THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

FEBRUARY 2000 £2.80

Servicing modern audio equipment

LOPT problems + a new tester design

Servicing TV chassis 11AK08 and 11AK10

The Setanta Sports satellite receiver

All about diodes

Fault reports TVs, VCRs, PC Monitors and Satellite

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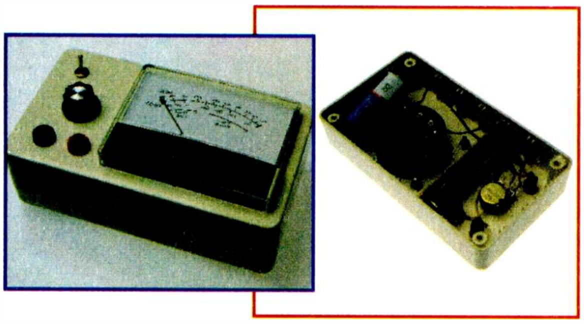

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Digital Contrasts

Over the years we have learnt that one of the most important things in video/ TV technology is selecting the best system to use. We have also seen how difficult this can be. Prior to the start of the colour TV era in Europe there was an great to-do about the best system to adopt. The US NTSC system seemed an obvious choice to start with. It had been proved in use, and refinements had been devised. But alternative, better solutions were proposed – PAL and Secam. PAL proved to be a great success, in fact a good choice. The French Secam system seems to have worked just as well.

Apart from the video tape battles of the Seventies, the next really big debate concerned digital TV. When it came to digital terrestrial TV (DTT), Europe and the USA again adopted different standards. One major difference is the modulation system used for transmission. Coded orthogonal frequency-division multiplexing (COFDM) was selected for the European DVB system, while in the USA a system called 8VSB was adopted. COFDM uses quadrature-amplitude modulation of a number of orthogonal carriers that are spread across the channel bandwidth. Because of their number, each carrier has a relatively low bit rate. The main advantage of the system is its excellent behaviour under multipath reception conditions. 8VSB represents a rather older, pre phase-modulation technology: eight-state amplitude modulation of a single carrier, with a vestigial sideband.

The decision on the US system was assigned to the Advanced Television Systems Committee (ATSC), reporting to the FCC. The system it proposed was approved by the FCC on December 26th, 1996. The curious date might suggest that there had been a certain amount of politicking. In fact there had been an almighty row between the TV and computer industries about the video standard to adopt, the two fearing that one or other would gain an advantage as the technologies converged. It was 'resolved' by adopting a sort of "open standard" – we are talking about resolution and scanning standards here – the idea apparently being that the technology would somehow sort itself out.

There seems to have been rather less concern about the modulation standard. 8VSB was adopted because it was assumed to be able to provide a larger service area than the alternatives, including COFDM, for a given transmitter power. Well, the USA is a very large place! But the US TV industry, or at least some parts of it, is now having second thoughts.

Once the FCC had made its decision, there was pressure to get on with digital TV. In early 1998 there were announcements about the start of transmissions and broadcasters assured the FCC that DTT would be available in the ten areas of greatest population concentration by May 1999. Rapid advances were expected, with an anticipated analogue TV switch-off in 2006. So far however things have not gone like that. At the end of 1999 some seventy DTT transmitters were in operation, but Consumer Electronics Manufacturers Association estimates suggest that only some 50,000 sets and 5,000 STBs had been sold. There have been many reports of technical problems, in particular with reception in urban and hilly areas and the use of indoor aerials, also with video/audio sync and other matters. Poor reception with indoor aerials in urban conditions is of particular concern: that's how much of the population receives its TV.

The UK was the first European country to start DTT, in late 1998 – at much the same time as in the USA. The contrast is striking. ONdigital had signed up well over 500,000 subscribers by the end of 1999, a much higher proportion of viewers than in the USA. Free STBs have played a part of course, but it's notable that DTT reception in the UK has been relatively hassle-free.

In making this comparison it should also be remembered that the main aim of DTT technology differs in Europe and the USA. The main concern in Europe has been to provide additional channels. In the USA it has been to move to HDTV, in particular to provide a successor the NTSC system. There have been plenty of channels in the USA for many a year. For example the DirecTV satellite service started in mid 1994 and offers some 200 channels.

Internationally, various countries have been comparing the US and European digital systems. They have overwhelmingly come down in favour of the DVB system. There have been some very damaging assessments of the ATSC standard.

The present concern in the US TV industry results from this poor domestic take-up and lack of international success. Did the FCC make a boob, in particular in the choice of 8VSB? Following comparative tests carried out by Sinclair Broadcasting Group Inc., the company has petitioned the FCC to adopt COFDM as an option in the ATSC standard. Not only did its tests confirm poor reception with indoor aerials: they also established that the greater coverage predicted for 8VSB failed to materialise in practice.

Could the USA have two DTT transmission standards? It seems unlikely. It would involve dual-standard receivers and non-standardisation of transmitters. In the all-important business of system selection, it looks as if the FCC got it wrong.

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What a Life!

Christmas time can mean more work for some of us, with increased expectations from customers. There's always a last-minute "can you help, ha ha, sorry I have to trouble you!" Donald Bullock's servicing commentary

It was getting close to Christmas and we were up to eyes in work – yes, really! The door opened and an armful of rags sallied in. It was Dancing Fred Entwhistle.

"Brought you boys a little job" he cried. "Our set went wrong about a fortnight ago. Thought it time to get you to look at it for me."

Paul took the set and started to check it.

"This one'll kill you" Fred piped as he danced about. "Here. Take a card." He fanned a handful of playing cards and pushed them towards us. Steven, looking perplexed, thought it best to humour him and took a card. It was the ten of clubs.

"Don't let me see" Fred ordered. "Now put it back. Anywhere. While I'm looking away."

Steven slotted the card back and Fred started flinging them at the counter, one by one. He stopped at the four of spades.

"That's it, isn't it?" he asked.

When Steven shook his head Fred repeated the performance and came up with the ace of hearts.

"Ah, of course. This one." Steven again shook his head. On his third attempt Fred came up with the two of diamonds.

Steven looked up with a frown. "Forget the cards" he said, "do something useful. Make the tea."

Fred went off to the back and Paul tried the set, a Toshiba Model 1400RBT. About a third of the raster was cramped at the bottom while the top was badly stretched. "What could this be?" he asked.

"The field time-constant is non-linear" I replied with, I thought, commendable cleverness.

"Yeah, but why?" Paul continued.

"God knows" I said. He studied the field output stage and removed the 2·2µF, 50V feedback capacitor C317 to test it. It had been sitting in a pool of dried up electrolyte and produced a reading of less than 1µF. But when he fitted a replacement and switched the set on again the fault was still present. He studied the board again and came across C303, which has the same value/rating and had failed in the same way. It decouples the height control and read 0·3µF. This time the replacement restored a fine, linear picture.

Flighty's Combi

We heard our next caller, Mr Flighty, chatting up a lady passer-by before we got sight of him.

"Not at all my dear. You pass first. This isn't heavy – or am I telling you I'm strong? Ha, Ha. I say, those are lovely ear-rings you're wearing. Nice colour, and they match your eyes."

Then he pranced in, carrying an Aiwa TV-and-video combination.

"Oh God" I let out.

"Don't you like Aiwa telly-cum-videos?" he asked.

"They're all right" I replied.

"Then what are you moaning at?" he said.

"Guess!" I said as Greeneyes came in wearing her £150 trouser suit, the one worth thirty bottles of Bells.

"I say, I say I say" jabbered Flighty. "What luck I have. How are you my dear? Not liverish like your father here?!"

I shot him a stern look.

"Your hubby I mean, yes of course. Silly me. Lucky chap!" he jabbered on.

Greeneyes glowed, and I wondered how such a bright girl could be so gullible.

"How's Mrs Flighty?" I enquired.

That quietened him and he sloped off.

Flighty's set was a Model VXT1000 Mk. 2. It's TV section was dead. Steven soon had the STK7348 chopper chip IC4 out and found that it was short-circuit between pins 3 and 7. R103 (1·5Ω, 3W), R104 (27Ω, 3W ceramic) and R105 (1kΩ, 0·5W) had also failed.

Replacements didn't complete the repair – the set wouldn't start. Further investigation brought Steven to C90 (1µF, 50V), which was short-circuit. It had obviously been the cause of all the trouble.

Colour Drop-out

Mr Tell is a tiny, tidy retired dentist from Wales. He has a perceptive mind, a soft voice and a delightful accent. He also has a 21in. Sony set, Model KVM2150U (BE2A chassis), that has given him quite a bit of stick.

"The colour drops out, Mr Bullock" he said carefully. "Sometimes it happens when my wife just walks across the room."

Surely such a small, pleasant man wouldn't have a wife that large, would he? I wondered how I could find out.

Paul took a look at the set and found that the trimmer capacitor CT332 in the colour oscillator circuit was pappy. It's a common offender. Sometimes just cleaning it helps, but we prefer to fit a replacement and keep a few in stock – the Sony part no. is 1-141-418-11.

When he called for his set Mr Tell complained about a record he'd just heard on his car radio.

"Dreadful it was, Mr Bul-lock. I had to switch it off. Those Beatles. Whining voices, the same over and over again and a heavy-handed beat. Noel Coward was right, wasn't he, when he said 'wonderful lads – quite without talent'."

"And how" I replied.

A Monitor Problem

Eddie Ebworth is a worrier. He's going grey the wrong way, from his crown to his ears, as the worst worriers do. He was carrying a Philips computer monitor, Model 17A280BQ-02C.

"Worries me to death it does, Paul" he said. "It's like my missus. All right one minute, useless the next. What d'you think it is?"

"Hard for me to say, Ed" Paul replied. "Haven't met your missus. Did she have an unhappy childhood?"

"Not my missus. I know her trouble all right, and am patiently awaiting the cure. I mean this monitor."

"Dunno about that either, Ed. Leave it with us for an hour or two and we'll see."

Paul put it on the bench and tried it. The monitor came on once or twice but not the third time.

"You're in luck" I said, "there's one thing you can usually count on – that an intermittent fault will seldom show up in the workshop."

He opened the unit and probed around in the chopper circuit. "Amongst all the bits and pieces here, I suspect R3944" he declared.

I asked him why.

"Well, it's a small resistor and its value is 1MΩ" he replied.

"Prejudice!" I said. But he was right. The resistor was virtually open-circuit. A replacement restored reliable starting.

Intermittent Loss of Signals

Hank had meanwhile dropped in. He does a bit of servicing in a nearby village. Just enough to finance his trips to the local pub. He was carrying a Daewoo TV set, Model T514 (CP365 chassis).

"No hurry for this chaps" he said. "It's supposed to loose the signal now and again. Maybe I've been unlucky. I've seen the fault at the house, but not at my place. You might have better luck."

When Steven tried the set the fault was present. There were on-screen displays but no pictures. He switched the set off and tried again. Up came a picture. But not for long. Half an hour later it disappeared, leaving just the on-screen displays.

It seemed likely that a supply was intermittent. Steven used a magnifier to study the circuitry on the secondary side of the chopper transformer and found several dry-joints. He resoldered the lot and pronounced the trouble cured.

An Alba 4859

The day wore on and we were also feeling worn. We were just thinking about sloping off to the Barley Mow when the phone rang.

"Hello Mr Bullock, ha ha ha" the voice said. "Sorry to ring you so late, ha ha. Thought I'd just phone to wish you a merry Christmas."

"That's kind of you" I replied, "I didn't catch the name though."

"Mr Nudger of 9 Flupps Road. But you don't know me. I'm a friend of Mrs Slye who knows the church verger. He always speaks well of you, though he reckons you're on the other side, ha ha ha. I've often seen you in the pub with your lads. Nice lads, you should be proud of them."

I looked into the phone's earpiece. It didn't help.

"Just one thing" the voice continued. "Ha ha. Our set's just gone dead. What a time to fail, eh? Ha, ha. Trouble is my wife's an invalid and her father's just been told he has diabetes. We're out of cat food and Miss Puke, our neighbour, is also a bit down. Her old donkey died a fortnight ago, and you know how lonely Christmas is without the telly. I just wondered, like. I'm only across the road, round the corner and up a bit. Do you think you could pop over? It went wrong when Terry Wogan came on . . ."

Paul went round and collected the set. We asked Mr Nudger to call round in half an hour's time.

The set turned out to be an Alba Model 4859. Its 2SK2750 chopper transistor Q801 was short-circuit. We had ordered some from Alba only a week or two previously and had been sent P2N60s, which aren't insulated like the original type. We had already fitted one in another set, making sure it was insulated from the heatsink, and this had been OK. So we decided to do the same again.

The 0·47Ω safety resistor R809 was also open-circuit, as expected. It's there to provide protection

"Here. Take a card . . . "

when there's a short in the chopper circuit. We also checked the high-value resistors in this area, as they can be troublesome. R802 (100kΩ) and R805 (330kΩ) were open-circuit while R826 (100kΩ) was high at 140kΩ.

After replacing these items we switched the set on. It powered up nicely and produced an excellent picture.

"This one had less wrong with it than the last 4859 I did" Paul commented. "With that one I carried out all the replacements we've just done and it still wouldn't work. I had to change the TDA4605-02 chopper control chip as well."

Mr Nudger popped in just as we'd finished. "You managed to get it done!" he cried. "So good of you. I've had to park across the road. I'll take the set over and call back."

He took the set and, a couple of minutes later, stuck his head around the door. "Thank you very much indeed boys. You've been very good. I'll spread the word. Oh, I didn't have time to bring any money with me. I'll settle up after Christmas, if that's all right."

He returned to his car at such a lick that I swear I heard the Doppler effect from his footsteps.

TELETOPICS

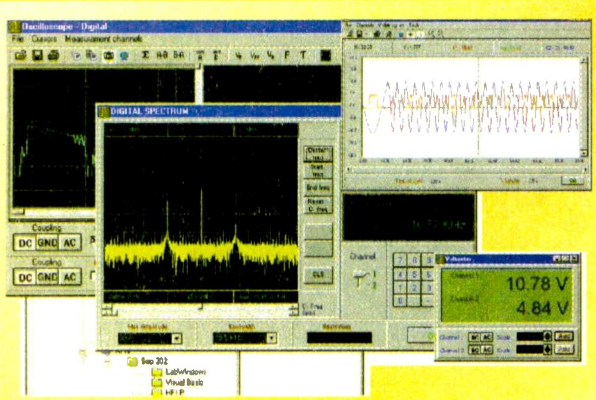
Rental Merger?

The current merger mania in the world of TV has extended to the rental sector with the announcement that Granada and Radio Rentals (Rental Holdings) propose to merge. The new company would be called Box Clever, would have over 900 outlets and 2·5m customers, and would be 50-50 owned by Granada and Rental Holdings. It would have an 85 per cent share of the rental market. The major question therefore is whether the Office of Fair Trading would allow the merger, with its virtual monopoly of the rental market, to go ahead.

The companies argue that the proposed merger has to be seen in the context of the overall TV market, in which the main competition consists of Dixons with 26 per cent and Comet with 12 per cent. Box Clever's share would be a lowly seven per cent initially. This rather overlooks the difference between renters and the high street retailers, though the renters have been selling sets for many years now. It can also be argued that digital TV has introduced considerable uncertainty amongst members of the public, with the result that many may prefer to move to rental until the situation becomes clearer. Box Clever would put the emphasis on providing a service, with rented equipment replaced every two years.

The proposed merger would involve a deal worth nearly £1bn. Box Clever would acquire the Granada Technology Group's rental business for £600m and Thorn UK (Radio Rentals) for £380m.

Because of overlapping, there would almost certainly be branch closures and job losses. One head office would go. But the two companies have already, over the past five years, cut employment by some 5,000. The hope is that the merger would strengthen the group and lead to job creation.



Vann Draper Electronics has released two low-cost instruments, Models SCP201 and SCP202 (single- and dual-channel respectively), that operate in conjunction with a PC. Both models provide a 20MHz real-time, 40MS/sec digital storage oscilloscope, a 20MHz spectrum analyser, a one second to 999 hours data logger (signal register) and an AC/DC voltmeter. A simple plug-in ISA card operates from a PC using Windows 3.1, 95, 98 or NT. The virtual instrumentation is designed to look and operate like conventional bench units, with a cursor and on-screen readouts. These features, together with the ability to import and export waveforms and data to other Windows packages, result in remarkable instruments for the price – £159 for the SCP201 and £199 for the SCP202.

The software enables several other instruments in the range to be easily added. Demonstration software is available on CD-ROM. For further details contact Vann Draper Electronics Ltd, Stenson House, Stenson, Derby DE73 1HL Phone 01283 704 706, fax 01283 704 707.

Pay-as-you-use

A UK company, Future TV, has launched a pay-as-you-use interactive TV system. It uses personalised smart-card technology to provide a billing system that debits the viewer's account for only the time actually spent watching a chosen programme, whether in part of in full. The Future TV system, known as Mi, will offer subscribers a range of services including a personalised electronic programme guide, 24-hour access to video-on-demand and audio-on-demand, unlimited live digital TV and radio programmes, e-mail, web browsing, home shopping, interactive games, multiple player gaming, low-cost telephone calls via IP (Internet Protocol) telephony, secure e-cash transactions and targeted advertising.

Future TV says that as subscribers continue to use the various Mi offerings, such as Mi Music, Mi Guide and Mi Movies, the system will develop a personalised service that reflects the viewer's watching and listening preferences.

Future TV's parent company is Future TV Inc.: it consists of Future TV UK and Hong Kong, NeXus Electronics (based in Cambridge) and Systems Magic Ltd.

Telewest/Flextech Merger

Telewest Communications, the UK's second largest cable TV operator, and Flextech, which provides various pay-TV channels, have announced plans for a £9·6bn merger. Other than the creation of a substantial media company, it's not easy to see what might be the advantages of linking these disparate TV activities. The companies have said that the merger will bring no immediate cost savings, but consider that the enlarged group will be in a better position to develop interactive TV services.

The Denver-based group Liberty Media, Microsoft and the US telecoms operator MediaOne will be amongst the combined group's shareholders.

Satellite News

SES, owner of the Astra series of satellites, has provided four shared digital-TV multiplexes at 28·2°E to cater for the needs of smaller UK broadcasters: the new channels to be made available in this way will be aimed at viewers of Asian, African and Caribbean origin.

SES and RealNetworks, an internet technology company, are to conduct broadband streaming media trials using the Astra-Net DVB/IP system: the aim is to provide video and audio to PCs.

Eutelsat and Loral Skynet have reached agreement on the use of the 12·5°W and 15°W orbital positions which provide transatlantic links. Eutelsat II F2 was recently moved to 12·5°W, Eutelsat's new Atlantic Gate location, and will be followed by Atlantic Bird 1 in mid-2001, while Loral has just completed in-orbit testing of Telstar 12 (previously known as Orion 2) at 15°W.

BSkyB has, for about £940m, acquired a 24 per cent stake in KirchPayTV, the main German Pay-TV operator – it was recently formed by consolidating DF1 and Premiere. As part of the deal, Kirch has acquired a 4·3 per cent stake in BSkyB. Rupert Murdoch has for several years sought such a deal.

Digital Video Development

Philips Semiconductors and Divio have announced a digital video (DV) system for use in products such as cameras, recorders, plasma TV sets and projectors. It consists of a Divio codec chip, a Philips FireWire communications chip set, analogue video and audio codecs and a microcontroller chip. Products that use the system will be able to import, capture, edit and distribute digital video. This ability to create DV content will provide an entirely new range of video applications. The DV format is being promoted as a standard for consumer digital equipment such as camcorders. It is understood to be compatible with other industry standards including MPEG-2.

The Divio chip replaces six/seven chips in other chip sets and has a data rate of 25Mbits/sec.

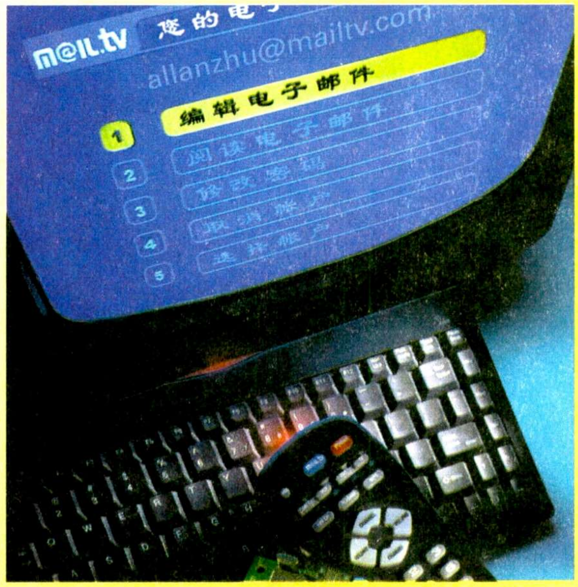
DVD News

A Norwegian hacker has forced Matsushita (Panasonic), Technics and JVC to delay launch of the DVD-Audio system by up to six months. Panasonic and JVC had been set to introduce the first DVD-Audio players in Japan before the end of December 1999: summer 2000 is now considered to be a more likely date. The DVD format uses a series of keys/codes to scramble and unscramble the disc data. An error in a commercially-available DVD decoder software package enabled the hacker to crack the keys, making it possible in theory to copy a DVD disc on to a PC hard drive and thence to a recordable DVD disc – recordable discs are due this summer. The hacker's information was posted on the internet. The rival Sony/Philips Super Audio CD format is not affected.

Pioneer has demonstrated its domestic DVD-RW player, Model DVR1000. The format is one of three recordable DVD formats likely to be launched this year, the others being DVD-RAM (backed by Panasonic, Hitachi and Toshiba) and DVD+RW from Sony and Philips.

Mobile Videophone

Orange intends to launch a mobile videophone in the UK this spring. A number of UK companies are contributing to the development. Cambridge Consultants is leading the overall technical design of the handset and user interface, Celestica is providing hardware and may manufacture the units, Motion Media is developing the video specific application software and control protocols, NMI is to integrate the Windows CE operating system while the University of Strathclyde is to provide video compression software that it has been developing with Orange for several years.



World CallNET has announced that following its introduction in Germany, Turkey and Australia the company's TV e-mail system, called M@ilTV, will be launched in the UK later this year. Further markets under consideration include France, Belgium, Spain, Italy and the Netherlands. The system provides access to the internet via a TV set without the need to pay a subscription charge to a digital broadcasting company or buy or rent a set-top box: it will be available via TV sets/STBs that incorporate a M@ilTV module. This uses a chip set developed by Zilog. Bush is to launch a 14in. set with the module early this year, and upgrade receiver units will be made available.

Up to five e-mail addresses per TV set can be provided. Text-based internet access and e-commerce will also be available. E-mail text can be entered using either a remote-control unit or a wireless keyboard. Connection is via a standard telephone line, using a local call number, with no membership, registration or subscription fee. The modem speed is 2·4kbits/sec.

A Chinese-language version, see photograph, is being developed. Users will be able to enter Chinese characters using a limited set of basic strokes.

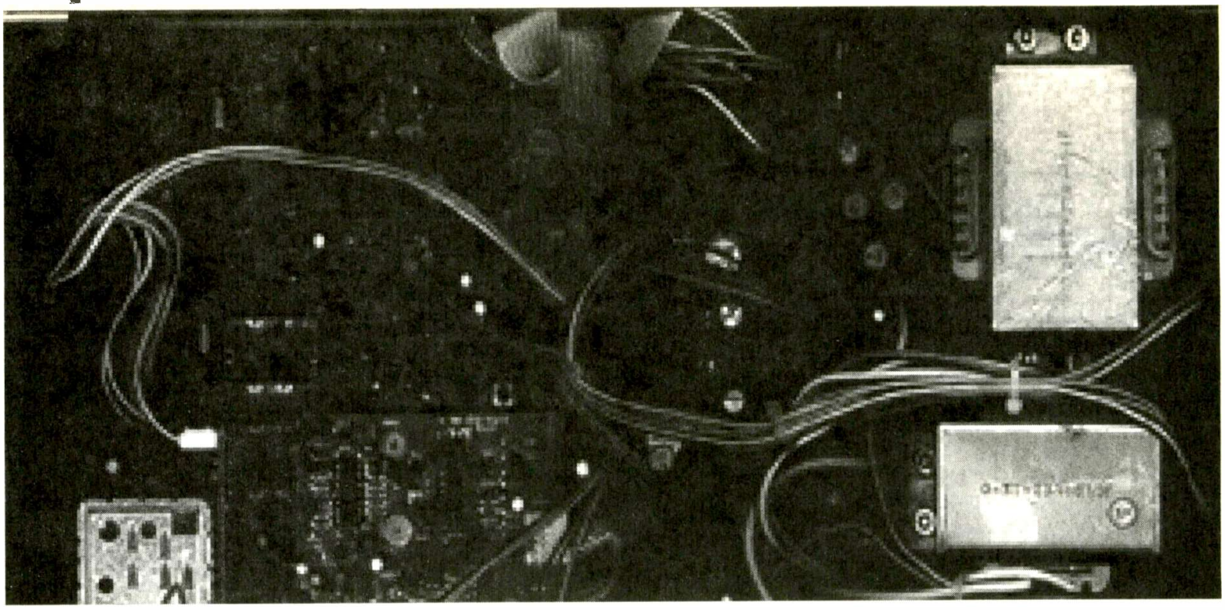
New from SoftCopy

SoftCopy can now supply Version 8 of the computerised index to *Television*, covering Volumes 38 to 49 (1988-1999). The price of the 3·5in. HD disc is £36. There is also a new fault report disc at £15, covering Volume 49. For further details of these and other products available from SoftCopy see page 247.

Show Dates

The Cable and Satellite Mediacast 2000 event is to be held at Earls Court 2 on May 15-17th. This year the emphasis will be on convergent broadcast communications, i.e. delivering broadband services to homes.

This year's *Electrical Retailing* trade show will be held at the National Exhibition Centre, Birmingham on March 26-28th. For further details apply to Steve Bromley on 01737 855 351 or fax 01737 855 482.



Satellite Notebook

Reports from Christopher Holland and Hugh Cocks

Digibox RC Problem

A customer was more than pleased to see me for a digibox installation – his old Pace SS9200 analogue system had died that very morning. While installing the digital box I found that the remote-control unit had to be used very close to the digibox for it to work properly. There was no difference when I replaced the digibox and its remote control unit!

The clue to the cause of the trouble was the fact that the TV set's remote-control unit suffered from the same insensitivity problem. In his frustration, while trying to get the SS9200 receiver to work that morning, the owner had jammed in one of the remote-control unit's buttons. As a result it was permanently sending an infra-red signal in the direction of the digibox, thus reducing the sensitivity of the box's infra-red pickup sensor. **C.H.**

Meteorite Trouble

One afternoon in mid-November we received a call from a customer for whom we had recently installed a digibox. He was very concerned.

"Do you still have a picture?" he asked.

"Yes" I replied, "why?"

To cut a long story short, he'd been listening to Radio 2 and had heard a report on the imminent Leonids meteorite storm and the damage it could cause to satellites. Shortly afterwards he had switched on his digibox and seen the on-screen message "no satellite signal being received". Quite naturally, he assumed that the satellite was in trouble!

