 \mu \mathrm{~F}$ | 6.3 v | CAP16 | 130 p | $2.2 \mu \mathrm{~F}$ | 50 v | CAP24 | 110 p |
| $10 \mu \mathrm{~F}$ | 16 v | CAP17 | 110 p | $4.7 \mu \mathrm{~F}$ | 50 v | CAP25 | 110 p |
| $22 \mu \mathrm{~F}$ | 16 v | CAP18 | 110 p | $10 \mu \mathrm{~F}$ | 50 v | CAP26 | 130 p |
| $47 \mu \mathrm{~F}$ | 16 v | CAP19 | 130 p | $22 \mu \mathrm{~F}$ | 50 v | CAP27 | 180 p |
| $470 \mu \mathrm{~F}$ | 16 v | CAP20 | 320 p | $47 \mu \mathrm{~F}$ | 50 v | CAP28 | 300 p |
| $33 \mu \mathrm{~F}$ | 25 v | CAP21 | 130 p |  |  |  |  |

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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: The following in any condition for spares: Panasonic NVWI and NVV8000, Sony SLHF950 Super Beta. Also require Pro-X Beta tapes. Phone Graham on 01604843536.
Wanted: Circuit diagram for the Amstrad fax Model FX7000. Does anyone know about a dead machine fault that blows the input circuit protector? Laurie Watkinson, Telesonic, Week St. Mary, Holsworthy, Devon EX22 6UJ. 01288341254.
Wanted: A LOPT for the Nikkai Tara 10 portable, also a circuit diagram. A second-hand LOPT would be OK and a photostat circuit. R.J. Long, 70 Bonfields Crescent, Havant, Hants PO9 5ER. 01705479678.
Wanted: LOPT part no. TLF700-24A for the Nikkai Model TLG010 and LOPT part no. BSC-24-10A for the Huanyu Model 37-C3. John McCallan, 72 Mullinslin Road, Omagh, County Tyrone, N. Ireland BT79 9PQ.
Wanted: Mechanical channel selector for the Grundig CUC42 (series 816). D. John, Central Electronics, 6 Queen Street, Stirling FK8 1HN. 01786451 230, fax 01786949830.
Wanted: Any Thorn/Ferguson 3000 series chassis PCBs, especially working. Also LOPTs for the GEC dualand single-standard hybrid colour chassis (Models 2038 and 2040) and an external teletext converter. Pat Hildred, 56 Theydon Street, Walthamstow, London E17 8EL. 0181 9880310.

Wanted: Philips car record player, circa 1960. Any parts, service information or complete units, working or faulty. Martin Randall, 3 Ashcroft Road, Cirencester, Glos. 01285658 715.

Wanted: Service manual and circuit diagram for the Pace MSS200 satellite decoder, photocopies OK. Also a PTV113 chip for this machine, secondhand OK. Wayne Brill, 31 Parnell Road, Ipswich, Suffolk IP1 6SP. 01473742568.

Wanted: Used electronic test equip-
ment such as an oscilloscope with component tester, Fluke digital meter and used service manuals for TV sets, VCRs etc. Allah Rak ha, New Diamond Electronics, 21 Bell Street, London NWl 5BY.
Wanted: Line output transformer for the Decca 30 series (Bradford) chassis, or complete set. D. Newman, phone 01202730935 or e-mail
Newdave07@aol.com
Wanted: LC display for the AVO DAll6 test meter. Also any service information on the Farnell DM131 digital meter. B. Senior, I Bedale Close, Coalville, Leicester LE67 3BA. 01530 832088 or 01530810962.
Wanted: Remote control handsets for the Grundig Model GT1402 and Osaki Model P145R. Also start-up disks for the Amiga A1200 computer. M. Payne, 66 Nevinson Avenue, South Shields, Tyne and Wear NE34 8WP. 01915363744.

Wanted: Panasonic NV430B VCR in working order or not. P. Ward, Petgra Forest Corner, Ringwood, Hants BH24 3JW. 01425475445.
For sale: Many back issues of Television, 490 in all, from the years 1950-1997. Phone or send for details. B.A. Milne, 149 Pleckgate Road, Blackburn, Lancs BB1 8QR. 01254 240315 or 0973510295.
Wanted: Remote control unit for the Proline Model 3200. Also help with no sound after a power supply blow up. H. Foyne, 7 Ennerdale, Tanhouse, Skelmersdale, Lancs WN8 6AG.
For sale: Finlandia 25 in . stereo Nicam model (Salora M chassis) with field scan fault. Also working Philips G11 chassis panels. R. Berwick, 493 Romsey Road, Maybush, Southampton SO16 9GN. 01703787033.
Wanted: Following copies of Television: Aug 1988, July 1989, Oct 1989, Jan 1993, Sept 1995, Oct 1995, May 1998, Aug 1998. Have one surplus Sept 1993 copy. L.C. Dilke, 106 Coldbath Road, Kings Heath, Birmingham B13 0AH.

Wanted: Any service information for a Philips projection TV/radio Model 799 dating from the Fifties, or any details of Philips projection TVs using EF50s. Steve Taylor, 11 Charnborough Road, Coalville LE67 4SF. 01530832695 or 07977805308 .
For disposal: Over 700 valves from AC/VP1 to X65. Please write for details to R.W. Noake, 69 Hazelhurst Road, Kings Heath, Birmingham B14 6AB.
Wanted: Diagrams for building a scratch filter circuit for use when playing worn vinyl or 78 r.p.m. records. A working unit at a reasonable price would be considered. David Evans, 70 Dallow Street, Burton-on-Trent, Staffs DE14 2PQ. 01283573177.
Wanted: Teletext PCB for the Ferguson Model D5IND. W. Simmons, 24 Standhill Crescent, New Lodge, Barnsley S7I ISU. 01226238204.
Wanted: 1 would like to build the Test Card Generator featured in the May/June 1979 issues of Television. Does anyone have the PCBs (D062/3 I think) or any part-built or faulty ones? C. Williams, 32 Aylesborough Close, Kings Hedges, Cambridge CB4 2HH. 01908568745 daytime.
Wanted: Decade resistance and capacitance box. Peter Antcliff, 63 Chester Road, Stevenage, Herts SGl 4JY. 01438225602.

Wanted: Circuit diagram for the Protech 3743 14in. CTV (photocopy OK). C. Rayner, 39 Northway, Lymm, Cheshire WA13 9AT. 01925822673 after 6 p.m.
For disposal: Service department clearance. Large quantity of service manuals, modern types, Sony, Panasonic, Technics, JVC etc. Test gear (scope, signal generators etc.). Large assortment of serviceable CTV sets, VCRs, audio equipment and spares. All very cheap as space is needed for other things. Jolly's Radio Ltd., 128-130 Hawthorn Road, Kingstanding, Birmingham B44 8QA. 01213821312.


## VCR Clinic

Reports from Philip Blundell, AMIIE Chris Watton Gerald Smith Ken Rigby Martyn Davis, MIIE Pete Gurney, LCGI Graham M. Colebourn and Colin J. Guy

## Grundig GV420

If the drum motor is noisy, don't immediately order a new one. Take a few minutes to remove the cover at the base of the motor and check whether the grease on the spindle thrust pad has hardened. Regreasing the pad sometimes cures the noise. P.B.

## Mitsubishi HSB12

If the picture obtained via the RF and scart sockets is poor, i.e. with weak contrast and poor sync, check $\mathrm{C} 2 \mathrm{~B} 4(10 \mu \mathrm{~F}, 50 \mathrm{~V})$ which tends to go low in value. P.B.

## JVC HRDX22

This machine had no control track operation, no playback colour and the tape counter ran very fast. It was all the result of power supply problems. The cure was to replace C24, C25 (both $680 \mu \mathrm{~F}$ ) and C32 $(470 \mu \mathrm{~F})$. C.W.

## Hitachi VTF350

A long list of fault symptoms was attached to this not too old machine: intermittent stops in record, intermittent lines on the picture, picture pauses during playback, sound distorts, mains fuse blows every two months. I suspected the power supply, because of the tell-tale sign of a change in luminance level during eject - this is when the power supply is most heavily loaded and the voltages
drop. Many of the electrolytic capacitors read low when checked with our tester. So I decided to replace the lot: nine on the secondary side of the power supply, two on the primary side. After that the machine worked correctly. C.W.

## Amstrad VCR400F

There was no sound with this machine's recordings. E-E and playback of prerecorded tapes were good, and the erase bias was OK. A check at pin 21 of IC201 showed that the audio was lost here even though rec H at pin 24 was present. A replacement chip restored normal sound. C.W.

## Sanyo VHR251

There were various intermittent faults - speed changes and failure to eject were the most the most frequent. The cause was a row of dryjoints in the power supply. C.W.

## GoldStar T16I

This machine was dead with no clock and no functions. Checks in the power supply showed that the primary side was not running or even trying to start. I replaced the start-up resistor and the $33 \mu \mathrm{~F}$ electrolytic capacitor but the situation was no better. The diodes on both sides of the circuit were OK, also ICP01 and FEP01. The cause of the trouble turned out to be optocoupler ICP02. G.S.

## Ferguson FV62L

This machine was dead with the mains fuse blown and the chopper transistor TP08 short-circuit. After fitting a power supply repair kit the machine loaded but there was no display and no front-key operation. There was also no -25 V output from the power supply, at pin 1 of socket BP02. The negative supply rectifier DP51 was open-circuit.

Once this diode had been replaced the display requested the code to be entered. Everything then functioned correctly. K.R.

## Akai VSG470

This machine would load and play tapes only when the lid was off and light fell on the left-hand tape sensor. It's usually the other way round I thought. The central lighthouse assembly had of course been knocked, possibly because a cassette had been inserted backwards. Resoldering it cured the fault. M.D.

