

Tips, ..... /visions and electronic equipment

TELEVISION

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# TELEVISION

## AND HOME ELECTRONICS REPAIR

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### Pace digital TV adapter

### Power-line communications

### A guide to the Panasonic Z7 chassis

Satellite, PC, Monitor, TV, VCR and DVD faults



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# CONTENTS

August 2002

Vol. 52, No. 10

## 579 Comment

Cooking the books

## 580 Teletopics

DTT transmission change? Wireless home networking system and other news.

## 582 Test report: the Pace digital TV adapter

The Pace digital TV adapter provides reception of the free-to-view terrestrial digital TV channels with any TV set that has a scart connector, and should



give a boost to DTT reception. Peter Marlow bought one and reports on its use and performance.

## 584 Guide to the Panasonic Z7 chassis

Large numbers of 14 and 21in. sets fitted with this chassis, successor to the Z5, were sold. Brian Storm provides a serviceman's guide to the circuitry used in the chassis, with a list of some common faults.

## 588 Power-line communications

For the past fifteen years the telecommunications and electricity supply industries have been collabo-



rating on ways of transmitting broadband signals via the mains distribution network. J. LeJeune takes a look at the current state of the art.

## 590 Servicing the Mitsubishi TFS6705K monitor

In this fifth instalment in his series Donald M. Henry starts on the digital control circuitry used, beginning with a description of the digital features incorporated in many modern monitors.

## 592 Test case 476

## 599 Help wanted

## 600 Thomson's ICC17 technology

Part 2 of Mark Paul's description of the circuit technology used in this chassis deals with the timebases.

## 607 Tom Baker's tales

A warning about security-coded machines, a dead Matsui TV and cheap VCRs.

## 610 DX and satellite reception

Terrestrial DX and satellite TV reception reports. News on international TV broadcasting and satellite band changes. Knife-edge signal refraction. Roger Bunney reports.

## 614 DVD faults

## 614 Satellite notebook

Digital channel update. Some digibox faults.

## 616 Monitors

Guidance on repairing monitors and related equipment.

## 618 VCR Clinic

## 620 Service casebook

Michael Maurice selects some interesting items from his notebook.

## 622 TV fault finding

## 626 Web service

## 628 Audio faults

## 630 Letters

Power switch problems. SkyLink connections. The TX92 tuner. A salutary lesson.

## 631 Next month in Television

## 632 What a life!

Donald requires some help while minding the business on his own. Enter Oscar, who turns out to be adept at fault-finding.

## 634 Strange faults

Alan Dent on some unusual and difficult faults.

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# Cooking the books

All too many years ago, when I was first thinking about what sort of job I might like, I met a very pleasant fellow who told me that he was an accountant. Poor chap was my reaction. What a terrible fate – to spend a lifetime adding up figures. I didn't quite put it like that to him, but in subsequent conversation he pointed out that once you've got beyond junior work it becomes quite interesting. More a matter of advising clients than checking the figures in their books. It seems that in recent years this activity has developed quite spectacularly, as current events have shown. I refer to the Enron, WorldCom and other scandals.

A lot of outrage has been expressed about them, and there's no doubt that there was considerable skulduggery. But there are many factors that make drawing up the accounts a tricky matter. Just how do you classify certain expenses and transactions? Large firms in particular spend considerable amounts of money on all sorts of things that are difficult to categorise. Several million pounds might be spent on bidding for a contract, and there will be all sorts of ancillary expenses. And large sums of money, including fees of various sorts, are paid when firms are involved in takeovers, mergers, revamps and so on. Where are these to be recorded in the accounts? The situation is not helped by the fact that in many cases there are no hard-and-fast rules to rely on. It's a question of deciding what is most appropriate. Basically the directors of a company are responsible for deciding on policy and issuing guidelines. Unfortunately they can all too easily fall to the temptation to adopt dubious practices, which can lead to devastating consequences – as the owners and employees of a firm such as Enron, and the banks that lent it money and its creditors were to discover.

There are lots of grey areas when it comes to drawing up the accounts. The aim of those who sail close to the wind in this respect is to maximise profits – quite likely for personal gain. In the case of Enron, subsidiaries were set up and expenses/losses were transferred to them, thus boosting the apparent performance of the parent company. The contribution of accountants Andersen to this has been clearly spelt out. There is little doubt that there was outright skulduggery here. The WorldCom affair was not quite so outrageous. It was rather a matter of classifying a great deal of expenditure that would normally be classified as running expenses as capital investment. The advantage is that the expenditure is taken out of the day-to-day accounts, again boosting apparent profitability. In neither case, it seems, was any law broken.

A much more common technique for boosting apparent profitability is to record the profit on confirmation of an order rather than the delivery of the goods or services concerned. Say your firm signs a contract to supply 100,000 widgets over a five-year period. One might think that this means a profit on

the supply of 20,000 widgets a year over the period. But there seems to be nothing illegal about booking the entire profit in year one – after all, that's when the order was received. Those inclined to conservative accounting would spread the profit over the duration of the contract. The more gung-ho would record it immediately.

Why on earth are these sorts of things

Something clearly has to be done. And the worst offenders must pay some price for their transgressions

done? To the more cautious of us it's obvious that they are likely to cause trouble in the long run. All firms are subject to business cycles, i.e. some years are better than others. The gung-ho approach makes the good years seem better – and the not-so-good years a lot worse.

The trouble stems from the top, when you have managers that demand profit, profit, profit and won't accept any dips in performance. This puts enormous pressure on everyone, and people fear for their jobs if they can't show improved results. Inevitably, it ends in tears. The real problem is when this sort of thing gets out of hand. A certain amount of doctoring of the accounts is probably inevitable, and within limits probably does little harm. After all, no one is likely to want to make things look worse than they need. But when a loss-making situation is dis-



guised as a profitable one it's only a matter of time before the organisation concerned is brought to its knees.

This sort of thing can happen with any firm or organisation, but is more spectacular with a firm that has grown rapidly and become truly substantial, as with Enron and WorldCom. The directors have the ultimate responsibility for what happens: in the 'bubble' economy of the late Nineties they all too often failed to act with due discretion.

It will be very difficult trying to ensure that in future firms act responsibly in their accounting practices, because laws and regulations cannot take into account the day-to-day complications of a rapidly changing business environment. But something clearly has to be done. And the worst offenders must pay some price for their transgressions, if only to serve as a warning to others.

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# TELETOPICS

## DTT transmission change?

One of the problems that ITV Digital had was its limited coverage of the UK. This problem remains, and will affect the timing of the eventual analogue-TV close down. Research carried out by Logica on behalf of the ITC suggests that more than 40 per cent of UK households would be unable to receive digital terrestrial services from the existing transmitter network. According to the research, 58 per cent of homes at best would be able to pick up a good signal. To reach even this level, the number of channels transmitted would have to decrease while the cost of providing them could "shoot up". Logica believes that increased transmitter power could improve the situation considerably.

Logica's technical director Dr Ian Jenkins commented that once an installation has been completed and all six multiplexes can be received there has been a tendency for unreliable reception, with random picture break-up and occasional picture freezing. Electrical interference contributes to the problem. According to Dr Jenkins, increased transmitter power and multiplex equalisation would be likely to enable 50 per cent of households to receive DTT transmissions with their existing aerial installations. A further 26 per cent of

homes could require an aerial upgrade or other changes to the installation to receive all the multiplexes.

It's understood that five of the six groups that applied for the ex-ITV Digital licences called for changes to the transmission standard to improve coverage. The current DTT transmission system uses 64QAM (quadrature and amplitude modulation with 64 states) that modulates 2,000 carriers spread across the multiplex channel's bandwidth (this is referred to as a coded orthogonal frequency-division multiplex), the data rate being 24Mbits/sec. The Digital Television Group (DTG) has just published a report, entitled "DTT (DVB-T) transmission mode trials", which concludes that better reception would be achieved by changing to 16QAM. Trials were carried out from the Crystal Palace transmitter, using frequencies that had not previously been used. They were carried out by the DTG, BBC Research and Development, Crown Castle and NTL, the work being part-funded by the DTI. Three different transmission modes were used, and the use of COFDM with 2k and 8k carriers was compared. The DTG says the results go a long way to support claims by the BBC's director-general Greg Dyke that

by using an alternative transmission mode the number of 'plug-and-play' DTT households could rise from 40 to 60 per cent, with the figure rising to 80 per cent with a new aerial installation.

According to the DTG's technical director Peter Marshall, use of 16QAM seems to provide a signal gain equivalent to about 6dB at the transmitter. A change from 2,000 to 8,000 carriers appears to provide a further significant improvement, though there has not been sufficient time to conduct exhaustive tests. He thinks that 40 per cent of existing digital receivers might be unable to handle 8,000 carriers.

A change to 16QAM seems quite likely, with the data transmission rate reduced to 18 or 16Mbits/sec. This would mean fewer TV channels per multiplex, but coverage would be increased and the signals would be more robust. If the ITC decided to change the transmission parameters, adjusting the transmitters would be a relatively simple operation that could be carried out quite quickly. Adjustments to receivers would be a different matter. Many existing set-top boxes and IDTV receivers would not work. Some would require a software upgrade, others a hardware modification.



*This watch-style video telegraphy unit, which incorporates a video camera, has been developed by Sony. The company says the unit is at present too heavy for the consumer market and needs refinement. A launch within two years is understood to be possible but depends on the results of market research.*

### New amateur radio licence

The DTI Radiocommunications Agency has introduced a new amateur radio licence called the foundation licence. Its aim is to get people interested in radio, electronic communications and computers, with a view to possibly seeking a career in these subjects. The youngest person taking the foundation licence course so far is an eight year old girl. For further information visit Ian Abel's website at <http://www.qsl.net/g3zhi>

## Wireless home networking system

Philips has demonstrated the first wireless domestic networking system that distributes digital content from IEEE 1394 (FireWire) sources using the IEEE 802.11a wireless LAN transmission standard. Large quantities of consumer electronics products and PC devices with IEEE 1394 ports, including digital TV sets, set-top boxes, digital cameras, games consoles, cable modems, printers and DVD players, are being

installed. It's forecast that by 2005 the number of consumer products connected to home networks will exceed seven million.

The Philips demonstration was the first to conform to existing and new industry standards under the direction of the IEEE 1394 Trade Association. These standards include IEEE 1394a-2000 and the latest IEEE 1394.1 bridging technology draft specification. The technology provides

wireless links via the high-performance IEEE 1394.1 serial bus bridge using an IEEE 802.11a domestic LAN. IEEE 802.11a operates at 5GHz, transferring data at 54Mbits/sec or higher. This means that the technology is suitable for linking audio, video and data streams.

In addition, the Philips technology includes DTCP - Digital Transmission Content Protection.

# New products

Daewoo is to launch a digital TV set-top box for reception of the free-to-view channels. It will use technology developed by the Irish company NovaPal. The STB will be branded the Daewoo SetPal and is expected to sell at about £99.

Philips has launched two DVD-Video players at less than £200. Model DVD623 sells at about £150 and Model DVD723, which includes MP3 playback, at about £180. Both models can read DVD+RW, DVD+R, CD-R, CD/RW, Video CD, Super Video CD and audio CD discs and have a disc resume feature. This enables the user to continue to view a programme at the point at which a disc was stopped. It works for up to five discs at a time.

The Samsung DVD-H40 DVD player that incorporates a 40GB hard disk with a recording capacity of forty hours of TV programming or ten DVD titles. Samsung's 'scene again' technology enables the user to watch a DVD film on a TV set and record it on the hard disk simultaneously. A user who is interrupted while viewing can catch up on the missed part by recording it on the hard disk. The Samsung VP-D590I MiniDV camcorder has a memory-stick facility and 'world-wide output' - its footage can be viewed on sets of any type throughout the world.

The Sharp ViewCam Model VL-NZ100H has numerous features including PC connectivity, to enable its material to be edited; a 3in. colour LCD screen; 10x optical zoom; 300x digital zoom; and a Digital Compensation Circuit that automatically lightens dark picture areas without saturating bright areas.

This year marks the tenth anniversary of the launch of the ViewCam design.

## TV/video chips

Philips expects to launch a single-chip MPEG-2 coder-decoder chip intended mainly for recordable DVD units later this year. Until now DVD recorder manufacturers have had to use a separate chip for transcoding from DV to the MPEG-2 format, with a separate memory for each chip. According to Philips the single codec chip will, with an industry-standard DVD+RW software stack, enable

development times for new models to be reduced by 35 per cent. Global sales of DVD recorders are expected to reach 1.3 million units a year quite soon, rising to over 10 million by 2005.

STMicroelectronics has introduced two class D field output chips, types STV9380 and STV9390. They operate at 150kHz with split  $\pm 18V$  supplies. Class D operation is more efficient than conventional class AB, but past chips of this type suffered from unreliability problems

(remember the TDA2600 in the Philips G11 chassis?). These latest chips incorporate comprehensive protection.

Samsung has built a digital TV processor chip around the ARM 920T processor core. This is a breakthrough for ARM, which had not previously had its designs used in consumer products. Samsung is to use the chip, which runs at 200MHz and integrates peripherals, memory and data transceivers, in set-top boxes and high-definition TV sets.



**Thomson Multimedia has launched this home cinema package based on the new DPL915 DVD amplifier. The package consists of the amplifier, a DVD player and six speakers, with built-in DTS and Dolby Digital. As the DPL915 also has Dolby Pro-Logic II surround sound, the user can have five-channel sound, even from a stereo source. A panoramic mode and spatial control are also provided. Films and music stored in a variety of formats, such as DVD, CD, CD-R, CD-RW and MP3, can be played. Output is up to 200W RMS. The Navilight remote-control unit that comes with the package can be used with other home cinema products, regardless of brand. Features of the DVD player include slow-motion playback, frame advance/reverse, quick search, zoom and still pictures. There are six compact satellite speakers plus a subwoofer.**



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Test report:



# Pace digital TV adapter

**The Pace digital TV adapter provides reception of the free-to-view terrestrial digital TV channels with any TV set that has a scart socket and should give a boost to DTT. Peter Marlow bought one and reports on its use and performance**

**W**e all have our own ideas about why ITV Digital failed – perhaps it was too expensive in comparison with BSkyB, maybe there were not enough channels, the reception was poor and so on. Digital terrestrial TV seems to be here to stay however. The government is enthusiastic about it, because the technology provides more efficient use of spectrum space and there's the prospect of revenue for the Treasury when the redundant analogue TV bandwidth is licensed out. There have been moves to establish a 'level playing field', possibly by putting a tax on satellite dishes. The fact that forty per cent of all TV sets sold in the

UK are now of the widescreen variety is an encouraging sign.

But making terrestrial digital TV accessible will be the key to its success. With improved coverage, good content and the wide availability of low-cost set-top decoder boxes, viewers will be attracted. A number of 'free-to-air' STBs are due for release in the UK this year, from Pace, Netgem and Nokia for example. There is also the PC adaptor from Hauppauge (reviewed in the June issue of *Television*). The price range for these STB decoders is £99 to about £160. They are not exactly cheap – you can buy a 14in. analogue colour TV for less – but may well tempt viewers to explore the world of digital TV. First on the market was the Pace adapter, the subject of this review.

## First impressions

Designed to widen the reach of digital TV, Pace's fully DVB-compliant terrestrial digital TV adapter (DTVA) was first made available through retail outlets in April this year – I bought mine from Comet. The adapter has a simple-to-use electronic programme guide (EPG) and can be used to convert any TV set with a scart socket for digital reception of the free-to-view channels. The graphical user interface (GUI) has Gaelic and Welsh options.

The DTVA is a stylish and compact unit, measuring just 185mm wide, 100mm deep and 45mm high. Its top is semi-transparent

and its back is curved. There's a single tri-colour indicator on the front panel. A card slot for possible future pay-TV services is included in the underside – more on this later. From the rear a single 85cm long lead emerges, terminated by a scart plug which has integrated coaxial aerial and power supply sockets, see Fig. 1. The unit comes with a remote-control handset, batteries, a manual and a mains-plug power supply. What first struck me was the small overall size in comparison with conventional STBs, and the tidy though unusual lead arrangement.

## Setting up

I started out by using "connection method 1" – four methods are displayed in the manual (see below).

I switched everything on and the DTVA's front-panel light lit up in red to indicate standby. When I pressed the remote-control handset's on button the light changed to green. The TV display then requested that I choose a language – English, Gaelic or Welsh – by using the remote-control unit's up and down arrows followed by OK. After that the channel scan commenced. About two minutes later the word "done" appeared at the bottom of the screen. I pressed OK to save the list of channels that the unit had found. The front panel light then changed to orange. I selected BBC News 24 and sat down to watch. It had been a straightforward, hassle-free set-up.

I modified my set-up slightly by adding a splitter in the aerial feed and taking a connection from this to the TV set's aerial input socket. In this way it was possible to enjoy both analogue and digital terrestrial TV. Other set-ups, to include VCRs, are described in the manual provided.

### Use

Channels can be selected by pressing the remote-control handset's number keys or using its prog +/- keys. Press the list button and a channel list is displayed on the screen. With the up and down arrow keys you can highlight a channel and select it by pressing OK. It's also possible to set up a favourites list.

Press the guide button to display the EPG. The screen takes a few moments to fill. There are four colour programme backgrounds as follows:

Blue	the currently selected programme
Yellow	the programme currently being broadcast
Green	the programme will be broadcast later
Orange	the broadcast has finished

More detailed information about a selected programme can be seen by pressing the handset's 'info' button.

A series of menus is available by pressing the 'menu' key. Parental lock and settings such as TV screen format and video and audio output can be enabled.

The 'TV/DTV' button provides switching between digital and analogue programmes, by forcing the TV set to accept or not its scart input.

The 'subtitle' and 'text' keys enable these services to be selected when available.

### Problems

I experienced a couple of problems, neither of which was a 'show-stopper'. The first was with video recording. I was using a Matsui TVR163 TV/VCR combi model and found that it would record digital TV properly only when the AV channel was selected. When I used the TV/DTV switch to select digital TV then tried to record, the playback picture would roll sideways. Anyone know why?

The other problem was when selecting BBC4. This channel is not available during the day - broadcasting starts at 7pm. After 7pm I sometimes have to select the programme three times before it will be displayed properly. The Pace support desk could not understand this. It could be because of the way in which the 'channel unavailable' signal is applied by different broadcasters.

### Extras

The DTVA unit can receive automatic software upgrades. When a download is available, a message is displayed on the screen (this happens only when viewing a BBC channel) to let you know that a

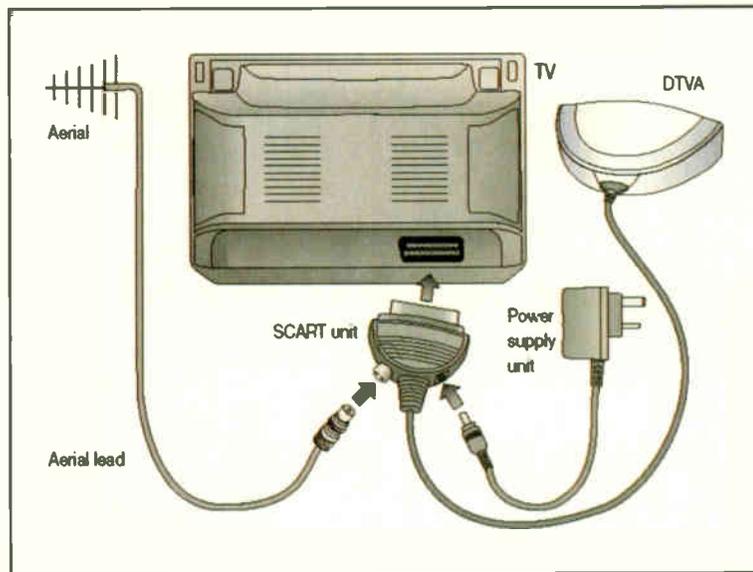


Fig. 1: The basic way of connecting the Pace DTVA unit to the aerial and a TV set

download is available and how to get it. In addition, if you know that a download is available you can go straight to the technical menu to get it.

Access to text/interactive services should be available from the end of July 2002. The reason why the DTVA unit cannot at present get teletext is that it doesn't contain the software necessary to produce the text. It is planned, during summer, to offer a software upgrade to load this into the box. The teletext channels will then be receivable.

Although the unit incorporates a card slot it cannot at present be upgraded to receive any pay-TV channels. This upgrade may be possible in future. The unit contains all the Mediaguard CA (conditional access) system hardware required to receive encrypted channels but needs a software update to enable this.

### Verdict

The Pace DTVA is an excellent product. It's easy to set up and has good documentation. Support from Pace via the dedicated telephone help line is reasonable, though I found that the e-mail support was more responsive. Once digital terrestrial TV settles down, I'm sure that it will be a very successful consumer product.

For more information, see the Pace website at [www.pacefreetoview.co.uk](http://www.pacefreetoview.co.uk)

Note that to use the DTVA unit successfully you will need a connection to a high-gain, wideband TV aerial system. To check the digital TV coverage in your area, visit the sophisticated postal code database at [www.dtg.org.uk/retailer/coverage.html](http://www.dtg.org.uk/retailer/coverage.html)

### Pace DTVA unit specification

**Basic features:** Fully DVB-T compliant (ETS 300 744); UHF input; embedded conditional access; automatic and manual channel search; 999 favourite channels; quick electronic programme guide (EIT based, ETS 300 468); interactive digital text; DVB subtitles; front panel on/off LED.

**General specification:** Fully DVB compatible; input 430-862MHz, 8MHz bandwidth; OFDM demodulator, 2k/8k modes (fully DVB-T ETSI 300 744 compatible), guard intervals 1/4, 1/8, 1/16, 1/32; video outputs PAL, RGB, composite, S-video; multilingual GUI; software downloadable; power consumption less than 6W, 0.06W in standby.

**Digital specification:** Video decoder MPEG-2 main profile at main level, 1.5-15Mbits/sec (720/576); audio decoder MPEG-2, Musicam (layer 1 and 2), 32/44.1/48kHz, mono/dual channel/stereo/joint stereo; Mediaguard conditional access; ISO 7816 smart-card reader; CPU 100MIPS with 16K data and instruction cache.

**Connectors:** Tuner input I EEC 169-2 connector; scart for PAL, CVBS and audio; mains at 90-240V, 50/60Hz.

### Currently available free-to-view digital transmissions

#### Television

BBC1	Channel 4
BBC2	Channel 5
BBC Choice	TV Travel Shop
BBC News 24	QVC
BBC4	ITN News Channel
CBBC	TV Travel Shop
CBeebies	Television X*
ITV1	E4†
ITV2	Film on Four †

#### Stereo radio

BBC Parliament

\* It is not clear whether this is a pay channel or not.

† Trailers during the day only.

Large numbers of 14 and 21in. sets fitted with this chassis, successor to the Z5, have been sold. Brian Storm provides a serviceman's guide to the circuitry used in the chassis, with a list of some common faults

# Guide to the Panasonic Z7 chassis

The Z7 chassis was used in 14in. portable and basic 21in. models for a number of years after replacing the Z5 chassis in 1997. Improvements over the previous chassis are as follows: new low-consumption (1W) standby power supply; simplified, highly-efficient main chopper power supply (because of the improvements, 21in. sets consume about 50W); new main microcontroller chip with built-in teletext processing and OSD generator; software-controlled service adjustments; automatic channel tuning, naming and sorting procedure; and improved circuit protection.

## Standby power supply

The standby power supply, see Fig. 1, was designed for very low power consumption

in the standby mode, typically about 1W. It's based on the circuit used in the Euro-2, -3, -4 and -5 chassis. T1201 is the standby mains transformer which, with rectifier circuit D1202/C1201 and the regulator transistor Q1204, produces a 5V supply. This is used to power the microcontroller chip IC1201, the EEPROM chip IC1202 and the IR receiver chip IC1204. Regulation is provided by Q1204, with zener diode D1209 and D1212 to set its base voltage. The voltage-doubler network C1202/D1205/D1208/C1203 provides bias for D1209 and Q1204 and a voltage to operate the on/off relay RL1201, which is driven by Q1203 and Q1202.

The circuit provides enough power to operate the set in standby only, thus keep-

ing the consumption in this condition to an absolute minimum. When the main power supply is brought into operation and the microcontroller chip starts to play its full role, the output from the standby power supply has to be supplemented; otherwise, the standby supplies would drain and the microcontroller chip would cease to operate, the set reverting to standby. The supplement is provided via R1205 and D1214 from the main power supply's 12V output.

## The main power supply

The main power supply, see Fig. 2, is basically a series chopper circuit based on an STR58041A-M chip (IC801). The HT supply to the line output stage is therefore not mains isolated, which was an unusual approach at the time when the chassis was designed. Instead, the line driver and output transformers provide isolation, see Fig. 3. The advantage of this arrangement is more efficient power transfer between the chopper circuit and the line output stage, with the consumption reduced to about 50W.

R804 and R811 provide a start-up feed and bias for the chopper transistor, whose base is connected to pin 2 of IC801, collector to pin 3 and emitter to pin 4. The chopper transistor is connected as a blocking oscillator, with feedback to its base from a secondary winding on the transformer (T801) via R807 and C808. T801's primary winding provides the energy store, with D810 as the efficiency diode and C812 to smooth the output. Transistor Q802 improves the fast switching of IC801: it does this in conjunction with C810 and C817. Feedback for regulation is applied to pin 1 of IC801 via R810 and D811, with C811 for smoothing.

R805 and Q801 monitor the current. If this is excessive, Q801 switches on. IC801 is then switched off until the current demand falls. Over-voltage protection is provided by the avalanche diode D812, which is connected across the chopper

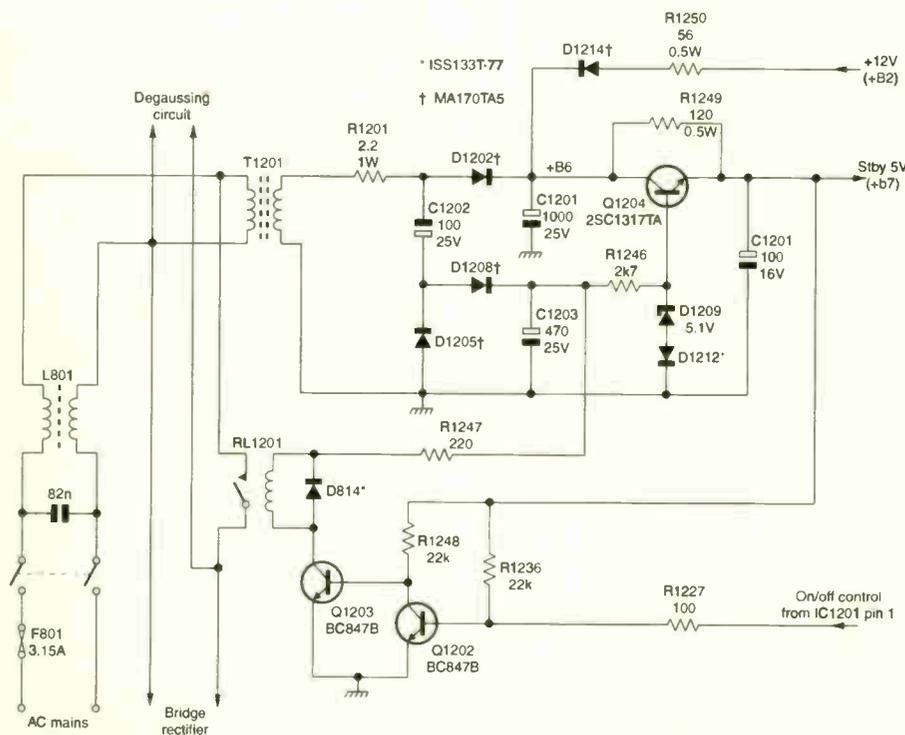


Fig. 1: The standby power supply circuit used in the Z7 chassis.