The remedy was straightforward. I told him to disconnect the receiver from the mains supply, wait for thirty seconds, then reapply power. A few minutes later he rang back to report the good news that his receiver was now working normally and that the satellite hadn't gone off air! **C.H.**

Enabling Canal Plus Digital Cards

Those of us who have installed digiboxes have become familiar with the subscriber card enabling process, mainly via the telephone line and the receiver's modem or, occasionally, manually via the telephone to the Sky switchboard. On a recent visit to France I had an opportunity to see how it's done with the Canal Plus digital system. The signals are transmitted via the Astra satellite system at 19·2°E, an IF loopthrough being helpfully provided at the rear of the box in case an analogue receiver is still in use. The instruction booklet contains a viewing card. There's no UHF modulator, connections being via scart sockets plus two standard phono sockets for use with a hi-fi system.

Once the receiver has been installed, either by a dealer or the owner, and the receiver's signal-strength menu is well into the green area, you get a screen which is blank apart from the name of the channel that's been tuned in. Even the preview channel is blank except for some scrolling text that indicates upcoming programme highlights. To add to the confusion, when changing channels the box tells you (in French of course!) to insert the viewing card even when this has already been done. The only indication that the card is OK is that the preview channel doesn't produce even rolling text when the card has been removed from the slot.

No contract is signed at the time of purchase. The shop provides a receipt with the receiver and card number and the phone number of the Canal Plus call centre. When you ring up they run a check to ensure that the box has been properly installed. You are asked to select several channel numbers and report the on-screen name present – for example channel 33 Disney and channel 81 History channel. Once the call centre is satisfied that signals are being received from the satellite, the box and card number are taken together with the caller's details and the address to which the contract is to be sent. This has to be filled in by the owner and returned to Canal Plus. In the meantime the receiver can be set to the preview channel 8 to provide viewing and left for half an hour while the card is authorised.

Unfortunately there's no way of telling when the card has been activated. It must be left in undisturbed, as no picture is seen on the screen. After half an hour the card has to be removed and the receiver switched off (there's a real mains on/off switch at the front of this digibox!). You then switch the receiver on again and re-insert the card. Pictures are now seen.

A phone line connection is provided for pay films, also a slot for insertion of a smart-type credit card – though home shopping doesn't seem to be available as in the UK. The various free-to-view Astra 19·2°E channels, such as RAI 1, Egyptian TV and Travel Channel, are available – but only when the card is in the slot. Otherwise they are not seen.

According to the Canal Plus instruction book the French word for a remote-control unit is now Le Zapper. The Canal Plus list of channels is available via a favourite list that's called Le Zap Liste. **C.H.**

Pace SS9000/9200

These receivers still occasionally come in for repair. Replacing the electrolytics in the power supply can work wonders for overall picture quality. Even when all the main ones have been replaced however there is often sufficient ripple in the output from the power supply to confuse a universal LNB, which can switch to high band (11·7-12·75GHz). This is less than helpful: you are mislead by an apparent no-signals fault because the receiver doesn't find any analogue signals. If a receiver with this ripple is tuned to 10·977GHz H, the German N3 channel should be seen – the receiver is looking at the very bottom end of the LNB's high-band output.

A simple way to remove the ripple from the receiver is to cut link LK205, which carries the supply to the tuner, and fit a choke in its place. A suitable one can be found on a scrap 9000 or 9200 panel – it's L3, which is adjacent to the 5V rectifier diode D13. This will restore normal LNB tuning. LK205 is just to the right of the tuner.

An alternative solution is to fit the choke in an external box with connection via two F sockets. Connect a low-value (about 22pF) capacitor across the choke to pass the wanted IF signal. The connections inside the filter box must be kept short – component lead length has a significant inductance in the satellite IF range (950-2,150MHz). **H.C.**

SkyDigital Radio Listing

The table to the right lists the radio stations currently available from SkyDigital. BBC Radio 5 is encrypted and requires at least a free-to-air viewing card. Talk radio requires a minimum Sky viewing subscription. All other stations are free-to-air and can be received with a European digital box. There's no station 925 yet, and nothing on 931-933. **C.H.**

SkyDigital Radio Listing

EPG No.	*Programme*	*Frequency GHz*	*Pol*
911	BBC Radio 1	11·798	H
912	BBC Radio 2	11·798	H
913	BBC Radio 3	11·798	H
914	BBC Radio 4 FM	11·798	H
915	BBC Radio 5	11·798	H
916	Classic FM	12·110	H
917	Virgin	12·324	V
918	Talk Radio	12·324	V
919	Classic Gold	12·110	H
920	The Mix	12·110	H
921	Planet Rock	12·110	H
922	Core	12·110	H
923	Capital Gold	12·324	V
924	XFM	12·324	V
926	BBC World Service	11·798	H
927	BBC Radio Scotland	11·798	H
928	BBC Radio Wales	11·798	H
929	BBC Radio Ulster	11·798	H
930	BBC Asian Service	11·798	H
934	BBC Radio 4 LW	11·798	H

All about Diodes

Peter Murchison describes diode development from the cat's wisker device used in early crystal radio receivers to the current family of pn-junction devices, on which the operation of modern TV sets so much depends

When you look in the back of a TV receiver you can't help but notice the large number of diodes present, dotted about the entire PCB. The power supply section probably contains the most, with mains rectifiers, chopper power supply rectifiers, one or two zener diodes and maybe an avalanche diode to shut the circuit down should the output voltages rise excessively. On the tube base panel you will probably find clamp diodes and maybe another voltage-regulating zener diode. There will be clamping, clipping and gating diodes all over the place. You will find several high-voltage diodes associated with the LOPT, and there will be other diodes in the line output stage, for instance in the EW correction circuitry with 110° tubes.

The Crystal Radio

The diode goes back to the very dawn of electronics, when the first, simple radio receivers appeared. Fig. 1 shows the basic crystal-detector receiver circuit. The transmitted RF signal is picked up by the aerial, the varying signal current being passed to earth via coil L1. This coil induces current flow in the associated coupling coil L2, which is tuned by C1 to enable a particular transmitter frequency to be selected. The signal thus produced is of AC form, with positive- and negative-going excursions both of which carry the signal information. To obtain the audio signal we need only half of this RF signal, either the positive- or negative-going excursions. When connected as shown in Fig. 1 the crystal rectifier, or detector, passes the positive-going signal (connect it the other way round to obtain the negative-going modulation). C2 filters out the RF carrier wave, leaving just the audio to drive the high-impedance headphones: in practice it might consist of the internal capacitance of the headphones.

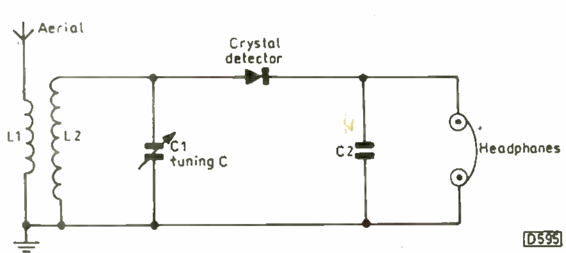


Fig. 1: The basic crystal-detector radio receiver circuit. This was the first application of the crystal diode.

In the early days of radio the crystal detector consisted of a small piece of mineral, such as zincite, bornite or galena, which was in contact with a fine wire known as the "cat's whisker". One side of the mineral was connected to the tuned circuit, the other side providing contact for the cat's whisker. The crystal was often housed in a metal cup, with three screws used to lock it in position and provide the electrical connection. The cat's whisker was made of various materials depending on the type of crystal in use.

This, the very first type of signal diode, was widely used but had the drawback of being difficult to set up: finding the most sensitive point could be a painstaking and slow procedure.

The Thermionic Diode

The introduction of the superheterodyne radio receiver introduced the need for IF signal demodulation (essentially the process just described) and some form of automatic gain control (AGC) to compensate for the effect of varying signal levels. For many years thermionic diodes were used for these purposes. AC mains radio receivers also required a power supply rectifier, as did the TV sets subsequently to appear. TV sets would also have a detector circuit and probably a DC restorer diode and boost HT and EHT rectifiers.

For detection and similar applications the Mullard EB91 double-diode valve came to be used in vast quantities. Fig. 2 shows how half an EB91 could be used as a DC restorer in the video stages of an early TV receiver. When a video signal (A) is capacitively coupled from one stage to the next its zero reference level is lost. It ends up rising above and below 0V as shown at B. This can be prevented by adding a clamp (DC restorer) diode across the resistive part of the CR coupling network. As soon as the signal tries to swing negatively, the diode conducts, clamping it at 0V. Thus output D is the same as input C. Clamping remains a very important feature in TV circuitry, but modern clamps tend to use a three-terminal device (transistor) so that they can be switched on at a precise time. This gives faster and more effective action, also greater flexibility.

Early Solid-state Devices

Thermionic diodes were big and very inefficient in energy use. The Fifties and Sixties saw a shift to the use of solid-state diodes in TV sets. Selenium rectifiers came into use for mains rectification, and semiconductor point-contact diodes for such purposes as vision and sound detection. There was also the copper-oxide rectifier, which found limited use for detection and clamping. Thermionic diodes continued to be used in the boost/efficiency diode position in line output stages, because at the time solid-state devices couldn't stand up to the high peak inverse current pulses present. GEC however did produce such a diode, which was used in the company's early colour sets.

Selenium and copper-oxide rectifiers are sort of forerunners of modern semiconductor devices. They were known generally as metal rectifiers and are based on the fact that certain metal oxides have semiconductor characteristics. The copper-oxide rectifier consisted of a pure copper element that was oxidised on one side. The same principle was used to make selenium rectifiers. Their action depends on the fact that electrons can pass more readily from the conductor to the oxide layer than the other way. One problem with these devices is that they tended to run hot, so that cooling was required – hence the fins with selenium HT rectifiers, which consisted of a number of selenium rectifier elements connected in series to achieve the required peak inverse voltage rating. Metal rectifiers were not all that reliable, and their electrical characteristics were not as clearly defined as those of the modern semiconductor pn-junction diode.

The PN-junction Diode

Once the semiconductor (germanium or silicon) junction diode came along other forms of diode soon became obsolete. How does it work? The junction diode, see Fig. 3, consists of adjacent p and n sections of semiconductor material. Impurity materials are diffused into the pure semiconductor material to produce in the crystal structure areas with a surplus (n-type) or a deficiency (p-type) of electrons – this is called doping. The extra electrons in the n-type section act as negative charge carriers. Doping in the p-type section produces holes in the crystal lattice. These act as positive charge carriers.

When such a junction is first formed, electrons are attracted to the p-type section and holes to the n-type section. There is electron-hole recombination in the junction area, forming a 'depletion layer' – an area depleted of charge carriers. The result is a potential difference across the junction, represented by the battery in Fig. 3. It has a value of approximately 0·2V with germanium, 0·6V with silicon.

The semiconductor diode conducts when its junction is forward biased, as shown in Fig. 4. By biasing the p-type section positively with respect to the n-type section, electrons and holes are attracted to the depletion layer. As a result the junction's reverse voltage is removed and current ('forward current') flows through the diode. Fig. 4 also shows the forward current/voltage characteristic curve for the device.

When the externally applied bias voltage is reversed, i.e. negative to the p-type section and positive to the n-type section, the barrier potential is increased. This is illustrated in Fig. 5. When the reverse voltage exceeds

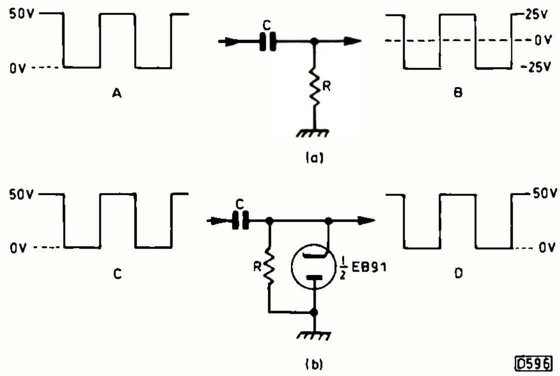


Fig. 2: When a signal is passed through a CR coupling network, the DC level is lost. This is illustrated at (a). It's a problem with video signals, which rely on the DC conditions to establish the black level. The solution is to use a DC restorer diode, as shown at (b). The EB91 double-diode valve was commonly used for this and other purposes in monochrome receivers during the Fifties.

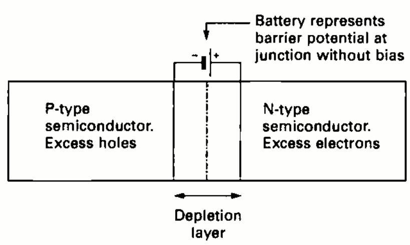


Fig. 3: The pn junction, which is the basis of semiconductor diodes. The junction is between p and n regions of semiconductor material. The depletion layer formed at the junction provides a potential barrier that, for conduction to occur, must be overcome by the application of a forward bias voltage.

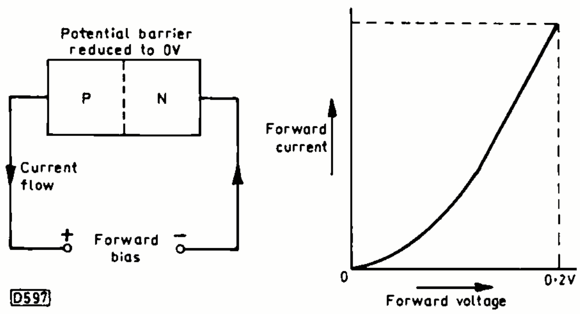


Fig. 4: Application of forward bias to a pn junction and the forward voltage/current characteristic.

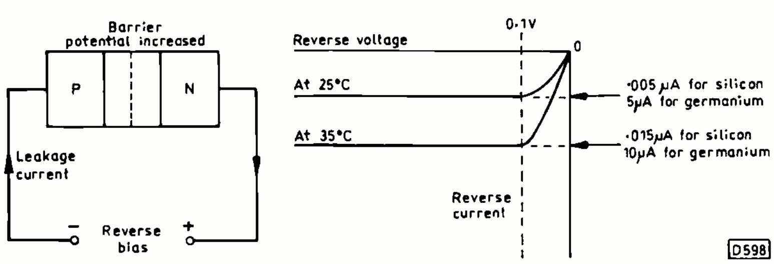


Fig. 5: A reverse-biased pn junction and the associated characteristic curves. The external bias reinforces the barrier potential. As the reverse voltage is increased from zero, current caused by impurity carriers subsides. It falls to zero at –0·1V. Thermally produced carriers are not affected by the bias, causing the flat reverse current characteristic.

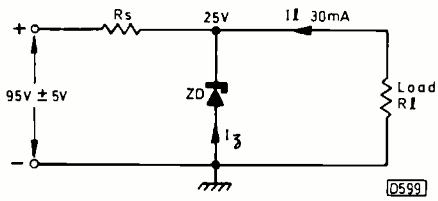


Fig. 6: Use of a zener diode as a voltage stabiliser. In this case a 25V supply is required, the load current being 30mA.

0·1V, there is theoretically no current flow through the device. But nothing in this world is perfect, and in practice some leakage current flows because of thermal effects – heat tends to dislodge electrons from their atomic bonds.

Basically the junction diode is a very efficient gate that allows current to flow in one direction only. As such it's an extraordinarily useful device. But the junction has other characteristics that enable it to do much more. One is that the junction capacitance alters as the reverse bias is varied – this is called the varicap effect.

The Varicap Diode

Setmakers soon realised that this was an ideal way of providing channel selection without the need for a cumbersome tuning capacitor. At VHF and UHF, only a small capacitance change is required to tune across the required band. This is easy to implement by varying the reverse bias applied to a group of varicap diodes in the tuner. All you need is a bank of presets and voltage-selector switches, giving channel change at the press of a button. One of the first tuners to use this principle was the Mullard ELC1043 that served us so well in the colour sets of the Seventies. It was the forerunner of today's tuners, which rely on a micro-controlled phase-locked loop to vary the channel selection bias.

The Zener Diode

The zener diode is designed to work in the reverse bias region. It's used mainly in power supply circuits, where it offers a simple and cheap means of providing a stable voltage. To achieve this characteristic the zener diode has a very narrow depletion layer, less than one micron in width, and heavy doping is used.

Basic stabiliser operation is illustrated in Fig. 6. Little current flows through the diode until its zener voltage is reached. At this point there is an electric field stress of some 500kV per centimetre across the depletion layer. Covalent electron bonds in the layer are broken, and there's a heavy current flow with virtually no change in the zener voltage. This heavy current has to be limited by including a series resistor (Rs), otherwise the diode would simply overheat, exceed its current rating and destroy itself.

The value of the series resistor is thus critical: if it's too low, the diode will pass excessive current and burn out. It's quite simple to calculate the value required when designing a power supply. Assume for example that we need a supply at 25V, 30mA which is to be derived from a 95V ±5V supply. A 25V zener diode is obviously required. If it's rated at 5W maximum, the maximum current capability of the device will be $(5 \times 10^3)/25 = 200$mA. Taking a half-way point, the current through Rs will be 100mA, made up of 30mA via the load and 70mA via the zener diode. The voltage drop across Rs will be 95 – 25 = 70V. So the value of Rs works out at

$$70/(30 + 70) = (70 \times 10^3)/100 = 700\Omega.$$

The nearest preferred value is 680Ω. The supply voltage can rise to a maximum of 100V. We can calculate how much zener current there will be under these conditions. There will be 75V across Rs, the current being

$$(75 \times 10^3)/680 = 110\text{mA (Is)}.$$

The zener diode current Iz = Is – Il, i.e. 110 – 30 = 80mA.

We can similarly calculate the minimum zener current. With the supply reduced to 90V, there will be 65V across Rs. So the current is $(65 \times 10^3)/680 = 96$mA. The zener current will be 96 – 30 = 66mA, which is well below the permitted maximum of 200mA calculated previously.

These calculations can be helpful in the workshop when repairing a zener-diode regulated supply – as we found recently when repairing a small Cathay 14in. colour portable. It had a simple zener-diode regulator circuit to provide a 12V supply for the sound, IF and field timebase sections of the set. The HT voltage had risen by 10V, with the result that the feed resistor Rs and the zener diode had been destroyed. As we didn't have a service manual, we were uncertain about the 12V supply's current consumption. We obtained the zener current from data tables. To get an idea of the supply current, we temporarily connected a 7812 regulator in place of the zener diode-resistor combination, with a meter in series with the output to indicate the load current Il. Having found a value for Il, we were able to calculate the value of the series resistor in the zener diode network.

Before doing this we had to repair the main power supply – by replacing a couple of dried out 47µF electrolytic capacitors on the primary side of the chopper circuit.

The Avalanche Diode

Had the HT voltage in the Cathay set risen by just a few more volts yet another type of diode would have come into operation, placing a dead short across the HT supply. This would have shut down the power supply by blowing the mains fuse. The diode is the avalanche type. It's a simple, handy form of protection that can be used where cost is a prime consideration.

As the reverse bias applied to a pn junction is increased, the field across the depletion layer reaches a very high level (hundreds of kV per cm.). This field accelerates the reverse saturation current carriers. They collide with the atoms in the depletion layer, and have sufficient kinetic energy to dislodge further electrons, creating hole-electron pairs. These additional carriers are in their turn accelerated, providing yet more free carriers to add to the reverse current, which is multiplied to a very high value.

This is the avalanche-diode protection system used in many TV sets. Avalanche diodes are available with various breakdown voltage ratings from 5·5V to 2kV. The breakdown voltage is determined by the level of semiconductor material doping.

In Conclusion

We have looked at the history of diode development and at the types that are most commonly used in today's domestic TV equipment. It is all thanks to the versatile pn junction, which is a far cry from the early crystal detector. When a second pn junction is added you get

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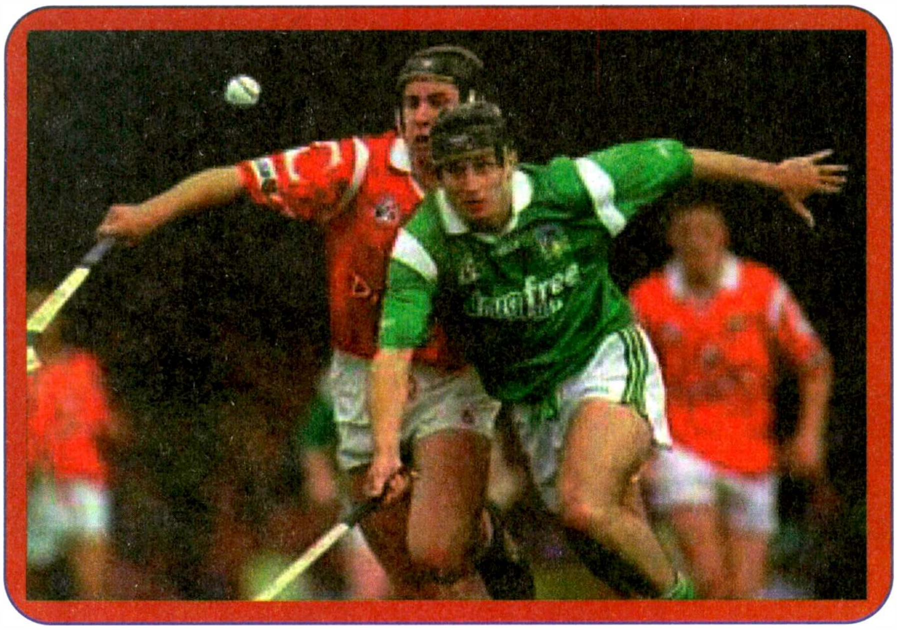
Working voltage	600V DC or pk-pk AC

Switch position 2

Bandwidth	DC to 150MHz
Rise time	2.4ns
Input resistance	10MΩ ±1% if oscilloscope i/p is 1MΩ
Input capacitance	12pF if oscilloscope i/p is 20pF
Compensation range	10-60pF
Working voltage	600V DC or pk-pk AC

Switch position 'Ref'

Probe tip grounded via 9MΩ, scope i/p grounded



The Setanta subscription sports channel has recently gone digital and is now available via the NSS K satellite. So a new receiver has been introduced. Hugh Cocks describes its operation

The Setanta Sports *Digital Receiver*

The Irish subscription satellite sports service Setanta is available to pubs and clubs throughout the UK and Europe. It is also available in North America and Australia, though the encryption system in use in those areas may be different.

Until recently Setanta used the Telecom 2C satellite at 3°E, with encryption a variation of the familiar VideoCrypt analogue system used by Sky. The receiver supplied to establishments that subscribe to Setanta was usually a modified Pace VideoCrypt type. 2C's footprint in southern Europe is relatively poor however. That, combined with the inevitable change to digital, has meant a change of satellite and the adoption of a new MPEG-2 based digital encryption system.

The new satellite selected was NSS K at 21·5°W, which provides pan-European coverage using a relatively small dish. Transmissions are at 11·627GHz V, with a symbol rate of 6,111 and FEC of 2/3. The encryption and subscription management systems are supplied by Irdeto/Mindport, which is active in various digital markets throughout the world.

Hurling is Europe's oldest field game. Our heading picture shows Limerick's Jack Foley getting in front of Cork forward Kieran Morrison at Limerick.

Receiver description

The receiver supplied by Setanta for the new service is the Irdeto DSD660, which has an IF loop-through and a sound subcarrier output that's software selectable between 5·5 or 6MHz via the ch. 21-69 UHF modulator. It seems to have originally been intended for the South African market, and is made there.

The viewing card is inserted at the front right-hand side of the unit. Irdeto uses a separate conditional-access module that slots into the receiver for the Dutch digital package via Astra at 19·2°E, but with the DSD660 everything is self-contained. The receiver's menu structure is very similar to that used for reception of the Dutch digital system however.

The advanced options menu

Photo 1 shows the main menu. When you have selected the advanced options submenu (Photo 2), then selected "change dish installation", you are prompted to enter a PIN code. This, from the factory, is preset at 9949.

The first item in the change dish installation menu is the LNB configuration submenu (Photo 3), which has six LNB setup options. These provide DiSEqC command and tone burst selection in addition to the usual LNB power and frequency adjustments, see Photo 4. The DiSEqC switching facility could be useful with an installation that has a common downlead from the roof and where satellite switching is required. There are six different options here, though this does seem like overkill, especially as the receiver will produce a picture only with a Setanta Sports signal (see below).

When you revert to the change dish installation submenu and select signal setup you can search through 24 different default frequencies. Signal setup 1 (home) is preprogrammed with the Setanta signal characteristics, see Photo 5. All the other 23 signal set options must have line one (signal source) disabled.

Setanta transmissions are available only occasionally. The receiver will carry out a search at each of the enabled default frequencies. Photo 6 shows what you get at 11·627GHz when there is no Setanta signal present. If other signal setups are enabled, after a few seconds the on-screen search frequency will go to the next one. When a signal is found, the search routine stops. The receiver won't revert to the Setanta until the signal it has found goes off-air. Unfortunately Setanta normally goes live with a signal just prior to a sporting event, so the receiver must have only signal setup 1 (home) enabled in normal use otherwise the big match is unlikely to be seen.

Signal setup 24 is preprogrammed with a Reuters downlink frequency that's on-air all the time via NSS K. It's useful to enable this signal setup during an installation. The receiver won't display a picture even when the Reuters signal is unencrypted (it usually is). Instead it displays the message "E37 reserved for future use" with any signal it locks to except Setanta.

The third option in the change dish installation menu, tune DSD, forces the receiver into the search mode, the result being a display such as Photo 6. Unfortunately it also takes you right out of the setup menus, so you have to repeat entering the PIN number etc. to get back to the same position.

Option 4 in the change dish installation menu, reset to factory defaults, is useful though not essential with this receiver. If you've been experimenting with different settings and are unsure of all the receiver's current parameters, this option will default the receiver to looking for only the signal setup 1 (home) with a universal LNB, no DiSEqC commands and the modulator's output on ch. 42 with a 6MHz system I sound subcarrier.

Option 5 enables or disables the tuner's IF loop-through facility.

When you return from the change dish installation submenu to the advanced options menu, the next option down is signal detection. This provides a useful check on the received signal, see Photo 7, though dish alignment is best carried out with a spectrum analyser and then checked with an MPEG-2 digital receiver, such as the Nokia 9600 or 9800, that can receive unscrambled single channel per carrier (SCPC) signals. Receivers, such as the Sky digibox, that will tune only MCPC (multiple channels per carrier) signals cannot resolve a relatively low symbol rate (narrow bandwidth) signal such as the Setanta one.

The third option in the advanced options menu is "information". This gives access to three submenus that list the software and hardware in the receiver. It should not be required for installation purposes.

TV Installation

The fourth option in the advanced options menu is TV installation. This submenu has five options, TV type, aspect ratio, UHF tuning, scart source and scart video output. The first switches the UHF modulator's sound subcarrier frequency (5·5 or 6MHz), the second the aspect ratio (4:3 or 16:9) while the third enables the UHF output to be set between chs. 21 and 69.

Photo 8 shows the test pattern produced for modulator tuning. It usually displays the frequency as well as the channel number and is identical to the Dutch Irdeto receiver's UHF test pattern.

The fourth and fifth options in this submenu enable all three scart sockets at the rear of the receiver to be individually programmed for the installation's requirements. This is a very handy feature that should be incorporated in all modern digital satellite receivers, see Photos 9 and 10.