## Samsung SII260

According to its owner this machine had made a whirring noise all night, followed by a burning smell. Why did he leave it on all night? Needless to say there was a tape (nothing interesting!) jammed inside. The KA8301 motor drive chip IC206 had died. A BA6209 from a scrap deck cured the fault. M.D.

## Aiwa HVFX2800

The head-switching point was misadjusted, the result being an unsightly line at the bottom of the playback picture. To set it up in this machine you play back an alignment (or good quality) tape, centre the tracking by pressing the auto-tracking button for more than two seconds, then set the switching point by holding down the play button for more than three seconds. Quite simple really - as long as you know which buttons to press! M.D.

## Amstrad DD8900

The complaint was no play with one deck, fortunately the top one of the pair for a change. While checking I found that fast forward/rewind worked correctly but in play the
take-up reel refused to rotate. The belts were obviously intact, as the only function that didn't work was play, and I initially suspected a drive clutch problem.

Closer examination after inserting a transparent dummy cassette revealed the cause of the trouble: the felt pad on the soft damper to the take-up reel had fallen off. This left only the remnants of the glue that had held it in place on the damper arm. Because direct drive is applied in fast forward/rewind, there was little effect on these operations. But in play the drive is applied via a clutch. This was enough to stall the take-up reel.

A replacement pad, made from a suitable back-tension band, cured the problem when securely glued. P.G.

## Matsui VXII05

This budget centre-deck VCR intermittently failed to load a cassette: either the cassette would be rejected or the machine would fail to complete loading then shut down. In every one of these machines I've come across the cause of this fault is a dirty mode switch. The switches seem to have some sort of lubricant in them from manufacture. After a time it becomes quite viscous. In each case stripping the switch down and cleaning has cured the trouble.

Before you dismantle the switch and deck, make a careful note of the timing marks. They are quite prominent and easy to spot.

While the deck is out, clean the switch/deck edge connectors and their corresponding contacts on the main board. They rely on pressure to make contact and tend to suffer from oxidisation problems. Doing this will improve reliability. P.G.

## Amstrad VCR6000

This old timer was apparently dead. It had no clock display and refused to accept a tape. A check at the power supply output connector produced correct readings however, but the voltages around the main microcontroller chip were low. Further investigation brought me to the nearby 78 L 055 V regulator IC651. Its input was correct, but its output was low at 3.5 V . As I didn't have a replacement in stock I decided to fit the higher-rated 78M05. This restored the display and normal operation. P.G.

## Bush VCR177

This 1996 machine was extremely slow to load or eject a cassette and
play, record or spool a tape. A check at the capstan motor connector showed that the 12 V supply was weak - the voltage fell perilously whenever there was a load. The main items in the 12 V regulator are a zener diode and an npn emitter-follower transistor, Q802. They are on a little heatsink near the front. The transistor was too busy oscillating at HF to attend to its proper job. Its emitter decoupling capacitor $\mathrm{C} 806(47 \mu \mathrm{~F}, 16 \mathrm{~V})$ was in a poor state.

The heatsink is wrapped neatly around the components and gets nice and hot. So all the $85^{\circ} \mathrm{C}$-rated electrolytics can be expected to fail sooner or later. G.M.C.

## Panasonic NVG40/NVG45

There was no front panel fluorescent display because Cl 020 $(330 \mu \mathrm{~F}, 6 \mathrm{~V})$ on the power supply PCB had leaked. It's the reservoir capacitor for the display's heater supply. A $220 \mu \mathrm{~F}$ replacement will suffice, as it's an HF supply, but the rating should be $105^{\circ} \mathrm{C}$.

I was not sure but wondered whether the original had been fitted back-to-front. The leakage from C1020 had corroded the track between DI009 and the -29 V supply's reservoir capacitor Cl 018 ( $10 \mu \mathrm{~F}, 50 \mathrm{~V}$ ). It's worth checking this capacitor as well. G.M.C.

## Mitsubishi HSB82

There was poor E-E picture quality and recordings tended to improve as the machine warmed up. At its worst the picture was very blurred, frizzy and in black-and-white only. "Out of tune!" we declared, but it wasn't. "Dried up surface-mounted electronytics" we roared. Not so. The cause of the problem was cracked solder joints at the vision IF SAW filter inside the IF can. G.M.C.

## Hifachi VTM740/VTF770

The playback pictures were fractured, with horizontal bands of noise. Fortunately the machine's owner had declined a quote to replace the heads, because they were perfectly OK.

Repeated tests revealed that the bands of noise and the headswitching point moved to new positions whenever the drum was stopped between tests, indicating loss of the drum-phase signal. The culprit was Cl $656(10 \mu \mathrm{~F}, 25 \mathrm{~V})$, which passes on the drum-phase pulses at pin 11 of the 15 -pin connector PG1643 on the main PCB. G.M.C.

## Samsung VIK320

The power supply was pulsing gently because of a short across the PC12 output. This rail follows a long and tortuous route all over the PCB. I eventually found that the cause of the trouble was C502, a $100 \mu \mathrm{~F}$ electrolytic which is mounted next to the audio chip IC501.

## C.J.G.

## Goodmans VP2350

This Philips clone wouldn't record in colour. The expensive LA7437A luminance/chrominance processing chip was the cause of the fault. C.J.G.

## Panasonic NVL20

The picture would break up into lines in forward search only. In these machines the cause is often lower drum wear. Not this time however. In fact there was more or less normal operation when the control head pins were shorted together. The culprit was the servo/syscon chip IC2001. C.J.G.

## Philips VR6185

This Charlie deck machine slammed the tape against the endstop on rewind, as often as not breaking the tape. The infra-red LED in the centre of the deck was open-circuit. There is obviously no safety circuit as there used to be when bulbs were used for this job. C.J.G.

## Samsung VI710

These old machines can still give a good account of themselves when in good order, and are therefore worth repairing. This one worked all right in the E-E and playback modes, but when record was selected the E-E picture disappeared. The record 9 V line was found to be low, in turn because the PC12V line went low when record was selected. The cause of the trouble was Q105 (2SB772) which was open-circuit base-tocollector. C.J.G.

## Mitsubishi HSB12

The carriage continued to try to eject when fully out, followed by shut down. If a tape was wound in manually it would be played normally. The cause of the trouble became obvious when I rewound the tape: it hit the endstop then broke. The infra-red LED at the centre of the deck was faulty. It was conductive and wasn't shortcircuit, but didn't emit any IR radiation. A replacement cured the carriage problem. C.J.G.

As a follow-up to last month's article on the Indiana 100/200 chassis, Alan Dent provides fault notes on the different tuning/control PCB used in the $\mathbf{2 0 0}$ version

## the Indiana 200 chassis

This chassis is very similar to the Indiana 100 , which was covered in detail last month. The exception is the TCR (tuning control) panel, which also contains the colour decoder and, where incorporated, the teletext decoder chips - some models don't have teletext. The remote control handsets are also different. Some versions made in Romania have an electronicallyswitched AV board.
For fault conditions not covered below, refer to the Indiana 100 chassis.

## TCR Panel

This panel houses the PCA84C640/030 microcontroller chip IC300, which has $\mathrm{I}^{2} \mathrm{C}$ bus connection. It provides the following functions: key panel control; tuning and analogue memory control; AFC; on-screen display (OSD) generation; and teletext control. The device has proved to be fairly rugged - unless there's a serious CRT flashover.
Tuner band switching is used in Irish and continental models only. The OSD displays the band selected and auto-switches at the end of each sweep. The bandswitching components are deleted in UK models - a 12 V supply is hardwired via link Jl to the tuner and the OSD band switching is disabled by fitting link $\mathbf{J} 2$.
Fault conditions experienced with this panel have been as follows.

No tuning but the OSD progresses: Check the output at pin I of IC 300 . There should be a 5 V peak-to-peak squarewave whose mark/space ratio changes as the tuning progresses. Check the 33 V tuning voltage supply: if low replace D001 (ZTK33) and C001 (the CRT may have flashed over). Q300 could be faulty or R312 opencircuit.

Tuning drift outside AFC: The gain of Q300 could be changing; the value of R312, R313, R314 or R364 could be varying; C304, C306 or C322 could be leaky; the connector pins of K300 or the PCB tracks to the tuner could be intermittent. The mark/space ratio of the squarewave output at pin 1 of IC300 could be changing: this is unlikely, but if so check X300 and IC300.

AFC drift: Check whether the tuning voltage is changing ( $1 \mathrm{~V}=15 \mathrm{MHz}$ ). If the voltage is stable, set up the AFC - follow the method laid down in the manual. If drift is still experienced, check R327/8, Q307 and C309 which could be leaky.

Will not stop sweep tuning: Ident at pin 29 of IC300 missing when a video signal is passed. Cause may be pin 6 of K300 open-circuit or any components associated with Q310/1.

Slow tuning and slow function operation: Scope the SDA and SCA lines. If there are bursts of pulses, not continuous, IC900's 12 V supply is missing (text only models). This upsets the data and clock lines. Check where the tracks go via the small interface PCB: the 12 V line is likely to be broken here.

Keyboard matrix faulty: The cause is usually K301 or the ribbon wire broken at the control PCB. If, with Turkish produced models, only one button is faulty it can be removed, rotated through $180^{\circ}$, and refitted. With Romanian produced models the button must be replaced if cleaning does not cure the fault.

No OSD or wrong colours: The outputs at pins 22/23/ 24 of IC300 are fed to IC500 via a resistive network and IC302. If one of the colours is/are missing, check IC302 and the resistor matrix. Check the V synch or sandcastle inputs at pins 26/27 of IC300 if there is no OSD.

OSD display cramped: R362 sets the OSD timing oscillator. C315 is the timing capacitor.

OSD jittering: The $V$ sync signal is missing.
The microcontroller won't come out of standby unless the mains button is held in: IC300 has been damaged by a CRT flashover. For protection, fit a 100 nF capacitor between pins 36 and 41.