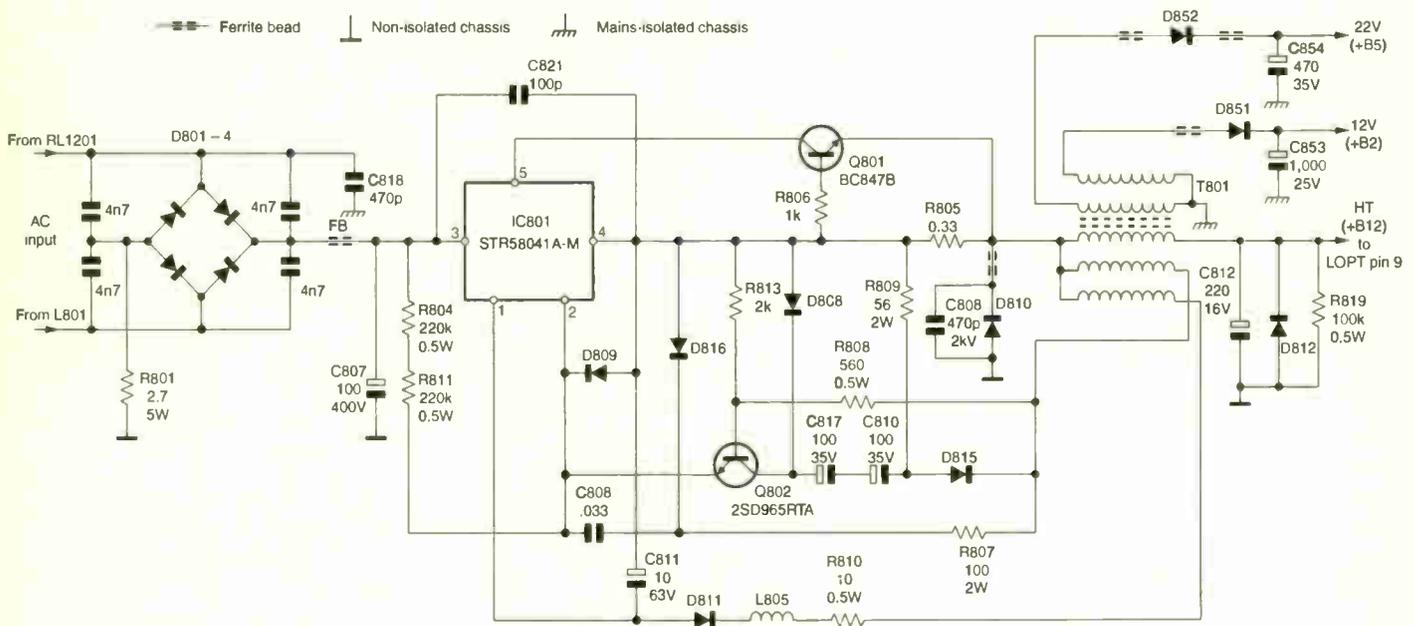


Fig. 2: The main power supply circuit used in the Z7 chassis.

power supply's HT output (+B12). D812 conducts when the HT voltage is excessive, removing the supply to the line output stage. It's obviously important to check this voltage with respect to the non-isolated side of the power supply and not the isolated chassis. A convenient point is the negative side of the mains bridge rectifier's reservoir capacitor C807. The HT/+B12 supply is 103V with 14in. sets, 125V with 21in. models.

Windings on the secondary side of T801 provide isolated 22V and 12V supplies. The 22V supply (+B5) is used by the LA4285 audio output chip IC251. This supply is monitored by Q252 and Q253, which is connected to pin 31 of the microcontroller chip IC1201. Pin 31 also monitors the field and line output stages, the 12V line (+B2) and the outputs from the regulators (IC851 5V, IC852 9V and IC853 8V). The latter all take their input from the +B12 supply. In the event of a fault in any of these areas pin 31 of IC1201 goes low. After five seconds the set will revert to standby, with relay RL1201 deactivated.

### The microcontroller chip

The microcontroller chip IC1201 is a 52-pin device which includes the teletext decoder and OSD-generator functions. Fig. 4 shows a basic block diagram. The pin functions are as follows:

Pin 1: Mains relay control. When this line is low Q1202 and Q1203 switch on, closing the contacts of relay RL1201.

Pins 2 and 3: The serial data and clock

pulse pins respectively. They control the I<sup>2</sup>C bus system.

Pin 4: Automatic contrast control tracking (CAT) input.

Pins 5-9: These pins are connected to the keypad. For activation they are pulled low by the relevant front control button.

Pin 10: Chassis connection.

Pins 12-13: These pins are connected to an 18MHz crystal, which provides a reference for the internal clocks including the teletext clock.

Pin 14: Not used.

Pin 15: Master reset. Holds the chip off until the power supply outputs are established correctly. IC1202 provides the reset pulse.

Pin 16: CAT on/off (see pin 4).

Pins 17-19: Not used.

Pin 20: Contrast reduction control for teletext and OSD operation. A high at this pin reduces the contrast level set by R1290 and R1291. Pin 20 also blocks the RGB signals from the scart input while the teletext mode is active.

Pin 21: Switches the OSD signals to lock to external sync when a stable sync signal is available.

Pin 22: Standby LED control.

Pin 23: Mute control for the audio output IC.

Pin 24: Chassis connection.

Pins 25-27: Filter pins for the internal text processing stages.

Pin 28: 5V (+B7) from Q1204.

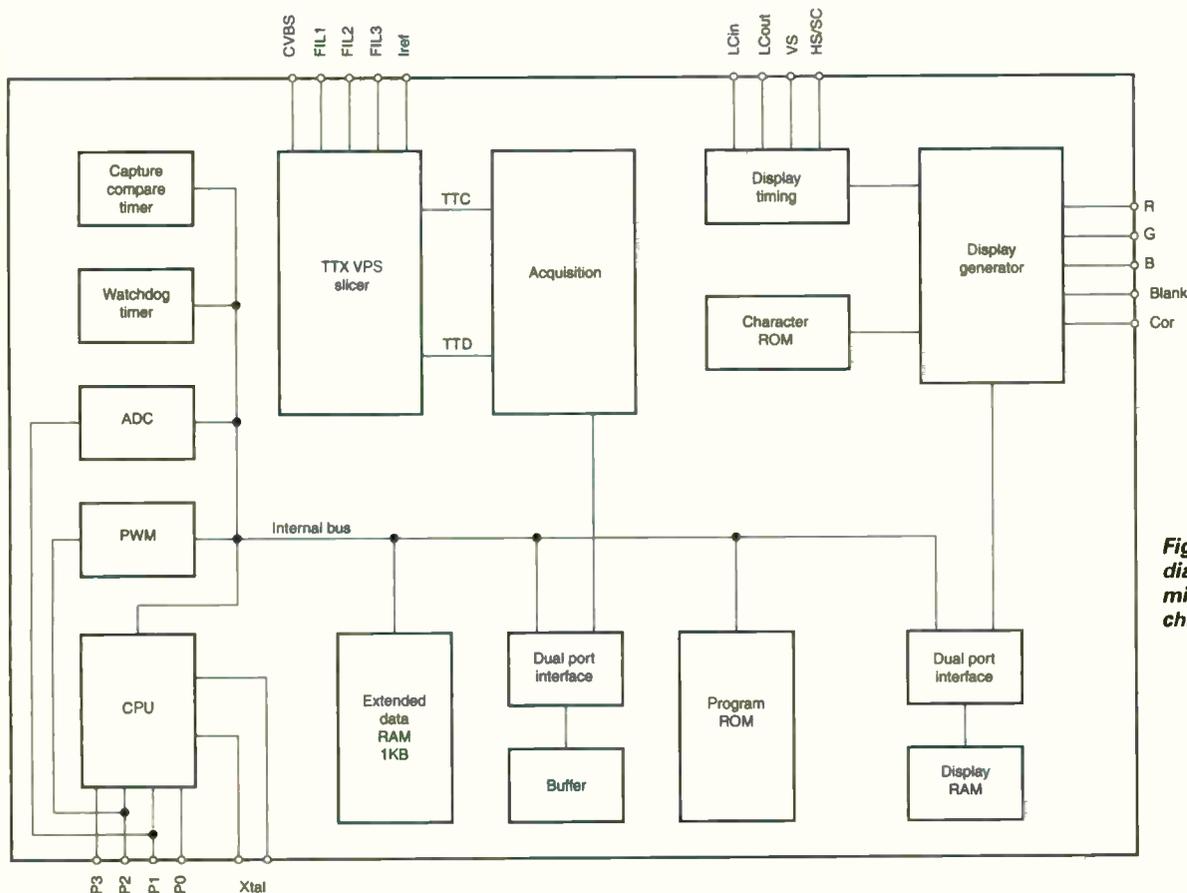
Pin 29: Reference current control.

Pin 30: Video input for teletext processing.

Pin 31: Protection monitoring. This pin is normally held high via R1218. The following supplies/circuits are monitored. The 190V supply (+B1) derived from the line output stage: this supply provides the feed to R1218 and to the tuning-voltage circuit. The 22V supply (+B5), via transistors Q252 and Q253. The 12V supply (+B2) via D857. The 9V supply (+B4) via D858. The 8V supply (+B8) via D860. The 5V supply (+B3 from IC851, not +B7 from Q1204) via D859. The operation of the LA7840 field output chip IC451 via Q453 and Q454. Should any of these inputs take pin 31 low, the drive to the mains relay RL1201 is removed, putting the set in the standby mode.

Pin 32: Automatic beam limiting protection. This pin is normally held high via R1220. If the beam current is excessive zener diode D506 conducts, taking pin 32 low. As with pin 31, the drive to the mains relay RL1201 is removed, putting the set in the standby mode.





**Fig. 4: Basic block diagram of the microcontroller chip IC1201.**

- Pin 35: Chroma APC filter components.
- Pin 36: Video input from IF section after filtering, via buffers Q301 and Q302.
- Pin 37: Signals section chassis connection.
- Pin 38: Video output to Q502 which extracts the sync signal.
- Pin 39: Sync input from Q502.
- Pin 40: 4-43MHz crystal for PAL decoding.
- Pin 41: B - Y colour-difference signal output to IC602.
- Pin 42: Not used.
- Pin 43: R - Y colour-difference signal output to IC602.
- Pin 44: B - Y input from IC602.
- Pin 45: R - Y input from IC602.
- Pin 46: Audio output to IC251 (LA4285).
- Pin 47: Audio input from the scart socket or front AV jacks.
- Pin 48: Audio output to the scart socket, pins 1 and 3.

Pins 49 and 50: Tuned circuit (L103) for the vision demodulator.

Pin 51: APC filter components.

Pin 52: Demodulated video and sound output for filtering and buffering. The FM sound signal returns to pin 2, the video to pin 36.

### Servicing notes

The Z7 chassis is fairly straightforward from the servicing viewpoint, once you are aware that the primary side of the line output stage is not mains-isolated. The set-up data for vision and sound processing is held in the EEPROM chip IC1205, so this is a critical and model-dependent item. A faulty memory chip can produce the following symptoms: no colour; no tuning; IF problems; distorted video (though good via the scart socket); and no or distorted sound. Distorted/inverted video can mean a poor, rolling picture.

In addition to IC1205 and, obviously, IC251, no sound (with AV sound OK) can be caused by IC601. A check on C208 (10µF, 16V) at pin 33 may be worthwhile.

The line output transformer can fail in various ways. With an open-circuit primary winding the power supply will start up then the set will revert to standby. OK at start up followed by excessive beam current then reverting to standby can be caused by a fault in the focus/A1 section.

D861 (1SS133T-77) in the +B10 supply

to the jungle chip IC601 can be troublesome. Should it go high-resistance the result may be distorted line drive, the symptoms being no results apart from a loud whistle. It can go open-circuit and be the cause of failure of the over-voltage avalanche diode D812.

Power supply faults are fairly predictable, as follows:

**Dead with a dim standby LED:** Check D1202, D1205, D1208 and C1201.

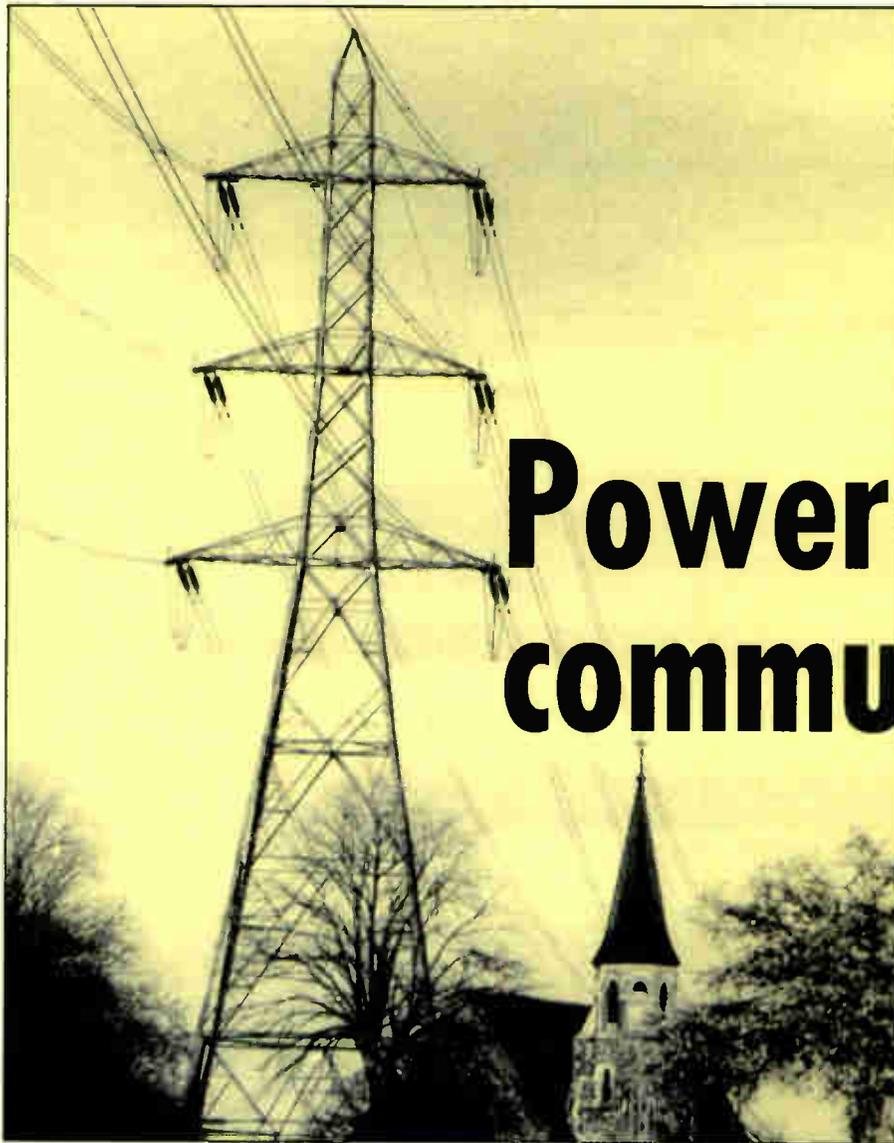
**Goes off intermittently:** Check D1202, D1205 and D1208.

**Goes off or stuck in standby:** R1218 (560kΩ) could be high-resistance.

**Q1203 leaky:** Replace RL1201 and D814 (1SS133T-77).

To enter the service mode select program position 60 and set the sharpness to minimum, then press the V (down) button on the front of the set at the same time as the remote-control unit's 'off timer' button. Use the channel up/down buttons to go through the menu, and the + and - buttons to alter the values. Press 'store' to retain new values. Use the normalise button to leave the service mode.

To activate the self-check mode in case of software problems, press the V button on the front of the set at the same time as the remote-control unit's 'status' button.



# Power-line communications

For the past fifteen years the telecommunications and electricity supply industries have been collaborating on ways of transmitting broadband signals via the mains distribution network.

J. LeJeune takes a look at the current state of the art

**A**ttempts to use the mains electricity supply for communications purposes have been made since the early Twenties, when a radio programme was distributed as base-band audio over the DC supply in a small town near Plymouth, Devon. Large chokes at each dwelling prevented domestic appliances being affected by the audio, and the audio signal being shunted away by electric cookers, bowl fires and the domestic lighting. The transition to AC made this scheme impossible, and systems using a carrier were tried as an alternative.

## Carrier systems

Sending a carrier signal via the mains supply is problematical because of the high level of electrical noise present, the uncertain and varying impedance of the cables and high signal attenuation, particularly with older installations. Partially successful schemes have been used for years within the shell of a building – these are purely local systems. Many use FM, because of the high electrical noise levels that would affect AM transmission. Place an AM radio receiver close to electrical wiring to sample the kind of impulse noise that's

present on the mains supply.

Items such as baby alarms, telephone extensions and remote-control extenders that use the mains wiring in a building are available. FM is suitable for small point-to-point services. The bandwidth required is very small, and the power output need not be excessive – and must conform to the prevailing regulations. Moreover FM circuitry is easy to implement, operate and repair.

## Broadband distribution

For the past fifteen years the telecommunications and electricity supply industries have been collaborating on ways of distributing broadband signals via the National Grid, medium-voltage and low-voltage lines. Numerous companies are involved, and of late the results have been encouraging.

The main efforts towards achieving effective broadband communication via the mains supply have been carried out in the US, but research in Europe has also been making progress. A successful system is up and running in Switzerland, providing customers of the Freiburgischen Elektrizitätswerken with internet access. Much of the information available is hazy,

probably to preserve a measure of security. If the technology succeeds in achieving reliable transmission over the grid system, the power companies will have an enormous network at their disposal.

The Swiss company Ascom is involved in some eighty projects around Europe. Its manufacturing facility turns out in excess of 6,000 adapters and 2,000 items of network hardware a week. Norweb has conducted a trial via medium- and low-voltage lines in the UK. The results of the Norweb experiment indicated a problem with radiation from street lighting standards! Work on the project seems to be divided into two, with some companies focusing on the medium- and low-voltage lines while others concentrate on long-haul communication via the National Grid.

## Advanced technology

Media Fusion in the US has patented a system based on quantum physics. It could provide multiple paths for data communication, with maser amplification and inductive power-line coupling, operating at frequencies between 30-24,000GHz. The technology is based on the premise that in a magnetic field there are numerous quantum wells by which signals can be transmitted. Supercomputers sited at strategic points in the network would supervise the alignment of the power grid's field. Negative elements in the quantum well are aligned by the computer so that they push positive protons into collision with one another, thus propagating signals along the lines over thousands of kilometres.

Work is proceeding to find a satisfactory method of inductive coupling to the power cables and, at this early stage, computer-aided magnetic alignment is only a theory waiting to be proved. The control of such a

network, signal routing and level adjustment remain unanswered questions. The signals also require processing to convert them into usable ones such as 10baseT Ethernet. Data identification and error-correction techniques remain to be studied. Processing via a "reduced Coulomb energy network" is proposed. The signals bypass transformers, and could be sent over great distances with low attenuation. Maser amplification (the m stands for microwave, the rest being as in laser) would provide very low-noise signal boosting.

Users of this type of technology would retrieve signals from the power grid via filters composed of shaped polymer electromagnetically-coupled material. The cost of such filters is likely to be very high initially, but mass production would bring the price down to a few dollars each.

One could be forgiven for thinking that this is largely science fiction, but those working on the project seem to be very optimistic. Ambient Corporation of Massachusetts also has its own technology, and claims that it is ready for use when the market climate improves. This company is also coy about its system, but it is known to involve capacitive coupling to the cables by means of a clamping arrangement. Ambient claims to be able to provide an "end-to-end" solution, from the electricity sub-station to the subscriber's premises.

### Local lines

Local lines are already being used for communication at speeds up to 1Mbits/sec in each direction. Coupling to the mains at the customer's end is made at the supply side of the meter, using 10baseT Ethernet to communicate with base stations. These forward the data over an ATM (Asynchronous Transfer Mode) network to main stations. The customer's computer is coupled via its USB port to a Nortel DPL1000 communications module, which is rather like a cable TV modem and is used to couple RF signals to the power lines.

The base station combines data from a number of communications modules and sends it over a link, either wireless, coaxial or fibreoptical cable. Work is in progress on video streaming, videophones, internet access, pay TV and high-speed data transmission. A rate of 4.5Mbits/sec is now becoming possible. It should be increased to 20Mbits/sec in the near future.

### Noise

The principal problem with power-line communications is noise. There are four main forms:

- (1) Impulse noise synchronised to the mains frequency.
- (2) Non-synchronous noise with a broad spectrum, e.g. hash from commutator motors.
- (3) Random single-event impulses from

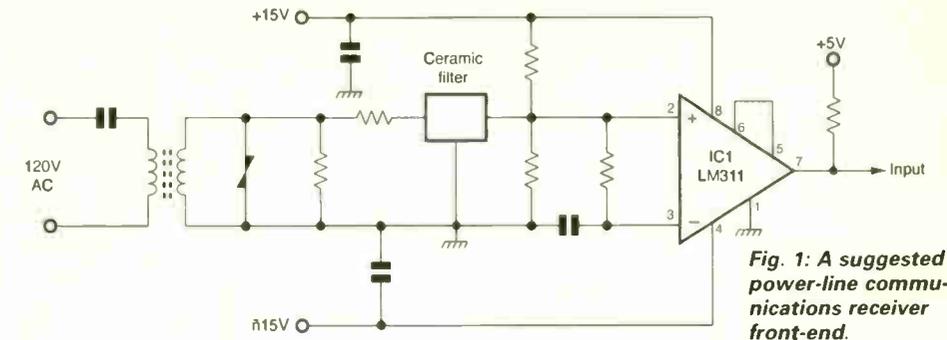


Fig. 1: A suggested power-line communications receiver front-end.

thermostats and manually-switched loads.

(4) Non-synchronous but periodic noise, e.g. from switch-mode power supplies, electronic lamps etc.

Noise that originates close to a communications module is particularly troublesome. The incoming data signal may be heavily attenuated by the intervening cabling but the noise, from close by, is not. It's easy for the signal-to-noise ratio to fall below the capabilities of the receiver, disrupting the service.

Signal coding is the obvious way of overcoming the problem. Of several types of coding available a form of forward error correction, which will familiar to those who have read up about MPEG-2, seems to be the most promising. Adaptive coding, in which an intelligent transmitter changes the type of coding in accordance with conditions, would also be useful but has been ruled out for the present because of

the erratic nature of changes in conditions.

### Circuitry

Hardware details of the systems proposed are very difficult to find. However suggested circuits for a power-line communications receiver and transceiver have become available, see Figs. 1 and 2. Both circuits are for the front-end only. Decoding and data-processing circuitry can vary markedly from one manufacturer to another.

### In conclusion

Power-line communication is very much a developing technology, though the use of the mains supply for such purposes is far from new. Signals are present on the national grid: power control and switching data is transmitted over it – the signals can be picked up by a long-wave receiver close to some lines.

Once the technology is right, a whole new chapter in telecommunications will open up.

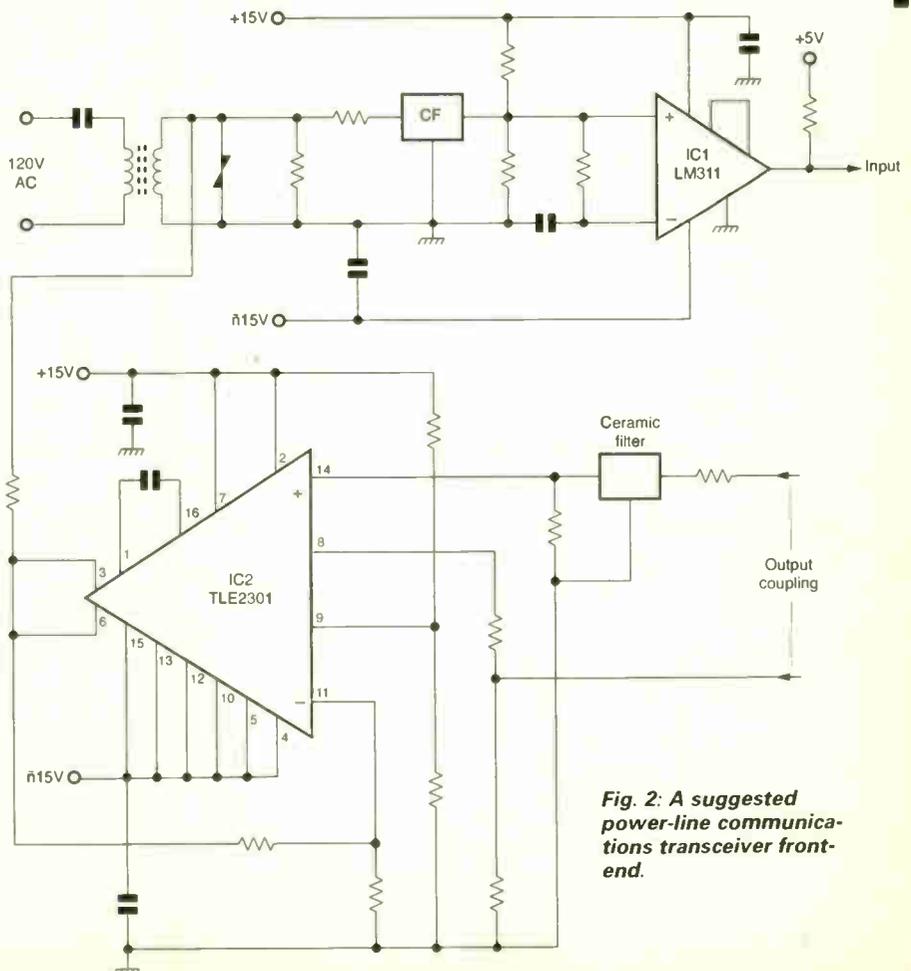


Fig. 2: A suggested power-line communications transceiver front-end.

# Servicing

## the Mitsubishi TFS6705K monitor

**This 17in. Trinitron-tube monitor's production run lasted for several years. Large numbers were sold as the Dell VC7EN. In Part 5 of his series Donald M. Henry takes a look at some digital monitor control techniques**

In this instalment we'll take a look at the digital control technology used in modern monitors. Parts 1-4 in the series described the Mitsubishi TFS6705K monitor's analogue circuitry. In those articles I was able to cover many aspects of modern monitor design: the TFS6705K is a good example, since it uses most of the techniques one comes across. In this and the concluding instalment next month I'll be looking at the monitor digitally, from the perspective of the microcontroller chip that supervises its operation.

### Microcontroller-adjustable features

The microcontroller board in the TFS6705K has much in common with more recent designs, in that its outputs are used to control various basic monitor functions. In Part 1 I described the RGB bias and gain control system.

These adjustments are carried out by the microcontroller chip IC101 (type M38002M2). They are intended to be set up by the technician rather than the user. IC101 also controls the display size, position, contrast and brightness, but these adjustments and the factory reset are available to the user.

More recent designs include many new digital features that are not found in the TFS6705K. Examples are DDC, OSD, Moiré patterning reduction, tilt, colour-temperature settings, power saving, digital convergence – even language and

volume control. Despite this sophistication, new models seem to have abandoned the use of static horizontal and vertical convergence. The TFS6705K is one of the rare models that have this feature. It's a particularly cost-effective approach to beam alignment, and is useful for fine CAD work when the user wants to concentrate on a particular area.

Before looking at the circuitry specific to the TFS6705K, I'll provide brief descriptions of the features just mentioned.