Option 5 in the advanced options menu, change modem settings, would enable an external telephone modem to be programmed. A modem is not supplied with the Setanta receiver however. Option 6 enables the

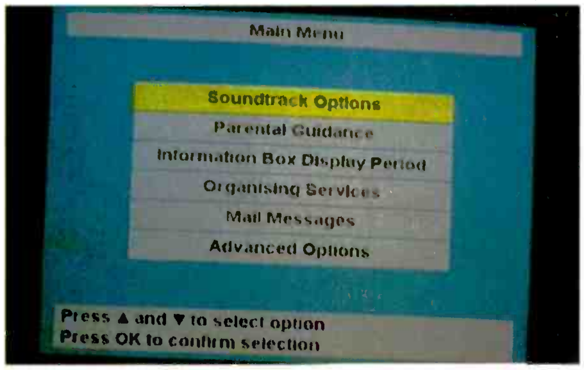


Photo 1: The Setanta receiver's main menu.

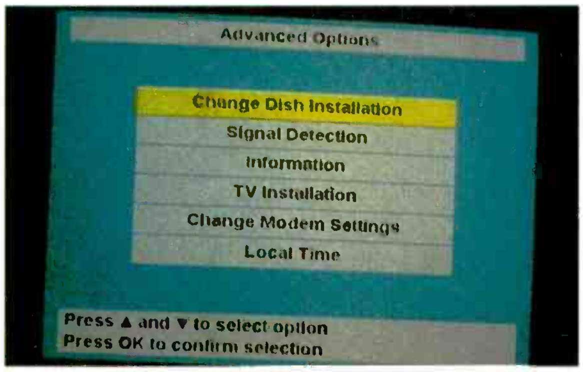


Photo 2: The advanced options submenu.

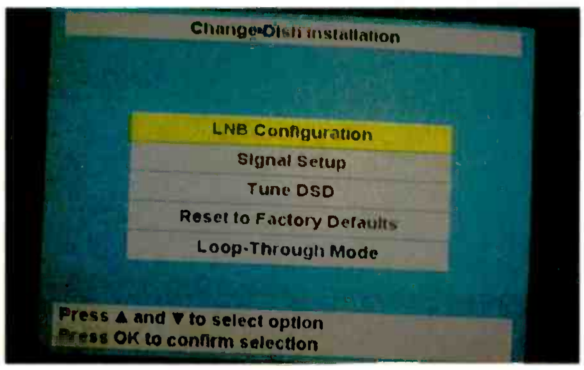


Photo 3: The change dish installation sub-submenu.

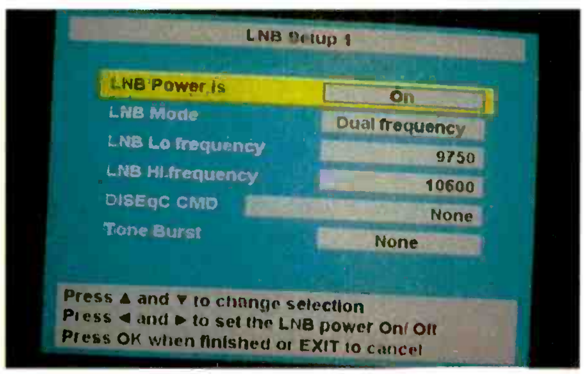


Photo 4: The LNB setup 1 display.

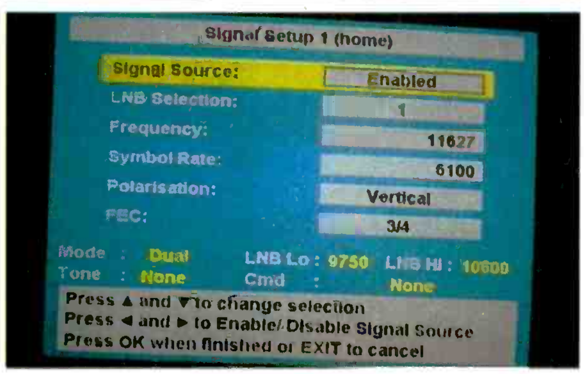


Photo 5: The signal setup option 1 (home) display.

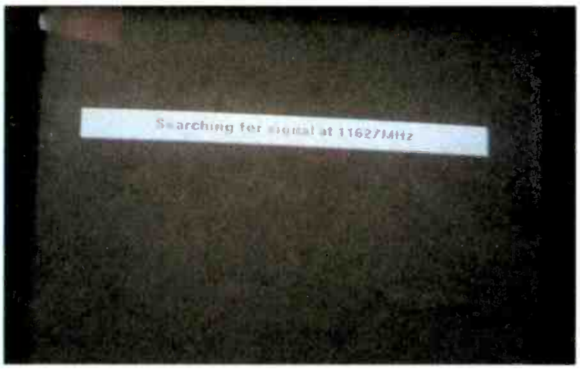


Photo 6: The screen display when no Setanta signal is present.

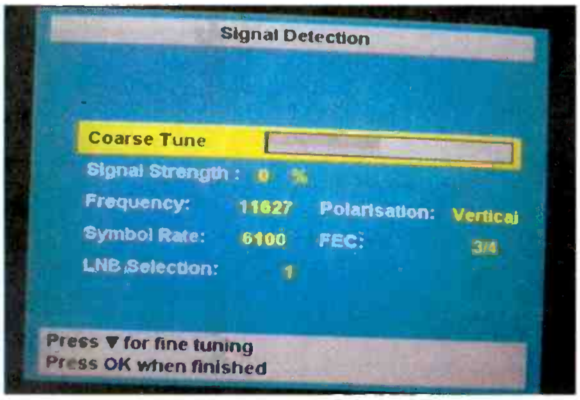


Photo 7: The signal detection display.

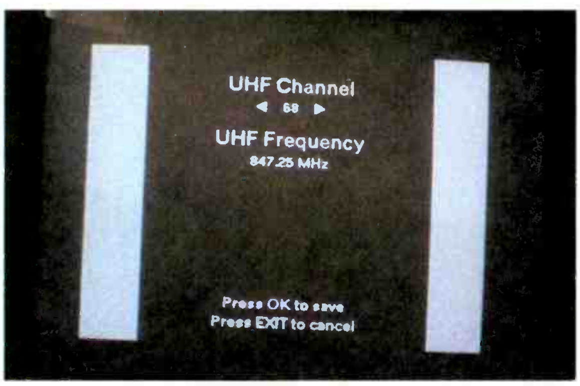


Photo 8: The UHF output tuning display.

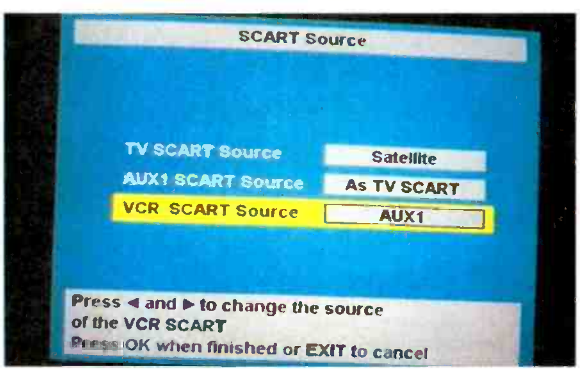


Photo 9: The scart source display.

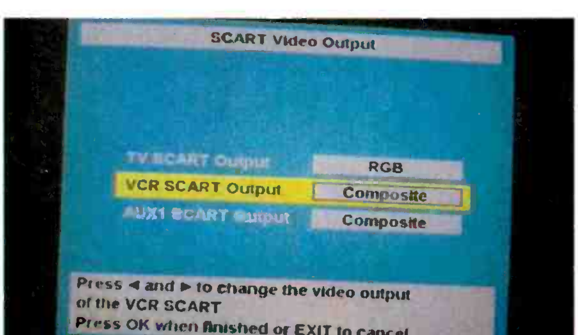


Photo 10: Scart video output display.

local time to be set. This is displayed on a programme information banner at the bottom of the screen for s few seconds when Setanta is first selected. Many MPEG-2 receivers do this. We have now covered all the options in the advanced options menu.

Main menu

Returning to the main menu (Photo 1), the first option provides selection of different languages. This was no doubt originally intended for the South African market. Option two, parental guidance, is not really relevant with Setanta. Option three adjusts the time duration of the information box at the bottom of the screen when the channel is first selected. Option four would enable received channels to be organised in a preferred order – in this application there's only one channel however! Option five is a mailbox facility that might possibly be used in the future.

Receiver installation

In my part of Europe (Portugal) a 1·2m dish is recommended for Setanta, though a smaller one will suffice in the UK. Dish installation is best carried out with a spectrum analyser to identify the satellite. If in doubt as to whether you have the correct one, you should find a Reuters signal which is normally present at 11·566GHz V, with SR 5,632 and FEC 3/4. You get some analogue signals via this satellite, particularly at around 11·6GHz V at the weekend, but there are no permanent analogue signals here any more. If you have internet access, up-to-date transponder listings can be found on

http://www.lyngsat.com

Select the European listings and click on NSS K 21.5 west. There is no particularly powerful satellite nearby to cause confusion, the nearest one being Intelsat 605 at 27·5°W – it still transmits the SIS bookmakers' feed in B-MAC analogue form at about 11·6GHz H.

LNB skew setting is of course critical. Because the satellite is to the west, not east as usually, the LNB has to be turned clockwise a little (when looking into the front of the dish), not clockwise as with Eutelsat and Astra. Skew can be fine tuned using the signal detection menu (Photo 7) – tune for maximum deflection.

One problem with the receiver is that if there's no signal a relay clicks intermittently. Sometimes there's no Setanta signal for up to a week at a time – transmissions are mainly on Sunday afternoons. For schedule information go to

http://www.setanta.com

Because of this clicking, one receiver we installed recently is normally switched off at the mains until just before a transmission starts.

There's a second potential gremlin. Once the receiver has found a Setanta transmission it goes to standby and has to be switched on using the remote control unit or the front panel button. When no signal is being received, the front panel display normally shows three horizontal flashing lines. Once the frequency has been found, the display changes to a rotating circular pattern. Then the receiver goes to standby with just a single dot on the front panel display. There's scope for confusion here but, fortunately, everything has worked well – so far!

The name Setanta is taken from Irish legend and is known to all Irish schoolchildren. A nephew of King Conor Mac Ńeasa of Ulster, who as a boy was Ireland's first great hurling hero, he is famous for slaying a magnificent hound with his hurling stick and sliotar and from then on was known as Cuchulainn – the hound of Culainn. Tréasa Ni Mocléir

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SRD510 , SRD520 , SRD540 , SRD545 , SRD550	SATPSU3
SRD500	SATPSU4
BRITISH TELECOM	
SVS300	SATPSU17
BUSH	
IRD150	SATPSU12
ECHOSTAR	
SR5500 EARLY PSU WITH ADJ.	SATPSU12
FERGUSON	
SRD 5 , SRD16	SATPSU1
SRD4	SATPSU11
SRV1	SATPSU2

MAKE & MODEL	CODE
FINLUX	
SR5700	SATPSU12
SR5100	SATPSU23
GOODMANS	
ST700	SATPSU1
GRANADA	
KR1 , LR1 , LR2 , M/N92MR1/A	SATPSU1
HR 1, JR1	SATPSU2
NR2 , PR2	SATPSU8
M92MR2	SATPSU9
GRUNDIG	
STR1	SATPSU1
GIRD2000 , GIRD3000	SATPSU2
GRD150 , GRD250 , GRD280 , GRD300 , STR200S	SATPSU20
HITACHI	
SR-1050D	SATPSU1
MASPRO	
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SRE250S , SRE350S , SRE450S	SATPSU2
ST5 , ST-12	SATPSU20

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RD600	SATPSU20
MITSUBISHI	
ST-PB10	SATPSU1
NOKIA	
SAT1500 , SAT1600	SATPSU2
SAT1700 , SAT2200 , SAT2202	SATP-
SU23	
PACE	
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SS9200 , SS9210 , SS9220	SATP-
SU2	
MSS100 , PRIMA	SATPSU8
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SAT301	SATPSU10
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SRD7/8 , SRS3 , SRS4	SATPSU2
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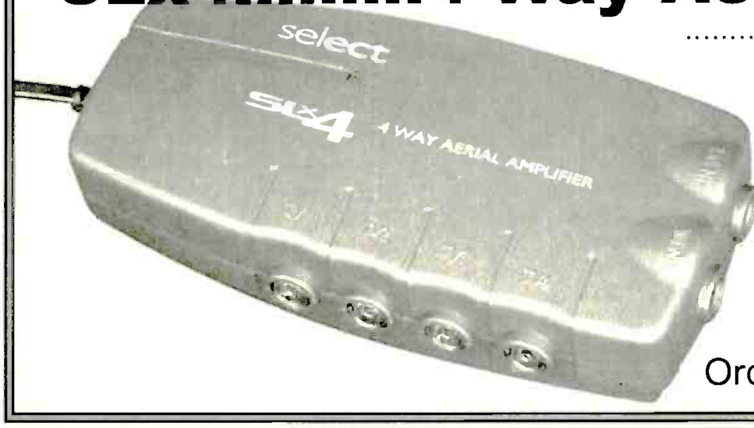

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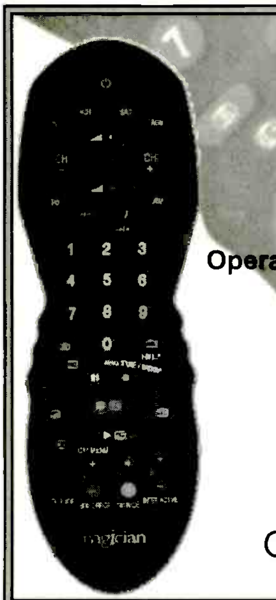

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BU2520AF	170p	BUZ90A	180p	MJ15023	400p	TIP35C	65p	LM723	40p	STR441	950p	TDA1518BQ	240p	TEA5101B	175p	UPC1488H	115p
BU2520DF	225p	BUZ90AF	280p	MJ15024	400p	TIP36C	65p	SAA1293	550p	STR44115	475p	TDA1557Q	300p	TEA5170	200p		
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BUH315D	175p	IRF740	90p	S2000N	150p	HA13155	920p	STK5333	650p	STRD4420	550p	TDA4601	120p				
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BUT1AF	35p	IRFBC40	210p	TIP127	35p	LA7830	90p	STK73605	375p	TA8215	300p	TDA8362N3	1200p				
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BUT12AF	90p	MJ11015	250p	TIP29A	22p	LM1207N	450p	STK7406	650p	TA8227	250p	TEA2018A	80p				
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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: Power supply/line panel for the Hitachi Model CPT2508 (G7P Mk 2 chassis) and a mains transformer for the Hitachi Model CPT1646R. D.G. Harris, 30 Boundary Road, Chippenham, Wilts SN15 3NN. 01249 444 275.

Wanted: Spare or scrap Sanyo VM-D6P 8mm camcorder. Particularly require the cassette (door) cover. Bryan Potter, 10 Holmbury Close, Southgate West, Crawley, Sussex RH11 8TG. 01293 407 567 (evenings).

Wanted: Mains on/off switch for the Philips CTV portable Model 14CN3001/05B (NC3 chassis). Also ICs to repair a no sound fault with the Thorn Model CT514TN Nicam stereo sound receiver (Daewoo CP365 chassis), or a complete set with working sound. T. Milverton, 121 Borrowdale Road, Northfield, Birmingham B31 5QL. 0121 477 2044 (evenings).

Wanted: Front flap and IR receiver 'prism' for the Tatung TV Model TU8711 (170 series chassis). Have for disposal a Sharp VC381 VCR (as featured in Denis Mott's recent surveillance system article) in good condition, free to collector. Nicholas Arnold, 30 Mere Road, Upper Wolvercote, Oxford OX2 8AN. Phone/fax 01865 556 991.

Wanted: Circuit diagram/servicing information for the Royal DN1782G monitor. Copies OK. R. Hamit, 36 Mill Road, Cambridge CB1 2AD. 01223 516 674.

Wanted: Circuit diagram for the Ferguson SRD4 satellite receiver. Les Swain, 53 Park Road, Buckden, Huntingdon PE18 9SL. 01480 811 058. E-mail leslie@swainmail62.freeserve.co.uk

Wanted: Chopper transformer, part no. 00D3-089-001, for the Ferguson TX100 chassis. Brian Long, Longster, Smerral, Latheron, Caithness KW5 6DW. 01593 741 249.

Wanted/for disposal: Require circuit diagram/service manual for the Saisho TCR600 TV combination player. Photocopies OK. Have for disposal a number of repaired mains/battery mono portables. R.E. Bailey, 22 Grebe Close, Waterlooville, Hants PO8 9UT. 01705 783 811.

Wanted: Copies of the April and May 1999 issues of *Television*. Costs will be paid. Please phone the *Television* editorial office on 0181 652 8120.

Wanted: Complete lower drum assembly and remote control unit for the JVC Model HRD860 VCR. A complete scrap unit would be fine. D. Kenney, 45 Bicton Avenue, St. Peters, Worcester WR5 3TF. 01905 351 905. E-mail dankenney@x-stream.co.uk

Wanted: Tuner unit for the Hitachi Model C2564TN, also the ICs for positions IC3000 and IC100, types not known; CRT for the Samsung CTV Model CI6230WN; power supply for the Sanyo Model VHR3300 VCR; power supply for the JVC Model HRD170EK VCR; display, PCB and facia parts for the Mitsubishi B10 VCR, complete boards or units considered. Steve Thomson, 51 Churchill Way, Manor Estate, Stafford ST17 9PB. 01785 223 219.

Wanted/for disposal: Require a remote control unit, e.g. RH880, for the Ferguson TX89 chassis; also operating handbooks for the Philips CD360 and VR6870. Have for disposal three working Philips Video 2000 type machines (VR2020/2021), free to a good home; and a new Philex remote for the Ferguson TX10 chassis with stereo and text. S.J. Sheppard, 12 Bedford Road, Harrow, Middx HA1 4LZ. 0181 863 5150.

Wanted: LOPT for the Tatung Model T21TD60 TV set (D series chassis) plus service manual and/or circuit diagram (photocopy OK). C. Irvine, 46 Sandringham Crescent, Moortown, Leeds LS17 8DF. 0113 228 0999.

Wanted: Anything to do with pre-Seventies radio and TV sets. Service information, parts, valves, books etc. Will travel anywhere to collect. I'm retired for medical reasons and restore old radios and TVs as a hobby. Steve Taylor, 11 Charnborough Road, Coalville LE67 4SF. 01530 832 695 or 07977 805 308.

Wanted: Melford Monitor Model DU2-22C, working or non-working. Contact Darren Bye on 01222 435 572 (Cardiff).

Free to caller: Advance AF signal generator Model H1. Classic instrument with handbook and circuit diagram. In full working order when last used. Call or arrange courier to colllect, but must phone first. Len Knott, Belgae, 8 Woodford Close, Ringwood, Hants BH24 1UT. Phone/fax 01425 474 584.

Wanted: Circuit diagram, (photocopy OK) for the Soundwave Model CTV2003T. P. Smith, 38 Rancliffe Crescent, Leicester LE3 1NQ.

Wanted: Lower drum assembly or complete drum assembly for the Mitsubishi Model HSB70 VCR. Paul Singh, Unit 4, White City Retail Park, Chester Road, Manchester M16 0RW. 0161 877 9391 or 0958 285 128.

For sale: Because of retirement I have for disposal copies of *Television* from 1987-98 and contents of workshop (TV/video manuals, two filing cabinets, ten 64-drawer storage cabinets, spares, meters etc. – also TV sets and VCRs for spares). All for sale, best offer. Can split if required. Phone 0191 477 3664 (Gateshead) and ask for George.

Wanted: Service manual for the Radio Rentals Contracts R6154 datatext 80 business terminal. R.A. Lord, 22 Elizabeth Crescent, East Grinstead, Sussex RH19 3JA. 01342 325 149.

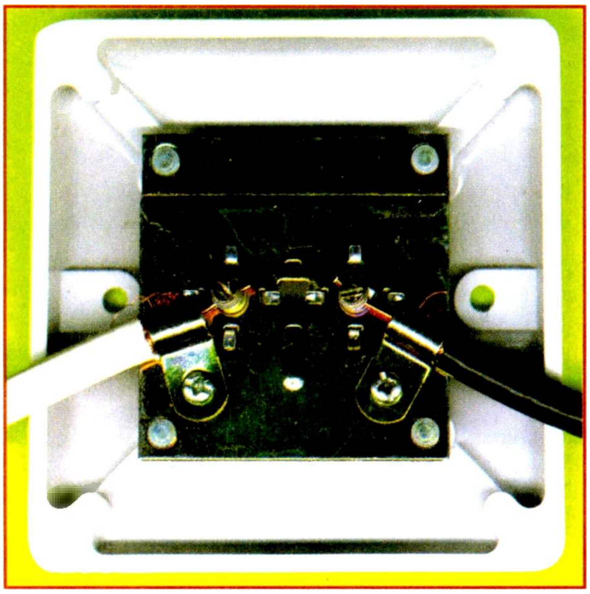
For sale: Canon portable VCR Model VR10 with tuner, carry cases and video camera Model VC10. £120 or offer. Also two Philips VLR700 LaserVision disc players. Offers. E. Richman, phone or fax 0181 590 4947 (Ilford, Essex).

Wanted: LOPT for the Mitsubishi Model CP1424B. The part no. appears to be 334B07701. C. Wass, 96 Whinmoor Crescent, Leeds LS14 1EG. 0113 273 2565.

Wanted: Chopper transformer for the Alba Model CTV4855; a TDA1770 IC; and a Bang and Olufsen handset type 3747TV. Paul Bertley, 43 Breach Road, Marlpool, Heanor, Derbyshire DE75 7NL. 01773 765 258.

Satellite WORKSHOP

Jack Armstrong



Our heading photo shows the wall-plate assembly, with saddle-clamp cable securing, that caused the digital Sky problem. The unshielded centre-core stub radiates the satellite IF signal, which is picked up by the adjacent terrestrial aerial connection.

Digital Sky

Funny how your ears can play tricks. I could have sworn that the lady's voice at the other end of the phone said "this guy's ruining my pictures".

"Huh? Which guy?"

"Not 'guy', 'sky'" said the now-irritated voice. "The sky is ruining my pictures."

"Ah!" I exclaimed, "it's best to keep paintings out of bright sunlight. They can fade. Put them in a darkened room."

"Which paintings? It's my SkyDigital box that's the problem. I can see the Sky drifting right across the TV."

Some things can never be comprehended from the explanations offered. I knew I was in this situation. So I asked a question that was simple to answer.

"What's your address?"

"Address?"

"Yes. If you are local I'll come round and have a look."

"How much?"

I groaned inwardly, anticipating the reaction when I told her.

"That's cheaper than the last man" she said. I almost fainted.

The problem was obvious when I was able to see the TV display. When the SkyDigital receiver was on, a faint picture floated across the terrestrial TV picture.

There was a mess of wires behind the TV set. I had brought a selection of cables with me, so I fitted some very short (18in.) scart leads. That seemed to help, but did not eliminate the problem. I next replaced the thin white 'clothes lines' that dealers seem to love, using double-screened RF leads instead. The display was better but still wasn't right. I needed to know what sort of coaxial cable had been used for the downleads, which were terminated at a wall plate. When I unscrewed this I saw that the satellite coaxial cable was of good quality with a double screen of copper foil and braid.

Unfortunately however the wall-plate assembly used a saddle-clamp system to secure the coaxial shield and a screw terminal for the centre copper core. As a result almost a centimetre of the centre core was unscreened. This might have been acceptable with the outputs from two terrestrial aerials, but was a disaster with the output from an LNB just millimetres away from the terrestrial cable termination (see photograph). The problem is that the satellite centre-core stub acts as a transmitting aerial, with pickup by the terrestrial centre-core stub. A centimetre is a significant length at frequencies above a GHz, so it's vital for connections to be shielded.

As a temporary measure I removed the wall plate and used F plugs with threaded couplers to connect the cables separately. The pictures were then perfect. I returned later to fit a longer back box and two separate wall plates, both with threaded F connectors. You will find these accessories at Satcure's web site: www.satcure.co.uk or www.netcentral.co.uk/satcure

An Echostar SR70VC

I couldn't quite catch the name of the bent-up old boy who brought in this Echostar receiver. It sounded like Methuselah.

"How can I help you, Mr Methuselah?"

"Mmf fmoked and gone dead" he replied.

"Oh dear. Smoked and went dead? But it is rather old. Would you like to exchange it for this nice Pace PRD800?"

"Mmf likely!" he said. "Mmf one haf no silly menuf. Thatf how I like it. Nife and fimple."

"Ah, nice and simple? Yes, I suppose that's an advantage. OK, I'll see what I can do. Leave it with me and call back tomorrow Mr Methuselah."

"Mmf ftop calling me Mefufelah. Name'f Maffewf."

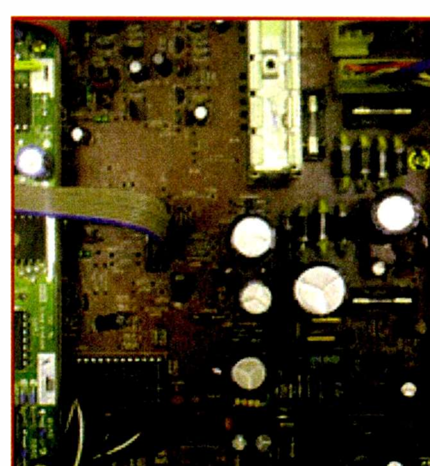
"Oh, OK Mr Mathews."

The Echostar SR70VC was also sold as the **Connexions CX95A**. Thanks to Protel in London I have a service manual for this model. The receiver's cover is held by only three screws, but you have to extract another eighteen to remove the circuit board.

I plugged the receiver in and checked the outputs from the power supply. According to my digital multimeter the 5V output was way down at 3V. I didn't believe it, so I switched on my oscilloscope to see what was present. There was a horrible ripple where 5V DC should have been. I pulled the plug quickly.

The circuit diagram shows that C601 is the reservoir capacitor for the 5V supply. It read infinity when I checked it with my Genie Plus ESR meter, so it was clearly dead. But out of interest I desoldered it and checked it with my capacitance meter. The reading was 67nF instead of 3,300µF. A replacement, rated at 25V, brought the receiver back to life.

I didn't at first recognise Mr



The Echostar SR70VC.

Mathews when he returned to collect his receiver. His back was straight and he looked me straight in the eye. Then he spoke.

"Ofteopafff!" he chuckled through missing front teeth. "Wonderful people these ofteopafff. Muff better than my ufeleff doctor."

Pace MSS200

I may have reported this fault before, but the symptoms seem to be different. So it's probably worth another mention. After a power supply repair the receiver didn't produce any decoder messages and the 'blue screen' couldn't be produced by pressing F then store. When picture menu was selected there was a blank screen. This suggested missing sync pulses, and I was right in suspecting the 1µF electrolytic capacitor C109 that lives next to the PTV111 sync separator IC.

This section of the circuit often causes problems. In later production C109 was changed from an electrolytic to a multilayer ceramic capacitor. You can understand a reluctance to use one from the start: it costs about ten times as much! An extra production cost of ten pence might not seem to be much, but in my experience it can become an extra pound by the time the unit reaches the retail outlet. It doesn't take much of this before the cry "rip-off Britain, too dear!" is heard. Unfortunately this places pressure on manufacturers to follow the Far Eastern practice of using the cheapest components available. With the help of modern central heating and the use of hi-fi cabinets (ovens!), in some cases the cheap parts are lucky to last the guarantee period.