TV starts up without start-up contacts: D308 is shortcircuit.

Memory will not store and fast sweep on first pass: R391 is open-circuit.

Memory will not store: Check whether R390, R369 or R370 is open-circuit. IC302 could be faulty.

Fusible resistor R1329 (33 2 ) open-circuit: This can occur with non-text sets. Some batches of IC1300 with date codes 5 W or 5 WX can cause large currents to flow when C1323, which is fitted to protect IC1300 in the event of a CRT flashover, is 100 nF . Reduce the value of Cl 323 to 4.7 nF - it will still provide protection.

## Teletext

The text chip set is totally different from that used in the 100 chassis. It's controlled by IC300 via an $\mathrm{I}^{2} \mathrm{C}$ bus. While various options could be fitted, i.e. Fastext, Tops Text or different languages, in production the chassis was fitted with only a standard four-page text option.
The text contrast is not set by the microcontroller chip: it's set by a resistor network around IC302.
Text faults are as follows.
No text, bar at top left of screen when text is selected: The SCL line to IC901 travels around three-quarters of the PCB at the edge. In some cases this track may have been broken or badly etched around the corner, where there is a mounting hole.

No text, blank raster: Check the RGB outputs from IC901. Check the sandcastle pulse input at pin 11 of IC901. Check the I ${ }^{2} \mathrm{C}$ clock and data lines to IC901.

Corrupt text: Check the alignment of the video detector coil L102 on the main PCB: try turning its core a quarter of a turn each way to correct. IC900 could be faulty; C917/1917 (1nF) could be leaky; C916/1916 (470pF), C914/1914 (270pF) or C913/1913 (100pF) could be open-circuit.
The problem can also be caused by RAM (IC902) address or data failure: the display will be random, i.e. the symptoms may change each time text is selected.

No text, headers and page no. OK: C915/1915 (22nF) is open-circuit.

No text, page no. only: X901/1901 (13.875MHz) could be faulty. Any of the following could be open-circuit: C909/1909 ( 27 pF ), C912/1912 ( 15 pF ), L900/1900 $(15 \mu \mathrm{H})$.

Text not synchronised: No video input via K900 or X900/C908 misaligned.

## Striations

In its unmodified form this chassis can show unacceptable striations because of excessive radiation from the line output transformer and the long leads that connect the main PCB to the TCR panel. Several modifications, as follows, are required to cure the problem:
(1) Fit a screening can around the LOPT.
(2) Remove connector K501 from the main PCB. If it has not been modified, remove the ribbon wires to pins 8 and 9 and make the same disconnection at the connector on the TCR panel. Fit a small DIMS screened lead to the connector at the TCR end: connect the other end to a hole adjacent to R508 and the luminance delay
line (only the centre wire is connected at this end).
(3) Change the value of C 009 from $10 \mu \mathrm{~F}$ to $100 \mu \mathrm{~F}$ or replace the Telefunken 3010 tuner with a Philips type U910.

## Flashovers

Quite a number of 20 in , sets were fitted with an Orion 22 mm mini neck tube. This is prone to flashover, which can destroy IC300 (PCA84C640/030), D00I (ZTK33) and IC500 (TDA3561). These components can be protected, without need to replace the tube, by carrying out the following modifications:
(1) To protect IC300, add a 100 nF capacitor between pins 36 and 41 , on the rear of the PCB.
(2) To protect D001, increase the value of C 001 from 1 nF to 100 nF .
(3) To protect IC500, add a $100 \mathrm{nF}, 250 \mathrm{~V}$ capacitor across C709 on the tube base panel.

## Remote Control Units

The handset contains an SAA3010 chip with a matrixstyle keyboard and a pair of IR diodes. If there's no operation, check the output from the IR detector. If there's no output, check the battery voltage, the battery contacts, the ceramic resonator and the IC.

## Make sure you get your copy of TELEVISION

It can be difficult finding a copy of Television at local newsagents. The number of magazines being published keeps on increasing, which means that newsagents have less shelf space for the display of different publications. Specialist magazines in particular get crowded out.

There's a solution to the problem. Most newsagents provide "shop-save" and/or homedelivery services. There's no charge for a shop save. You simply ask your newsagent to order a copy for you: it will be kept on one side each month ready for you to collect. Home-delivered copies are ordered in the same way, but often incur a delivery charge.

A newsagent can order any magazine for you, whether or not the shop normally stocks it.

If you buy your copies of Television from a newsagent and want to make sure you get every issue, just ask at the counter.


Part 3 of K.F. Ibrahim's series tells you everything you need to know about the various types of memory devices and the way in which computer memory is used

## Operation <br> \& Repair

Acomputer requires memory devices to store programs and routines. These consist of sequences of instructions and related data. Memory is also used to store temporary or permanent data that's used or created by the program. When a program is being run, the CPU will need access to the memory store at a rate of $10-50 \mathrm{MHz}$.
In theory any type of memory store can be used, including a disk drive, provided it's large enough to store the program instructions and associated data. But because disk drives are extremely slow in comparison with the speed at which the CPU operates, use of them as the main processor memory is impractical - the processor would spend more of its time waiting for access to the disk drive than carrying out program instructions. Thus the main memory, where application and other support programs are loaded, must operate at a speed comparable to that of the CPU. This means a memory store that consists of integrated circuits. A small amount of memory is also provided in the processor itself.

## Memory chips

Two main properties determine the use of particular types of memory chip: these are the storage capacity

Table 1: Memory chip comparison.

| Property | DRAM | SRAM | ROM | EPROM | EEPROM | Flash |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |
| Capacity | MB | KB | KB | KB | KB | KB |
| Speed (ns) | $60-120$ | $20-40$ | 200 | 400 | 400 | 100 |
| Life span | Long | Long | Long | Short | Short | Short |

(size) and access time (speed).
A memory chip contains a number of locations, each of which stores one or more bits of data (the bit width). Storage capacity is the product of the number of locations multiplied by the bit width. For example a chip with 512 locations and a 2-bit data width has a memory size of $512 \times 2=1,024$ bits. Since the standard unit of computer data is a Byte ( 8 bits), this storage capacity is normally expressed as $1,024 \div 8=128$ Bytes.
The number of locations depends on the chip's address width. For example a 2 -bit data width chip with 10 address lines has $2^{10}=1,024$ locations. This is referred to as 1 K locations. Given an 8 -bit data width, a 10 address width chip has a memory size of $1,024 \times 8=1 \mathrm{~K}$ $\times 1$ Byte $=1 \mathrm{KByte}$ or 1 KB .
In practice a number of chips are usually connected in parallel to form what is known as a memory bank.
Access time is the speed at which a location within a memory chip can be made available to the data bus to which the chip is connected. It's defined as the time interval between the instant when an address is sent to a memory chip and the instant when the data stored at the address location appears on the data bus. Access time is specified in nanoseconds (ns). It varies between 20 ns and the relatively slow 200 ns. Table 1 compares the characteristics of various types of memory chip.

## Chip markings

The marking on a memory chip indicates its size and speed. A typical configuration is

XXXYZZZ-S
where XXX is the manufacturer's identity, Y the bit
(data) width, ZZZ the number of locations in K and S the speed in ns. A speed indication of - 60 means a speed of 60 ns . Sometimes the last digit is missing, e.g. - 10 . This indicates a speed of 100 ns , since the fastest access time is 20 ns . The number of locations (two or three figures) is a standard size, e.g. $64 \mathrm{~K}, 128 \mathrm{~K}, 256 \mathrm{~K}$ and 512 K . One Mega Byte (MB) is usually indicated by $1000,1024,100$ or $10,4 \mathrm{MB}$ by 4000 or 400 . The number to the left of the location specification is the data width, in bits. Hence TMS 841 128-7 indicates a chip with 128 K I-bit locations and an access time of 70 ns .

## RAM

The Random Access Memory (RAM) is a volatile memory chip that can be used to read data from or write it into - it's also known as a read/write memory. Data is held in the device for as long as DC continues to be applied to it. There is random access to locations by putting the selected location address on the chip's address lines. Fig. 1 shows RAM chip connections. In addition to the address lines and the data input/output connections there are three control lines, which are all active low: write enable ( $\overline{\mathrm{WE}}$ ) goes low when the CPU wishes to write (insert) new data at the selected location; output enable ( $\overline{\mathrm{OE}}$ ) goes low when the CPU wishes to read (extract) data from the selected location; chip select ( $\overline{\mathrm{CS}}$ ) goes low when the selected location is within the address range allocated to that particular chip.
There are two main types of RAM, dynamic (DRAM) and static (SRAM). DRAMs store information in the form of a charge on a MOS capacitor. Because of leakage, the charge is lost and thus has to be restored at frequent intervals - between $2-4 \mathrm{~ms}$. This process is known as refreshing the memory cells. The advantages of a DRAM are high storage density and very low power consumption. SRAMs use flip-flops as the basic storage cell and require no refreshing. They are very fast: the access time is 20 ns or less, compared with a DRAM's 60 ns . But they are more expensive than the dynamic variety. This inhibits their use as the main memory store in a computer system.

## Multiplexing

Because of their low cost and high storage capacity DRAM devices provide the bulk of computer memory a few Mega Bytes. As the number of address pins that would be required to accommodate this memory size is physically inhibitive for manufacturing purposes, address multiplexing is used. Fig. 2 illustrates this.
A multiplexer chip receives the full complement of twenty address lines from the address bus. The address is then fed to the memory chip in two stages, first A0A9 then A10-A19 - to the same memory chip pins. Two memory chip control pins, /CAS (Column Address Strobe) and /RAS (Row Address Strobe), route the two address sets to two internal latches. The full address is then held within the memory chip for long enough to give access to data at the selected location.