### DDC

This stands for Display Data Channel. For various reasons, the Video Electronics Standards Association (VESA) produced the 'plug-and-display' protocols DDC1 (unidirectional), DDC2B (bi-directional) and DDC2AB (access bus version). Basically the idea is to reduce system-configuration difficulties, but it's a bit of a sledgehammer to crack a nut.

In its basic form DDC has no direct bearing on monitor operation. It doesn't interact with or control any of a monitor's digital or analogue circuitry. Typical hardware for versions DDC1 and DDC2B consists of an EEPROM that runs at 5V from the monitor's power supply, see Fig. 1. It's output is not used by the monitor itself. The EEPROM contains code which, when interrogated by the PC during boot-up or Windows initialisation (assuming that

the PC has the relevant hardware and software and is correctly configured), responds to the PC via the signal cable. The EEPROM may be located far from the microcontroller board, typically near where the signal cable terminates. It's usually on the CRT's base panel.

Pins 12 and 15 of an interconnecting DB15 plug and socket carry serial data and clock signals, just like an I<sup>2</sup>C bus. Pin 14 feeds the V sync signal to the EEPROM as an initial clock, to synchronise its output data. If you look at a 15-pin D sub-connector and find that pins 12 and 15 are missing, the monitor is not a DDC type. So don't bother looking for the EEPROM!

The 128-byte data stream provided by the EEPROM at boot-up/initialisation tells the PC what type of monitor it is, and the operating modes for which it's designed and is capable of displaying. The PC then restricts the user to a subset of display modes – these can be seen in the Control Panel Display Settings dialogue box. The result of this is that the user cannot ask the monitor to display too high an image resolution, which might require a line frequency beyond the analogue circuitry's capability. It also limits potential damage.

The rare DDC2AB version enables the PC user to adjust the monitor controls indirectly, by interacting with the microcontroller chip via the keyboard or other device, using a 'virtual' control panel. You might wonder why anyone should

want to go to this trouble! It helps however with multiple monitors at an exhibition or conference, and could perhaps be beneficial for some disabled people. But I can't think of a single current model that implements this standard. If you find one, let us know by writing to the Letters column!

### OSD

Readers will be familiar with these initials, which refer to On-Screen Displays. You are nowadays more likely to find +/- buttons and a digital rotary-selector that work with a menu-instruction system than the old variable-resistance potentiometers. This change has come about mainly as a result of competitive marketing and manufacturing automation. Eliminating potentiometers has reduced hardware costs, while cheap digital devices have made it possible to include sales features not previously feasible. An example is colour temperature, with a range that the user can select on-screen. Alignment during manufacture is now totally machine-controlled: a camera watches the screen, feeding the image back to the control system which then adjusts the parameters via an I<sup>2</sup>C bus. This is a real production labour saver. Phone-line help desks probably find it easier to lead a confused user through visually-confirmed results on-screen in order to establish whether a genuine failure has occurred.

An OSD chip enables various messages to be displayed. These can tell the user that the applied signal is out of range, or that the cable isn't connected to the PC. When a signal is present, the 'status' indicates the horizontal and vertical sync rates and the resolution. As an aside, the Philips Brilliance monitor range had a small back-lit LCD panel to show status – rather costly additional hardware when you consider that there's a CRT available to do the job!

Some models display internally-generated patterns when the signal cable is disconnected. This is useful when soaking testing without a PC.

An OSD can enable the user to tell the microcontroller chip which language to adopt – English, Spanish, German, French and Italian are the top five in use.

The MC4320P is a commonly-encountered monitor OSD display chip that's used for example in the Samsung 15Gli, 17Gli and 17GLSi series of Sync-Master monitors. Its outputs are fed to the video output stage after the preamplifier stages, so that OSD results are visible even when the contrast is turned down.

### Moiré-patterning reduction

Moiré patterning has become a problem because, in part, of improved beam

focusing and ever-decreasing shadow-mask dot pitch. It's most obvious with large speckled-grey areas, looking a little like Ordnance Survey map contour lines. The problem arises when the size of the electron beam approaches that of the shadowmask holes.

It used to be that a small amount of defocusing would largely eliminate the problem. But nowadays some monitors have separate horizontal and vertical moiré adjustments. The technique used to reduce the patterning involves shaking alternate lines (horizontally) and jittering the frame up and down (vertically). The focus remains sharp but the characters and detail become fat and bold.

### Tilt

This is magnetic field compensation. Nowadays most monitors, even 15in. ones, include controls that enable the user to rotate the image about the centre of the screen. You will often find a circular coil that's an integral part of the deflection yoke but is connected by fairly thin wires and is usually well away from the line timebase circuitry. A finely controlled amount of DC is applied to the coil to 'twist' the raster in a clockwise or anticlockwise direction. This compensates for the earth's magnetic field, which changes the position of the image when the monitor is spun round on its swivel base.

### Colour-temperature settings

This is primarily of interest to professional users of desk-top publishing and photo-printing packages. There are usually a few preset colour-temperature levels, for example 9,300°K, 6,500°K and 5,500°K, as well as user settings for RGB. The latter can be a nuisance when a home-use monitor suffers because a child likes to fiddle, the result being a

display that looks more like a 25-year old TV with an exhausted tube. Many of these monitors are equipped with a factory reset for colour only, leaving the geometry settings alone.

### Power saving

There's more to this than just a standby light! I recall attending, some time back, a training session at Samsung. We spent a long, tiring day studying in great detail the exhaustive efforts of the designers at getting the monitor concerned to fall into different standby levels to save power when its associated PC was not in use. Later that evening I went in search of something that would pass for food. Unfamiliar with the area, at about 8pm I came across a retail park. There was not a single vehicle in the car park, but there were lights burning in all the shops, which were open. As I walked past these deserted sales outlets, all vying for each other's trade – including Currys, Comet etc. – I noticed that the electronics outlets each had at least a hundred CRTs (TV and monitor) displaying brilliant pictures. There was not a soul around, except myself and the sales assistants, to witness the wasted effort of the designers' power-saving technology.

Two years later our network service provider recommended the installation of Windows NT throughout the forty PCs in the office. One night after the NT upgrade I noticed that every single PC monitor was still alight, and made a note to mention this to our service provider the following day. I pointed to the "Energy Star EPA Pollution Preventer" logo on all the monitors and asked why they didn't power down in the normal way when left alone. "Oh" he said, not very concerned, "NT doesn't support DPMS energy saving. And anyway your monitors are better left on to keep

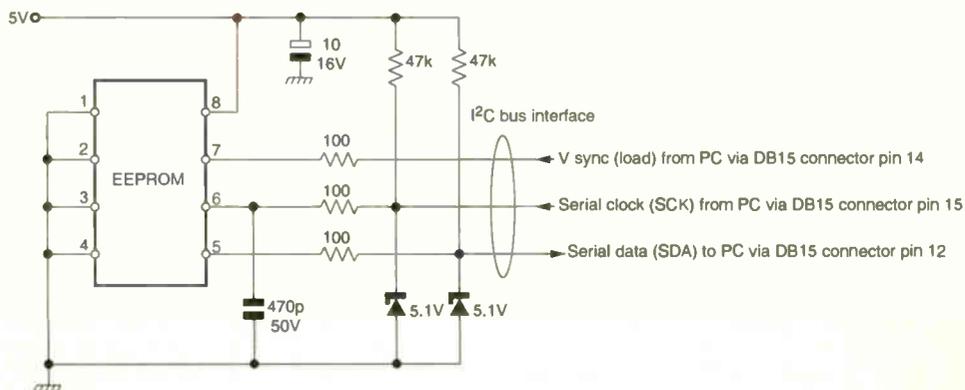


Fig. 1: A typical DDC1/2B EEPROM arrangement. Receipt of V sync (load) by the monitor triggers a 128-byte data stream which it sends the PC. This stops when SCL goes low.

warm." Thank you, Bill Gates!

The DPMS (Display Power Management System) scheme developed by VESA (see [www.vesa.org](http://www.vesa.org)), the Energy Star logo promoted by the US Environmental Protection Agency, and the Swedish Nutek TCO92 and TCO95 labels have one thing in common: their aim is the reduction of power consumption by monitors when the associated PCs are not in use.

Monitors generate heat and, particularly in offices, they place a burden on air-conditioning systems. A 17in. monitor typically consumes about 100W. The standards bodies acknowledge compliance by monitor manufacturers provided consumption falls below 30W, preferably to less than 15W, when the keyboard or mouse has not been used for a few minutes. After a further delay consumption must fall to below 8W, preferably less than 5W: this must happen within 70 minutes.

To implement the standard, a monitor requires a video graphics card or on-board chipset and software. With VESA's DPMS, the monitor's hardware detects the presence or absence of horizontal and vertical sync signals from the PC's graphics card. Though not all manufacturers adopt

the same approach, the following is a basic scheme. When the H and V sync signals are both present the monitor is on. With only the H sync pulses absent, the monitor falls into standby with the video blanked. With only the V sync signal absent the monitor falls into the suspend mode: the line drive and EHT shut down, and the voltage on some rails drops to about half. When both sync signals are absent the monitor is in a 'nearly-off' state with only the microcontroller chip powered to keep checking on the sync inputs. The reason for three levels of power saving is to provide recovery times that are acceptable to the user. Typically, manufacturers specify a wake-up time from standby of about three seconds, with longer for wake-up from the suspend mode, though the TCO standards don't specify a performance requirement for this.

In the monitor-off state the only thing usually left running is the microcontroller chip, so wake-up is from a condition where even the CRT's heaters are cold. Full off is never achieved unless power is disconnected physically by use of the AC mains switch. Where there is no such switch and the manufacturer

provides only soft controls at the front panel, the AC lead must be disconnected. Such monitors are best connected to the AC output from the PC power supply if an output socket is fitted. This way the monitor does not waste power when the user switches his PC off.

All these little standby circuits add up to unnecessary nuclear pollution!

### Digital convergence

I've only come across this feature in monitors that are at the really expensive end of the range, for example Eizo models. I understand that the screen is divided into a 5 x 5 or 8 x 8 matrix and that digital techniques and a section of memory are used to store settings for very accurate convergence in each sector. So don't go swapping tubes around if you don't have the gear!

### Next month

My task in describing the digital aspects of the TFS6705K will be simplified by the fact that it doesn't incorporate any of the above features. In next month's concluding instalment attention will be turned to the monitor's 'processor' board to see what it contains and what it does.

## Test Case 476

It's that time of year again! Sage was in seat 37B of an Airbus, heading south at thirty-five thousand feet en route to a Spanish island for a fortnight. Mrs Sage was beside him in seat 37A. Meanwhile Cathode Ray, who is nowadays responsible for washing machines, satellite dishes and other large metalwork, was in his own seat in the workshop, about ten feet above ground level, puzzling over the VCRs and other equipment that Sage normally handles. Already there were two VCRs on soak test, waiting for intermittent faults to appear. The one with the report "as if heads dirty after one hour" had been running faultlessly for two days. The second one, with the report "distorted sound - intermittent", continued to affect the concentration of everyone in the workshop with the perfectly good sound it had been producing since 8.30am that morning. Now there was another one, a Sony SLVE200UX, with the complaint that it sometimes left a loop of tape caught in the works at eject.

Ray inserted a cassette, pressed the play key then eject. There was no loop when the tape came out. He fed the cassette back in and put the deck in the fast-forward mode, letting it go to the end then auto rewind all the way. Once again the tape came out with no loop. After some more deck thrashing, during which it performed correctly, Ray decided to have a go at repair anyway - there was no room for this one to be left to run! He knew that this sort of problem is, with virtually any make and

model, very often caused by a faulty mode switch. His suspicion seemed to be confirmed by the fact that there were two of them in the store, which stocks only items that regularly go wrong. In it went, taking care to ensure that its mechanical phasing was correct. Ray reassembled the machine and tested it. As before it worked correctly, with the tape fully wound back in when the cassette was ejected.

As Ray carried the machine to the waiting-collection rack a horrible thought struck him. He recalled that several previous cases of tape looping had been caused by the sticky surface of a partially-stripped back-tension band attaching itself to the periphery of the supply spool during tape unlacing. Though it hadn't happened here before with a Sony machine, this had to be checked. Ray couldn't risk any more bounced jobs - he was still smarting about that sock in a Hoover washing machine! Back to the bench then, off with the top cover and out with the torch. The back-tension band was perfectly OK.

Three days later the machine's owner was back, waving his invoice in one hand and a VHS cassette in the other. There was a small loop of tape hanging from the cassette flap, with creases and a tear where it had caught the pip on the machine's cassette cradle.

Much running on the bench, beside the other two intermittent VCRs which were still there, established that the fault did occasionally occur - and with another cassette. What was the cause of the trouble? Here's a clue: the cause is more common with Hitachi and Sanyo decks of a certain vintage. For the solution, turn to page 631.

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330uF	.CAP87	£4.00	10
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3.3uF	.CAP95	£0.50	5
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47uF	.CAP106	£4.35	10
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47uF	.CAP112	£3.50	2
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1452T	PSU	ONWAKIT	2029T	PSU	ONWAKIT	CT214V1BS	PSU	MITSKIT3	310.32262		PHILKIT8
1427T	PSU	ONWAKIT	2029TA	PSU	ONWAKIT	CT25A2STX	TDA 8178S	MITSKIT1	310.62264		PHILKIT1
1402	PSU	ONWAKIT	F16 CHASSIS	FRAME	GOODKIT1	CT25A3STX	TDA 8178S	MITSKIT1	ANUBIS A	SOPS	PHILKIT2
1455T	PSU	ONWAKIT	F16 CHASSIS	LINE	GOODKIT1	CT25A4STX	TDA 8178S	MITSKIT1	CP110 CHASSIS	SOPS	PHILKIT8
1456T	PSU	ONWAKIT	F16	PSU	GOODKIT1	CT25A6STX	TDA 8178S	MITSKIT1	G90A CHASSIS	SOPS	PHILKIT10
1458T	PSU	ONWAKIT	F16	VIDEO	GOODKIT1	CT25AV1B	PSU	MITSKIT3	G90B CHASSIS	SOPS	PHILKIT10
1459T	PSU	ONWAKIT	<b>GRUNDIG</b>			CT25AV1BS	PSU	MITSKIT3	G110 CHASSIS	SOPS	PHILKIT3
1499Y	STANDBY	MODKIT37	CUC 7350		GRUNDIGKIT1	CT25AV1BD	PSU	MITSKIT3	GR2.1 CHASSIS	SOPS	PHILKIT1
2002	PSU	ONWAKIT	CUC 7301/3			CT25AV1BDS	PSU	MITSKIT3	GR2.2 CHASSIS	SOPS	PHILKIT1
2009B	PSU	ONWAKIT	(BUZ90)	PSU	GRUNDIGKIT2	CT28AV1B	PSU	MITSKIT3	D-16 CHASSIS	SOPS	PHILKIT6
2052T	PSU	ONWAKIT	CUC 7301/3			CT28AX1BD	PSU	MITSKIT3	HSM VIDEO	SOPS	PHILKIT5
2152T	PSU	ONWAKIT	(MJF18004)	PSU	GRUNDIGKIT3	CT28AV1BDS	PSU	MITSKIT3	JSM VIDEO	SOPS	PHILKIT4
2099TX	STANDBY	MODKIT37	<b>HINARI</b>			CT29AS1	TDA 8178S	MITSKIT2	KSM VIDEO	SOPS	PHILKIT9
BTV17	STANDBY	MODKIT37	HIT14RC	PSU	ONWAKIT	CT29A4	TDA 8178S	MITSKIT2	LSM VIDEO	SOPS	PHILKIT7
CTV501	PSU	ONWAKIT	<b>JVC</b>			CT29A6	TDA 8178S	MITSKIT2	<b>SAMSUNG</b>		
CTV701	PSU	ONWAKIT	AV29SX1EK	FIELD O/P	JVCKIT1	CT29B2	TDA 8178S	MITSKIT2	CJ5944	FRAME	SAMKIT2
CTV840	PSU	ONWAKIT	AV29SX1EN	FIELD O/P	JVCKIT1	<b>MAKE &amp; MODEL</b>	<b>KIT TYPE</b>	<b>CODE</b>	CI6844	FRAME	SAMKIT2
CTV841	PSU	ONWAKIT	AV29SX1EN1	FIELD O/P	JVCKIT1	CT29B6	TDA 8178S	MITSKIT2	VJK310	PSU	SAMUNGKIT
CTV485	PSU	ONWAKIT	AV29SX1PF	FIELD O/P	JVCKIT1	CT33B3	TDA 8178S	MITSKIT2	VJK320	PSU	SAMUNGKIT
<b>AKAI</b>			AV29TSIE1	FIELD O/P	JVCKIT1	M5 SERIES	PSU	MITSKIT3	VJK350	PSU	SAMUNGKIT
CT1417	PSU	ONWAKIT	C14E1EK	PSU	ONWAKIT	<b>NEI/NIKKAI</b>			VI375	PSU	SAMUNGKIT
CT2159U	PSU	ONWAKIT	C14T1EK	PSU	ONWAKIT	CE25 CHASSIS	PSU	NIKKAIKIT1	VI395	PSU	SAMUNGKIT
CT2162UNT	PSU	ONWAKIT	C21ET1EK	PSU	ONWAKIT	C289FTXN	PSU	NIKKAIKIT1	WINNER 1	PSU	SAMUNGKIT
CT2863UNT	PSU	ONWAKIT	CS21M3EK	PSU	ONWAKIT	C28F41FXN	PSU	NIKKAIKIT1	<b>SHARP</b>		
<b>DECCA/TATUNG</b>			<b>MATSUI</b>			<b>PANASONIC</b>			51CS03H	PSU	SHARPKIT1
TVC563	STANDBY	MODKIT37	1455	PSU	ONWAKIT	IC561	TDA 8175	PANKIT1	51CS05H	PSU	SHARPKIT1
<b>GOLDSTAR</b>			1498	PSU	ONWAKIT	TX25XD60	VERT OUTPUT	PANKIT2	59CS03H	PSU	SHARPKIT2
CF25A50F	FRAME	MODKIT36	2086	PSU	ONWAKIT	TC28XD60	VERT OUTPUT	PANKIT2	59CS05H	PSU	SHARPKIT2
CF25C22C	FRAME	MODKIT35	2098	PSU	ONWAKIT	TX28XD70	VERT OUTPUT	PANKIT2	59CSD8H	PSU	SHARPKIT2
CF28A50F	FRAME	MODKIT36	21V1N (BUZ90)	PSU	GRUNDIGKIT2	TX29XD70	VERT OUTPUT	PANKIT2	59D503H	PSU	SHARPKIT3
CF28C22F	FRAME	MODKIT35	21V1T(MJF18004)	PSU	GRUNDIGKIT3	TX-W26D3	VERT OUTPUT	PANKIT2	66CS03H	PSU	SHARPKIT2
CF28C28F	FRAME	MODKIT36	TVR180R/T/2080	STANDBY	MODKIT37	<b>PHILIPS</b>			66CS05H	PSU	SHARPKIT2
CF29C42F	FRAME	MODKIT35	<b>MITSUBISHI</b>			310.10708		PHILKIT3	66CSD8H	PSU	SHARPKIT2
<b>GOODMANS</b>			AV1 SERIES	PSU	MITSKIT3	310.20491		PHILKIT2	<b>THOMSON</b>		
147TT	PSU	ONWAKIT	CT1M5B	PSU	MITSKIT3	310.20496		PHILKIT10	35029400		THOMKIT2
149T	PSU	ONWAKIT	CT21M5BT	PSU	MITSKIT3	310.31994		PHILKIT6	35065920		THORNKIT1
1430RA	PSU	ONWAKIT	CT25M5BT	PSU	MITSKIT3	310.32252		PHILKIT5	FV70	PSU	THORNKIT1
1430RW	PSU	ONWAKIT	CT21A2STX	TDA 8178S	MITSKIT1	310.32253		PHILKIT4	ICC7 CHASSIS	TDA 8178FS	THOMKIT1
1450T	PSU	ONWAKIT	CT21AX1B	PSU	MITSKIT3	310.32254		PHILKIT9	ICC7 CHASSIS	FRAME	THOMKIT3
1455TS	PSU	ONWAKIT	CT21A3STX	TDA 8178S	MITSKIT1	310.32255		PHILKIT7	ICC8 CHASSIS	TDA 8178FS	THOMKIT1
2019R	PSU	ONWAKIT							ICC8 CHASSIS	FRAME	THOMKIT3

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GRUNDIGKIT3	£ 10.50	MODKIT36	£ 5.00	PHILKIT10	£ 8.50	PHILKIT8	£ 4.25	THOMKIT1	£ 7.00
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<b>FERGUSON</b>	
IR 9584 .....	RCU1734 , RCU1742 , T742 , T752 , T758
IR 9594 .....	RH880 , T789
IR 9325 .....	RH885
IR 9259 .....	RHT01 , RHT30
IR 9639 .....	RHT10
<b>FUNAI</b>	
IR 9719 .....	30T1 , 30T2 , 31T1
<b>GOLDSTAR</b>	
IR 9403 .....	105-068 , CBT2190E , CBT4902 , CBT9905
IR 9854 .....	05-219J , 105-224V , 105-229H , 105-230C
<b>GRUNDIG</b>	
IR 9529 .....	CUC5301 , CUC5302
IR 9614 .....	CUC5200 , CUC5303 , CUC5310
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IR 9477 .....	CLE876C , CLE876D , CLE876E , CLE876G
IR 9982 .....	CLE922A , CLE922B
IR 9576 .....	CPT1556 , CPT1557 , CPT1560 , CPT1561 , CST1430 , CST1435 , CST1560
IR 9575 .....	CPT2155 , CPT2164 , CPT2558 , CPT2564 , CPT2566 , CPT2669 , CPT2785 , CPT2870
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<b>NOKIA</b>	
IR 9573 .....	FS4/1 , FS4/2 , FS5/1 , FS9 , FS10
<b>ORION</b>	
IR 9640 .....	RC37 , RC56 , RC565633 , RCQ
<b>PANASONIC</b>	
IR 9826 .....	EUR37211 , EUR50100 , EUR50370 , EUR51140 TNQ8E421 , TNQ8E0422 , TNQ8E0428
IR 9834 .....	TNQ8E0461
<b>PHILIPS</b>	
IR 9510 .....	RC5002 , RC5140 , RC5154 , RC5240 ,

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IR 9710 .....	RC7507 , RC8205 , RC9057 , RC9133
IR 9864 .....	RC7512 , RC7535
<b>SAMSUNG</b>	
IR 9546 .....	RM100
IR 9432 .....	RM104 , CX532WT , CX534WT , CX5312W
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<b>SHARP</b>	
IR 9487 .....	C1421 , C2021 , CV2121 , CV3707 , CV3709 , CV3710 , DV1416 , SV2044 , SV2145
IR 9711 .....	RRMCG0739BMSA , G1014BMSA RRMCG1023BMSA , G1036BMSA
IR 9788 .....	RRMCG1031BMSA , G1046BMSA RRMCG1048BMSA , G1050BMSA
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IR 9336 .....	RM650 , RM651 , RM652 , RM654
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# HELP

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

**Wanted:** FM front end for an Akai FM/AM quartz synthesiser tuner Model UC-S5. Please phone Mahmud Araarah on 01752 768 203 (Plymouth).

**Wanted:** Transformer for the remote-control PCB (RX), part no. 145 37039, labelled WA866, used in the Philips TV Model G26C672 (G11 chassis), or a working full PCB. C.R. Tomlinson, 25 Kelmscott Gardens, Leeds LS15 8HL.

**Wanted:** Circuit diagram or full manual for the Wharfedale TV Model 550S. Alan Robertson, 261 Warrington Road, Abram, Wigan WN2 5RQ. E-mail alan.robertson4@btinternet.com

**Wanted:** Sony MHC650/HCD-H650M mini hi-fi system with a working or repairable CD player section. Condition of the rest of the unit unimportant. Call Brian Dicken on 0121 236 0442 (Birmingham).

**Wanted:** My company, Falcon, has an urgent requirement for a quantity of Philips AT2140/170 line output transformers, designed to drive 90° monochrome data graphic display tubes with a 20mm neck diameter. These are no longer available from the manufacturer. Can anyone help? Phone Mike Illingworth, Falcon Equipment and Systems, on 01684 295 807, fax 01684 850 011 or e-mail

mike.illingworth@sda-falcon.co.uk  
**Wanted:** Installation booklet for the Response single surveillance camera Model CU500. Photocopy OK, all costs reimbursed. L. Symons, 14 Maidenwell Road, Plymouth PL7 1RB. Phone 01752 343 074.

**Wanted:** Information on the fault codes displayed when using the clip-on diagnostic adapter with the Philips VR2020 (Video 2000 system) VCR. Also Video 2000 system heads. Tony Hughes, 41 Underhill, Moulsoford, Oxon OX10 9JH. Phone 01491 651 576 (evenings) or 07808 827 479 or e-mail thu6073569@aol.com

**Wanted:** Power AC board for the Panasonic WV-F250 camera, part no. L/WVKCF250E2A. Please phone Vincent Ward on 00 353 905 43960 (Co. Galway).

**Wanted:** Does anyone know the cause of a fault that seems to happen only when my AST Vision 41 monitor goes into standby (power-save mode): when it comes back on there is partial field collapse. I have replaced all likely capacitors. Also, does anyone know of a source of spare parts for

this monitor? Ian Johnson, 6 Heathfield Crescent, Kidderminster. Or e-mail audiorepairs@beeb.net

**Wanted:** Instruction book for the Ferguson Videostar camera Model FC04. P.T. McKeever, 4 Castleview Park, Derry, N. Ireland BT48 8DL. Phone 01504 353 613.

**Wanted:** Chopper transformer for the Matsui CTV Model 1422, part no. 5914-06002A-AA (also marked KV89157). An A51JXH61X 21in. CRT for the Sony Model KV-X2152U, part no. 8-738-758-05. Must be in good condition – not scratched or low-emission. LA6358S ICs for the power supply in Amstrad SRX100/200 satellite receivers. Part no. 240015, circuit reference IC004. Please call Steve Roberts on 01687 462 189 (Inverness-shire) any time.

**Wanted:** For spares, Quad 405 power amplifiers, Quad FM3 tuners, Quad 33 or 44 control units and Denon DL103 cartridges. Also require a tuner/converter pack for the Panasonic NVG21 VCR and a tube base for the Sony Model KVM21TU (AE1 chassis). Contact Mike on 01758 613 790.

**Wanted/for disposal:** Require a 24in. widescreen CRT type W56 ESF 002 X04 for the Philips CTV Model 24PW6322/05 – must be in good condition. Have for disposal a Philips PM5334 TV sweep generator and *Television* magazines from 1980-2001. Offers please to Roy Woodhead on 01706 641 477 (Rochdale).

**Wanted:** Audio synchronisation head for a Sony C5 Betamax VCR. Phone David Goodsell on 01473 214 865 (Ipswich).

**Wanted:** Instruction book (photocopy OK) and RC2200LDP remote-control unit for the JVC HRD820EK VCR, also a YC-18 PCB, part no. 1-606-950-1, for the Sony SLC6UB VCR. Has anyone got a Beta rewriter? Ron Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP. Phone 01708 558 792.

**For disposal:** Philips TV sweep generator; Grundig 100MHz oscilloscope Model M0100 4CH A and B timebase; 1960s TV valves. Phone F. Willing on 01277 374 166 (Essex).

**Wanted:** Service manual/readable circuit diagram for the Hitachi CTV Model C1714T. Does anyone know why the Toshiba TA8427K field output chip constantly fails (field collapse)? On my fourth! The last one lasted for about a year. TV goes to standby

lockout. Is there any protection or modification to solve the problem? D. Lee, 16 Devonshire Place, Claughton, Birkenhead, Cheshire CH43 1TU16.