The PTV111 sync separator chip sometimes fails. It can usually be replaced with the more readily available TEA2130 or with the chip in position U18 in Pace PRD series receivers. Purists might argue that the design parameters are fractionally different, but if it works and the customer is happy and wants the job done cheaply an alternative is acceptable.

Possibly the least reliable chip in this model (and all its variants) is the MSP3400 audio processor, followed by the expensive and virtually unobtainable PTV110 chip that, amongst other things, carries out A-D and D-A conversion for the decoder circuit. I sometimes wonder whether the cause of failure is the 5V supply, which is often high – I've measured it at 5·5V in many receivers. When it's as high as this I reduce it to about 5·15-5·25V by fitting a slightly lower-value resistor in position R55. This surface-mounted resistor has a nominal value of 9·1kΩ. It's connected to pin 8 of U3 (TEA2018A) and is in parallel with a 1kΩ resistor. Do not replace the 1kΩ resistor by mistake or you will get expensive smoke from every chip that's connected to the 5V supply – and also the tuner.

[redacted]

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

http://www.ukstay.com/jack

If you have no internet access you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

Test Case 446

Cathode Ray is a sort of jack of all trades in the TV and video business. When he's not climbing ladders in icy weather to fix dishes he could be trying to suss out the software set-up of the latest 28in. widescreen TV or, as we saw a short time ago, getting to grips with the workings of a twenty-year-old VCR. Ray has at least been warm and dry in the workshop recently, repairing rental and chargeable VCRs. Even here life has been no cinch for him however, as two examples in a single morning show! If only Ray would look at machines and mechanisms more closely he would be more effective . . .

His troubles started with a Panasonic NVJ45. According to the job card, the fault was "poor results with own recordings". To be methodical, Ray started by confirming that playback of a good recording was OK. The vision and sound on the workshop test tape were reproduced very well. Ray then made a five-minute recording of the workshop test pattern while he brewed some coffee. The playback of this was terrible! There was no colour in the picture, which continuously twitched sideways. Even the sound was accompanied by a rhythmic wow effect. At the end of the five-minute recording on the tape, the original recording (made on another machine) came through fine, both sound and vision. When the VCR's own recording was tried in another VHS machine, the monitor TV's screen displayed a mass of diagonal lines.

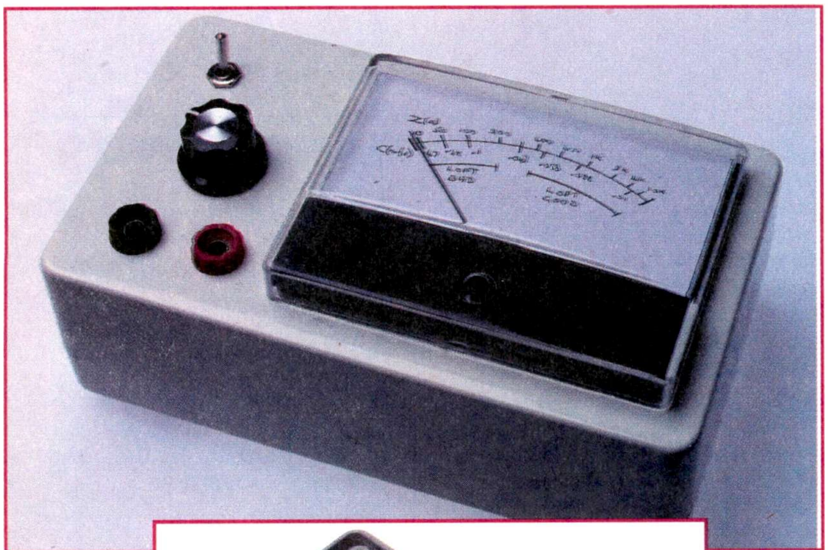
It seemed to Cathode Ray that there was an evil fault in the VCR's recording circuitry, possibly in the servo department. Not so. Look at the machine, Ray! Not even necessarily inside it!

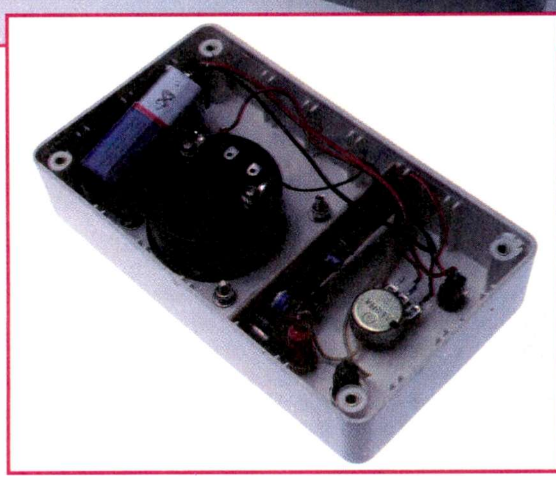
Next up on the bench was an Akai VSG270. This VCR's fault could, and indeed has, cropped up with other makes and models, so there's no need to rush off for the service manual. The symptom this time was flutter on sound: a rapid (perhaps five times a second) variation in the pitch of the playback audio. It was bad with the 1kHz tone from a test tape, worse still when a recording of a steady audio tone from a test-pattern generator was tried. There was hardly any effect on the picture however – perhaps a very small side-to-side movement of the pattern being played back, in time with the sounder flutter. It was noticeable only if you looked hard, and invisible with normal programme pictures.

Well, the second fault didn't appear to be too difficult! Ray checked the VCR's take-up torque – this sort of thing can be caused by a sticky or 'jumpy' reel-drive clutch. As the torque was steady and correct, attention was turned upstream to the capstan and pinch roller. In fact the latter was replaced. But the fault persisted.

Ray connected an oscilloscope to the capstan speed-control line. He saw only a steady DC level that responded when he loaded the shaft mechanically by gripping it with his fingers. What else could cause sound pitch variations? The oscilloscope also showed that the amplitude of the audio output signal was varying slightly in time with the pitch changes. There was nothing wrong with the capstan motor that Ray then replaced.

Use your eyes, Ray! Where, in this deck, lay the cause of the trouble. It was highly visible. For the solution to the two problems, turn to page 247.





Alan Willcox describes LOPT failure modes and the problems of diagnosis, then presents a new tester design that doubles as a capacitance meter. He also provides guidance on efficient servicing procedures

Problems with LOPTs

We all know that line output transformers fail. But correct diagnosis of a faulty LOPT is not always straightforward. In most modern sets protection circuitry will shut down the power supply in the event of an overload or excessive HT. This presents a problem: is the power supply at fault, or is there an overload ? More to the point, is the LOPT OK or not? You can carry out a lot of work to put right a power supply failure only to find that the LOPT is faulty and it may not be economically worthwhile to obtain and fit a replacement.

LOPT testers have been available as an aid to diagnosis for almost as long as we've had flyback transformers. In the early days, with valve chassis, a common solution once the EHT rectifier had been eliminated was to use a known good LOPT – any one would do – with top-cap connectors. These were connected to the cathode of the efficiency diode (e.g. PY81) and the anode of the line output valve (e.g. PL81). If a healthy spark could then be drawn using a screwdriver, the original LOPT was invariably defective. The lack of protection circui-try in those early days meant that there were often physical clues, in particular the overwinding would get very hot when there were shorted turns. How many of you remember the tell-tale burn ring around the overwinding of the LOPT in the ill-fated Philips G9 chassis? Many will remember the difficulty of LOPT replacement in the G8 chassis, but at least the transformer was known to be fault-prone. In my view, diagnosis problems began with the advent of the diode-split type of LOPT. I think others will agree that the use of a separate tripler was inherently better.

Causes of failure

In general a LOPT can fail in either of three ways. A short-circuit may develop between the primary winding and one of the secondary windings. In this case diagnosis is simple: because the secondary windings have an earth connection, a meter check will record a low resistance between the collector of the line output transistor and chassis. But you can be fooled about this, as we shall see.

The second and less well understood cause of LOPT failure is shorted turn(s). In parts of the transformer where the potential difference between physically close sections of the same winding is high, the insulation can break down. Internal arcing may then occur. This usually creates a permanent shorted turn by welding. In this case there is no tell-tale low-resistance reading to chassis, and the change in the DC resistance of the affected winding will be so small that it cannot be used as an aid to diagnosis.

The third common failure mode is when the EHT section of the transformer breaks down under load. There is usually a way round this problem. But first more on the shorted turn.

The shorted turn

Why does a shorted turn have such a drastic effect? This is one way of looking at it. If transformer losses are ignored, the current flow in the primary winding is proportional to the current flow in the secondary windings. Say there's a short-circuit in a field output stage that draws its supply from the transformer. Because of this, extra current will flow in the primary circuit. We say that the circuit's AC resistance (impedance) has fallen. In this condition, assuming that the feed to the field output stage is intact, it's likely that protection circuitry will shut down the power supply. But a shorted turn in a transformer is far more effective at drawing extra current. It's equivalent to an artificial shorted secondary winding that's very tightly coupled. If the transformer is left operating in this condition, the excess current can cause overheating to the extent that the transformer may spew out.

The effective inductance also falls. Older readers will recall tweaking the low end of the band in a radio receiver by sliding a washer (shorted turn) in a rubber grommet along the ferrite-rod aerial, thereby altering its inductance. In this case the circuit inductance was designed to be higher than its optimum value, so that it could be reduced by adjustment of the shorted turn.

LOPT testers

LOPT testers generally work by sensing this drop in impedance/inductance, but more so the Q (quality) factor. They do this with various degrees of success. A common approach is to use the transformer's primary winding as part of a sensitive oscillator circuit. If there's a shorted-turn anywhere within the transformer, it damps the circuit and the oscillator shuts down. A typical design was described by Hamit Mustafa in the May 1982 issue of *Television*. In the September 1993 issue Ian Rees suggested ringing the LOPT and using an oscilloscope to observe the result. I like this approach. Rather than a simple good/bad indication, which can often be misleading because of circuit and transformer differences, there's a display that can be interpreted to give meaningful results. Ian's design and a later development by Charles Ritchie (*Television* February 1998) require the use of a scope to take full advantage. You have to remember that a short-circuit across a secondary supply derived from the LOPT can give similar results to a faulty transformer.

The use of a scope should not be a problem. In fact in many cases a faulty LOPT can be diagnosed simply by holding a scope probe near the transformer at switch on. With the gain set high, the main flyback pulse will be of similar amplitude to the following resonant pulses when there's a shorted-turn. With a good transformer the main pulse will be clearly defined, the harmonics being at a low level in comparison.

Much of this is rather hit-and-miss however, and calls for some experience in order to be able to interpret the results correctly. Ian's circuit is good and has formed the basis of subsequent testers. The test is analogous to ringing a bell. If a bell is given a sudden blow it will vibrate at its resonant frequency, the vibrations decaying over a relatively long period of time. If the bell is damped, say by having a cloth placed over it, the number of vibrations will be drastically reduced. The shorted-turn is an electrical equivalent of this damping. The sudden blow takes the form of an applied square wave. Because of its rapid rise and fall times, there is no frequency dependence and the transformer rings at its resonant frequency. This contrasts with normal circuit operation, in which the LOPT is part of a tuned circuit (to generate the flyback and EHT).

Bob Parker in Australia has taken this concept further with a tester that counts the rings down to about fifteen per cent of the test pulse amplitude, displaying them on a bar graph. By keeping the amplitude of the test signal low, Bob's meter doesn't switch on any of the semiconductor devices in the circuit. With Bob's circuit, the more rings the better.

A new tester circuit

I decided to see whether it would be possible to design a tester that could be simply connected between the collector of the line output transistor and chassis to assess LOPT condition without the need to desolder any secondary connections. In doing so I have adopted a different approach from those described above.

The design (see Fig. 1) doubles as a capacitance meter that gives useful indications in the range 4·7nF to 1μF. This is handy for checking the high-voltage capacitors used in line output and EW-correction circuitry. Sometimes one of these capacitors will go open-circuit without showing any physical signs of failure. One example is the 10·5nF capacitor CL48 in the Ferguson ICC5 chassis – when it goes open-circuit the line output transistor is destroyed.

The tester can be used to measure resistors over a limited range, from a couple of ohms to about 10kΩ.

It doesn't measure the Q of the transformer: it measures the reduced impedance when a transformer is faulty. In the circuit (we'll provide a description later) the impedance is compared to R7.

Initial checks

Next to a variac, an AC current meter is one of the most invaluable pieces of test equipment. You can obtain a 1A moving-iron meter for less than £15 from Maplin (order code CE50). A moving-iron meter responds equally to AC and DC. Because its mode of operation depends on the repulsive force between two bodies of the same magnetic polarisation, and the effect of this force decreases with the square of the distance, its tolerance to overloads is far in excess of that of a moving-coil movement. If a dedicated power socket is set up, complete with meter and power-on indicator, servicing will be transformed at a stroke. Just as when you start to use an ESR meter, servicing becomes so much easier with a current meter.

The beauty of having such a meter in series with the supply is that from switch-on so many things about a set can be assessed, often without even removing the back. If there's no pointer movement, it's clear that the mains supply isn't getting as far as the degaussing posistor. The next step therefore is to check the on/off switch and the mains fuse(s). Normal current consumption is about 0·4A. A portable may take 0·2-0·3A, a large-screen model up to 0·6A. If the consumption of a working set is significantly higher, it's a safe bet that the HT has risen.

It is important to observe the meter at switch on. Operation of the degaussing circuit should make the pointer kick briefly past full scale. If this happens but the set remains inactive, at least you know that the on/off switch and the mains fuses are intact.

A current reading of 0·4A or so after the initial surge means that the line output stage is working normally. If, on the other hand, the reading drops to a very low value the set has reverted to standby. A reading of 0·2-0·3A with a set that has a blank screen suggests that the field output stage has failed and its safety feed resistor has blown. This sort of current is drawn when the line output stage is running with a very light load, i.e. there's no beam current and no supply to the current-hungry field output stage. If there's a blank screen and a heavy current reading, this usually means that the field output device is faulty with its feed resistor intact. In modern sets field collapse is rarely seen, because protective circuitry extinguishes the beam, e.g. by shutting down the line timebase so that there's no EHT.

The current meter is also helpful with an apparently dead VCR: the pointer deflection caused by the surge as the mains filter capacitor charges confirms that the supply is getting past the mains fuse.

Line output stage checks

The first check to carry out in the line output stage is to use an ohmmeter to measure the resistance between the line output transistor and chassis. If the reading is say 200Ω - 1kΩ, the transistor is almost certainly leaky. This is often caused by dry-joints at the line driver transformer (with Panasonic chassis in particular). If a very low reading is obtained, there are two basic possibilities. The transistor could be short-circuit. If you have an ESR meter for capacitors (as you will by now!) it can be used to test the transistor without desoldering. If an open-circuit reading is obtained, the short-circuit is elsewhere – the remaining LOPT inductance gives an open-circuit reading when an ESR meter is used. If the short-circuit remains, the transistor is faulty.

With the right test equipment to hand there should be no need to desolder the line output transistor or indeed any other semiconductor devices in the line output stage or the chopper power supply for test. The combination of an ESR meter, a good low-ohms meter and an 'impedance' meter of the type described in this article provides a very useful test set-up.

There are times when the LOPT breaks down only when operated under its normal high-voltage conditions. There is no tester I know of that can simulate these conditions – the best test equipment is often the TV set itself.

Having eliminated the possibility that the line output transistor is leaky or short-circuit, switch it off by linking its base and emitter. Connect a 40W mains bulb between its collector and chassis and switch the set on. There will be one of four possible outcomes as follows:

(1) The bulb doesn't light up. So there's a fault in the power supply.

(2) The bulb is dim and the HT is found to be low. Again there's a fault in the power supply, probably the mains bridge rectifier's reservoir capacitor or the HT rectifier's reservoir capacitor.

(3) The bulb is very bright and the HT is high. There are two basic HT levels, about 110V for most small-screen sets and about 145V for others. If the HT is excessive, the most likely causes are a faulty electrolytic capacitor in the power supply or change of value in a resistor that forms part of a network used to monitor the outputs. Protection circuitry may have shut down the line timebase. If you are lucky, the set will be up and running once the correct HT level has been restored. Look out for faulty 10μF and 47μF capacitors and resistors with values around 39kΩ or 82kΩ. Don't leave the set running when the HT is very high, as the HT smoothing capacitor will cook.

(4) The bulb lights in accordance with the HT level which is correct. If, in this condition, the bulb dims or goes out when the link across the line output transistor's base-emitter junction is removed, the LOPT is suspect. In this case it's in order to disable the trip circuit if you know how to do this (some manufacturers approve of this step) and see what gets hot. It is here that a supply-current meter is helpful. If the consumption increases to 1A or more, the LOPT is almost certainly the culprit. Don't run it for long, as the output transistor might pack up. If all is well, the fault is likely to be in the protection circuit.

The above is a generalisation of course. There will always be exceptions. For example with a few chassis the line output stage has to work normally for the power supply to operate correctly. Some modern TV sets carry out a check sequence in different areas before they power up. I find this idea quite irritating, as it makes fault finding more difficult. Safety resistors in the major supply lines would seem to be all that's required.

Meter circuit

Fig. 1 shows the new LOPT tester circuit. Much of the circuitry is common to the ESR meter and was described in detail in the March 1999 issue of *Television*. IC1b provides the negative and positive supplies required for the correct operation of the op-amps from a single 9V battery. Because of the 100 per cent feedback between pins 7 and 6, the 0V supply (pin 7) is at half the 9V supply voltage.

IC1a and its associated components form a Wein-bridge oscillator that produces the test waveform. The frequency of oscillation is set by the values of R3, R4, C3 and C4. When the two resistors and the two capacitors are of equal value, the frequency is approximately equal to $1/(2\pi RC)$, which in this case works out at about 19kHz. The amplitude of the output is set by VR1, with the miniature wire-ended lamp LP1 in the feedback loop providing stabilisation – it has a positive temperature coefficient. The minimum amplitude at which the oscillator stabilises depends on the type of bulb used. With the type specified, 2-3V p-p is about as low as we can go.

To prevent the semiconductor devices in the circuit under test being switched on, the maximum applied voltage is arranged to be approximately 1V p-p. This is where IC2a comes in. The gain of this stage is equal to the ratio of R5:R6, and is thus 0·39. So the stage is an attenuator that reduces the amplitude of the signal at the test sockets while allowing the oscillator to run at about 3V p-p.

The impedance of whatever is connected to the test leads forms a potential divider with R7, whose value was selected empirically to provide the most meaningful readout. Diodes D3 and D4 are optional. They provide protection where a voltage (e.g. a charged capacitor) is present at the test leads, but will reduce the sensitivity at near FSD when the oscillator is set a little on the high side, as they will clip the waveform. The resultant error is significant only when you want to measure low-value capacitors. For easy replacement D3 and D4 are best fitted directly at the test sockets.

IC2b is the detector stage. Amplification is provided here, set by the ratio of R8:R9.

Construction

There should be no problems as nothing is critical. I used 0·1in. matrix stripboard for the prototype – see Fig. 2 for the layout. The board is quite small but will accommodate the components specified in the parts list. Trim the board so that it fits into the grooves of the specified case. I used Velcro to hold the battery. It's simple, effective and can be re-used many times. There's no power-on indicator because the meter's pointer, being at

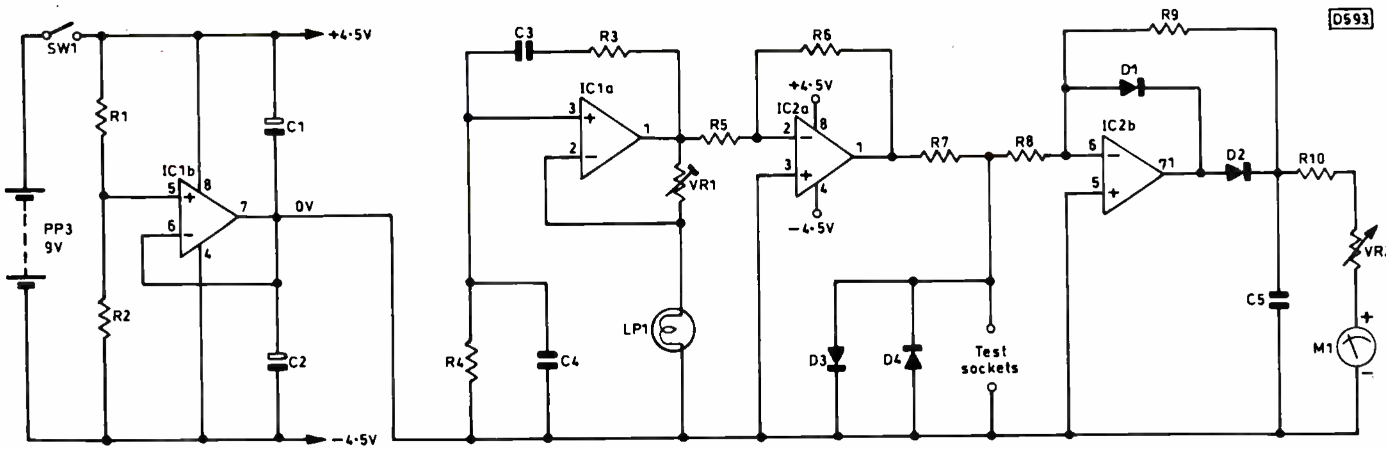


Fig. 1: Circuit diagram of the LOPT test meter.

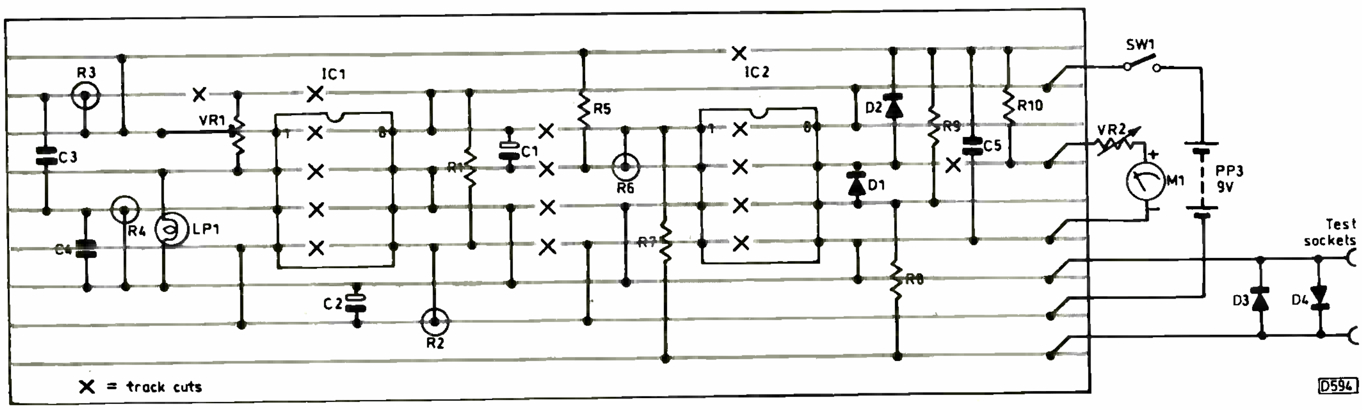


Fig. 2: Layout of the meter circuitry on stripboard.

full scale, serves the purpose. The auto power-off circuit described in the July 1999 issue of *Television* would be a worthwhile addition.

The meter scale is best tackled with the meter mounted firmly in the case. Take care not to over-tighten the fixing nuts. Gently prise off the cover, from the bottom, and hinge off. The drawing shown in Fig. 3 can be photocopied and glued to the scale. Slide the dial off carefully, after removing the two fixing screws. Use an adhesive such as UHU Power Stic (superglue is not suitable), applying it evenly over the dial face. Put the copy in place and smooth over with a cloth. There will be time to slide it into position, then leave it for a while to dry.

It is important that the new paper scale doesn't overlap the original, otherwise it will catch on the plastic cover and give problems. The best way to trim it is with a file, using downward strokes. Use a small round file to clean up round the arc. When replacing the cover, clip the bottom in first, taking care that the set-zero engages, then press down firmly at the top.

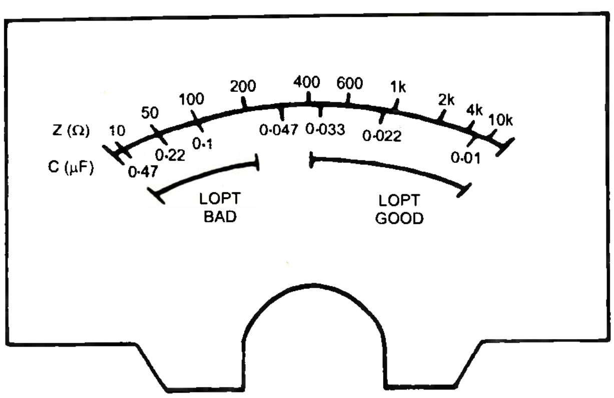


Fig. 3: The meter scale.

Setting up

Before you apply power, set VR1 (oscillator output) fully anticlockwise and VR2 (FSD) to halfway. Centralise the control knob. Don't connect anything to the test sockets. As a first step it's wise to check for errors in construction by monitoring the current drawn. The simplest approach is to leave the power switch at off and insert a battery – don't consider an external power supply until you know that all is well. Complete the circuit by connecting a milliammeter across the switch. The meter's pointer should not move and the milliammeter should produce a reading of 5-8mA. If these two conditions are not met, there's a fault. Common errors are bad print cuts or soldered joints that extend to an adjacent track.

When all is well, remove the milliammeter and switch on. The oscillator will not be running at this point. Advance VR1 to half way, then keep going until the pointer deflects. This indicates that the oscillator has started up. With the FSD control VR2 kept at mid position, advance VR1 bit by bit until the meter is at FSD. That's it!

With each advance of VR1, the pointer will twitch and settle. The reason for this is thermal lag in the lamp used to stabilise the oscillator's output. There's no need to be fussy about this adjustment – in use the FSD is set by VR2. VR1 is used simply to get the oscillator set up to provide an output of about 3V p-p.

Use of the meter

Each time the meter is switched on the pointer will go to full scale, hit the stop and come back to position. This is because the oscillator's output shoots up before it settles. The overshoot is well within the meter movement's overload capability. It can however be avoided by linking the test leads or having the FSD control at minimum when you switch on. Your ordinary multimeter leads will do as the test leads: there is nothing critical about them.

Testing LOPTs for shorted-turns

As stated earlier, the idea behind this meter is to be able to test without desoldering anything. **But you must unplug the scan coils.** Because of the way in which this meter operates, the scan coils would severely damp the test signal and the result could be an erroneous LOPT-faulty indication. With the scan coils disconnected, connect the test leads between the emitter (chassis) and the collector of the line output transistor. If the transformer has a shorted turn, the pointer will fall to the bottom third of the scale. A healthy LOPT will leave the pointer in the upper third (high-*Q* end). Large-screen sets may produce a reading of close to half scale with a good LOPT. Although the test results may in some cases seem a bit marginal, there is usually little doubt, deflection often falling to zero with a faulty transformer.