## NV-RAM

The data stored in a RAM chip can be preserved when the mains supply is disconnected by using a back-up battery to maintain the DC supply. To avoid the need for back-up batteries the non-volatile RAM (NV-RAM) can be used. In an NV-RAM chip each memory cell has a shadow non-volatile storage transistor. Data is fed to the cells in the normal way, but can be transferred to nonvolatile storage cells when an enable signal is applied. The main disadvantage of this type of device is its reduced component density - about five times the chip


Fig. 1: Connections to a RAM chip.


Fig. 2: Principle of multiplexing.
area of a normal RAM is required to provide the same storage capacity. Another disadvantage of the NV-RAM is its relatively long access time.

## ROM

Although computer memory consists mainly of RAMs, ROM (Read Only Memory) devices are also required. They store the start-up program, configuration details, input/output routines and conversion tables. Compared with RAMs, ROM devices are slow, with a typical access time in excess of 200ns. This makes them unsuitable for applications, such as video graphics, where fast memory access is required. There are several types of ROM device.
Mask ROM is a non-volatile memory that stores data permanently. The stored data can only be read: new data cannot be written into the device. A ROM of this type is programmed by the manufacturer in accordance with a preset specification, and once entered the data cannot be altered.
PROMs (Programmable Read Only Memories) fulfil the same basic function as a ROM device but can be programmed by the user, a process known as 'blowing' the chip. Once it has been programmed, a PROM cannot be altered.
The EPROM (Erasable Programmable Read Only Memory) overcomes this limitation, enabling the user to delete or erase the stored data and thus change the program. The program stored in an EPROM can be erased by exposing the memory cells to ultra-violet light via a 'window' in the IC package. This process takes 20-30 minutes, after which the IC is in a 'blank' state ready to be reprogrammed.
The EEPROM (Electrically Erasable Programmable Read Only Memory), which is also known as an EAROM (Electrically Alterable Read Only Memory), can be programmed and erased while still in circuit by the application of suitable electrical signals.

# A Run-on Timer Circuit 

# This delayed switch-off arrangement, devised by Keith Cummins, could find several uses. The basic aim was low cost with reliability 

There are situations where something needs to be switched off, but not immediately. My problem arose with an extractor fan that vented steam from the shower: it was a nuisance to have to get up and switch it off after going to bed. Hence this run-on timer, which had to be inexpensive but reliable.

## Design Considerations

The power supply is often the most costly part of a piece of equipment, so I decided to investigate the feasibility of a design that didn't require a mains transformer. As the idea developed, it became clear that the unit could be used to replace a switch connected by a two-core cable. This opened up a further application: it could be retro-fitted to control lighting.
The delay time often needs to be quite lengthy, up to say fifteen minutes. While a 555 timer chip can provide such a delay, the time-constant has to be correspondingly long, involving high resistance and large capacitance values. I've always tried to avoid this, believing it preferable to use a binary divider to count down clock pulses generated at a higher frequency. This is the technique used in the design presented here.
Use of a counter is also helpful in that it can provide an output to drive a flashing LED. The unit employs two industry-standard CMOS ICs that are readily available and cost a matter of pence.
Fig. 1 shows the basic switching and power supply arrangement. It operates by 'stealing' voltage from the load. In the 'off' state the switch is open. Mains voltage is fed via the load, in my case the fan motor, to a bridge rectifier which produces an output that consists of unidirectional peaks. As a result capacitor $C$ is charged via resistor $R$, the potential thus developed being held at 12 V by zener diode D. The CMOS circuit used requires only a small current, so the value of $R$ can be high. The small current $(2 \mathrm{~mA})$ is insufficient to affect the load.
In the 'on' state the switch is closed, shorting out R. The output from the bridge rectifier is clamped at 12 V by the zener diode, and the rest of the mains voltage appears across the load.


In the circuit to be described, the switch in the basic circuit is replaced by a set of relay contacts.

## Full Circuit

Fig. 2 shows the complete circuit. In this practical arrangement a fuse is included and a VDR provides protection when an inductive load is being switched. The relay contacts are arranged as two sets in series to provide adequate voltage-handling capability.
IC1, a 4001 device, contains four two-input NOR gates. Two are used as a LF oscillator to provide clock pulses for the 4020 counter IC2. The other two NOR gates are used as a latch.
In the load-off state, rectified mains pulses, attenuated by R2 and clamped by D2, are applied to the latch (pin 1), which is thus held in its reset mode. Pin 4 is high, so Trl is off. Thus no voltage is applied to the relay coil or $\operatorname{Tr} 2$ and the relay contacts are open.
When SWl is closed, 12 V is applied to pin 6 of IC1. Pin 4 goes low and Trl turns on. Although the current via R1 is insufficient to energise the relay, C 1 has sufficient charge to pull it in, closing its contacts. When the contacts close, the much larger current flow provides enough energy to keep Cl charged and the relay energised.
Closing SW1 also resets IC2 (pin 11). Its outputs, including the ones which we are using here (Q4 pin 7 and Q14 pin 3), are low. As Tr 2 now has voltage at its emitter and Q4 is low, $\operatorname{Tr} 2$ switches on and D4 lights up.
When SW1 is open-circuited, the supply to pin 6 of ICl (set) and pin 11 of IC2 (reset) is removed. The latch does not reset, because Q14 is still low and there are no attenuated mains pulses via R2 - as the relay contacts are closed, the input end of R 2 is at 12 V instead of receiving 340 V peaks.
IC2 now starts to count each input from the clock oscillator, which runs at about 5 Hz . Output Q4 pulses high and low, switching Tr 2 off and on. The LED thus flashes to indicate that the unit is timing out. This is especially useful if a pull-cord switch is used.
Once IC2 has counted 8,192 transitions, output Q14 goes high. This resets the latch. Trl switches off, the relay and consequently the load are de-energised, and the LED goes out. The mains-derived reset pulses ensure that the latch cannot set 'by accident', and the unit awaits the next 'on' instruction.

## Delay Time

The clock oscillator frequency determines the delay time. It can be adjusted by altering the value of R5. The frequency of a complete cycle, i.e. two transitions, is given by

$$
f=1 /(2.2 \times \mathrm{R} 5 \times \mathrm{C} 2)
$$



With the values used here, this works out at 4.54 Hz . When I checked this I found that the actual frequency with the prototype unit was 5.2 Hz , presumably because of component tolerances. The number of transitions per second is thus 10.4 and the total delay is $8,192 /(10.4 \times 60)$ $=13$ minutes.
If you want a different time, just change the clock frequency. For example, if R5 is $470 \mathrm{k} \Omega$ instead of $1 \mathrm{M} \Omega$ the delay time will be about 6.5 minutes. Increasing the value of R 5 to $2 \cdot 2 \mathrm{M} \Omega$ will provide a delay of nearly half an hour.

## Design Detail

If you need to be able to cancel the run-on, simply connect a push-to-make switch in parallel with D2. The latch can then be reset manually.
I would like to be able to claim that the circuit worked perfectly first time. It didn't! At the end of the time-out the sequence would sometimes immediately restart. The cause was a transient induced on the latch set line when the switch was off and the opening relay contacts interrupted the inductive load. The problem was cured by adding C3.

## Construction and Testing

Stripboard is suitable for constructing the unit. A point to watch is the clearance between the high-voltage part and the rest of the circuit. It's best to cut away unused strips and provide a clearance of at least 3 mm . The stripboard panel can be housed in a small plastic box: I used a small Maplin project box that cost about $£ 1.50$.
Because of the lack of mains isolation, you need to be careful when testing the unit. I used a mains isolating transformer and, as the load, a 15 W bulb. You can then connect the scope's ground to the notional 0 V line with relative safety - though you still don't want to place a finger across the open relay contacts!
The current switching capacity of the unit is determined by the ratings of the bridge rectifier, the relay and D1, which is a 5 W device permitting approximately 400 mA . The quiescent dissipation is about 500 mW , mostly in R1, costing possibly 30 p a year. I see no reason why these components shouldn't be 'beefed up', except perhaps that the energy 'stolen' from the load and dissipated in a large zener diode could be considered excessive.

Lastly, beware: C 1 has to charge via R 1 before the circuit will work. So, when power is initially applied, allow about twenty seconds to elapse before switching on. Should the power fail while SW1 is closed, i.e. in the per-manent-run state, switch off to enable Cl to charge fully when power is restored. Under normal conditions, with power constantly applied, the switch can be operated without any limitations.
If the unit is to work in the run-on mode only, without the permanent-run facility, replace the switch with a push-to-make button or a biased-toggle type.

Fig. 2: Circuit diagram of the complete unit.

## Parts list

| C1 | 2,200 $\mu \mathrm{F}, 16 \mathrm{~V}$ electrolytic |  |  |
| :---: | :---: | :---: | :---: |
| C2 | $0.1 \mu \mathrm{~F}, 63 \mathrm{~V}$ polyester |  |  |
| C3 | 10 nF , 63V ceramic |  |  |
| BR1 | KBPC104 | 400 | 1A |
| D1 | 1N5349B | 12 V |  |
| D2, 3 | 1N4148 |  |  |
| D4 | LED not critical |  |  |
| IC1 | 4001B |  |  |
| IC2 | 4020B |  |  |
| Tr1, 2 | ZTX550 |  |  |
| VDR | 275V AC transient voltage suppressor |  |  |
| R1 | 120k $\Omega$, 1W 5\% |  | carbo |
| R2 | $2.2 \mathrm{M} \Omega, 0.5 \mathrm{~W} 5 \%$ |  | high- |
| R3/6/7/9 | 10 k ת |  |  |
| R4 | $100 \mathrm{k} \Omega$ |  |  |
| R5 | $1 \mathrm{M} \Omega$ |  |  |
| R8/10 | $3.3 \mathrm{k} \Omega$ |  |  |
| R11 | $1 \mathrm{k} \Omega$ |  |  |
| All 0.25W $5 \%$ metal film unless otherwise stated |  |  |  |
| F1 | 500 mA quick fuse |  |  |
| SW1 | Switch as required |  |  |
| RL | Maplin BT47/6 relay, $12 \mathrm{~V} 750 \Omega$ |  |  |

PX1 (Maplin) ABS box ( $49.5 \times 99.5 \times 40 \mathrm{~mm}$ )
IC sockets, stripboard, sleeving, interconnecting wire etc.