**Wanted:** Can anyone help with the following problem? The set is a Ferguson Model 59L5BQ (ICCS chassis). At switch on the EHT rustles up then shuts down within about two seconds. I eventually found that the power supply would continue to run (HT at about 147V etc.) when the LOPT-derived 13V supply was disconnected at DL51, but systematically disconnecting the feeds associated with this supply has revealed nothing. Shorting TL17 collector-to-emitter doesn't alter the status at pin 28 of IL14 (TEA2029C), which remains at 0V under all conditions! I was suspicious of IL14 and the LOPT, but have replaced them both during the fault-finding marathon. Any ideas anyone? Brian Long, Longster, Latheron, Caithness. Phone 01593 741 249.

**Wanted:** I run a small TV/VCR workshop and want to start transferring by business records to a PC I now use. Can anyone suggest a suitable and not-too-expensive piece of software that I could use to transfer my customers' service histories from index cards to a database? I have approximately 20,000 index cards to transfer. Any advice would be much appreciated. Alan Robertson, 261 Warrington Road, Abram, Wigan WN2 5RQ. Phone 01942 865 621 or e-mail alan.robertson4@btinternet.com

**Wanted:** I have an unbranded 17in. monitor supplied by Tiny Computers. The problem is a damaged data plug. My first thought was to replace the plug. But there's only about an inch of cable between this and the ferrite sleeve, so reterminating the individual wires and screens appears to be impractical. An alternative solution would be to replace the complete cable, which plugs into a circuit board on the tube base. But where to obtain it? The rear label has the following details: Model name 29J76C; Model no. JD176C; FCC no. ID:AMPJD176; serial no. 0747005857; manufactured in Taiwan during November 1997. Ian Penfold, 12 Roger's Close, Elsworth, Cambridge CB3 8JJ. Phone 01954 267 321, fax 07020 968 970 or e-mail ian.penfold@telco4u.net

# Thomson's ICC17 technology

## Part 2 of Mark Paul's description of the circuit technology used in this chassis deals with the timebases

**P**art 1 of this series dealt with the fairly complex discrete-component chopper power supply used in the ICC17 chassis. One topic covered was the wake-up system, which is used to bring the chassis out standby – to minimise power consumption, there's no supply to the microcontroller chip in the standby mode, hence the need for circuitry to take the power supply from standby to on. This is relevant to the timebase start-up sequence.

### The deflection processor

This chassis uses the Philips TDA8855H signals processor chip, which contains the vision and sound IF strips, the colour decoder system (PAL/NTSC/Secam) and the time-base generator stages. Fig. 4 shows a simplified block diagram the time-base-generator section of the TDA8855H chip (IV01). Amongst the features of this section of the IC are: horizontal and vertical zoom; an alignment-free line oscillator; field drive outputs optimised for the DC-coupled field output stage; I<sup>2</sup>C bus control of picture geometry; and implementation of safety shutdown.

Once the power supply reaches the initialisation phase in moving from standby to on, the microcontroller chip IR01 switches on the +8V out-

put from IP95 (TDA8139). This supply is fed to pin 53 of IV01. Two further voltages are generated internally from this single input, with decoupling at pins 19 and 55. When the +8V supply is switched on, IR01 downloads deflection data to IV01 via the I<sup>2</sup>C bus, which is connected to pins 18 (SDA) and 17 (SCL) of IV01. The line and field output stages are switched off during this period, and remain in this condition until IV01 instigates the correct start-up routine.

### Generating the line-drive output

The video signal produced within IV01 is passed through a controlled amplifier, which sets the sync pulse amplitude, and is then passed to the sync separator. This consists of a slicer that operates at 50 per cent of the sync pulse amplitude. There are two outputs from the sync separator, to a separate field sync separator and to the first line-frequency phase-lock loop (PLL) detector. The latter has a very high static steepness, to ensure that the phase of the picture is independent of the line frequency. The slow or fast time-constant used by the first PLL is controlled by the incoming signal or can be directly controlled by IR01 via the I<sup>2</sup>C bus.

The filtering components (CV21, CV22 and RV17) for the first PLL are connected to pin 59. A variable time-constant ensures good performance of the PLL under weak-signal and VCR-playback conditions.

To overcome problems that could be caused by anti-copying guard signals, the first PLL is gated during the field flyback period. In addition an internal noise detector monitors the incoming video signal: if the noise becomes excessive, the first PLL automatically switches to the slow time-constant.

A coincidence detector is used to establish whether the line oscillator is synchronised and whether the sync pulses can be used for transmitter identification. It can be desensitised when search tuning is carried out to ensure that the tuning system doesn't stop at very weak input signals.

The voltage-controlled line oscillator section incorporates a digital control circuit. This determines the free-running frequency of the oscillator and is locked to the colour decoder reference frequency (4.43MHz for PAL operation). An internal capacitor sets the line oscillator frequency at twice the line frequency. Because of internal component tolerances, the automatic 'calibration' circuit compares the oscillator frequency with

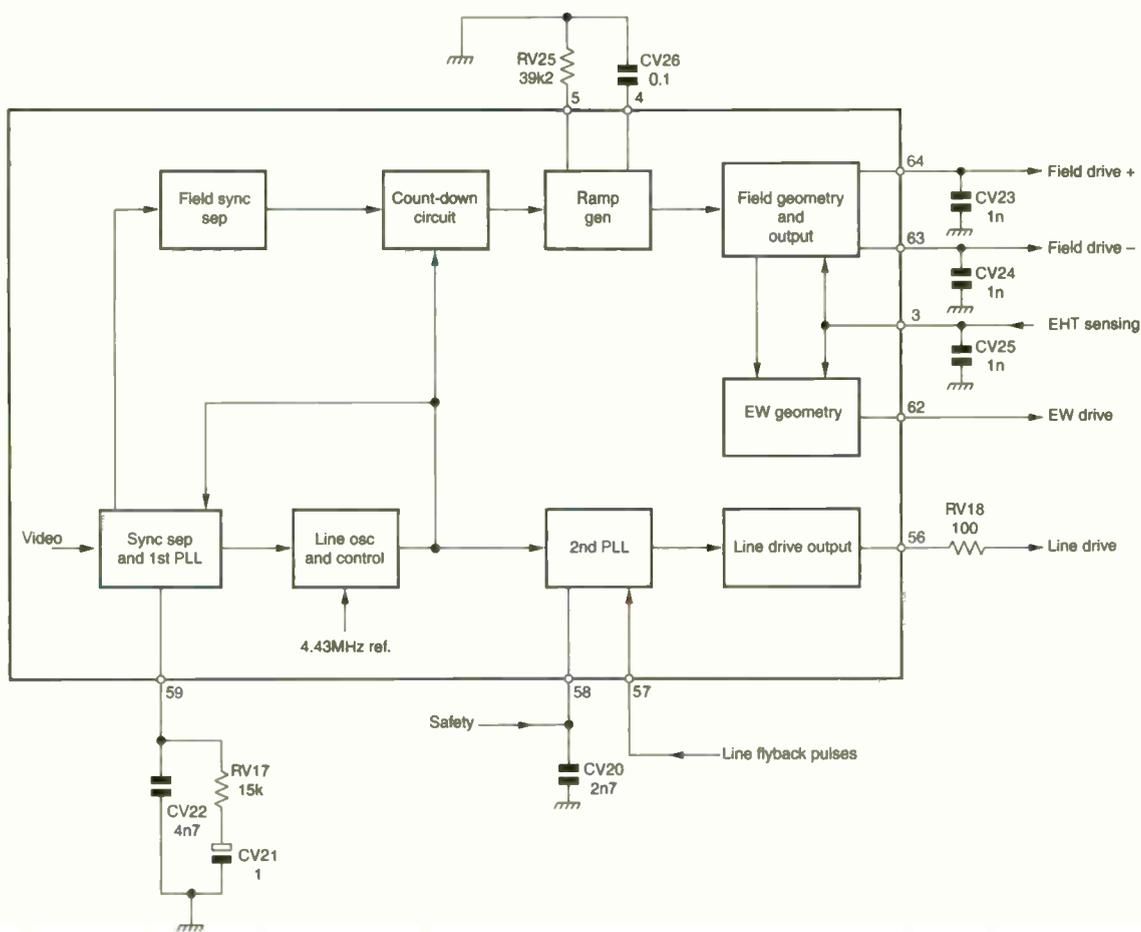


Fig. 4: Simplified block diagram of the timebase generator section of the TDA8855H signals processor chip IV01.

that of the colour decoder's crystal-controlled oscillator. If the coincidence detector finds an out-of-lock condition, the calibration process is repeated.

The line drive output (at pin 56) is suppressed when IV01 is first powered. Once the deflection sub-address data has been downloaded via the I<sup>2</sup>C bus into the deflection register, the line oscillator is calibrated and, when the frequency is correct, the line drive output is switched on.

The line oscillator is followed by a second PLL, which receives flyback pulses from the line output transformer LL05 at pin 57. This section is used to generate the line drive output. The arrangement ensures that the line output transistor cannot be switched on during the flyback period. Capacitor CV20, connected to pin 58, is the filter capacitor for this PLL. Pin 58 is also connected to the safety input – a safety circuit monitors the timebase voltages and the integrity of the deflection coils. If the output from the safety detector circuit, via DL75, rises above 6.8V

the line drive is switched off. It can be switched on again only via an internal soft-start procedure. The EHT tracking input at pin 3 also provides over-voltage protection.

Pin 57 is also used to produce the sandcastle pulses. The line flyback pulses fed to this point are added to an internally generated burst key timing pulse of 4µsec duration and a field blanking period of fourteen lines.

### The line driver stage

Fig. 5 shows the line driver stage and the circuitry on the primary side of the line output transformer. The line drive output at pin 56 of IV01 is open-collector, so a load resistor is required. This is RL31. RV18 is included to limit the collector current and reduce radiation.

The line driver circuit consists of a classic three-transistor push-pull output arrangement. The line drive pulses are fed via a potential divider (RL39/32/33) to the base of transistor TL31 which in turn drives the complementary-symmetry push-pull pair TL32/33. The values of RL31

and the potential-divider resistors ensure that TL31 remains on in the absence of drive pulses. CL37 and DL31 provide bootstrapping, while RL35 and RL36 provide current limiting. The output from TL32/33 is connected to the primary winding of the driver transformer LL32, with CL38 as a coupling capacitor. The average DC developed across this capacitor is approximately half the supply voltage: DL32 and DL33 provide a discharge path when the set is switched to standby.

The secondary winding on LL32 is connected across the base-emitter junction of the line output transistor TL34, which is type BUH516H16 or S2000N depending on tube type. RL37 helps to shape the drive waveform and provides a degree of damping.

The drive pulses at the base of TL31 control the direction of current flow in the primary winding of the driver transformer LL32. When TL31 is switched off, its collector voltage rises and TL32 switches on. TL33 is switched off, and CL38 charges via LL32, TL32 and RL35.

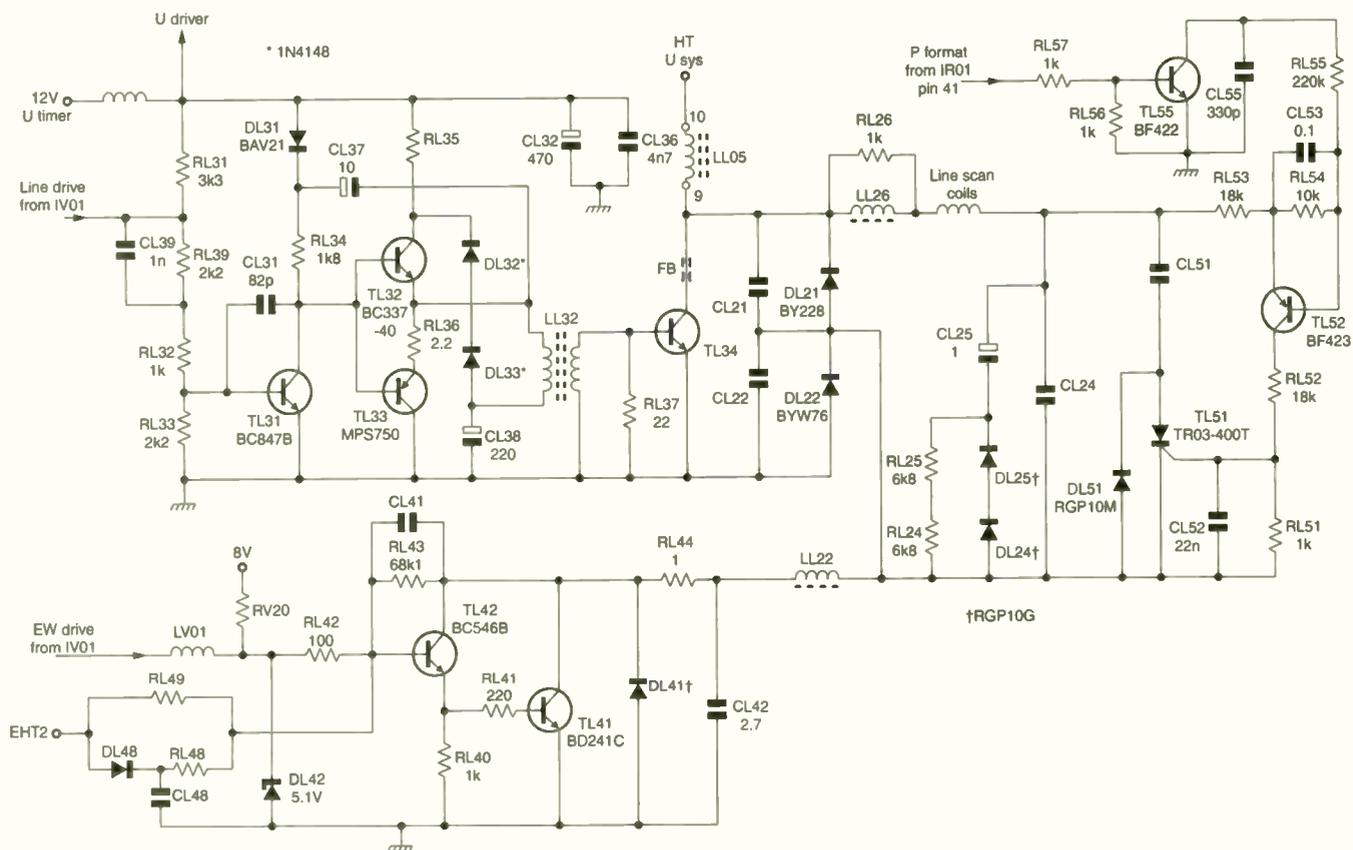


Fig. 5: The line driver stage and the circuitry on the primary side of the line output transformer, including the EW diode modulator and its drive circuit. Some component values have been omitted as they depend on the type of tube used.

When TL31 is switched on, TL32 switches off and TL33 on. CL38 then discharges via LL32, RL36 and TL33. The line output transistor TL34 is on when TL32 is conductive and off when TL33 conducts.

### Line output stage and EW correction

The line output stage and the EW-correction diode modulator are conventional. TL34's collector is connected to pin 9 of the line output transformer LL05 and, via the linearity coil LL26, to the scan coils. CL24 is the S-correction capacitor, which is returned to the centre point of the diode modulator network DL21/22 and CL21/22. The network across the S-correction capacitor, i.e. DL24/25, RL24/25 and CL25, is included to damp and suppress oscillation in CL24 with rapid changes in beam current. With 16:9 sets a second S-correction capacitor, CL51, can be switched into circuit in parallel with CL24. This reduces the line

deflection power and corrects the picture linearity when viewed in the 4:3 centre mode.

The diode modulator is similar to that used in the ICC9 chassis. Its purpose is to modulate the line deflection at the field rate with minimum effect on the supply voltage. This can be achieved only when the primary current is not affected by changes within the deflection circuit as a result of width correction.

The diode modulator can be considered as a short-circuit bridge network which is between the supply voltage and chassis. The two sections (top and bottom arms) of the bridge have the same resonant frequency and reactance, i.e. AC resistance values. One side of the bridge consists of the scan coils and the S-correction capacitor CL24 in parallel with the upper flyback capacitor CL21. The second half of the bridge consists of the EW correction coil LL22 and CL42 in parallel with the lower flyback capacitor CL22.

In operation the two capacitors CL21/22 form a voltage divider, with the energy stored in CL22 used during the flyback period. The integrated value of the flyback voltage is stored by CL42. Because the voltages across both arms of the bridge must remain equal, the voltage developed across the scan coils mirrors that across CL42. The parabolic EW-correction modulates the voltage across CL42 and thus the current flowing in LL22.

The EW correction parameters are downloaded to IV01 via the I<sup>2</sup>C bus. This information is used by IV01 to produce, in conjunction with an internally-generated field sawtooth waveform, an EW-correction drive that appears at pin 62. The drive is applied to the base of transistor TL42, which operates as a Darlington pair with the power transistor TL41. RV20 and RL43 define the working range of the EW correction circuit: CL41 is incorporated to reduce any tendency for the circuit to

ring. RL44 protects the EW correction circuit against overloading.

Because of the source impedance of the EHT system, excessive beam currents could modulate the line output stage. To prevent this, a voltage derived from the earthy end of the EHT stack is fed back to pin 3 of IV01 via RL45 (see Fig. 6). Breathing compensation, from the same source, is applied to the EW correction circuit via DL48, RL48, RL49 and CL48.

Fig. 6 shows the secondary side of the line output stage, which produces various voltages in addition to the CRT's EHT, focus, A1 and heater supplies. These are as follows:

**V RETRACE:** Flyback supply for the field output chip IF01, 42V or 48V depending on CRT type. Produced by winding 5-6.

**V SUPPLY:** Basic supply for the field output chip, 13.5V or 15.5V depending on CRT type. Produced by winding 4-6.

**+5V DST:** Unregulated 5.6V supply for the tuner and MSP audio processor chip. Produced by winding 3-6.

**+5V ON:** 5V supply derived from +5V DST via regulator transistor TL14.

In addition flyback pulses of approximately 10V peak-to-peak amplitude are produced by winding 1-6 for pin 57 of the signals processor chip IV01. Pin 8 of the LOPT is connected to the earthy end of the EHT block. This is the source of the beam-current limiting (BCL), EHT safety and breathing supplies.

### Format switching

The ICC17 chassis is designed to drive 4:3 and 16:9 aspect ratio CRTs, with specification changes to suit a number of different types of tube. The various parameters for these CRTs are stored in the EPROM chip IR02, and are downloaded to IV01 via the I<sup>2</sup>C bus. Access to this data is via the 'service mode' menu, under the subtitle 'tube' - for further details see the full service manual. In addition to these parameter changes, the maximum beam current and the deflection

current have to be set for each type of CRT. For this purpose the micro-controller chip IR01 issues two commands, FORMAT/BCC at pin 43 and P\_FORMAT at pin 41.

The FORMAT/BCC command adjusts the sensitivity of the BCL circuit. The maximum beam current is set by the voltage fed to pin 8 of the LOPT via the resistor chain RL01/3/4/5/6, which is fed from the HT (U sys) line. The pulse-width modulated FORMAT/BCC signal from IR01 is converted to a DC voltage by the integrating network

RL59/CL59, which feeds the base of the emitter-follower transistor TL59. This transistor drives TL02, which with RL02 shunts RL03-6. Thus when IR01 produces the FORMAT/BCC command, TL02 diverts a certain amount of current, thereby adjusting the beam-current limiter's sensitivity. Varying the mark-space ratio of the FORMAT/BCC signal sets the voltage at pin 8 of the LOPT.

The maximum beam current must be reduced to 75 per cent of its nominal value when a 16:9 CRT is used

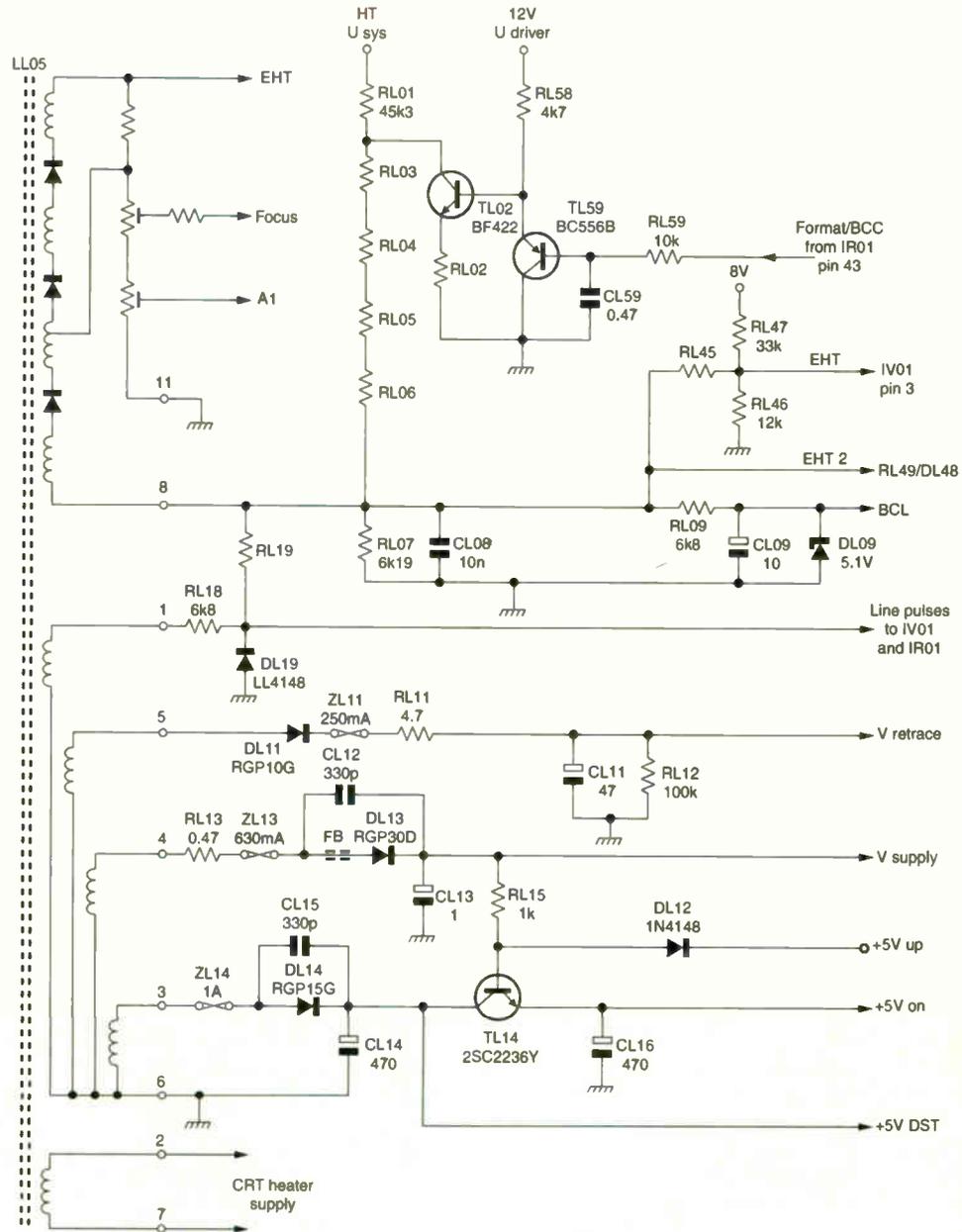
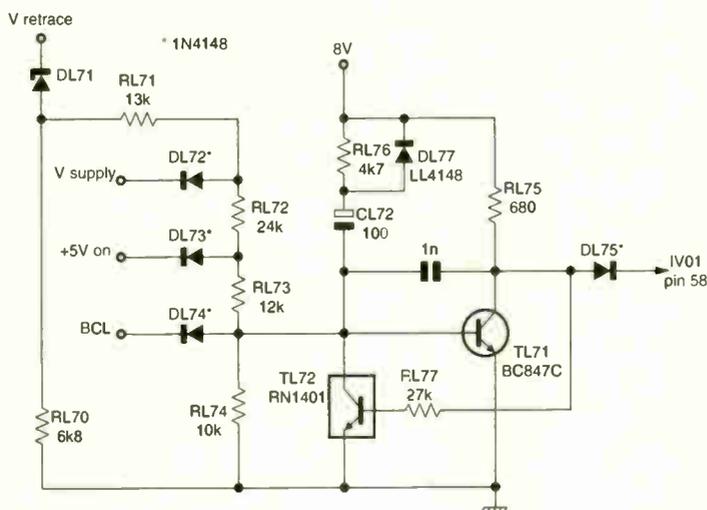


Fig. 6: Circuitry on the secondary side of the line output transformer. Some component values have been omitted as they depend on the type of tube used.



**Fig. 7: The safety circuit that monitors the operation of the line and field output stages. Its output is fed to pin 58 of the signals processor chip IV01. In the event of a malfunction, IV01's line drive output is switched off.**

in the 4:3 centred picture mode. The beam current must also be reduced when a 4:3 aspect ratio CRT is used in the 16:9 (letter-box) mode.

The P\_FORMAT output at pin 41 of IR01, also referred to as P\_SWITCH, is fed via RL57 to the base of transistor TL55. This transistor in turn drives TL52, which is used to switch thyristor TL51 on, thus adding CL51 in parallel with CL24. This additional S-correction capacitor reduces the deflection current and improves the linearity of a centred 4:3 picture.

### The safety circuit

The line output stage incorporates a safety circuit, see Fig. 7. This provides continuous monitoring to prevent damage as a result of CRT burn-in, open-circuit line or field scan coils, a short-circuit across any of the voltage outputs provided by the LOPT, or a short-circuit in one of the RGB output stages.

When the safety circuit is inactive, TL71 is switched on and its collector voltage is held at almost 0V. Thus isolation-diode DL75 is reverse biased. As previously mentioned, the safety circuit's output is monitored at pin 58 of IV01. When a fault condition is detected, TL71's collector voltage rises and, once the level of 6-8V is exceeded, the line drive is switched off.

When the set is switched on, the voltages that TL71 monitors are missing. So TL71 would be non-conductive and the safety line voltage would be above 6V, making it impossible to switch the receiver on! A delay circuit is used to overcome

this problem. At switch on TL41 is provided with forward bias from the +8V supply while CL72 charges via RL76 and RL74. Charging takes approximately 800ms, which is long enough for the voltages produced by the line output transformer to appear and take over control of TL71.

If a problem subsequently occurs, the safety circuit operates and the line drive is disabled. The POWER\_FAIL circuit associated with the +5V ON supply will inform IR01 of the failure, shutting the set down. To reset the safety circuit, the +8V supply must switch off and capacitor CL72 must be allowed to discharge via DL77 before switching the set on again.

When the set is working normally, the V RETRACE supply is the source of forward bias for TL71. To cater for different tubes, zener diode DL71's voltage rating is either 24V or 30V (V RETRACE 42V or 48V respectively). RL70 provides a load for DL71. The voltage developed across this resistor is applied to the potential divider chain RL71-4. DL72, DL73, and DL74, which monitor the V SUPPLY, the +5V ON and BCL line voltages respectively, are all reverse biased.

In the event of an open-circuit failure in the line output stage, the V RETRACE voltage will drop to almost half its normal level and DL71 will no longer be conductive. The voltage applied to the potential-divider chain will fall to zero, TL71 will switch off and its collector voltage will rise to the 8V supply provided by RL75. DL75 will conduct and the voltage at pin 58 of IV01

will rise above the trip value.

A short across the V SUPPLY or +5V ON supply will switch on DL72 or DL73 respectively, removing TL71's forward bias and thus tripping IV01. If one of the RGB output stages goes short-circuit the beam current will increase and the voltage on the BCL line will fall below 0V. DL74 will then switch on with the same result.