Here are a couple of tricks you can try if in doubt. Keep the meter connected and observe the change when the tube base is disconnected. There should be a small increase in the reading as the load falls with diconnection of the CRT's heaters. If the transformer is faulty this change is imperceptible. Another dodge is to introduce a shorted turn by looping a piece of wire around the limb of the transformer. There should be a drastic drop in the reading. If the transformer is faulty, this change is not so significant. In both these cases the reason why the change is not so apparent with a faulty transformer is that the effect of external damping is far less than that of an internal shorted turn. To get used to these changes, try the tests on a good set: it should be switched off of course, but remember to unplug the scan coils first! Note also the effect when you reconnect the scan coils. Don't forget to reconnect them each time after testing.

When the meter is used in this way it's effectively across the LOPT's primary winding, since at the test frequency the HT reservoir capacitor is a virtual short-circuit.

Components list

Item	Value/type	Order code*
R1, 2	100kΩ	M100K
R3, 4	18kΩ	M18K
R5, 8	10kΩ	M10K
R6, 10	3·9kΩ	M3K9
R7	390Ω	M390R
R9	22kΩ	M22K
VR1	500Ω cermet preset	WR39
VR2	10kΩ linear potentiometer	JM71
C1, 2	22μF, 16V electrolytic	VH09
C3, 4	470pF polystyrene	JA84
C5	0·1μF miniature resin dipped	RA49
D1-4	IN4148	QL80
IC1, 2	TL082CN	RA71
LP1	28V, 24mA	BT44
M1	100μA	PM11125 (CPC)
SW1	SPST switch	FH97
Case	ABS box type BM12	CC82
Knob		YX01
Stripboard		JP46
PP3 clip lead		HF28
Probes		HF21

*Maplin unless otherwise indicated.

Chopper circuit tests

Although it's not so common for a chopper transformer to develop shorted turns, it can occur. The above test procedure applies, but this time the test point is the collector of the chopper transistor. The earthy test lead must be connected to the emitter of the chopper transistor or the negative side of the mains bridge rectifier's reservoir capacitor, not the TV set's isolated chassis line.

Testing chopper transformers is a question of suck it and see. I've not myself done any tests, but a colleague reports having a Beko colour TV set with a chopper transformer that had a shorted turn. It produced a near zero reading, a good transformer producing a half-scale reading.

Tread carefully here – and make sure that the mains bridge rectifier's reservoir capacitor is discharged before you carry out any tests.

Testing capacitors and resistors

There is not a lot to say on this subject, other than the fact that in these applications it is not an in-circuit tester that's unaffected by associated components. Unlike ESR measurements (see *Television* March 1999), to measure its capacitance a component has to be disconnected. This is not a true capacitance meter. What it can do is to assess capacitance by the component's impedance at the test frequency. Because of this, capacitors with the same capacitance may give slightly different readings depending on their construction. It's not important in this application. Accuracy is not an issue: when the types of components in which we are interested fail, they do so drastically.

Final note

As a final note, remember that just because a LOPT tests OK this doesn't mean it will be all right under normal working conditions. If on the other hand it tests bad, it is bad. If you want to be one hundred per cent certain that there is no other cause for a low reading, take the transformer out and connected the meter across its primary winding – one lead to the HT connection, the other to the output transistor's collector connection. Once an estimate for a job has been accepted, there's nothing to lose anyway. The transformer would have to come out.

But you'll soon come to trust the in-circuit reading. There is a small difference between the in-circuit and out-of-circuit readings obtained with a good transformer, very little difference between the readings with a bad, low-reading transformer.

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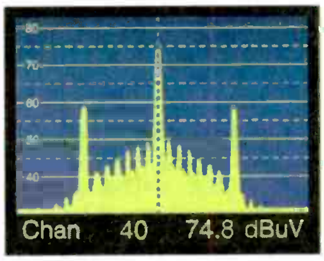

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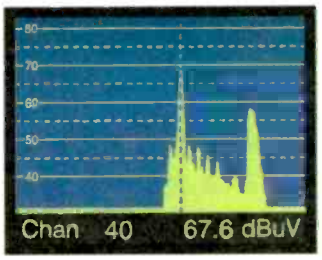

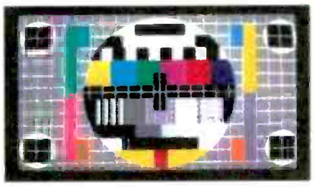

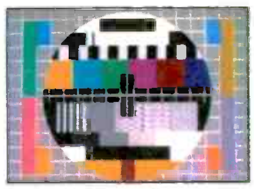

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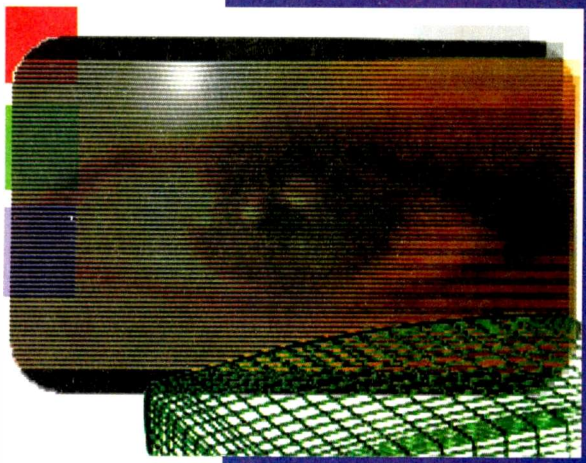


Monitors

Reports from Ian Field and Philip Blundell, AMIIEelec

AST 1764G

The complaint with this monitor was no red. It provides a choice of a 15-pin sub-D socket or five BNC socket inputs. A torch shone through the gaps in the shielding on the input subpanel didn't reveal any circuitry, so it seems that the alternative connections are simply wired in parallel. Although there was little likelihood of a fault here, it was easier to try both types of connection than dismantle half the back of the chassis to check on this.

Once this diversion was out of the way, I carried out some voltage checks on the CRT base panel. The red amplifier voltages were wrong. The transistors were quickly checked with a continuity tester to confirm that they weren't leaky collector-to-emitter and that their base-emitter and base-collector junctions weren't open-circuit. They were all OK in this respect. But when voltage checks were carried out Q204 (2SC3953) was found to have a base-emitter forward bias of over 6V! A DMM diode test on the junction produced an "out of range" reading. A new 2SC3953 restored the red output, and slight adjustment corrected the grey scale. **I.F.**

Elonex XV17

This could cause confusion! Another Elonex XV17 on the in rack looked totally different, more like a Digital VRC16. Anyway this one had no display, because the contacts at the front panel sync-on-green/separate selector switch were dirty (with the VRC16 version this switching is automatic).

Once the display had been restored I found that there was no red content. The coaxial lead to the red video amplifier had been pulled from its connector by the weight of the hefty ferrite ring through which the three coaxial leads are looped. Anyone called out to deal with loss of one or more colours could find the job that easy! **I.F.**

Viglen MC1726PE

This model resembles the Digital VRC16 outside but is different inside. One came in recently with most of the screws missing and the main PCB rattling about loose in the chassis. The complaint was loss of vertical scanning, i.e. a horizontal line across the screen. Although the TDA1675A frame timebase chip appeared to be undamaged, R242 in its feed was so badly discoloured that its value couldn't be identified.

I replaced the chip along with D212 (1N4002), C216 (1,000µF, 35V), C220 (220µF, 35V) and C213 (2,200µF, 35V). This restored the frame scanning. What to do about R242? Its size suggested that it was a 3W resistor and it measured 4·7Ω, which is about as high as you would expect in this position. The scanning remained correct when a 4·7Ω replacement had been fitted, so I assume this value was correct. **I.F.**

RML CM1412

This monitor is fitted with a Liteon chassis. The complaint was no operation. It didn't take long to establish that one of the two 47kΩ start-up resistors, R807, which is next to the UC3842 chopper control chip, was open-circuit. It's is a rare fault with this chassis, but can happen. The other start-up resistor, R806, is next to the pair of white, ceramic snubber resistors. R806 and R807 have the same value, but R806 is a pink high-voltage type while R807 is a normal, small colour-coded resistor. I replaced them both, using 3W high-voltage resistors.

It is worth checking R821 (220kΩ), which is the HT sampling resistor for the TL431 device. The supply for the LED in the optocoupler is taken from the heater line, which is smoothed by C823/4 (470µF and 47µF, 16V). Excessive ripple on this line will play havoc with the regulation! To avoid failure during your warranty period, these two electrolytic capacitors should be replaced as a matter of course. There's a good case for fitting mylar or polycarbonate capacitors in parallel with them – I usually add 0·47µF, 63V capacitors.

This chassis is one of a range of similar ones produced by Liteon. They turn up under literally dozens of different badges. Most have very similar regulation circuitry, though the component reference numbers can differ. In extreme cases of excessive ripple on the 6·3V supply the monitor shuts down to give a convincing imitation of LOPT failure. **I.F.**

IBM 6321-R13

There was no display because a small chunk had been chipped off the rear edge of the main PCB, right behind the white connector for the CRT base ribbon cable. Once the damaged area had been cleaned up and repaired with links, I checked for dry-joints – there were quite a few! When this had been attended to the monitor powered up all right but it was obvious that every preset had been twiddled. Fortunately there aren't that many, and the ones on the main PCB all have their functions clearly marked.

If the six presets on the CRT base panel are as clearly marked, this is obscured by the screening. They had also been got at. The three on the top edge are for colour bias. At the side, the red and green drive controls are grouped as a pair with the sub-contrast potentiometer a small distance away. The latter should be adjusted with care: it's possible to set this control at a point that makes shadowmask overheating likely. **I.F.**

Compaq 460

The only thing that was obviously wrong with this monitor was that the outer insulation of the signal cable had come away from the moulded plug. While I was checking this for loose connections the screening came away all around. There were no signs of loose connections, and the monitor appeared to be working well. But I've been caught out several times with these monitors.

The nylon PCB support pillars transmit stress from the swivel-base directly to the PCB. The result is fatigued solder joints and, in extreme cases, hairline fractures in the copper tracks. These monitors usually have sufficient flux coating to hide cracks etc., so cleaning the PCB is the first job. In this instance the soldering was reasonable. The worst dry-joints had been caused by heat from the snubber resistors in the chopper power supply. There were no signs of cracks. Part of the problem is the very sturdy swivel base which, if over-tightened, needs such force to move it that the cabinet base and PCB are distorted.

Something I find very useful is 'FINISH LINE' Teflon-fortified bicycle grease. It is pure white, so over application isn't conspicuously messy. It makes plastic moving parts glide like precision-machined assemblies (try the website www.finishlineusa.com). The part no. of the product is G00350101.

There were also a few dry-joints on this monitor's CRT base panel, though various attempts to instigate faults while bench testing failed to do so. **I.F.**

Mitac M1458

The complaint was "no picture". There was a vigorous EHT rustle up, and some time was wasted checking the CRT grid circuitry. In fact there wasn't a fault: the contrast and brightness controls had both been turned down. These rotary controls operate back-to-front in comparison with most other monitors. With both at minimum the screen is completely blank. This confuses a lot of people, including me!

You will often find that if nothing is done about this the monitor will shortly be back with the complaint "still the same". My solution is to follow the yellow, red and black leads from the front-panel contrast control back to the CRT base panel where the yellow and black leads each go to a resistor, one to 12V and the other to chassis, while the red (wiper) lead goes to one of the pins of the LM1203 chip. Swapping over the resistors to which the yellow and black leads are connected will shift the contrast adjustment range so that it cannot turn the picture off completely. The setting of the A1 preset on the LOPT must be reduced slightly to avoid the possibility of shadowmask distortion. **I.F.**

Compaq 171FS (Model 490)

This monitor was dead with the 2SC4542 line output transistor short-circuit. Inspection suggested that the probable cause was a multitude of stressed solder joints in the EW, B+ regulator and line drive areas. J3 pins (microcontroller subpanel) were also starting to pull from the solder. Often these monitors will work very well, only to fail when fully assembled!

As with other Compaq monitors, the basic cause of the problem is the rather tight swivel base. My solution, once the repair has been carried out, is to lubricate the moving parts of the swivel base with Teflon grease. I also find that a thin smear of Teflon on the nylon PCB pillars enables them to move slightly in their clip fittings, which means that the casing can flex a bit more before the the movement is transmitted to the PCB. Even with Teflon applied, the swivel base centre bolt need not be more than finger tight. **I.F.**

GVC Corporation M1448P

The relay clunked noisily with every burst from the power supply. As an initial inspection failed to reveal the cause, some voltage readings were carried out. During this exercise C322 (10μF, 160V) burst. A check on the circuitry around this component revealed a non-PWM B+ switching arrangement involving Q104, Q325 and Q327 (all type 2SA940. It's similar to the arrangement used on pre-PWM B+ control versions of the Acer chassis, except that this one switches tappings on the LOPT instead of power supply secondary tappings.

In addition to the three 2SA940 transistors, you should check D321 (BYV26C) and D322/323 (both type HER105). In this case D322 and Q325 had failed, damaging C322. Replacing these items cured the fault. **I.F.**

Acer 7134T

There was no job ticket with this one and no fault showed up despite rigorous tapping and flexing. So I decided to clean and resolder the main PCB then put the unit on soak test. Once the flux had been cleaned off, I got on with the soldering. When Q303 (2SD669A) was examined I saw that its pins had pulled through the solder fillets. The pins were tight-fitting, which would have accounted for the difficulty in instigating any symptoms. I assume that these would have been loss of width with pincushion distortion, since Q303's collector is connected via L303 to the junction of the EW-correction diode pair. **I.F.**

Watford Electronics AL5064

This monitor is a Mitac in disguise. The BU2520D line output transistor and p-channel IRF9620 series B+ chopper transistor were both short-circuit. The likely cause was the flyback tuning capacitor, which was slightly low in value, but there was also a fair amount of doubtful soldering, particularly around the rectifiers on the secondary side of the power supply and the MOSFET switches for flyback tuning. Not all the switched capacitors are controlled by MOSFETs: one is switched by a relay. The soldering to this item was particularly bad – a good tug would have pulled it out.

With all these possibilities, it was unlikely that the failure of the semiconductor devices had been caused by a faulty LOPT. It's not unknown for the line output transistor and series-chopper MOSFET to fail together, damaging the LOPT by placing the 140V supply across its primary winding. With only the replacement line output transistor fitted you can check the LOPT, without risking loss of a p-channel MOSFET, by temporarily running the line output stage from the 85V rail. **I.F.**

Gateway 2000 YEO 711-01

The power supply wouldn't start. Cold checks soon showed that one of the pair of 220kΩ resistors R318/R335 was open-circuit. As it's difficult to get at the solder side of the PCB you might feel it as well to replace the two 47μF, 25V capacitors C304/C305 at the same time. **P.B.**

Servicing

TV Chassis 11AK08 and 11AK10

These chassis were sold in the UK under several different brand names. Alan Dent provides fault notes based on experience gained with NEI and Nikkai models

The 11AK08 and 11AK10 chassis were produced by the Vestel TV plant in Turkey. They were bought by several importers and were distributed in the UK under various brand names. The 11AK08 was designed for use in 14/15in. sets and is physically smaller than the 11AK10, which is intended for use with 20/21in. tubes. Electrically the two chassis are almost identical. The following article is based on experience with the versions imported by NEI and used in the following models:

11AK08 chassis: NEI NE3743TX and Nikkai K3743TX.

11AK10 chassis: NEI NE5155NT, NE5159NT, NE5159TX, NE5555 and NE5559TX. Nikkai K5155NT and K5159NT.

There are models with and without teletext. The sets are operated by a microcontroller chip: there are two versions of the software, one a normal OSD system and the other for full menu control.

Note that you may well find minor circuit variations in the versions of these sets supplied to different importers.

The Power Supply

The chopper power supply circuit used in the 11AK08 chassis is shown in Fig. 1. Fig. 2 shows differences in the power supply circuitry in the 11AK10 chassis. The following notes are based on the 11AK08 chassis.

No output with the fusible resistor R809 open-circuit: TR802 could have shorted windings. Chopper transistor Q801 could be short-circuit: if so D808 should also be replaced – use type BYT52M. R805 could be open-circuit: this will damage Q801 and IC801. Note that this fault can also damage the mains filter choke TR801.

No output with no start-up voltage at pin 6 of IC801: Check whether R802 is open-circuit, IC801 has an internal short at pin 6 or D806 is short-circuit.

No output with the start-up voltage pulsing and low drive to Q801: Check whether D808 is faulty or R804 open-circuit. With the latter fault IC801 will also fail.

Slow tripping (HT output but tripping): Check whether VR801 is open-circuit. In this case D809 could also have failed.

Slow tripping (no HT output): Check whether D809 is open-circuit. IC801 could be faulty, damaged by either R804 or R805 going open-circuit.

Low output (HT about 85V): Check whether R813 has gone high in value.

Will not come out of standby (LED stays in standby mode): If pin 41 of IC501 changes state check Q802, Q803, Q804 and Q805 – the latter could be low gain. D840/841 (1N4148) could be leaky. Regulator IC802 could be short-circuit.

Line Output Stage

The line output stage is very straightforward. It uses a BU506D transistor (Q602) and has proved to be reliable. One problem you can get is a shorted turn in the line scan coils. The symptoms are no raster with the power supply tripping and maybe motorboating in the speaker. The DC resistance will probably still read 2·2Ω, but the flyback pulses at the collector of the line output transistor will be approximately 400V p-p and wide rather than 1·2kV and narrow.

If the set reverts to standby, the LED turning to green then going out slowly after five seconds, the line scan coils could be faulty. With this fault the EHT comes up then decays. Check whether the line output stage is consuming over 450mA.

If the line output transformer TR602 has an internal short you can get the following symptoms. The set will come out of standby but immediately goes back. The

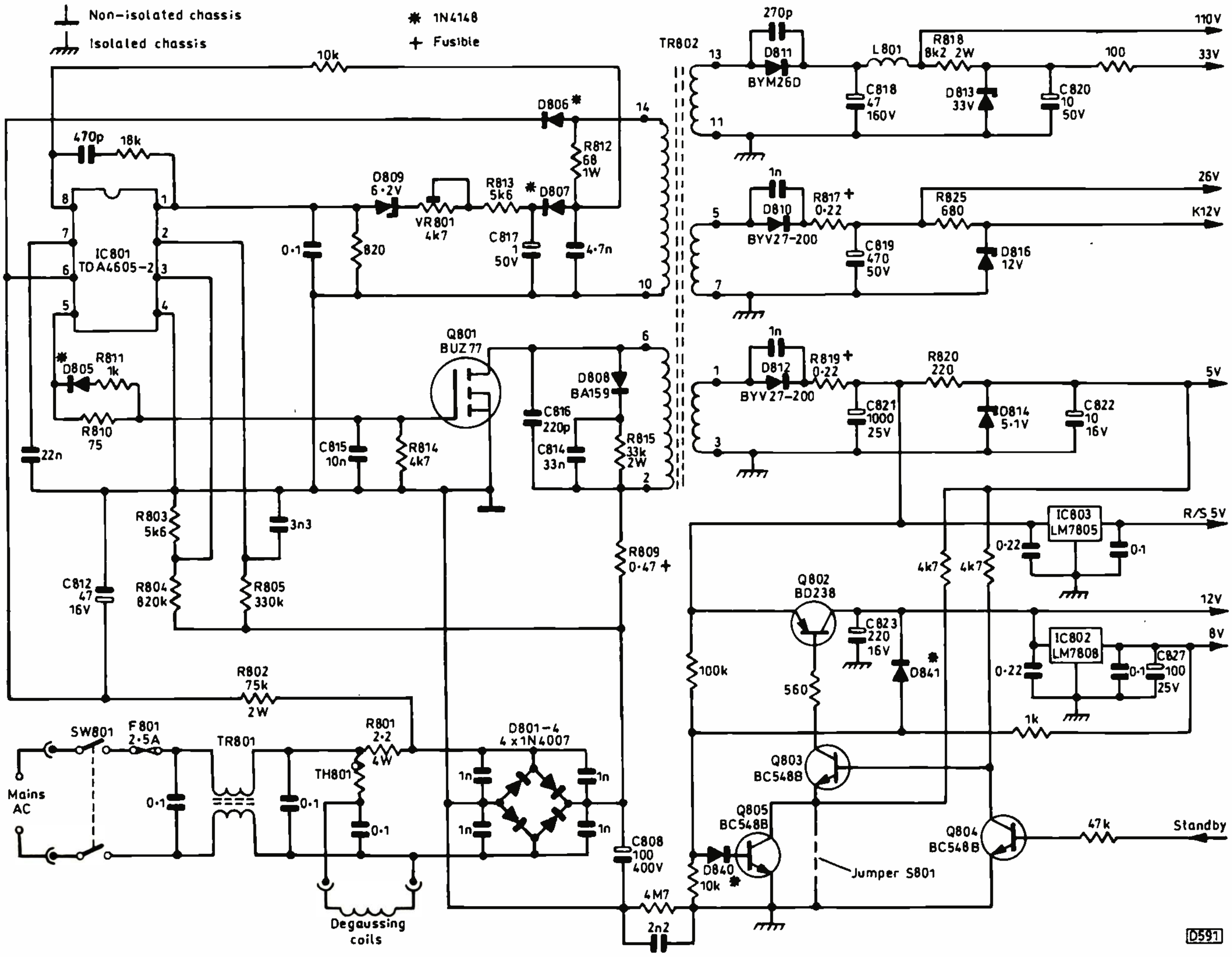


Fig. 1: The chopper power circuit used in the 11AK08 chassis.

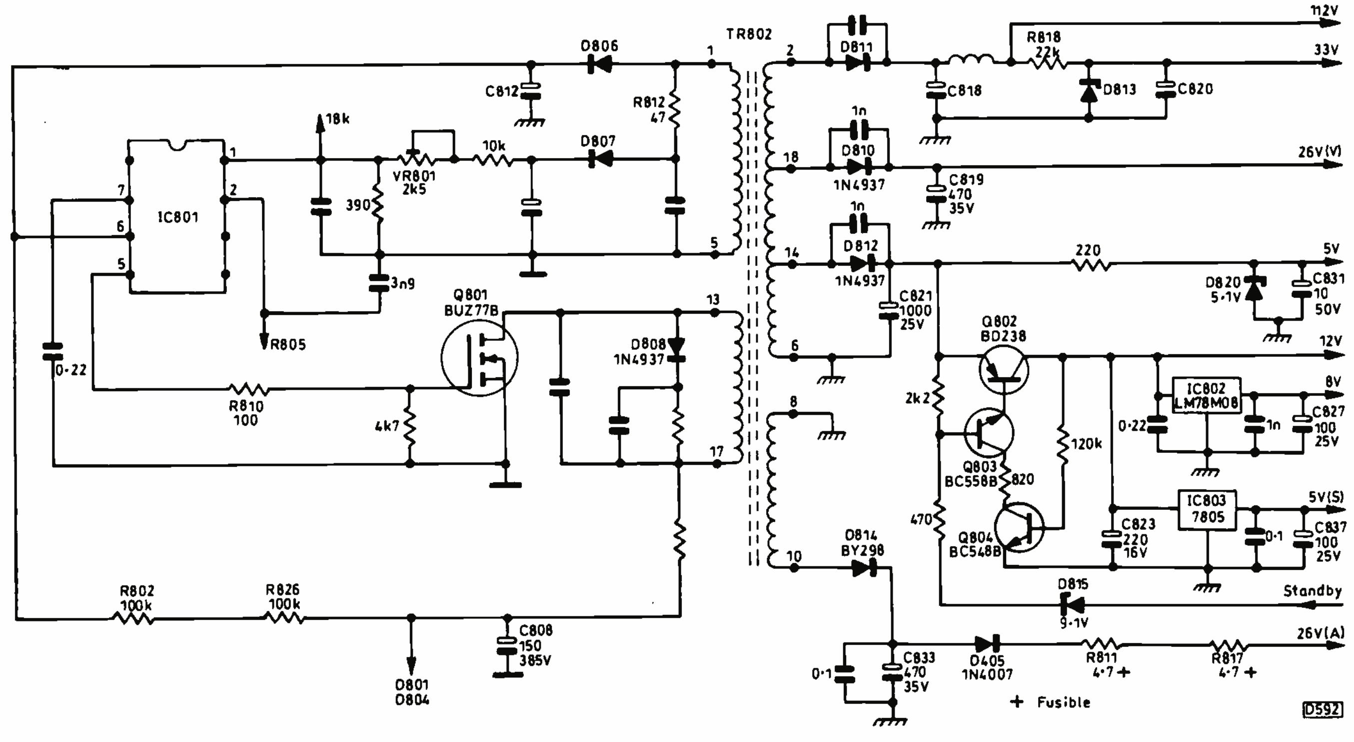


Fig. 2: Chopper power supply circuit differences in the 11AK10 chassis. The rest of the circuitry is as shown in Fig. 1.

LED flashes and the sound may motorboat.

The Field Timebase

Both chassis use a TDA3653B field output chip (IC701) with the field generator circuitry in the TDA8362A 'jungle' chip IC401.

Field collapse: There are several things to check. Look for cracks around IC701's pins. Cracks can be repaired, but IC701 will almost certainly have failed. Check that the 26V supply is present at pin 9 of IC701: if not, R711 (4·7Ω fusible) is probably open-circuit. C701/702 (4·7nF) could be leaky (below 2kΩ). R707 (3·9kΩ), R702 (10kΩ), R706 (1·8Ω), C426 (10nF) or C453 (33nF) could be open-circuit. C426/C453 are the ramp generator capacitors at pin 43 of IC101, where a 2V p-p signal should be present. The 11AK10 chassis has a single 33nF capacitor (C426) in this position. Note that the 33V supply is used as the feed for the ramp generator circuit: if missing, check R818. No ramp could also mean that R441 (10MΩ) is open-circuit. C705 (3·3μF, 50V) could be leaky. The flyback boost diode D701 could be open-circuit: it's type BYD33J in the 11AK08 chassis, type 1N4003 in the 11AK10 chassis. There could be a dry-jointed heatsink/PCB connection or broken copper. If C703 (470pF) is leaky, the voltage at output pin 5 will drop to approximately 5V.

If there's about an inch of severely distorted field scan when the setting of the first anode control is increased, the flyback boost capacitor C707 (100μF, 63V) is open-circuit. This situation could kill IC701.

If there's nearly complete field collapse with maybe the picture bouncing, check R442 (330kΩ) in the ramp generator circuit.

If there's about an inch of scan shifted upwards, check R702 (10kΩ) which is probably open-circuit.

Varying height: Check for faulty contact at the track of the height control VR702. The heatsink earth tab/PCB connection could be cracked or dry-jointed.

Top foldover: D701 or C703 (470pF) could be leaky or R717 open-circuit. R717 is 1kΩ or 560Ω in the 11AK08 chassis depending on the CRT type. In the 11AK10 chassis it's 680Ω with the circuit reference number R710.

Top foldover, bottom cramped: C704 (0·1μF) is probably leaky.

Line pairing with top linearity stretched: R709 (470Ω) is high in value or open-circuit.

Severely cramped frame – bright foldover in the centre with edges curved from horizontal: One section of the scan coils is open-circuit. The DC resistance of the field scan coils should measure 13·5Ω.

Top severely cramped, bottom reasonably OK: IC401 is probably faulty.

Bottom cramping (lower linearity varying): Check C701/2 (4·7nF) for leakage.