DX and

# Satellite Reception 

Terrestrial DX and satellite TV reception. UK transmissions update
and latest satellite TV news. Eclipse '99. The bookies TV channel.
Roger Bunney reports

The Maharishi Open University, received as a digital signal from Eutelsat II $F 3$ at $36^{\circ} E$.

Prior to the start of the 1999 Sporadic E season in this hemisphere the first SpE signals were received by Ryn Muntjewerff in the Netherlands on March 13th. He logged RAI (Italy) ch. IA for over half an hour, in the morning. RTS (Serbia) ch. E2 was also present during this period. Two Czech Republic transmitters, operated by TV Nova, are possible SpE catches: Cukrak ch. R1 at 25 kW and Ceske Budejovice-Klet ch. R2 at 10 kW - these are transmitter powers, so the ERPs should be several times greater. There has not been any F2 activity to date, and I don't expect reception of this type until the autumn. Tropospheric propagation at UHF lifted slightly in mid-March, but produced only Benelux signals in SE England.

A letter from Todd Emslie

(Ryde, NSW, Australia) mentions late-season SpE reception from New Zealand during February/ March. His TE (transequatorial) skip reception of signals from China and other Asian sources was perhaps more dramatic. Late afternoon/evening TE reception appears in his log from March 7th onwards. It includes Chinese reception in chs. $\mathrm{C} 1(49.75 \mathrm{MHz})$ and C 2 ( 57.75 MHz ), with video and audio carriers plus offsets. Other TE reception includes Thailand and Malaya ch. E2.

It's interesting that Todd heard the 'Russian Woodpecker' at $43 \cdot 65 \mathrm{MHz}$ on several occasions. This is a mega high-power jammer. I thought that it had long since ceased to operate - it was the curse of short-wave listening!

Most of these signals were picked up by Todd's Icom R7000 scanner rather than a TV set, but it does show that the maximum usable frequency (MUF) is on the way up. In a final comment Todd says that he is not too happy about the move from analogue to digital TV. He asks whether there is a chance of digital DX?

Enthusiasts have in general been cautious about the advent of digital satellite TV. It has been somewhat painful, with most of us experiencing a sharp learning curve. The ideal digital satellite receiver for 'DXing' has still to appear: most models seem to have odd quirks and operating problems. But we are slowly coming to grips with digital
sat zapping. Perhaps we will be successful with digital terrestrial DX-TV, though I suspect that this will be a much more frustrating matter, and that terrestrial DX-TV will largely come to an end with the cessation of analogue TV. Maybe I'll be proved wrong.

## Satellite Sightings

There has been much about the Kosovo crisis from the Clarke belt. Unlike earlier conflicts (Bosnia, Baghdad) when satellite uplinks continued to operate in the war area, the Serbs quickly kicked out most journalists/TV crews who departed to Italian air bases or neighbouring countries. Lack of coverage initially concealed the full extent of the ethnic cleansing horror, but the refugees who appeared at the borders soon confirmed what was going on. As I write this at 2100 on 30/3/99, the APTN feed ( 11.684 GHz H, SR 5632 , FEC 3/4) is uplinking from Skopje with depressingly familiar pictures of the refugees. The UK Sislink 29/UKI148 , with ident flagging as ' 9 MHz 2PAL', is at Gioa Del Colle ( $11.580 \mathrm{GHz} \mathrm{H}, \mathrm{SR}$ and FEC same as APTN).

Jim Scofield (Lake, IW) has provided an update of Yugosaly zone uplinks via Eutelsat II F3, which is now at $36^{\circ} \mathrm{E}$. CNN has moved its uplink to the Italian airfield at Monte Negro, though the flag indicates that a Newsforce (Farnham) uplink unit (NewsforceCNN) is being used. Jim mentions an RTV

Moscow feed that carries BBC newslinks at 11.6 GHz H , again $5632,3 / 4$. Other sightings include Belgacom digital at $11 \cdot 173 \mathrm{GHz} \mathrm{H}$, and a weaker feed at 11.096 GHz H that causes digital breakup with ITV and Channel 4 inserts (both 5632, 3/4). Amongst all these Jim noted a Russian programme, suspected as being Armenian, at 12.578 GHz H and the unusual 4338 SR, 1/2 FEC.

Most of these were present when I checked with my RSD ODM300, though several of the signals were dancing tantalisingly at half strength on the signal-strength scale, with the FEC etc. in lock but picture sync refused. It's clear that in times of conflict 'emergency' news feeds will be digital, the advantages being lower power, smaller dishes etc. Satellite enthusiasts will have to make the move to digital sooner rather than later. I've seen no analogue feeds from the Yugoslav conflict region yet.

It was interesting to monitor the RTS satellite programme from Belgrade via Eutelsat II F2 at $10^{\circ} \mathrm{E}$ ( 11.596 GHz H in clear PAL): the bombing has been reported with no mention of the plight of the Albanians. Programming included many repeated video inserts that feature a montage of Serb jets in a clear sky, army personnel running and firing weaponry, the navy patrolling empty seas etc., all for morale boosting.

A couple of readers report seeing Yugoslav news/war material via Intelsat 801 at $31.5^{\circ} \mathrm{W}$, so it's worth checking across the Clarke belt. Eutelsat W2 at $16^{\circ} \mathrm{E}$ is another news bird: it operates in the Telecom band - check the 12.5 $12 \cdot 6 \mathrm{GHz} \mathrm{H}$ spectrum. Hugh Cocks (Algarve) has sent a long listing of Yugoslav feeds - all digital!

Eutelsat II F3 at $36^{\circ} \mathrm{E}$ is a busy craft. Most mornings feature live inserts for the Channel 4 Big Breakfast programme (try 11.674 GHz H , analogue) while the BBC's SNG unit UKI-234 starts early with Scottish input. On the 30 th , at 11.010 GHz H PAL with 6.6 MHz sound, there was coverage of Alexander Ferguson, MBE, being given the freedom of Aberdeen. This was from 1800 onwards and included a trip around the town in an open-deck bus. Tesco's car park at Northampton was the scene of an event on the 28th, with CITV uplinking live material for a children's programme at about $0900(11.636 \mathrm{GHz}$
H); then, at 1110, SIS 18 UKI-45 came up (on the same frequency) with It's Your Shout live from Winson Green prison.

A test transmission for Kurdish TV. appeared earlier in the month via Eutelsat W2 at $16^{\circ}$ E. The smudgy VHS-quality pictures relating to hostilities were in clear PAL from $1700-1900$ at $11 \cdot 163 \mathrm{GHz} \mathrm{H}$.

In all a busy month. Perhaps the most unusual sighting was via PAS-3R/6 ( $43^{\circ} \mathrm{W}$ ) on March 12th at 12.698 GHz V PAL when extracts from the American Robin Byrd Show, produced in "midtown Manhattan", presented several min-imally-clad ladies doing remarkable things, then with equally minimal-ly-clad males participating - hard porn in fact, with music and in clear PAL. The Sound of Music was never like this! Uplinked by the SITN facility in New York, the transponder's carrier was subsequently cut and the screen went to noise .

## The Bookies TV Channel

 Several trade readers have queried whether domestic customers can subscribe to the SIS TV racing feeder service that can be seen in high street bookie shops. The SIS coverage is clearly marked in the horse-racing sports pages of daily newspapers.I checked with Gordon Smith of SIS who confirmed that the service is for licensed bookie shops only and is not available to domestic viewers, even if they consider themselves to be professional gamblers and are prepared to pay the subscription fee and for the installation (via $27.5^{\circ} \mathrm{W}$ ), decoder etc. The bookie SIS service includes other sports such as greyhound racing. SIS also produces the Racing Channel via Astra. This is intended for the viewing/gambling public.

## Terrestrial Matters - UK

NTL has recently signed contracts with the ITV companies, including Channel 4, to maintain analogue transmissions throughout the UK until 2012, in effect confirming that the present analogue system will remain in operation for the next decade at least. But there are optout clauses should the government of the day decide on an earlier close down in favour of total digital terrestrial transmission. The total contract is worth over $£ 500 \mathrm{~m}$.

The use of SRBR (Short Range Business Radio) equipment in the


49 MHz and 461 MHz bands for paging is to be discontinued from December 31st 2003. The issue of SRBR licences will end in Seplember. Eight new channels for speech/paging will be provided between $446 \cdot 00625-446.09375 \mathrm{MHz}$, with 500 mW maximum ERP, under the PMR446 authorisation code.

There have been murmurings
Aerial Techniques

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Jordan TV test pattern via the Eutelsat Hot Bird slot at $13^{\circ} \mathrm{E}$.
about digital transmissions causing interference to established analogue transmissions. My domestic terrestrial TV reception is from

Rowridge, IW (group A). BBC-I on ch. 31 has digital transmissions on the adjacent chs. 30 and 32 . As a result my previous noise-free (Sky News quality) picture has become grainy, the effect being similar to that produced by a weak signal. An ex-TVS colleague near Eastleigh has been suffering from Nicam noise problems with BBC-1 since the start of the digital transmissions from Rowridge. The digital transmissions seem to ignore the normal channel guard spacing for minimal adjacent channel interference. Have other readers been experiencing interference to their local signals? Perhaps someone from the broadcasting side would like to comment.