Digital transistor TL72 is included in TL71's base circuit. Its purpose is to ensure that once the safety circuit detects a fault condition TL71 remains off until IR01 switches off the 8V supply.

### Field drive generation

Field timebase operation begins with the extraction of the field sync pulses from the video waveform, see Fig. 4. These pulses are used to trigger the count-down divider, which uses pulses from the line oscillator as the clock signal. The count-down circuit has various 'windows', depending on whether the incoming video is at a 50Hz or 60Hz field rate. It can also be forced into various modes via the I<sup>2</sup>C bus to cater for conditions such as channel changing, no signal or a non-standard AV video signal.

The count-down circuit is followed by a sawtooth generator. CV26, which is connected to pin 4, produces the ramp. RV25, connected to pin 5, sets CV26's charging current. CV26 is discharged during the fly-back period. The result is a sawtooth waveform with an amplitude of 3V peak-to-peak superimposed on a 2V DC pedestal. To compensate for circuit tolerances, correction values can be loaded into the field geometry register via the I<sup>2</sup>C bus. These control the height, field shift, field linearity and vertical zoom. As previously mentioned, an EHT-related feedback voltage is applied to pin 3. This prevents breathing effects caused by excessive beam current.

The sawtooth voltage waveform is finally current amplified to enable direct-coupled drives to be fed to the field output IC. Negative- and positive-going outputs appear at pins 63 and 64 respectively. These outputs are asymmetrical, to ensure that neither temperature nor external disturbance has any effect on the field scanning. CV23 and CV24 are included to avoid interference radiation.

### The field output stage

Fig. 8 shows the field output stage circuit, which is based on a Philips TDA8351 chip (IF01). This has two

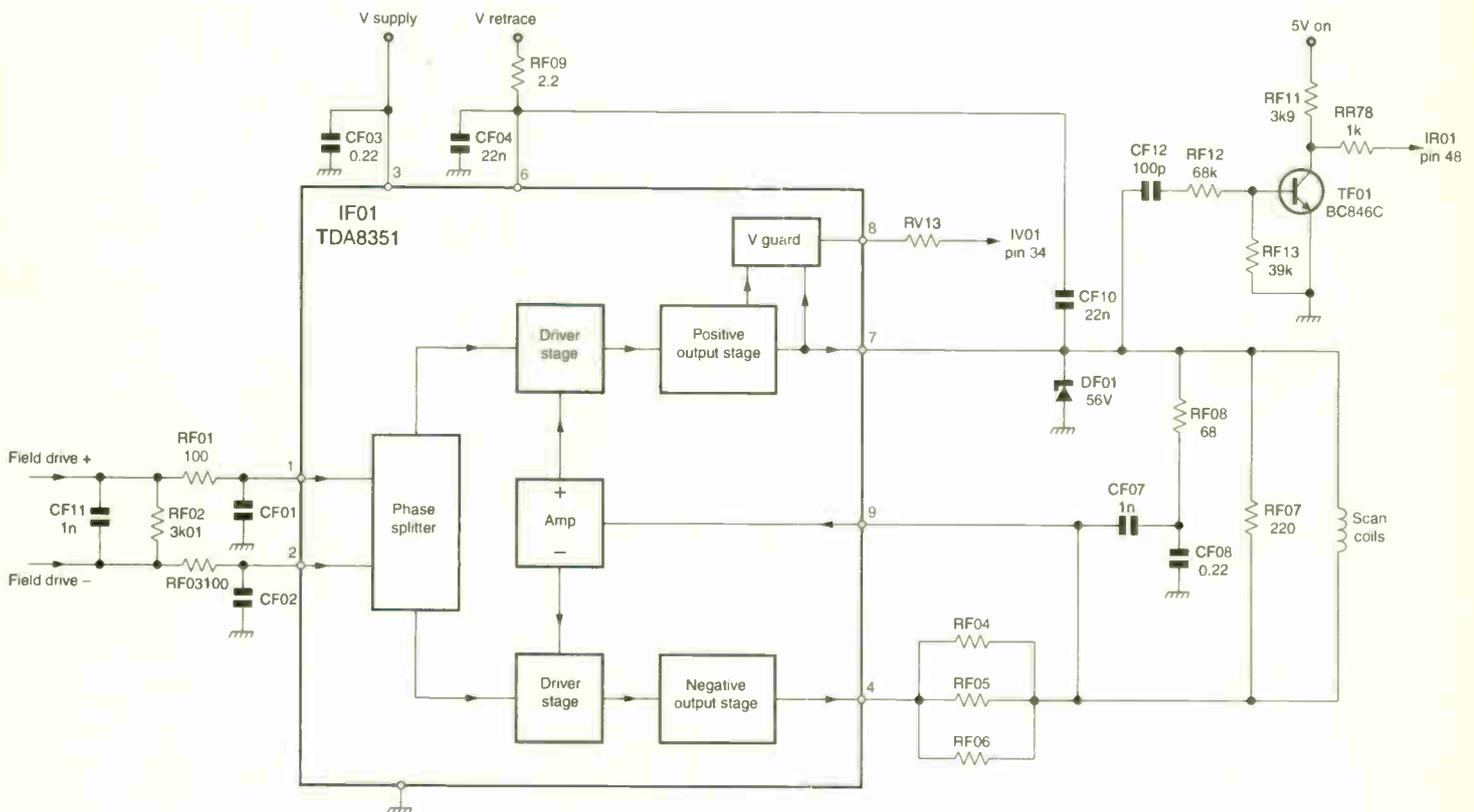


Fig. 8: The field output stage circuit.

output stages which are driven by a phase splitter. The field scan coils are connected between the output stages. This is a bridge configuration, which improves the overall linearity and the power output efficiency. IF01 requires two supplies. V SUPPLY (13/16V depending on tube) at pin 3 and the V RETRACE flyback supply (42/48V) at pin 6.

RF02 converts the two asymmetrical drive currents from IV01 to a voltage waveform. Its value determines the current gain of the field amplifier in IF01. CF01, CF02, CF11, RF01 and RF03 are included to reduce interference.

The incoming signal voltage drives the positive output stage during the first half of the field scan and the negative output stage during the second half: the outputs are at pins 7 and 4 respectively. The parallel resistors RF04/5/6 provide current feedback to pin 9. This, with RF02, sets the overall gain.

Zener diode DF01 provides protection against CRT flashovers by limiting the voltage across the field scan coils to 56V. CF10, CF03 and CF04 protect IF01 from supply voltage spikes caused by flashovers. RF07

provides scan coil damping, while RF08 and CF08 decouple out-of-frequency components.

IF01 incorporates a 'vertical guard' circuit which produces a pulse at pin 8 during the field flyback period. This is connected to pin 34 (beam current limiting) of IV01, which will blank the screen to prevent CRT damage under any of the following conditions: missing field flyback pulses; a short-circuit across IF01's output pins: shorted field scan coils;

an open-circuit field deflection loop; or when thermal protection is activated.

TF01 and its associated components produce field flyback pulses that are fed to pin 48 of the microcontroller chip IR01 to synchronise the on-screen display menus with the field scanning.

### Next month

In Part 3 next month we will turn to the signals side of the chassis.

## NEW BOOK

The Confederation of Aerial Industries has published a new book entitled *An Introduction to Domestic Radio, TV and Satellite Reception*, by R.A. Calaz. More than half of the book is devoted to terrestrial and satellite TV reception, with many practical tips on installation and setting up each part of a system. The remainder of the book covers signal distribution with IRS and SMATV systems, Health & Safety requirements and the choice and use of test equipment. A comprehensive glossary of terms is included.

The book is intended as an introduction for newcomers to the industry and members of the public who wish to know more about the reception and distribution of electromagnetic signals, also as a technical reference source for installers, and to provide further information for course students. Subjects covered include IRS system planning, the theory of digital TV, home-cinema systems, broadband datacasting, DiSeqC switching, plasma displays and fibre optics.

The book is available from Book Sales, CAI, Fulton House, Fulton Road, Wembley, Middx HA9 0TF at £35 + £2.95 postage and packing for CAI members or £39 + £2.95 for non-members. The CAI's phone no. is 020 8902 8998.



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# Tom Baker's tales

**A warning about security-coded machines, a dead Matsui TV and cheapo VCRs**

**H**ave you ever noticed how, just as you feel you are winning a race, someone always seems to catch up and overtake you? That's exactly how I felt last week when I was fixing, or so I thought, a Matsui VX1108 VCR.

## **The VX1108 saga**

The day had started well enough, and I was feeling great. Then Mr Jenkins from across the road came in with his video recorder. "Morning Doctor" he said.

He always calls me doctor, as in Dr Who, my name being the same as one of the actors who played him in that TV show. "Morning squire" I replied, "what can I do for you today?"

"It's me video" he continued, "very poorly I think. Might be near death's door."

"Quite possibly" I said, "but what's the matter with it?"

"Dead" he replied.

"Then it's already gone" I replied, "but I'll try and work a miracle for you. Give me a ring later."

After those comforting words he left with a spring in his step.

I put the machine, a Matsui VX1108, on the bench and switched it on. It was indeed dead. Not being one to allow that to bother me, I took the cover off and checked the mains fuse. It had blown, but wasn't black. So, before fitting a replacement, I carried out some checks in the mains input department and found that one of the bridge rectifier diodes had gone short-circuit. The machine had a laced-up video stuck inside and, as it's of the type with a centre-mounted deck on a single PCB, this had to be removed before I could get to the diode to unsolder it. Fortunately the only screw that was difficult to get at was accessible, albeit difficult to remove with the tape still in, but I managed it. Once the tape had been removed it was fairly easy to strip the rest down. Then, after fitting a new rectifier and checking to see if anything else had gone, I reassembled the machine, minus the awkward screw, replaced the fuse, switched on and waited for the bang and the smoke.

It worked all right, or so I thought, because it ejected the tape that had been stuck inside and, once reinserted, accepted the tape and laced up. Then the dark clouds started to appear. There was no play, fast forward or rewind operation. So I called half time, with the score VCR 1

Tom 0, put the kettle on and tried to refresh the old grey cells.

This seemed to work. While I was drinking my coffee something started to nag at the back of my mind. I recalled an article I'd seen recently about this same type of fault. Yes, Test Case 469 last January. So I reread it and then looked to see if the spool release post was broken. Yes, you've guessed right, it wasn't.

Feeling dejected, I decided to put it aside and leave it for another day. But at this point I noticed something on the front of the machine, the words "security coded". I hadn't paid any attention to this as lots of machines have this on them and it's not caused me any problems before. Why should it now?

At this stage I hadn't connected the VCR to a monitor, as I was mainly interested in getting it to work mechanically. But I thought I would see if there was anything wrong with the E-E picture. A bright blue screen appeared with, flashing, the word "pin" on it. So I phoned Mr Jenkins and asked him for his pin number and remote-control handset.

He turned up almost immediately and put in his year of birth. Then, as if by magic, the machine allowed me to play, rewind, etc.

I'm not sure about the moral of this story but, in future, I won't accept a VCR with "security coded" on it unless I have the remote-control unit and the customer's guidance as to whether it has been activated or not and, if it has, the pin number.

Final score VCR 1, Tom 2.

## **A Matsui 2109NS**

Later that day old Tom from the camp site turned up with his TV. "Morning young Tom" he said, "can you have a look at me telly? It's just out of guarantee with Currys and they want £45 to come out and look at it."

I like it when he comes to see me, because not many people call me young any more. So I asked him to bring the set along.

It turned out to be a Matsui 2109NS. I have to say that in recent times more of my customers seem to be unhappy about the after-sales service they get from the big multiples, who want an arm and a leg just to look at something. But don't get me wrong, I think this is great – it's more work for me.

I put the set on the bench and switched

it on. There seemed to be no life in it at all. After doing the usual things like checking the fuses and diodes etc. and finding nothing amiss I started to look for dry-joints. Still no luck. So I switched it on again and started to carry out voltage checks. There was voltage across the mains bridge rectifier's reservoir capacitor, but nothing much else. I switched off and waited a few seconds then checked the main reservoir capacitor before going any further. To my surprise it was still charged to 245V. So I discharged it properly and started to look for open-circuit resistors.

This proved successful, as R504 (2.2MΩ, 1/8W) was open-circuit. There are two of these tiny resistors, of the same value, in series. After fitting a replacement I switched the set on and waited for maximum smoke. Fortunately it worked well enough and, after a bit of setting up, I couldn't fault it.

I phoned Tom and gave him the good news, that I had found the cause of the trouble and repaired it. He turned up a short while later, paid me and thanked me for the wonderful same-day service.

## **A cheap VCR**

I had to write off a VCR the other day. It was one of those awkward occasions, because the customer said she couldn't afford a new one. As she had been recently widowed I felt I should try and help and said I would see what I could get a new one for.

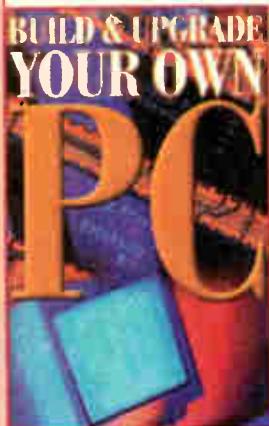
So out came the catalogues and flyers, but the cheapest was still nearly £100 including the dreaded VAT. I spent a long time making enquiries, then my wife asked whether I'd looked in the Argos catalogue. I hadn't thought to do so, and when I did I was gobsmacked to find a Bush VCR905 for sale at £64.99. I rang the customer and said I could supply one for £70 – after all there was time and petrol to pay for. As she was happy with this price I went off, joined the queues and came back with a cheap and cheerful VCR.

Somewhere along the line this machine had been manufactured, packaged, stored, shipped, transported and delivered to the depots – and VAT added. Assuming that all these processes had involved costs, one's mind boggles at how low the initial cost of the unit must have been. And everyone along the line must have been making a bit of profit.

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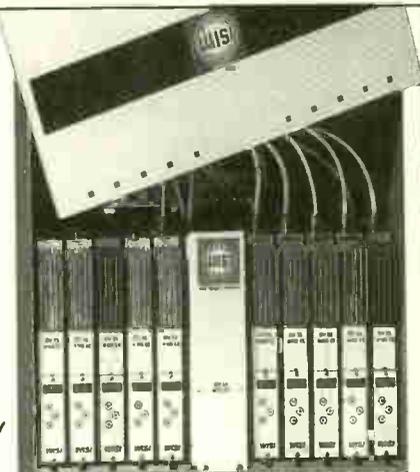
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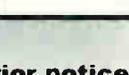


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# DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. News on international TV broadcasting and satellite band changes. Knife-edge signal refraction. Roger Bunney reports



French presidential election night shot, showing the president and his wife.

May brought the start of the 2002 Sporadic E season, which was a little late this year. I had the first reports of SpE reception on May 5. Thereafter the log was as follows:

- 8/5/02 NRK (Norway) chs. E2-4.
- 9/5/02 C+ (Canal Plus, France) ch. L2; RAI (Italy) ch. IA.
- 15/5/02 RAI IA, B; Tele-A (Italy) E2-; TVGE (Guinea E2).
- 18/5/02 RAI IA: TVE (Spain) E2-4; RTP (Portugal) E3.
- 20/5/02 NRK E2-4.
- 21/5/02 RAI IA.
- 22/5/02 NRK E2; unidentified signals in ch. R1.
- 26/5/02 LRT (Lithuania) R2; RAI IA; HRT (Croatia) E4; unidentified signals in ch. E3.
- 27/5/02 RAI IA (twice), IB, IC; LRT R1; Video (Italy) E2-.

The polarisation of the Italian private-station transmissions that use ch. E2- (the Tele-A vision carrier is at 47.86MHz, the Video vision carrier at 47.96MHz) is vertical when received here at Romsey, Hants via SpE propagation. These signals tend to be more consistent than the higher-power RAI transmissions that use the higher-frequency channels IA, IB and IC.

Of particular interest was Cyril Willis's reception of Conakry, Republic of Guinea ch. E2 at his home in King's Lynn on May 15 at 1845 BST. This station is not listed in the 2002 edition of the *World Radio and TV Handbook*. The reception may have been dual-mode - SpE plus evening TE (transequatorial skip).

It's pleasing to note that TVE-1 (Spain) continues to use the three System B Band I channels despite well-publicised pronouncements that VHF transmissions were to cease by the end of 2001. But I suspect that the high-power Madrid ch. E2 transmitter is now operating at a considerably reduced ERP.

It's been a slow start to the season but, hopefully, things will soon pick up.

## Satellite sightings

At the time of writing, Fox News Kabul continues to maintain daily uplinks with the latest developments from the battle zone in Afghanistan. Most of the coverage features the GIs, for the folks back home. but on May 8 there was extensive coverage of the Canadian forces in action. A camera aboard a Chinook helicopter followed the troops into mountainous terrain, with footage of caves being searched, then the return to base at the end of the operation. Fox and the BBC both use Europe\*Star-1 (45°E), which provides strong downlink signals - an 80cm dish provides reception in the UK. Fox News can be found at 11.676GHz V (SR 5.632, FEC 3/4). In mid May there was widespread illness amongst the UK marines. A press conference was convened, and the BBC news SNG unit was fired up. BBC UKI-302 provided an update on the situation, live for the 2200 news. The downlink was at 11.661GHz V.

On May 22nd my Pace dish positioner threw a wobbly, losing its memory. The user manual makes sorting out this type of problem really hard going. Some time had to be spent on translating the instructions into user-friendly English. When I checked the dish pointing alignment versus readout next day I used the West reference - Intelsat 801 at 31.5°W. All proved to be well when I found ITV, in the form of "MERIDIAN 8MBIT TES 9" with a news programme inject, at 10.974GHz V (5.632, 3/4).

At 10.977GHz V (again 5.632, 3/4) there was French TV activity with the service identification "801.CANAL210G14 TF1 SNG LC1 VIDEOMOBILE". The pictures from the two cameras on site were unusual. My initial impression was that there had been a motorway crash: the traffic was at a halt, there were tapes across the road, police were swarming everywhere and there were helicopters overhead. Close-ups showed a large van/small lorry with a large circular hole in its cargo side, which seemed to have been burnt. Another, smaller Transit-sized van had been pushed off the carriageway into the verge. This was hardly a major crash, but there was heavy security and great interest in the incident. Then the pictures cut to colour bars with the alternating identifications

"EMERAINVILLE" and "AMBASSADE ISRAEL 23/05". There was no voice-over commentary, and the transmission was abruptly cut. The town of Emerainville is to the SE of Paris. There was no news item about any terrorist activity in any UK news broadcast, though the French police and TV service had clearly treated it as a major incident. Most odd!

Jacques Chirac was elected French president on May 5. That evening the downlinks were humming with activity. I noted at least three feeds via Intelsat 801, including an impromptu speech by Chirac at a pop concert venue near his Paris HQ. Roy Carmen logged 19 different SNG trucks on election day, with signals via Eutelsat W1, Telecom 2B and 2D and the Eutelsat Atlantic Bird 2; at least another three trucks were active via Intelsat 801 – curiously, one used encryption.

On the French election night the Reuters circuit via NSS K, at 11.462GHz V (5,632, 3/4), carried a couple of US NBA basketball matches, Detroit v. Boston and San Antonio TX v. LA Lakers. Interesting that the NBC network corner logo indicates that 2002 is the broadcaster's 75th anniversary. Several major horserace meetings have been seen via NSS K, using the Globecast multiplex, including the Kentucky Oaks and the Preakness Stakes from the Pimlico Racecourse, Baltimore MD. PGA golf has continued of course, with several Stateside meetings. Check Globecast at 11.590GHz V (20,145, 3/4).

Last month I mentioned Dave Dyson's comments on horse racing feeds via Eutelsat 2F3, using SisLINK Ku-band capacity. You will normally find at least one English meeting during the afternoon. The majority of these sports feeds are in the clear. During the course of two weeks Dave locked in to nearly all the downlink channels listed at the SatCoDx internet site – check the updated orbital listings at

<http://www.satcodx.com>

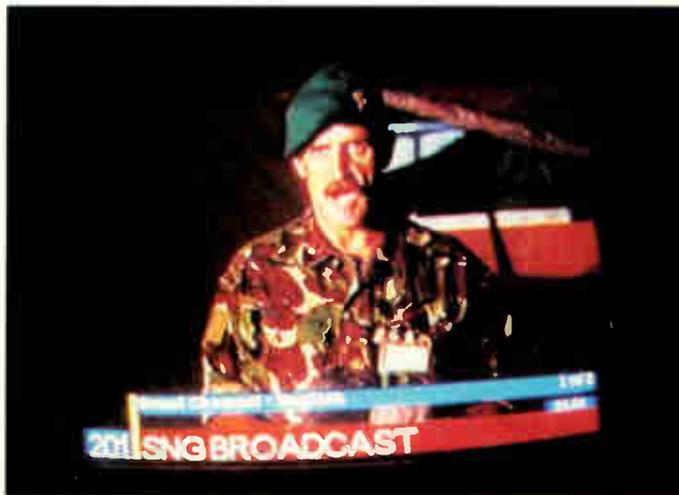
In late May President Bush and his entourage visited various European countries. On the evening of May 27 ITA64 Roma uplinked live coverage of his arrival in Italy and a meeting with officials. This was via the Reuters NSS K circuit at 11.462GHz V – it's the "Rome Pool Feed, Path #1".

During the month the British Forces TV transmissions (BFBS-1, -2) via Telstar-11 (37.5°W) at 11.561GHz V and Eutelsat W3 (7°E) at 11.324GHz V ceased encryption for a few days then resumed scrambling. The transmissions usually have a symbol rate of 27,500 and FEC of 1/2. Radio services for various overseas postings, e.g. Kosovo, Cyprus and the Falklands, are also present at these frequencies. The US military surveillance transmissions from the Balkans via Telstar-11 continue at 11.495GHz H (19,500, 3/4): the Airscan clock that appears in the surveillance downtime mode has been modified, with a central Batman crest and wording!

Edmund Spicer (West Sussex) reports finding a brand new 80cm dish with garden stand and "other bits" for £40 at his local Safeway postcard sales. It has improved his reception considerably, but he still has problems with the Telstar-11 surveillance transmissions. The Marahisi Open University via the same satellite at 11.533GHz H (3,122, 7/8) locks well however. Results with the analogue transmissions from the Turkish slot at 42°E (Turksat/EurasiaSat-1) have improved greatly, and he now finds it easy to separate the Eutelsat W2 (16°E) and the power-house Astra transmissions at 19.2°E.

### Broadcast news

**Pay TV:** The Spanish terrestrial pay-TV broadcaster Quiero TV closed down in late April. It had attracted only some 220,000 subscribers and had difficulty competing with the satellite pay-TV services Via Digital and Canal Satellite Digital. The latter have since agreed to merge, to stem increasing losses: they would have a combined subscriber base of over 2.5m households, but the merger has to be approved by the competition authorities. Pay-TV is doing poorly worldwide, with Italy's Telepiu, the US DirectTV and Australia's Austar and TARBS all reporting poor results because of a lack of subscribers and extensive smart-card piracy.



**An explanation of the UK marines' illness in Afghanistan being given, live, via Europe\*Star-1 for BBC News.**

**Lithuania:** A new analogue TV channel, Tango TV, is being broadcast from Vilnius. It's aimed at the under 35s, with pop music, the latest movie news and sports. The channel is run by Viasat, which also provides the main Lithuanian commercial TV channel TV3.

**Malaysia:** A further two terrestrial TV channels are to be opened by the state-owned service Radion Televisyen Malaysia (RTM), which currently broadcasts the analogue channels TV1 and TV2, both of which carry advertising.

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**Nepal:** Kantipur Television Network pvt (KTN) is to broadcast a commercial TV channel, initially in Katmandu and the surrounding area, with a gradual increase in terrestrial coverage over the next five years or so. It also plans to transmit via satellite from year two, to extend coverage and reach expatriates elsewhere.

### Satellite news

A new North American company, SAT49, aims to form a satellite broadcasting group that will be based on existing programme makers and TV networks. Participating networks will be allocated ten free channels to make regional programming more widely available – in each state across four time zones. Local programming from over 140 channels could be used. Main satellite programme providers such as ESPN, MTV, HBO etc. would be available to viewers as premium pay-TV channels.

The Manchester United channel MUTV is now being broadcast by the Russian NTV-Plus premium digital satellite service, enabling fans on holiday in Russia to keep up with what's going on back home. NTV-Plus provides 45 channels to over 200,000 subscribers. A Russian business TV channel, RBC-TV (RosBusinessConsulting), is to open in 2003, transmitting 18 hours daily. Its coverage will be based on the Bloomberg and CNBC TV channels.

James Murdoch (no relation of Rupert!), chairman of the Hong-Kong based Star TV, has asked the Indian government to lift the current restriction that prevents its DTH service reaching Indian viewers. The Indian government is considering a law that would force DTH subscription-channel operators to provide set-top boxes with a common conditional-access system. The Bangladesh government has removed its ban on satellite TV reception.

The US-financed channel Liberty TV, which had been broadcasting to Iraq via Telstar-12 at 8°W, closed in early May when the State Department stopped providing cash for the operation. It's likely to be back once new funding has been agreed. The channel is known in Arabic as Hurriah TV.

NileSat 101/102 (7°W) is now transmitting Euronews as an FTA service, with English and French sound channels. This is a difficult satellite to receive in much of the UK. Check at 11.882GHz H (27,500, 3/4).

### Knife-edge signal refraction

Knife-edge refraction of signals was discussed in this column some years ago. Bob Cooper of the New Zealand trade magazine *SatFACTS* has written on the subject at various times over the years. Living in the southern UK, I never thought that I would experience the phenomenon myself. Now I have, during a recent visit to the Isle of Wight.

Back to basics for a minute. A VHF or UHF signal normally travels from the transmitter straight towards the horizon – unless the transmitting aerial has been designed to produce a different radiation pattern, possibly a tight beam downwards into an otherwise screened valley etc. As the signal frequency increases, the screening effect of hills, mountains, tall buildings etc. also

increases. Anyone who lives in a valley in South Wales or Scotland will be all too aware of the problem. In situations like this reception requires a high-gain aerial mounted on a tall mast. But there are cases where a signal is 'bent', i.e. refracted, by the object that provides the screening, and as a result is present at a screened location. When such refraction occurs there's also a focusing effect: the refracted signal doesn't reach the whole of the screened area, only certain parts, which you could call 'hot spots'. Fig. 1 illustrates the phenomenon.

Certain factors increase the likelihood of refraction. The screening mass, i.e. hill, mountain, etc., will refract more efficiently if its top is a sharp ridge rather than a rounded surface. In addition a bare surface is better than one covered with foliage. The refracting surface should be perpendicular to the signal path. A small section of ridge, perhaps within a few wavelengths of a signal, will happily refract. In a recent article on the subject Bob Cooper mentioned various examples of signal reception/refraction in New Zealand.