Bottom severely cramped, linearity control has no effect: C705 (3·3μF, 50V) is open-circuit.

Picture shifted upwards – no real change in linearity: The scan coupling capacitor C706 (1,000μF, 35V) is leaky.

Visible horizontal lines on still pictures: If there are line-frequency pulses on the field output waveform C704 (0·1μF) is open-circuit.

Picture blanks after several hours: Flyback boost capacitor C707 (100μF, 63V) is leaky or fitted with incorrect polarity.

Field jitter: R441 (10MΩ) in the ramp generator circuit is high in value or intermittent.

Black lines on the picture – very noisy field drive: R461/463 (560Ω) noisy though values are OK. These resistors, connected to pins 42 and 43 of IC401, are not present in the 10 chassis.

The Jungle Chip

The TDA8362A chip IC401 contains the IF strip, the colour decoder and the timebase generators. Colour decoding takes place in conjunction with IC402 (TDA4661-V2B) and IC403 (TDA8395). Some faults associated with the circuitry around IC401 have been covered in the field timebase section above.

Poor or no sync – if the line locks, there no field sync: C408 (47nF) at pin 15 is leaky. This shifts the DC and thus the sync slicing level.

Low-gain, noisy picture. AGC preset works but doesn't set correctly: C428 (1μF, 50V) at pin 48 is open-circuit. In the 10 chassis this capacitor is listed as 2·2μF, 16V.

No colour: IC401 could be faulty. In particular it could be pulling down the saturation control voltage at pin 26. Check as necessary X401 (4·43MHz), C420 (18pF), R437 (100kΩ), C418 (0·1μF) and C419 (4·7nF).

No video (OSD OK) – stuck in AV mode: If the TV/AV software switches but not pin 16 of IC401, check at the collector of Q404. If stuck at 7V, measure the resistance between pin 12 of IC501 and chassis. If 0Ω, there's a short on the TV/AV line adjacent to the right earth tag on the base screening can. If pin 16 of IC401 is stuck at 2V, Q404 (BC548B) is leaky.

No video, no OSD: Check the sandcastle pulses at pin 38 of IC401. If they are low or missing, disconnect pin 5 of IC402 which could be faulty. If necessary check back to R612 (24kΩ).

CRT Base Panel

The RGB output stages are mounted on the CRT base panel and use discrete component circuitry. There is black-current feedback to pin 14 of IC401.

Low or varying brightness: The first anode supply will be affected if C907 (1nF or 10nF, 1kV) is leaky or R925 (470kΩ) or the track is open-circuit.

Bright coloured raster (one colour): The relevant output transistor is short-circuit.

Excess of one colour – drive control makes CRT saturate in that colour: Check the relevant 680kΩ resistor R904, R911, R918 in the black-current feedback circuit and the associated transistors for open-circuits.

One colour missing: Either the relevant RGB output transistor (Q901, Q903, Q905) is open-circuit or R905, R912, R919 (all 1·2kΩ) is open-circuit.

Low general saturation level: Check the 680kΩ resistors R904, R911 and R918 and the associated transistors.

One colour missing after a CRT flashover or internal short: Check drive at relevant CRT base panel input pin. If present but low, i.e. about 30 per cent compared with others, check the relevant isolation diode (D506/7/8, all type 1N4148) at IC501's OSD outputs. If low-resistance, replace. This fault can mean that IC501 has been damaged.

Audio circuitry

The following notes are based on the stereo plus Nicam module, which has a TDA1521A audio output chip (IC305). This chip is a bit fragile and can easily fail if lines or pins are accidentally shorted. An audio isolation transformer must be used if external equipment, such as active speakers, are connected.

No sound: If the supply is 30V with respect to chassis, the earth track adjacent to the cut-out in the PCB is broken: this will probably kill IC305. IC305 could be faulty, possibly short-circuit.

Intermittent sound (both channels): Check whether C364 (100nF) is shorting to link pins 2 and 8 of IC305.

Distorted sound: If the input to IC305 is OK, the chip is faulty.

Apparent arcing noise from speaker (no internal sparking visible): This can be caused by an internal problem in IC401 on the main PCB.

No audio but nasty audio pulses in speaker: No intercarrier output from pin 14 of IC301.

Microcontroller System

The microcontroller chip is IC501. Three different software versions may be installed: one is a full menu-operated system, the others are normal OSD systems. Chassis 11AK08 and early versions of the 11AK10 use the OSD systems CTV351S or CTV422M. The menu-operated system CTV551SV2 is used in 11AK10 sets with serial numbers from A600001 and 660001. This system requires a service password, which is 734.

In the event of the install function not working, go to Features and clear all locks to 'off'.

Goes to standby after a short period – removing the Nicam PCB clears the effect but no text (11AK10): S+5V supply to Nicam and text circuits missing.

Display shows locked. When unlocking, strange effects can occur, e.g. lock changes when addressing, not toggling: IC501 faulty.

Display shows all channels locked – unplugging Nicam PCB cures problem: Nicam PCB cracked, break affecting supply to IC304. This upsets the I^2C bus.

No menu functions. Comes out of standby but no menu functions selected. When install button selected, XXX is displayed. Vol +/– makes set revert to standby. Gobbledegook may be displayed on menu functions: The RAM IC502 is faulty.

No remote functions. Set reverts to standby when vol +/– are used: IC502 faulty

Goes to standby when a signal is located while tuning: IC502 faulty.

Goes to standby while operating normally (no real time scale): IC501 faulty.

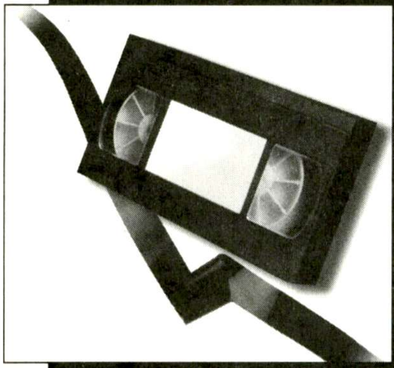
Shows time-out clock and will not stop search tuning: No ident at pin 34 if IC501. Possibly the track by the square hole for the audio heatsink is broken.

Failure to store channels or analogue control levels. Will store on channel one but all data is in other locations as well. Also no text or Nicam: SDA line at pin 40 of IC501 not at TTL level. Pull-up resistor R539 (3·3kΩ) under field IC heatsink is cracked.

Sweep tune doesn't stop: If it doesn't slow down, look for ident at pin 34 of IC501. If sweep slows down, look at AFC pin 9: if it doesn't swing between 0-8V, suspect IC501 but first check C509 (2·2nF) for leakage. If the ident doesn't switch, check the pull-up resistor R534 (33kΩ) and C454 (2·2nF, not shown on circuit diagram).

No Tuning

Band switching is carried out by the LA7910 chip IC503. With the 08 chassis you can get failure to tune though the tuning voltage is OK because this chip's 12V supply is missing. Check whether R825 (680Ω) is open-circuit.



VCR Clinic

**Reports from
Derek Bogiscin
John Poulton
Michael Dranfield
Pete Gurney, LCGI
Brian Wright
Dave Hewitt
M.R. Sabir and
Michael Maurice**

Panasonic NVHD605

The complaint with this VCR was that it couldn't be tuned in. I tested it and discovered that it didn't find any channels when auto-tuning, but if the channel number was dialled in manually a dark picture could be seen, with both line and field slip, suggesting poor sync. The menu displays were fine, and the symptoms were the same with the output at RF or via the scart connector.

Scope checks showed that the detector module's output was OK, but once the signal had passed through a 150Ω resistor the sync amplitude was greatly reduced. There are only three components through which the signal passes on its way to the input/output PCB at the rear of the machine: they were all OK.

Checks on the supplies to the audio and video switching ICs on this board revealed that the VE 5·4V supply at pin 7 of five of these ICs was low – it was only 0·8V. By lifting IC pins in turn I established that the cause of the trouble was the surface-mounted 4053 switching chip IC3902. Once this IC had been replaced everything seemed to be OK – except when a signal was fed in at scart connector 2. This signal path goes straight to pin 15 of the 4051 chip IC3906. There was no video output at pin 3, though the tuner's video output, which also goes via this IC, was OK. A replacement 4051 chip restored full operation. **D.B.**

Toshiba V856

Intermittent failure to record or play back was the complaint with this VCR. It was put on test and worked for many hours before the fault appeared – the playback picture went blank. At this point I made a quick recording: when it was played back via another machine there was no picture.

The mechanism and main PCB were removed from the lower case. As feared, the fault was no longer present. The complete assembly was then run upside down. When the main PCB was gently flexed the fault came back. Checks around the main YC processing chip IV001 showed that the luminance signal emerged at pin 46, to pass through two transistor stages, but failed to return at pin 47. The cause of the fault turned out to be a surface-mounted shorting link, ref. RV048, which is near the tuner/modulator unit. **D.B.**

Panasonic NVHD620

Severe patterning on the E-E video was present only when record was selected ("interference" had been the complaint). It started just after the machine finished its back-space operation, prior to the start of recording. I found that one of the two wires to the full erase head had been caught under a metal bracket at the rear of the mechanism. It was shorting the head to chassis. **D.B.**

Panasonic NVHD90

The customer complained that the machine made a noise all the time when there was a tape in it. It sounded to me like the capstan motor bearings, but when I took the lid off I realised that the capstan motor wasn't running and that the drum motor was making the noise. It's quite easy to remove the upper drum assembly complete – undo the three small torx screws that hold the plate in the centre and lift out the circlip inside. The bearings can then be cleaned and oiled before reassembly. I gather from CHS that this problem is not uncommon. **J.P.**

Sharp VCM26

This machine was dead with a tripping power supply. The customer's son had inserted a metal object through the cassette flap. As the customer had removed it, we didn't know what it had shorted out. I narrowed the cause of the problem to the area around the power supply optocoupler. The –25V line used to supply the fluorescent display is also used as a source of bias for the optocoupler, and was found to be missing between power supply trips. The cause of the fault was R995 (10Ω), a surface-mount resistor, which was open-circuit.

The clock display tube stands up from the PCB on tall legs in these VCRs. This must have been shorted out, causing the demise of R995. **M.Dr.**

Sharp VCM27

Although the power supply was tripping none of its output voltages rose. The cause of the fault was the feedback optocoupler IC901, type FX0007GE. **M.Dr.**

Toshiba V854

A 'jumping picture' was the complaint with this machine. There was obviously a tape-path fault. When the wrap was observed while a tape was being played I could see, viewing it from above, that there was a distinct bend on the supply side. The cause was the back-tension lever, which was slightly bent. Straightening it so that it was vertical cured the problem. It remains a mystery how the lever became distorted. **P.G.**

JVC HRD750
This machine was dead following a power cut. Most voltages on the primary side of the chopper power supply were present, but there were no outputs. In a case like this the usual cause is a failed electrolytic capacitor. The culprit was C14 (1µF, 50V), which was open-circuit. It's on the primary side of the power supply. Replacement with a 105° type restored normal operation. **P.G.**

JVC HRDX22
There was poor capstan lock and colour flashing on the playback picture. Checks showed that the switched 5V supply was high at 5·9V. Adjustment cured the fault. R805 should be set for 5·3V at TP803. **B.W.**

Hitachi VTM620
When play was selected there was no sound for about five minutes. The cause was C411, which was low in value and leaking electrolyte. It's best to replace C407 as well. They are both 47µF, 16V capacitors. **B.W.**

JVC HRJ625
There was no RF output from the modulator. It can be a very misleading symptom with this model, which has a rear switch marked 'RF out'. It appears to be a test signal on/off switch, but is a three-way switch marked 'on-test-off'. The indentations are so slight that the user wrongly thinks the off position is for the test signal. In fact it switches off the RF output. This is a case of bad ergonomics: it's very difficult to set the switch in its centre position. **B.W.**

Akai VSG2DPL
This machine wouldn't accept a cassette and displayed 'error 2' in the window. The cure was to replace the mode switch, which lifts out with the mode motor. Take care to remove the ribbon cable from the lower head drum before you lift out the deck for access to the switch – it's hidden by a small screening can. **D.H.**

Panasonic NVSD600
There was no capstan rotation. The cause turned out to be failure of the BA6871 servo chip IC2501. The self-test mode and direct address procedure to the microcontroller and servo control chips, outlined in the service manual, helped greatly in diagnosing the cause of this fault. It's the first capstan servo chip I've had to replace in a machine with the K deck. **D.H.**

Ferguson FVB9
This machine was completely dead. I've come across the same one branded **Daewoo** and **Roadstar**. The power supply unit has to be unsoldered from beneath the PCB to gain access, so you have to take the mechanism out first. C53 (1µF, 100V) was found to be open-circuit. C63 and C65 (22µF, 50V) were also replaced as they didn't look too good.

If one of these machines leaves a loop of tape behind on eject, replace the mode switch. **M.R.S.**

GoldStar T2631
I've had two of these machines in recently. The first one had a tape stuck in it and there were no functions. CP25 (100µF, 10V) in the power supply was open-circuit.

The other one would load a tape then the front display would play tricks and a clicking noise would come from the mechanism, like capstan shuffling. This machine had been to another dealer who had replaced all the electrolytics in the power supply. I had a spare power supply, which enabled me to carry out some comparison checks. This led to the discovery that RP09 measured 93Ω instead of 22Ω. So I removed it for a further check: the reading jumped from around 22Ω to 2·3MΩ! A replacement restored normal operation. **M.R.S.**

Ferguson FV21R
This machine required new video heads. After replacing them the tape wouldn't go in. If a tape was loaded manually, play etc. worked but there was no eject. When I've had this fault on previous occasions the STK5482 IC has been faulty. Not this time. After much head-scratching I found that the wires on the carriage motor were loose. **M.R.S.**

Panasonic NVSD220 (K deck)
This machine had a cassette in it and wouldn't unload – F4 appeared in the display. The cause of the problem was one that's become quite common. The plastic collar shaft on the loading motor splits. As a result the motor turns but the mechanism doesn't. You used to have to order a new loading motor complete, but the plastic collar can now be obtained on its own – the part no. is VDP1434. **M.M.**

Toshiba V212/V213
This machine appeared to be dead. Checks in the power supply revealed that DP71 (BA158), one of the rectifiers on the secondary side, was leaky. It provides the 33V supply. A replacement brought the machine back to life. **M.M.**

Aiwa FX11
The customer said that the trouble started with failure to eject a cassette. When he disconnected then reconnected the mains supply the tape unlaced and the fault appeared to have gone. Subse-quently he had intermittent problems with getting the tape to stay in: the machine would accept a cassette then, after a few seconds, eject it. The cause of the trouble was the mode switch: a replacement restored reliable operation. **M.M.**

Toshiba V804
The original fault with this machine, which came to me from another dealer, was that it wouldn't accept tapes. When I plugged it in it was dead! Quick checks showed that the power supply was in fact working. The cause of the original problem was the cassette lid opener on the carriage: it had come adrift, together with a couple of springs. This was easily put right. When I checked around the main microcontroller chip I found that its 5V supply was missing. This comes from a 5V regulator. R591 which feeds this regulator was open-circuit. Once a new resistor had been fitted the machine was OK. **M.M.**

Matsui TVR141
When this combi unit was used for tape playback it was very slow. The cause was excessive back tension. To cure the problem, remove the back-tension band and the supply-reel table. Clean both thoroughly with isopropyl alcohol or Servisol head cleaning fluid. Allow the alcohol to evaporate, then reassemble. Finally, check and adjust the back tension. **M.M.**

Akai VSG270
I've had two of these machines with the same problem: the cassette carriage is floppy and won't accept a tape. In both cases the cause of the trouble was the right-hand loading arm. When a replacement is fitted the tension in the carriage mechanism is restored and a cassette can be loaded. **M.M.**

Servicing Modern Audio Equipment

Much modern audio equipment is worth repair. There's quite a lot that will be new to those who have not been involved with audio in recent years. Edgar Beddow provides a guide to current equipment, the faults you can get and what to do about them

Trying to make a decent living in this beleaguered trade has become a lot harder. It seems necessary to take on almost anything to keep the till ringing. Some audio equipment is worth repair, especially the more up-market type. The aim of this article is to give you an idea about what to expect.

Overview

It's difficult to imagine a more diverse range of equipment than modern hi-fi. The current offerings are complex pieces of kit, both electronically and mechanically. This means that a reasonable level of mechanical skill is required if things like auto-reverse tape decks and multi-stacking CD players are to be fixed. All but the cheapest equipment uses microprocessor control, so troubleshooting techniques here at any rate should be familiar to you.

Don't, in most cases, expect ease of access. Getting all that gear into a small space usually means that a a lot of dismantling will be required. Some manufacturers provide load patch leads to assist with repair, but these are usually available only to authorised service centres.

Specialised test gear can be obtained but, generally speaking, the equipment already available in the workshop will suffice. A wow and flutter meter with a drift (speed) feature is very helpful however, also a simple audio oscillator and signal tracer. A laser power meter is useful: ensure that it has adequate ranges, as a mini disc laser provides a very high output in comparison with a normal CD pickup.

Power Supplies

The power supply is usually quite simple, consisting of a fairly hefty mains transformer and a bridge rectifier to provide plus and minus supplies for the power amplifier stages. Fig. 1 shows the basic idea. Simple series regulators are used to step down these supplies to obtain the low-voltage feeds required – most of these are switched off in standby. There will of course always be a 5V unswitched supply for the main micro chip and remote-control receiver. With most recent designs these supplies are protected by zener diodes across the outputs. Obviously if one of the regulators goes short-circuit considerable damage could occur in the absence of the zener diode. So protective zener diodes must always be replaced after a repair.

Before any stripping of the unit is carried out, even before any connectors are removed, I strongly recommend that the HT capacitors are discharged and a few minutes are then allowed for the other supplies to subside. If this procedure is not followed, sooner or later you will do some damage – and it won't be obvious what has happened.

Flat wire connectors are very widely used. They need to be fitted carefully: if contact is made with an adjacent pin, the results could be disastrous.

Chopper power supplies are normally used only in very expensive and very high-power amplifiers, such as those used in theatres etc. I have however come across them in some hi-fi amplifiers of US origin.

Output Stages

A single or a pair of output ICs are used in most midi systems. Some recent units have discrete component designs however. In either case the speakers will probably be connected via a relay which is there to switch off the speakers when phones are connected and to provide protection for the speakers should the amplifier develop a short-circuit. The circuitry within an output chip usually consists of a straightforward push-pull output stage.

Should the positive or negative supply be missing, or one half of the output stage be short-circuit, a supply of 30V or so would be connected across the speaker. To prevent this happening, the mid-point voltage (normally zero) is monitored. If a shift of even a few millivolts is detected, the system control IC's protect pin will change state and the relay will drop out. It's nice to hear the relay drop in when the unit is first switched on! Other things are sometimes monitored, typically the heatsink temperature and the current. So you can find that the protection circuit is almost as complex as the circuit being monitored.

It's common to condemn the output ICs when a DC offset is present, but they are not always to blame. Missing supplies and dry-joints are common. And don't overlook the speakers: they lead a hard life and can develop shorted turns – this will activate the excess-current protection (a tweeter fault is favourite).

There is a tendency to try to squeeze more and more power out of midi systems while keeping their size small. The result is more complex output stage circuitry. One approach is to switch the supply rails electronically between full and half power in accordance with the drive signal. The result is greater efficiency and a smaller heatsink.

Expensive hi-fi amplifiers with discrete-component output stages are a different proposition. They are usually DC coupled throughout. This means that a fault in a preamplifier stage is quite likely to cause big voltage changes in the output stage and vice versa. If there's a voltage offset in both channels, the cause is most likely to be a missing power supply. Fault isolation by disconnecting suspect components is not usually feasible. The best approach is to check the transistors for shorts and leakage. If this proves to be inconclusive and no other fault is found, block replacement of all the semiconductor devices in the channel will usually restore normal operation.

If you do have to resort to this en-mass replacement, initial testing is best carried out by increasing the mains input slowly via a variac while monitoring the mid-point voltage. Any deviation from zero means that a fault is still present. This procedure can save a lot of expenditure on blown transistors. All supplies should be checked before you embark on such drastic measures.

If the unit now works, it will need to be set up in accordance with the instructions in the manual. This will involve setting the quiescent current, which is usually done after the unit has warmed up. Don't ignore this adjustment: the amplifier could run too hot and you might end up doing the whole lot again. Finally, a power test using dummy loads is a good idea.

One further point is to ask a customer, when an amplifier is brought in for repair, if it's connected to a graphic equaliser. If so the customer may not have refitted the links, at the back of the amplifier, that connect the main amplifier to the preamplifier – a favourite with Technics equipment. The result will be no or very low sound. Not all amplifiers have these links, but check to make sure – otherwise you could be looking for the cause of a non-existent fault.

CD Players

There was an excellent, comprehensive series on CD player servicing in *Television* some years back (from March 1989 to July 1990), but here are a few comments that should help. The biggest nuisance is dust. It will cover the laser lens and cause either mistracking or no reading of the TOC (Table Of Contents). It's possible to use a cotton swab to remove the dust, but there will always be some left inside the pickup. Replacement is the best option, and is nowadays quite cheap.

Skipping and jumping is another common complaint. It can be caused by the disc itself, but the laser unit is the more likely culprit. The spindle motor can wear and the sled motor can stick, causing disc playability problems. Sometimes, fortunately not often, a motor can be replaced and the disc still won't play. Start by checking supply voltages and reset lines, and that the clock crystal is running.

There will be data communication between the system controller and the CD panel. A scope can be used to check this. It's also possible that the door- or tray-closed switch may be faulty.

If the disc spins briefly but the TOC isn't read, one of the processing chips on the PCB may be faulty. They are always of the flat-pack variety. In my experience however they very rarely fail, the cause of the trouble being dry-joints or broken print.

If there is one thing the Japanese seem to revel in, it's designing weird and wonderful mechanisms. Some multichanger CD mechanisms are good, some are lousy. Reference to the relevant service manual is the only way of finding out how to rephase them. Careful observation

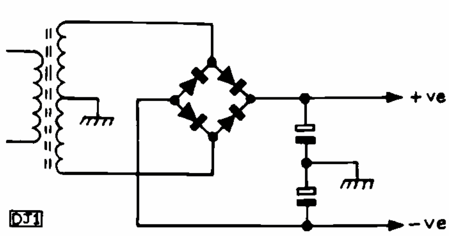


Fig. 1: Use of a transformer and bridge rectifier to produce positive and negative supply lines.

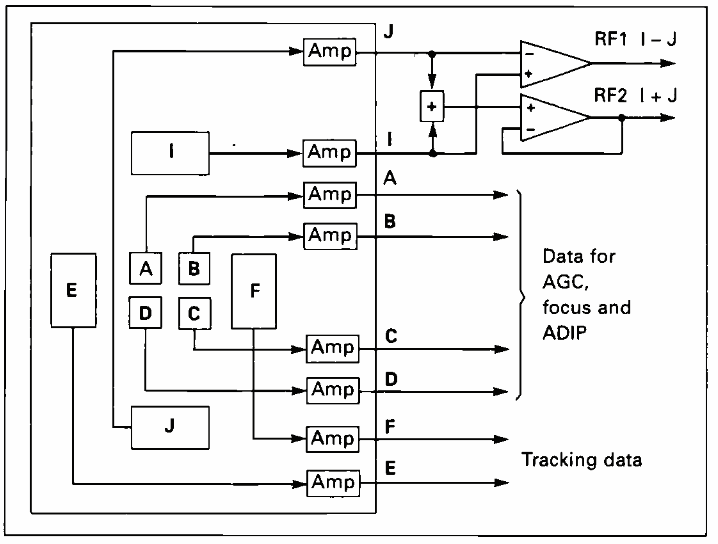


Fig. 2: Layout of the photodetector section of a mini disc optical unit. Output RF1 is used with recordable discs, output RF2 with premastered discs.

will often enable simple faults to be rectified. The golden rule is to strip as little as possible and to make a note of any phasing marks to assist with reassembly.

Mini Disc Players

Some recent units have a mini disc player instead of a tape deck. This provides very high quality recording and playback, with the added advantage that customising the individual tracks is easy.

Two types of discs are available, premastered and recordable. When a premastered disc is being played back the machine works like a CD player. Similar servicing techniques apply. Mini disc players have an extended anti-shock memory.

In order to be able to fit the data in the much smaller disc, a special data compression system known as ATRAC (Adaptive Transform Acoustic Coding) is used. It carries out an analysis of the incoming frequency spectrum and decides which parts can be removed or altered without the listener noticing. This is obviously a gross over-simplification of a highly complex and clever system. An in-depth study of the way in which human beings perceive sound was carried out to provide the basis of the system.

A magneto-optical recording system is used. In the record mode a magnetic head is in contact with the top side of the disc, directly opposite the laser beam. The laser power is increased tenfold, to about 5mW, so that the disc's magnetic layer is heated to 180°C. The data to be recorded is applied to the head, which magnetises the layer either north or south for one or zero.

When the disc is read in the playback mode the laser light, reduced to a much lower level, undergoes a 90° phase shift as it's reflected back through the magnetic layer: the phase angle depends on whether the beam passes through a north or south section of the layer. The beam then passes through a Wollaston prism in the optical unit. This produces two extra beams, called I and J. The outputs from the I and J sensors in the pickup are passed to the RF chip, which provides the familiar eye-pattern output. The effect of the prism and the light phase-shift produces I and J vectors of unequal length. This is known as the Kerr effect. The vectors are added together mathematically to reproduce the recorded data.

Recordable discs also have a physical groove, known as the ADdress In Pregroove (ADIP), to provide a guide for the spiral track – the unrecorded disc is otherwise completely blank. It's pre-stamped during manufacture and is exactly the same on all discs.

Fig. 2 shows the layout of a mini disc photodetector unit. Compare it with the well-known CD arrangement, noting the additional I and J outputs.

Mini disc player mechanics are smaller in scale than those of a CD player but are not too bad provided care is taken. There are various different designs. In the ones I've come across laser replacement has been fairly straightforward.

The record power should really be checked and adjusted. This is done using the electronic screwdriver approach. The sensor has a useful slot that can be connected to a DVM to read the output in millivolts. This makes adjustment easy, but care needs to be taken to avoid ruining a new pickup.

Tape Decks

Recent tape deck designs have become simpler mechanically. Most use an output from the microcontroller chip to pulse a solenoid. This controls a lever that releases the main control cam, making it stop at the required function position. There is obviously a window within which this system will operate correctly. Motor speed and solenoid timing are critical, so motor speed errors can cause malfunctions. The decks don't use a mode switch, operation relying on the timing of the solenoid. The result is a deck with fewer component parts and fast movement between modes, but with a tendency to noisy operation.

Faults are usually caused by broken plastic parts and poor tapes. The head auto-reverse mechanism can jump a tooth and cause jamming. Replacement of the heads requires the azimuth to be adjusted in both directions. A 6kHz or better still a 12kHz test tape and scope are handy for this purpose, though a good result can be achieved by ear using a good prerecorded tape – adjust the azimuth screws for best HF response commensurate with correct channel balance.

If a deck has very intermittent problems it's worth checking whether a complete assembly is available: the price can be surprisingly cheap.