## Eclipse '99

On August 11th there will be a total eclipse of the Sun across the South West (Cornwall, S. Devon, Portland and part of the Channel Islands) between 1012-1018 GMT. The path of darkness will then track south east to Le Havre (1020), Munich (1038) and the Hungarian/Austrian border (1053). When the sun's radiation is removed, partial night-time propagation conditions will be present. For example E-layer reflection will occur in the MW band because of loss of the absorbent daytime $D$ layer. Unusual fading effects will occur along the path of the eclipse.

In theory August will still be within the ' 99 SpE season, so unusual sitings may occur in Band I. Unfortunately it will be a
working day for most of us, but if you are at home that morning I hope you will take advantage of this once-in-a-lifetime opportunity - the next total eclipse will be in 2090 . 1 suggest you start monitoring about half an hour before the eclipse, to be able to assess 'normal' conditions. Monitor Band I (ch. E2/Rl if clear of interference) and, for interest, perhaps a MW frequency. Please let me know of any unusual signal propagation. Don't sit indoors throughout the event, and pray for clear skies!

## The Antipodes

Wenlock Burton (Victoria) reports that during the HSV-7 digital test transmissions on ch. A6 he lost his reception of VTV-6 Ballarat under digital white noise. The digital test transmissions were subsequently suspended because of concern, from the Epworth hospital, over possible interference to heart monitors. The suspension was announced by GTV-9 and has been confirmed by Robert Copeman.

This solar cycle may present the last opportunity for us in the northern hemisphere to receive low-VHF TV transmissions from Australia and New Zealand via F2 reflection. So let's hope for good conditions this autumn.

A few Australian ch. A0 $(45 \cdot 25 \mathrm{MHz})$ and New Zealand ch. 1 ( 46.25 MHz ) transmitters are still on air. In Australia there are just ABNM-0 Wagga Wagga, New South Wales, and RTQ-0, Northern Queensland. In New Zealand there are TV-1 transmitters at Invercargill (South Island), Wellington and Hamilton (both North Island). In addition there's a ch. 1 transmitter in the Cook Islands, 2,000 miles to the NE of New Zealand (for Cook Islands Television).

## Satellite News

New slot: Eutelsat has established $12.5^{\circ} \mathrm{W}$ as its "Atlantic Gate" for transatlantic operation, with TV, data and internet carriage. It will use Tele-Globe's teleport and terrestrial fibre-optic cable in North America. The old Eutelsat I F5 and TV-SAT-2 craft have been positioned at $12 \cdot 5^{\circ} \mathrm{W}$ and are in operation - downlinks have been monitored in the UK. It's possible that these old craft may be subject to a degree of inclined orbit movement as their on-board sta-
tion-keeping fuel stocks dwindle. Launches: AsiaSat-3S should be in orbit by the time this is read: it's to be slotted in at $105 \cdot 5^{\circ} \mathrm{E}$. Orion-3 will shortly be at $139^{\circ} \mathrm{E}$, carrying the usual Ku -band load and transponders that give extended C -band coverage of $3 \cdot 4$ $4 \cdot 2 \mathrm{GHz}$ with linear polarisation. New channels: BBC Worldwide Pay-TV recently launched an expanded service to North/Central Africa as part of a major expansion of its MultiChoice digital package, offering eighteen hours of programming daily. Next stop in the expansion of regional coverage will be the Middle East. Summer 2000 should see BBC Worldwide extended to India/S. Asia.

A new digital satellite news service from the German PRO-7 group, called N 24 , is due to commence next January, providing financial coverage. Canal Plus plans to launch a rolling news service in November to rival TFl's La Chain Info.

Zone Vision, a Polish entertainment channel, started on April lst. It plans to extend to Romania and Russia. A version of The History Channel to cover Japan will be launched later this year. Music channel MTV Networks Europe is to open three new round-the-clock digital music channels by September for the UK/Ireland - VHl Classic, MTV Base and MTV Extra.
News gathering: NTL has merged with the Swedish Teracom AB SNG group, forming one of Europe's largest newsgathering operations. The move will provide access to over twenty SNG/OB units and to teleports in the UK, Sweden and the USA. France: The TPS digital service now includes several terrestrial channels, TF1, France 2, France 3 and M6. Rival Canal Satellite Digital already carries these channels as part of a ten-year agreement.
Nasty story: It seems that while PAS-8 ( $166^{\circ} \mathrm{E}$ ) was being prepared for launch by a Russian Proton rocket a faulty Ku-band PCB was discovered. A replacement was fitted, but an error was made when the aerial feeds were reconnected. As a result the footprints are far from correct: the expected west spot beams look east while the east spots point west. Ooops. Information from SatFACTS, NZ, March 1999.

# John Edwards' Casebook 



## Matsui 209R

The owner of this set was a formidable woman. "Look" she said, pointing at the set. I obeyed immediately. "Those twinkling dots are ruining the picture". Teletext lines extended from the top of the picture to half way down. I told here what they were. "Well, I don't know about that" she said, "but in case you hadn't noticed it, this is not a teletext set." I decided to say no more and just fix it.
In any set the cause of this problem is usually a capacitor in the field timebase drying up or changing value. I got out my 'useful capacitor box', which contains a couple of each type of electrolytic ranging from $10 \mu \mathrm{~F}$ to $470 \mu \mathrm{~F}$ and from 63 V to 400 V working. Once the PCB had been slid out from its retaining grooves, I had easy access to all parts. The field output circuit was easy to identify - there are two Lshaped heatsinks attached to the output transistors Q302 and Q303. All the electrolytic capacitors in this area looked tired. I decided to replace a few and check the results.
I ended up with a perfect picture When I got back to the workshop I used my scope's built-in component tester to check the capacitors I had removed from the set. Over the years the tester has proved to be a really useful tool, especially with transistors and diodes that appear to be OK when checked with a meter but prove to be faulty when checked with a tester/scope display.
The results were quite interesting. In fact I was surprised that the only symptom was teletext interference. C301 $(100 \mu \mathrm{~F})$, the reservoir capacitor for the supply to the field output stage, was very leaky and measured $12 \mu \mathrm{~F}$. The bootstrap capacitor C302 ( $10 \mu \mathrm{~F}$ ), and C303 $(4.7 \mu \mathrm{~F}, 160 \mathrm{~V})$ which is connected between the collector of Q302 and
chassis, were both open-circuit. And $\mathrm{C} 316(10 \mu \mathrm{~F}, 100 \mathrm{~V})$, which is actually the reservoir capacitor for the supply to the RGB output stages, measured about $2 \mu \mathrm{~F}$.

## Matsui 1465

This was a classic case of multiple failure. The set's owner, an old boy, said "it's working of sorts: I can hear fizzing inside, but no matter how long I waits it don't do nuthin' else." I removed the back cover and, in view of his description of the fault, was not surprised to find a puncture hole in the line output transformer's case, adjacent to the focus control. So I took the set back to the workshop and ordered a new transformer.
When it arrived I set about removing the original one. While doing so I noticed, towards the front right-hand side of the PCB, the remains of a small electrolytic that had once occupied position C240. The now empty case, which I found in the corner of the cabinet, was marked $2 \cdot 2 \mu \mathrm{~F}, 50 \mathrm{~V}$. So it seemed that there was an excessive voltage problem. As further proof, R416 and R328 were burnt to a cinder. Time to investigate the power supply.
An external winding (three turns) on the LOPT feeds pulses back to the power supply. Would the power supply work without this feedback? I guessed that it should still provide an HT output and connected a 100 W bulb as a dummy load. With a meter to monitor the HT voltage, I slowly wound up the mains input via a variac. At about 150 V AC the power supply shrieked and howled in a most frightening manner. The meter read 140 V and rising!
There are only a few components in the power supply, so I disconnected and examined each of them. The cases of the two $4,700 \mathrm{pF}, 1 \mathrm{kV}$ pulse capacitors C808 and C811 were split, but
everything else seemed to be in order So I took a chance, left the STR5412 chip alone and simply replaced the two capacitors. The power supply then rewarded me with a silent 103 V HT supply. But what surprises lay in store for me when 1 fitted the new LOPT?
I installed the transformer and its overwinding, and replaced R416 ( $7.5 \mathrm{k} \Omega$ ), R328 ( $10 \mathrm{k} \Omega$ ) and C240. When I switched on there was field collapse. The cause turned out to be no 12 V supply at pin 2 of the TA7698AP colour decoder/timebase generator chip IC501 because D406 was shortcircuit and R435 ( $2 \Omega$ ) open-circuit. When these items had been replaced there was still field collapse, plus a very loud, high-pitched whistle. The voltages around IC501 were all over the place and it felt warm. To restore the field scanning I had to replace IC501 and D242 (1N4148), which was short-circuit - it's in parallel with the previously replaced C240. There was now a normal snowy raster and sound.
When I tuned in a station there was a good picture and sound - but the set wouldn't store! Checks around the M58655P memory chip IV02 failed to reveal anything amiss. The all-important -31 V supply was present, the CS pin went low and so on. A new memory chip finally restored normal operation. As you will have guessed, this was another break-even/no-profit job.

## Philips K30 Chassis

There was no field scanning and no 32 V supply. I soon found that the surge-limiter resistor R1590 (1-2 2 ) was open-circuit, but a replacement immediately failed. Further checks showed that the field scan coupling capacitor $\mathrm{Cl} 521(1,500 \mu \mathrm{~F})$ was shortcircuit. Once this had been replaced there was a superb picture. Relief all round!


We welkome letiers 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 Letfers Edifior, Room 1302,
Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

## DTT Reception

There were several references to digital terrestrial TV reception problems in the May issue. The cause of most problems is the quality of the installation, in particular the feeder, rather than the signal. A very high-quality screened cable is required.