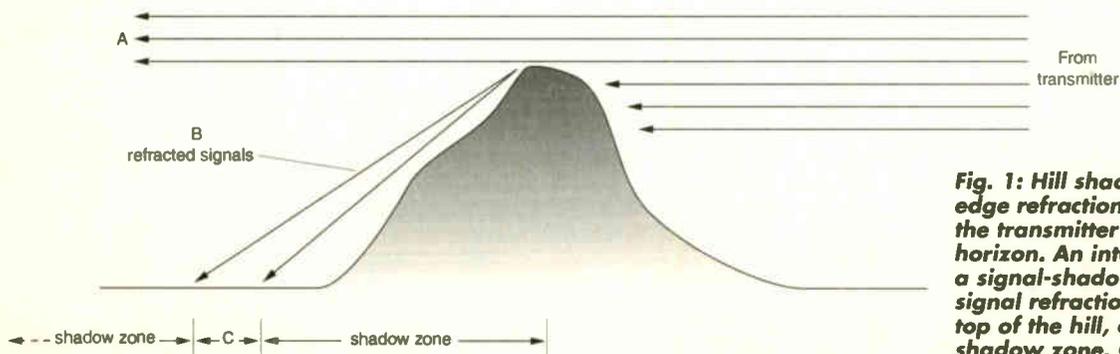
I've previously mentioned my holiday visits to Ventnor, Isle of Wight. It's a Victorian town which is built on a narrow 'ledge' known as the Undercliff. This runs for four-five miles east-west, and is well screened to the north by a range of cliffs and downs. In winter these provide shelter from northerly winds, creating a unique climate in which sub-tropical plants, trees etc. thrive.

On May 1 my wife and I were checking various sites in the area, in the vague hope that one day we'd be rich enough to retire! We were heading for Bonchurch, at the eastern edge of the Undercliff. At 1pm we parked at Shore Road, Bonchurch car park, overlooking the sunny sea from the low 12m cliffs (Ordnance Survey SZ 576 777). And of course I tuned the car radio to see what the conditions were like, with a sea path that extends for miles. A strong, non-fluttery BBC local radio station was present at 104.4MHz: surprisingly it turned out to be Radio Berkshire, from Hannington at 1kW ERP, many miles to the north.

Bonchurch is overshadowed to the north by the mass of St. Boniface Down, which rises to 235m above sea level at about 45° elevation. A farther 6km or so north there's another range of downs (Mersley Down) that rises to 135m ASL. Both obstructions have rounded tops but are bare of vegetation. One or other was providing Radio Berkshire reception by signal refraction. It certainly wasn't a case of wave back-scatter.

Reception of this sort doesn't occur across an area, only at odd spots.

In the late Fifties I stayed at Madeira Road, approximately 0.5km to the west. As in most parts of Ventnor, the 405-line ch. 3 BBC-TV signal from Rowridge was dimly down in the noise. A three-element array or a double-H array, on a high mast, was required, and even with this only a snowy picture was obtained. Chillerton Down ch. 11 was just not possible. In fact Ventnor was an aerial installer's dream, with big arrays, including the Dale Parabolic, everywhere. But you would come across the odd spot where BBC-TV could be picked up with a three-element ch. 3 aerial mounted next to the pavement. That was knife-edge refraction for you. It's still doing its stuff!



**Fig. 1: Hill shadowing and the knife-edge refraction effect. A, signals from the transmitter travel towards the horizon. An intervening hill will create a signal-shadowing zone. B, some signal refraction may occur across the top of the hill, deflecting signals to the shadow zone. C, area where refracted signals may be present.**



# DVD

**Fault reports from**  
**Geoff Darby**  
**Matthew Biddlecombe**  
**Robin Beaumont**  
**Nick Beer**  
**John Coombes**  
**and**  
**Gary Laidler**

We welcome fault reports from readers – payment for each fault is made after publication. See page 616 for details of where and how to send reports.

## **Pioneer DV717**

This was an odd problem: the unit would play DVDs without fuss but, when asked to play a CD, would run it up, refuse to read it and then eject it. I've had this sort of problem on a number of occasions, but always the other way round, i.e. the unit reads CDs but not DVDs. A defective optical block has always been the cause of the problem. Although I was a little reluctant to suspect the laser in this instance, I eventually decided to give it a try. The replacement deck assembly, which comes mechanically prealigned, restored normal operation in all respects. **G.D.**

## **Sony DVP-NS300**

This started out as a nice simple fault. The job ticket said "when lead wriggled, the left speaker comes on; otherwise no sound from the speaker". When I tested the unit however it seemed that the owner was mistaken, as the output from both phono sockets was solid with my leads and test amplifier. A note was made on the job card to supply the owner with a new phono lead, as this was the most likely cause of the trouble he had been experiencing.

To be on the safe side however I thought that, while I had the unit apart on the bench, I had better check the soldering at the sockets. I removed board AV56 and examined the joints. All was well. But when everything was reassembled there was no sound from either channel!

I eventually discovered that PS402 (1A) in the ever-11V supply was open-circuit. It's a surface-mounted item, the

size of a pinhead (really!), on board IF80. As there didn't seem to be any short-circuits present I temporarily hung a 1Ω safety resistor across it. This proved that all was now well, with normal sound present, and a replacement of the correct type completed the repair. The mystery is why PS402 had failed. **G.D.**

## **REC 850**

This DVD player would attempt to read a disc but, after several seconds, it would show "no disc" in the display. When I removed the top I could hear a high-pitched buzz that came from the power supply. On closer inspection C622 (2,200μF, 16V) appeared to have a slight bulge at its top. There was no sign of any electrolyte leakage when I removed it, but a check on its value revealed that this had fallen to 10μF. Replacement with a type rated at 105°C restored normal operation. **M.B.**

## **Philips DVD750/004**

This machine had gradually become very particular about which discs it would play, either not reading them at all or stopping after a while. A new loader assembly, which includes the laser unit and the spin and sled motors, restored normal operation.

Be careful when fitting this, as there are two laser diodes and thus two solder bridges to unsolder on the flexiprint. If you miss the inner one, which is difficult to see with the machine assembled, the unit will play only audio CD discs. **R.B.**

## **Toshiba SD3109**

This player wouldn't read discs. When I removed the top cover I saw that the traverse didn't move the sled to the centre of the disc. In fact it didn't move the sled at all because the traverse gear, which consists of two interlocked and sprung gears, had fallen apart. Reclipping and re-installing restored normal operation. **N.B.**

## **Grundig GDV210**

The complaint with this DVD player was no results. Checks on the primary side of the power supply showed that it appeared to be working correctly. There was no 12V output on the secondary side however. The cause was traced to D7 (SB1100) which was short-circuit. **J.C.**

## **Medion MD7950A**

The customer complained that there was no display and poor sound. As I had no circuit diagram the best place to start seemed to be the power supply. I soon found two 10Ω fusible resistors, R306/7, that were open-circuit. I couldn't find any reason for their failure, and replacement cured the faults. A long soak test proved that all was now well. **G.L.**



# SATELLITE NOTEBOOK

**Reports from  
Christopher Holland  
and Michael Dranfield**

## Digital channel update

The latest channel additions at 28.2°E are listed in Table 1 – where assigned, the EPG number is shown in brackets after the channel name.

Film Four, Film Four + 1, Film Four World and Film Four Extreme have left Channel 4's Astra 2A transponder (24, at 12.168GHz/V), moving to Eurobird transponder D6S (11.565GHz/V). Channel 4 transmissions continue to use transponder 24. Curiously, E4 (EPG no. 205) is at present being transmitted via both transponders.

The BBC has started to transmit more interactive services, via Astra 2D transponder 50 (10.847GHz/V). This takes the BBC transponder total to four – with radio and TV channels via Astra 2A transponders 1 and 5, and other interactive services via Astra 2B transponder 38.

ITN Radio News has left Astra 2A transponder 17 and the EPG. C.H.

## Channel 4 regions

Channel 4 transmits six regional variations via transponder 24 (Astra 2A). The only difference appears to be the advertisements carried. The regions are: London; South East; Midlands; Scotland; North; Northern Ireland. The correct regional transmission for the subscriber's post code is present on channel 104 (184 in Wales). Out-of-area Channel 4 regions can be added via the 'extra channels' menu, though there is no regional identification label. To check which region is being received is simple however: enter teletext page no. 399 and the region will be seen in the middle of the 'clock cracker' page. Three different versions are shown in Photos 1-3 – for the SE, Scotland and the North. C.H.

## Pace 2200 and other digiboxes

I've noticed the following strange phenomenon with Pace and other digiboxes. The software in a box that has been refurb-

ished after standing in the pile for some time will be out of date. When the signal strength and quality are checked I find that, with say the 2.6A9 software, they are both at about half way on the strength meters. Update to the new 2.8B software and you find that the signal-strength meter reading has fallen to about an eighth to a quarter while the quality has increased to up to three quarters of the scale. Yet the box still functions normally. M.D.

## Amstrad DRX100

This digibox was stuck in standby. There



Photo 1: Channel 4 SE identification on teletext page 399.



Photo 2: Channel 4 Scotland identification on teletext page 399.

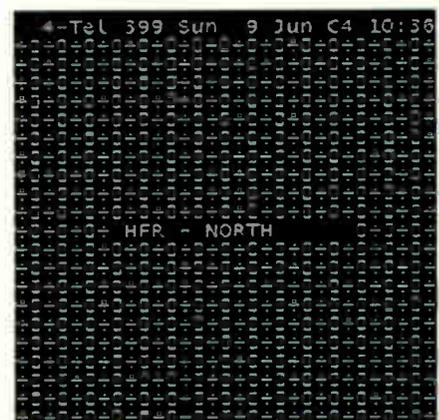


Photo 3: Channel 4 North identification on teletext page 399.

GMT	GMT
05:00 ARABIC VIDEO CLIPS	15:00 CONSUELO
05:55 KIFF WOL LEICH	15:45 CHABEBZ
06:45 LBCSAT NEWS	16:50 LBCI NEWS LIVE
07:45 NHARKOUM SAHD	17:30 LUZ CLARITA
11:00 MA ELAK ELLA HAIFA	18:30 MIN BIZID
11:30 SOUFRA DEYMEH	20:00 EGYPTIAN MOVIE
12:00 FLASH NEWS	Kalil minal hob kassir onf
12:15 Gillette World Cup	21:00 SPOTLIGHT
12:45 BAS MAT WATAN	21:00 DARABEAT
13:15 Na'f Rabih El-Akbar	23:30 ARABIC VIDEO CLIPS
14:00 KIF WOL LEICH	

Photo 4: LBC (Lebanon) programme list.

was no oscillation when I checked the 56-4480MHz clock signal at pin 20 of the R6715-13 modem chip U305. A new crystal was tried first but didn't alter the situation. Replacing the chip cleared the fault. M.D.

### Pace 250053

There were red and green blocks on the picture with this digibox, though the menu was OK. I tried replacing the two SRAM chips U1701 and U2000 but the fault was still present. It was cured by replacing the ST15512 BGA chip U300. At £42 plus VAT it's not cheap. M.D.

Table 1: Latest digital channel changes

Channel and EPG (GHz)/pol	Sat	TP	Frequency
ART Europe*	EB	D4S	11-527/V
ART Movie*	EB	D4S	11-527/V
ART Music*	EB	D4S	11-527/V
LBC Europe*	EB	D4S	11-527/V
McColls FM†	EB	D9S	11-623/H
Rapture TV‡	EB	D5S	11-546/H
Shop Aid TV (657)	EB	D4S	11-527/V
Shopping Genie (658)	2B	33	12-344/H
Tantalse TV (989)	2A	17	12-032/H
You TV (229)	2A	22	12-129/V
Vibe TV	2B	33	12-344/H

TP = transponder, 2A = Astra 2A, 2B = Astra 2B, EB = Eurobird.

\* The Arabic Radio & TV (ART) and LBC (Lebanon – see Photo 4) are relayed from Arabsat at 26°E.

† Transponder D9S has only recently been activated. At present it carries McColls FM and a colour-bar pattern.

‡ Rapture TV ceased transmission last year but is due for relaunch.

## Dealing with customers' digital TV problems

We often receive several phone calls a day from customers who have digibox-related problems. The following checklist sits by the phone to help us when advising them what to do. Normally we don't suggest that anyone does a 'software upgrade', by holding the backup button in while applying mains power, as this can cause more problems than it solves when it's done while the digibox is not receiving a signal from the satellite.

### General problems

First, general problems such as the on-screen message "no satellite signal being received", failure to receive BBC or Sky Text, no access to the red spot 'active' service with Sky News, the message "there is a technical fault with this channel", or there's no picture and/or no sound.

Tell the customer to unplug the digibox from the mains supply. Ask him/her to confirm that there is then no red or green light at the front of the digibox – to ensure that the correct mains plug has been removed from the socket. Note that people sometimes confuse unplugging the digibox from the mains supply with unplugging everything that's connected to it: be aware of this when giving advice over the phone. Tell the customer to wait for sixty seconds, then reconnect the digibox. Get him/her to wait another sixty

seconds, then press the Sky button on the remote-control unit. If things are now normal, the Sky Welcome channel (998) should be seen.

If the "please insert card" or the "there is a technical fault with your viewing card" message is seen, tell the customer to ensure that the card is pushed in properly. If the customer tells you that the viewing card appears to be in the slot, ask him/her to ensure that it's in the Sky viewing card slot and not the interactive card slot.

### Limited channel availability

If the digibox can receive only Sky News ch. 501, CNN ch. 513, TCM ch. 327 and some others and, when you try to enter for example BBC1 on ch. 101, the digibox produces a red "channel unavailable" message, almost certainly the card has not been inserted in the slot properly. Go to ch. 998 and the digibox may display the "insert card" or the "technical fault with card" message.

### Listings problems

If there's no on-screen radio station and no TV programme information when the remote-control unit's 'i' button (TV guide listings) is pressed, go to a BBC programme and access any digital text page. The problem will be cured when the digibox returns from the text mode

to normal operation.

### Scart connector problems

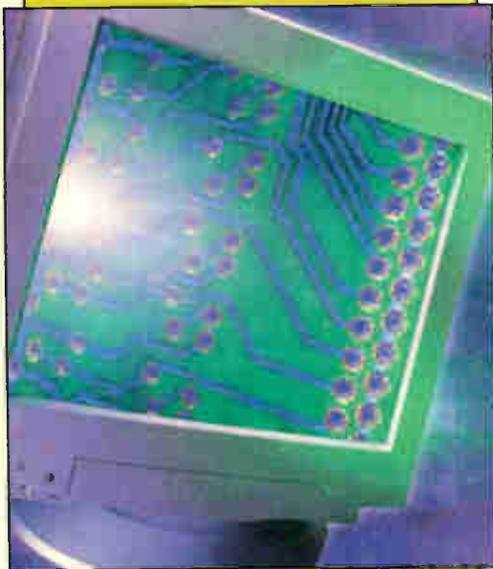
If a scart connection is in use between the digibox and the TV set and, after following the earlier advice, there is still a picture but no sound or sound but no picture problem, tell the customer to check that the scart cable is pushed in properly. As the digibox has two scart sockets, tell the customer to ensure that the cable is inserted in the TV and not the VCR socket.

### Compounded problems

When one of the problems mentioned above is present, such as the card being slightly out, we often find that the customer has made matters worse by unplugging and replugging connections before calling for help. This can result in more than one problem being present.

### No remote-control response

Normally the red light at the top of the remote-control unit comes on when a button is pressed. If the light doesn't come on after replacing the batteries, check whether one of the buttons – in particular the large backup one below the green button – is slightly stuck into the plastic surround. If it is, the button will be 'on' all the time and the remote-control unit will stop working. C.H.



# MONITORS

Fault reports from

Roy Jones

Gerry Mumford

Dave Husband

Duncan Robinson, LCGI

and

Ian Field

We welcome fault reports from readers – payment for each fault is made after publication.

Reports can be sent by post to:

Television, Fault Reports,  
Anne Boleyn House,  
9-13 Ewell Road,  
Cheam,  
Surrey SM3 8BZ

or e-mailed to:  
tessa2@btinternet.com

## IBM 2124

The screen would black out intermittently then, a few days later, the display was permanently dead, with just the mains LED blinking. I had no service data, but it seemed likely that the cause of the fault was in the line output stage. Sure enough the BU2520AF transistor Q310 and the 2SK2161 transistor Q317 were both short-circuit. Replacements brought the monitor back to life, with a healthy crackle and the expected unsynchronised raster when it was on the test bench. But there was still a blank screen when it was connected to the PC.

Further investigation in the same area revealed a ceramic capacitor, C335, with a deep tan and a split in the top. Fortunately the designation was still legible – 220pF, 2kV. A replacement rated at 3kV (RS type 118-842) restored normal operation. R.J.

## CTX 1769ME

This monitor was dead apart from the usual clicking noise. The 2SC4942 line output transistor Q313 and the 2SJ306 B+ regulator FET Q306 were short-circuit, also the associated BYV26C diode D310. Once these items had been replaced the monitor worked normally. G.M.

## Dell VP1428E

This monitor was stone dead. The chopper power supply is based on a UC3842 control chip, and I soon found that there was no start-up voltage. The cause was the 16V, 500mW zener diode D105, which was leaky. G.M.

## Samsung SyncMaster 410B (CHA4217L)

This monitor's chopper power supply had shut down because D615 (HER305) on the secondary side was short-circuit. Once a replacement had been fitted the unit just buzzed loudly. The cause was the mains bridge rectifier's reservoir capacitor C617 (150µF, 400V), whose value had fallen significantly. G.M.

## AOC 7V1R

If one of these Spectrum monitors has an insatiable appetite for line output transistors, check the 1.5Ω resistor that's in series with its base. In a recent case the value of this resistor had fallen to 0.7Ω. D.H.

## Tiny A1554NEL

"Pink video" was the complaint with this monitor. The display had a magenta cast, suggesting failure of the green video drive circuit. I removed the metal screening can on the CRT's baseboard and, after resoldering a number of joints, noticed the

cause of the trouble. There were dry-joints at the collector and base of Q931 (BC190). Once these had been attended to there was a correctly-coloured display. D.R.

## LVI Magnilink 600/A45 vision-impaired microfiche

This version has a choice of colour or mono display. When mono is selected, reverse video is also available. But with this one the reverse video switch failed to make the change between positive- and negative-video. The PVS engineers had had a go. One of the ICs concerned had been replaced, with a socket fitted, but was the wrong type – HEF4070 XOR gates instead of HEF4071 OR. The HEF4001 NOR gate IC had also been replaced. No socket had been fitted, and several tracks had been lifted and repaired with bits of clipped wire. To check for any other damage, I removed all the ICs and fitted turned-pin sockets with exposed 'pin barrels' to enable any necessary track repairs to be carried out. These sockets have 'ground clearance', so the finished work can be easily examined.

Although the company supplied me with most of the circuit diagrams, it was not immediately obvious that the NE592-N14 video amplifier IC is switched out in the colour mode and is in circuit only in the mono mode, to provide the differential outputs. So it took a while to figure out why the picture was still present with the NE592 chip lifted out! The choice between positive- and negative-video signals is carried out by one of the three multiplexers in the HEF4053B chip IC20. This part of the circuit was working. The polarity-switched video signal appears at pin 14 of IC20. It passes through an assortment of discrete-transistor buffers, level-shifters and blanking gates then returns to pin 2, where another multiplexer chooses between direct and polarity-switched video. The output, at pin 15, was permanently switched to direct video.

Pin 10 is the input to select between direct or polarity-switched video. The input is buffered by IC101 (an HEF4001 NOR chip), emerging at pin 4. Pins 5, 6 and 10 are connected together, pin 10 being the output related to pins 8 and 9. Pin 8 is fed from pin 3 of IC100 (an HEF4071B OR chip), the related inputs being pin 1 from the colour/mono switch and pin 2 which leads to an unused pin on the camera interface connector.

The voltage at pin 1 of IC100 changed when the colour/mono switch was operated, and the output at pin 3 produced the correct level change at pin 8 of IC101. So attention was turned to the two-transistor

sandcastle-pulse shaping circuit, which consists of transistors T100 and T101. Everything seemed to be normal up to T101, whose collector pulse was obviously insufficient to drive the input of a CMOS gate operated with a 12V supply. T101 is a Schottky-clamped amplifier, with the 1N6263 diode D100 connected cathode to collector and anode to base. The purpose of the diode is to speed up the transistor's switching time by preventing it from being driven to saturation. This is accomplished as follows. The transistor's collector-emitter saturation voltage is lower than the base-emitter bias voltage required to drive the transistor to saturation: as the transistor approaches saturation, D100 becomes forward biased, clamping the transistor's base voltage at a value that prevents saturation.

The cause of the trouble was that D100 was leaky. A DMM diode-test produced a forward voltage reading of 0.3V, where 0.175-0.2V would be more usual. The reverse reading was just over 1V. Thus D100 was holding T101 just short of saturation regardless of the instantaneous pulse amplitude. A replacement diode cured this, restoring normal control at pin 10 of IC20 and correct operation of positive/negative in the mono display mode. I.F.

### **Apple Vision 1710 (family no. M2935)**

The fault with this monitor was folded frame scan at the bottom. Now I have to say that I'm not keen on these monitors, to put it mildly. When the last one came along, I had to spend half a day working out how to open the case. It took me almost as long on this second encounter. The first step is to remove the swivel base. When turned fully 90°, the swivel stand clicks into position with the two smallest of the six lugs in position, where they can be levered towards the centre and, with firm pressure, the base can be eased off its spigot. The fixed part can then be removed from the bottom of the case by removing four screws.

The bottom of the cabinet back is fixed to the metal chassis by two long machine-thread screws, which also have to be removed. Then, with the monitor the right way up, the small semicircular insert has to be removed. A flat-bladed screwdriver can then be eased between the gap now visible to unlatch the top of the case. It sounds easy, but isn't!

If the main PCB has to be removed, you will find that most of screws are clearly visible. The exception is a single black screw at one of the two mounting holes in the IEC mains connector. The middle of the PCB is supported by slotted

pegs. To release the PCB, it must be eased forward – again not easy. As there is insufficient clearance, the four black screws that secure the side struts to the CRT surround metalwork have to be removed, so that the CRT/front assembly can be flexed forward. The side struts have locating hooks, so it's safe to leave these screws out until final reassembly.

The cause of the fault itself was very simple: one end of DP10 in the power supply had a spark-eroded fracture around its soldered joint. It's the rectifier that provides the negative supply for the TDA8172 frame output chip. By the time I spotted this I had already checked the frame flyback boost diode and the ESR of all the electrolytic capacitors in the vicinity of the IC. The only electrolytic with a suspect ESR was CF6 (1 $\mu$ F, 50V) – the reading was about 2 $\Omega$ . As this capacitor is in parallel with a zener diode, its specification is probably not all that important. But to be on the safe side I replaced it with a 1 $\mu$ F, 63V PTPE capacitor.

Up to this point I had been testing with an adaptor to fit a PC. When the display was examined I found that it was over-bright with flyback lines and couldn't be adjusted. No problem I thought, the monitor is not designed to run with a PC so I'll get the Mac IIsi. When these two items were connected the monitor just sat there – no lights on, nobody home!

As I knew that both units were in working order, I consulted the Apple call centre. They had to look into it and call back. I was subsequently told that the monitor is "too big and heavy for such an old model as the Mac IIsi". So I asked if an upgrade video card could be fitted in the one available expansion slot to rectify the situation. I was given another number, for Apple Store. After rather a long wait I decided to give up and rummage in the bits box! Several bit boxes later I found an expansion slot Apple Video card and fitted it. This time when the IIsi was powered up with the monitor plugged into the added card there was the welcome sound of the degaussing thump followed by the EHT rustle. After what seemed an eternity the display appeared. It was of the correct size and shape, and at the correct brightness level with no sign of flyback lines. Fortunately these monitors are much easier to put back together than take apart.

The difficulties I experienced testing this repair show that a PC adaptor is not always satisfactory, though it sometimes is. I continue to use an adaptor because it's convenient. Then, if necessary, I get the Mac base unit for final testing. A PC adaptor can certainly be used to resolve mysterious no-results situations. Since the

monitor worked with the PC and I knew that the Mac was in good working order, it was clear that the repair was OK.

The adaptor I used on this occasion was a Mitsubishi AD-A205. The Unimacfly also works. These adaptors are intended to enable a PC monitor to be used with a Mac computer, and are sometimes included with the pack of accessories that comes with a larger monitor. Although my application uses the adaptor the other way round, it often works.

Obviously the adaptor needs a 'gender-changer' at both ends. The VGA 15 sub-D changer can be made from a scrap VGA lead by cutting it down to a suitable length and fitting a second VGA plug. The easiest way to make the 15D changer is by pressing a pair of IDC 15D sockets on to a short strip of flat cable.

It's worth mentioning that the added video card was a 'high-resolution' type, also that it seemed to overrule the built-in video adapter without any menu or jumper configuration changes. I.F.

### **Apple M2978**

There was a short burst of activity when this multi-scan 15in. monitor was switched on, followed by immediate safety shutdown. The IRFS9630 B+ buck-regulator transistor Q506 was short-circuit, feeding the full 173V supply to the line output transformer. Attempts to power the line output stage failed because, in the shutdown mode, the line driver transistor Q702 is shunted by Q705. I unsoldered Q705 to enable the line drive and tried the 74V supply as an alternative feed for the LOPT, but it proved to be insufficient. The only other supply was the 173V rail, which was obviously too much. With a bit of trial and error, I devised a dropper resistor of value 247.5 $\Omega$  rated at 60W.

This enabled the monitor to start up, and the full-width scanning indicated that the LOPT was probably OK. But the scan collapsed to a few inches as the monitor warmed up. After a bit of checking I found that disconnecting D705 (DD54) cured the horizontal collapse, with the dual-diode D706 taking over the efficiency diode function of D705 as well as its basic task as the EW diode modulator.

A new IRFS9630 was fitted, but when the monitor was tried again the display had terrible barrel distortion. This could be removed by using the front-panel buttons, which led me to suspect that it was another example of a Mac monitor giving odd results when run with a PC. It seems that the monitor is designed to run at a much higher scan rate. If this results in LOPT core saturation, it could account for the blown IRFS9630. I.F.



## VCR CLINIC

Reports from  
**Eugene Trundle**  
**J.S. Ogilvie**  
**Robin Beaumont**  
**Ronnie Boag**  
 and  
**Bob Flynn**

We welcome fault reports from readers – payment for each fault is made after publication. See page 616 for details of where and how to send reports.

### Sanyo VHR777E

The only way to describe this fault is "erratic behaviour". The deck would shut down intermittently, the lights would go out when a function was selected, and so on. These problems were all caused by the loading motor, which drew over 50mA from a 5V supply with no mechanical load. Replacements are available from SEME as MOTOR4363 at £13.95 net. **E.T.**

### Hitachi VTF540E

The problem with this machine was intermittent tape looping at eject. Various things can cause this fault. In this case the cause was simple and obvious: the back-tension band's felt strip was partially adrift and sometimes stuck to the supply-spool turntable. Its part no. is KX11631. **E.T.**

### Daewoo V2235

The cause of noisy, 'snatchy' rewind with this machine was a badly worn brake pad on the take-up (right-hand side) spool turntable. Strangely it didn't cause tape tangling or spillage, as far as I could see. **E.T.**

### Sony SLVSE70UX

As with many other Sony models, this one uses the SR deck mechanism. We've recently had two of these machines whose deck became jammed because the cam-follower spigot broke off the press block assembly pinch, part no. A6759 863B. As a result it caught below the flap-opener moulding. **E.T.**

### Hitachi VTFX765E

The lightning season is here again! A bolt via the mains supply had disabled this machine, which was dead. It came back to life when I replaced the STRF6653 chopper chip 1085 and optocouplers PC0851 and PC0852. **E.T.**

### Mitsubishi HS651

The cassette cradle tended to jam towards the end of the eject phase. The cause was FL arm/lever 621C2500010, which had warped sufficiently to catch the cradle slider.