Pro-Logic Systems

These have become very popular with the advent of surround-sound encoded video tapes. Home cinema outfits usually consist of a main amplifier with outputs for two front speakers, two surround (rear) speakers and a centre speaker. The set-up can provide various options to suit the room acoustics, including the use of the TV set itself for the centre channel. If the Pro-Logic option is selected when a normal sound source is in use the result is awful, so it's best to deselect it with an unencoded tape, radio broadcast etc. When properly configured, the system can sound truly spectacular.

The Pro-Logic processing sections are purely digital and are usually very reliable. But, as with any digital system, confusing problems can occur. Always check that the data and clock lines are active and that the reset pulses etc. are present and correct before embarking on IC replacement. Most systems have a test tone (white noise) that's useful for checking that all sections are working correctly.

The amplifiers usually have five output stages, two front, two rear and one centre. They can be all-IC affairs or a combination of ICs and discrete component circuitry. Whatever the arrangement, failure of one output stage usually means that the protection relays drop out. Measurement of mid-point voltages will lead you to the faulty section.

It's important to check that the cause of a complaint is not simply the various levels being incorrectly set by the user.

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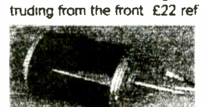

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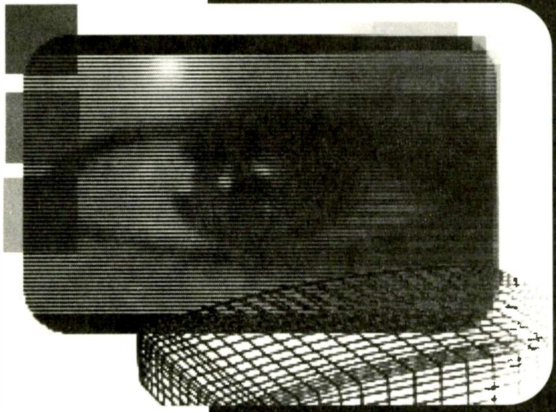


TV Fault Finding

Reports from
Philip Blundell, AMIIEelec
Paul Hardy
Kevin Green, TMIIE
Graham Coleborn
Michael Dranfield
Adrian Spriddell
Michael Maurice
Mike Leach
Gerald Smith and
Colin J. Guy

Philips G90AE Chassis

If the BUT11AF chopper transistor 7625 is short-circuit you will have to fit kit SBC7023, part no. 4822 310 20496. The instructions in the kit tell you to add two 1N5061 diodes in positions 6608 and 6609 but don't explain where they go. The positions are marked on some boards. Where these markings are not provided, connect the diodes in series and connect the anode of the pair to the base of the chopper transistor and the cathode to its emitter. **P.B.**

Samsung SCT12B Chassis

In the event of failure of the TDA8350 field output chip IC301 in this chassis the following components should be added when fitting the replacement chip:

Connect an MTZ15C 15V, 500mW zener diode (DZ403, part no. 0403-000656) between pin 3 and chassis (in parallel with C303) with its cathode to pin 3.

Connect a 1N4004 (400V, 1A) diode (part no. 0402-000132) between pin 9 and the 46V side of R307, with its anode to pin 9.

Remove L301 which is in the PCB position marked J349. In its place fit a 10μH axial coil (part no. 2701-000116) and a 1·2Ω, 5%, 2W fusible resistor (part no. 2008-001013) connected in series. Then add, from the junction of this series combination and R302/R303/C301 to chassis, an MA2560 56V, 1W zener diode (part no. 0403-001039) with a 470nF, 5%, 100V capacitor (part no. 2305-000407) in parallel. The anode of this added zener diode goes to chassis.

The extra components can be added on the underside of the PCB.

Check resistor R307 (10Ω, 0·5W, part no. 2008-000179) which, if faulty, can be responsible for flyback lines on the screen. **P.B.**

Sony KVE2512U (AE1A chassis)

The complaint with this set was intermittent field collapse. Feeling confident, I dived in straight away and attended to the numerous poor joints on the main panel. I also removed the IF unit and resoldered most of the joints here, to avoid a possible bouncer. When I switched the set on I discovered that the problem hadn't been resolved: there was partial field collapse. As carrying out voltage checks in these big Sonys is not particularly easy, I replaced the TDA8170 field output chip as a first guess. But the partial field collapse was still present. My attention was then drawn to the 680μF, 25V field output coupling capacitor C531. It looked as if it had been under stress, as the insulation had contracted appreciably. It proved to be open-circuit.

It's quite common to find that the field output coupling capacitor in Sony sets has gone low in value. The result is cramping in the lower part of the display. An open-circuit capacitor is rather more unusual. **P.H.**

Nokia MP37H1

The line driver transistor VK01 had failed. When I fitted a replacement BC327 transistor all was well – note however that this is a pnp device, which is unusual in the line driver stage. About a week later the set bounced with the same fault. When I consulted Nokia technical I was advised to replace the surface-mounted transistors VK51 (BC848) and VK52 (BC858) as well. This seems to have done the trick. **P.H.**

Deccacolour D28NEE5 (Tatung E1 chassis)

There was slight top field foldover, its severity depending on the aspect ratio in use – you can select high, wide or normal with these sets. The high and normal ratios produced the greatest error, hardly any foldover being seen in the wide mode. A replacement TDA8350Q field output chip cured the fault. **P.H.**

Proline M5900TT (Tatung 170/180 series chassis)

The cause of no picture was safety resistor R433 (1·2Ω) being open-circuit. It protects the supply to the field output stage. **P.H.**

Naiko N1495

This 14in. portable with twin speakers was supplied by a local cash and carry outlet. It was dead and, needless to say, servicing information was virtually non-existent. The internal fuse and posistor had failed. The latter was marked 180C915*34S, but I couldn't find a source. A König 4740 positor, as used in the Ferguson ICC5 chassis, proved to be a reliable replacement. **P.H.**

Sony KVM1421U (BE2A chassis)

This set suffered from extremely intermittent loss of red. I replaced the R output transistor Q706 and the emitter-follower Q709 but this made no difference. In the fault condition the red input at the CRT base panel seemed to be of the right amplitude. The only thing I could find wrong was the DC voltage at pin 1 (red output) of the TDA3505-V1 video processor chip IC302: it seemed to be a little on the low side. In the end I cured the problem by replacing this chip. I can only assume that the internal biasing for the red output suffered from intermittent failure. **P.H.**

Beovision 8092 (type 7233)
There was no picture because of no CRT heater supply. The cause was traced to poor joints at P23 and poor contacts at the connector, which had to be cleaned. Once these problems had been dealt with there was a picture but the line hold was poor. The line hold preset R108 was intermittent. **P.H.**

JVC C1480EK (BX11 chassis)
If the problem is drifting off tune, remove the station selector module and replace the surface-mounted capacitors C014, C017 (both 3·3μF, 50V), C015 (22μF, 6·3V) and C016 (0·47μF, 50V). You will almost certainly find that at least one of them is leaking, so the board will need a good clean. If you are lucky it should then work. After the repair you may find that search tuning operates but the tuning information cannot be stored. This means that either part of the print or some of the plated-through holes near or below these capacitors has been damaged. You may also find damage under the memory chip – repair is sometimes possible. A replacement module is very expensive, making repair uneconomic if one is needed. **P.H.**

Toshiba 210T6B
Complete loss of colour was the problem with this set. It took us some time to discover that C506 (0·01μF) was leaky. It's connected to pin 7 (colour control) of the TA7699AP colour decoder/timebase generator chip IC501. **K.G.**

Sanyo CBP3012 (A3-A14 chassis)
This portable was a bit old for our service department but, as it was a chargeable job, we decided to have a quick look. There was no output from the chopper power supply though there was HT at the collector of the chopper transistor Q513. Checks on the transistors in its drive circuit revealed that Q511 (2SA608) was short-circuit. When the set was switched on after replacing this transistor it was tripping. Some further checks revealed that the voltage error sensing transistor Q553 (2SC536), which is on the secondary side of circuit, was also faulty. **K.G.**

Samsung CI5337 (US60A chassis)
The basic complaint with this 21in. Nicam set was no sound after warm up. When the sound cut out the picture darkened a little. Sometimes the picture would blank out altogether. There are two 12V regulator chips on the signals board. The output from one of them, IC802, was low at only 7·5V. Its input was also low at 8·5V. Both regulators are fed from the 16V rail, each one via a series diode. D802 in the feed to IC802 was dropping over 7V, and as a result was extremely hot! A new 1N4003 diode restored the picture and sound. I checked the current through it and found this to be satisfactory at 270mA. **G.C.**

Panasonic TX25AD1DP (Euro 2 chassis)
The mains supply to the chopper circuit is switched off in standby by a relay that's operated by the microcontroller chip I1801 – at pin 19. This set came on with no picture and sound: the relay and standby LED were pulsating at a frequency of about once a second. As the 150V HT supply was very low and pulsating an overload was, incorrectly, suspected. I then noticed that the HT rail pulsed up to a modest voltage several times during each of the relay's on periods. So the relay drive was overridden by connecting a shorting link between the emitter and collector of Q6114 on the front board (M), near the relay.

With the power supply now running continuously, and some peace and quiet in which to work, it became clear that the chopper circuit was too feeble to maintain its own operation let alone run the set. A new TDA6505-3 control chip (I611) failed to make any difference, as did several other replacements. The culprit turned out to be C637, a 2·2nF polyester capacitor which had gone clean open-circuit. It's connected to pin 2 (current simulation) I611. Whatever next?! **G.C.**

Sharp 37VT-24
The complaint with this TV-video combi unit was "no TV operation". When the owner was questioned, it seemed that the unit would switch itself to standby after about half an hour. What would happen is that the CRT beam-limiter circuit would shut the set down to standby, which is unusual. The cause of the trouble was the 1·2MΩ resistor R626 in the beam-limiter circuit: it had gone high in value – in fact by the time we had the unit it was effectively open-circuit. Thus as soon as any beam current started to flow the unit tripped off. **G.C.**

Philips K40 chassis
Although these sets are now quite old we still come across them from time to time – and usually find that they produce a better picture than some new budget-priced sets. A recent example required a new line oscillator chip, a memory battery and a little resoldering to put it into good order – all quite routine. But it bounced on us with the complaint "intermittent blank screen and no sound, getting worse, a knock may restore normal operation".

I initially assumed that a dry-joint somewhere had been missed, but none could be found. In the fault condition the power supplies were all normal, also the scanning and EHT – and the fault disappeared when the chassis frame was hinged down. The cause of the fault was found in the middle of the signals board, at connector M13, which links video signals to and from the scart socket. The screen braids of the coaxial cables fitted into the plug in M13 were long and uninsulated, and had become draped across the plug's signal pins, thus shorting out the video signal. **G.C.**

Sony KV2020/KV2022
Severe line oscillator warm-up drift made it impossible to obtain line lock at all times. The usual cause of this is C507 (33nF polyester): it gets fried by R514 which is next to it. On this occasion however the cause was a defunct electrolytic capacitor, C509 (10μF, 16V). It decouples the oscillator's 5·5V supply. **G.C.**

Sharp 59CS05 and 66CS05 (CS chassis)
This nightmare took several sessions to sort out. The chassis is technically advanced, with digital processing and class D amplifiers for field scanning, EW correction and the audio outputs. It's built on a compact plated-through-hole board with conventional parts and surface-mounted components on both sides. Much of the board runs

too hot for its own good. There were dry-joints, cracked joints, porous joints and cooked joints all over the place. The BUH515 line output transistor had failed, the surface-mounted RGB output transistors were going intermittent and Q707 (BC338-40), one of the two 5V sub-regulator transistors, was intermittently open-circuit. The result of all this was a vast array of ghastly symptoms! **G.C.**

Philips CP90 Chassis
This set had no front LED display though the HT supply was present. The 2·4V NiCad battery was short-circuit and there were plenty of dry-joints, but the culprit was C2691 (330µF, 25V) which had dried out. It's the reservoir capacitor for the 19V supply. **M.Dr.**

Grundig CUC7350 Chassis
This set wouldn't come out of standby and the output from its LM317T regulator was very low. It took a while to find the cause of the problem, though it was actually staring at me. The aluminium heatsink for the regulators had become unclipped from the PCB and had risen up. As a result of this the spring clip holding the LM317T regulator was shorting to its tab. **M.Dr.**

Toshiba 140E4B
If the problem is no tuning or memory functions, replace capacitor CA17 (3·3µF, 160V). It's right next to the chopper transformer. **M.Dr.**

Mitsubishi CT2555STX (Euro 4Z chassis)
The customer complained about a buzz when changing channels. Initially I thought that the AFC was slow to pull in or that a mute circuit had failed, but the penny dropped when I pressed the Nicam-off button. The result was no sound, just a buzz. When changing channels the set defaults to mono sound before the Nicam sound drops in. The 6MHz resonator X3 in the IF module needed replacement. **A.S.**

JVC C14ET1EK (Onwa chassis)
There was no picture or sound. In fact this set seemed to be so dead that I at first thought that the power supply or line timebase had failed. In fact the cause of the trouble turned out to be an open-circuit 0·68Ω resistor, R434, in the feed to the 14V supply rectifier D408. It's tucked down beside the LOPT. When you have slid the PCB back into the cabinet, make sure you plug the speaker lead into CN201, not CN403, or you will think you have a field fault.

With another of these sets there was no picture or sound, just the standby LED on. Its power supply was OK but there was no line timebase operation. R323 (6·8kΩ, 5W) in the feed to the AN5601K chip IC301 was open-circuit. **A.S.**

Panasonic TC1485 (Z3 chassis)
There was no colour, just a bright, pink screen with a Hanover-blind effect. C601, a 10nF disc ceramic capacitor in the PAL delay-line circuit, had turned into a 320Ω resistor. **A.S.**

Mitsubishi CT15M2TX (Euro 7 chassis)
The source of a singing inductor noise was traced to the chopper transformer, though the noise didn't come and go when the usual push test with a screwdriver was applied. Oddly enough, resoldering the earth connection to the PCB for the STR54041 chopper chip IC901's heatsink completely cured the noise. **A.S.**

Ferguson TX99 Chassis
The cause of intermittent spots and/or flashing over the picture was traced to the HT smoothing inductor L21, which had a cracked iron-dust former. I fixed it with superglue. **A.S.**

Panasonic TX28A1 (Alpha 2W chassis)
There was a faint squeal at switch on then nothing apart from the channel no. indicator. The line output transistor Q551 and the overvoltage protection diode D854 were both short-circuit, while the fusible link (R567) in the feed to the line output stage was open-circuit. There are two suspects in this situation: C808 (10µF, 63V) on the primary side of the chopper circuit and the STR54041M chopper chip IC801. Once the components mentioned above had been replaced I checked for dry-joints at the line driver transformer. The set then worked normally. **M.M.**

Sony KVA2532U (AE2A/B chassis)
The picture would go off intermittently with a flash. At the same time the standby LED would start flashing. The flashing is an error code. In this case it was 13, which means a timebase fault. The cause of the trouble was dry-joints at the field output chip. Once these had been resoldered there was normal operation. **M.M.**

Philips 14TVCR240
Sound but no picture was the complaint with this portable TV/VCR combi unit. A quick check revealed that R8511 was open-circuit. When this item and the TDA3653B field output chip IC7510 had been replaced normal operation was restored. **M.M.**

Thorn CT5122T
The customer's son had put Flash down the front screen of this **Tatung** clone. Checks showed that the damage was confined to the microcontroller/EEPROM section of the PCB. I cleaned this with video head cleaning fluid, then allowed it to dry before reinstalling the board in the set. This revealed that the memory had been corrupted. After resetting everything (not easy) I had a working receiver. With some modern chassis resetting the software takes longer than carrying out the actual repair. **M.M.**

Salora L67 Chassis
At switch on there was a bright spot at the centre of the screen. Yes, there was both line and field collapse. At switch off a faint vertical line could be seen, so I decided to check the line output stage. The scan coupling capacitor CB513 (250nF, 400V) was dry-jointed, but resoldering made no difference. When it was checked with a capacitance meter it turned out to be open-circuit. A replacement restored normal operation. Why field collapse? The scan coils form part of the line output stage tuning. When they are disconnected the line output stage is detuned and the voltages derived from it will be low. **M.M.**

Hitachi C2119R (G7PS Mk II chassis)
This set would shut down after about twenty seconds, with a buzzing noise that came from somewhere around the line output stage or the power supply. A quick check showed that the HT voltage was present and correct. I assumed, correctly, that a protection circuit had probably come into operation, and found that a shut-down voltage was present at pin 20 of the TA8690AN jungle chip. This voltage will normally be present when there is either excessive EHT or excessive beam current. In fact nei-

ther of these conditions applied: the 3·9V zener diode ZD701, which monitors the beam current, was leaky. A replacement cured the fault. **M.L.**

Hitachi C2118T (G7PS Mk II chassis)

This fault was of my own making. I had rebuilt the power supply and repaired the print around the 9V regulator IC703. The set bounced because the field scanning was stretched at the top and cramped at the bottom. Many capacitors and other items were checked or replaced before I saw what I'd done. The 9V regulator should point towards the tuner: this one pointed towards the LOPT. I'd reversed it when repairing the print.

In this condition the device produced an 'output' of about 10·5V, which accounted for the distorted field scanning. It's something that is all too easy to do. **M.L.**

Philips CP110 Chassis

There was no picture and the sound pulsed on and off. A check on the HT supply revealed that it was low and fluctuating. Once the 100μF capacitor on the power supply subpanel had been replaced the picture and sound came up but there was ripple on the verticals. This was cured replacing C2633 (100μF), which smooths the supply to the line driver stage. **G.S.**

Panasonic TX29AD1DP (Euro 2 chassis)

This set was dead with no sound, picture or power. You could hear the power supply tripping. I replaced the short-circuit BU2508AF line output transistor (Q534), disconnected the HT feed to the line output stage and used a 60W bulb as a dummy load for the power supply. When I switched the set on the power supply was OK, producing the correct 145/150V HT voltage. Now to find the cause of Q534's failure.

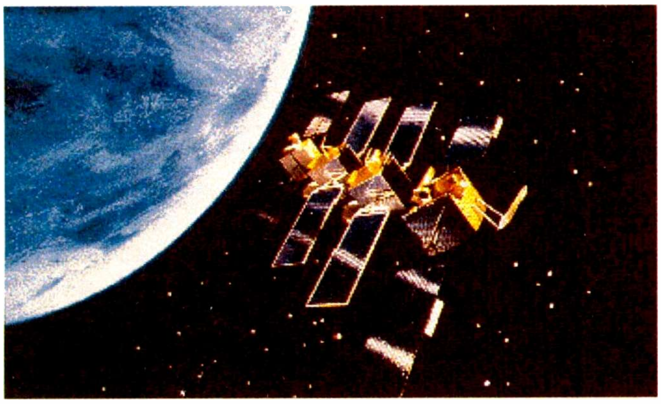
I checked the waveform at the base of the line driver transistor Q526 and found that it was too low. There was only 0·5V at its base, which is not enough to trigger it and produce a drive waveform at its collector. The drive comes from the digital PCB at the rear of the set. It was OK at pin 27 of I1601, but was low at the collector of Q1612. The voltage here was low at about 0·5V. When I replaced D1614, which is shown on the PCB and the circuit diagram as a coil (L1614), Q1612's collector voltage rose to about 4·5V and the level of the line drive at the base of Q526 rose to 2·8V. When I removed the bulb and reconnected the LOPT the set came on normally. **G.S.**

Grundig CUC20/30 Chassis

There was no sound or picture, just a blue screen. The cause was a collection of dry-joints at the 5V and 8V regulators IC61050, IC61060 and IC61040. Resoldering them restored the sound and picture. **G.S.**

Hitachi C1714T

The picture's size decreased as the brightness increased. Needless to say the HT was low and varying. The cause of the fault was the CNX82A optocoupler IC901, which was short-circuit on the primary side. **C.J.G.**



DX and Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and of satellite developments. Meteor shower dates for 2000. How to go about F2 DXing. Roger Bunney reports

This is the first column of the new year, decade and millennium. By the end of this decade I expect analogue transmissions to have ceased, leaving us with only digital TV. Will terrestrial DX activities continue, or will those remaining enthusiasts switch to satellite TV in their quest for something different or unusual? There has already been a decisive switch to satellite reception.

Meanwhile, there has been some encouraging terrestrial activity. As the solar cycle approaches the sunspot maximum, conditions in the F2 layer have been producing some really exotic DX reception, though most of it has been unidentified. Here's a log of the more noteworthy reception.

On the 3rd of November Petri Popponen (Finland) and Ryn Muntjewerff (Holland) received ch. E2 signals from Thailand and Malaysia (RTM) while in the UK Cyril Willis (King's Lynn) logged two Arabic ch. E2 signals. Ryn received the same signals on the 4th, while Cyril logged Russia ch. R1 and an Arabic ch. E2 signal. There were ch. E2 Arabic signals from 0850-1050 on the 8th and 9th. The 10th and 11th produced ch. E2 Arabic signals with carriers at 48·24 and 48·26MHz and a ch. R1 signal with the carrier at 49·74MHz. Arabic ch. E2 reception was again logged on the 19th. The 20th produced very strong ch. E2 video with carriers at 48·24, 48·25 and 48·26MHz – the pictures had the usual smeared, multiple images. There were strong ch. R1 signals on the 25th, but high-level local baby alarm signals made picture reception impossible here.

There were small SpE openings on the 11th and 19th. The former produced Russian signals (YT-1 chs. R1 and R2 and ORT ch. R1), the latter ch. E3 and E4 signals from Scandinavia. The Leonids meteor shower produced minimal signal pings on the 16th, but good MS reception was reported during mid morning on the 17th.

The rising F2 activity and daytime maximum usable frequency (MUF) have produced low-VHF reception from the east through to the south and west over several thousand miles. As at the end of November, US police communications, public utilities and pagers have been heard at up to 41MHz. I have heard an Italian calling CQ to a cordless UK phone in the 31MHz band, and at 37·221MHz an American ansaphone was being interrogated over the air (a cordless phone?) for its recorded messages – there was mention of Denver in the recordings. Most communications messages mention streets but rarely the town, which is very frustrating.

Things really look good, and both NZ ch. 1 (45·25MHz) and the Australian ch. 0 (46·25MHz) are being monitored by scanner for the tell-tale 50Hz video buzz. Dust off those scanners!

An ident from Reuters via NSS K (21·5°W) at 11·566GHz H. This was a digital feed for a UK SNG uplink.

Satellite Reception

The last Friday in November is the traditional BBC Mastermind Children in Need appeal day. A casual evening check at Euteslat II F3 (36°E) on the 26th produced a couple of programme feeds for this event. SISLink 25 – UKI-253 was providing an uplink from Dundee at 11·675GHz H. At the same time (1925 GMT) SISLink-29 UKI-418A was covering a small aircraft, occupants unknown, that took off from Prestwick. These two digital feeds were at 11·684GHz H with SR 5,632 and FEC 3/4. The previous evening the 418A unit was at Luton airport covering a royal visit, once more digital via 36°E at the same frequency. In recent times checking out the various new UK SNG identifications has become like the old hobby of train spotting!

An unusual Reuters UKI-415 identification was present via NSS K (21·5°W) at 0800 GMT on the 24th, "RTV VERYLOWDELAY" on digital colour bars. The signal was cut abruptly, the mystery delay never being revealed. On the 25th SISLink 38 UKI-507 was outside

Preston Crown Court to report on the trial of Dr Shipham. The signal was at 11·079GHz H with SR 5,632, FEC 3/4, A-PIDS 256 and V-PIDS 308. With the RSD ODM300 receiver you need to enter only the known/suspected frequency: the receiver will then work out and tell you all the digital parameters. This isn't the case with certain popular Nokia receivers.

The latest Nokia receiver, Model 9800, has been criticised on the grounds of bad memory retention and inability to self-seek digital parameters. Roy Carmen tried the Nokia 9600 with DVB2000 board and found it a complicated receiver to set up and operate. One reason for this is that the on-board tuner has been changed, the new version being without auto tune. Tuner lettering can be seen through the ventilation grilles. If the tuner is type DF1 ST 1173 Art no 55-50075-01, it is the later non-autosearch version (it's made in Latvia). The autosearch 9600 tuner is the EU type NDT 1006 A Art no. 56-70090-02 rev B or similar.

There's a small multiplex at 11·740GHz V from the Astra 2A/Kopernikus slot (28·2°E). In addition to the TV Travel Shop, Bravo, Trouble, Challenge and Living channels, colour bars with "NTL Newman St" have been seen. The receiver flags as XN, with the usual Astra parametrers – SR 27,000, FEC 2/3. At the same slot you will find the analogue Antenna Hungaria PM5544 test pattern – this is at 11·547GHz H.

With military action in Chechnya continuing, the BBC Moscow circuit via 36°E has shown some grisly footage. Uncut material is sent to White City at 11·615GHz H (SR 5,632, FEC 3/4).

Analogue signals are often seen via Telecom 2C (3°E), but I'm uncertain where the "DLT E/S" earth station is located (11·634GHz V, November 12th). On the same day the BBC-UKI-234 analogue Scottish SNG truck provided coverage of the Scotland v. England football match (11·601GHz V).

One of the most active satellites for digital signals is NSS K (21·5°W). On November 11th Sky Sports was in Las Vegas for the Lennox Lewis match, with transmission via BT Washington's 11·566GHz lease. On the same night Maxat was taking a live feed of MTV's Countdown from Dublin to the USA at 11·625GHz V – the outgoing feed showed a delay compared with the direct Astra (19·2° E) analogue downlink.

There has been a first report of test transmissions being seen from Orion-2 (Telstar 12) at 12°W. Colour bars were received at 11·546GHz, both H and V.

Terrestrial News

UK: It's probable that another RSL-TV station will be on air in the Southampton area by the autumn. A local group has gained ITC approval and awaits channel confirmation. One transmitter will be at Lymington, another at Toothill (near Romsey). Coverage includes the New Forest (east and south), West Southampton and Test Valley south. The group is to cooperate with others planning to open services in the Portsmouth, Southampton and Bournemouth areas. The power of the ch. E54 H TV 12 transmitter at Rowridge has been doubled to 2kW ERP.

France: The government is collecting information from broadcasters on their plans for terrestrial digital TV and is to produce a channel allocation plan. Initial DTT transmissions are unlikely to start before autumn 2001.

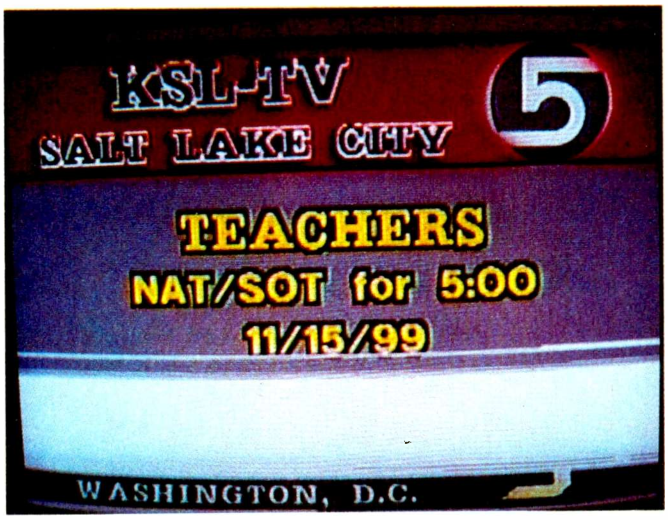
Germany: The BDXC has provided a detailed list of evening regional opt-outs. Regional programming is transmitted during 1700-1705, 1800-1805 and 1930-2000 hours local time and is provided by studio centres at Aachen, Bielefeld, Dortmund, Dusseldorf, Essen (Rhur), Koln, Munster, Siegen and Wuppertal. A new local broadcaster, Saar-TV, has opened in the Saarbrucken region with transmissions on chs. E26, E36, E38, E46 and E60. The main Sachsen transmitters broadcast SAT-1 via Leipzig ch. E26, Dresden ch. E48, Chemnitz ch. E56 and Zwickau ch. E53.