As in the rest of our industry, the tendency over the past twenty years has been to achieve an acceptable picture and that's it! All too many people have ignored the need for quality aerial equipment. It's only in the UK that you find cheap contract aerials without a balun to maintain the $75 \Omega$ impedance. The attitude has been that if the picture is OK with a cheap aerial and cheap cable, why pay more?

We are now finding out why. The problem is not only with flats where mains and aerial cables are run close together. You get just as much trouble at individual houses from any electrical appliance within 50 yards. Even next door's lawnmower firing up on Saturday just as the match starts!

The causes of these problems are:
(1) Cheap imported cable with very poor screening properties, even though the loss per foot meets the required specification.
(2) Cheap contract aerials that have a wide acceptance angle and poor

Letters
front-to-back ratio
(3) Cheap or poorly fitted coaxial plugs.

In our experience the most common remedial work required at an ONdigital installation is to fit a quality aerial head with a balun, Volex CT100 screened cable and a high-quality plug that must be crimped or soldered to the cable where practical we use a one-piece crimp-on plug.
Dave Cooper,
www.bud-1.demon.co.uk

## Hitachi 46TN Series

In connection with the article on servicing these sets (May issue) it is important to note that the HT should be 110 V with 21 in . sets and 146 V with 25 and 28 in . models. ZD950 is not a 10 V zener diode, it's a voltage reference diode (see comments on page 499, April issue, editor). If a 10 V zener diode is fitted in this position the HT will be very high (about 180 V ) and the set will go into the protection mode. If the protection is then disabled, as many engineers tend to do in desperation, the result is damage in the power supply and line output stage.

With issue 5 and later PCBs Q902 and Q951 are type 2SA1390 and Q953 is type 2SC3413. The pin leadouts are different, and the print layout was changed accordingly. BC series transistors cannot be used as replacements.

## B.S. Rahelu,

Hitachi Spare Parts.

## PC Operation and Repair

A few points are worth making in connection with Part 1 of this series. At the bottom of page 389 it says three or four five-way connectors: Fig. 4 above shows, correctly, four-way connectors. There have been other types of disk drives and expansion slots. The PCI type expansion slot has now become predominant. Table 4 is correct, the text under Modern Motherboards
incorrect (female and male serial and parallel port connectors). Many PC manufacturers, not just IBM, use six-pin keyboard connectors. Alan Knight,
The Open University, Oxford.

## Taxan

I note a request for information on a Taxan monitor in the May help wanted page and would like to take the opportunity to draw readers' attention to our web site address, which is
http://www.taxan.co.uk
There is much useful information here. Technical assistance is available at our e-mail address, taxan@taxan.co.uk Keith Caley, Engineering Supervisor, Taxan Engineering, Bracknell.

## Anyone know the answer?

I had two problems with an Osaki P1420R portable. First, there was a raster but no picture or sound, as if the set was in the external-input or AV mode with no signal input. Secondly, the on-screen display corresponded with all the remote-control selections but, when the set's up/down buttons were used for channel change, there was always default to channel ' 32 '. Thereafter the buttons had no further effect. The channel OSD could be changed by remote control only.

I didn't have a circuit diagram, and it was made clear to me that the set had been bought cheaply and the owner wasn't prepared to spend much on it. But I decided, out of curiosity, to attempt repair. The nopicture symptom seemed to be a logical place to start.
I noticed that the set uses a TA7698AP colour decoder/timebase generator chip (IC201). I've had to replace this type of chip on many occasions, in various sets, for a wide variety of timebase and video faults. Fortunately I had a second-hand one in stock. So in it went. When I switched the set on again there was a good picture and sound. I confidently pressed the
front-panel channel button, then sank back into depression - the screen filled with snow and the onscreen channel number flashed 32 at me. Selecting channels by remote control restored normal operation.

I decided that the cause of the problem must be to do with the microcontroller chip's input scanning circuit, or possibly the chip itself. When I scoped the control buttons I found that there were scanning pulses across each one: they altered when the button was pressed. After checking a number of 1 N4148 diodes that seemed to be part of the channel-change circuit I came to the conclusion that the TMP47C434N3147 microcontroller chip was probably the cause of the trouble. Repair was rapidly becoming uneconomic, but I just had to know.

I ordered a new chip from SEME and, true to form, it arrived next day. I fitted it, then had to admit that I was beaten. The fault was still present. There was little more I could do, and after all the owner had said that it didn't matter - he only used
remote control. But I still want to know the answer. Does anyone out there know?
John Edwards,
30 Wendoyer Way,
Welling, Kent DÄl6 2BN.

## Digital Repairs

People are beginning to ask me about digital receivers, which I don't repair. There are several reasons for this. First, most of them are still under warranty. Secondly, although Pace provides training courses for repairing its Sky digiboxes the investment in equipment required is quite high for a one-man business such as mine. In addition, I understand that the diagnostic software copyright belongs to BSkyB and cannot be released. Thirdly the other manufacturers of digiboxes don't at present offer training courses. Fourthly the digibox is so heavily subsidised that customers regard it as a $£ 50$ rather than a $£ 300$ product. As a result they expect very cheap repairs - despite the fact that a single memory chip can cost up to $£ 40$ !

Fifthly some digital receivers are "grey imports" for which no service information or parts are available.

I could of course plunge in without a circuit diagram, as I have in the past. But although power supply repairs would be feasible, very little else would. The basic problem with a digital receiver is that there's no video or audio path to follow. The signal from the tuner disappears inside a very fast computer board with bus signal paths, then reappears as video and audio after digi-tal-to-analogue conversion. No one repairs PCs at component level nowaday - it's not cost-effective when a complete motherboard can be bought for $£ 50$ or less.

It's my view that digital receivers will, for the next couple of years at least, be dealt with like phones: a faulty unit is returned to a local dealer who sends it to a central repair depot. Very few small businesses will find repair work
worthwhile.
Jack Armstrong.
Middlesbrough.

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We can also offer equivalents (at customers' risk). We also stock a full range of other electonic components. Mail, Phone, Fax, Credit Card orders \& callers welcome

Fig. 3: The real and protected modes.


Furthermore individual locations can be erased and programmed without affecting the rest of the data pattern. As a result of location over-writing, the EEPROM has a comparatively short life span.

## Flash RAM

The Flash RAM is an advance on the EEPROM. Once again all locations can be erased and reprogrammmed, this time using normal voltages that are available in the PC. Flash RAM also suffers from a short life span, and has a long access time of $60-150 \mathrm{~ns}$.

## Real and protected modes

The original XT PC used an Intel 8086 microprocessor and had a total RAM space of 1MB. DOS was therefore designed to work within a 1 MB limit. When AT PCs were introduced with the Intel 80286 microprocessor, 16 MB of memory was provided for the processor to address. But to ensure backwards compatibility, i.e. ensure that adaptors and application programs designed to work with the XT could continue to be used with the AT system, the IMB limit was retained. A computer that operated within the 1MB limit was said to be operating in the real mode. See Fig. 3.
In order to address memory locations beyond the IMB boundary a special device driver (or program) was required. A PC was then said to be operating in the protected mode. The commercial need for backwards compatibility assumed by MS-DOS designers perpetuated
this unhelpful dual mode of operation. Other operating systems, such as $O S / 2$, were designed without this $1 M B$ limit. Windows incorporates a memory manager to cope with protected-mode operation.

## Software requirements

PCs carry out their operations by following software programs. The main software program is an application program such as a wordprocessor routine, a database or a football or other game. To bring an application program into operation, DOS is instructed to load a file with an .EXE or a .COM extension from a disk drive, CD-ROM or other mass storage device into the system's RAM. Additional program data files may be loaded into RAM to enable the application program to be run, and as long as the application package is running these files must continue to be present in RAM.
In addition to the application program a PC requires a number of other programs so that it can perform tasks such as generating a video display, controlling a mouse, and executing DOS commands. These programs, known as memory-resident software, are loaded into the system memory (RAM) at the boot-up stage.
Utility software includes such routines as system BIOS, the video/graphics display program and other programs that control optional devices such as a mouse, a CD-ROM drive or a sound card.
Where these programs are provided in ROM or PROM packages they still require and must be allocated space within the total system memory.

## Memory map

When DOS was designed, with the introduction of the XT PC, it accommodated both application and memoryresident programs within the IMB limit. Furthermore, DOS software requires that application programs must occupy contiguous memory locations, i.e. a memory space without any gaps in the entire range from the beginning to the end.
The original 1 MB of real-mode memory was divided into two parts: a lower 640 KB , known as the conventional or base memory for the application program and the transient programs; and an upper 384 KB , known as the upper memory area (UMA), for utility programs. Backwards compatibility made it necessary for this division to be continued and, until the advent of modern memory-management techniques, DOS applications were limited in size so that they fitted within the 640 KB of contiguous base memory. Memory space above 1MB is known as extended (protected-mode) memory. Fig. 4 shows a basic PC memory map, Fig. 5 an allocation of memory addresses and locations to various programs.
Although in theory 640 KB is available for software applications, in practice a large chunk of conventional memory may be occupied by memory-resident programs such as device drivers and TSRs (Terminate and Stay Resident programs). One way of maximising the memory space available for DOS application programs is by loading device drivers and TSRs into unused upper memory spaces, thus freeing precious base memory space.

## Extended Memory System (XMS)

The memory of a system based on a 286 or higher processor can, as previously mentioned, extend beyond the 1MB boundary for processor operation in real mode. With a 286 processor the memory limit is 16 MB : with 386-, 486- and Pentium-based systems the limit is 4GB $(4,096 \mathrm{MB})$.
Such a system enables programs to use any part of the
extended memory area. The result could be that different programs use the same memory space. To prevent this happening Microsoft, Intel, AST Corporation and Lotus developed an Extended Memory System (XMS) specification.
XMS is introduced by loading into the system RAM an extended memory-manager driver such as HIMEM.SYS. As mentioned earlier, such memorymanagement techniques are irrelevant with a system such as OS- 2 because it is a protected-mode operating system that's designed to use extended memory.