This fault could also occur with the **Tatung Model TVR952** and other machines that use the same deck. **E.T.**

### Philips VR6547 (JVC deck)

If the machine shuts off on rewind and goes to standby, check the reel sensors for dry-joints. **J.S.O.**

### Goodmans SD1600

The complaint was "tape stuck". When the machine was switched on you could hear the motor running, then it shut down. If

you get this fault, remove the bottom cover carefully and look for the loading motor pulley. It falls off. I find that a spot of Evostick prevents a recurrence. **J.S.O.**

### Sony SLV625

The display flashed wildly and there were no functions. After a few minutes everything was OK. For this fault check C202 (3,300µF, 16V), which tends to leak, and C208 (2,200µF, 10V). It also pays to check the following electrolytics: C111 (1µF, 100V), C204 (1µF, 50V) and C212 (100µF, 50V).

In addition remove the FF/rewind/play control then strip and clean it. It can be the cause of all segments of the display lighting up when FF/rewind is selected. **J.S.O.**

### Toshiba V804B

When FF or rewind was selected this machine would stay in that mode. The cure is to remove and clean the FF/rewind control. **J.S.O.**

### Grundig GV411

This Philips manufactured machine produced a very low contrast picture via the RF output. The feed via the scart output connector was OK. I found that the fault became worse as the machine warmed up. The video signal is fed to the RF modulator via a BC858B emitter-follower transistor, which was the cause of the trouble. It was leaky. It's a common problem with this and similar surface-mounted devices. **R.B.**

### Panasonic NVSD410B

All functions worked correctly but the timer display was very dim. The cause was diode D7532, which sets the bias conditions for the display tube. It was leaky. A replacement 22V zener diode restored full brightness to the display. **R.B.**

### JVC HRA631EK

The dealer who brought this machine to us had done some work on it but, after reassembling it, found that the cassette was ejected immediately after it reached the loading down position. The nylon pin that operates the cassette-down switch was missing and had to be replaced. Presumably it had fallen out during the previous repair. **R.B.**

### Sony SLVSE800G

This VCR's power supply was dead. Sony has available a modification kit to overcome a problem with the start-up resistors, but fitting this didn't cure the fault. The TDA16846 power-control chip, IC151, had an internal fault between its supply pin and ground and had to be replaced. For good

measure I also replaced the feedback optocoupler (PC151). **R.B.**

### Toshiba V726

This VCR produced a snowy E-E picture. The cure was to replace capacitor CP051 (1µF, 50V) which is associated with the -32V rail. **R.Bo.**

### Sanyo VHRH791

There was no tape take-up with this machine. The cure was to replace the clutch assembly and the arm assembly. **R.Bo.**

### Samsung SV637B

This machine was dead. It returned to life once capacitors CISS35 and CISS36 in the power supply had been replaced. **R.Bo.**

### Hitachi VTF350E

There was no front display and the mechanism would go straight into play after which there was nothing. If it was turned on again there would be a brief movement then nothing, with still no display.

I happily replaced C12 and C13 which are usually responsible for this sort of thing, also C11, C16 and C6 which cause

trouble. My smile vanished when, on plugging the machine back in again, nothing had changed. A more scientific approach was required. So I measured the outputs from the power supply and found that the -30V feed at pin 3 of the connector was missing. Further checks revealed that the tiny 68Ω, 1/6W fusible resistor R36 was open-circuit. Just in case, I replaced C15 (10µF, 50V) as well. My smile returned when I plugged the machine in again. **B.F.**

### LG BC999NI

There was poor playback of some tapes while others were OK, the cause being a worn pressure roller. I couldn't find this model listed anywhere, but SEME can supply the complete arm under order code PW6151 (the LG part no. is 4261R-0011A). It's easy to fit the replacement, the arm being held in place by a twist-off piece of plastic. **B.F.**

### Toshiba V857B (V3 CAT 2)

According to the customer this machine "went pop then dead". Mysteriously, neither the fuse in the mains plug nor the one inside the power supply had blown. What was even more mysterious was that the heatsink for power transistor TP001

had lifted away from the board at its anchor end and forced the legs of the transistor loose at the other end. It's the second time I've seen this, and I still can't understand how it happens.

A repair kit with all the parts required to restore power supply operation is available - Ferguson part no. 20343140 or Thomson part no. 35065920. **B.F.**

### Philips 14TVCR240/05 (Turbo deck)

The customer had removed a cassette from this combi unit as it wouldn't eject normally. An examination of the deck revealed that the tape-loading arms were jamming the mechanics. The cam wheel tension (item 113B) and the tension lever (item 112M) under the deck were found to be adrift. The metal shaft that the cam wheel clips on to had come loose from its plastic base on the chassis, because of a hairline crack in the plastic.

I couldn't find a repair kit listed, so supergluing the shaft at the correct height was the only option. The height at which it's glued is important, so that the gear will click into the shaft slot and align with the surrounding gears.

A very long soak test proved that all was now OK. **B.F.**

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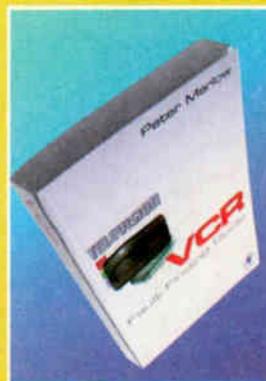
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# Service Casebook

Michael Maurice

## Sony KVA2922U (AE1C chassis)

There were several problems with this set, which came to me from another dealer. First the tuner's aerial socket had broken off and was, according to him, nowhere to be seen. Other faults were intermittent loss of colour and intermittent cutting out. The set was now dead.

I stripped out the chassis and removed the PCBs. At this point I found the tuner's aerial socket, which was lying on the main PCB, across several links. All dry-joints around the 5V and 12V regulators IC604 and IC608 were resoldered, also those around the TDA2050 audio output chips IC251 and IC261. The tuner was replaced, as a new one had been obtained. It was necessary to carry out a small modification on board A, as the tuner supplied was a replacement for the original Fagor unit. For the intermittent colour problem I replaced X301 and CT301 on the colour/video processor PCB. I then reassembled the set.

At switch on I was greeted with EHT coming up, then nothing. I eventually found that D010 and D011, which are across the SCL and SDA lines, were short-circuit. Replacements restored normal operation.

Pity the CRT's emission was low!

## Akai VSA77

The customer said this VCR switched itself to stop when in the record mode. But it also happened in playback. I told him that I needed to carry out more detailed tests, at which point he produced a service manual and an oscilloscope! Checks showed that the reel sensor wasn't switching correctly. Once a new one had been fitted the machine behaved itself.

## Bush 2863NTX (11AK12 chassis)

This set was dead with the line output transistor short-circuit. While looking for a possible cause I found a dry-joint at the scan-coil connector on the main PCB. Once this had been resoldered and a new transistor had been fitted all was well. I booked the job in, collected some money and departed.

A couple of weeks later I was called back. The new transistor was short-circuit and, when looking for a cause, I found that a wire link that connects its emitter to chassis was open-circuit. Once this had been resoldered and a new transistor had been fitted the set was OK. This seems to have provided a permanent cure.

## B&O 3382 (30AX chassis)

There were two faults with this set. The

picture would come in at the sides, then go off. And there was no teletext. I noticed that the line output transistor, which in this chassis does not provide the EHT, field output stage supply etc., was running hot. There's a 220µF, 35V capacitor in the line output transistor's base drive coupling circuit (the component reference number varies with different sets that use this chassis). This was the cause of the scanning trouble. Resoldering various dry-joints on the text module restored the teletext.

## Philips 28CL6770/05 (FL1.0 chassis)

This set was dead with the standby light out. The mains fuse was intact however. What had failed was the separate standby (µSOPS) power supply, which is not covered by the repair kits for the chassis. I had to replace the fuse (F1250, 250mAT), the three transistors (Tr7201, BC558B; Tr7250, BUX85F; Tr7251, BC848), the two diodes (D6251 5-6V zener; D6201, LL4148) and R3250 (68Ω) on the primary side of the circuit, and the 5V regulator transistor Tr7270 (BD135) on the secondary side.

I also attended to a suspect joint on the CRT's scan-coil connector PCB – this is a common cause of problems with these sets.

## Ferguson S59N (ICC9 chassis)

The fault with this set was simple. The set was dead, the culprit being the mains switch. The cure wasn't so simple however. Just follow these 'simple' steps.

- (1) Remove the back – but where are the screws? Remove the front bezel and you will find them.
- (2) Remove the main PCB – not so difficult.
- (3) Remove the front operation PCB, which carries the switch. It's jammed and won't budge, and there is no room between the CRT and the panel to grab hold of it!
- (4) Remove the CRT.
- (5) Second attempt at removing the operation PCB is successful.
- (6) Replace the mains switch.
- (7) Reassemble. The procedure is the reverse of the above.

The repair took me the best part of one and a half hours, but was in the comfort of the customer's home – and the coffee was good!



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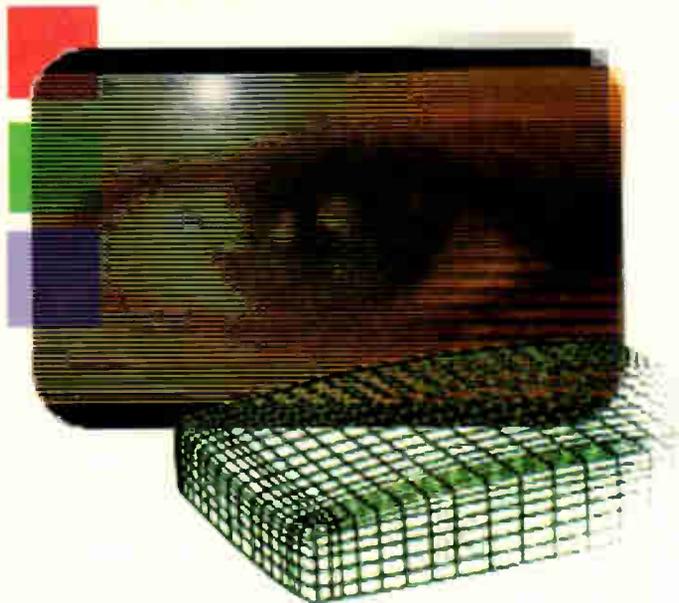
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We welcome fault reports from readers – payment for each fault is made after publication. See page 616 for details of where and how to send reports.

### Philips 28PW6305/05 (A10E chassis)

This set was buzzing, but the noise didn't come from the loudspeakers. I initially suspected the deflection yoke, which is part of the CRT assembly, but in fact the cause of the problem was the 'mains harmonic choke', which is on a sub-panel next to the power supply. These circuits, known variously as harmonic chokes or power-factor correctors, are now widely used to reduce interference fed back into the mains supply. They can cause a variety of problems by buzzing, overheating or going open-circuit.

In this case the plug and socket connections are such that the panel can easily be bypassed to prove the cause of the trouble. **R.B.**

### Panasonic TC14S3R (Z7 chassis)

The picture produced by this 14in. portable was very distorted. A check on the video waveform at the scart socket suggested that it was inverted. After a while the penny dropped: the set thought it was in France, where positive modulation is used. The option codes in the memory chip were wrong. As these are programmed into the IC during manufacture, it had to be replaced.

Be careful to order the exact part from Panasonic, as there are many different versions. I have also known the memory chip in this set to cause sound problems.

Another Panasonic portable fitted with the same chassis, this time **Model TX14J1**, came in because there was no colour. Again the memory chip was the cause of the fault. By swapping the memory chips over between two of these sets the fault could be moved from one set to the other. **R.B.**

### Philips 28CL6770/25Z (FL1.10 chassis)

A new line output transformer had been fitted in this set, which came from another dealer. He had wired out the burnt connections at the plug on the scan coils. Unfortunately he had made a common mistake in assuming that the plug connections follow the tags at the top of the yoke. They don't! Wiring them this way produces a short-circuit between the line and the field coils: the set then shuts down. After correcting this error I replaced a number of components in the horizontal shift circuit. This restored full performance.

It's now difficult to obtain original line output transformers for some Philips FL series chassis. The HR Diemen web site lists a large number of equivalents: search the database, using the Philips part number but omitting the 4822 prefix. This will often reveal a replacement transformer that may be available from your usual supplier but is not cross-referenced in his catalogue. **R.B.**

### Sony KV28LS35U

This set was dead apart from the fact that the standby light flashed eleven times. This error code is supposed to indicate that the 8V supply to the jungle chip is missing, but in fact the main power supply wasn't starting up. The power-factor correction choke in the AC feed to the mains bridge rectifier was open-circuit. As there were no obviously poor connections a new choke had to be fitted.

Another similar set, **Model KV29LS30U**, produced the same symptoms but in this case the cause of the trouble was a dry-joint at the drain of the upper chopper transistor in the power supply. Resoldering this cured the fault – no parts were required. **R.B.**

### Philips 28PW6006/05 (L01.1E chassis)

This new receiver would often fail to switch out of standby when cold – several attempts would sometimes be required. Once the set was running it would keep going without any problems.

I discovered that the EW protection circuit was tripping as the line timebase started up. As there didn't seem to be any particular reason for this I consulted Philips

Technical. The advice provided was to reduce the sensitivity of the protection circuit by changing the value of R3040 to 10k $\Omega$ . This worked. **R.B.**

### **Hitachi C24W410SN**

There was a very intermittent sound crackle, usually when the set was cold and present with the left-channel output only. This type of noise suggested a fault in the output amplifier, so I replaced the TDA7263M IC. Unfortunately the repair bounced straight away. Once a number of through-board earth links near the output stage had been resoldered the fault had permanently gone. **R.B.**

### **Philips 28PW6315/05 (A10E chassis)**

This set would switch to the scart input at random when it should have been showing the programme output from the tuner. The fault is not uncommon. It's caused by the 'painter' chip IC7064 on the small-signals panel. This IC is also the main microcontroller chip and in addition handles the on-screen and teletext displays. Equipment suitable for small surface-mounted devices is required to replace it. The A10E chassis uses three versions of this IC with different software, as follows:

A10ED1-1x, part no. 9965 000 10425  
A10EP1-1x, part no 3111 250 54501  
A10ET1-1x, part no. 3111 250 54511.

Make sure that you order the correct one. With some boards the software version can be read from the label on the chip. In all cases it's displayed on the screen when the set is in the service mode. **R.B.**

### **Sony KVM1421U (BE2A chassis)**

This portable set worked normally when it was first switched on, but after twenty minutes or so the contrast and sound faded to almost nothing. Precise use of freezer spray in the tuning department showed that C012 (22 $\mu$ F) was faulty. It had leaked electrolyte, which had penetrated to the print side of the board where the 47k $\Omega$  chip resistor R045 was found to be open-circuit. Cleaning the contaminated area and fitting replacement components cured the fault. **K.G.R.**

(Editorial note: There seems to be some variation in this area between different models that use the chassis.)

### **Ferguson A51F (IKC2 chassis)**

The customer complained that this set would occasionally go into standby then switch itself back on. As I couldn't instigate the fault I resoldered various dry-

joints in the line output stage and checked the mains switch. After a prolonged test I replaced the back, whereupon the set tripped off with a very dim LED display.

Twisting the chassis produced the fault, and I eventually found a dry-joint at the earthing point for the chopper transistor's heatsink, beside the main smoothing block. **G.D.**

### **Bush 1433**

A large number of these sets are coming in with broken buttons. The mouldings usually break when the debris is removed, so I find that the best method of replacement is to drill up to four fine holes and use short self-tapping screws to secure the new strip. A lot easier than gallons of hot-melt!

One set that came in displayed rolling on-screen garbage after this repair. Close inspection revealed that L503 had broken off because the customer had used a plank to try to get at the tact switch through the hole where the button had been! **G.D.**

### **Ferguson T14R (TX805 chassis)**

No picture with these sets is usually because RT40 (68k $\Omega$ , 0.5W) on the CRT base panel has failed. It provides base bias for the RGB output transistors, which receive the RGB drive signals at their emitters. **G.D.**

### **Hitachi C1405R**

This set had been in for a new BUT12AF chopper transistor and mains fuse some weeks previously. Everything had seemed to be OK at the time once replacements had been fitted, but they had failed again. It's a common occurrence if a non-Hitachi transistor is used, but this was a genuine one (at a genuine price!).

The set worked once another genuine replacement had been fitted, but I decided that more detailed investigation was required. I discovered that the HT varied by over 5V with varying picture content. It shouldn't! A new optocoupler cured the fault and, hopefully, the set's expensive appetite. **G.D.**

### **Daewoo 1R20A5T**

Dead was the complaint with this set – and three others. The cause was a dry-joint at the AC input socket on the PCB. Worth a mention I think. **P.S.**

### **Bush 6690D (11AK19B chassis)**

This widescreen set produced a bright screen with no picture information. I found that the TDA6108JF RGB output chip IC901 on the tube's base panel was

stone cold. Further investigation revealed that R914, a 47 $\Omega$  safety resistor in the 200V feed to pin 6 of the IC, was open-circuit. Normal pictures were displayed once these two items had been replaced. **P.S.**

### **Sharp 56FW-53H**

This widescreen set was stuck in standby. A quick check at the collector of the BUH515 line output transistor revealed a short-circuit. Isolating the line output transformer revealed that it was the cause of the short. The part no. is RNF2069BMZZ. **P.S.**

### **Toshiba 2857DB (C5SS chassis)**

It's not often that you get a short-circuit line output transistor (Q404) with these sets. If there is no apparent reason for its failure, make sure that you fit the correct type, 2SD2253FA, part no. A6872801. Guess how I found out! **P.S.**

### **Goodmans GTV69W3 (11AK19 chassis)**

Set dead with a ticking noise is a fault I've reported with the Bush 2871NTX etc. 4:3 aspect ratio sets. It's now happening with these widescreen sets. The 2SD2579 line output transistor Q605 goes short-circuit because of a dry-joint at C626 in the EW diode modulator network. You invariably end up with a EW fault because R629 is open-circuit. It's value may be 2.7 $\Omega$  or 4.7 $\Omega$ . **P.S.**

### **Bush 2868NTX (11AK19 chassis)**

This set was dead apart from a squealing noise – normally they come in because they are tripping. The line output transistor was OK. The short-circuit reading was across D612 (BY228), the upper diode in the EW diode-modulator circuit. Makes a change! **P.S.**

### **Tatung C series chassis**

Many models are fitted with this chassis. If there's what seems to be a microcontroller fault, for example failure to respond to customer controls, try resetting the EEPROM. This is done by switching on while the volume-down key on the set is held. **P.L.**

### **JVC AV29SX1EK (JA chassis)**

No sound was the complaint with this set. Scope checks revealed that good audio was present at the input to the Dolby PCB but nothing came out. Further checks revealed that L + R signals were present up to IC401 (TDA7315D). Amongst other things this rather expensive chip provides volume control, but a

replacement failed to cure the fault. As the IC is controlled by an I<sup>2</sup>C bus, suspicion fell on the EEPROM chip IC703. After replacement (part no. AT24C0429SX1EK) and a full set-up I was rewarded with excellent sound and pictures. P.L.

### Philips 14PV182/05

The customer's complaint with this TV/VCR combi unit was "smoke then dead". I found that the 1.6A anti-surge mains input fuse F1311 had blown because the P4NA60F1 chopper transistor Tr7330 was short-circuit. D6336 (PH33D) was also short-circuit, and the MC44603P control chip IC7310 had to be replaced.

Before you switch on, check the mains bridge rectifier's reservoir capacitor C2317 (47 $\mu$ F, 400V). In this case it was bulged out underneath and leaking. J.W.

### Thorn P1402A

This portable was dead. The cause was simple: the 330k $\Omega$ , 0.5W start-up resistor R802 was open-circuit. But when a replacement had been fitted I found that there were horizontal lines, similar to teletext, across the centre of the picture. C310 (4.7 $\mu$ F, 160V) had fallen in value. J.W.

### Bush 1550

There was no sound or picture, and no standby LED illumination. The power supply and the line timebase were working, and a blank white raster appeared when the setting of the tube's first anode preset was advanced. Checks around IC102 (TDA4505E) showed that its supply was missing at pin 7. It comes from the L7812 12V regulator IC103. Replacing this item and its decoupling capacitor C125 (100 $\mu$ F, 16), which can cause patterning problems, restored normal operation.

I also replaced the usual capacitors – C909 (47 $\mu$ F, 50V) and C910 (10 $\mu$ F, 50V) – in the power supply. B.F.

### Hitachi C2556TN

Intermittent loss of power was traced to a poor connection at IC951. B.F.

### JVC AV25F1EK (JX chassis)

The problem with this set was intermittent loss of line hold. It could be instigated by tapping the video/chroma PCB. No obvious dry-joints could be found, but resoldering X501, IC203 and the plug/socket connections solved the problem. B.F.

### Sony KV29X5U (FE1 chassis)

Intermittent loss of the picture with the sound OK, or nothing at all with the standby LED flashing four times, was the

complaint with this set. Although this is a new chassis, it's nice to know that Sony still can't solder properly! Once I'd removed the main board from its plastic cradle I discovered that the cause of the trouble was a dry-joint at the line driver transformer T531. B.F.

### Ferguson C51F (ICC6 chassis)

A red P1 was displayed at the left of the picture and none of the remote-control functions worked. The front controls did work however, so it was not a problem with the membrane. The solution was to hold the channel up and down buttons while switching on at the mains. Presumably P1 is the display for child lock, but there is no mention of it in the customer's instruction book. B.F.

### Wharfedale 550

This set would intermittently shut down, with a repeated thumping noise. The chassis looked familiar, and is probably similar to that in the Bush Model 2866NTX etc. The cause of the trouble was certainly one that's found with some Bush models: the connection plug for the line scan coils overheats internally, the result being a poor connection with the socket. I remove the plug and the socket and wire the two leads directly to the board. B.F.

### Tatung E chassis

According to the report this set was dead. When I connected it up I could hear the power supply clicking away. The cause was quickly traced to the S2000AF line output transistor TR401, which was short-circuit, undoubtedly because C420 (6.8nF, 2kV) was faulty. It's the upper capacitor in the EW diode-modulator circuit. I decided to replace the other capacitor as well – C421 (22nF, 1kV). G.B.

### Sharp 37AM23H (5BSA chassis)

The owner of this little portable complained that he would sometimes see strange on-screen characters and graphics he was not used to seeing. They appeared only briefly, but he was concerned about them. The clue was that the tuning menu wasn't available. A new EEPROM chip (IC1002) put matters right. G.B.

### Goodmans 3375 (F11 chassis)

The job sheet said that this set was dead. Normal operation was restored once the following items in the power supply, which is based on a TDA4601 chopper-control chip, had been replaced: the BU508A chopper transistor TR15; its base-drive coupling capacitor C103 (100 $\mu$ F, 35V); PTC2 in the start-up feed; and C102 (100 $\mu$ F, 16V), which is the

reservoir capacitor for the control-chip's supply. G.B.

### Hitachi C2164TN

This 21in. set was dead. We see a lot of them and, as usual, the 82k $\Omega$ , 0.5W start-up resistor R901 was open-circuit. It's advisable to replace R952 (47k $\Omega$ , 0.5W) as well, as this resistor can be the cause of power supply tripping. It's in the HT sensing network. G.B.

### Nikkai Baby 10

This 10in. portable was dead. Being 12V/mains operated, it's worth repair. It is quite common for the DC input socket to melt. A new socket and 630mA fuse set the customer up for the caravan season. G.B.

### Hitachi C32WF810N (A/D8 chassis)

This has become a stock fault. The set comes in with the complaint no picture, dead or stuck in standby but works all right on the bench. The cause is always dry-joints on the 'line oscillator velocity modulation panel', which is at the rear of the set, lying horizontally. Simply unclip it (unsolder the flylead) and resolder all the link wires, in particular KZ14, KZ16, KZ18 and KZ20. Don't forget to reconnect the flylead when reassembling the set. M.S.D.

### Philips 25PT4103/05 (L6.2 chassis)

This three-year old set was dead/squealing. The squealing stopped when I disconnected pin 2 of the line output transformer and fitted a microwave bulb, which glowed nicely, between its feed point and pin 3. To cut a very long story short, capacitor C2912 (2.2nF, 2kV) had burnt and blown itself up. It lives on the deflection module and is a disc type, part no. 4822 126 13451. M.S.D.

### Toshiba 2550TB

I was told that this set had suddenly lost its sound. A quick scope check suggested that there was no audio around the TDA2611A audio output chip, but was rather inconclusive. As I didn't have a service manual to hand I ordered a replacement chip from SEME, using the company's excellent CD-ROM/internet-based system SALI. But when the new IC was fitted there was still no sound.

The audio output is routed to the speakers via a small PCB that contains a headphone socket. I began to feel very suspicious about this socket, and found that someone had shoved a length of mains wire into it, holding the contacts open. I wish I'd discovered this earlier, as the repair was carried out under our own extended warranty. M.S.D.

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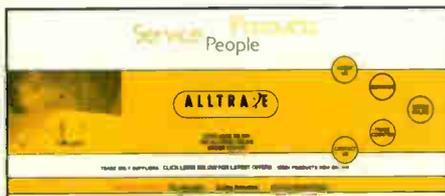
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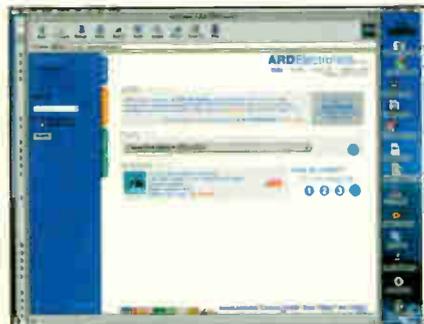
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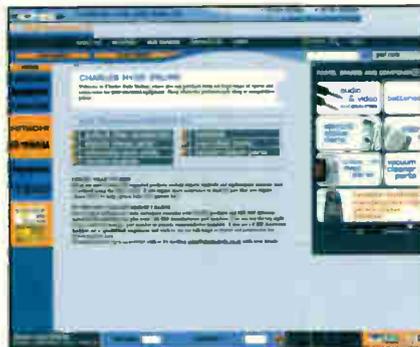
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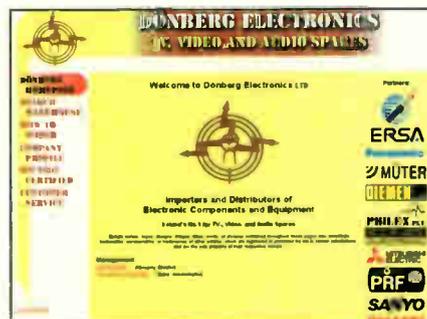
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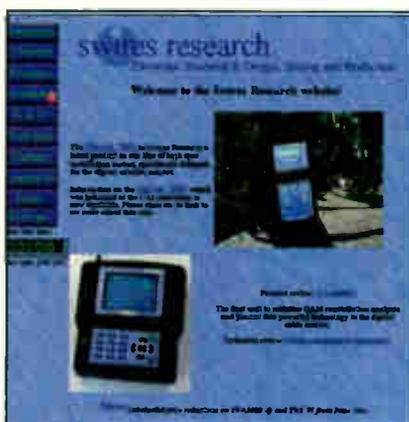
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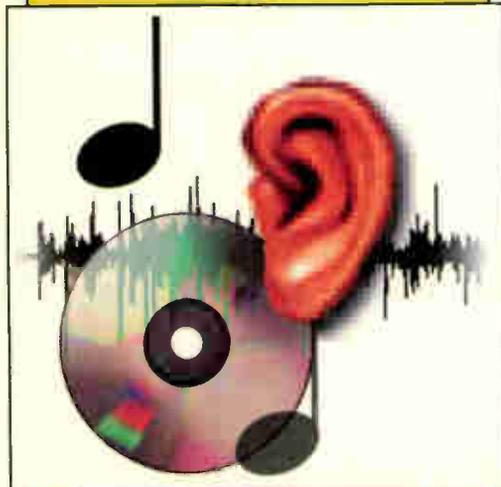
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# AUDIO FAULTS

Reports from  
**Geoff Darby**  
**Eugene Trundle**  
**J.S. Ogilvie and**  
**Robin Beaumont**

We welcome fault reports from readers – payment for each fault is made after publication. See page 616 for details of where and how to send reports.