Australia: Robert Copeman reports that a new high-power digital commercial TV network is to open in about 2007. A number of analogue UHF transmitters are being built in the Melbourne area to avoid expected interference problems when the high-power digital VHF transmitters go on-air.

Satellite News

As a follow up to last year's formation of New Skies Satellite (NSS), which is based in Amsterdam, Intelsat is now to be privatised. A restructuring formula is expected in July, with confirmation at a members' assembly in the autumn, the aim being to launch the New Intelsat group in April 2001. Full protection is to be maintained for those countries that rely on Intelsat for communications needs.

BT will be the first company to offer full ISDN capability via the Immarsat Satelan network, using a portable 64kbits/sec unit. The simple briefcase unit, weighing about 4kg, will provide broadcast-quality voice, small video packages and internet access with handset operation. It will cost £10,000. Immarsat



Signal from a VTR ready to play out a news item from KSL-TV, Salt Lake City via the Bonneville News Bureau, Washington for transmission to Europe via NSS K.

A live TV action feed from Northlake, Seattle. Police had surrounded an office block with a killer inside. Reception via NSS K at 1945 hours on November 3rd.

charges are $2 for voice and $8 for full-bandwidth operation per minute.

The Orion satellites, which are owned and operated by Loral Space, are being renamed Telstar. Thus Orion-1 at 37°W and Orion-2 at 12°W have become Telstar 11 and 12 respectively. This will maintain corporate identity with the rest of the Telstar fleet, which mainly serves the Americas. Telstar 12 is now in operation with 14 transponders between 11·006-11·1672GHz and a further seven between 12·528-12·717GHz, all within the European footprint. There's a high degree of reverse polarisation sharing.

Astra 1K, which is shortly to be launched for 19·2° operation, will have 52 high-power Ku-band transponders plus two experimental Ka-band (18·3-21·2GHz) transponders. It will provide partial replacement of the current fleet as older satellites expire or a moved to 28·2°E for digital service. The two beams will be centred on the British Isles and continental Europe, including western Russia.

Astra 1D has been moved to 28·2°E and will remain there until 2B is launched in April/May. During the summer of 2001 2C and 2D will arrive at this position. The Sirius-3 standby satellite has been moved back to 5°E. 2B has been returned to Fokker for the glass covers over its solar panels to be replaced – there have been problems with other satellite panels.

Stefan Hagedorn's internet news letter reports that a digital Maltese channel is now present at 13°E. A travel offering called WWWTravel is available via Hot Bird 5 at 12·538GHz H (SR 27,500, FEC 3/4, A-PID 1183, V-PID 1180). He also mentions that Amos (4°W) has stopped downlinking RTS-SAT and Radio Beograd (11·335GHz H digital) following US government advice that it was in breach of the current international embargo on Yugoslavia.

Because of an engine misfire another Russian Proton-K rocket has failed to orbit, with loss of the new Express-A satellite which had been intended for 80°E. This will cause serious communications problems, with Russia having to rely on old Gorizont stock. All launches from Baikonur are on hold, which is delaying the launch of Eutelsat's SESAT.

Meteor Shower Dates

My thanks to Neil Bone, director of the British Astronomical Association, for the following information on meteor showers during the year 2000. The Quadrantids shower occurred in early January.

Lyrids April 19-25th with main peak over the 21-22nd.
Aquarids April 24th-May 20th, peaking over May 4-5th.
Cetids May 7th-June 9th, with main peak over May 14-25th.
Delta Aquarids July 15th-August 20th. Peaks July 28-29th and August 6th.
Perseids July 23rd-August 20th. Peak August 12th at 0900 UT.
Orionids October 16-27th, peak 20-22nd.
Taurids October 20th-November 30th, peak November 1-7th.
Leonids November 15-20th, peak November 17th at 0800 UT.
Geminids December 7-16th, peak on the 13th at 1600 UT.
Ursids December 17-25th peaking on the 22nd.

F2 DXing

We are now on the ascending slope of Solar Cycle 23. As the sunspot count rises, the sun's UV radiation and the maximum usable frequency (MUF) increase. The UV radiation ionises gases within the F2 layer, enabling incident radio waves to be reflected. Since the F2 layer is at about 200 miles above the Earth's surface during daytime in winter, low-VHF TV transmissions can be reflected over quite dramatic distances – a minimum single hop may be 2,700 miles, and you can get several hops.

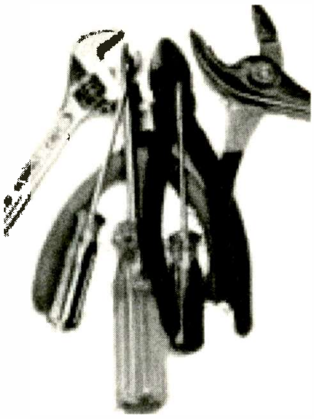
Cycle 23 should peak during 2000. If sunspot activity is high enough, low VHF signals from the Far East, Australasia and the Americas could reach the UK. F2 propagation can rise to 55MHz or so, but is totally dependent on the sun. Look to the east in the early morning, say around 0800 GMT, for signs of distant Russian/Asian signals. As the morning progresses, signals from the Middle East could be received. At noon reception from the south is enhanced – but unfortunately there are few ch. E2 transmitters in Africa. Come the afternoon a North Atlantic path opens.

Signals appear suddenly and rise to very high levels. The higher the aerial, the sooner a signal is captured. Because of multipath propagation the signals suffer from ghosting and distortion. They drop out rapidly as the sun tracks westwards – F2 is a daytime phenomenon.

You need to be able to tune down to 45·25MHz for NZ ch. 1. A scanner or VHF radio with AM capability is very helpful for monitoring video frequencies. The recently introduced Icom IC-R75 communications receiver is ideal. A check above/below 40MHz will produce communications traffic: when the MUF reaches about 45MHz it's time to check for video. During the solar cycle peak in the early Seventies I heard the NZ ch. 1 video buzz and received ch. A0 video using very simple aerials (check at about 0830-0930 GMT). Russian, Asian and N. American video was commonly received. By the next solar cycle peak there may be no analogue transmissions, so this could be your last opportunity for successful F2-layer reception.

A related phenomenon, transequatorial (TE) skip, occurs as the sun progresses westwards and the daytime F1/2 layers collapse to form a common F layer. As a result, in the early evening you can get even higher-frequency signal reflection. It's possible to receive up to 55MHz via TE: when the conditions are very good, signals from the south can reach the UK. The best bet is to monitor ch. E2 (48·25MHz AM) for weak video buzz. It may be present within a narrow bandwidth and be impossible to lock when an IF bandwidth of several MHz is used.

During previous peak F2 periods we didn't have the problem of interference at 49MHz from baby alarms and the like. This can prevent useful ch. R1 reception unless a phasing system is used. With the Chinese baby alarms now widely sold you get strong local FM carriers and repeating tones at around 48·21 and 48·28MHz. Anyway, I wish you all success!



John Edwards' Casebook

Philips G110 Chassis

My heart sank. This is my least favourite chassis and its notorious power supply had failed. I ordered two repair kits, issued orders that I was not to be disturbed for at least a week, then set to. Two hours later it was time to check out the repair, with the set powered via my variac. I slowly increased the mains input to about 210V, and noticed that the HT output from the power supply remained steady at only 40V. I've never had success first time when repairing a G110 power supply. This was no exception.

I checked the numerous surface-mounted components I'd replaced for correct orientation, and was confident that I had fitted the kit correctly. So I started to check the components I'd not replaced in the primary side of the circuit – by taking resistance readings across them. For once luck was on my side. The 100Ω resistor R3616, which is connected between the base and emitter of Tr7616 in the chopper drive circuit, had risen in value to 1kΩ. When I fitted a 'normal' resistor I was rewarded with a fully functional TV set. I still don't like these sets though!

Ferguson 59P7 (ICC5 chassis – mono sound version)

There was no sound from this set's speaker and none at its scart socket. An IF input was present at pin 14 of the TBA120T sound detector chip, and audio fed into the scart socket appeared at pin 3, but there was no output at pin 8 of the chip. After confirming that its 12V supply was present at pin 11, and that there was no muting at pins 4 and 5, I fitted a new chip. After that the sound blasted out.

Alba CTV4881NTX

The screen was blank and there was no sound, as if the set was in the AV mode with no signal input. When the setting of the tube's first anode preset was turned up there was a blank raster with flyback lines. Time to check around the tuner, where I found that the 12V supply was missing because R422 (10Ω) was open-circuit and the 12V zener diode ZD402 was short-circuit. Replacing these items restored the tuner's supply, and once the channels had been tuned in I had sound and a picture. But my problems weren't over.

The picture varied in size depending on the brightness of the scene, which meant that the HT regulation was poor. In fact it measured about 124V and varied up and down by as much as 6V with brightness changes. The way to tackle this second problem was to check components in the power supply. I found that C909 (47μF) was almost open-circuit, C910 (10μF) was leaky, while the resistance reading between the base and emitter of Q902 was only a few hundred ohms. It's type 2SB774, but a BC212 is a suitable alternative. Once replacements had been fitted the HT was correct at 115V and the picture was stable.

The last time I had one of these sets in I had to replace the 2SC2335 standby control switching transistor Q907. I used the readily available BUT56A.

Matsui 209R

This set's power supply had shut down in the protection mode. I found that C613 (4,700pF, 1kV) in the network connected across the HT rectifier D607 was short-circuit.

Philips 21CE7550 (3A chassis)

Although this set appeared to be dead, its power supply produced an HT output of 35V that rose to 135V when pin 15 of the line output transformer was disconnected. I don't like estimating for LOPT breakdowns, as there always seem to be additional problems such as field collapse, failure of the microcontroller chip or whatever once a replacement transformer has been fitted. On this occasion I was lucky. A new transformer restored normal operation.

Texet DVT9254P Combi Unit

When a cassette was inserted the carriage would go down about half way then stop, wait a few seconds and return to the eject position. To confuse matters, when I inserted a dummy cassette so that I could see the cause of the jamming it loaded normally. An embarrassingly long time elapsed before I realised that the tower LED had rotated slightly from its normal position, with the result that the underside of the approaching cassette rested on top of it.

In this design the LED is mounted on the deck diecast and is held in place by only a couple of thin strips of moulding. The problem was solved by rotating the tower back into its correct position and applying a small drop of superglue to its base to hold it there.

Decca CV9371

Fuse F802 had shattered because the BU426A chopper transistor was short-circuit. Checks in the power supply revealed that R808 (150kΩ) had risen in value to almost 1MΩ while C814 (1μF) was virtually open-circuit. I replaced these items and, for good measure, the TDA4600 chopper control chip. A soak test confirmed that the set was now OK.

Letters

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

Rocky Road to Digital TV

Several contributors to *Television* have, in the past, highlighted the problems caused by the introduction of Channel 5, which appears to have undermined the excellent planning of the original four-channel UHF terrestrial TV transmission system. Having pondered over the implications of introducing digital transmissions, I wonder whether "we ain't seen nothing like it yet".

There are at present about 1,000 relay stations in addition to the main terrestrial transmitters. Not many relay stations transmit Channel 5 but, if the digital multiplexes are to be available to all before the analogue switch off, relay stations will have to be used. If six multiplex channels are to take the place of the analogue four, how will the frequencies be assigned so that interference is avoided during the interim period when there are both analogue and digital transmissions? Will the relays, like the main stations, be required to handle four analogue and six digital frequency allocations simultaneously? And what happens when the analogue channels are finally switched off? We're told that the gaps in the frequency spectrum will be sold off. But only unoccupied channels will be available, not large chunks of spectrum. I fell that they will be used to provide additional digital multiplexes.

In view of the difficulties caused by Channel 5 with, in most cases, only main stations involved, what interference problems will arise when digital multiplexes are relayed from hundreds of sites all over the country? We are now told that terrestrial digital transmissions are not as robust as originally thought. So better aerials, cables and connections are required. More wideband aerials, with their known limitations, will have to be used. Furthermore there are the 'white holes' mentioned by Peter Murchison (Letters, August 1999). Will there be hundreds of them?

In the January issue John Hopkins suggests that a single large screen may replace several small ones around the house. This would take care of the problem of needing several subscription cards. But I'm not sure about this: a significant reduction in amenity is involved. People are used to having extra sets in bedrooms, guest rooms, kitchens etc. They would probably regard centralised viewing as a retrograde step, especially when family viewing conflicts arise! A universal decoder box that serves the whole house, suggested by John Hopkins as an alternative approach, appears to be a better solution.

I remain unconvinced that the long-term planning of digital terrestrial transmissions has passed the "it'll be all right on the night" stage. There are already anomalies where I live, in the southern part of the Isle of Wight. To prevent interference to French services, 'new' transmissions to the south have been restricted. Channel 5 is transmitted to the north from Fawley and cannot be received on the island. The 1kW TV12 RSL transmissions from Rowridge are also directed to the north – I believe I am the only person in my area who can receive them (see my article Polarisation Puzzle in the August 1999 issue).

The digital transmissions from Rowridge are the latest puzzle. Multiplexes A, B, C and D are in group A and are transmitted along with the analogue channels from the main aerial. Southerly radiation from this long-established aerial is needed to provide analogue coverage, consequently the above digital signals are transmitted in the same way and are available in my area at good strength. The BBC, ITV and Ch. 4 digital services however are on chs. 67 and 52, and are transmitted by separate new aerials that face north. I'd like to be able to receive them, but the signals are way down in the noise – even when a group C/D aerial is used. My question is, in view of the strength of the four group A multiplexes radiated to the south, why aren't the French jumping up and down in protest? It's anomalies like this that force one to question the planning. If four of the six multiplexes don't upset the French, why can't we have the other two?

So, will it be all right on the night come the analogue switch off, or will there be some blank screens? If, in this rural area, there are I'm sure that many people will rally forth with pitchforks to sort out the authorities – they will be closely followed by me with my soldering iron!

Does anyone have the full picture? Does it exist? If so, can someone please tell us all about it? I suspect that changes and revelations to come will lead to a situation that has not, so far, been fully assessed. As Peter Murchison commented, a satellite would be a lot easier.

Lastly, Ceefax page 698, BBC Engineering, no longer lists any new relay stations. Is this just a coincidence?

Keith Cummins,
Chale Green, Isle of Wight.

Digital Picture Quality

Take a perfectly good analogue video signal, lop off the top MHz, throw away 80 per cent of the rest, shove it down a too-narrow channel and then tell the public that it's "crystal-clear digital". Who are the Moving Picture Expert Group trying to fool? They might be expert at talking bull and drawing good salaries, but should visit a good optician. Digital is fine in theory, and would be fine in practice if it was allowed to occupy its full natural bandwidth of 200MHz per channel. But the aggressive compression employed to make it spectrum friendly ruins the quality. There are three main problems:

(1) Shuffling backgrounds. When a reporter stands in front of an almost stationary background (grass or gently waving trees) there is a freeze/unfreeze/freeze effect. This is caused by non-transmission of unchanging parts of the scene and its storage in the receiver. It's bound to happen, but is far too obvious.

(2) Banding and tiling effects. A clear blue sky with a smooth gradation often shows discrete stripes or squares of slightly different shades.

(3) Odd skin tones and textures. Faces often look 'plasticy' and overly smooth, as if caked in make-up. This is sometimes accompanied by a black-after-white or 'cardboard cut-out' appearance.

These effects have been observed under workshop conditions with a variety of STBs, both terrestrial and satellite.

Analogue at its best is a fine sight (with a decent receiver the PAL artefacts, such as dot-patterning and cross-colour, are almost nil). But even the best digital signals seem to be second-rate. This, of course, is what happens when you hand over a finely-honed system to a bunch of computer nerds who have spent their lives drooling over .MOV or .AVI files. If this letter sounds angry or negative I apologise, but what I've seen over the past few days has filled this particular ex-TV engineer with horror and, unfortunately, there's no way back.

Andrew Howlett,
Dukinfield, Cheshire.

Test Cards

Several correspondents have complained about the lack of transmitted test cards for analogue and digital TV. Snell and Wilcox have an excellent test card available. It includes all the old favourites (a grey scale, resolution checks and colour test areas) and in addition some moving areas to check the video decoder. For demonstrations, check out
www.snellwilcox.com
Look under downloads and then screensavers and movies.

Steven Harris,
Camberley, Surrey.

The Spares Question

My letter on spares in the November 1999 issue was based on past experiences. I have found that pattern idlers and pinch rollers do not work for long – if they work at all! Capacitors obtained from a number of sources have caused many problems in the past. Replacement batteries fitted in Philips TV sets last for only a few months: Philips' originals last much longer and are not much more expensive. Most customers will pay the difference. Even semiconductor devices can be suspect, as Martin Pickering has warned us in recent months.

Main distributors who act as agents for manufacturers often sell at retail rather than trade price, with mark-ups of over 100 per cent not uncommon.

Over the past five or so years I have had good service from J.J. Components. Jay knows that video parts must be genuine, and that I'm very fussy. J.J. Components sells a wide range of genuine video and TV spares as well as pattern ones, giving the engineer a choice. Some parts distributed by König are genuine originals supplied in a König box or bag.

As a special favour to me, Jay will often deliver parts or let me collect them out of hours. This is the sort of service only a small company can give you: you won't get it from the big boys!

Remember that if you use parts of dubious quality, you face the comeback. You are responsible for ensuring that the materials used are of a high standard. If a fire should occur and its cause is subsequently proved to be a sub-standard part, you could be held responsible. If a repair you have carried out results in a death, you could be charged with manslaughter. Such cases are very, very rare but can occur.

I have been told that if you repair a product that subsequently proves to be dangerous because of a previous repair you didn't carry out and didn't notice you could, under European law, be held responsible. I am not a lawyer but, given the complex nature of consumer law, would be very interested to know how we might be affected.

The bottom line is to take care when buying parts. Most customers will be happier with a quality, longer-lasting repair than a cheaper, short-term bodge. Some engineers like cheap parts, thinking that low cost will bring repeat business. It might, but unless you are very good at gabble it won't generate customer faith in you.

Michael Maurice,
Wembley, Middx.

The Aussie ESR Meter

Jim Kirkman (Letters, January) mentions a batch of faulty BC328 transistors supplied with the Genie ESR meter. I have been supplying these meters, in both kit form and fully built, as the Genie and Genie-plus (with audible tone) since the review in the January 1999 issue of *Television*. The fault described by Jim was first reported at the SatCure web site in March 1999 as follows:

"Display dim, Q1 (BC328) low-gain or faulty. In extreme cases there may be additional symptoms: display dim; display won't stay on when the 'on' button is released; even if the display works correctly (EA followed by "–") it may switch off when measurement is attempted."

There can be other symptoms as Q1 is not the only BC328 in circuit, but these symptoms are usually swamped by the effect of Q1 being faulty.

SatCure eliminated most of the faulty transistors and used good ones instead. But many kits ordered direct from DSE were still in transit from Australia and couldn't be intercepted by the supplier, hence Jim's problem. Good transistors can be identified by the black lettering on a silver background. If anyone bought a meter from SatCure before June and thinks they have faulty transistors they should contact me for free replacements.

There is lots more information (with pictures) at the SatCure web site
http://www.satcure.co.uk/design/genie.htm

Martin T. Pickering, B.Eng.,
satcure@netcentral.co.uk

Estimates and Quotations

Those more interested in technical problems may overlook the importance of good customer relations when it comes to presenting an estimate, a quotation – or the final bill. Paul Smith provides guidance on how to charge

While pricing policy should be kept under continuous review, the start of a new year is a good time to carry out a thorough analysis of costs and charges. Even the best engineers can fail in business if this is overlooked. Make your estimates too low and you'll have plenty of work but little profit: make them too high and the number of jobs will dwindle, again along with your profit. Achieving a price level that suits your accountant and your customers can be a difficult balancing act. As far as both are concerned however, this is as important as your technical expertise.

Because there are so many variables, including location, competitors, overheads and the value of the item to be repaired v. the cost of a replacement, it's not possible to specify how much a particular business should charge to carry out a specific repair. But some guidelines can be provided. The following are based on the experience of a number of engineers.

(1) Have fixed prices for the more common jobs. This will avoid arguments when you subsequently do repairs for a customer's friends or relations. It will also enable you to provide some instant quotes.

(2) If an old or obscure item is brought in, rather than quoting a high price to put the customer off consider a 'parts no longer available/don't handle that make' approach. If the customer then goes to a competitor he won't be able to make an unfavourable comparison with your inflated quote, and may return with future work.

(3) Tell a customer that something is beyond economic repair only when it is. Most customers get a second opinion.

(4) To base quotes on how much you think a customer is willing to pay is unwise. It introduces an unknown factor – £20 may be too much for one customer while another may consider £50 to be a bargain. Spending too long on a diagnosis before you provide an estimate tends to emphasise this factor: to avoid losing a job and payment for the time you've already spent on it, you might reduce your quote to reflect what you think the customer is prepared to pay then kick yourself when he says "is that all – I expected it to be more!"

(5) Don't waste hours on fault-finding when you prepare estimates. Give yourself a reasonable amount of time then, if it has not been possible to establish a definite diagnosis, prepare a quote based on the most expensive likely cause (by this time you will have ruled out the more obvious causes). If the quote is accepted, further diagnosis will not be wasted time. The final bill can always be less than the quote.

(6) If you make a quote when the diagnosis is still unconfirmed, it may be wise to make it subject to "10-15 per cent either way" then stick to this except in an extreme case. If the quote is £40 ± 10 per cent and the final tally is closer to £50, charge £44 – show it as £50 – £6 on the bill. This helps to obtain further custom and recommendations. To charge even £1 above your estimate may not cause a complaint but could affect your reputation.

(7) Consider telling customers at the start "if it's less than £XX I normally go ahead – any more and I will contact you".

(8) If a customer says "no more than £XX", don't charge that amount. A colleague charged £30 (the customer's maximum) when the bill should have been closer to £35, only to be told "if I'd said no more than £40 I suppose that would have been the charge". If the charge is slightly over, tell the customer (they usually accept) or explain the situation and say you will charge only the agreed maximum.

(9) Special offers to boost trade are not always successful. A local engineer offered a full deck service for £15 inclusive of parts and labour. He went out of business shortly afterwards.

(10) Charging by the hour can lead to all sorts of problems – for instance keeping a record with an on-going or intermittent fault. You might have to increase your quote several times, with the danger of an eventual turn down and consequent loss.

For repairs under warranty, manufacturers pay a specific labour rate for different types of equipment. This is perhaps the easiest system to adpot for out-of-guarantee repairs as well. You may wish to consider dividing each category into straightforward repairs and more complicated ones. This adds a degree of fairness.

A check on allowances paid by manufacturers for under-guarantee repairs revealed the following:

TV sets up to 14in.	£12.50-£25
TV sets over 14in.	£15.50-£38
VCRs	£17.50-£29
CD and audio	£12.50-£23
Portable hi-fi	£10-£16

In general, the lower allowances are for the cheaper brands.

(11) There are occasions when it's possible to quote different prices for a repair, for example using an original manufacturer's or pattern part, or when a second-hand replacement for an expensive part may be acceptable.

(12) Split the total cost of a quotation into its contributory items, e.g. parts £XX, labour £XX, total £XX. This is easier for the customer to understand and can result in a higher acceptance rate. If more than one item has been left for a quote, price each one separately rather than presenting the customer with a larger total quotation.

(13) Take a tip from sales techniques – charge £49.75 instead of £50 etc. Some customers are suspicious when a bill comes to an exact number of pounds.

(14) Finally, don't be apologetic when you present the bill – which of course is fully itemised. After all, you are charging a fair price for a first-class job.

Answer to Test Case 446

– see page 217 –

Close and careful inspection of faulty equipment often pays dividends. You might find corrosion, corona discharge, cracked print, electrolyte leakage, dry-joints, dirty contacts or whatever. A five-minute examination of the inside and outside of everything that comes into the workshop for repair could well save time overall – and make time for a coffee break with every job!

All that was wrong with the Panasonic NVJ45 that recorded such a mess was that its owner had inadvertently set the standards switch on the front panel to NTSC-4·43. So the machine was trying to record to the wrong scanning and colour standards. It's rare to find such a switch, but this eight-year old model has one. When a switch is provided, you can be sure that someone will set it incorrectly, can't you?

The Akai deck that produced fluttery sound had an oscillating back-tension arm. As a result the tape tension fluctuated rapidly. Why this has so little effect on the picture and so much on the sound is hard to understand, but it is so. You get it with other machines. To be sure that he'd cured this one, Ray replaced both the spool turntable and the tension-regulator band assembly.

NEXT MONTH IN TELEVISION

Off-air test signal source

One often requires an off-air signal when working on audio and video equipment. With this need in mind, Keith Cummins designed his 'black box', a conveniently small piece of test gear that accepts analogue UHF signals and provides video, audio and FM mono sound outputs, a DC level indication of input signal strength, plus switched and unswitched 12V supplies. Some sections are optional. The unit is build from items that are available cheaply from Sendz Components.

Servicing the JVC HRD720 VCR

John Coombes provides a fault-guide for these well-built machines.

State of the trade: summary

In our September issue Michael Maurice started a debate on the state of the trade and the prospects. Many engineers subsequently wrote giving their views. Michael now summarises the situation as he sees it.

Dealing with cracks

There are several ways of dealing with a cracked PCB. Paul Smith describes different approaches, their advantages and disadvantages and provides additional practical advice.

Rebuilding battery packs

A major expense incurred with high-tech portable equipment is battery pack replacement. It's possible to save on this by rebuilding a pack. Pete Roberts describes what's involved.

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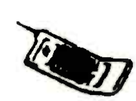

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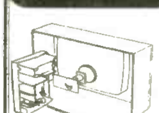

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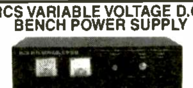

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All products are clearly and logically presented to make the items easy to find.

We have a highly trained and caring staff and perfect systems to try and make every contact with A.R.D. Electronics a pleasurable and problem free experience.

- Aerials & Audio Accessories
- Batteries & Accessories
- Cable & Accessories
- Capacitors
- Computer Components & Accessories
- EHT Components
- Electrical Accessories
- Filters/Surge Protectors
- Fuses & Holders
- Games Consoles & PC Game Accessories
- Intercommunication Equipment
- Loudspeakers & Accessories
- Optoelectronics
- Power Supplies & Adaptors
- Relays
- Remote Control Handsets
- Remote Control Konig Cross Reference Chart
- Resistors, Positors & Trimmers
- Satellite Spares & Accessories
- Security Products Semiconductors
- Service Aids
- Soldering Equipment
- Stands & Brackets
- Storage Systems
- Switches
- Test Equipment
- Tools
- Transformers
- Video Accessories
- Video Heads

In response to your requests we have changed our delivery charge policy.

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