## Memory packaging

Earlier computer systems used discrete memory chips. An alternative is memory packets or packages with individual chips mounted on a PCB in 16 - or 32 -bit format. There are two versions, the single-in-line memory module (SIMM) and the dual-in-line memory module (DIMM), see Fig. 6.
Because of their large capacity, small size and the ease with which they can be replaced, SIMMs and DIMMs are universally used in modern PCs.

## Wait states

When the speed of the processor is faster than the access time of the memory devices, one or more wait states may have to be introduced to slow down the CPU. A wait state causes the processor to suspend its activities for one or more clock cycles to allow slower memory to catch up. The number of wait states required depends on the speed of the memory and the type of CPU in use.
Some computer systems provide automatic wait state detection and settings. Wait states curtail computer performance drastically. With one wait state a PC operates at two-thirds of its potential speed. Two wait states reduce the performance by a half.

## Cache memory

The only way to avoid wait states as processor speed is increased is to use faster memory devices. The most straightforward way of increasing the speed of a computer memory is to use fast SRAM devices. But the cost of SRAM chips and their low packing density make extensive use of them prohibitive. Use of SRAM devices has to be more targeted and specific to make economic sense.
To this end the cache memory technique was introduced. Motherboards that can incorporate cache memory have a set of IC sockets, holders or a SRAM module slot available into which SRAM chips or a SRAM module can be inserted, as outlined in the manufacturer's user handbook.
The cache memory technique involves the use of a block of a few $\mathrm{KB}(8-512 \mathrm{~KB})$ of fast SRAM to store the contents of the most frequently accessed RAM locations and the part of the program that the CPU is most likely to call for. Identification of these instructions and data, and loading them into the cache memory block, is carried out by a cache controller that continuously updates the contents of the cache memory as required.
The processor will first attempt to obtain instructions or data from the fast cache memory. If they are not available, wait states will be introduced and the processor will turn to the slower DRAM locations to obtain the information required. With a hit rate, i.e. the likelihood of the processor finding what it wants in the cache, of 95 per cent the net effect is that the system acts as though nearly all its memory consists of very fast SRAM.
The cache controller has to keep a record of the information inserted in the cache and where it is stored. A
small memory known as a tag memory is used for this purpose.
A faster and more effective cache memory was introduced with fourthgeneration processors ( 486 upwards). These processors have between 816 KB of built-in cache memory known as Level 2 (L2) cache. The result is a very fast access time of $5-10 \mathrm{~ns}$.
Cache memory location reading can be speeded up by using the burst-mode technique introduced with the 486 processor. This technique makes use of the fact that programs usually access locations in sequence, enabling the processor to carry out four sequential data transfers without an intervening address cycle.
The cache technique described above speeds up the process of reading memory locations by going to a cache memory location instead of a main memory location, but writing into memory continues to take place at the slower speed of the DRAM chips in the main memory. This is because of the synchronous operation of a cache memory, to ensure that a cache memory location has the same content as the corresponding location it mirrors in the main memory. Cache and main memory locations must therefore be updated, i.e. written into, simultaneously, with all the waste-


Fig. 5: Allocation of addresses and locations to various programs.


Fig. 6: SIMM (top) and DIMM (bottom) packages.
ful wait states this entails. The process is known as write-through.
A new technique, known as write-back, enables the processor to write changes in cache memory, speeding up the process. The changes made in the cache memory are subsequently transferred to the corresponding main memory locations by the cache memory controller when some spare time becomes available.

## Special DRAM chips

Modern computers use special DRAM devices known as extended data out (EDO) to improve the system memory speed. The use of EDO can save one wait state, in comparison with the page-mode technique, at no extra cost.
Another special DRAM chip that provides fast access time is the video RAM (VRAM). VRAM chips have
two independent data paths, for input and output. Memory locations can thus be read and written at the same time. This is essential for fast video/graphics displays.
RDRAM (Rambus DRAM) is a very fast, high-density memory chip that uses a dedicated bus known as a Rambus. Capacities of up to 64 M bits per chip are available, with operation at 100 MHz or more and a data transfer rate of 500 Mbits per second.

## Making more memory available

The amount of memory available for a computer to use determines the programs it can operate and how fast they run. More memory can be made available in several ways:
(1) By deleting unnecessary files. This makes more conventional memory available.
(2) By loading MS-DOS into the high-memory area. This again saves conventional memory space. It's carried out by including DOS=HIGH in CONFIG.SYS.
(3) By using memory-management routines. There are two of these, HIMEM.SYS and EMM386.EXE. The former manages the use of extended memory and provides the first chain for DOS to use the upper memory area. The latter provides access for relocating device drivers from conventional memory to the upper memory area. It also simulates expanded memory, by allocating a section of extended memory space for
expanded memory applications.
When expanded memory is not required, NOEMS is added to the device driver. Conversely RAM is added to the driver for expanded-memory operation.
EMM386.EXE works in conjunction with HIMEM.SYS and must be entered into CONFIG.SYS after HIMEM.SYS. A typical entry in CONFIG-SYS for an MS-DOS operating system is:

## DEVICE=C:\DOS\HIMEM.SYS DEVICE=C:\DOS\EMM386.EXE

Memory management is essential for Windows 95. The following lines are included in CONFIG.SYS:

## DEVICE=C:IWINDOWS\HIMEM.SYS DEVICE=C:IWINDOWSIEMM386.EXE

(4) By relocating TSRs (Terminate and Stay Resident programs) and device drivers from conventional memory to upper memory. This is carried out by the DEVICEHIGH command in CONFIG.SYS and LOADHIGH (LH) in AUTOEXEC.BAT. The number of relocations possible depends on the size of the programs and the free space available in the upper memory. Optimum relocation is achieved with the larger programs located in the larger spaces in upper memory.

## Next Month

In the concluding instalment next month we will outline logical procedures for PC fault-finding.


A11 training establishments face the challenge of bridging the gap between old and new technology. When it comes to digital TV. launched last year and now becoming a major consumer product, the College of North West London got off to a flying start. The College is based in Willesden, with other centres at Wembley Park and Kilburn. Last September it invested $£ 20,000$ on twenty fully-equipped digital TV work stations. Each station has a digital storage oscilloscope, a spectrum analyser and a logic probe. The College has digital set-top decoders from various major manufacturees, including Philips, Nokia and Pace. Students are trained to test and fault-find with all

## Technical Training for Digital TV

of them, both satellite and terrestrial.
Because the technology is so new, the College of North West London is still the only FE college in the country able to provide digital TV training courses. It attracts lecturers and engineers from employers throughout the UK, including the $B B C$, IBM, the Comet chain and other FE colleges.
One-day courses for the servicing industry are offered either at the college premises or on site. They can be either off-the-shelf or customised for service engineers who need a specific updating or upgrading programme. The aim is to bridge the gap between analogue and digital technology and to familiarise engineers with microproces-sor-based systems.
Three one-day courses are held at the college approximately once a month, leading to a College certificate. They are: (1) Digital TV Broadcasting and Reception; (2) Servicing Digital TV Decoders; and
(3) Microprocessors for TV Service Engineers.
A member of the College staff has special responsibility for industrial liaison and retraining. He is available to visit individual clients to assess their needs and devise appropriate training programmes.
The College has recently gained approval from City \& Guilds to run courses on digital television at Level 3 of the 2240 Electronics Servicing Programme. Students can thus gain a qualification which is recognised throughout the country. The courses are available on a dayrelease or evening basis. The syllabus will be made available to other colleges
Places are currently available. Applicants should contact Ana Boyland on 01812085117 or the course information hotline 0181 2085050.

For more details about the courses, anyone with internet access can call up the College website -
www.cnwl.ac.uk

## Answer to Test Case 438 - see page 531 -

Cathode Ray did in fact connect a temporary cable between the dish and the receiver to check whether the existing downlead was the cause of the trouble. But the low-signal symptom was still present as sparkly interference on the picture. This, added to what had already been established, suggested that the dish itself was the cause of the problem - provided it had a clear line-of-sight to the satellite. As there were no visible obstructions, the dish was condemned. Its surface turned out to be badly rusted and corroded. Because of this the reflected signal was being scattered, thus reducing the gain of the dish system.

We've noticed that other rusty and corroded dishes, mainly of the earliest perforated type, tend to produce a lower signal level than a 'clean' dish. It's quite likely that dishes deteriorate faster at our coastal location than in other areas.

Dave Dawson decided to update to SkyDigital, and thus had a completely new dish, LNB and receiver. He then complained about loss of the cheeky late-night German programmes! What concerns us is that the new 46 cm digidish looks to be as vulnerable to rust attack as its predecessor.

## NEXT MONTH IN TELEVISION

## Servicing the NEI E5 Chassis

Alan Dent continues his series on NEI sets with a detailed fault rundown on the E5 chassis.

## DTT Explored

Ian Martin decided to obtain an ONdigital set-top box and find out what could be received - at several locations from different transmitters. He provides a detailed assessment of reception prospects.

## Auto Power-off Circuit

This circuit was designed by Alan Willcox as an update for his ESR meter. It's a handy circuit that can be used with other low-power, battery-operated equipment.

## Nokia 9600 Blue Menus

The 'blue' menus available with Nokia 9600 series digital satellite receivers are not as well known as the 'red' ones. They enable new satellite signals to be entered into the electronic programme guide directly, while adjustments can be made to receiver settings in more ways than with the standard installation menu. Hugh Cocks explains it all.

## Multiple Output Plates for TV

With the increasing complexity of many domestic TV installations there's a need for a neat and tidy multi-pole coaxial wall plate with good electrical performance. Finding nothing suitable on the market, Bill Wright came up with a DIY solution.

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