## **Aiwa 3/5-disc CD changers**

If you get one of the many models in these ranges with the complaint “intermittent display”, remove the CD changer unit to obtain clear access to the front panel PCB and check all four VFD heater pins for bad joints – the two at either end of the row of pins. You will usually find that two or more of the pins are dry-jointed. Note that the fault may not be apparent when the unit is first powered: it can develop after some minutes when the display and its pins have warmed up.

For no display with any of these models, check the -30V VFD supply. It can be conveniently measured to chassis at the heater pins, as the AC drive to these is superimposed on the -30V supply. When the display is missing you will find that one of the power supply electrolytic capacitors used to couple AC to the negative-voltage generator is open-circuit. Component reference numbers, values and locations vary from model to model. You will usually find a cluster of physically small electrolytic capacitors by several small diodes, generally at the top, left quadrant of the main PCB looking from the print side. The open-circuit one can easily be found using a scope or ESR meter. **G.D.**

## **Sony ST-EX100 tuner**

This unit had no display. My trusty ESR meter soon revealed that both of the VFD heater supply coupling capacitors, C161 and C162, were well out of specification. Replacements (100µF, 50V) restored normal operation. **G.D.**

## **Aiwa CX-Z1290K**

This unit was stuck in standby. When you get a problem like this with any make or model, not just Aiwa, it's worth checking that all the front-panel buttons move and produce a positive click from the switch behind. Ham-fisted operation, or broken button hinges, can cause the operating pin to jam under the switch button. As a result the switch is kept in the permanently-pressed condition. Because of the way in which the front-panel switches are multiplexed to the microcontroller chip's key ports, all the other switches will be prevented from working.

In this case the BGM switch was jammed. Releasing it and straightening its hinges enabled the on/off and all the other buttons to work normally. **G.D.**

## **Daewoo AMI-517DP**

This unit was to all intents and purposes dead, though the mains transformer was working. I soon found that the two 4.7Ω fusible resistors RF901 and RF902 in the AC feeds to the low-power bridge rectifier (D905-8) were open-circuit. The cause was

not far away. The 4.7nF disc ceramic decoupling capacitor CC907 at the negative output side of the bridge was short-circuit. **G.D.**

## **Sony RX100AV**

The 16-way ribbon connector that links the OPU sled and the motor panel in the CD deck used in this and many other Sony music centres is a common cause of problems – for example no or intermittent disc play etc. Replace it: the part no. is 178-281-711. **E.T.**

## **Panasonic SA-AK17**

I've had a couple of these that were stuck in standby. Disconnect the mains transformer and check its primary winding. You will usually find that it's open-circuit. The part no. is RTP2W3B001 – it's available from SEME. **J.S.O.**

## **Sony HCD-H5**

If the problem with this music centre is no power, check Q735 on the main PCB. You will usually find that it's burnt. A 2SD1388 or a BC639 will cure the fault. **J.S.O.**

## **Sharp DXR555**

If this CD player fails to work, check the optical block drive motor. It's probably seized. A little WD40 on the shaft usually cures the problem. **J.S.O.**

## **Pioneer PDM603**

This multi-disc player was jammed with a fully-loaded magazine. When I removed the optical block assembly I found that the magnet on the spin disc had dropped out and was stuck where it shouldn't be. After applying a spot of Evostick and reassembling the unit everything worked fine. **J.S.O.**

## **NAD 304**

I've had a couple of these integrated amplifiers in with the same problem: no sound because the loudspeaker relay hadn't pulled in. Checks showed that one power-amplifier channel had a DC offset of about 10V, though there was no excessive current drain and none of the transistors appeared to be faulty. Looking at the front end of the power-amplifier section I found that R334 (47kΩ) was of the yellow-painted type that often causes problems in TV power supplies. It had gone high-resistance. To ensure reliability, I replaced the matching items in both channels, using power oxide resistors. **R.B.**

## **Panasonic SAHD52**

The CD section of this unit would stop playing after a while. Panasonic recommends upgrading the 9V regulator for the CD section – it suffers from overheating. Change zener diode D135 to a 9.1V type. I also replace Q131 and Q132, using TIP42A power transistors. This solves the problem. **R.B.**

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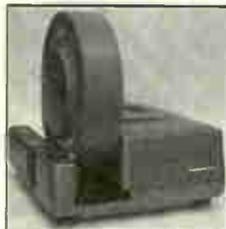
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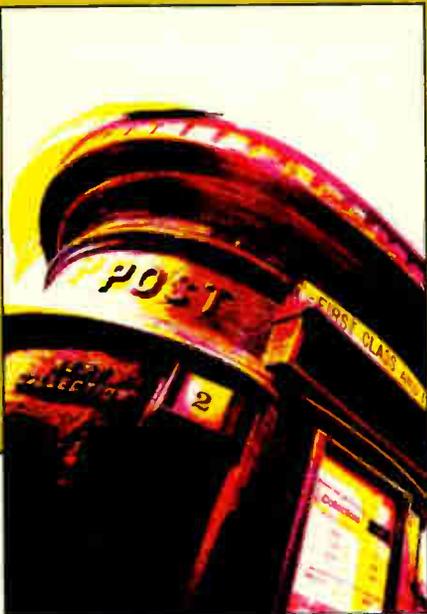
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# LETTERS

## Mains switch problems

I recently had in three Philips 32PW\*\*\* TV sets with the same fault, a burnt and damaged mains power switch. One set involved a straightforward replacement, another quite a bit of PCB cleaning before the new switch could be fitted, while the last one was horrid! The switch was burnt to cinders and the board was so bad that a replacement switch couldn't be fitted. I consulted various suppliers, then had to wait while "inquiries were made". Philips simply referred me to one of its suppliers, whom I had already approached. Ten days later a quote arrived: £61.00 for just the switch and an unpopulated PCB. The quote, relating to a four-year old set, was declined by my customer.

Now a question. If the burning had been so bad that the cabinet had started to melt and had ignited, the consequences would obviously have been serious. Who would have been held responsible, the set

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designer or the switch manufacturer? Just imagine what would have happened had I gone ahead, fitted a new PCB and the same thing had occurred, with the cabinet catching fire. I imagine I would have needed "three legs to stand on" in view of the outcome.

Surely in this day and age power switches should be made with safety in mind.

*David Smith,  
Leigh, Lancs.*

## TX92 tuner trouble

In the June TV fault-finding column Graham Boor mentioned a tuner problem with the Ferguson TX92 chassis, the symptoms being snowy/off-tuned pictures. You don't have to replace the tuner to cure this fault. Remove the tuner and, with a very fine-pointed soldering iron and a steady hand, resolder all the earth points, these being high and low raised from the PCB, and the PCB-to-casing connections. This cures the trouble.

*Vincent at Hammonds, Gibraltar.  
vince@hammonds.gi*

## A salutary lesson

I was recently called to see a Ferguson set fitted with the TX91 chassis. From the customer's comments I gathered that it was going off tune, though it didn't while I was there of course. So I took the set to the workshop and noticed that on occa-

sions the AFC seemed to be somewhat sluggish. I resoldered everything in the vicinity of the AFC circuit and carefully adjusted the coil, then returned the set to the customer with a bill to be paid a week later if the set was still OK.

Within a few days I received a call to say that the fault had returned. When I'd got the set back to the workshop I came to the conclusion that the cause of the trouble must be in the relevant IC. The exact one seemed to be unobtainable, and the nearest that was available was so expensive I was not prepared to take the risk of ordering one on spec. I returned the set to the customer FOC.

Not many days later I was called to another set that appeared to have the same fault, with a cycling AFC action as if it was trying to tune. I related the tale of the previous set to the customer, who decided to buy a new one. But when I installed it the same symptoms were present.

Once the initial feeling of panic had subsided I followed the aerial lead into a cupboard beneath the set and found a Ferguson VCR. Although it was connected, it showed no signs of life. When I removed the aerial leads and connected them together the set's symptoms disappeared. My feeling of panic was now replaced by one of guilt. The 'fault' with the original TV set was because the VCR's power supply was tripping!

Fortunately the customer seemed to be very pleased with his new purchase, and to ease my conscience I repaired the VCR at nominal cost.

I still feel guilty, but when you come across a situation you've not experienced before, what do you do?

*Peter Nutkins,  
Charmouth, Dorset.*

## 11AK19 chassis

In his July column Donald Bullock mentioned repeated failure of the TDA6108JF chip IC901 on the CRT base panel in the Bush Model 2571NTX (11AK19 chassis). We have found that this problem can be cured by replacing the CRT socket.

*Eric McKie,  
Congleton, Cheshire.*

## SkyLink installations

Having had the same problem that Robert Philpot mentioned (Letters, June), I took the following action. The three-wire link between the SkyLink coaxial unit and the 'eye' (TSOP 1736) was replaced with a length of screened-twin microphone cable. The unit plugged into the second digibox output. This was a complete success. Subsequent experiments revealed that the cable length is not critical and, better still, that TSOP 1736s can be paralleled with no detrimental effect.

Additional 'eyes' can be soldered to lengths of the microphone cable, sleeved and terminated with 3.5mm stereo plugs (CPC AR70486). Dual stereo-jack adaptors (CPC AR707170) can be used for the parallel connections and an in-line socket (CPC AR70496) for the feed.

A two-eyed system has been working for over two years now with no problems – apart from the domestic ones!

*Gus Cusick,  
Preston, Lancs.*

## Answer to Test Case 476

- page 592 -

It's perfectly true that dirty or oxidised contacts in a mode switch can cause tape looping at eject. It's also true that the mode switch in this particular deck, which is not of Sony manufacture, can be the cause of erratic mechanical operation, as indeed can the always-5V regulator transistor Q5102 in the power supply. The part numbers for these two items are 3963-78001 and 1809-60211 respectively.

In this particular case however the guilty item was the capstan flywheel brake. Its friction surface was very worn and smooth, and the flywheel edge was shiny. Why its loss of 'bite' had such an intermittent and elusive effect is difficult to understand. Maybe it depended on the particular tape, the ambient temperature, the phase of the moon - who knows? Anyway, a thorough clean of the capstan flywheel's periphery, a new brake assembly, and a careful splicing of the customer's tape cured the problem permanently.

So, there had been two visits to the workshop and a lot of time spent and hassle, all for forty-three quid net of VAT. Maybe the Test Case workshop wallies should all work at Gatwick airport, where Sage had departed for the Mediterranean. Skills like theirs are better appreciated and rewarded there. Do you know what's paid for changing light bulbs and for appliance insulation testing? Better, perhaps, that you don't!

## NEXT MONTH IN TELEVISION

### Servicing the Sony FE1 chassis

The FE1, introduced in 1998, became Sony's core chassis for 50Hz Nicam models, taking over from the BE3D and BE5 chassis. It's much simplified in comparison with the BE3D, most of the circuitry being housed on a single main board. A major change from previous Sony designs is the use of a separate standby power supply, to keep the consumption in this mode to less than 1W. Giles Pilbrow describes the circuitry and provides fault-finding guidance, including a list of known faults.

### Test report: The Promax MC377+

Hugh Cocks has been using this signal analyser for a while and has found it ideal for day-to-day satellite and TV aerial alignment work. Coverage includes the VHF low and high bands, UHF and satellite IF (850-2.050MHz).

### The 3-D IC memory

Getting more into less space has been the story of IC development to date, particularly with respect to memory devices. But the point is being approached where a fundamental limit is reached - when gate size is as small as electron wavelength. At this point transistors don't work! One technique that could be used to increase storage capacity is to adopt 3-D instead of 2-D fabrication. David Buckstone describes past work on this possibility and some recent advances.

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# WHAT A LIFE!



**Donald requires some help while minding the business on his own. Enter Oscar, who turns out to be adept at fault-finding. Donald Bullock's servicing commentary**

I came back from Spain last week to find that Paul was off for a few days, having managed to buckle his knee when he fell over his beloved cat. Steven announced that he would have to be away for most of the day attending to various accountancy and tax matters. "So it looks as if you'll have to run the lot on your own" he said, "do you think you're up to it?"

"Can't wait" I replied, pulling a manic smile on to my stony face. "Mind you it wouldn't be so bad if we had a trainee lad or something. Just someone to mind the shop so that I can pop out to make the odd call."

## Enter Oscar

Just then Mrs Grunge popped in, followed by her son Oscar. He managed to trip over a vacuum cleaner that the previous customer had left on the floor by the counter.

"Stop prancing about, Oscar" Mrs Grunge ordered, "you really are a block-head. No wonder Snoddies didn't give you that job."

"Job?" I asked.

"Yes, they wanted someone to help out

during the holidays. Just suit my Oscar I thought – he's so keen on 'lectronics. But that tall, thin chap there chose a lah-di-dah type instead. 'Course Oscar can be a bit of a prat, but so could his father."

"Yes I'm sure" I said, then turned to Oscar.

"We could do with a hand over the next day or two" I told him. "Could you make yourself useful here? Make the tea and look after the shop when I have to go out?"

Oscar's face lit up. He raised his arm and breathed in to reply.

"Of course he could" Mrs Grunge cut in. "Now speak up, Oscar! He's a very bright boy, Mr Bullock. So intelligent – and sharp as a razor! He's got his own soldering thing and a screwdriver that lights up, and made our wireless talk in French the other day."

So, once Mrs Grunge had picked up the repair Steven had done for her, Oscar stayed behind to help out.

## A Pye Video

Our first caller after that was a delightful young lady who brought in a Pye video, Model DV105. "The 'lectric just went off" she said "after that it was dead".

Sure enough when I tried the machine it was dead. I don't like mending Pye recorders, but I had to delve in. "Look Oscar" I said, "dead after a power cut. This won't take a minute. You can bet your life that C2361, the 47µF, 50V electrolytic in the start-up circuit has failed. They always do. I'll check it just to make sure."

"Isn't it more likely to be the chopper-control chip. Mr Bullock?" Oscar asked.

"Oh no, no, Oscar" I replied, "it's always this fellah."

So I checked it, and it was perfectly all right.

"Oh, ah, well" I said, "we'll have to check some of the associated components."

Twenty minutes later the young lady had long since departed and I was still checking.

"Wouldn't it be an idea to check the voltages around the chopper-control chip?" Oscar asked.

"I was wondering how long it would

take you to suggest that" I said. The chip, IC7354, is an MC44603P. I soon found that most of its pins were at 4V. A replacement brought the machine back to life.

Oscar pursed his lips and blinked a few times. As I was reassembling the machine Mrs Bishop arrived.

## A TV/VCR combi

"Ah, Mr Bolter" she said "problem is with my combi. It's in the car."

Oscar fetched it and I saw that it was a Proline TV/VCR unit, Model TVC140. I don't like mending these either, but what could I do? I plugged the unit in and up came a bright screen laced with flyback lines. Then the unit suddenly died.

"It's never done that before!" Mrs Bishop exclaimed.

I smiled at her and said "we'll give you a ring when it's ready."

When she had departed I turned to Oscar. "Talking twaddle, she was" I said, "the unit obviously shut down because of the over-bright screen. The problem's excessive beam current. If we switch the unit off for a few minutes then switch it on again the same thing will happen."

We did, but it didn't.

"Might she have been right, Mr Bullock?" Oscar asked.

I nodded grimly, opened the unit up and saw a burnt-out 27Ω resistor on the main chassis. It was R996, which is in the 200V supply. Bearing in mind the original symptoms of excessive beam current, I turned to the CRT's base panel. This incorporates a TDA6107 RGB output chip that's powered by the 200V line. I reckoned that if it had gone short-circuit this would explain the trouble. When I replaced it, along with the resistor, and switched on again there was a good picture.

## Tics

Our next customer was a tall chap who danced in. He didn't say anything for a moment but I noticed that he had a tic.

"Some form of trouble?" I asked, to encourage him.

"Ah, I've got a tic" he replied.

"Sorry about that I said. How can we help?"

"It's on the TV" he continued.

Strewth I thought. I know they're scraping the bottom of the barrel nowadays, but what next? "Which channel?" I asked.

"All channels" he replied. "Telly's in the car. Can the lad help me with it?"

They struggled in with a monster 28in. Black Diamond set, which turned out to be fitted with the 11AK19B chassis. I plugged it in and switched it on. Instead of a picture all it did was to produce a rhythmic ticking noise.

"That's all I get, a tick" he said.

When I'd taken his details he departed. I called Oscar over.

"Will it be a spark arcing across somewhere?" he asked.

"No, no, Oscar" I smiled, "that ticking tells us that there's a short-circuit in the set."

I took the back off and looked at the chassis. A tiny spark jumped about at one side of a wire link in the line output stage. I looked at Oscar, who smiled politely.

"Just testing you, Oscar" I said. The link was dry-jointed. Resoldering it stopped the arcing, but the set remained dead. So I checked the BU2508AF line output transistor Q605, which was short-circuit base-to-collector. Once a replacement had been fitted a picture appeared, but it kept going red. This could be instigated by disturbing the RGB lead between the main chassis and the CRT's base panel. When I looked more carefully I saw that there was no solder whatsoever on the blue and green pins at the chassis end. Properly resoldering these connections cured the trouble.

### Smoking set

As I finished I thought I saw someone clutching a huge 25in. TV set while riding a bicycle towards our door. But it wasn't that. It was Chris Butterhome, who walks like that, bringing us a TV for attention.

The set turned out to be a Goodmans

Model 255NS, which is fitted with the Daewoo CP775 chassis. The symptoms were sound but no raster. "It was smoking last night Mr Bullock," Chris said.

"Bad for its health" I replied. "har, har."

He looked perplexed, so I opened up the set and saw that C416 (680pF, 2kV) was cracked and burnt. It's connected to the collector of the line output transistor Q401, forming part of an AC tap to provide feedback pulses for the line timebase generator in the TDA8375A jungle chip I501 and other circuits. Tracing along this path I discovered that R409 (4.7k $\Omega$ ) and R503 (10k $\Omega$ ) were both open-circuit. But after replacing these items I was no further forward.

"Is the line drive present?" Oscar asked.

It wasn't, but it took some time to discover why. The surface-mounted resistor RC527 (10 $\Omega$ ) in the same pulse feedback path was open-circuit. A replacement restored normal operation.

### A cricket enthusiast

The phone rang and I asked Oscar to answer it. He took the name and address of the caller and showed me the card.

"Graham Pike" it said. The address was a large house on the outskirts of town.

"Says he's a cricket enthusiast and must be able to see the matches" Oscar reported. "The set's an NEI NE5155NT (11AK10 chassis). Apparently the players are normal-looking to start with, but become squat and deformed as the match goes on..."

"I expect it's those silly coloured outfits they wear these days" I said, "and the birdcages they wedge over their heads and the thick white lipstick they plaster on their faces. It screws them up."

Anyway I felt like a break, and reckoned I might know the cause of the trouble. So, grabbing a capacitor from the drawer, I left Oscar to answer the phone, drove to the Pike residence and rang the bell.

There was a loud thump, then the door was opened, revealing a tall gentleman in

a full white cricketing outfit, including kneepads, heavy gloves and a cap with a huge peak. He was swinging a cricket bat. "Just knocked a six!" he announced, then leapt around the wide hall, swinging his bat about at a torrent of imaginary cricket balls.

"Can't beat it" he said, "wonderful game." Then he motioned me to follow him farther into the house. I entered a reception room and saw the set in the corner. Sure enough there was field cramping.

When I removed the back and directed a flow of hot air at C504 (100nF, 50V) the cramping became much worse.

"Hey, you're making it much worse, not better!" Pike exclaimed.

"All part of the diagnosis" I explained, then went ahead and replaced C504 which, as I expected, had become extremely heat-sensitive. It's a special type, 10Z4. The replacement fixed the trouble without any need for adjustments.

C504 is probably not where you might expect to find a capacitor that affects the field scanning – until you realise that in this chassis the 33V tuning supply also feeds the field ramp generator network associated with the TDA8362A IF/colour decoder/timebase generator chip IC401.

Cricket-mad Pike was more than pleased, and gave me extra on top of the service charge.

### Can anyone help?

Before I close this month, here's a plea for help. Bobby Doorwanand, a regular reader who lives in Mauritius, says he can't get manuals there for love nor money. It's not all that better here Bob! Transmissions in Mauritius use the Secam colour system, and he wants to convert a Sony Model K VX2562U to this standard. If anyone can help in any way, they can reach him at

doorwanand@state.gov

"My thanks" he writes, "and regards to everyone."



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# STRANGE FAULTS

Alan Dent reports on some unusual and difficult faults that could have you running round in circles. These tips could save you a lot of time and stress

## Akura Model AVTV028WSS/ Wharfedale Model M8/890 (PT92 chassis)

We've experienced several tricky faults with these sets, as follows:

**No picture, EHT OK and heaters lit, low-brightness OSD and text:** This is a beam-limiter circuit fault, caused by transistor TD50 (BC556) going short-circuit. It's possible that the jungle chip IV01 may also be damaged. To check this, measure the resistance between pin 49 and chassis. The reading should be several MΩ. If it's about 2-3kΩ, replace the chip.

**Power supply dead, i.e. no outputs:** As usual check the mains fuse, the surge-limiter resistor etc. If everything is OK, check at pin 14 of the TDA16846 chopper power supply chip with an oscilloscope. If the voltage is slowly oscillating at about 9-15V, check at output pin 13. If the output is also oscillating slowly, but is *not* producing RF bursts, check resistor RP06 (3.9MΩ). This resistor is part of a potential-divider that feeds 1V to pin 11. When this voltage is missing there will be no output.

### Set didn't seem to come out of standby:

In fact there was a rustle of EHT but no line scanning. The jungle chip IV01 has at least four supply points, 3.3V at pins 54, 56 and 61 and 8V at pin 14. When the set comes out of standby, IV01 produces line drive pulses for approximately 1-2 seconds. This is enough to start up the line output stage, which then provides the 8V supply for pin 14 of IV01. In this case the 8V feed was not produced, so the line drive stopped after about a second.

To continue the diagnosis I disconnected the feed to the 8V regulator TD04 in the line output stage and instead fed it with 10V DC from the power supply. After this, when the set came out of standby there was very narrow line scanning. The causes were a dry-joint at the line-loss coil LD01 and the fact that RP38 (22Ω fusible) was open-circuit. Once these points had been attended to the line output stage produced the correct 8V feed and the set worked normally.

**Poor tuning range, i.e. will not tune above ch. 50:** The usual cause of this is that the surface-mounted capacitor CT17

(0.1μF) is leaky. It's connected to pin 9 of the tuner unit.

## Bush Model WS6671/ Goodmans Model GTV288 (11AK19 chassis)

The following fault condition can be experienced with any of the many sets that use this chassis. The symptoms are a raster but no or a very weak picture when the setting of the A1 preset control is advanced. The chassis uses a TDA6108 RGB output chip and a TDA8843 jungle chip (or variants). This combination incorporates auto grey-scale correction, and if either chip fails you can get these symptoms.

I've had two sets with these symptoms recently. In both cases replacing the two ICs failed to cure the fault, so I had to look elsewhere. It was obviously a beam-current limiting fault.

Set one had had its cabinet front replaced because of damage. The fault was present after the cabinet repair. A junior engineer was given the task of finding the cause and discovered that the beam-current limiting line from the cathode of D608 was grounded and not at approximately 10kΩ as it should have been.

Where was the short-circuit? In fact this was a man-made fault. When the CRT had been refitted to the cabinet front, the wire from the CRT's Aquadag coating to the point near the tuner had become detached. It had been resoldered to the tuner instead of the correct position on the PCB, thus shorting the BCL line to chassis. Reconnecting the wire to the correct position restored normal operation.

Set two had a similar problem. But the picture came on after about ten minutes, though it was a bit 'flat'. Again replacement of the two ICs made no difference, so the fault had to be in the BCL circuit. After checking around for a few minutes I decided to use freezer and the heat gun to try to localise the fault area. This investigation suggested that there was a dry-joint rather than a defective component. In fact the cause of the trouble was a hairline crack in the track to the pad where R617, which is connected to the base of Q601, is mounted. It was heat-sensitive.

Resoldering the track/pad restored normal operation.

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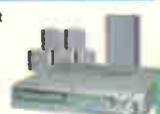
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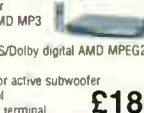
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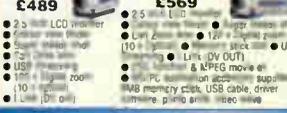
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Coastal Aerial .....	635
Cricklewood Electronics .....	639
East London Components .....	578
Electronics World TV .....	638
Express TV .....	609
Grandata .....	593-598
Hameg Instruments .....	578
Electro Centre .....	636-637
Homevision .....	639
JPG Electronics .....	629
JW Hardy .....	608
LA Electronics .....	629
MCES .....	608
Peak Electronics .....	IBC
Seme .....	635
Sendz Components .....	625
Stewart of Reading .....	635
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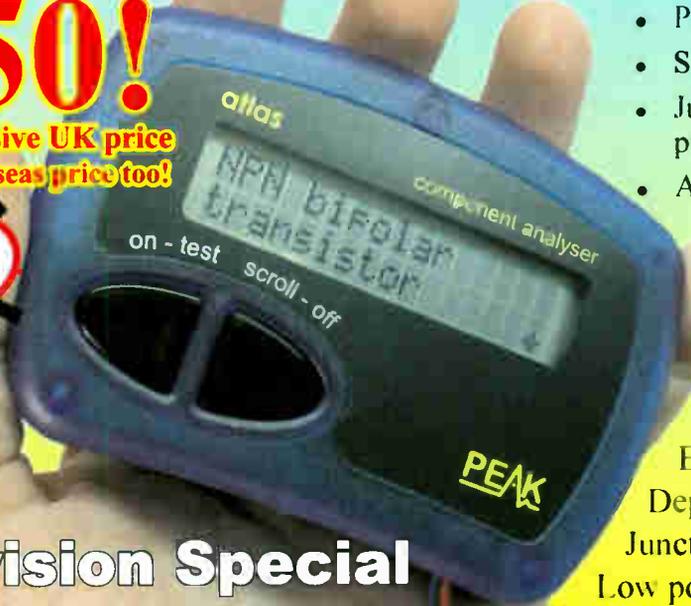
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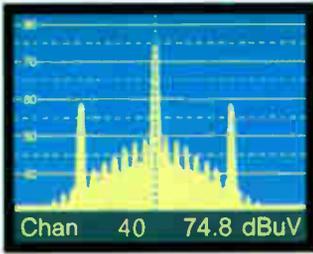
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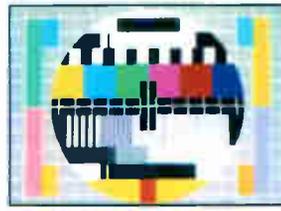
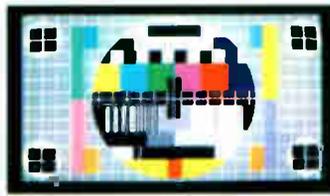
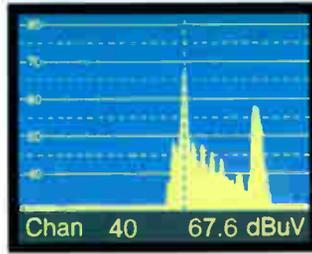




# TELEVISION TEST PATTERN GENERATORS

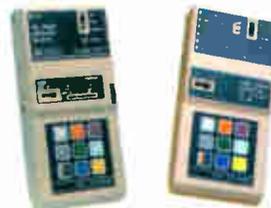


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